"Expanding the Human Economy through Off-Planet Resources"

Moon Miners' Manifesto

& Moon Society Journal

#147 August 2001

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In Focus ▣ Mars Analog Stations are Proving their Value

Maintaining "Simulation" or "Sim"

For two months each summer, six scientists and engineers conduct a sustained program of field exploration in the 75 °N polar desert of Canada's Devon Island. They do this while operating under the same operational constraints as a human expedition exploring Mars. They live in a combination habitat/ laboratory module that is an architectural duplicate of what is planned for Mars.

No one goes outside without wearing a simulated spacesuit, and spending ten minutes in the airlock going each way. All communication between spacesuited crew members is by radio. All communication with "Mission Control" in Denver is via radio messages with a built-in 8 minute time delay.

Water is rationed tightly. While the outside environment only actually poses the ordinary Arctic hazards of weather, polar bears, logistical cut off, etc., they behave as if it is as lethal as Mars. Under these conditions, they have begun developing the book of field tactics needed for humans on Mars

This is a brief statement of the "sim" rules, rigorously followed, have allowed the M.A.R.S. teams to validate expected operations procedures, and, more importantly, ferret out things that have not been foreseen, or fullly thought out. Progressively increasing simulation fidelity, they explore how much science can accomplish under "sim" constraints.

Instead of daily showers, they sponge bathe every other day, using about two gallons each, much better than the Navy showers, which take about six. These tests show that Mars crews could operate with a water ration less than half that assumed by NASA, without cost to morale. This will reduce the mass, and thus the price, of a human Mars mission.

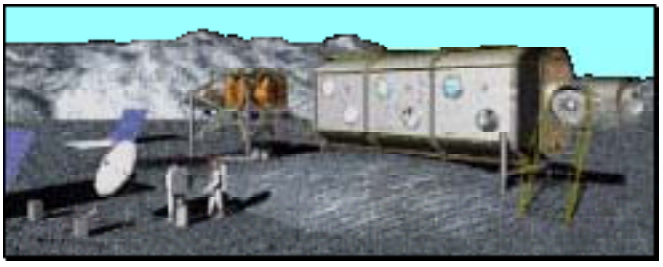
Humans and Robots

Under Sim conditions, they do broad-ranging field surveys, cross or climb over very tough terrain, find stromatolites and cyanobacteria, and deploy seismic arrays and telerobots. This would not have been possible using strictly robotic means.

Human resourcefulness can allow recovery from apparent disaster -- last year's feat of erecting the arctic station even after some paradropped parts and equipment were damaged beyond repair, thanks to crude substitutes from nearby Resolute. On Mars, this might not have been enough -- good reason to erect a forward base on Deimos first. [=> p. 2, col. 2]

Two Mars Analog Stations, None for the Moon

Last year, the Mars Society, with funds from excited sponsors and individuals, fabricated a Mars Hab-Lab analog station and erected it on Mars-like terrain on Canada's far north Devon Island. This year they have built another for the Nevada desert. At right is what a similar Artemis Moonbase analog station could look like, given an equivalent effort.



Moon Miners' Manifesto

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® 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.

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fi IN FOCUS Editorial continued from p. 1.

The crews compare performance of humans and robots side by side under varied conditions. A human explorer can climb up boulder-covered slopes to attain an elevated position -- high ground from which to survey the surroundings. Humans so vastly outclass robots as investigators that it's a waste to time to send a robot to sites accessible by humans. But tests show the value of pairing human explorers with tethered telerobots that can go places difficult for suited humans to access: e.g. underneath the habitat or down a crevasse. If the robot rover gets stuck, one can use the tether to jerk it free.

Everyone cooperates with tests that attempt to find out what kind of people make the best rover operators, and to see if such abilities could be tested for in advance. They test done under realistic fatigue conditions. EVA teams prove necessary for timely rescue and recovery from occasional mishaps.

Miscellaneous findings: each crew should include at least one person skilled with a musical instrument. Posters of rugged lifeless scenery on Earth are valued more than lush paradise scenes.

Meals: dinner together is a mandatory attendance group event. Resourceful cooking with canned goods and room-temperature preservables. The 2001 arctic field teams progressed from eating precooked and packaged meals, like MREs or TV dinners ("to save time") to cooking every day. It'd be very bad for morale for a crew of a 2.5 year Mars mission to eat MREs every day. Real cooking is an important ritual.

The first crew established the value of single person all terrain vehicles. On Mars, they'd scout the way for the bigger pressurized crew cabs. As ATV's can carry two in emergency, there seems no need for the Apollo type 2 man open dune buggies.

Simulated Mars Suits are needed to duplicate is the loss of mobility, agility, dexterity, vision, and general sensory awareness that a Mars explorer on EVA might experience. The 40 pound suits are not real spacesuits, but elaborate nevertheless, looking somewhat like Apollo gear, with an electric powered air ventilation system, voice activated dual band UHF/VHF radios, and a water provision system with bite vales inside the helmets. It is awkward to write in a suit, so the capcom takes notes for the EVA team.

5 psi (3 psi oxygen, 2 psi nitrogen) is used, as on Skylab. Thus no prebreathing is necessary. Instead, the only delay during egress will be about a 5 minute wait to allow for airlock pumpdown.

They quickly learn that a marginal power supply will not do and could prove disasterous. It is essential that a Mars mission be conducted in a power-rich environment. Here a power shortage is a matter of discomfort; on Mars it could be fatal.

With more Mars Analog Stations in the works, these invaluable learning sessions will continue, and pave the way for success on Mars itself. -- PK.

Urban Lofts & Settlement Style

Part II: More Clues from Loft-Living Styles

by Peter Kokh

In the MMM #136, JUN '01 issue, we tried to sketch out what the "feel" of lunar settlement interiors might be like, taking pages from the urban frontier's "Loft" decorating trends. Loft styles have been called "industrial" and that is fitting considering the origin of loft spaces - former factories and warehouses. But that origin is really incidental and does not get at the essence of the style, which I would prefer to call "direct decor" -- accepting the surfaces of construction materials (e.g. brick, concrete, steel, ductwork, etc.) as they are, not as a substrate for adding layered faux (false) surfaces such as plaster or drywall (sheet rock in some parts of the country) or paneling for walls and ceilings.

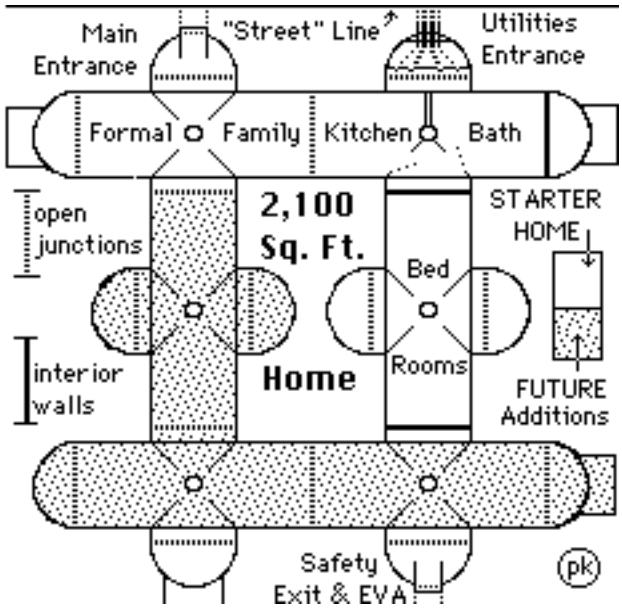
In a Lunar, or Martian, frontier setting, use of "direct decor" would allow faster occupancy, and showcase native materials instead of let's-pretend-we're-still-on-Earth "secondary" surfacing. Thus in addition to having modular habitats ready to occupy much faster, this type of transplanted loft style will go a long way to create unique and genuine Lunar and Martian home decors. But we have not exhausted the list of "Lofty Ideas" worth transplanting.

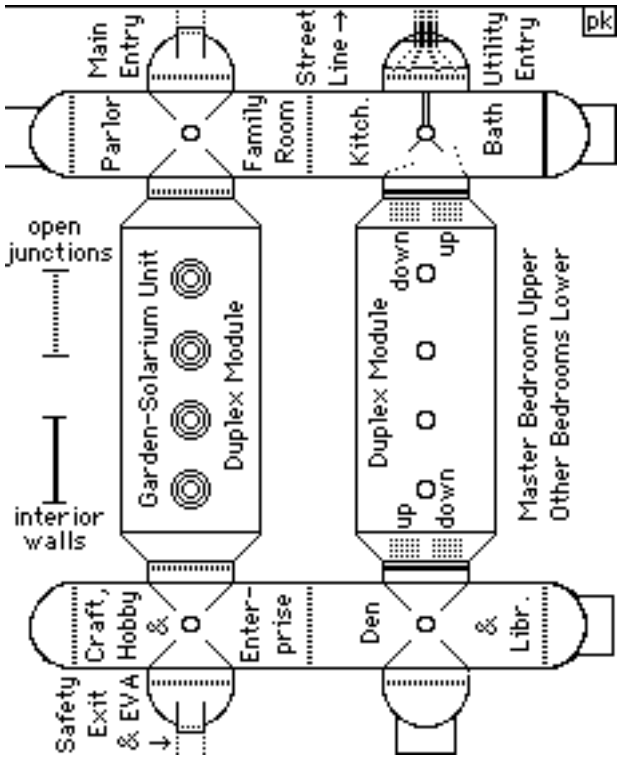
Open Floor Plans for Common Spaces

In the prior article, we suggested a number of ways interior walls could be built to be direct-decor friendly. At the same time, it would be beneficial to pioneers eager to occupy their homesteads quickly, if the amount of interior wall structures needing to be built was kept to a minimum. Of course, such walls could always be added -- and moved -- later as desired with evolving life styles and family needs.

