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

Moon Miners' Manifesto

& The Moon Society Journal

#165 – May 2003

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In FOCUS: Deep Pocket Heroes to the Rescue of Space Frontier?

A few years ago, Robert Bigelow committed $500 M of his wealth to pioneer tourist facilities in space. Last month, Burt Rutan unveiled his entry in the X-Prize "race." Now we have Jim Bezos of Amazon.com starting up Blue Operations, LLC with a goal of launching a reusable spacecraft carrying seven tourists to the edge of space, in the next few years. What's up?

The suggestion that ultimately, it will take the wealth of one or more very generous, farsighted tycoons to really open the doors to space is many decades old, being the theme of more than a few science fiction yarns. While many still pin their hopes on NASA and government largess, a few have continued to hope that ultra wealthy individuals would be motivated by personal dreams, if not by profit, to "do the right thing," and help create a breakthrough enterprise or two. Are recent announcements at long last vindicating such Quixotic forecasts?

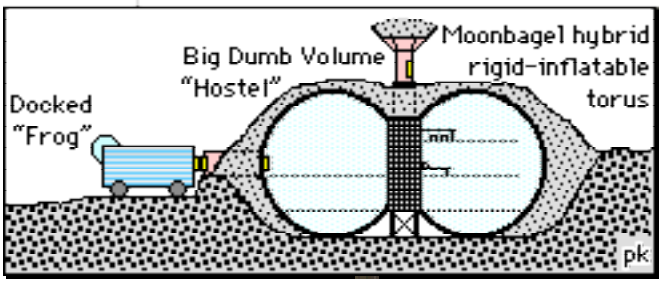
The fact is that many of the schemes for busting wide open the gates to space would require many billions, or even trillions of dollars: solar power satellite networks; lunar solar power grid arrays & relays; a helium-3 economy. It would seem that only an international space agency or a multinational power generation company consortium could possibly come up with sufficient pump-priming funding.

But there is growing belief that Space will be pioneered not in the name of "Clean Energy" but in pursuit of the ultimate in "Tourist Experiences." Power schemes can come later. This brings the gambit undertaking into a more realistic area of fully terraceable steps: sub-orbital hops of an hour or less; into orbit for a once or twice around and back; orbital hotels; round-the-Moon up-close flyby loop excursions; self-contained lunar lander "picnics" à la Apollo; dedicated lunar surface tourist facilities; tapping lunar resources for cheaper expansion of same; using those starter industries to build the first lunar power arrays for power beaming to Earth. One easy upgrade after another in a logical progression in which each phase pays for itself and generates seed money for the next. Each phase has reasonable near-term promise of Return On Investment. It would seem that Rutan and Bezos are buying into this game plan, as had Bigelow.

It is only natural that space enthusiasts from in the ranks of wage and salary owners, many of whom might imagine that "if only I had the money ... " [➪ p. 2, col. 2]

Brainstorming the Frog & Hostel Gambit

On pages 6-7, this issue, J. Craig Beasley. examines the details of Peter Kokh's proposal for a low threshold starter lunar base {ISDC 1991 Paper & MMM 153]. What things have to be considered to make the "Frog & Hostel" approach work to best advantage? Others are encouraged to help take the devil out of the details in advancing this alternative "Reference Mission" architecture.



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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÷ **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.

would wonder why those among the ultra "haves" who are known to be fascinated by space, space exploration, and visions of space development have not yet put there money where there heart is. But such expectations (and disappoint-ments) rise out of a total misunderstanding of how money and wealth are generated. None of these wealthy enthusiasts got to where they are by committing major capital to undertakings that promised no realistic near-term Return on Investment. Capital is not for wasting on cathedrals or other monuments. It is for making more money.

Yes there is tax-deductible charity. But who in their right mind expects the Internal Revenue Service to see the commitments of hundreds of millions or even some billions of dollars to a space undertaking that might very well prove to be a dead end as a "charitable donation?"

So what has changed? Clearly two things:

a. the obvious whetting of the public appetite for tourist experiences beyond Earth's atmosphere
b. the emergence of a clearly terraced master plan in which each phase pays its own way and leads to the next

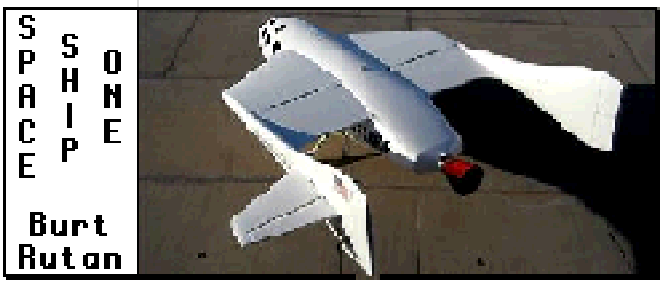
The tourist pathway to space, even though only a few can now afford a ticket to the International Space Station, now has enough legitimacy and has attracted enough talented people to bring space tourism out of Blue Sky country into the realm of serious money-making opportunity. The X-Prize organization has helped generate abundant publicity, and helped somewhat to justify the gamble. What role it will have played in the successful opening of space is something left to future historians.

At any rate, these two latest "hats in the ring" are encouraging. One can hope that this will be but the start of a venture capital groundswell behind a workable scheme of terraced space development. Three Cheers !!! **PK**

Read more:

For the Jim Bezos story:
http://www.msnbc.com/news/904842.asp?cp1=1

For more on the Burt Rutan story:
www.airventure.org/2003/news/rutan_forum.html



NOTE: Space enthusiasts can hear Burt Rutan discuss his new space tourist plane proposal at the upcoming EAA AirVenture at Oshkosh, WI. See link above for details.

Settlement Garden Tours: A Favorite Frontier Pastime

by Peter Kokh

Why Settlement Gardens will be Tour-worthy

Without the multi-shade greens of the garden, without the bright colors of flowers and fruit, the gray monochrome color schemes enforced by available building materials will become dreadfully dreary. Public and private gardens will provide an ever changing feast of eye candy.

More importantly, lunar settlement will always be to some degree "provisional." Talk of returning to the Moon, or settling Mars, "for good" may be a statement of unanimous deep commitment, but without a planetary biosphere that could live on without our constant tweaking, our continued existence will always be 'tentative" and dependent on our collective economic success and environmental "good behavior." In each settlement, all habitable spaces and structures will share a pressurized "safe house" and a shared mini-biosphere nourished within it. That human-installed biosphere will always be at risk, never be more than several months away from beoming a "ghost town." Lunans will know that, and take it in stride, much as people survive day to day in areas where death by senseless terrorism is an ever present possibility.

> Given the native barrenness and sterility of the Moons, nothing will be quite so comforting to most pioneers as vegetation and lots of it - greenery and flowers - and healthy crops of grains, fruits, vegetables, herbs and spices. At first, the number of successfully transplanted species will be small. The pioneers will be especially encouraged, heartened, and delighted with the establishment of each new species, whether it means a welcome addition to food menus, a source of natural dyestuffs, new fibers, medicinals, or just purely ornamental. The truth of the matter is that increasing biodiversity within the settlement biosphere will mean increasing strength and vigor, increasing resistance to environmental catastrophe, and progress towards a true biospheric "flywheel." But we are not talking just about what is needed to keep our bodies alive, but also about *what is needed to keep spirits alive* -- and productive.

Garden tours of noteworthy green spots, whether in the settlement farm areas, parks, streetside landscapes, or private homesteads stands to be a very popular and frequently indulged pastime. From year to year there will be more to see: new food crops, new landscape plants, new flowers. These tours will work to instill a real sense of biospheric progress in both diversity and security. Pioneers will notice that more and more of "Gaia" has made the move outward with them. They will feel less and less biologically isolated. That they must also be making economic progress goes without saying.

Garden Tourists

Who will go on such tours? Certainly the local inhabitants! But also visitors from any other lunar settlements and outposts that may be established over time. For, as the Moon has no "climate" other than the 29.5 day long sunthly cycling of dayspan and nightspan, the various settlements and outposts may each choose differing types of vegetation and crops. These differences will help fuel intersettlement and interoutpost tourism -- and rivalries!

Some Earth tourists may want to do the garden circuits, but for many of them, there will be little to see that holds a candle to what they take for granted on Earth -- unless Lunans succeed in growing flower "forests" of especially tall plants in light gravity, a yet to be proven prediction of Arthur C. Clarke. No, the real reasons for garden tours will be to encourage the spirits and morale of the pioneer settlers, and to spur healthy competition and spin-off garden-based cottage industries and enterprises.

