"Expanding the Human Economy through Off-Planet Resources"

Moon Miners' Manifesto

& Moon Society Journal

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In Focus ▣ The Hare and the Tortoise — Guest Editorial by David A. Dunlop

Recent news on the space front reminds me of Aesop's fable of the Tortoise and the Hare. You may recall that in the unequally matched race between the tortoise and the Hare, the Hare reached what he considered to be an overwhelming lead and took time out for a nap. While he was fast asleep the steady slow plodding of the tortoise enabled him to pass the sleeping Hare and win the race.

On March 5, 2001 *Space News* reported that NASA, the U.S. Hare, had stunned it's partners in the International Space Station effort by canceling a number of hardware contributions including the U.S. Habitation module, a Centrifuge Facility Module, a Propulsion module, and the Assured Crew Return Vehicle -- the X-38. The seven person X-38 would have served as the life boat for the full space station crew compliment. The 3-person *Soyuz* capsule could not evacuate the station in the event of an emergency or catastrophic failure. These changes would reduce the Space Station's permanent manned capacity from 7 to 3, greatly reducing the potential of conducting useful scientific work on the space station.

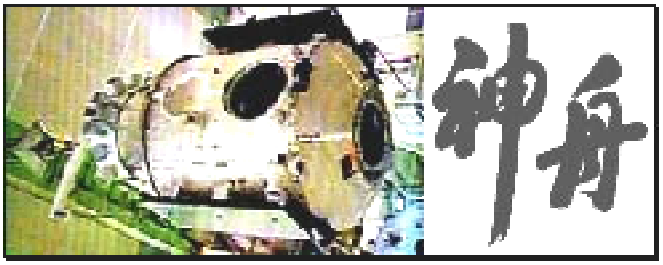
On April 9, 2001 *Space News* reported, "Just operating the station requires 2.5 people, Goldin testified before Congress." The reductions effectively reduce manning available for research to just 0.5 persons. The budget reduction strategy effectively guts the research capacity of the space station effort which is its principal justification. The Bush budget puts $ 1 B in cash into the space station over the next 5 years yet time cuts space station research by $ 840 M, a 40 percent reduction over the same period. What pray tell is the use of funding and manning a space station unable to do research and development?

In addition NASA has abandoned it's X-33 reusable launch vehicle effort after an investment of $912 M by NASA and $356 M by Lockheed-Martin. NASA also spend $205 M on the canceled X-34. Art Stephenson, director of NASA Marshall's Space Flight Center in Huntsville told reporters March 1st, "based on the proposals we are seeing, we really think a multi-stage design is necessary to achieve our goals for the 2nd-generation reusable launch vehicle." This is the second time the U.S. has abandoned a reusable launch program since the promising Delta Clipper crashed on landing, when one leg gave way.

The growth in costs for the space station have also steadily eaten into the space sciences and exploration budgets. This has limited missions and stretched out the Mars initiatives. [=> p. 2, col. 2]

Here Comes the Shenzhou !

The Chinese have recently test flown their Shenzhou manned spacecraft - unmanned, of course. A Soyus "take-off with improvements," this capsule may soon cary Chinese "Taikonauts" into space, making China only the third nation with a real manned space capability. What are the implications? Read Dave Dunlop's article, pp. 4-5.



Moon Miners' Manifesto

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fi IN FOCUS Editorial continued from p. 1.

Consider that the U.S. economy even with the current slowdown from the roaring "90s" is so robust that the U.S. government has cut taxes over the next 10 years by $1.2 Trillion. There is no lack of economic capability to keep our commitments to our international partners in the most complex international research and engineering project in history. There does seem to be a lack of "the vision thing" at both NASA and in the new Bush administration. It is perhaps unfair to lay the blame for this entirely at the feet of the new administration when the $25 B budget cap for NASA was set by Congress.

If there is a $4 B cost overrun that caught NASA by surprise, then several things are important. We need to understand the overrun. Did it occur because of necessary, unavoidable, and unforeseen factors or was it waste and mismanagement? If the latter, we should sack Goldin and the top management team. If the former, then we should accept the reality that space is a difficult and expensive place in which to operate, especially when one is doing something this complex and extensive for the first time.

In the midst of all this was the even more incredible spectacle of NASA opposition to the space station visit of the world's "first space tourist", a paying customer yet! God forbid the cash-strapped former Russian communists adapt a little actual free enterprise philosophy and sell some of their unused crew occupancy rights to an American tourist! Can we really be this tied up in contradictions in our space policy? It sadly appears the answer is yes.

In contrast with the U.S.'s sleeping Hare, the news on other fronts is of a distinctly different character. The Italians have now expressed an interest in putting up a habitation module so that the occupancy of the station is not crippled. Apparently, others see these U.S. stumbles as an opportunities.

On April 9, 2001 *Space News* announced that the reusable launch vehicle prototype *Phoenix* had received final funding from Germany -- a suborbital flight test set for 2003. The Germans have taken the lead in European involvement in NASA's X-38 space station lifeboat program. "The Phoenix", said Mathias Spude of Asrium GmbH of Bremen, "is viewed as the first step toward a reusable vehicle concept known as Hopper. Hopper would use magnetic levitation techniques to be launched horizontally from Europe's Space Center launch base in French Guiana, South America to place payloads into low Earth orbit at an altitude of about 1500 km. These satellites or space station supply containers would use onboard motors to reach their final destinations. Walter Kroell Chairman of DLR, the German Aerospace Center said, "reusable vehicles are the most likely next step in reducing the cost of launch vehicles after 2015."

On March 12, 2001 *Space News* reported "A long term program of solar exploration that ultimately

would include robotic and human colonies on the Moon, will be submitted for European government approval in November," according to European Space Agency Officials. ESA officials say they are determined to sketch a strategy that starts with satellites and probes and ends with a quasi-permanent manned presence on the Moon and later on Mars.

Marcello Coradini, ESA coordinator for solar system exploration, said the agency's scientific and manned-space directorates are working together to assure that an ambitious program of human exploration is ready once funding requirements for the ISS have eased. Caradini said the Moon is the best place to test technologies and will be needed for future Mars habitation. Any future manned missions to Mars probably should be preceded by a lunar colony. Aside from being much closer, the Moon presents fewer risks. Yves Kangevin, chairman of ESA's Solar System Working Group agreed that the long path to a manned Mars Mission should include a stop at the Moon. "There has been lots of recent focus on Mars, but the Moon offers a much friendly environment with its proximity and the fact that is has gravity, even if it's only one-sixth of Earth's."

ESA is launching its first lunar reconnaissance satellite, Smart-1, in October 2002 using a new electric propulsion system. ESA will also launch the Mars Express orbiter in 2003 and is weighing a possible second satellite with a similar mission in 2005. Bernard H. Foing, Lunar Explorer Society chairman and a Smart-1 project scientist at ESA said advances in landers, computing power and cameras in the past 20 years make a renewed effort at lunar exploration much less expensive than it was during the U.S. Apollo program in the 1960s and 1970s.

On January 22, 2001 *Space News* reported that China had a successful week long flight of the *Shenzhou-2* spacecraft, an unmanned version of the spacecraft intended to eventually launch the first Chinese astronaut." Phillip Clark, a Chinese and Russian space expert at Molniya Space Consultancy in Great Britain said, "Everything seems to have gone well with *Shenzhou-2*, If *Shenzhou-3* is as smooth a flight as *Shenzhou-2* seems to have been, perhaps the first two astronauts will fly on *Shenazhou-4* in 2002.

Somewhat similar to a *Soyuz*, the *Shenzhou* is larger, caries extra solar panels and has a differently designed forward module. China has talked for a decade about human space flight, always in the context of having their own space station. "I am sure that the only way that a Chinese space station program could be sold to the government would be to have military as well as civil applications and photo reconnaissance is the most likely application.

The Feb. 26, 2001 *Space News* reports that NASDA is readying its H-2A rocket for launch on July 22. The development of the H-2A is NASDA's highest priority, said Toshihiko Fujita, Director of NASDA external relations. NASDA Pres. Schuichyiro Yamanouchi said, "It is not an exaggeration to say that the future of Japan's space activity relies on the successful launch of the H-2A, equipped with capabilities comparable to today's major rocket fleets.

On January 22, 2001 *Space News* reported that an Israeli firm was eying the air-launch of microsatellites. Maj. General Isaac Ben -Israel, Israel Ministry of Defense said the ministry is interested in a family of light minisatellites to be launched from small reliable rockets as a solution to future military intelligence requirements. Israel's Armament Development authority also intended to use the concept as a springboard for entry into a space market now dominated by Lod-based Israel Aircraft Industries. Israel has demonstrated effective technologies in areas of propulsion and rocket thrusters that MoD intended to cultivate for future space - related initiatives. The issue is extremely complex and requires lots of testing. It is too early to start commenting publicly on any progress."

Final Reflections

These examples of Italian, Russian, German, Chinese, Japanese, and Israeli space initiatives all reported in *Space News* in 2001 are in stark contrast to the staggering, chase-your-tail style the U.S. has recently demonstrated in its own program.