Urban Lofts commonly preserve as much of the "wide open spaces" feeling of their host shell as possible. Interior walls, often not extended up to the ceiling, are provided only where privacy is needed, and then commonly only to interupt sightlines rather than to provide complete enclosure -- for bathrooms and bedrooms. To be sure, "great rooms," "keeping rooms," and other open floor plans for "commons" areas of the home are also growing in popularity in conventional new home construction and also in older home remodeling. The open plan fits today's life styles. Yet many "compartmentalized" older homes, such as my own, have floor plans that resist being "opened up." They serve well enough, however.

On the lunar and Martian frontiers, homestead construction is likely to consist of various assemblies of pre-manufactured modules. In MMM #75, May '94, pp. 4-6 "Lunar Appropriate Modular Architecture" we showed how a "language" of only a few basic module types would permit quite a variety of "expression." Use of modules provides spaces that have identities, even if the passage from one to the other is unrestricted. Such an architecture allows interflowing common spaces easy to individually dedicate to special uses: kitchen, dining, family, library, garden atrium, etc. It also minimizes linear footage of privacy walls needed for bedrooms and baths. Below are some illustrations from that issue altered to show which module seams are open, and which are fitted with walls and doorways. Again, the layout options are endless -- these illustrations are meant to give the reader a general idea only.





For a more expansive floor plan (that of the Lunar Reclamation Society's table-top Moon Base) see:

http://www.lunar-reclamation.org/page11mm.htm

Photos of this display are at:

http://www.lunar-reclamation.org/page12.htm

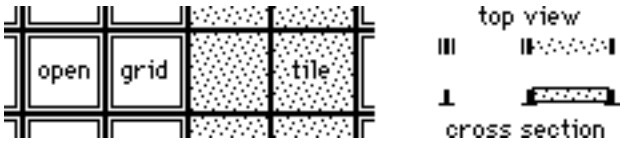
Working with the open floor plan

As is clear from the floor plan samples above, the space within each of the interconnected modules is already "distinctive" by its shape, how it meets or intersects with adjoining modules, and possibly by customer-chosen mold-impression texturing. Each of these is a bonus not all terrestrial urban lofts offer. With this built-in distinctiveness, it is easier to give each space its own ambience and personality.

1. Distinctive Flooring: While pioneers can elect not to build interior walls where privacy is not an issue, they cannot elect not to add flooring unless they wish to confine their walking to a narrow strip along the bottom. This is so because pressurized modules in the full or near vacuum environments of the Moon and Mars must be either spherical, cylindrical, or toroidal to avoid critical level stresses on their structures from interior air pressure. Thus they "come with" curved bottoms. We must add flat flooring. A framing platform of metal alloy or glass composite members has to be installed, on/in which can be set tiles, slabs, or other types of floor panels.

The choice of metal alloy panels restricts the amount of decorative freedom somewhat. Different surface textures can be used, along with contrasting color (i.e. a different metal alloy) "inlay" borders or stripes might be possible.

We recently wrote about using cast basalt tiles, especially wear and abrasion-resistant, for flooring in MMM #135 MAY '00, pp. 7-9 "Cast Basalt: industry perfect for a startup outpost." Here is the accompanying illustration.



Cast basalt tiles are self-glazed -- there is no opportunity to "add" color by glazing. However, there may be room to vary the shading of gray-tones by choice of basalt feed stocks. That color range will be very subtle at best. Perhaps the best option here is to impose distinctive surface textures by varying the mold shapes. One could also vary the size and shape of cast basalt tiles and create patterns in that way.

Once we start producing metal oxides for use in producing better alloys, we will be able to use many of those same oxides as colorants for stained glass and ceramic glazes. That will open a wide range of decorative possibilities.

Panels made of glass composites can be made in various "moontones" by varying the mix from which the matrix glass is formed. Once we are able to cast clear or transparent matrix glass, then we could add color by using metal oxide powders to dope the glass batches used for making the glass fibers that give the composite its strength. Then we might also play around with combing or otherwise arranging the glass fibers in the matrix to give distinctive "grain" or other patterns to the composite. Nothing like this has yet been tried as glass composite research has been stuck in the lab, totally ignoring a potentially tremendous Earthside market for products like boat hulls, architectural elements, and high end case goods furniture items (where appearance, not price, is important.) We wrote about that line of terrestrial R&D in MMM #16, JUN '88 "Glass Glass Composites."

2. Arrangement of Furniture & Furnishings: even if we pass on the opportunity to create extra distinctiveness of continuous areas by playing with flooring options, we can easily create distinctive "room settings" by simply clustering furniture and furnishings into cozy groupings. Creating a focal point for each setting will help. We are used to doing this here on Earth. Focal points can be a picture window, a fireplace, a catch-your-eye painting or sculpture, or a beautiful area rug. In time, Lunan pioneers will create enough home grown options to do likewise. If there is a generous "heirloom allowance," allowing each settler to bring along one personally special item from Earth within certain reasonable weight and volume restrictions, then a painting, a rug, or as piece of sculpture from "Old Earth" could be used for such "focal points."

3. Using Accent Colors: On Earth, many homemakers in recent decades have chosen to go with neutral or monochrome color schemes. Some even go so far as to profess a certain "superiority" for such choices. That is a very euphemistic way of diverting attention from their fear of being able to handle color in a non-gaudy way. We humans see in a full range of colors, and *enjoy* them. Not to play to that pleasure within our homes is a personal self-inhibiting choice but hardly a mark of higher culture.

On the Moon and Mars, where the exterior landscapes are so extremely monochromatic to begin with, almost everyone will feel the need to use abundant colors indoors, especially those not to be found out on the surface. Pioneers will cultivate their green thumbs to an extent unusual on Earth. With no life at all outdoors, abundant green foliage and flowers will be welcome and pursued with dedication.

Other coloration options will come slowly as we learn to extract specific elements and element combinations from the regolith. On the Moon, true white (calcium oxide = lime, aluminum oxide, titanium dioxide) and true black (ferrous oxide, manganese dioxide) will help "bookend" the gray-tones with classic emphasis.

Among the first real "colors" will be ferric iron oxide or "rust". Sulfur provides a pale yellow, chromium oxide a green. The holy grail will be the isolation of cobalt: cobaltous aluminate produces the brilliant "cobalt blue." These oxides can be mixed to produce in between colors and shades. There seems to be no lunar-sourceable inorganic source of either brilliant yellow or true red. We'll have to satisfy our appetite for these colors with flowers, and maybe birds. See also MMM #63 MAR '93, pp.10-11 "Color the Moon anything but Gray."

Once such colorants are available, they can be worked into the decor scheme as stained or art glass (including lamp shades or light diffusers), fiberglass fabrics, ceramic objects, "regolith impressionism" paintings, and other ways. Giving each "room setting" a different accent color or suite of accent colors will help create special areas.

4. Dividers: on Earth we frequently resort to "room dividers" to subdivide large rooms or create special settings in great rooms and lofts. Dividers can be made of anything, and be either free-standing or suspended from the ceiling. One attractive option for use on the Moon especially is suspended carpets. Carpets, and fabrics in general, are very useful for acoustic sound deadening. The problem on the Moon is twofold: first it would be prohibitive to produce carpets (or other fabrics other than for clothing or towels) from the usual organic or synthetic organic fibers. That pretty much leaves us with glass fibers. We have been producing fiberglass draperies for years and they work well for one reason: very little wear and tear. We do not walk on them or sit on them. Fiberglass is not very wear resistant. Happily, on the Moon with its light gravity, the natural cushioning of our feet and buttocks may be enough. We can still make fiberglass carpets, possibly of unlimited color and design options, if we put them on walls or if we suspend them from ceilings. Carpet dividers will be a great way to subdivide inter-module common spaces.

5. Accent & Mood Lighting: Another way to create "room-like" settings in larger open spaces is with controlled, discriminate lighting. In the past, one often had only one choice: ceiling light fixture or table/floor lamp -- each at one set level. The introduction of three-way lamp bulbs, then of dimmers created many more options. Today with all new light bulbs (especially, halogens and folded fluorescents) and new recessed lighting options, the possibilities for controlled accent and mood lighting are endless.