What's to see on agricultural / horticultural tours?

What's to see will change constantly. The Local Gardens Online magazine will post farm areas, streetside landscapes and plantings, and open house private gardens available for touring along with hours and other particulars. Download the self-guiding tour lists and hit the byways.

There will be rows and rows of crops in the agriculture areas, As the seasons can be separately controlled in the various farm areas, there may always be something in bloom, something ready to harvest or in the process of harvest. The season you are in the mood to experience may be but a walk away. Many agricultural areas may include picnic facilities and mini parks in their midst, respite places from the hectic pace of life and frontier stress.

Along settlement thoroughfares and byways, every plantable square foot put to good use, there will be beautiful landscapes and flower beds in every state of season. Even the lower part of curved cylindrical walkway module walls can be used for diversified terraced plantings without taking up flat space needed for walking. Some of these landscapes and gardens will be planted and cared for by garden clubs, rather than by the settlement municipality.

Water for garden use, even for ponds, fountains, and waterfalls in garden settings will likely be waste water in advanced stage of treatment. We can stretch limited water reserves much further if put it to work at every stage of the recycling loop. Both public and private gardens on tour will commonly have water features. Some will be unique enough to merit special notice in online tour guides.

Homesteads will be interconnected within a larger biospheric maze, each opening via a securable pressure door onto a pressurized "street" on the analogy of our terrestrial residential blocks. If these streets are sunlit at intervals, then these frontages are also opportunities for private gardens in public view, testaments of civic pride as well as personal pride of place.

On the Moon or Mars where surfaced "lots" are barren and lifeless, the "front yard" and "garden" has to be *interiorized,* located in the "reclaimed" space within the pressure hull complex. It is likely that many, if not most (or all) modular homesteads will include indirectly sunlit interior garden spaces. Private homestead gardens bring many advantages: interior air quality; point source treatment of toilet wastes; supplemental herbs, fruit, and vegetables; garden stuffs for cottage industry income; the delight of greenery, flowers and garden scents; pools of sunlight; the reassuring contrast to sterile moonscapes out the window; and more -- in sum, a psychological security blanket.

Not all private gardens will be tour worthy. Even the best of them will merit a visit only at certain times. Nonetheless, home garden tours on the Moon and Mars may be every bit as popular as they are in our own cities and suburbs. Here we will find more varieties of plants, greater diversity of design, and something special: garden products for sale, some not be available anywhere else: jams, jellies, pickle relish, herbs & spices; wood jewelry, home crafted paper art and products, etc. The list of potential garden-derived cottage industry products is endless. Times, locations, descriptions, specialties can all be advertised online in a common Garden Tour watering hole website.

Adding to the treats of greenery, flowers, and garden design, will be the sights, sounds, and smells of water features. Delighting many will be the sights and sounds of the vegetation-hosted urban wildlife hosted: song birds, humming-birds, butterflies, bees, fish, and other creatures.

We can expect many stands selling garden produce and products: fruit and berries and jams, jellies, and pies; vegetables and other salad stuffs and salads; herbs and spices and dyestuffs; specialties not available from settlement farms such as coffee, tee, hot peppers, and more; gourds, dried flowers, home made craft papers, baskets, mats, and wreaths; seeds, shoots, sprouts, bulbs; how to books, garden tools and apparatus; home made fertilizers and other soil amendments. All of these things, the result of a healthy homestead garden-based cottage industry.

Garden tour traffic will be inviting to other entrepreneurs, artists and craftsmen as well, and there will be home made glassware and ceramics and other non garden-based creations for sale as well. And music, both canned and live! Add food and drink in great variety. Truly, there will be no better way to take the pulse of an increasingly thriving settlement than by making in the garden rounds.

In sum, on the frontier, *interiorizing* the biosphere will become not only public practice, but also *second nature* for each pioneer. Children will grow up with *the biosphere instinct* and be green-conscious, freshwater conscious, fresh air-conscious. Settlements cannot survive long term without a culture of *greening wherever possible. While* not all of us have *green thumbs*, most children can learn how to care for plants, and learn to enjoy doing so. **<MMM>**

Trees in Lunar Settlements

In 1990, a student working on the NASA grant Genesis CAD [computer assisted drafting] Project for Lunar Base & Habitat Design at the U. of Wisconsin-Milwaukee's Dept. of Urban Planning and Architecture, produced an interesting plan in which his base design was capped by a dome "*to provide a place for trees*". A NASA auditor excitedly protested that there was no way we could afford to waste space in such fashion. The student, unabashed, replied that if there were no trees, it would not be a human place, a place fit for human habitation; he stuck with his design.

This little anecdote illustrates a real dilemma. Even if the costs of space transportation fall, spaciousness will still be at a premium until we begin to build expansion shelter from local building materials. But even with locally produced housing, pressurized areas will still tend to be close-ceilinged, without tree-scale headroom; for the Nitrogen needed as a buffer gas to pressurize extra volume may well be a costly import.

Yet the student's observation is quite on target. Without trees, we'll have only a caricature of a human place, despite the fact that in some desert and plains areas, people *do now* live without them. Trees are essential to the functioning of Biosphere I (Earth!) Second to oceanic algae and phyto-plankton, Earth's forests make the greatest contribution to the sweet oxygen necessary to all higher life forms, single cell on up.

What place will trees have in the mini-biospheres of the Moon and Mars? Their ornamental use in landscaping will be a minor consideration. Yet, for frontier agriculture, trees would add greatly to the variety of fruit, syrups, pulp, fiber, and artstuffs etc. - purposes that are less easily satisfied by smaller plants or bushes. Happily, tree "dwarfing" by nursery breeders serving home gardeners has made much progress. Settlement orchards may feature short but fruit-laden apple, orange, pear, peach, and cherry trees, etc.

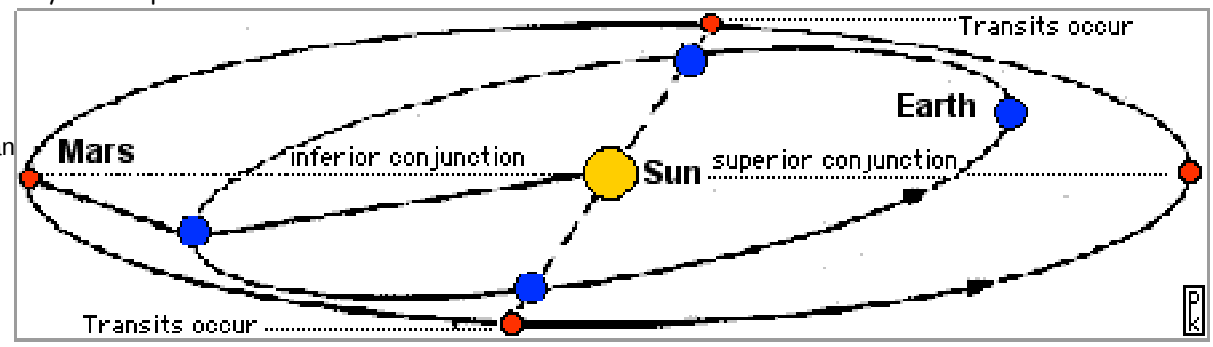
"Arboriculture" is one radical proposal to grow nothing but ultra-fast growing trees on lunar or space settlement farms, harvest them for pulp to feed vat-cultures of microorganisms to transform this fodder into synthetic foods of every imaginable taste and texture. This pseudo "Saylent Green" may well be the most efficient way to do farming on the space frontier.

Bonsai miniature trees can provide ambiance for early pioneers. The Japanese have long cultivated the art of dwarfing trees by controlled pruning and fertilization, grown them in small pots into caricatures of older, bigger trees. Evergreens, leafy deciduous trees, vine and fruit-bearing varieties are all successfully miniaturized. Waist-high setback platforms in passageways can be lined with Bonsai forests. **<MMM>**

Observations from Mars: Transit of the Earth – 2084

By Bob McGown < r_mcgown@msn.com >

There have been six transits of Venus observed across the face of the Sun, but the 2084 transit will be the first observation of an Earth transit by human eyes. The last transit of Earth from Mars took place 100 years ago. This transit will be shared with all people on Earth who are watching the live CCD broadcast, just as they observed the first steps of Man on the Moon. Witnessing the images of our clockwork solar system is a once in a lifetime experience. What would it mean to humanity to heighten the adventure of solar system exploration?