Perhaps its is a disservice to have put these other nations, which their much smaller space budgets, into the role of the tortoise in the space race. The drive and agility that the U.S. demonstrated in the Apollo era is not completely gone. The Discovery Missions series and the New Millennium initiative show much of this spirit and have given the U.S. many notable recent achievements. The steady progress in getting the ISS is also not to be under estimated as a major achievement with the consortium of interna-tional partners. The U.S. however, cannot in its commitment to purse the international space station become just a huge lumbering stumblebum. So far the station has been eating much of the resources needed across the space sciences exploration, and new tech-nology and aviation development.

We need both tight management and a vision that comes with the resources to keep the U.S. on the leading edge. The global community is showing both vigor and competitive spirit. We have been brilliant when we perceived we were behind. Let's hope we will not actually have to run from behind and that the Bush administration and the public expect an excellent, aggressive, and well funded vision for the space program. We also need consistency and persistence in the face of failures to continue to fund what is strategically vital: cheap access to space.

We fail in "the vision thing," the above examples show that there are many others who are willing to look at the long view ahead and pick up a fallen torch as they sprint to the lead. **<DAD>**

The Long March:
Chinese Manned Capabilities in Space

by David Dunlop

The Chinese launchers are named after Mao's long March to escape the forces of the "nationalist" Chinese. This incredible feat of endurance and determination is justifiably memorialized but also symbolizes contemporary Chinese determination to regain great power status as measured by the development of aerospace capabilities and weaponry.

The April 2001 issue of Aerospace America contains an informative article concerning the *Shenzhou* capsule which has been successfully test flown twice the most recently in January of 2001. A third flight is anticipated by the end of this year. The article states that 3 to 4 test flights more are anticipated before the program is expected to support a manned launch.

While of the prospect of Chinese *taiokonauts* would seem to the Western public to be a sudden emergence of another major player in the ranks of space faring nations this achieve really does reflect a long march determination. and the annual expenditure of over $2 billion on its space program. The program has developed a new version of the Long March called the LM-2EA which can deliver 14,000 kg to LEO.

Philip Clark, an international space expert is quoted as saying, "I can't think of anything other than a small space laboratory that could fill that rocket. There's just no other obvious payload. The Chinese have also built a new launch pad and vertical vehicle assembly building at the Jiquan Satellite Launch Center specifically for human space flights, reports Aerospace America. This center, one of three Chinese launch sites, is located in the Gobi desert in Gansu Province in Northwest China because of its proximity to the plains of Chinese Inner Mongolia. Clark expects a small lab to be orbited in the 2004 to 2005 time frame if the Shenzhou capsule is used successfully.

It is reported that Chinese officials have announced a new family of Long March rockets the Long March 5 which can carry 20 metric tons to LEO. This would be comparable to the Russian Proton-K which launched the Zarya and Zvezda modules to the International Space Station. Clark is cited as expecting to see China erect a large space station in orbit.

The justification for this level of effort is likely to have multiple purposes. This article indicates a due use policy of both military and civilian purposes being served by the Chinese program. Spectacular launch failures early in the 1990"s created significant uncertainties about the reliability of the Long march program in the minds of Western satellites launchers. US restrictions on export of technology to China have also created a determination to develop independent capabilities. The development of a manned program capability would silence skeptics about Chinese capbilites and reliability if they succeed. Both military reconnaissance and Earth surveillance would be served by a Shenzhou laboratory module as military justifications.

The Shenzhou capsule is a "second generation" knock off of the Russian Soyuz module which however the Chinese are quoted as saying, is "made solely by Chinese engineers and scientists," The Chinese clearly used the Soyuz as a jumping off point for their own Shenzhou design.

Aerospace America reports the interesting comparison. Shenzhou measures 2.8 meters in diameter and is 8.8 m long with a mass of 7,600 kg. A Soyuz-TM, like those carrying cosmonauts to MIR, is 2.3 m in diameter 7.9 m long with a mass of 7,300 kg according to Clark. The Shenzhou has two sets of solar arrays. One is on the the orbital module and one on the instrument and propulsion module. Soyuz has solar arrays only on the later. The Shenzhou orbital module is cylindrical and the Soyuz is spherical. The Shenzhou orbital module has the ability to remain in space with its solar array power system.

A recent Indian research report,"Chinese Missiles: Winning the Limited War," also provides an interesting peek at Chinese development of aerospace capbilites. This report can be located at:

http://www.idsa-india.org/an-jun-600.html

and looks at the progression of Chinese missiles in relations to their military modernization programs and the evolution of Chinese military doctrine.

The Second Artillery Corps of the PLA formed to deploy strategic missiles today has 125,000 personnel. In 1995 the Chinese fired six SRBMs missiles from Fujian province to a point in the east China sea 90 miles north of Taipei. Again on the eve of Taiwan's first democratic elections the Chinese fired another four SRBMs between March 8 and March 13, 1996 into the sea close to Taiwan.

The first Chinese space satellite took place in 1973 followed by a total of 44 to date. A Chinese nuclear submarine said to under development woould carry 16 of the JL-2 class of SLBM and is expected to be ready around 2010. The Chinese demonstrated the ability to MIRV its missiles in 1981 by launching three satellites with one carrier rocket. While the US and Russian are coping with the problems of downsizing their nuclear holdings, China is steadily increasing its nuclear and missile inventories.

On a strategic level the paper indicates Chinese missile holdings display two significant trends. The first is to perpetuate a nuclear capability that theoretically has a global reach and thus provides a nuclear deterrent notwithstanding that a nuclear attack on China is unlikely, The second trend is the endowment of some of the missiles with conventional capability.

These trends support:

1. The possibility of using missiles against Taiwan (not nuclear but conventional warheads) may have a salutary effect without the attendant risk of escalation.
2. The need to have a capability to threaten mainland US, including Washington DC, so as to prevent US getting fully committed to a showdown over Taiwan.
3. The need to project force without having to renege on its "no first use of force" policy, a possibly target adversary could be India with whom territorial disputes still remains unresolved.
4. The commercial value of missile sales - US intelligence claims that "China is the world's worst proliferator of equipment and technology associated with weapons of mass destruction.

"Chinese missiles seem to fit snugly into a doctrinal framework of providing nuclear deterrence while preparing to win local/limited wars under high tech conditions. Sustained economic growth will provide the backdrop for modernization and restructuring of the military during the next decade. The ongoing strategic encirclement of India by China (via Pakistan and Myanmar) could then be the launch pad for more precipitate military action."

Conclusion

What seems clear about both articles is that the world is once again engaged in a "great powers "race" not dissimilar to the battleship building programs of the late 1800's and early 1900's. The new arena is spacefaring capabilities. Put into this context the Chinese long march into space with its Long March launchers is somewhat chilling. India too has developed an expanded launch capacity with geo stationary launch capacity. The Japanese H2-A is also scheduled for a July launch. To the old bipolar cold war nations are now added the Chinese, the ESA, and not far behind Japan and India. Farther behind, it is clear that Brazilian launch capacity, aerospace industry, and a Brazilian equatorial launch site reflect Brazilian, but also the Merco Sur (South American common market) countries' aspirations to "great nations" economic and technological status.

The last century was both wonderful in the development of scientific and technological capabilities and terrible to behold in their utilization for global destruction and warfare. Let us hope that these growing aspirations of the Chinese Long March and Shenzhou programs and the others discussed can be peacefully restrained and that the competitive energies channeled into an accelerated movement toward a space faring global civilization that raises the economic well being of everyone on Earth through the utilization of space based resources and technology. **<DAD>**

The Shenzhou Spacecraft

"shen zhou" in Chinese characters

神舟

complete with fan club

Full scale mockup of Shenzhou at Harbin Institute of Technology, Nov. 2000. (Xinhua News Agency)

Shenzhou Links:

- http://www.friends-partners.org/mwade/craft/shenzhou.htm
- http://www.geocities.com/CapeCanaveral/Launchpad/1921/shenzhou.htm
- http://www.spaceref.tv/china/shenzhou3.html
- http://www.geocities.com/CapeCanaveral/Launchpad/1921/ (Go Taikonauts Site)

Urban Lofts & Settlement Style

Decorating Styles common in Urban Lofts may Offer us a Preview of Lunar Habitat Interiors

by Peter Kokh

"Lofty Ideas" is a weekly program (hosted by Katherine Stone) on Home & Garden TV (HGTV), a cable station offered by many cable networks. For those contemplating moving into an "urban loft" in a recycled old factory or warehouse, and for those just intrigued by the idea, this show gives a fascinating look at how a new generation of "urban pioneers" are making themselves very much at home, thank you, in the heart of cities once being abandoned in droves by residents not up to the new frontier challenges.

Lofts characteristically retain the relatively high ceilings of floors formerly given to manufacturing and warehousing. The interior surfaces of outer walls of lofts commonly consist of exposed brick, concrete, concrete block, and other "industrial" materials, unfaced with plaster or drywall or paneling - those more "civilized" interior surfaces all-but-universal in more "traditional" residences: single family homes, town homes, condominiums, apartments, duplex flats, etc. Floors are commonly concrete or refinishable wood plank with a healthy hint of industrial wear and tear character worked in.