It is too early to say which light bulb types are best suited for local manufacture on the Moon. One option is to keep light sources, and the heat they produce, on the surface and use fiber optics and light pipes to deliver light where needed in homestead interiors. Movable shutters can throttle the amount of light delivered to any one spot. Working in special diffusers will multiply the special lighting effects available. Shades can be made of glass, ceramic, and punctured sheet metal. Light diffusers of stained glass can lend color to the whole surrounding area.

Take two identical pioneer homesteads: same floor plan, same furniture, same furnishings. Give one only full-on high level general lighting. Install full control lighting in the other so that one room can be fully lit, another have just task light by an easy chair for reading, other areas just enough light to find one's way without stumbling. In the first, the colors are fixed. In the second, you can alter the colors to suit your mode just by switching colored diffusers. Obviously if it is a comfortable home that we want (and we need to prevent gross defections back to Earth,) providing a full range of lighting options is important, not just to defining interior spaces but to the level of comfort and satisfaction.

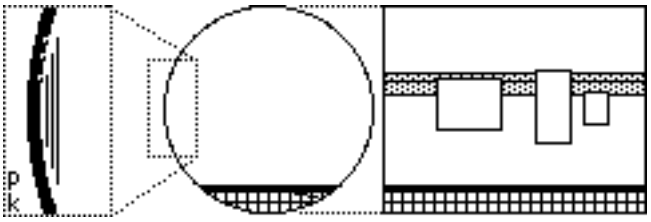
Open Shelving

Another choice one sees in some Lofts -- it is by no means common, however -- is to scratch the high expense of wall cabinets for kitchens and other areas by using open shelving systems, which can be built in a number of ways. Doing so involves a deliberate choice to let the shelf contents provide decoration.

In kitchens this is relatively easy if one has tableware and utensils worth showcasing. One can choose to do this elsewhere as well, in bedrooms and bathrooms for example. Here, if decoration is a goal as well as simple storage, one can either sort items by color (sweaters, towels, blankets, etc.) or arrange sundry items into pleasing "vignettes."

In MMM #76 JUN '94 p.8 "On the Wall" we described ways in which the curved walls of habitat modules could be designed to make shelving easy.

On the horizontally concave outer walls of cylinder modules, only the central portion is suitable to hold things flat so that both top & bottom of the object 'touch' the wall.



A series of built in *hanging strip grooves* is a solution that may work, and even presents decorative possibilities, i.e. as broad horizontal striping. Objects can be hung anywhere along the length of the wall, utilizing the hanging groove that best suits their individual height. While the result may be that pictures and other objects are hung slightly below the customary "eye-level", the hanging grove stripe, perhaps differentiated by texture and/or color from the rest of the wall, will be at the top of this range, serving as a visual corrective of sorts.

Shelving is cheaper and easier to provide than furniture-quality cabinetry. So this is yet another "Lofty Idea" with appeal to frontier pioneers. <MMM>

Return to the Moon: What's in it for Earth?

by David Dunlop

For many Americans, including those in the in the science and aerospace technology community, "been there, done that" is the almost reflexive intellectual and emotional response, to those who mention much less openly advocate a return to the Moon initiative. This quick dismissal is also symptomatic of the general public apathy toward the space program and the only modest level of political support That NASA generates in Congress. The Apollo program is the political high water benchmark of faded glory days for NASA It is also a huge historical achievement by what is now termed the greatest generation, ranking up there with the winning of WWII , and the Manhattan project.

The Apollo Program Benchmark

The American public was largely indifferent to the two most recent US lunar missions, Clementine, a test of SDI sensor technology that happened to use the Moon in its first mission phases, and the Lunar Prospector which was the first and the least expensive of the Discovery Mission initiatives to fly. Yet these missions did fundamentally change the perception of the Moon. With the discovery of ice at the permanently shaded lunar polar craters the Moon is now perceived as a place much more capable of sustaining a human presence. This human presence can in theory be much less expensive to maintain by the use of local water-ice.

Elsewhere, I believe the Moon is perceived differently. Only the Americans have sent men to the Moon. The Russians didn't make it. No one else was even in the running in those cold war years. Yet today, the capability to send men to the Moon exists no where. The capability to do so still exists as as a benchmark of technological progress and of the strength of the national economy. In a psychological sense the rest of the world is still in a "catch-up" mode. The "Luna Club" is still an exclusive one with only the US, Russia (formerly Soviet Union", and Japan having successfully achieved Lunar missions.

Today, the Japanese and the ESA are planning lunar missions. The Japanese Planet-B will orbit the Moon and send two penetrators to the surface. NASDA talks of a long-range Japanese intention to develop a lunar colony in the 2020-2025 time frame. While the Japanese funding commitment to NASDA is not great only NASDA and large Japanese corporations are talking about lunar bases. The Japanese clearly see the Lunar benchmark as an important measure of technology achievement, a spur to technological excellence, and as part of the economic future of a vibrant and leading Japanese and world economy.

The ESA mission, SMART-1 is the first European counter part to NASA'S new millennium series. It will use an ion drive motor to push their package out of the Earth's gravity well and into a lunar orbit. It will finally qualify the ESA as a member of the "Luna Club."

Clean Energy For Sustainable Development

Other US initiatives have been proposed such as the Inter-Lune One initiative which was submitted as a Discovery Mission Proposal by the University of Wisconsin. This proposal with Harrison Schmidt as the Principal Investigator along with the Fusion Research Institute at UW Madison proposed a lunar lander which would have measured the helium-3 concentration in the lunar regolith. Commercial fusion reactor technology has been the"holy grail" for nuclear research for the last thirty years but has diminished support. The 'Green' forces have limited the appeal of this research initiative as have the lack of a short term pay-off. With an energy hungry world however this lunar derived Helium-#3 resource still is a potentially big part of a sustainable, clean, high tech and prosperous global economy. The broad international collaboration on fusion research is clear evidence that all the major technology players understand this.

The fusion initiative doesn't get much space in the headlines and has struggled in recent years from diminished funding. It also is a benchmark of scientific capability and would not only be the engine of "clean and sustainable" economic growth for the world but it would also be the breakout technology for human expansion in the solar system. Fusion reactors would provide the means to make "short" transit times to Mars and the Asteroid belt a matter of months rather than years. Even long journeys to the outer solar system could be feasible with fusion technology as the enabling technology.

Engineering Development as Aerospace Corporate Welfare

In the absence of a cold war, the retreat from basic research, and the ascendancy of "bottom line" political rhetoric, the NASA space program might evaporate, and the same disease affects ESA and NASDA. There just isn't the political horse power of the Apollo and cold war era to fuel further development. The costs of investment are so large and the risks of failure are so great that private capital cannot be attracted for a "reasonable short term prospect of profit. Thank God for corporate welfare. The NASA, ESA and NASDA enterprises and their corporate dependents are the best bet for continuing development. Under the umbrella of the International Space Station work will continue.

The completion of the ISS will force a crisis for these enterprises. They could face a great scaling back unless they come up with "the next big thing" for self perpetuation.

A return to the Moon for developing a Lunar Base would provide such a ticket. It is important to

learn whether Lunar gravity is sufficient to maintain cardiovascular function and whether Lunar micro-gravity is adequate for the rest of the biosphere on which we humans depend. It will maintain an international scientific collaboration which permits the addition of national partners such as China, India, and Brazil in this very expensive enterprise.

A Return to the Moon will necessitate several Engineering Developmental Challenges:

1. A truly cheap reusable system providing manned access to LEO is needed. Now that the single stage to orbit approach has been abandoned by NASA for the moment, a two stage approach to LEO as now seems necessary will be a immediate goal.

2. A cheap heavy lift capacity to LEO is needed and a high production volume big dumb reusable booster is needed. Several such vehicles were proposed in the 60's which would still be providing much less expensive costs per pound to orbit today with an expendable design. A reusable design might not mean reusable in the sense of returning to Earth but in the sense of creating large habitable volume in orbit for fuel storage or atmospheric gases, habitable volume, or merely enclosed vacuum volume for safe EVA assembly work on repair of satellites. or solar array sub-assemblies. Such dual use considerations of large dumb volume would of course mean a heavier tank structure, but there is no free lunch.

The potential use of the shuttle external tank has been studied and the creation of "new land" in the ocean of space with each launch should not be missed. This cost will of course will not be cheap but each such tank should be first designed for reuse in the future and should be outfitted with a solar array driven, electrodynamic tether fuel-less propulsion system as is now being developed for flight testing. This enhancement of large booster will make them more expensive but will also permit them to be stored in orbit for future use. The flight test of this fuel-less propulsion system in the next two to three years will tell how effective such a system could be in now only station keeping for large mass structures but how high a storage orbit can be attained.

The creation of a annually small but growing inventory of large dumb volume environments could reduce the subsequent costs of many future projects:

a. creating new volume on the ISS
b. providing fuel and storage capacity as a back-up to the ISS in case of catastrophic losses in a meteorite storm
c. providing fuel and atmospheric tankage capacity on the lunar surface for a lunar base.
d. providing fuel and atmospheric tankage capacity and human habitation capacity in GEO for a human tended construction station for a solar power satellite
e. providing fuel and atmospheric tankage and habitation capacity for an L5 outpost for the development of an O'Neill colonies.
f. providing a standard structural component for a large rotating space station such as originally envisioned by Von Braun.
g. providing fuel and atmospheric tankage capacity for a Mars space station. We might consider sending a space station into Mars orbit in support of a Humans to Mars program. with the capacity to support and provide a back-up environment in close proximity to the surface as an additional fail-safe system to the Mars Direct strategy.