** Because the planes of the orbits of Earth & Mars differ by 1.84°, transits can only occur when they are simultaniously on the same side of the Sun *where the orbits cross.*

The Arthur C. Clarke science-fiction story "Transit of Earth" about a doomed astronaut witnessing the 1984 transit event inspired the following scenario where we observe a transit that will take place in 2084 as predicted:

The temperature of the Earth has increased by about 8 degrees F causing worldwide problems. In four generations we have seen the Earth's biosphere drastically transformed by global warming. The effect may be the global warming caused by green-house gases in conjunction with a natural cyclical warming by the Sun. Besides the global ecology efforts, the situation has created an upwelling of support for the colonization efforts. Colonization of Mars has become a priority for the human species to survive and it could be that Mars would be trans-formed into a home for human life beyond the Earth.

As humans set foot on Mars for colonization it will be a vindication of the vision and persever-ance of all those dedicated men and women of the National Space Society, the Mars Instrument & Science Team [MIST] and the Mars Society and other scientists, who so stubbornly persisted to follow their dream.*

When the first samples came back in 2031, using genome technology, our astrobiologists were able to determine that the complex amino acids and bacteria discovered were of a com-pletely different structure than those found on Earth. Subsequent probes found extremeophiles living in the ice and rock hundreds of meters below the surface in grabens and confirmed that there was indeed life on Mars. This stimulated the International colonization movement, which has resulted in the current situation of several groups of scientists living in lavatube cave shelters found from observations of infrared orbiting telescopes.

From the lavatube ice caves on Mars, the early well-used habitats near the front entrance still bear the logo of the original MIST builders. Most scientists and colonists live underground, but all use the old habitats like the models developed for the Mars Desert Research Stations, built in the late 1990's. The surface habitats are similar to the Mars Excursion Module, originally designed by the Mars Society.*

Our robotic C-14 solar telescope, like one used 80 years ago on the ISS, gives us an eerie view of earth and the glow of the sun through the limb of the atmosphere. The famous black drop effect is evident as the Earth moves into the disk of the sun.

From this distant Martian outpost, we can see the silhouette of the Earth across the solar fusion furnace. The Moon also has become outlined as a glowing disk approximately 6 hours after the Earth entered the Sun's coronal limb. The entire transit of the Earth will last up to 9 1/2 hours.

Carl Sagin proposed that the Voyager spacecraft look back from deep space to the 'pale blue dot', the Earth. In the future our deep space probes should also take advantage of transits of the giant gas planets as well as Mars and Earth. Imagine the spectacular vision of Jupiter entering the disk of the Sun, obscuring almost one-fifth of its diameter, like an artist's fantasy rendition of an extra-solar planet. To make the event even more fantastic, the Galilean moons of Jupiter would follow the giant planet and rotate in their orbits against the solar disk.

Another type of transit sought by amateur astronomers is the anti-transit, also known as occultation, in which the planet appears to disappear behind the Sun's corona. An observation from a spacecraft in the Kuiper belt could have its orbital elements engineered to catch a transit of Saturn or Mars. Manned or robotic missions could take advantage of these rare astronomical events giving a Newtonian-like perspective to the solar system.

* Mars Instrument & Science Team [MIST} is an activity group of the Oregon L5 Society and has its own webpage at: http://www.OregonL5.org/mist/ **<RMcG>**

BACKGROUND: The original paper, "**The Lunar Hostel: An Alternate Concept for First Beachead and Secondary Outposts © 1991**" was presented at ISDC 1991 in San Antonio, and printed in its entirety in the Proceedings of that conference. The paper is online in its entirety with the original illustrations at this location (2 parts):

http://www.lunar-reclamation.org/hostels_paper1.htm
http://www.lunar-reclamation.org/hostels_paper2.htm

Loading the Ox-Cart:
The "Frog" & "Hostel" Refined

(c)2003 by J. Craig Beasley

In MMM #153 {March 2002, pp. 10-12], Peter Kokh made a compelling case for a Frog & Hostel Artemis Reference Mission. In a nutshell, this is a mission scenario in which:

- A separate living and working module is established on the Moon without much, if any, independent operational capability. This would be the HOSTEL.
- A crewed spacecraft, upon landing on the Moon, taxis to the Hostel and, docked with it, provides for the Hostel's lack of independent capability. This craft will later undock, taxi back to the landing site, and serve as the Earth return vehicle. This would be the FROG.*

  [* This term denotes the vehicle's "amphibious" nature, able to operate in space and on the Moon's surface. PK]

Employing the Frog & Hostel system should provide an early ability to "overnight" on the Moon. It is truly an intriguing idea to explore. In that exploration, there is one concept that Peter mentioned that could be in question:

"It will probably take several missions to build up this capacity to overnight." - Peter Kokh

The quote above brings some questions with;

- Are sure it will take several?
- How do we quantify "several"?

Certainly, a series of missions will be required to establish a self-contained long-duration facility, but it may not be all that difficult to build up an "overnighter" capacity to the system. It is a matter of how the hardware is designed, and what technology is available. The speed with which we establish an overnight beachhead rests on how much of the necessary supplies and facilities we can deliver per launch. If there is excess launch mass to be had, we would be foolish not to take advantage of the situation. A full assessment of such issues seems to be in order, so let's take a look at that.

"If we want to bring all the equipment we need to achieve this on the first mission, we will be creating an impossibly high threshold for the first mission." - P. Kokh

This is completely true, and is the basis on which the Frog & Hostel concept exists. Obviously, launch mass plays a major role in how all mission systems are devised. This leaves us with the inevitable need to decide what functions we include on the Hostel side of the equation, and what is part of the Frog side. The trick in either case is to optimize both halves of the Frog & Hostel system.

This optimization would be guided by the following:

1. What are our bare minimum hardware and consumables for survival at any point of the mission?
2. What is the mass of the minimum hardware and consumables?
3. What are high-priority, but non-survival class items?
4. What is the mass of the non-survival class items?
5. What is our minimum lifting capacity available per launch?
6. What mitigating factors demand that certain systems reside in either one or the other half of the Frog-Hostel system?

Given the above, here's one way to proceed on creating a baseline designing the Frog & Hostel system:

1. Designate all mandatory items for the Frog.
2. Calculate the maximum weight of the survival-equipped Frog.
3. Subtract the mass from Step 2 from the minimum per-launch lifting capacity.
4. Designate all mandatory items for the Hostel.
5. Calculate the maximum weight of the survival-equipped Hostel.
6. Subtract the mass from Step 5 from the minimum per-launch lifting capacity.
7. From a list of non-survival items, sorted by mass, application, and relative importance, allocate as much of these non-survival items as possible in the manifest of the Hostel.
8. From the remainder of the list of non-survival items, allocate as much as possible to the Frog.

The main goal of the above baseline is to ensure that the Hostel carries as much hardware as possible to the Moon, on a one-way trip. Starting with an emphasis on survivability, we've ensured that each system, in their independent roles, will provide for the needs of the occupants. After survivability is addressed, then the system provides at least some excess capability to send desirable items to the Moon to stay. This will minimize the time and number of mission launches required to make a useful outpost.. Indeed, this will compress the time reach an "overnighter" capacity, which is a major goal.

Of course, this is a very simplistic overview of how to produce the Frog & Hostel complex, but it should provide a framework to build upon. The next task would be to populate the optimization and baselining steps with more detailed questions to answer.

Below are my assumptions, which are up to revision.

As a matter of fact, revision by any reader is encouraged - I want the experts to speak up. We can develop the detailed architecture of the Frog & Hostel complex together.

Optimization:

1. What are our bare minimum hardware and consumables for survival at any point of the mission?
- Structure and Pressure Shell for the Spacecraft.
- Life Support Systems, including air and water for three crew to and from the Moon.
- Reconstituted foodstuffs for 10 Days Transit
- Fuel and oxidizer for propulsion and maneuvering thrusters.
- Bare minimum power generation capability for Frog Guidance-Navigation-Control (GNC), in the form of solar cells and/or fuel cells. The latter should be the preferred source, since it can typically provide more copious and predictable amounts of electricity than solar cells. Fuel cells are admittedly more difficult to produce, but the technology can be obtained nearly off-the-shelf.
- EVA supplies for in-transit contingency

2. What is the mass of the minimum hardware and consumables?
- This will need to be determined in work outside of this article. Experts are encouraged to fill in the data holes that exist.