As purchased by their new occupants, lofts also most commonly boast exposed heating ductwork, plumbing pipes, and electrical wiring. And most new loft dwellers choose to keep it that way. To this shell which most lovingly accept, they may or may not add dividing walls (seldom full height), partial step up floors (a loft within a loft, e.g. for a bedroom) window and floor treatments and furniture and accessories. The extraordinary amount of highly personal creativity demonstrated in the half hour episodes of "Lofty Ideas" week after week is utterly amazing. For loft-aficionados, this is where it is at.

What has all this to do with future frontier settlements on the Moon? It occurs to me, that some of the "styles" we see emerging in this new residential medium, will also prove to be the most appropriate, the most efficient, and the most economical, once we are manufacturing modular housing shells on the Moon, for pioneers to turn into "home sweet home" oases in this magnificiently desolate new setting. The reason is simple. Adopting the "as is" inner surfaces left by construction of pressure hull habitat modules removes the labor-intensive *burden* of giving them a faux finish, e.g. plaster or wall board plus paint or paper or paneling. The settlers need to save their free time for where it counts. Let's take a look.

The Shell (or hull)

The Moon is well-endowed with the all four of the so-called engineering metals: iron (steel), aluminum, magnesium, and titanium. Metal alloy pressure hull modules are a primary option for the lunar architect and module manufacturer. Lunar concrete, reinforced with steel rebar or glass fibers to give it strength under tension is certainly another. Glass fiber/glass matrix composites are a third. Surface treatment options available to the architect depend both on the character of the material, and on the manner in which the pressure hull is fabricated.

If the hull material is poured wet, and/or hot, into a prepared mold, its surfaces will take on the character of the surfaces of the mold into which it comes in contact and by which it is constrained. Molds can be smooth, textured, embossed, or carved to create surfaces with special design characters.

In the case of concrete, if coarse aggregate is used, and the surface of the cured cement abraded somewhat, the aggregate with all the character and variation it may have, is brought to the surface. If this is not done, character can be imparted by the mold itself. We have all seen the clear tell-tale imprint of plywood forms on poured concrete walls. If the form, of whatever material it may be, is given deliberate texture or pattern -- and the possibilities are virtually endless -- that texture or pattern will be transferred to the surface of the cured concrete.

This option can be used to endow surfaces with random or repetitive design patterns. I have seen a basement wall of poured concrete that looks like brick, thanks to the pattern worked into the pouring forms. With two inches of styrofoam bonded to the outside, the result is an instant "rec-room-worthy" surface. Surfaces with leaf patterns, coarse cross sawn wood patterns, almost any kind of pattern is possible with concrete. Colored concrete sidewalk pavers with embossed patterns are also appearing. As are concrete shingles that look like cedar shakes. It seems that concrete can mimic almost anything.

We can speculate how we might fabricate habitat pressure hulls from glass composites, but until we have proven, debugged methods and options, we can only guess at the design possibilities. That we can texture the surface seems likely. We may be able to etch it, applying resists and sandblasting. We might be able to color, even grain glass composites, by embedding colored glass fibers in either a random or "raked" pattern in a clear glass matrix.

Metal plate and sheet can easily be embossed, but perhaps only coarse pattern can be imparted to poured metal by mold forms. These uncertainties aside, the use of mold forms in habitat module fabrication and manufacture are a primary opportunity for textural choices with the goal being to use the resulting interior surface as decor in itself, not as a substrate for some hiding faux surface treatment.

Construction-processed surfaces might then subsequently have any mold imparted patterns or textures enhanced by several means.

- wall washer lighting can enhance textural shadow patterns
- colored bulbs or colored glass diffusers can wash textured surfaces with color tints.
- whitewashes based on lime (CaO) or Titanium Dioxide should soon be available to beat the concrete gray blahs.
- perhaps "stains" using metal oxide pigments might be used to highlight textural surfaces in directional patterns, depending on means of application

What we are talking about is principally the interior surfaces of the exterior pressure hull. In one-story modules, that includes the ceiling, which, if of concrete, may commonly be whitewashed.

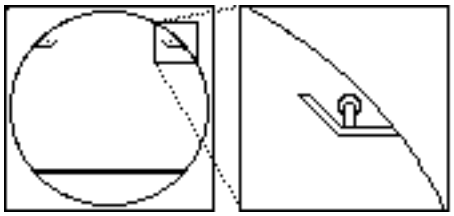
Our point is that here is a method of instant "direct decor" in which the architect and purchaser have many options to choose from, simply by allowing the character (the "grain" as it were) of the chosen hull material to give an "encore performance." By choosing any of these direct decor options, the lunar habitat is finished and ready for occupancy much sooner. Then any sweat equity required or voluntered on the part of the frontier homesteader can be post-poned, saved for other things and features to be added as time, energy, and funds are available.

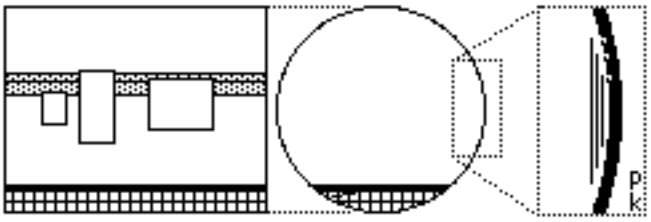
On the Moon we cannot afford to have housing units "under construction for months." The ideal ground-breaking to occupancy-ready interval should be much shorter, week at most, but with the ideal of "in one day" ever the target. Construction in vacuum is a risk-involving activity and we want to do it in as manhour-light a manner as possible, reserving man-hour-intense activities for optional interior custom-izing at leisure.

Hull Details

"Trimwork" (akin to our "woodwork"), if any is desired on interior hull surfaces, can be of sheet metal, ceramic tile, or glass composite, depending on the hull material (alloy, concrete, glass composite.) This trimwork can be of colors and shadings that blend in, compliment, or contrast with the substrate. Glass and ceramic glazes are made with metal oxide pigments, many or which are lunar-sourceable. Steel trim could be rust-finished or even stainless.

In addition to surface texture, pattern and detail, functional features can be built into exterior hulls, such as coves to hold ceiling wash lighting, chases for electrical wiring or conduit, and well-placed purchase points for hanging shelving, wall art, etc. The built-in features also serve to shorten the construction to occupancy interval. Even bench or banquette style seating can be provided as desired.





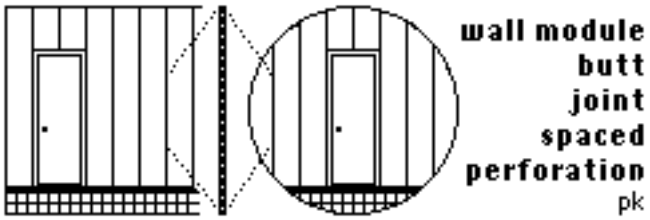
Built-in hanging grooves for on-the-wall items

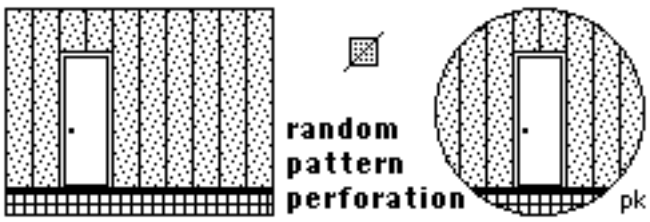
Interior Wall and Floor Stuffs

Interior walls and surfaces of interior ceilings (i.e. another floor above) are also likely to be manufactured, fabricated, or constructed with materials that can provide an acceptable surface. Logical interior wall options are:

- modular half meter sections with steel frames covered with steel panels: finished through a controlled rusting process to introduce relief from gray monochromes, or of stainless steel. They can be variously textured or embossed
- custom built on site using steel studs and duroc™ panels (a familiar item: half-inch thick fiber-glass-faced concrete sandwiches): the duroc surface can be accepted as honest direct decor, possibly whitewashed, or stain-washed. Trim-work and/or wainscotting can be of ceramic tile.
- glass block walls - transparent, translucent, or opaque; of clear glass, frosted or sandblasted, or crude formula lunar glass of gray-black tones.
- steel framing "upholstered" with stretched fiber-glass fabric over foil-faced fiberglass batting

Interior walls too, even though made of harder materials than we are accustomed to using on Earth, can be pre-fitted with purchase points for hanging wall art and shelving. Consider this:





We wrote about wall options in MMM #76, June '94, p. 4. "Inside Mare Manor: Interior Walls."

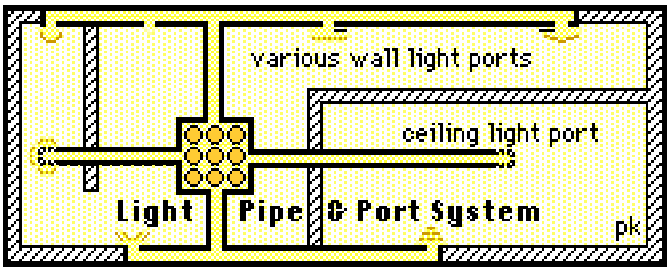
Exposed Ductwork

Another commonplace in urban Lofts are exposed ductwork for heating and air-conditioning. Using Systems to Decorate has become a flagship feature of the "industrial" style for many public buildings in the past two decades. Ductwork can be designed to have a simple comeliness of its own, adding interest, not ugliness. The original motivator, of course, is the substantial cost savings of not having to "hide" such systems with false ceilings.