I'm sure this list of potential future uses of large dumb volume could be expanded. All this to underscore that a tank in orbit is a terrible thing to waste. All this to underscore that a commodities market for such tankage should exist for those willing to provide the incremental cost of designing for such utilization and paying for the cost of the fuel-less propulsion systems needed to get them to a high safe storage orbit. As the reader may have noticed the frequency of their use for storing fuel and atmospheric gases is the least cost and most likely best use of these tanks. Retrofitting these tanks in orbit would be cost prohibitive for many purposes. Large dumb volume capacity should be extensively needed as a human space-faring civilization expands. It is only very short term bottom line thinking that makes this proposal "infeasible." Storage and reuse of this capacity would greatly lower the cost of many subsequent projects and therefore should be studied as a "futures infrastructures commodity."

3. An orbital transfer vehicle is also needed to expand and tend GEO platforms and provide a supply chain to the Moon (and later to Mars).

4. The further development of TransHab will provide next generation modules for extending the life of ISS, providing capacity for space tourism, and making a modular system for Lunar Base development, and a future Mars Base.

5. The just canceled funding for the Lunar/Mars base mock-up initiative at JSC will need to be restored so the CELSS will be mature by the time it is needed.

6. The development of mag-lev launch rail launch systems for high frequency low mass payloads to orbit is needed.

7. An orbital debris mitigation program should be initiated to limit and decrease the hazards of "space junk" to expanded levels of manned activity.

8. An international rescue-crew return vehicle capability or mini-shuttle. Recent new of German interest in developing this option will provide a manned vehicle for ESA.

9. Rather than scaling back aerospace corporate welfare in the G-8 nations these challenges can maintain employment, stimulate engineering education, and rekindle the Apollo vision in the next generation. These pieces of infrastructure not only provide the support for a Lunar Base initiative but also pave the way to a serious contemplation of Mars.

The Political Economies of a Lunar Initiative Partnership

The number and scale of these investments also provide plenty of "room' for spreading the work among the international space faring nations. Getting the political commitment to undertake new engineering objectives as the global economy develops is still going to be difficult. It is reasonable to expect more national economies developing to the point where they have the capacity economically and politically to support aerospace industry initiatives which lead to space faring partnerships. The development of cheap access to space should greatly lower the cost of participation by nations that are now in the second and third economic tier. Nations with maturing industrial and academic capacity will see the educational stimulus of such participation and also see participation as an important national political asset for national pride and as a benchmark of economic progress.

The best arguments for this view of of the political economies of third world countries are:

a. The stubborn refusal of Russian to retreat from their spacefaring capacity even though as present their economy can't "rationally" support the "luxury" of a space program. Could military requirements and defense of national sovereignty be worth it?

b. The persistent and long term commitment of the Chinese to develop and refine their missile program and now a manned capacity.

c. The persistent and successful efforts of India to expand its booster capacity to GEO capacity.

d. The growing capacity of Brazil in aerospace and the development of its own equatorial launch site.

Like the International Space Station, the effort to ramp up to a lunar base project will be a complex political as well as technological partnership. Part of the glue that has held the ISS together has been the international perception of disgrace due to the unreliability of any member withdrawing from the project or not honoring its commitments. It clearly has not been easy for the Russians to continue but they have. When the ISS has become unpopular with the US Congress due to perennial cost overruns the issue of honoring international commitments has carried weight. Japan's stagnant economy while limiting new plans has not detoured their commitment to the ISS.

Another art of the glue that drives this partnership is the sense that the national partners cannot permit themselves to fall behind others in technology capability. Just as the emerging economies feel a need to catch-up there is the resentment of allowing one country to develop a commanding lead. The US is continually poised on the razor edge of the competitor/partner position as the remaining superpower. It must itself not fall behind or face the treat of losing its leadership position. Selling the Moon Base to domestic political constituencies on its own scientific merits may not create a ground swell of domestic political support among the current Space Station partners but the persistence of entrenched bureaucracies to press for this commitment to their own perpetuation is not unrealistic.

Commercialization

While a Lunar base is sufficiently high risk and of a scale beyond what private capital will now risk, the enterprise will create many smaller opportunities for commercialization. The recent announcement of a withdrawal of the US from some ISS commitments is an example that has resulted in the Italians stepping up to fill the gap of a needed habitation module. Their multi-purpose logistics module design will be upgraded to provide a habitation module. This lets a new initiative emerge.

The development of an orbital transfer vehicle that can provide the boost to the top of Earth's gravity well can also provide a more robust way of reaching GEO. The GEO communication satellites of today are surely destined to become enhanced communications platforms with huge solar power arrays and more powerful signals. GEO antenna farms will be developed by telerobotic technology which will permit the delivery, installation and removal of telecommunications equipment. The exploding demand for phone and data communications will mean a continually expanding market for such communications platforms capacity. The saturation of GEO orbital slots will require the upgrading of the capacity of existing slots. It is therefore probable that an orbital transfer vehicle and telerobotic system capable of creating and servicing the GEO platforms will result. Since the high value of the GEO antenna farms has a well established market, it seems a reasonable bet that a commercial development of this technology will result. It remains to be seen, however, whether this will occur with a limited government partnership or without a major government subsidy. The potential for a commercial orbital transfer vehicle being developed may not be far off.

The deployment of telerobotic arms systems on the ISS which will participate in the further construction process is the beginning demonstration of systems that could be used for next step projects such as an expanded GEO broadcast satellite platform, a prototype solar power satellite, ==>*continued p. 13*

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®

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

Questions? email:
membership@asi.org

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

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

"As Long As We Are Here ..." Entrepreneurial Opportunities for the First Lunar Return Mission

July 24, 2001

Oregon L5's abstract for "As Long As We're Here...." has been accepted by *Space 2002* for presentation in Albuquerque next Spring. Members of the Oregon L5 Lunar Base Research Team have already been working on this and other papers. "As Long As We're Here...." is about small and medium business opportunities that will arise when lunar bases become a reality. As a one-time small business proprietor myself, I'm looking forward to developing this thesis.

Bryce Walden
Lunar Base Research Team (Oregon Moonbase)
Oregon L5 Society, Inc.
http://www.OregonL5.org

Working "In Situ Enterprise" into the Artemis Moonbase Reference Mission

by Peter Kokh

The Oregon L5 paper under preparation by Bryce Walden and his colleagues is a very important study with relevance to the success of the first commercial Moonbase. "Day one" entrepreneurial opportunities will lay the foundation for an enterprise-based settlement. More importantly, earning income to defray the costs of establishing the first for-profit outpost, will make that endeavor much more viable, and therefore more likely to happen at an earlier date -- something we all hope for.

Indeed, the money-making capacity of the Moonbase must be seen in a much more all-embracing sense than that of "entertainment enterprises." Systems and equipment developed by contractors looking to prove the performance of their products so as to be marketable to many or even all missions to follow, might "contribute" them to this first mission, in exchange for the crew's efforts at fieldtesting them: new carbon dioxide scrubbers, new water recovery systems, new thermal management systems, new closet-sized salad stuffs agripods. Of course, there is a real risk in integrating equipment into the mission that "needs to be proven." Mission planners need to weigh the risks. Free is hard to argue with.

Other firms may also contribute optional equipment and pay the Moonbase Company to field test and debug it. But then there are new enterprises chosen for pioneering by the Company (LRC) for extra profit-making potential. It is this class of activities the Oregon L5 team is endeavoring to illustrate.

If everything about the mission, not just its entertainment value, is looked at as an opportunity to make money, the enterprise may just succeed.

Moon Society Chapter Rules

www.moonsociety.org/chapters/chapterRules.html

- Written October 2000 by Jim Burk, Vice President
- Modified April '01, Tim Cadell, Chap. Coordinator
- Approved 30 May 2001 by the Board of Directors

Chapter - a local, regional, or national grouping of Moon Society members, brought together to work on common projects and to promote social interaction within the society.

1. Officially recognized Chapters of The Moon Society are made up of five or more current Moon Society members. A chapter with less than five members is designated a *Chapter-in-formation* but does not have official chapter status. Chapters which are officially recognized will be listed on the Moon Society website and other publications. A Chapter that loses enough members to drop below the five member requirement will have a one-year grace period to restore its membership.

2. Chapters are legally and financially indepen-dent from The Moon Society, a 501(c)(3) non-profit corporation registered in Texas. Chapters are encouraged to register their organizations and seek non-profit status in their parent region or country. Moon Society HQ will provide assistance with this, where possible.

3. The overall goals of the Moon Society chapters system is overseen by a Chapters Council, made up of one representative from every official Moon Society chapter. These representatives are given voting rights. The Chapters Council may also accept volunteers and hire staff to assist with projects and mundane tasks.