3. What are high-priority, but non-survival class items?
- Foodstuffs - Fresh
- Excess Fuel for discretionary maneuvers
- Excess Power capacity

4. What is the mass of the non-survival class items?
- This will need to be determined in work outside of this article, as well. Once again, experts are encouraged to fill in the data gaps.

5. What is our minimum lifting capacity available per launch?
- This requires a survey of what launchers are available, or are projected to be available at the date of launch.

6. What mitigating factors demand that certain systems reside in either one or the other half of the Frog-Hostel system?

Another issue for the experts – Please weigh in!
Baselining:

1. Designate all mandatory items for the Frog.
- Structure and Pressure Shell for the Frog.
- Life Support for In-transit Duration
- Foodstuffs, shelf-stable
- 10 Days Transit
- Fuel and oxidizer for propulsion and maneuvering thrusters
- Power generation capability for Frog Guidance-Navigation-Control (GNC), in the form of solar cells and/or fuel cells. The latter should be the preferred source
- Power generation capability for Lunar Launch Standby
- EVA supplies for in-transit ops.

2. Calculate the maximum weight of the survival-equipped Frog.
- The maximum mass will have to be developed ahead of time, via expert analysis.

3. Subtract the mass from Step 2 from the minimum per-launch lifting capacity.
- This will give a margin to work with for Step 8.

4. Designate all mandatory items for the Hostel.
- Structure and Pressure Shell for the Hostel.
- Life Support for 14 days (Half-Sunth)
- Foodstuffs, shelf-stable.

14 Days (Half-Sunth)
- Power generation capability for Hostel electronic systems, in the form of solar cells and/or fuel cells. The latter should be the preferred source.
- Power generation capability for Lunar Launch Standby.
- EVA supplies for surface ops, 8 hrs/day for 14 days: 112 hrs of capability

5. Calculate the maximum weight of the survival-equipped Hostel.
- The maximum mass will have to be developed ahead of time, via expert analysis. Factored into this will be the mass of the Hostel structure and pressure shell, which should be relatively simple to determine from SpaceHab module mass numbers.

6. Subtract the mass from Step 5 from the minimum per-launch lifting capacity.
- This will give a margin to work with for Step 7.

7. From a list of non-survival items, sorted by mass, application, and relative importance, allocate as much of these non-survival items as possible in the manifest of the Hostel.
- This task will take considerable planning, and will vary to accommodate each mission profile.

8. From the remainder of the list of non-survival items, allocate as much as possible to the Frog.

Certainly, the outline of items above is the barest of skeletons upon which to build a spacecraft complex. All of the issues will require more focused attention if we want to bring the ideas into realization, but it seemed important to start somewhere. Begin at the beginning - the details will work out over time.

NEXT MONTH - The Details

J. Craig Beasley < bginstitute@ev1.net >
BGI Webpage:

http://members.tripod.com/bginstitute/index.htm

Luna City Yellow Pages

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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

Moon Society Supports Space Settlement Summit

Plano, TX, March 23, 2003: The Moon Society has announced that it is enthusiastically supporting recent efforts to build consensus among various space oriented organizations around the idea that settlement be the core of the human space flight agenda.

In the weeks following the Columbia tragedy, prominent space leaders, opinion makers, entrepreneurs and financiers met at what has been characterized as a "Space Summit". The goal was to "to seek common agreement on guiding principles for the U.S. human space flight effort and begin coordinating strategies to provide a direction for a currently rudderless U.S. space program."

That group's first top level statement was that the permanent, open settlement of space be the ultimate goal of space-related efforts and that settlement provides for prosperity, abundance of resources, fulfillment of the drive of discovery, and the long term survival of human civilization and the biosphere. Since one of the major goals of the Moon Society is permanent human settlement of the moon, the Moon Society heartily supports this effort to build consensus. Randall Severy, Chairman of the Board said, "The statements made were completely in line with the lunar settlement efforts we are working towards. We wish them luck and offer our support where needed."

Moon Society Presence at ISDC 2003 – San Jose, May 23–26

From: "Arthur P. Smith" <apsmith@aps.org>
Moon Society Conferences Committee

If you haven't already registered for NSS's International Space Development Conference, now is the time to do it. We've been helping put together an excellent Moon track this year - confirmed speakers include:

- Our very own Randall Severy, chairman of the Moon Society board, President and founder of Cyberteams, ...
- David Criswell, University of Houston - lunar solar power proponent
- Lynn Harper, NASA Ames, involved in a current NASA Lunar design reference mission
- Martin Lo, JPL, "Interplanetary superhighway" proponent and Lagrange-point trajectory expert
- Marianne Dyson, author of the just-released "Home on the Moon: Living on a Space Frontier" (children's book, published by National Geographic) and more!

Registration and more information available at http://isdc.nss.org/2003/

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

Moon Society and Artemis Society Endorse Space Settlement Initiative

From: Dave Brett, Webmaster: http://SpaceSettlement.org

Two leading space activist foundations, The Moon Society and Artemis Society, have endorsed the Space Settlement Initiative given at http://SpaceSettlement.org

The timing of the endorsements is particularly significant. Following the Columbia accident, several other key space advocacy groups now say they are ready to publicly espouse the idea of space settlement -- after years of being afraid to do so very loudly for fear it sounded too "way out".

A recent meeting of those space activist groups strongly endorsed space settlement as a goal but, as always, failed to support any plan directly targeted to promote space settlement. The Moon Society and the Artemis Society, on the other hand, have now endorsed the Space Settlement Initiative as the most realistic and achievable method for encouraging private enterprise in outer space.

The premise of the Initiative is simple: the federal government cannot afford to spend the billions of dollars it will take to go to Mars -- or even to go back to the Moon. Therefore, the capitalization will have to be raised from private enterprise, and the only way to interest investors in privately funded space development is to make that investment potentially very profitable.

The most valuable asset on the Moon and Mars is the land itself, as real estate. Although it is virtually worthless now, someday in the future, once there is a true permanent settlement, regular commercial access, and a system of space property rights, Lunar and Martian real estate will acquire a multibillion dollar value.

What the Space Settlement Initiative is

The Space Settlement Initiative explains how the United States can make that potential value into an incentive for private investment in developing safe, reliable, affordable space transport. It would have the U.S. promise that when and if anyone succeeds in establishing a permanent, privately funded space settlement and space line, U.S. courts will accept the settlement's claim to ownership of a substantial share of that land.

That would allow the settlement to sell deeds to its Lunar land back on Earth. They could sell to those who intend to book passage on the settlement's ships and use their land, but also to the much, much larger market of land speculators and investors who hope to make a profit on Lunar land deeds, without ever themselves leaving Earth.

The website http://SpaceSettlement.ORG includes a Q&A with answers to common questions about the plan, such as:

- Could this law produce a new "space race"?
- What if other nations refuse to recognize land claims in space?
- Can there be property ownership without national sovereignty?
- Could lunar land really be worth enough to make a difference?
- How much land should a settlement be able to claim, and why?

Gregory Bennett, President of the Artemis Society International,has this to say about the plan:

"The Space Settlement Initiative clears the legal path for everything we want to do in the realm beyond the sky. This may be the most realistic and achievable way to accomplish our goal of establishing permanent human settlements on the moon. It is certainly a necessary step."

Alan Wasser (awasser@worldnet.att.net) principal author of the plan, and a veteran of a quarter century of space activism, says:

"Space activism has accomplished much less than it should have because so many groups are controlled by people unwilling to support anyone else's ideas but their own. Fortunately the Moon Society and the Artemis Society are led by people more interested in achieving our mutual goals than inflating their own egos. Hopefully some other groups will now follow their lead."

Dave Brett, April 24, 2003 ###

"The Secret of Success:
Fall down twice. Get up three times."
from a Chinese Fortune Cookie

GREAT BROWSING !

(from the Artemis Data Book)

Recently featured illustrations on the Moon Society's newly redesigned Home Page.
Check it out at: www.moonsociety.org/

The Carousel Lunar Farm

www.asi.org/adb/02/12/01/01/carousel-farm.html
by Vik Olliver

How Lava Tubes Form

www.asi.org/adb/02/01/lava-tube-formation.html
by Gregory Bennett

What is the Luna City Hotel Like?

www.asi.org/adb/02/07/lunacity-hotel.html
by Gregory Bennett

Check out the All New www.moonsociety.org

If you haven't visited the Society's home page recently, you are in for a pleasant surprise: an all new look; all new layout; user-friendly features, as of April 6th.