The same is often true of conduit carrying electricity throughout the loft or building. With a little forethought, the design of conduit and other "working" electrical (and plumbing) elements can be enhanced for eye appeal without compromising utility, and at nominal extra cost. Routing such systems offers another opportunity for input from the interior space designer. Slight changes of placement and routing cost little. All one needs to do is pay attention to the decor effects of various options - an attention that is not ordinarily given, but can be.

Light Pipes

On the Moon, where we have a chance to start fresh on many fronts, one significant opportunity to do things differently is lighting. Light pipe technology has been advancing steadily. Light pipes are passive systems that deliver light efficiently from concentrated sources (solar concentrators, sulfur lamps, etc.) throughout interior spaces, in both straight runs and around corners, to places where the light is needed. Light ports in the pipe/duct system can then be decoratively enhanced by the choice of diffuser or lamp-shade analog. They can also be shuttered to "turn off the light."



We reported on light pipes in MMM #66 p.7 June '93, "Let There Be Light: light delivery systems for lunar settlements need to be rethought", and on Sulfar Bulb technology in MMM #36 JUN 2000 p 3. "Nightspan Lighting: Sulfur Lamps & Light Pipes."

Flooring

Pressure Hulls have to have curved surfaces to avoid stress points along surface "intersections" that would be prone to fracture, and hence pressure loss. Thus for most hull designs, flat flooring has to be added later. So we will not discuss that here except to mention some of the obvious choices: cast basalt tiles, ceramic tile, glass-composite sheets, concrete pavers, and embossed steel sheeting.

A Frontier Primary Color Palette

The reliance on "direct decor" - letting the honest character of construction materials provide the setting for added furniture, furnishings, and accessories will result in a naturally lunar, frontier palette of hues, shades, and tones to be played to in monochrome, complementary, or opposite suites.

Concrete gray tones can be easily "tinted" by washing them with colored light (bulbs, diffusers, etc.). Eventually, as locally produced sodium silicate and metal oxide pigment powders are produced, applied color "washes" may become an option. Lime or titanium dioxide "whitewash" will surely be the first of these to appear and become popular, on walls and ceilings alike. Metal oxide pigment stains might be used to give highlights to the texture relief.

Tile "trimwork" can accent the concrete, with glaze colors that play to or enhance the natural lunar grays. Steel and aluminum silvers, rust-cured steels or rust-cured steel trimwork can also add accent. Enamels for steels may not come soon.

Natural raw frontier glass will be of variegated moontones ranging from blacker to lighter. If regolith is routinely sifted for glass spherules which are then automatically sorted for color, crude glass with orange and green tones should soon be available.

Mirrors hung on moontone walls can also capture and "import" the brighter colors of added furnishings. Lamp shades, ceramic glazed items, art glass, and, of course, abundant foliage and flowers can add all the "pop and punch" colors one could want. The "industrial" "loft-like" host decor of lunar frontier habitat modules need not be drab. The great creativity and amazing variety of ways in which our urban loft dwellers make spaces with industrial histories very homelike gives us not only insight into the future of lunar frontier homes, but confidence.

It's a wrap! - of course, those who can afford it will find it chic, appropriately pretentious, to bury the construction-processed surfaces with faux facade treatments of one sort or another. But our purpose here is to show what an "everyman's frontier decor" might be like. **<MMM/>**

Many Thanks

to **Craig E. Ward** of Los Angeles, for donating an upgrade of the Word Processor we use to produce MMM. We have been using Claris Works 4.0 (for Mac) for some time now. Craig sent us **Claris Works 5.0**. Its many new features are much appreciated and make our job easier.

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 the further exploration 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 Moonbase 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®

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www.asi.org/adb/06/09/04/1999/09/news-19990915.html

Project LETO Discussion & Brainstorming

by Gregory R. Bennett, Moon Society President

[EDITOR: Recent discussion has included the topic of business type: profit or non-profit, with appreciable misunderstandings of the nature of each option.

But there has been a note of impatience in some posts to the Project LETO discuss list. Greg has posted this list of *things that need to be discussed.*]

What topics should be discussed?

- Architecture: What does thing look like? Why?
- Requirements for the laboratory: Facilities, utilities,personnel, equipment.
- Candidate program participants, partner organizations,sponsors.
- Studies to be performed at the lab and expected results.
- Techniques for keeping the team in synch.
- What skills, knowledge, talents, and resources you bring to the project.
- Methods for financing the project.
- What can be done remotely and what must be done on site.
- What do we need to know before we can build a permanent,self-supporting human settlement on the moon?
- Organization of the laboratory staff.
- Options for inviting folks to participate in the research.
- Opportunities for ancillary businesses.
- How to get people involved in the ancillary businesses.
- Who you know who can help, and what you'll do to get those people on the team.
- What do YOU want to happen at the Project LETO site? When you think of a laboratory research into development of human settles on the moon, what mental image comes to mind?When you walk in the door of the place (does it have a door?), what do you see? Who do you see? What is going on?
- And, of course, how best to organize the whole program?(Reference the Project LETO Status thread.)

Nothing is cast in concrete until we start pouring concrete, so now is the time to put on your thinking caps. Even the site selection discussion was on topic; it's just that if you want to change the baseline, the challenge is to figure out how to pay the bills at the alternate site.

How's that for a start? Stimulate any cranial corpuscles? :)

What's in the 20,000 lb. Cargo Container of the 2nd Artemis Mission?

29 Mar 2001 12:58:59 -0800
From: Gregory Bennett <grb@asi.org>
Subject: Mission 2

Mission planning time - the Setting:

The permanent lunar exploration base has been deployed. The crew anopy over it, set up geophones in the surrounding area, tested all the systems, took lots of pictures, and gathered rock and soil samples. Some little robots are busily sweeping Moon dust onto the canopy to shield the base. The robots also feed a briefcase-sized lunar oxygen pilot plant that is busily munching Moon dust into tanks of compressed volatiles.

The first crew came home safe, happy, and exhilarated. They are off on a world-wide concert tour promoting the new movie and the opening of four new theme parks. You can catch them at the Southern Cross Hotel in Sydney next weekend. After that, they are off to Alice Springs for the inevitable opening of the lemonade stand, and then on to Perth to christen another big boat.

Publicity from the 1st flight and the apparent success of the ancillary businesses has enabled us to raise enough capital for another Moon shot. The Lunar Transfer Vehicle is docked at the LEO servicing facility, refueled. Refurbishment of the Ascent Stage is almost complete, and the replacement fuel tanks launched just this afternoon from Groote Eylandt.

The exploration base awaits its next crew, who are doing their final rehearsal in Belize before they board an FBN Spacelines charter rocket.

A cargo container with a second Artemis Project payload is headed for a launch pad on Matagorda Island. This flight will land 20,000 lbs [10 tons] on the lunar surface.

What's in that cargo container?

Greg

What's in that cargo container? Brainstorm Time!

James Gholston <jamesg@dimensionality.com>

- Guess #1: Mining equipment, construction equipment, or both.
- Less ambitious: regolith-moving experimental equipment that might, in a pinch if successful assemble the first on-site construction.
- Subsequent guesses from me are pending...

Michael Eckardt --http://orbitalhabitat.com

- Solar concentrator & crucible & mold making stuff => cast basalt pavers and other items
- Additional mining/processing equipment to actually make things (sintered regolith blocks?) out of. The sooner we can get away from importing materials from Earth, the sooner we can have a real base.

Kirk Pierce <kpierce@mrj.com>

- My vote is for a first try at a closed-cycle electrolysis/fuel-cell energy storage system, with big ol' solar arrays.
- Also, to do serious industrial work (i.e. digging) we need (in the immortal words of Tool-Man Tim Taylor) "MORE POWER!!" Electric motors just won't cut it for doing real regolith-moving in any sort of short time-frame. I'm thinking internal combustion of H2 & O2 with total water recovery.
- I'm also thinking of some kind of system with "rechargable" modules that hold H2 and O2 for fuel-cell or combustion, also with a resevoir for the water. When a module runs out of gas(es), plug in another one and send the expended one to the solar farm to be recharged. These modules could come in different sizes, too, from hand-tool sized up to bull-dozer driving monsters.

Access Systems (Bob) <accessys@smart.net>

- Radiation hidey hole,
- Bigger first aide kit
- Geology gear (is there a lava tube nearby)
- Precious metals?
- Water?
- More photovoltacs
- Wheels (lunar rover)
- Spare universal space suit
- Small greenhouse
- Start of something to put in small greenhouse
- Some sort of power storage for overnight survival (human/vegtable/equipment)
- Real food
- More film for cameras (IMAX???)
- Whatever is needed for permanent manning of base, next mission stays -- overnight???
- Redundant O2 H production facility (2 small better than 1 large)
- Another antenna
- Permanent landing beacon(s)

Charles Radley <cfrjlr@netzero.net>

- 20% of the robots have already failed, we'll need spare parts, tools, repair manuals and a service robot (or two).
- The O2 production rate is painfully slow, we'll need more robots, more solar arrays, a second oxygen plant (incorporating lessons learned from the first one).
- More tanks (e.g. inflatables) to hold the volatiles being produced.