4. The day-to-day operations of the Moon Soc. chapters system is overseen by a Chapters Coordinator, an individual appointed by the board of directors of The Moon Society. The Chapters Coordinator is the single point of escalation at HQ for chapter leaders. The Chapters Coordinator will also serve on the Chapters Council (not necessarily as the leader). The current Chapters Coordinator of the Moon Society is Tim Cadell who can be reached by email at:

<chapter-contacts@moonsociety.org>

5. Chapters are required to fairly elect their own leadership structure from within their member-ship. Chapter leaders must consist of at least two officers, one of which is responsible for financial matters. In addition, chapters are expected to appoint or elect a representative to serve on The Moon Society Chapters Council. In situations where a dispute arises over the leadership or council representation, the Moon Society Board of directors will arbitrate the decision.

6. Chapters and their members are expected to support the goals, creeds, and purposes of The Moon Society. The exact methods of doing so are left up to the chapters.

7. Chapters and their members may not act in ways which are opposed or detrimental to the goals, creeds, and purposes of The Moon Society.

8. Chapters will submit their proposed Bylaws to the Chapters Council. The Chapters Council will respond to proposed Bylaws within one month of filing, and can either accept the proposed Bylaws, or reject them with recommended changes. The Moon Society Chapters Council will provide a Chapter Bylaws Template that can be used as a starting point for a new Chapter's formation.

9. Chapters are required to report their activities regularly to Moon Society HQ and other chapters, through publications, announcements, or electronic communication (Web, Email, Team Lists). The frequency of this report is determined by the Chapter Bylaws for each Chapter.

10. The Moon Society Bylaws, available at http://www.moonsociety.org/organizing-documents/bylaws.html, will control in the event of a conflict with these Bylaws. See, especially, Article IV.

Steps to Civilian Lunar Home Rule

This is the title of an LRS "white paper" which you can find online on the "White Papers" page on the Lunar Reclamation Society website at:

http:/www.lunar-reclamation.org/page12wp.htm

In fact, this paper is a collection of articles which we ran in Moon Miners' Manifesto two years ago in issues #128, 129, 130, & 131 (Sept-Dec '99). There has been some discussion on the Artemis list about this topic recently by some of our newer members who did not get a chance to read these articles. You can read it online following the link above and might find it interesting.

On June 19th, Backwash.com, an internet content surfing service, noted the paper, gave us an award, plus an online link to its own discussion message board. So now you can not only read this collection of articles, you can post your comments. The articles, by MMM Editor Peter Kokh, look at the topic from a wide variety of angles, and tried to look at it from a long range view.

Look for more interesting reading in this online list of white papers, from MMM series past. **<PK>**

A Moon Society Liaison Committee Report

Other Players in the Moon Game: The "Data Miners"

LUNAR RESEARCH INSTITUTE

http://www.lunar-exploration.net/

Task 1: mining already harvested data

LRI is the "post mission home" for *Lunar Prospector* ('98-99) and Alan Binder, the mission's principal investigator. *Lunar Prospector* was first conceived as a space activist community low budget mission. Binder is the hero who designed the craft and then kept this bold startup alive until NASA picked up his team's "ready-to-go" plan for the second Discovery Mission Opportunity. The rest is history, proud history.

At LRI, Alan Binder and a small staff attempt to carry on the unfinished task of analyzing the great wealth of data from the LP's six major instruments. NASA had funded preliminary analysis, enough to draw some exciting conclusions and significantly expand our knowledge of the Moon. But much of the data remains unanalyzed. There is a lot of "data mining" begging to be done. This is true of almost all NASA missions, and the cheapest way to do a sciencemission to the Moon, to Venus, to Mars, to Eros, or anywhere else does not involve a penny for hardware or launcher or fuel. All it involves is time and dedi-cation. The data is there. But we have yet to learn all we can from it. LRI is not government (NASA or NSF) funded. Its work depends entirely on philanthropic donations and so proceeds slowly and deliberately.

Task 2: planning future missions to fill the gaps

Based on *Lunar Prospector's* spectacular scientific and programmatic success, LRI is planning a series of unmanned missions to continue the scientific exploration of the Moon and the development of a lunar base which will serve as the basis for the first extraterrestrial lunar colony:

Three additional lunar polar orbit mapping missions would finish global mapping of the Moon. Between them they would map the Moon's:

1. mineralogy
2. thermal and microwave radiation
3. topography
4. shallow crustal structure
5. provide metric mapping
6. high resolution stereo-imager data on the Moon

The LRI staff will also carry out a series of unmanned Lunar Landing Missions which will:

1. Set up a seismological/heat flow/magnetometer network on the Moon to study moonquakes, the seismic risk factor, and the properties and thermal budget of the deep interior of the Moon
2. Bring back samples from various features on the Moon to continue the studies of lunar petrology, chemistry and resources
3. Land rovers on the Moon to verify and map the water ice at the poles and to make gravity, magnetic and composition traverse across major lunar features.

CENTER FOR LUNAR RESEARCH

http://www.nss.org/lunar/home.html

The CLR was set up by the National Space Society in 1998 to address the same need. Even before the *Lunar Prospector* Mission was concluded, it had become apparent that NASA had not set aside enough money for data analysis. The players at CLR are pretty much the same ones as at LRI. But here the idea is to find funding for *student* data mining projects using the *Lunar Prospector* data.

In the summer of 1999, NSS announced three graduate student internships for data interpretation at selected research institutions. There is nothing on the website about work or progress after 1999. So this effort may have faltered.

Prospects for Data Mining "Missions" Where does the Moon Society Come In?

Comment by Peter Kokh, Liaison Committee Chair

It is clear that we are not going to get money from NASA or find it in government budgets, to support continued data mining missions, as fruitful as they may promise to be, with relatively high "returns on investment." The Moon Society might consider raising funds to support individual Lunar Prospector data mining project proposals when the findings of the individual project promise to be especially relevant to the goals of the Society.

There are also some promising data mining proposals aimed at *Clementine* mission data, such as Oregon L5's plan to search this wealth of "high noon low shadow" lunar photographs for "high shadows" which could indicate lavatube openings.

Would diverting funds for such projects hurt other Moon Society projects? First of all, "diversion" is the wrong word. This is the same *fixed pie theory* that NSS has used through the years to shoot down proposals for embarking on significant projects.

Funds for projects need not (and should not) come from general funds or general fund sources. Instead special appeals should be made. If a proposed project arouses interest, it will flush out *money that would not have been forthcoming for blank check general funding.* We have to abandon zero sum thinking and take the risk.

The Mars Society has the right idea. *"Propose it, and they will come".* So far, this game attitude has been reaping rewards right and left. Without touching a cent of general funds, they have put up a Mars Research Station on Devon Island in Canada's arctic (which opened its second season on July 4th) and built a second, mobile "Mars Desert Research Station" which will begin service on location this fall after a summer on display at the Kennedy Space center Visitor's Center. The publicity for these efforts has been enormous and widespread, bringing in new members and ever more money.

The Moon Society can do the same thing. Not only do exciting projects flush out unsuspected money, they also entice new members, people who want to be part of a "can do, will do" outfit. The stumbling block seems to be a dearth of individuals (other than already over-stretched officers and board members) who are ready to take charge and commit time to organizing such efforts. The record of enthusiasts who have volunteered for this or that task and not followed through is disheartening. But we cannot allow ourselves to be disheartened.

Taking the first step, then the second, then ...

As to data mining, the first step would be to create a proposal review board, a team of experts or of individuals who know where to find the experts. Then we would issue a call for proposals, advertising this on university campuses in the appropriate departments as potential "doctoral theses" subjects.

Once worthy proposals were identified, we could advertise them and point out what could be gained, knowledge wise, from undertaking them. *IF the money comes in, we fund the winning proposals. If not, then not.* There is nothing to lose, everything to gain. Not only will such projects generate their own funds, they will also generate any volunteers needed to carry them out, plus Publicity!

The Liaison Committee was established with two tasks: keep up with what each group or organization is doing: their active and proposed projects, their completed projects etc., and where there might be mutual benefit through synergy; look at PROJECTS ongoing or proposed elsewhere and see if The Moon Society wants to lend support (if so, what kind) and/or become involved in those projects. Data Mining Opportunities are an especially appropriate way for us to take a part, even take the lead. <PK>

Interesting Copyrighted Material Online

Dutch Architect Designs Lunar Hotel

http://www.space.com/businesstechnology/technology/lunar_hotel_010719-1.html

AUTHOR: Hans-Jurgen Rombaut, Rotterdam Academy of Architecture

HIGHLIGHTS:

- Location Rima Prinz, a deep rille on the Moon near Schroter's Valley. [Actually, the Prinz rille system is E of the partially buried crater Prinz, SE of Aristarchus, whereas Schroter's Valley is to the NW of Aristarchus. This would seem to be the same rille that was the equally hypothetical location of the Lunar Reclamation Society's 1989 award winning design study "Prinzton" - a rille bottom settlement for 3,000 people. This report, serialized in MMM's #'s 26-29 , 31-32. We hope to have these online on the ASI website soon.]
- Twin towers 160 meters high (525 ft.) with great views over the moonscape
- Timeline: perhaps in the 2040-2050 timeframe

New Details on Planetary Crash Believed to have Created the Moon

http:/www.swri.org/press/impact.htm

According to an August 15th Reuters report by Deborah Zabarenko, new computer simulations have reinforced the idea that one big collision between the Earth and a Mars-sized planet gave birth to the Moon. Scientists at the Southwest Research Institute in San Antonio, TX and at UCal-Berkeley have put together improvements to the scenario that would now account not only for the Moon's creation as well as the fact that a day on Earth is 24 hours long - both the result of one and the same impact. This increases the probability that the impact theory is pretty close to what actually happened.