A wholesale revision of the home page has been a high priority action item for the Moon Society Leaders and the Web Team, led by John Schrock, since last fall. The process took longer than expected, but we are sure you will be happy about the results. The web team worked under Moon Leader guidance for months to come up with a page that worked well in all browsers and at all common screen sizes. Our hats off to them!

The New Look

The first thing you will notice is the blue background. While a few leaders preferred black, the majority liked the blue best. So blue it is.

New Right Hand Menu Bar

The new page is divided into three columns: a right hand menu bar joins the old left hand one, with pictures, announcements, and news in the body of the page between.

The Left hand Menu Bar is largely unchanged:

- About the Society -- Purpose & Goals of the Moon Soc.; Frequently asked Questions; Organization
- My Moon Society -- if you have set up a user name and password at http://www.moonsociety.org/teamdir/ the My Moon Society link will call up a personalized page which will list any "teams" you have joined.
- Chapters -- Chapter Rules; Chapters Coordinator; List of Chapters & Outposts; more
- Teams -- lists all active Moon Society and Artemis Society teams (those you have already joined show up in bold face) and gives you options to join others or cancel etc., in other words, to manage your parti-cipation in the Moon Society and Artemis Society International
- Members Only -- if you have set up a user name and password at http://www.moonsociety.org/teamdir/ this page will direct you to the archive of MMM pdf files (#s 145 to current) along with a link to online MMM articles archive on www.asi.org

The new Right Hand Menu Bar adds several new "Destinations:"

- Conference List -- A list of upcoming conferences that may be of interest to Moon Society members
- Missions -- a list of known Moon Missions in some stage of planning
- Moon Info -- This page gives various links to more information about the Moon
- Archives of Changing Images -- Past Featured Images

The Center Panel

a. Changing Featured Image

Designed to attract frequent visits to the page, a featured image, changing every few days, is added, with a link either to the original full size image, or to the online article from which it was taken. We're sure you will enjoy this feature. For those who miss a picture becuase they have not visited the site recently, the new right hand menu contains a link to the Archive of Changing Images.

b. Moon Society Announcements

This section includes recent public announcements, some for members, some for members and visitors alike. It includes announcements about new member services and programs. Here too, you will occasionally find Society position statements.

c. Today's Space News

This feature of the old site is retained, but we now have a new feed source. The switch was necessitated by the sudden notice from the old source that there would now be an exorbitant fee for this service.

Happily, the new service is improved, conveniently sectioned by source:

- Space.com
- Everthing Space
- ESA Science News
- NASA Liftoff
- NASA's Earth Observatory
- Spacetoday.net
- CNN-Space
- Rocket Forge
- NASA News Releases

Why all these improvements

The old site presented a static image. We felt the need to get across to members and visitors alike, that this is a society on the move, worth joining, worth membership renewal, worth one's participation. We hope you will visit soon and often. We are confident that you will enjoy both the new look and new features.

You can send constructive comments as well as any suggestions for further improvements to Web Team Leader John Schrock at < schrock@ccrtc.com > or to MMM Mail c/o < kokhmmm >.

GREAT BROWSING !

The Moon–ISRU Project

http://www.ims.org/projects/project_info/moonisru.html
http://www.moon-isru.com/moon-ISRU.htm

Amazon.com's Jim Bezos Starts Own Space Company

http://www.spacetoday.net/Summary/1639

Moon Society Mid–Atlantic Chapter Event

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

from Randall Severy < severy@asi.org >

On Sunday, April 27th, 2003, the Mid-Atlantic Chapter of the Moon Society staffed an exhibit about the Moon Society and the Artemis Project at the Rockville Science Day 2003 in Rockville, Maryland. Representing the local chapter were Randall Severy and Dana Carson.

The Rockville Science Day is an annual event organ-ized by the Rockville Consortium for Science, a science advocacy organization. With a target audience of people of all ages, the event included exhibits ranging from reptiles to rocket building workshops. With perfect weather for the portion of the exhibits that were outdoors, attendance at the event was strong all day.

The Moon Society exhibit was based around the excellent Artemis Project storyboard designed by Peter Kokh. (http://www.nsschapters.org/hub/storyboards/sb_artemismoonbase.htm)

The printed handouts available from that page were also made available for exhibit visitors. Although I didn't have the materials or tools available to make a set of gravity bricks, I made a set of "Gravity Jugs" (http://www.nsschapters.org/hub/exhibits.htm#gravjugs) and placed them on the exhibit table. They were a huge hit with kids that stopped by and even most of the adults!

We also set up a TV display and a computer monitor to provide video images to catch the attention of people wandering by the exhibit. The TV included a VCR that played segments of the Future Fantastic episode that featured the Artemis Project. The computer monitor was hooked up to a laptop that displayed the recent footage from the E=M6 French TV segment on the Artemis Project. The background noise from the crowd in the exhibit room (a gymnasium) was too loud to hear sound from the video or computer, so the volume was turned off on both.

We estimated that between 50 and 100 people stopped by the exhibit and many of them asked questions about the Artemis Project and the Moon. Most of the questions were very serious and I detected little skepticism about the overall plans for the Artemis Project. Some of the best questions came from kids! We made available a hastily-drafted Moon Society flyer with an updated membership application form, and about 40 people picked up a copy of the flyer. Dana also brought samples of **Artemis Magazine** as well as postcard ads and writers' guidelines sheets for **Artemis Magazine**. Quite a few of those were picked up as well.

In addition to our exhibit, the local chapter of the Mars Society had an exhibit, staffed by Tom Hill and Bob Terry. Neither group was willing to be drawn into a futile "Moon vs. Mars" debate and everyone got along just fine.

As one of the first events of this type for the Mid-Atlantic Chapter of the Moon Society, it was a very successful way to learn what works and what doesn't work about providing such an exhibit. All of the exhibit materials that were developed for this event will be available for future chapter exhibits at other events in the area. And we can steadily improve them as time goes on.

For other local chapters interested in putting together a similar exhibit at local events, I can't recommend highly enough Peter Kokh's Space Chapter Hub web site at http://www.nsschapters.org/hub/. The resources available there make putting together such an exhibit ridiculously easy (I spent only a couple of hours getting everything ready) and provide every detail that you need. This kind of event is a perfect opportunity for outreach activities to spread awareness about the Moon Society and the Artemis Project and to attract new members to the society. I encourage all local chapters to look for local events that would provide an opportunity to set up an exhibit. It's a great way to get the word out and gives your local chapter a good activity to do together. **<RS>**

Moon Society Huntsville Outpost

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

On Tuesday, April 8th, 2003, we held our first meeting. There were eight of us there, so we should get five paying national membership dues soon.

Patrick Vitarius < vitarius@hotmail.com >

Huntsville, Alabama Outpostman

Moon Society Utah Outpost

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

Jonathan Goff, Utah Outpost leader, attended the Space Access Conference in Phoenix in late April "to connect faces with names" and get generally charged up. Jonathan Goff < jongoff@myrealbox.com >

Moon Society St.Louis Chapter

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

Saturday April 12th we met from 1:30-5 pm at the Schlafly branch of the Saint Louis Public Library.

Tentative Chapter Schedule for rest of 2003

- May 18th is CIA Day at the SLSC. we'll visit the planetarium and maybe go see "Space Station" at the Omnimax.
- June 21st CIA meeting at Schlafly branch ofSt. .Louis public library from 1:30-5:00 pm.
- July - Sunday meeting and DW panel at Show Me Con
- August -- CIA meeting at Schlafly branch 1:30-5:00 pm.
- October -- CIA party and meeting at Archon!
- November -- Chicago tardis
- December -- Xmas party and election set up stuff!