- Closed loop life support equipement, water purifiers, hydroponic greenhouse.
- Multimedia DVD player(s); movies and audios.
- Telescope for looking at Earth, Moonscapes, celestial objects.
- Several autonomous or teleoperated rovers with metal detectors (our search includes meteorites)
- Seismoemeters, seismic charges, portable seismic survey thumpers, other stuff for seimic surveys - we will be doing excursions in the rover, using seismic methods to search for lava tubes.
- Mortar grenade launchers (similar to Apollo) to fire seismic charges over several kilometres to extend the lava tube seismic search area.
- Robot rover with an experimental ground penetrating radar - to complement the seismic stuff.
- Long range (100 km) pressurized lunar rover.
- A couple of winch cart robots.
- Experimental robot to convert Si-metal slag to structural components for solar dynamic generators.
- Freon for heat exchangers.
- Mountain climbing equipment. We'll want to put some repeater stations as high as we can get them.
- How about a portable pressurized tent.
- Deployable tower antennas (if no nearby peaks)
- Lots of towels; a vacuum cleaner for the dust.
- Lots of duct tape.

Andrew Newstead
A.Newstead@pop3.appleonline.net>

Good ideas on what the Mission 2 cargo should be! B*ut what should the "container" become?*

- Perhaps this Cargo Container could be designed to serve as a workshop/machine shop once it is unloaded. The experience of Mir found (I suspect ISS is duplicating this) that maintenance became a major issue for the cosmonauts. A machine shop and a comprehensive range of tools that would allow for creative (i.e unplanned) engineering, I personally think, is a must.
- Of course, pack the module with lots of other stuff for the trip to the base (at least one bag of Thornton's Special Toffee!).

Roger <roger@escore.demon.co.uk>

- A machine shop is good
- Duplicates of critical items from first mission
- Ground radar and a robot to move it around (from a previous post)

George MacDonald <gmd@slip.net>

- I wouldn't mind sending up some robo-miners to harvest H2, O2 before a team arrives. It might take the robo-miners a year to fill up a fuel cache, but then the visitors would not need to haul the return fuel to the Moon.

Vik Olliver <vik@olliver.family.gen.nz>

- We don't really want to melt or heat up regolith outside of the factory if we can help it. Heating it up drives off all the desirable volatiles.

Organizing all these suggestions

Charles Radley <cfrjlr@netzero.net>

To reach a conclusion the mission definition needs a step by step process. Greg has kicked off a braimstorming activity, usually the first step in a development process. This brainstorming has already resulted in several small shopping list.s

These should be consolidated into one big shopping list. Next we need to assign a cost/benefit to each item and come up with a list of priorities.

- The cost is primarily its weight, with volume a secondary cost (small and light are good).
- Benefit is a bit more subjective, and depends heavily on the business model and near term mission objectives. How many of each item do we want to take? What is the risk that this stuff won't work? We don't need expensive dead weight.

Individual crew preferences should also be considered. For example, we should probably allocate a fixed weight of, say, 100 pounds for personal morale items, this should include the DVD player. Food supplies are a separate allocation and should also cater to crewmember preferences, this would include the Kendall Mint Cake and toffee.

I can see a lot of discussion about personal preferences to put in the 100 pound limit. This is fun and worthwhile in itself. But in practice, we all know it is really too early to spend much time on those issues, fun though they certainly are.

For the Artemis plan to get funded, we need to ponder at more depth and length *on the remainder of the 19,900 pounds of the package.*

We should first categorize (then prioritize) the types of items we want. The types of items depend on mission objec-tives, which could include these (not necessarily in order of priority):

- life support/survival (top priority)
- oxygen production
- energy production
- communications infrastructure
- transportation infrastructure
- finding lava tubes
- equipment repair and maintenance
- health management (e.g. excercise, medical)
- consumables management
- temperature control

We need to decide the priotirities of these objectives, some of them are inter-dependent. What that then means is we need to design a model of what functions we want the post-Mission-2 base to perform and how these functions interact.

- The items from the master shopping list should be categorized under an agreed heading.
- Then the weight of the items in each category needs to be estimated.
- Then we can have a focused debate on the relative importance of each of the item types with respect to the mission objectives, and the cost of each item type in terms of its weight and volume.

Ten tons or a hundred, or one -- many times?

Arthur (apsmith@aps.org)

Nice outline there. Is this premise of 10 tons of cargo the right starting point though? We would certainly be better off with *100* tons - the more resources we have, the faster we can grow. On the other hand perhaps we can get by with just 1 ton packages, delivered more frequently?

What *are* the practical limits and considerations on the mass we can get to the lunar surface? If we can get anywhere starting with 1 to 2 tons of payload, we might be able to avoid the heavy-lift and assembly pieces that seem so expensive. Maybe then mission costs would be in the hundred million range instead of billions? Even manned payloads -- do you really need much more mass than a typical SUV for a 3-day trip for 3-4 people (assuming things have been arranged on the ground ahead of time)?

Do You Want to Join in Discussions Like These?

This fascinating discussion took place 4/29-5/5/2001 on the Artemis Discuss List. If you are a Moon Society Member (and thus also an Artemis Society Member) you can take part in the creative and constructive mind-stretching, preconception-adjusting fun activity simply go to the following web page and follow the easy instructions:

http://www.asi.org/adb/09/03/artemis-list.html

Romance to Reality: Moon & Mars Expedition & Settlement plans

http://members.aol.com/dsfportree/exannotations.htm

by David S. F. Portree <dsfportree@aol.com>

An extensive Bibliographical List of Papers, most online, on the topics of Moon & Mars Expedition & Settlement Plans. 230 some papers in all, by all the brightest minds in the business. These papers cover the whole range of brainstorming from 1950 to the present. *A tremendous Resource!*

The Editor's 2 Cents: "Overnighting" and Early Lunar Stone Age Industry Attempts

Having been brainstorming how to grow a starter Moonbase for a couple of decades, here is my attempt to answer Greg's Question.

In the light of the major "unattainments" of the Apollo Mission Series*, the first strategic goal of a back-to-the-Moon-to-stay effort should be to demonstrate the capacity to "Overnight" and to do it productively. So whatever we need to do this for the first time, or do it better than the first time if the first mission succeeded in this major, major feat, should be unquestionably our Number One Priority. The previous posts do not mention this milestone, or take it for granted. "Overnighting Ability" is the first holy Grail of Moon Missions very much on a parallel with "Breakeven" for Nuclear Fission Experimenters. Accordingly, here is the Cargo Manifest for Mission #2:

- Energy Production Equipment
  - Solar Concentrators
  - Solar Panels
  - Nuke
- Energy Storage Equipment
  - Fuel Cells, more of them

Next Priority should be to prepare for more serious lunar industry: handling and sorting regolith; lunar oxygen production; cast basalt products; powdered iron products

- regolith handling equipment or more of it
  - regolith sifting equipment
  - sortation bins galore
  - compacting, sintering, equipment: molds
- magnet to extract pure iron fines
  - equipment to test powdered iron products

Relevant MMM Back Reading Online

MMM # 88 SEP '95, p 3. Starting Over on the Moon: I. Bursting Apollo's "Envelope"
==> http://www.asi.org/adb/06/09/03/02/088/bursting-envelope.html

MMM # 90 NOV '95, p 7. Overnighting on the Moon
==> http://www.asi.org/adb/06/09/03/02/090/overnight.html

MMM Editor & Artemis Society figure in recent Space.com Europa article

In early June, we received a phone call from Space.com contributor, Don Lipper, who had stumbled across an article we wrote, in the MMM ADB archives. We talked for almost an hour and the result is:

http://www.space.com/missionlaunches/missions/europa_colonies_010606-1.html

Meandering *through the Universe*

A Column on the Cooperative Movement on the Space Frontier © 2001 by Richard Richardson

Temper Tantrums over Turf

"Stay outta *MY* room! ... Mom, he's gonna wreck my stuff!! Stop it ... *STOP IT !!!*" -- Almost (though not quite) a direct quote from NASA on the subject of Dennis Tito visiting *THEIR* space station. Somehow, there just isn't much dignity nor respectability left to NASA's thin and sensitive hide. One could hope that just as with the Wizard of Oz, the U.S. space agency would finally come out from behind the curtain, admit that it isn't the be all and end all of supreme wisdom and power, and take on a modicum of humility and sense. But the Wiz was fantasy. Things like that seldom happen in real life, so I'm sure not going to be holding my breath.

Big Brother (yes, I'm still referring to NASA) had an exhibition truck in my neck of the woods a while back. Lordy Mercy! It's hard to imagine the billions of dollars they must have expended ... to be able to come up with something *SO BORING!* If anyone went away from the presentation inspired about space then somebody sure must have fouled up, because something so uninspiring couldn't have been created by accident. Anyway, they don't have to worry about me, it was all I could do to not cry about people wasting time, money, energy, and effort on space after I saw the "Good News" presented in the NASA van. Sheesh, I'm cutting them out of *my* will!