[Shades of Immanuel Velikovsky! We think the culprit "proto-planet" should be named in honor of the much maligned Russian thinker. :)) - Ed.]

The new research is presented in the journal *Nature*, suggests that then enormously energetic crash between Earth and a proto-planet the size of Mars some 4.5 billion years ago shortly after the formation o the Solar System, occurred at an oblique angle -- perhaps 40 degrees or so. This caused Earth to start spinning in a day only five hours long. As the then much closer Moon gradually receded from the Earth due to tidal forces, Earth's rotation slowed.

The origin of the Moon has been a mystery whose solution has eluded astronomers and astrophysicists for centuries. The new theory synthesizes the old "wife" and "daughter" theories. **<MMM>**

Return to the Moon: What's in it for Earth?

by David Dunlop

Continued from page 8

==> or orbital retrieval vehicle which could retrieve dead satellites. Commer-cialization of niche markets which have a prospect of growth and stability of utilization is likely to be a force in the creation of some of the missing pieces of a return to the Moon.

Summary

The Return to the Moon offers many benefits to the earth including education, corporate welfare employment of high technology industry capabilities, the maintenance of international partnerships, hope for a clean energy future, and support for expanded telecommunications capabilities. These benefits will still be propelled by government funding as the predominant mode in the next 20 years, but with expanding private funding where growth in demand for commercial services is foreseen to be consistent and relatively low risk. The return to the Moon is f credible in providing these benefits. The "been there and done that" reaction of many would suggest that the rationale above is not understood. It think the arguments above will prevail when at the end of the ISS construction we come closer to determining "the next big thing." **<DAD>**

The Volunteer MMM Production Staff wishes to apologizes for the tardiness with which too many issues of MMM reach your mail box, including this one.

Precisely because we are unpaid volunteers, none of us has *guaranteed protected time* in which to complete our various tasks.

We each "have lives" and that means that occasionally, *much more frequently than we'd like*, other events and commitments beyond our total control, interfere with our individual abilities to get our various roles in the production and mailing of MMM completed at the ideal time to ensure that each issue will arrive in your mailbox when it should.

We thank you for your patience. Each of us remains dedicated to putting out a quality product in a timely manner.

Peter Kokh, Editor (my fault this issue)

Charlotte Nelson, collating, folding, mailing

Joe Mackowski, label production & merging (according to *arcane* Postal Service rules) from disparate membership lists. **<LRS>**

Meandering Through The Universe

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

What Kind of Settlement do we want? Think of it from the point of view of Work Days on the Frontier

What do you think your work day will be like in the good old space settlement? This question involves a consideration of psychology, sociology, logistics, economics, and probably some other considerations as well. There are some known factors to start with. One is that human beings cannot function well for extended periods of time without receiving certain minimums of sleep as well as restful and/or diverting opportunities while awake. Most human beings need certain minimum quantities and qualities of interpersonal relationships in order to be able to continue to function effectively over extended periods of time. And, of course, humans need reliable, continuously available supplies of air, water, and food which meet or exceed certain quality minimums and which also must be consumed by the individual within the constraints of certain quantity ranges if optimal performance is to be maintained. People also need appropriate mental and physical exercise to remain acceptably productive. And, owing to the very nature of life and being living beings, humans (and any other living organisms in the space settlement) will require quality medical services (and for other organisms, horticultural or veterinary services) in order to be and remain profitably effective.

However, merely knowing what is necessary to make and keep a human being as physically and mentally fit as possible does not give us enough information to answer the question of what one's work day at the space settlement will be like, unfortunately. We must also ask, who will be the boss? And what kind of boss will they be? Will there be laws, regulations, ordinances, rules, and customs to guide the boss' expectations, demands, and benefits provided to the workers? The cultural, political, and spiritual aspirations, expectations, and inclinations of the workers will definitely influence the expectations and demands of most employers but, ultimately, the tenor of the workplace is set by those in authority over the workers.

We even have to ask, will it be a settlement in fact, or only in name? Will workers be pushed to the point of burn out, injury, or death and then replaced? [as in the Sean Coonery film *Outland*?] Will workers be treated well enough but rotated in and out of the site on a short rotation or be permanently replaced after stints so short that it will be all but impossible to develop any sense of community or establish the power base necessary to effect an evolution (or revolution) toward becoming a permanent settlement

community? Or will the controlling powers allow a complete and sustainable society to develop?

How can we know the answers to these questions in advance? How can we influence events so as to move toward the future we want to see? Will everything turn out the way we want if we just believe that it will? I'm inclined to think that if we bury out heads in the sand, that sooner or later we're going to end up getting kicked in the butt.

So what *will* your work day be like in the good old space settlement? I'm proposing that the answer to that question is something we are going to decide by our actions and inactions, by our critical, analysis-based foresight, and by our starry-eyed fantasies. Either we will shape the future according to our aspirations, or others will shape it without reference to our concerns and wishes.

I can't tell you what you *should* do. But I can tell you that if you don't think very seriously about what you want, you are pretty much guaranteed to *not* get what you want. And once you have analyzed what it is that you want you are still pretty unlikely to get it if you don't work smart and diligently for it. Even then, no one can guarantee that things will work out the way you want. But the chances are sure a lot better that they will!

A worst case scenario (of those which seem reasonably possible) might well resemble a harsh servitude. All of the factors which in the past have made slavery possible will be present to some degree.

A best case could conceivably be just a ways this side of Nirvana, I suppose. But it is not unreasonable to expect that the eventual reality will be somewhere between the two extremes. I, personally, am concerned that without our proactive, carefully crafted intervention in the course of the politico-economic side of the evolution of space development we may well end up seeing something very much like a totalitarian "workers paradise" police state which could keep a strangle hold on space communities for decades, even centuries. I would rather not see that.

Kudos to those groups and individuals which are working hard to craft a desirable future with regards to space. But I'm convinced that far more needs to be done. Although a near Nirvana *might* be possible if *everything* were to come together according to our fondest wishes, I think that the best we can reasonably hope for is far less rosy.

Baring numerous Star-Trekian technological breakthroughs, we are much more likely to see settlement lifestyles which strongly resemble the lifestyles of people who are in the early stages of creating and running small businesses or of the Yukon gold rushers from the first decade of the twentieth century. But unlike those Earth based folks, space settlers may not be able to give up and return home nearly as easily.

The Alaska Gold Rush Experience

The "new business" folks and the gold seekers work(ed) something like 14 to 20 hours each day for as long as several years. In consequence, very frequently, their marriages break up, their children either don't bond with them or actually resent them and often show signs of social maladjustment — sometimes for the entire rest of their lives. These hard workers and members of their families often end up lost in addictions because of the strain. Sometimes people even die — one way or the other — because of the strain and, more often they suffer fairly serious health consequences directly related to stress and exhaustion.

And what *we* want to do requires working with a set of far more challenging economic circumstances -- with immensely greater technological hurdles -- in a physical setting which will tax the body and mind to a much greater extent. One is tempted to exclaim, "What are we thinking!" But this is not the first "impossible" task to be undertaken by humankind. We just need to be holding the reins or else we might end up with something similar to the many dark blots on human history which have come out of previous great achievements — for example, the slavery, murder, and oppression lasting for centuries which went hand in hand with the discovery, conquest, and development of the western continents by the peoples of Europe.

For a long time I have advocated the idea that (within the greater space enthusiast community) we have the talent, wealth, and cleverness to be able to do nearly all of what we want to see done, ourselves -- *if we are serious and have the will*. I believe that we could do these necessary things better, faster, and inexpensively enough to be within our financial means. Although there are positive things happening in the space activist/enthusiast community, there still seems to be a serious need for more and better ideas, more cooperation, more creativity, and greater determination on the part of the space enthusiast organizations as well as each of us who individually make up the membership of these organizations.

And so, the purpose I have in mind when I ask questions such as, "What will your work day be like in the space settlement?" is to try to engage our minds in the critical task of surveying the course of our road to a future in space. As we discovered with our road to Earth's moon the first time, if we don't survey carefully and plot the course of our road around obstructions and over solid ground, we will find the costs of construction to be extremely outlandish and our road will begin falling apart even before we have finished constructing it. In the end, it will have to be deserted — just like last time. That's something else I would rather not see. **<RRR>**

visit Richard's homepage:
http://richardpatricia.homestead.com

Mars Arctic Research Station News

http://arctic.marssociety.org

The brief 6-week field season on Devon Island came to a close August 14th. The start of the session was delayed by heavier than usual snow pack that took its time melting. By all accounts, the season was very successful. The Flashline Mars Station was erected last year, in a heartening feat of determination and resourcefulness - the last of five paradrops of components and equipment crash landing. This season, the interior outfitting of the station was completed, allowing it to support much more field activity. The journals of four participants, including Bob Zubrin's, can be read online (links on site above) and we encourage interested readers to do so.