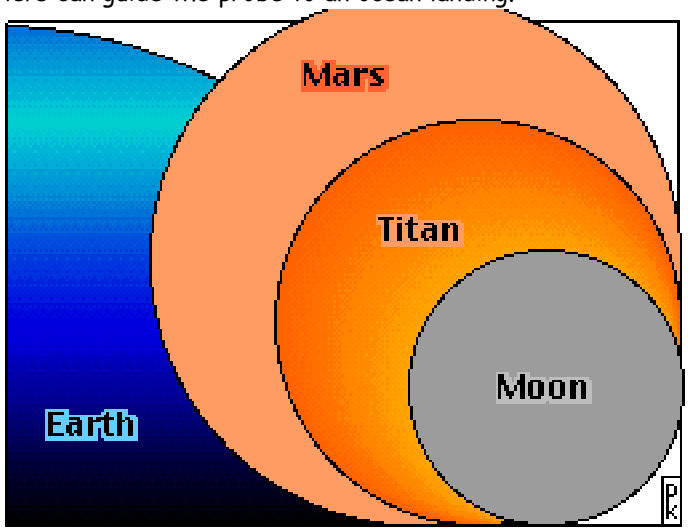
Splashdown on Titan, January 2005

by Peter Kokh

based on a Cassini Project Report / ESA Science News

Titan is the second largest moon in the Solar System. More importantly, it has a thick Nitrogen atmosphere, thicker even than our own. It appears to have continents and oceans. There resemblances to Earth end. You can easily see Titan in a small telescope, looking like a bright star near Saturn which it orbits in the same plane as that planet's famous rings. But that sighting gives no clue to its hidden nature. The dense cloud and fog filled atmosphere hides the surface quite effectively to the eye, but fortunately radar can probe the surface.

Titan is very, very cold. Yet organic molecules enrich its atmosphere. It has oceans yet is far too cold for liquid water. Is the land rock? Or ice? Are the oceans liquid methane? Hopefully the European Space Agency's Huygens probe, hitchhiking a ride on NASA's Cassini orbiter, will provide many tantalizing answers on its descent through Titan's atmosphere, and hopefully, for an all too brief time on the surface after landing, or more likely, after splashdown. Indeed, it is hoped that mission controllers can guide the probe to an ocean landing.



Any answers will be tantalizing, predictably raising more questions than the ones they answer. But such has been the history of space exploration to date. We start out with limited information and so cannot ask "intelligent" questions. Each probe provides fresh insights, raises deeper questions, begging successor missions. So the quest of science is endless. And the need to push NASA to work on follow through missions never ends. Hopefully, a much more complex and capable mission to Titan will follow -- someday.

How far can low temperature organic chemistry proceed in the direction of life? This is a tantalizing question. What has happened on Mars, Europa, and Titan will teach us much about how wide or narrow the niche of Life, capital L, really is. And that in turn will help us get a better grasp of our Earth Life fits in the Universe. Earth is a very specialized niche for life, one which is likely to be repeated much less frequently throughout the galaxy (and galaxies) than Europa-like and Titan-like situations. Life in such "extremes" may be much more common than we had suspected. But will those same "extreme" conditions cap its evolution at levels we consider primitive? We can expect only tentative answers during our lifetimes. The quest for understanding of the "big picture" will occupy humanity for centuries, perhaps. **</MMM>**

Meanwhile, [condensed from http://sci.esa.int]

. "Here on Earth, ground-based telescopes ... will help scientists to decide how and where precisely Huygens will land. What will it be -- on solid ground or in an ocean of methane?

"NASA's Voyager 1 provided the first detailed images of Titan in 1980. They showed only an opaque, orange atmosphere, apparently homogeneous. ... so thick that you could not see the surface, ... mostly nitrogen but there is also methane and many other organic compounds.

"On Earth today, it is life itself that refreshes the methane supply. Methane is a byproduct of the metabolism of many organisms. Could this mean there is life on Titan?

"Titan is far too cold for liquid water to exist, and all known forms of life need liquid water. Titan's surface is -180 C [-292 F] ...[making it] unlikely that Titan is a site for life today. ... [yet scientists are] puzzled by the amount of methane that persists in Titan's atmosphere. Could there be oceans of methane on or under the surface?

"Before Huygens arrival, astronomers will observe Titan using powerful ground-based telescopes. Images from the W. M. Keck Observatory reveal methane-containing clouds near Titan's south pole. Could Titan have the equivalent of a weather cycle? ... the atmosphere is much more dynamic than we used to think." The NASA Cassini orbiter will clearly see these clouds, carrying out precise observations before, during and after releasing the Huygens probe.

"Over the years, scientists have dramatically changed their minds about There is no doubt that the surface appears very diverse, not uniform.

"Where will Huygens land? This could be the the first landing in an ocean outside the Earth!" To land on an ocean would probably mean better data from Huygens. Even if the probe lasted only a few minutes before sinking, it would at least stay in an upright position. Being the right way up is essential for sending the data back to the Cassini orbiter ... some of Huygens's instruments are better prepared to analyze liquids." **<sci.esa.int>**

More about Huygens

http://sci.esa.int/huygens/

More about Cassini

http://saturn.jpl.nasa.gov/cassini/index.shtml

Where is Cassini–Huygens now?

http://saturn.jpl.nasa.gov/cassini/english/where/

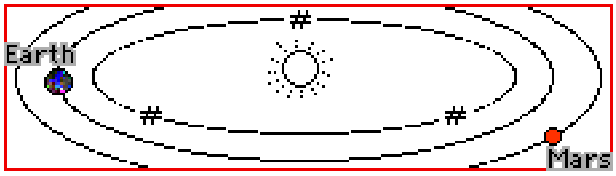
Mars Odyssey Shows Extreme, But Managable Radiation Risks

based on an article by Robert Roy Britt
http://www.space.com/missionlaunches/odyssey_radiation_030313.html

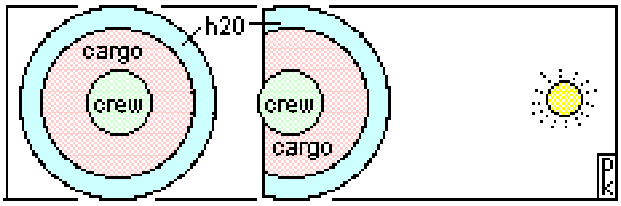
Radiation levels at Mars orbit have been monitored for the past year by the Mars Odyssey orbiter's MARIE experiment. The results make it clear that astronauts on 3-year round trip missions to Mars will face exposure to radiation approaching the lifetime safety limits set by NASA.

Several strategies must be pursued to minimize this exposure will require:

- a network of radiation sensors in the inner solar system to warn astronauts of erupting solar flare storms in time for them to take cover. (The simplest such network would be a trio of monitor satellites maintainging a 120° separation in a close in orbit.)



- on-board storm shelter at the core of the crew cabin, or leeward of the cargo and any water & fuel tanks



- procedures and equipment to cover the Mars outpost habitat and other frequently occupied structures with shielding supplied locally, either from regolith soils, or from the atmosphere (e.g. graphite powder produced from carbon dioxide)

Data from Odyssey's Martian radiation environment experiment [MARIE] show that the radiation dose level at Mars is 2-3 times greater than that aboard the Space Station where astronauts are protected by Earth's magnetic field, and in particular, by the Van Allen radiation belts which trap incoming radiation out of harms way. Mars, however, lacks both a strong magnetic field and a thick atmosphere. The planet is thus more exposed to two types of space radiation even at ground level: cosmic rays and solar flares. MARIE looks for both types of radiation. Both can have serious health effects over time even in low doses.

Cary Zeitlin, the principal investigator for the MARIE radiation detection instrument on Odyssey, gave the findings a JPL press conference, March 13th.

Pluto Mission Victory!

In February, President Bush signed a spending bill that included funding for "New Horizons," NASA's mission to Pluto.

This is a major victory for 2 1/2 year long grass roots campaign in support of the Pluto mission led by the Planetary Society. Said Louis Friedman, Executive Director of The Planetary Society, "It shows that public input can still have a decisive effect on policy making, even when it is faced with substantial opposition."

http://planetary.org/society/pluto.html
http://solarsystem.nasa.gov/missions/pluto_missns/pluto-pkb.html

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.

SETI@home "Stellar Countdown" Update

http://planetary.org/stellarcountdown/

March 27, 2003: On Monday, March 24, SETI@home's Stellar Countdown came to an end at the Arecibo Radio Observatory. The 24 hours of observation needed to visit the top SETI@home candidate signals should have taken three days, but instead took nearly a week. The eruption of a rare Solar flare pushed the sessions back several days, ending with a 14 hour observation marathon on Monday.