Revisiting the Moon Treaty

I was reading about the history of the Moon Treaty the other day. Although one can understand the concerns addressed in the document, hindsight would seem to indicate that, as written, it never was, nor ever could have been the right solution. And in the light of current circumstances it would seem to be less appropriate than ever before. I suppose it may turn out that the course of space settlement history will be such that the current Moon Treaty will just be ignored until it is completely plastered over by an overwhelming body of precedence and practice. Still, it seems like it would grease the gears of space development a bit if we could create a new and more reasonable Moon Treaty/Outer Space Treaty and get it generally endorsed.

Here are a few brain storms from my corner for what such a treaty might consist of:

1. A procedure somewhat like that used in the past for frontier homesteading as the process for the distribution of ownership of outer space land surface properties.
2. No Earth imposed taxes or fees for the first ***x*** number of years and then *maybe* something like 1/1000 (0.1%) of net profits to be paid to the U.N. after the grace period. No other Earth authority may impose taxes or fees at any time. The U.N. must designate and use 100% of this money for development in poorer nations or allow poorer nations to use it to purchase outer space properties ... something along these lines.
3. The nation of origin of the citizen or business which is generating the net profit in space will be responsible for the collection of the 0.1% (or what ever) tax and for transmission of the full amount to the appropriate office of the United Nations.
4. Pursuant to the forgoing, the only other imposed regulation of activity would relate to security of nations on Earth, security of others in space — including security of the property rights of others in space, preservation of historic sites, and matters relating to visibility of activities from and/or their consequential effects upon the Earth.

Well, they're thoughts ...

Now, off to Europa

And now, some thoughts about the problem of communicating with an under-the-ice Europa explorer: The parameters are that Europa is still a very remote corner of our solar system, that a mission to explore beneath its icy mantle will be expensive by any real measure (whether or not it is expensive compared to any other mission), and that those with a broader, clearer vision of the future will want to successfully obtain the potential data from such a mission pretty earnestly and eagerly. Also, until the data is gathered and analyzed, the conditions to be encountered will be largely unknown.

A threefold approach would seem to be called for in order to ensure the maximum likelihood that the data would be successfully returned and the maximum amount of useful data could be gathered. Since it will be unknown (until after the data starts to come in) whether electric or electromagnetic signals can penetrate the medium beneath the ice (if, indeed, there really is a medium beneath the ice), a well tested spooled cable with several kilometers range would seem to be a must.

Second, if there is, in fact, a fluid medium then there is a fair chance that a sonic communication system working rather like whale song using the fluid itself as the communication link could allow the explorer much greater range and mobility (than the cable) — if the environment is not overloaded with other sounds, e.g. from flexing ice, living creatures, volcanoes, etc. It would seem that such a capacity could be added for not too much extra cost and have a reasonable chance of not only working but of proving quite versatile — and therefore valuable to include.

The other communication method would rely on the explorer returning periodically to the underside of-the-ice crust terminus of the link to the surface to download the data it had gathered while out and about. This would require a pretty sophisti-

cated navigational ability. But that would, in and of itself, greatly increase the quantity and quality of useful information which could be collected by allowing the explorer to map the locations of the data samples it gathered.

[Ed.: Those interested in brainstorming sub-ice exploration of Europa can check out this site:

http://www.klx.com/europa/

This is the "Europa Icepic" website: The Europa Ice Penetrator Internet Committee (IcePIC). There are links to other Europa sites and instructions on how to get plugged into the email discuss list.

Sorry NASA! It's just your month!

Poor NASA! I don't usually pick on them too much, but I guess this is the month. I just read that NASA is pursuing a (new) Space Launch Initiative which is "a research and development effort designed to substantially improve safety and reduce the high cost of space travel." Find out more about this at www.slinews.com and www.spacetransportation.com. (Note that I haven't tried these web sites myself ... so good luck.) Isn't this the very procedure by which NASA wasted billions of dollars and ten years of our lives a decade ago?! And didn't they use this process to effectively keep the feet of pip-squeak space transportation designers tied to the ground?! What's the difference this time? What is the new U.S. administration going to do about this? What should they do about it? What should *WE* do about it?

I also found reading about comet LINEAR (C - 1999 S4) pretty interesting. This comet broke apart as it neared the sun not long ago and totally disintegrated last May. The most interesting thing to me, though, was that it was estimated to have contained about 3.6 million tons of water. It probably contained many other volatiles as well. And it conveniently delivered all of this good stuff to the inner solar system. None of this constitutes a big story, I suppose. But, nonetheless, it is a vibrant reminder of the resources available to space settlement and development if we will only learn to reach out and take hold of them. It's one more sign post on the road telling us, "Yes, if you are willing to put forth the effort, you can get there from here!" **<RRR>**

Richard's homepage:

http://richardpatricia.homestead.com

What is a Fabber? Do you know?

If this is a new one for you, it won't be for long. A.Fabber is part of a new kind of manufacturing / production technology ideally suited for the space frontier as it could drastically minimize the tonnage of capital manufacturing equipment we need to export to the Moon. Check out:

http://www.Ennex.com/fabbers/fabbers.sht

Please send mail to KokhMMM@aol.com or by stamp mail to the "submission address" listed on page 1. - Two letters this month:

Response on Attitude towards Nuclear Power and the need for Public Education

You had replied to me: "I am not a nuclear "fan". I do realize that it is an important option that can make some things doable that will be harder or even impossible to do otherwise. I recognize the public fear and have no confidence in our ability to reedu-cate the public. That's why I push so hard for the consideration of a lunar thorium-based nuclear fuels industry as a priority industry. It may be unreal-istic for the near term, but I think it needs to be looked at. Otherwise, I agree, the public may well succeed in slamming the door in our face."

My Comment: I might be described as a nuclear power fan, but in a rather modest way. Not that I think it is perfect by any means. Only that I think nuclear power is in many respects cleaner than, and safer than, fossil fuels for Earthbound power generation, as well as for space applications. As Jerry Pournelle pointed out once in a panel discussion at a science fiction convention, you've got to compare a system to available alternatives. Including the alternative of not having the power available. (Talk to Californians, right now.)

As for educating the public, sometimes I want to throw up my hands myself. But I believe that the MAJORITY of the public can listen to reason, and will do so if the facts are presented clearly. We need more scientists like Carl Sagan and Gene Shoemaker, who are both able and willing to explain scientific concepts clearly to a general audience. Those two did it so well, that lay audiences were not only willing, but INTERESTED in listening to them.

More important, I think we MUST educate the public. Eventually, if the public doesn't understand enough about the scientific process, and how to distinguish science from pseudoscience, I think technological civilization on THIS planet is doomed. And without technological civilization on this planet, I don't think we'll manage to establish sustainable settlements off Earth. Because it's going to take some time, and a nontrivial amount of support from Earth, before extraterrestrial communities have enough population, and enough manufacturing and other facilities, to sustain themselves in the event support from Earth is cut off.

Larry Jay Friesen
<ljfriesen@ev1.net>

MMM #143 articles on Phobos and Deimos

May 10, 2001

I finally had a chance to read your commentary in the March issue about a "forward base" on the Martian moons. I always enjoy your unconstrained thinking and clever ideas, but I think you may be getting a bit strident and carried away lately. Perhaps it is a sense of frustration that I notice in some of your recent articles.

For example, on page 1 you suggest making "demands" on mission planners and describe the need for data on Phobos and Deimos as "desperate". Not just a little hyperbole there, eh?

As a satellite engineer, I would question the practicality of justifying a base on a Martian moon for the purposes of a more unified approach to robotic exploration of Mars. Certainly, setting up such a base has political ramifications relative to the commitment to the human exploration of that planet, and I acknowledge that that may indeed be the main point of your article. But such a viewpoint must be based on some notion of reality, and the reality is that there is no way that building probes on Deimos will be less costly than building them on Earth.

Setting up a manned base on Deimos just to integrate, recycle, and control surface probes is going to be vastly more expensive than doing that from Earth. There is no real technical advantage, and the costs of establishing a manufacturing infrastructure locally will be prohibitive. Setting up a base with "a supply of programmable landers" (page 5) needs to be compared to other options such as shipping multiple landers to a Mars polar orbit and setting them down as determined by previous missions. This is another way to work around the Earth-to-Mars launch window constraint.

I could go on, but I simply wanted to point out that while I support your effort to change the thinking about how to explore Mars, there are still some real technical constraints that you may need to consider. Additionally, I think and that there are other approaches that could return the same sort of data, but they may not meet your need for redirecting the political winds.

Before we can achieve the goal of an "uncancellable opening of the Mars Frontier", we need a sound economically justifiable reason why we must do so. If not, the reasons will be based on science and politics, and it appears to me that neither of those is adequate for Mars advocates.

Michael Mackowski,
<mackowski@specastro.com>

EDITOR'S RESPONSE: I could hardly agree more with the point of your last paragraph. We do need to establish an economically justifiable reason to embark on an "uncancelable opening of the Mars Frontier" - my words. That is my problem with Zubrin's and the Mars Society's political push to get a government commitment to a manned Mars program. We have homework that WE should be doing first, before we dare demand anything. That homework includes what is called a "discovery phase." What is there on, or about Mars, that would make opening the Mars Frontier an economically viable proposition? Are there unknown and unsuspected resources on Mars that would both greatly reduce the costs of such an effort and generate cost-defraying income?