Already, several lessons have been learned on the island that will improve operations and lead to equipment changes for future Mars missions. In that light, the arctic exercises are much more than a very good publicity program (to the consternation of some sour-grapes types). They *are* advancing the day when we can go to Mars safely. They are also *increasing the odds of a very productive and safe operation* on the red planet. Moon advocates *need to take note and start* making *doable* plans for something similar. - P K

Mars Desert Research Station News

http://desert.marssociety.org

The MDRS website finally appeared on July 26th, almost a month late. You can tour the MDRS on this site, thanks to its gallery of interior & exterior photographs. Same scale but "half the weight" of its Arctic predecessor, the Desert Station is relatively easy to assemble and disassemble. Prior to its first field season later this Fall in the Nevada Desert, the MDRS is on display at the Kennedy Space Center, FL.

Mars Society volunteers, required to observe a strict dress and appearance code, are serving as guides for tourists visiting the station in Florida. The Mars Society picks up their airfare, lodging, and food costs. Mars Society members fortunate to have free time to dedicate to this effort can contact Maggie Zubrin at MZubrin@aol.com.

After this stint which is gaining the society and its simulation exercise program, much publicity, the MDRS will be shipped to a Nevada site for its first season of operations simulations. In the future, to take advantage of sites with other Mars terrain analog features, this new mars habitat prototype may be moved from location to location in the off season. For the MDRS, summer (and its heat) is the off season, just the opposite of the case in the Arctic.

The field season for MDRS will be much longer than the arctic climate affords for the MARS on Devon Island. With its debut, simulation exercise can now continue virtually year-around. - PK

New Found Channels on Mars "Largest"

http://www.space.com/scienceastronomy/solarsystem/mars_flood_010802.html

MMM Synopsis:

A system of gigantic ancient valleys -- some as much as 125 miles (200 kilometers) wide -- has been spotted partly buried under eons of volcanic lava, ash and wind-blown dust on Mars. Observations using a laser altimeter on the Mars Global Surveyor spacecraft reveal what may be large flood channels near a volcano called Arsia Mons, the northern most of the three great shield volcanoes on the Tharsis Ridge and just south of Amazonis Planitia, an area thought to have once been a vast ocean.

The system of apparent flood channels is 10 times larger than Kasei Valles, the largest previously known outflow channel system on Mars, and seem to have been formed by catastrophic floods that at their peak potentially discharged as much as 50,000 times the flow of South America's Amazon River. Hot magma melting permafrost or glaciers on a massive scale are thought to have been the source of the flooding in several episodes. Other research has shown that some channels on Mars were carved by ice, not water.

The discovery was reported in the June 2001 issue of the Journal of Geophysical Research.

NRC Urges Design Work begin ASAP on Mars Return Sample Quarantine Facilities

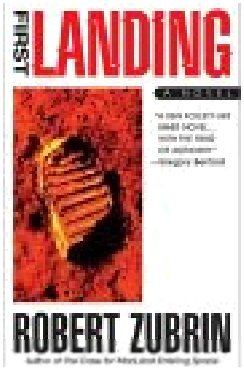
http://www.space.com/scienceastronomy/solarsystem/mars_quarantine_010530.html

The first Martian samples could reach Earth as early as 2014 and a maximum security quarantine facility would take seven or more years to design, build and test, so preparation for the facility should begin soon, says the National Research Council (NRC).

The NASA-sponsored report was released May 29th at the meetings of the American Geophysical Union in Boston. It outlines a two-edged challenge. The facility will have to contain biological specimens to prevent potentially hazardous Martian organisms from escaping, It would also house "clean rooms" to prevent terrestrial organisms, dust and other foreign matter from getting into the Martian samples.

Those two cross-contamination work at cross-purposes because containment facilities rely on low air pressure so leakages move air into the sample chamber. Meanwhile, clean rooms are held at higher gas pressures to push Earth particles outward to protect the enclosed samples. -- extensive experimentation will be needed to design this two-way protection system prior to any actual building.

[Ed.: The biggest challenge is to allay unfounded fears. Organisms evolved in mutual isolation are by that very fact not evolved to prey on one another -- or likely to find one another tasty.]



First Landing

Robert Zubrin's 1st Novel - about Mars, of course

©2001 by Robert Zubrin. July 10, 2001
Ace Books, Berkley Publishing Group,
Penguin Putnam, Inc.,
375 Hudson St., New York, NY 10014
262 pages - ISBN 0-441-00859-3
List $24.95 - Amazon.com $15.36

Review by Peter Kokh

Robert Zubrin proves he is a man of "what if" imagination as much as he is a master of "outside the box" engineering. As ardent an advocate as he is of manned missions to Mars leading to the opening of the Mars Frontier as a second human homeworld, he is not afraid to bring home to the reader how very difficult the steps may prove to be. "*First Landing*" might as aptly have been titled, "Murphy's Law lands on Mars." Just about everything that could possibly go wrong soon does. The odds of recovery are slim.

Yet, fresh on the heels of his, and the Mars Society's, brilliant recovery from the crash landing of the fifth of five paradrop payloads of materials and equipment "needed" to build the Flashline Mars Arctic Research Station on Devon island in the Canadian Arctic last summer, his crew on the *Beagle* recovers from one mishap after another from a forced landing to ... Well, I don't want to give anything away!

Zubrin is a firm believer that of all the tools we need to do a successful venture to Mars, human resourcefulness and determination are the most invaluable. If morale survives, so does possibility.

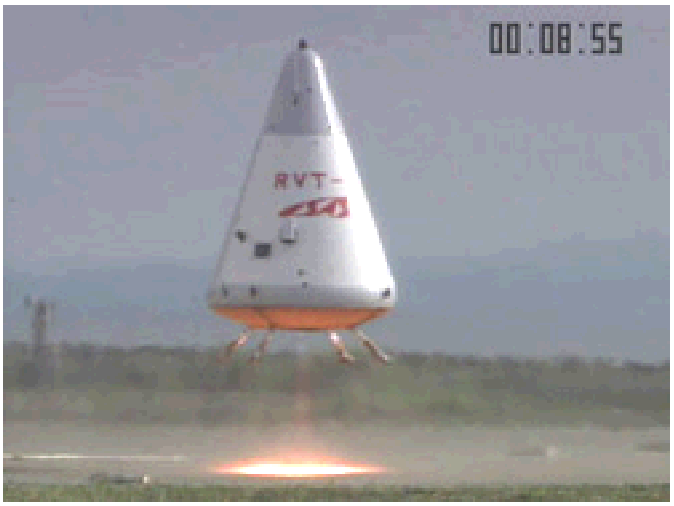
The author is not afraid to tackle some real tough situations. What do you do if someone can't return to Earth, or refuses to? What do you do if the public back home doesn't want you to return? And what if the Administration doesn't have the moral guts to lead the public, but finds it more politically expedient to follow?

Most people seem to expect the Mars Program to follow the script of *Apollo*: a series of stand alone missions, each of them "send them and get them back alive." We all know where that led. Sooner or later, after a "return to Earth," there are no more outbound missions. This kind of script may suit NASA and the government and Congress, but it does not suit the goal of the Mars Society to open up Mars to settlers. Zubrin, as does Jeff Landis in his brilliant *Mars Crossing* (see MMM #143), scripts an unplanned end-run. In the end the situation must be forced and can only spring from the unpredictable autonomy of the spirit of the individuals who actually get to go.

First Landing is a good yarn and we highly recommend you get your own "can't put it down" copy. It will leave you determined! <PK>

Son of Delta Clipper Lives in Japan!

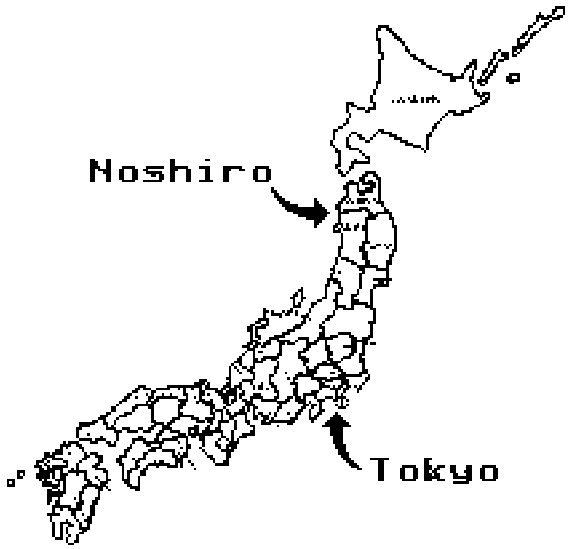
www.isas.ac.jp/e/new/release/2001/06_01.html
includes 640kb movie (frame below)



Reusable Rocket Vehicle Test (RVT)

July 3, 2001: ISAS [Japan's Institute of Space and Astro-nautical Science] has successfully completed the secnd flight test campaign for its reusable rocket vehicle test (RVT) June 9-26th at ISAS's Noshiro Testing Center in northern Japan.