This change of plans did not matter. The Stellar Countdown proved even more successful than expected, revisiting 166 of SETI@home's most promising candidates signal, more than the 100-150 predicted. Plus, SETI@home Chief Scientist Dan Werthimer and team found time to target 35 nearby Sunlike stars, 15 nearby galaxies, 6 candidates from the SERENDIP SETI search, and 5 extrasolar planetary system. All in all the Stellar countdown observed 227 promising locations in the sky.

Within the next few weeks all this data will be processed by SETI@home users around to world, to determine whether any of the targets proves to be a true alien signal. We promise to keep you posted!

SETI@home is moving forward with plans for a more sensitive and comprehensive sky survey. Within the next two years the SETI@home team hopes to phase out the aging receiver at the base of the line feed. In its place, SETI@home observations will be conducted using a new multi-beam array to be located within the Gregorian dome that will be able to point at seven locations simultaneously, and a much higher degree of sensitivity than is possible with the current arrangement.

Continued support by SETI@Home contributers is vital for the success of this expanded effort. **‹TPS›**

Mail For MMM

More on Moon Rockets & Lunar Cyclers

April 11th -- I confess, I am disoraganized and tend to get long winded, fail to make things clear enough to readers and miss the main point. If only I had a girlfriend who would read stuff for me then tell me where the reader is left wanting. I don't think I ever mentioned the core of my thinking about rocketing all that stuff to the Moon as described in the Jan.2003 MMMR. If we are going to mine 25 tons of helium 3 on the Moon every year, enough to power the USA for a year, then we will mine 0.0685 tons a day. At $3 billion a ton, this is $205 million worth of the stuff every day!!! If we mine 150 tons a year or more to power the world, then we mine $1.2 billion worth a day!!! This is why I wanted to use fast chemical rockets to get the Moon mining base up and running as fast as possible. If I wait a month to get a payload up there with solar-ion propulsion I could have made $6.15 billion to $36 billion gross in the meantime.

Interestingly enough, Dr. Kulcinski has designed an 18 ton mining rover that can obtain 33 kg. of he3 a year. We would need 757 of these machines to get 25 tons a year-that's 13,636 tons of machines. In the CD that comes with the 3rd ed. of the High Frontier there is a study in which they propose sending about 20,000 tons to the Moon to build a mass driver, etc. for a SPS building program. Should we send the finished machines or the equipment to make the machines on the spot? Since the machines we use to make the miners could be used to make other stuff, seems that would be the way to go. Dave Heck has a lot of interesting thoughts about this. When he3 fusion is real, we will need a HLLV. I have a hunch, nothing more, that he3 will be more practical than SPS or lunar power stations, but you never know.

When cycling stations fly past the Moon they will be deflected by lunar gravity. Using SEP, solar sails and Al/LUNOX rockets will be done for course corrections. What if we could build microwave beaming stations on the lunar surface, similar to Criswell's power schemes, to push the sails of the cycler and make course corrections every time the cycler flew past the Moon, inbound as well as outbound?? If we had a hundred cyclers the lunar surface stations could stay busy and earn their back the investment. If 100 cyclers as big as cruise liners are built some day, many people will visit the Moon. We set sail at dawn! ♪ Visit my website -- http://groups.msn.com/DaveDietzler - I have been making improvements. There's still more to do, but I think you will like it. I've deleted some of the bad ideas and replaced many pencil drawings with much cleaner CADs. Shortened many of the articles also. Still more to do. -- *Dave Dietzler* < Dietz37@msn.com >

Thousands of New Pix to Mars Album

JPL/NASA Image Advisory: 2003-048, April 4, 2003

The winds of Mars leave their marks on many of the 11,664 new pictures being posted on the Internet today by the camera team for NASA's Mars Global Surveyor mission.

In one image, the pattern of sand dunes on a patch of southern-hemisphere desert resembles scales on a fish. On a larger scale, full-globe Mars images show wispy water ice clouds shaped by winds as the seasons change. Other new images reveal details of features such as gullies, landslides and seasonal frost.

The new batch, taken between February and July 2002, brings the total number of images in the online gallery to more than 123,800. The images are available on the Internet from the Mars Orbiter Camera Gallery at: http://www.msss.com/moc_gallery .

Mars Core May Not be Solid

From *SCIENCE* April 11 2003

The Sun causes solid-body tides on Mars, and the amplitude of the tidal effects can provide information about the structure of the martian interior. Yoder et al. (Ibid. p. 299; see the Perspective by Dehant) used small changes in the orbital dynamics of the Mars Global Surveyor spacecraft, attributed to these tidal effects and measured for more than 3 years, to redefine martian structure. They determined that the outermost part of the core is probably partially liquid, thus altering the current stiff, solid-core paradigm. More work will be needed to understand how this liquidity affects the evolution, size, and composition of the core as well as the mantle.

Build a Cosmos−1 Solar Sail Model

http://spacecraftkits.com/cosmos1/

Thanks to Ben Huset, MN SFS

Cosmos-1 is no ordinary spacecraft. It's humankind's first solar sailing craft, a project led by The Planetary Society.

http://www.planetary.org/solarsail/index2.html

And this is no ordinary scale model. It's a complete, enjoyable, "hands-on" course on solar sailing, and it's free! When you finish with this sizzling website, you'll not only have a handsome scale model of Cosmos-1, but you'll you'll understand all about the actual Cosmos-1 Solar Sail Spacecraft itself! Plus, you'll know just how everything works... how the spacecraft works in flight, and in general how solar sailing works in Earth orbit and beyond.

International Lunar Conference Info

For a brochure with more information download:
http://www.spaceagepub.com/ilc_2003..pdf

National Space Society & Mars Society Do Joint Congressional Outreach

From Bruce Mackenzie <BMackenzie@alum.mit.edu>

During the week of April 6, some Mars society members led by Mike Turner traveled to Washington DC to take part in a joint capitol hill outreach activity with the National Space Society. The event, which commenced with a forum on space policy organized by the NSS, continued with joint walking tours through the halls of congress by teams of NSS and Mars Society members. The citizen lobbyists from both groups carried a strong message to America's political representatives that the nation needs a space program that is going somewhere, and that the human exploration and development of space beyond low Earth orbit needs to be the goal.

Following the event, Mars Society delegation leader followed the following report: "Our Trip to DC was VERY fruitful. We learned pretty much everything we need to know to move forward in our mission here.

"We have identified most of the key reps, and all of the key issues (many of which are very much Mars related). We sat in on the NASA appropriations hearing, and listened to all of the congressman who are in charge of appropriating funds for space exploration give their views on space. Across the board we heard some good support for future space exploration, including what seemed to be very strong support for **Project Prometheus**. There were even some congressman that were interested in hosting the project in their districts. And another high point we noted, Congressman Simpson gave his view that NASA lacked a clear goal, and that Mars just might be that goal.

"We came across this, and MUCH MUCH more excellent information to our cause. So now the next immediate step falls to the conference delegation. We need assess our information and set out a report that outlines all of the key issues and reps, and gives a forward strategyfor our plan of action in the future. Once we have that, we can set this endeavor into motion, most of the reports should be finished by the end of next week. Soon thereafter we plan to craft a hard policy which will include new approaches, specific funding and congressionalitems we support, updates to the briefing book. We then plan to sit down with Rob Zubrin (and hopefully some SC members) and discuss it with them, then finalize the agreed items. Soon thereafter we'll be going into full swing and start going after the key men and women ofcongress.

"And let me say personally, that I think we truly can make ground towards our cause. Through our meetings with our elected representatives in Washington, we did get the true feeling that there are those that will be willing to support what we have to say."

Following the event, NSS Executive Director Brian Chase sent the following note of thanks to the Mars Society contingent:

"Glad you and the other Mars Society members could attend the NSS conference last week. I think it was a great opportunity to continue building a routine presence of space advocates on the Hill. I think it's critical we establish coalitions where possible, and develop a sophisticated political strategy and message that builds our credibility yet still moves us towards our common objectives.

"Robert [Zubrin] and I had a good discussion last week while I was in Colorado Springs and we're going to continue chatting about areas of cooperation between Mars Society and NSS. I look forward to hearing from you as your plans progress."

The Mars Society strongly believes in working jointly with other organizations interested furthering in the common goal of the exploration and settlement of Mars. We look forward to further work with the NSS urging congressional action to enable human exploration beyond low Earth orbit, and invite all other organizations who support this objective to join the campaign.

A complete report on Mars Society political work will be presented at the 6th International Mars Society convention, to be held in Eugene Oregon, August 14-17, 2003. Conference registration is now open at:

www.marssociety.org.