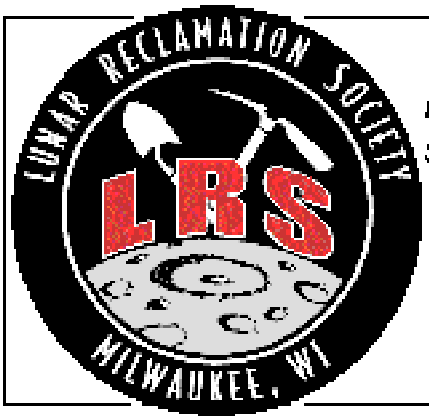
We have a start on such a "discovery" project, but only a start. The pro-Mars community has collectively brainstormed aerobrake technology. Zubrin himself has introduced "live off the land" "in situ" production of fuel needed for a return to Earth from Mars atmosphere. These help reduce costs considerably. Yet very considerable costs still remain.

When it comes to establishing a permanent presence on Mars, we have much to do in locating, quantifying, and qualifying resources such as metal deposits, permafrost water ice, and possible ready to use lavatube shelters.

That is the whole point of my essay! At one or two missions every 25 months, and with response time to data from ongoing missions for the purposes of designing new ones added in, this "discovery phase" is going to stretch out decades. I tried to sketch out an alternative "meta-mission strategy."

I agree with you that the establishment of a major manufacturing operation on Deimos would be both prohibitively expensive and itself consume years of effort. In an effort to fit the essay into the space I had allotted for it, I may have been too economical with my words. That is not at all what I was calling for. IF there are resources on Deimos that can be turned into crude low-performance-required products needed for the Deimos to Mars orbit or Mars surface mission WITH the kind of regolith-handling technology that we propose to develop for the Moon regardless of whether or not it is useful on Mars mini-moons, then that would be worth deploying and could probably be put in place at a worthwhile cost IF that resulted in the time-telescoping of the series of missions needed to earn us the information we need to make this economic case.

As to the stridency of my tone towards NASA. Please do not read that as hostility. Read it as deep disappointment that a once proud agency now habitually underperforms. NASA seems to have no drive, no élan, none of its youthful "can-do, sir!" brash confidence. This is not entirely NASA's fault. The agency is repeatedly hamstrung by both successive Congresses and successive Administrations. If the Administrator were to protest "Now see here, senators, etc., we demand a full commitment to this and that, and will not accept this or that cut," the only result would be his summary firing. -- PK.



The Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

www.neighborhoodlink.com/org/lunarbase

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

LRS OFFICERS - (area code 414) through 10/'99

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(* LRS Board Members)

LRS NEWS

• **The LRS Website has been updated:** There is now a link at the top of the home page to a List of Recently Updated & New Pages (with update or creation dates). Now you will be able to tell at a glance what is new. Do check it out. We have been adding some White Papers among other things, and keeping the Meeting Page current.

• **A Field Trip to Argonne National Laboratory?:** 13 members previously visited this facility 25 miles SW of Chicago on June 16th, 1990, eleven years ago. This was the popular suggestion at the May 12th meeting. In 1990, we had to inform Argonne of the names and addresses of all participating, two weeks in advance. Peter is to make inquiries and report at the June meeting. As to dates, three possibilities were suggested, in this order of preference: July 21, July 28, August 4 - all Saturdays. The trip would be conducted as a car pool. Meanwhile you can whet your appetite by taking a virtual tour of this legendary place: http://www.anl.gov/OPA/vtour/

• **Do check out our MMM PDF experiment:** go to:
http://www.lunar-reclamation.org/mmm_pdf_test.htm
While the motivation behind this new publishing venture was to allow our many overseas subscribers and members to get MMM at a reasonable price, this option will become available to any member or subscriber who prefers it. PDF editions, other than the May and June issues, for test purposes, will only be accessible from a password-accessed web page and possibly also by email to a maintained list of those current in their membership and subscription dues (if we have on file, an agreement not to forward the file to others, except as one-time samples.)

LRS JUNE Events

Saturday, JUN 9th, 1-4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G110** (lower level, NE part of Mall) near the ground-level entrance below General Cinemas.

• Our next Regularly Scheduled Meeting will be on **September 8th** - Have a good summer! And do come back refreshed and energized!

Collaborating Milwaukee Area Space Groups

Moon Society of Milwaukee c/o Peter Kokh
414-342-0705 - KokhMMM@aol.com

http://chapters.asi.org/milwaukee/
(freshly updated)

MSM currently meets jointly with LRS

Wisconsin Mars Society c/o Matthew Giovanelli
7133 West Wells Street, Milwaukee, WI 53213
414-774-8952 - chooy@execpc.com

http://chapters.marssociety.org/usa/wi/

WMS usually meets at address above on 3rd Sat. 1pm contact Matt by phone or email address above

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

We meet the 3rd Tuesday of the month at **7-9pm**

June 19th MEETING at the Stoelting House in **Kiel**
July 17th at Foerster Academy of Dance, **Sheboygan**

Recent SSS Events:

- Astronomy Day, April 28-9, 2001) We shared a table with the Sheboygan Astronomical Society at the Sheboygan Mall
- We also had a table at the Rockets For Schools event at the Sheboygan Armory on May 19th.

U.S. CHAPTERS

NSS Chapter Events

MMM 9 Chapters Strong

Space Chapters HUB Website:

http://www.nss.ac/hub/

MINNESOTA

Minnesota Space Frontier Society

c/o Dave Buth, 3331 Cedar Ave. S. #2
Minneapolis, MN 55407

612-721-4772 (Dave Buth) 612-375-1539 (Jeff Root)
Email: mnsfs@freemars.org

http://www.FreeMars.org/l5/index.html

note: l in /l5/ is a small L, not a 1 (one)

Upcoming MN SFS Events planning:

- ConVergence (July 6-8, 2001) http://www.convergence-con.org/
- ASP (July 13-18th, 2001) http://www.aspsky.org/meetings.html

Pix from MarsCon

http://marscon.org/m01/conpix/

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 [new]

☞ Monthly Meetings, the 4th Thursday **7-9:15 pm**, **rm 106**, **Wilker Hall**, **Baldwin Wallace College**, **Berea**
NEXT DATE: **June 28th, July 26th**

MICHIGAN

Ann Arbor Space Society

P.O. Box 130118, Ann Arbor MI 48113-0118

John Wolter (734) 665-1263 johnswolter@provide.net

☞ 2nd Wednesday (**June 13th, July 11th**) **7 pm**, MEETINGS at members' homes. Contact above

CALIFORNIA

OASIS

OASIS: *Organization for the Advancement of Space Industrialization and Settlement*

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

http://chapters.nss.org/oasis

Odyssey Newsletter Online

http://www.geocities.com/CapeCanaveral/Lab/4005/articles.html

☞ **Regular Meeting 3 pm 3rd Saturday of each month.** Information: OASIS Hotline, 310/364-2290, website.

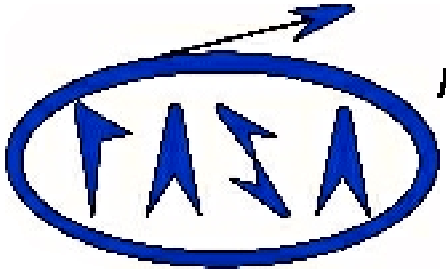
- **July 21st** -- OASIS Monthly Meeting, 2 p.m. Redondo Beach Public Library, Main Branch.
- **August 18 --** OASIS Monthly Meeting, Location TBD.

• Recurring Events

- **Daily, except Mondays *(call observatory for show times)*** -- "Oceans of Mars," live, multi-media planetarium show. Griffith Observatory, 2800 East Observatory Rd, Los Angeles. Admission: $4 for adults, $2 for children, $3 for seniors. Information: 323/664-1191 or http://www.griffithobs.org/.
- **Fridays, 7:00 p.m. --** "The Night Sky Show." Fridays, 8:00 p.m. -- Guest lectures. Santa Monica College John Drescher Planetarium, 2nd Floor of The Technology Building, 1900 Pico Blvd. $4 admission per show or $7 for both. Information: 310/452-9223 or http://www.smc.edu/events/weeklyeven.
- **Fridays** -- *Mike Hodel's Hour 25* webcast. The world of science fact and fiction with interviews, news, radio dramas, artists, writers, stories, reviews, and much more. Information: http://www.hour25online.com/

• On the Oasis Website:

- **AgamemCon V Gallery** -- Check out the photos on our Gallery page
- **Is Anyone Out There?** -- Read Craig Ward's excellent article in the April Odyssey Online
- **Diane Rhodes' April *The Surf Report*** -- Several sites with "pretty and pretty interesting" pictures worth checking out.



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://region.philly.com/community/PASA

Note NEW WebSite - CAPS required [PASA]

☞ **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 17 th street side and go **left**. Look for table sign. Parking at Liberty One on 17th St. Verify meetings with Earl.