The test comprised three successive lift-off and vertical landing flights to demonstrate the vertical-landing, repeat-flight capabilities and turn-around characteristics of the liquid hydrogen-propelled rocket vehicle. The test vehicle was designed and built based upon studies and considerations of general technical issues in designing future vehicles such as flight on demand, quick turnaround, higher performance, light weight structures and materials and so on. The performance of the present test vehicle is still very limited, however, many lessons were learned and more flight hardware oriented studies making use of repeated flight environment will be conducted. ISAS will do more works for the readiness of the fully reusable launch systems.<ISAS>



A Stirling Radioisotope Generator (SRG) for Mars Surface Probes?

Thanks to Gary Fisher, PASA/MS Technology Group <GCFisheris@aol.com>

The following website gives information about a NASA research project for a Martian surface probe power system:

http://nais.msfc.nasa.gov/cgi-bin/EPS/synopsis.cgi?acqid=97997

To quote from the synopsis:

"The objective of the project is to develop advanced technologies for use in a radioisotope space power generator comprised of a free-piston Stirling power convertor, along with the associated thermal management technologies and electric controller technologies.

It is envisioned that these technologies will provide the basis for an advanced version (2nd generation) Stirling Radioisotope Generator (SRG), with performance improvements beyond the SRG that is presently being developed by the Department of Energy (DOE) for NASA long-life Mars surface and deep space missions." (Ref. below)

http://www.oak.doe.gov/procure/main_pg.html

Note: the documents available from the RFP link in the link immediately above indicate that the goal is to produce something that will only be producing 325 Watts after six years, so we are not talking a lot of power, but it is interesting.

ILLINOIS

Chicago Space Frontier #5

610 West 47th Place, Chicago, IL 60609

Larry Ahearn: 773/373-0349

Call Larry for MEETING INFORMATION

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!

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(* LRS Board Members)

LRS NEWS

• **Our July 28th Field Trip to Argonne National Lab:** Five of us were able to make the trip to this enormous 1,700 acre facility outside of Chicago: Gene and Charlotte Dupree, Carol Nelson, Peter Kokh, and Robert Bialecki. We had not been able to finalize the trip or itinerary until the last minute (due entirely to slow response by the staff at the Argonne Visitors Center) and that worked to lower participation.

Nonetheless, we had an excellent guided VIP tour that lasted almost 3 hours. Three facilities were featured (text from Argonne): The Argonne Tandem Linear Accelerator System (ATLAS); the Superconductivity Lab; and the Advanced Photon Source (APS)

• **LRS NEWS now ONLINE** on our meetings page:
www.lunar-reclamation.org/page4.htm

LRS SEPTEMBER Events

Saturday, SEPT 8th, 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 monthly meetings resume after the summer recess. AGENDA: Recruitment, New Projects. We encourage members to be on the alert for potential speakers. Today we'll have a VIDEO feature to be determined.

U.S. CHAPTERS

NSS Chapter Events

MMM 9 Chapters Strong

Space Chapters HUB Website:

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

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**

Aug 21st MEETING at the Stoelting House in **Kiel**
Sept 18th at Foerster Academy of Dance, **Sheboygan**

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

- ConVergence (July 6-8, 2001) Pics online at http://www.FreeMars.org/mnfan/convergence/2001/
- ASP (July 13-18th, 2001) Pcs can be viewed at http://www.FreeMars.org/mnfan/mas/asp-meeting/
- Pix from NW Starfest http://www.freemars.org/mnfan/cvas/nwsf2001/

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: **August 23rd, September 27th**
NOTE: For August only, our meeting place will be The Parma Public Library

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.

- **August 18, 3:00 p.m. --** OASIS monthly meeting at the home of Norm Cook, 10460 Greta Avenue, Buena Park. Info: *OASIS Hotline*, 310/364-2290.
- **September 15, 2 p.m. --** OASIS monthly meeting, Redondo Beach Public Library, Main Branch.

MICHIGAN

Ann Arbor Space Society

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

John Wolter (734) 665-1263 johnswolter@provide.net
☞ 2nd Wednesday (**Sept. 12th, Oct. 10th**) **7 pm**, MEETINGS at members' homes. Contact above

OREGON

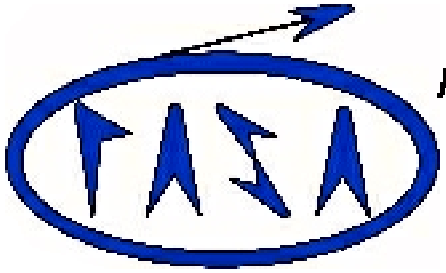
Oregon L5 Society, Inc.

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

http://www.OregonL5.org/

Allen G. Taylor <allen.taylor@ieee.org>
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: **Sept. 15th, Oct. 20th**



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)

NEW URL http://pasa01.tripod.com

Note : PASA is now on the tripod.com system

☞ **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: **September 15th, Oct. 20th**

• **Scheduled PASA activities**: Members will be attending the Millenium Science Fiction Convention on Labor Day Weekend. We may have a group table. *Michelle Baker* will give her presentation on Saturday Sept. 1st 1 pm for the *JPL Ambassador to the Solar System* program. Mitch Gordon may be a panelist, unconfirmed at time of writing. Hank Smith is working on an NSS party in his room or in a suite at the Philadelphia Marriott Convention Center -- time TBD. The con runs from Aug. 30th to Sept. 3rd.

• **July Activities:** Our meeting opened with *Dennis Pearson*, from Allentown a city 50 miles away, giving us our new *National Space Society Banner* and Placard which he picked up for us while attending the 2001 ISDC in Albuquerque, New Mexico. He also told usof Harrison Schmitt's talk on Lunar geology and his thoughts on sovereinty and lunar treaties. He was the only geologist on the Moon in the past but brought up a great reason for future operations -- Helium 3. We may not be able to claim the Moon but we can get material from it that could save us from CO2 effects via jumping some cultures to fusion and cutting out some of their greenhouse contributions (my comment, not Mr Schmitt's). There were many other great talks.

*Michelle Baker*discussed the N.S.S.s call for information on our groups outreach activities and her trip to the 25th(!) anniversary of the *Viking Landing* on Mars.This happened on the anniversary (July 20th) of the Apollo Lunar Landing, which we call Space Day. There where staff who developed the craft and ran the mission at the Washington event.*Daniel Goldin* gave the keynote adress.

Michelle also mentioned her work as an Ambassador doing a talk at *The Franklin Institute* for its *Discovery Camp* program. She has given eight presentations this year at various venues. We should all be this active!

Larry Pezutto gave us a chance to discuss our website problems during his report and offered the solution we will use: tripod.com. We approved this choice. Dotti (Mrs Pezutto) uses this service for her publication *Dotties Dimensions*. She is also our *Planetary Report* corespondent.

Hank Smith talked on various topics including travel and convention connections, the problems of public outreach to the Sci-Fi and Fantasy communities and the 2002 location of Philcon. A guest, Janet, gave a Usenet newsgroup url to check/chat on (rec.sf.arts). I don,t know details on navigating this. Hank is busy with his World Con duties and so will not attend the Mars Society gathering that *Gary Fisher* is going to in California.

Gary Fisher, Pres., Independance Chapter of the Mars Society, went to the New York Chapters' Space Day talks and dinner. Of particular note is the attendance of serveral Toronto members working on an *analog Mars Rover* for use at the Society's analog habitats. They are "reconfiguring" a truck for this job. Another significant thing in Gary's report was the number of non-society members attending: about 25%. I've asked that his report be put on our website.

Dorothy Kurz gave a report about "We can All go to Mars" from *The Planetary Report* and brought up the *Solar Sail* the group was launching, *Dennis Pearson* reported that it had been launched. Information on planetary .orgs website for the *Cosmos* (sail) project. This was only a first test folks.

Earl Bennett gave a short technical report from the July issues of Design Fax and NASA Tech Briefs. The Design Fax had an article on the *Flywheel Energy Storage System* which has been brought to the point of practicality recently for space applications with replacement of batteries in orbital, and especially geosychronous, satellites. This is due to the power requirements of big communications systems which experience power loss in eclipse periods. The savings are in the hundreds of pounds and millions of dollars ($5000+/pound launch). A related article on how this was made to work describes the explosive bonding technique used for the rotor mass. See *designfax.net* for more. *NASA Tech Briefs* (nasatech.com) had serveral reports including one on Fractal Encryption, Near I.R. InGaAs detector arrays, Reconfigurable Robotic Vehicles and more. In adition the ongoing work on *The Faulkes Student Telescope Project* which will allow school students to use serveral 2 meter instruments, one in Hawaii and another in Austrailia for their projects was presented. The project is possible due to the internet. Source: Photonics Spectra Magazine. Report by PASA Pres. Earl Bennett

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❍ $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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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

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❍ $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

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