Information about the Mars Society: www.marssociety.org
Information about the NSS: www.nss.org.

Getting back up; Mechanical Pressure Suits

Reading in MMM about the Columbia tragedy and where do we go from here, I was reminded of something I read from a Chinese fortune cookie. "The secret of success: Fall down twice. Get up three times." As long as we get up each time we fall down, with the willingness to try again, we are not beaten.

Recalling remarks recently made in MMM about the need to develop improved space suits if we're to settle, not just explore, other worlds, I point you to an article I came across quite recently. The Univ. Space Research Association (USRA) is run by a consortium of universities. Among other things, it operates the Lunar and Planetary Institute (LPI) here in Houston. It puts out a journal called the USRA Researcher. The Spring, 2003 issue of this journal has a page one article on space suit research.

Among the technologies the researchers cited are looking seriously at is one recommended in MMM: mechanical pressure, rather than gas pressure, to provide the required pressurization; i.e., stretchy fabric or something similar. The USRA has a web site at www.usra.edu .

Larry Friesen

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!

LRS OFFICERS

LRS PRESIDENT, MMM/MMR Editor - Peter Kokh*
< kokhmmm@aol.com > 414-342-0705
VICE-PRES/TREAS../LRS/MMM Business & Database Manager - Robert Bialecki*..... 414-372-9613
SECRETARY. - Charlotte DuPree
< cmdupree@netwurx.net > 262-675-0941
NEWSLETTER ASSEMBLY - Charlotte DuPree and Carol Nelson 414-466-2081
(* Board Members, & Ken Paul < kenpaul@cape-mac.org >

LRS NEWS

• **April Meeting Report:** Peter was out of town on vacation. Bob showed a NASA video. Sciene Fiction film Video of "**Plymouth**" rescheduled for May10th Meeting.
• **LRS & Moon Soc. Milwaukee Outpost** will have a booth at the Rockets for Schools event in Sheboygan, May 16-17th.

LRS JUNE Events

Saturday, JUNE 14 th1–4 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. 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
Michelle Baker - Princeton, NJ/Philadelphia, PA
chaos@cybernet.net

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

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

Vote on Property Rights in Space

at: http://www.space-frontier.org/FFO/

Complete this Statement:
"A Private Property Rights Regime in space should be defined by"

- ☐ The United Nations
- ☐ National governments
- ☐ Corporate entities
- ☐ Private citizens
- ☐ No one and they shouldn't be allowed

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

• Submitted by Dave Buth <dbuth@freemars.org>

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.
MAR 15th -- OASIS Monthly Business Meeting, location: Microcosm, 401 Coral Circle, El Segundo.

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/

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: **MAR 15th, APR 19th**

• See **Bob McGown's Article**, "Observations from Mars: Transit of the Earth - 2084" on page 5, this issue!

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.

Meeting Dates: May 17, June 21, July 20th (A Sunday, Landing Day for Apollo). Call Earl or Mitch 215-625-0670 to verify all meetings

• **Meeting Notes:** We had a good turn out with **Simon Koumjian III**, a Professor of Architecture, attending (more later). Also our meeting location was shifted due to changes at the food court location.

Hank Smith gave an extensive report on the operational needs of the science fiction conference and the vendors with the December dates for this event in Philadelphia being a root cause of attendance problems for the *Philcon* event. Attendance by students was added to the list he is compiling. These are also lost customers for event vendors due to family and social obligations of the Holidays calling them to there home states. However; its not all gloom on this front: Hank says *15* Science tracks are scheduled this year! More on *Philcon* later in the year.

Of the many other science fiction related events Hank talked of he mentioned in the immediate future he, as well as *Dottie and Larry*, will attend *Lunicon* and Hank will go to both The **I.S.D.C** and **Baycon** in *San Francisco.* **Larry** our Webmaster asked for more material to explain our Science Fair pictures and mentioned an ongoing problem getting on a Yahoo list of links that would include us in the *N.S.S. section* of Yahoos' links for N.S.S. chapters. Solutions anyone?

Dotti Kurtz reported on several articles: from **Smithsonian Air & Space;** *May 2003* has a tribute to **Columbia** as well as a report on Americas *Flying Saucer Program.* This is about vectored thrust and Condan (?) effect lift, not Sci-Fi or X-Files stuff. The pictures are nostalgic in appearance. She also reported on **The Planetary Report** wherein *Columbia* and its loss was discussed, but in this case reflecting on the experiments

that had gone up with joint participation by a *Palestinian* and an *Israeli* who had cooperated on the **Gobbs bacterial growth experiment** they had designed. Also material on the future of space programs; we should have a Mars launch in May and then in June also.

Mitch Gordon went over a range of topics including *the book signing at Barnes & Noble* which will have happened on *April 30th starting 7 P.M.* Not related, but another public event mentioned is an **art exhibit** on *May 15th* at 307 Market St. (Center City Philadelphia) exhibiting works by **Rodebaugh** from the 1950s of futuristic art to 9 PM.

As our **N.S.S Coordinator** Mitch also reported on the *March, April, May Issue* of **Ad Astra** which was a special **Columbia Memorial** issue. This should be available at some large book stores (Borders or Barnes & Noble in our area) In reference to his connection with the **World Future Society** he brought the *May, June issue* of **The Futurist** with an article on SETI featuring **H. Paul Shuch** PhD. titled "The Search for Extra Terrestrial Intelligence". We also voted on his proposal on a new handout with he and **Simon Koumjian III** working on this with him. Since Simon has access to art and graphic talents at his University we should have great choices!

We also talked of finding a meeting venue at a book store (Borders discussed) including doing a reading group with something currently available; but this would not allow us to use the space for meetings. Mitch is constantly looking out for space for us and other organizations he is part of.

We had a guest report from **Simon Koumjian III,** who had been away for over a year, on some of his current interests and things that have happened in his life. He has married, his career as a teacher is going well, as is his wife, also a teacher, and he is working on a paper for a European conference. He also has done some self examination and worked on goals clarification (my interpretation).

A result of our talk on Simon's activities was an invitation for members of our group to come to an introductory meeting of **The Landmark Forum** which is to help us improve our performance as a group and/or individuals when dealing with goals and problems. This will be after our meeting in May. This will last from 4 till 7 p.m. and can be attended or not at your option. Background is at several websites including: *www.landmarkeducation.com*. Thank you Simon!

Earl Bennett gave a short technical presentation including a reminder from **R&D Magazine**'s editorial of *March 2003.* The author, *Tim Studt*, who is Editor in Chief, says in his summation that we should find the problem, fix it, and fly again and that we owe it to ourselves to do this. He also has an article on "Modeling and Simulation: Recreating the Real World" which includes material on N.A.S.A.'s research centers working on Columbia's loss as well as preconstruction simulation used in the *X-38 crew return vehicle* at the *Advanced Supercomputing Division* and other centers. They are at r&dmag.com on the web. In **The Industrial Physicist** for April/May on page 9 is a short note on "Twenty Watts of Terahertz" which describes the technique used to generate power in this difficult area of the spectrum and work on shrinking the hardware to do it. The idea is to redo the size of the *Free Electron Laser Accelerator* elements from 30 meters to 2 to 3 meters which can fit into a hospital exam room format. In the application mentioned, surface examination for skin cancers, it is pointed out that the energy doesn't penetrate very far. If the principal can transfer to other materials to be examined it looks like a tool useful for spacecraft laminate non destructive testing. This interesting issue (Earth-based Solar Panels including the chief manufacturers etc.) is on the web at *tipmagazine.com* . In lieu of additional material I would like to mention a post meeting contact with **Pat Bahn** whose company **TGV Rockets, Inc.** works on providing low cost launches via simple reliable equipment with limited ground crew need. He and other people working on sub-orbital systems and other concerns will be going to Washington in Mid-May to talk to various congressmen and staff. To check on this and the company Pat is C.E.O. of go to: *tgv-rockets.com* on the web.

Added note: **The Space Studies Institute Conf.** has been shifted to the fall. They are at *ssi.org* on the web.

Submitted 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**

May 20: Foerster Academy of Dance, **Sheboygan**
JUNE 17: Stoelting House, **Kiel**

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

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❍ **$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

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- **For members residing in other locations:**
  Printed **MMM** delivered by postal mail: **$60**
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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

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PO Box 2102, Milwaukee WI 53201-2102.

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