NEXT MEETINGS: **July 21st, August 18th**

Report by PASA President Earl Bennett

• **May Reports:** Serveral members where unable to attend but we had reports from: *Dorothy Kurtz* who gave a report on her and Larrys' trip to Canada and the National Museum of Science and Technology in Ottawa. There was a class in the Space area at the time and they had a live Q&A with an astonaut in space about using their Arm. The museum had other space exhibits aswell as other technologic exhibits with a Canadian perspective. They enjoyed it and recommend it.

Larry Pezutto gave a report on the website that evolved into a discussion on the sites operation and links with Michelle Baker and Larry leading the talks . See end of report for some sites.

Hank Smith told us of his travel plans for Sci-Fi events he'll attend and updated us on the speaker areas he needs people for. By happy coincidence I remembered that *Tom Ligon* had given a talk and demonstration of a fusion reactor serveral years ago and Hank will consider him as a speaker or panel member or both. He (Tom) also has written on multi-element fuels and alternative spacecraft structure design. Speakers and ideas wanted! Hanks e-mail is hankscifi @hotmail.com . See www.milphil.org for World Con registration and other data.

Michelle Baker came with her report on the NSS chapters website (nss.ac) and its large amount of organizational discourse. She also brought several publications that had space related material: P.N.C. Bank "The Art of The Relaunch" on buisness relaunching with the Shuttle launch on the opening page; Toastmasters Magazine presenting "What I Learned from Star Trek Captains" and Space Illustrated with Dennis Tito on the cover. The significance is the audiences these are for with the first two being professionals in the general populous. Space Illustrated is aimed at the general public as well.

• **SETICon01 and SSI Summary Sessions** Earl and Michelle^ where attendees at the *Seti League's* first technical symposium and annual meeting with great technical presentations on Saturday April 28th with both radio and optical seti being discussed with speakers coming from Austrailia (optical) and England (seti & radio astronomy throughout Europe). We went to the dinner and also met executives from the Society for Amatuer Radio Astronomy, a U.S. based organization. Check the Seti League site at the end of this report. Note that this is not "Seti @Home" but a grass roots group of individuals with telescopes of various kinds networking to look for extra terrestrial signals and develope the framework such a group can use.

SSI, which developed as a result of an early seventies seminar long thought experiment concieved of by Gerard K. O'Neill, held its biannual conference from May 7th to the 9th. This time Gary Fisher was the only member able to attend the sessions which he described as "great" which also desribes the summary sessions which Michelle and I came to see. Although there was a great number of excellent presentations I will mention only the ongoing work by *Leik Myrabo* on light propelled craft "Beam Propelled Lightcraft and Lightsails: Latest Developements" including a talk on sails of molybdenum and carbon compositions (foils , Matrices, etc.) glowing white from 55 Kilowatt laser impingment and the scalability of the craft he is working on.

There was also a report on *Derek Tidman's* idea "Progress on the Spiral Slingatron and its Possible Developement Path" giving a taste of the session information on his concept for imparting acceleration to an object by "pushing" it arround in a spiral. This is grossly oversimplified but the work is an extension of the earlier work on the elegant idea of imparting motion through continuos low level energy inputs in a cyclic manner. Mr Tidman also received a financial award in recognition of his ongoing work. We had the good fortune of having Freemsn Dyson sit next to us. Fantastic!

• **Websites** -- Sites related to the reports above:

National Sace Society Chapters: www.nss.ac
Seti League: www.setileague.org
Space Studies Institute (SSI): www.ssi.org
World Science Fiction Conv: www.milphil.org

Aditional links are at our site at the beginning of this report. -- Submitted by Earl Bennett

OREGON

Oregon L5 Society, Inc.

P.O. Box 86, Oregon City, OR 97045
voice mail / FAX (503) 655-6189

http://www.OregonL5.org/

Allen G. Taylor <agt@transport.com>
Charles F. Radley <Cfrjlr@aol.com>
Bryce Walden <BWalden@aol.com>
(LBRT - Oregon Moonbase) moonbase@home.com

☞ Meetings the **3rd Saturday** of each month at **2:00 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**
NEXT MEETING DATES: **June 16th, July 21st**

ILLINOIS

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

Larry Ahearn: 773/373-0349
Call Larry for MEETING INFORMATION

http://www.astrodigital.org/csfs/

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Bill Higgins
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higgins@fnal.gov

Herald Schenk
Sheboygan, Wi
hschenk@excel.net

www.jpl.nasa.gov/ambassador

Future Civilizations in Space: Life in the 22nd Century: An Exhibit by Roy Scarfo

Press Release: Downingtown, PA – An exhibit of thirty-two illustrations that produces a picture of motels, hotels, and cities in space and beneath the oceans will soon be making its way on tour throughout the U.S. Science fiction? "Not so," states Scarfo, originator of the exhibit. "Travelers are lined up for tours into space, a hotel entrepreneur is investing over $500 million to expand his chain into a lunar realm. Other major investors are planning to back space travel. Landings have been made on asteroids, and we expect to be on Mars within twenty years."

The exhibit is based upon revolutionary break-through developments taking place today. Spaceports, aerospaceplanes that take off horizontally carrying two to three hundred passengers, orbital space hotels, lunar villages, and cities on Mars are only a part of the exhibit. Spending a night or two at a space motel, or at an undersea motel experiencing the beauties and wonders of the ocean deep are also shown as possible forerunners of space and undersea cities of the future.

Inside-out worlds with 10,000 to a million people created in hollowed asteroids, spaceships larger than the Queen Mary, a lunar city with universitites, sports complexes and even a site for the first Lunar Olympics are shown in the exhibit.

"Future Civilizations in Space" is based upon the book "Beyond Tomorrow" by Dr. Dandridge Cole and Roy Scarfo - the product of many years of careful factual scientific study and evaluation concerning the future of mankind. Many prominent scientists have made contributions to many of the illustrations originated by Roy Scarfo, one of America's most prominent futuristic thinkers and space artists.

Scarfo has been described as "a citizen of the firmament of man's imagination and of the worlds beyond." For sixteen years he was the creative art director for General Electric's Space Division. He was a science and space art consultant-illustrator for The New York Times for over ten years. Scarfo has collaborated with many of our country's scientists such as Werner von Braun, Isaac Asimov, Willy Ley, and Dr. Dandridge M. Cole. His concepts have appeared in over forty books and in every prominent magazine and newspaper throughout the world including his own book Beyond Tomorrow. His TV credits include "The Sky Beyond", and "The 20th Century" and "The 21st Century" with Walter Cronkite, and the TV one-hour special based on Alvin Toffler's best seller "Future Shock". Scarfo's first exhibit "Beyond Tomorrow" opened the International Space Hall of Fame in Alamagordo, New Mexico.

The exhibit "Future Civilizations in Space" is inspiring yet frightening, scientifically plausible yet emotionally staggering. It is for those who are interested in hopes and dreams and who care what happens to civilized society, to their children and to the human race in the tomorrow and beyond.

The exhibit will open with a private showing at the Scarfo Gallery in Downingtown, Pa, on Sept. 1, 2001, before going on tour.

Amateurs Built the Ark.

Professionals Built the Titanic

NAME _____ ÷

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PHONE #S _____ ÷

❍ $35 **NATIONAL SPACE SOC.** dues w. **Ad Astra**

❍ $20 NSS dues if under 22 or over 64. *Must state age* ___ NSS, 600 Pennsylvania Ave SE #201, Washington DC 20003 (Make payable to local chapter *for 1st year **free** local dues*) (Offer not honored by Oregon L5 Society)

❍ $35 **MOON Society** dues with **MMM**

❍ $25 **Moon Society** dues for those already getting MMM Moon Soc. Membership, PO Box 940825, Plano, TX 75094

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Member Dues -- MMM/MMR Subscriptions:

Send proper amountto address listed in chapter news sections.

=>*for those outside participating chapter areas* <=

❍ $15 **Individual Subscriptions to MMM/MMR: Outside North America** ❍ $45 Surface Mail -- Make payable to "LRS", P.O. Box 2102, Milwaukee WI 53201

ANN ARBOR SPACE SOCIETY
❍ $10 regular dues

CUYAHOGA VALLEY SPACE SOCIETY
❍ $10 presently; Raise to $15 under consideration

CHICAGO SPACE FRONTIER L5
❍ $15 annual dues

LUNAR RECLAMATION SOCIETY, INC.
❍ $15 regular, ❍ $20 family, ❍ $12 student / senior cit.

MINNESOTA SPACE FRONTIER SOCIETY
❍ $20 Regular Dues

OREGON L5 SOCIETY
NOTE DUES RAISE: ❍ $23 for all members

O.A.S.I.S. L5
❍ $18 regular dues

PHILADELPHIA AREA SPACE ALLIANCE
❍ Annual dues for all with MMM $16, due in March or $4 times each quarter before the next March

SHEBOYGAN SPACE SOCIETY
❍ $15 regular, ❍ $10 student, ❍ $1 / extra family memb
"SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake, WI 53020

Moon Miners' MANIFESTO

Lunar **R**eclamation **S**ociety Inc.
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