"Expanding the Human Economy through Off-Planet Resources"

Moon Miners' Manifesto

& Moon Society Journal

#155 May 2002

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In Focus ▣ Opening of Space Tourist Era is for Real. Where to From Here?

Those if us forty or older may remember the excitement over the maiden flight of Space Shuttle one, the *Columbia* -- and the even greater excitement over its second flight. It was, in fact, the second flight, not the first, that confirmed that we had a *'reusable'* vehicle (well, an *'overhaulable'* one at least.) In like manner, I personally got a higher high from finishing MMM #2, than from getting out the maiden issue. The point is that the first time something is done or achieved often turns out to be the last time -- in other words, a 'fluke.'

There was a lot of excitement in the space enthusiast community when Dennis Tito, after many NASA-imposed roadblocks, succeeded in making it to orbit in April 2001. Space tourism was here, said many. Not so fast! But a year later, we have Mark Shuttleworth following in Tito's footsteps, and, bringing back some respectable souvenirs to boot! Now, at last, it seems that we can be confident that Space Tourism has a foot in the door.

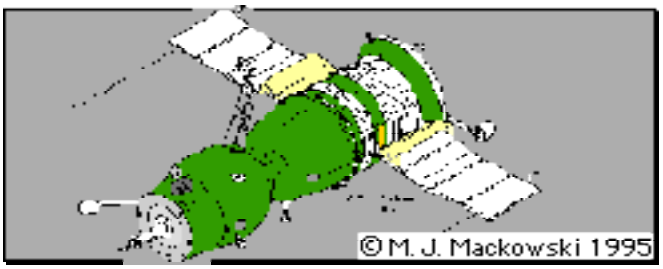
I say a 'foot' because, as Ben Huset of the Minnesota Space Frontier chapter remarks, "When I can book a flight on Orbitz.com, don't need to pass a physical and do a year of training and you get complimentary drinks upon boarding station, then we can start to use the T word." Indeed, what we have here in "guest astronaut assignments to the International Space Station" is not the ordinary tourism of casual relaxed change of pace, but a "working vacation," with a *lot* of prior training. Nor is this an entirely new category. We have long had "working vacations" here below: "Windjammer" Cruises and archeological "digs" being instances.

Yet, thanks to the the zealous conversion of the Russians to the cause of private enterprise, out of sheer economic necessity, and to begrudging and belated compromises by our more socialized space program (who'd have thought!), the door to repeated working guest astronauts willing to pay the steep price does now seem to be propped open. And they might start occurring on a semiannual basis.

Ironically, it is the U.S. government itself that left the door open to civilian visitors to ISS when it canceled the X-38 Assured Crew Return Vehicle program, forcing reliance upon the Russian Soyuz craft. A Soyuz arrives at the station for a six month visit twice a year, and each time it has an otherwise empty seat. (This is only one example of how U.S./NASA cutbacks will have the unintended affect of commercializing ISS.) [=> p. 2, col. 2]

Space Tourist Prize Souvenir Not to Be

Civilian "Guest Astronaut" Mark Shuttleworth had wanted to bring home to South Africa the three-ton Soyuz capsule that protected him during the fiery return to Earth, but was not able to reach agreement with the Russian space agency. It is expected , however that he will succeed in buying his custom made space suit. *Space Tourism* pp. 1-6.



Moon Miners' Manifesto

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fi IN FOCUS Editorial continued from p. 1.

Bringing down the Price of Space Tourism

$20 million smackers is a lot to pay for even a "once in a lifetime" experience. Yet there are indeed enough people out there with that kind of money, and, that kind of free time, to guarantee that even at that price, not too many empty Soyuz seats will go unfilled. It would seem that the Russians need not worry about pressure to reduce prices anytime soon. So how do we get off this dime?

A week-long visit to the International Space Station is, when you think of it, a rather ambitious level at which to jump start space tourism. In fact, that is not how we thought it would start. The X-Prize program, which has yet to produce one viable space-craft, was supposed to open the door to suborbital hops, the kind of threshold crossing pioneered by Mercury capsule astronauts Alan Shephard and Gus Grissom in 1961, and by a X-15 pilot Joe Walker twice in 1963. To be officially considered having reached the edge of space, all one has to do is reach an altitude of 100 kilometers, 62 miles, however brief the stay (International Aeronautics Federation.)

Things haven't started that way. What the X-Prize incentive has failed to produce, however, the dire economic circumstances of the Russian Republic have. Necessity is the mother of invention, and the Russians have vehicles they can produce for the purpose of quickie sorties to gates of space.

Not only does Nature abhor a vacuum, so does Economics. Market demand, awakened by Tito's feat, is there in undeniable force. That someone wpi;d find a way to serve that market was inevitable. The "some-one" with the "right stuff" turns out to be a Russian-American for-profit partnership.

This time, a new start will be made from the first rung on the ladder -- the suborbital hop. And the price being quoted is more than two orders of magnitude (powers of ten) more reasonable, just "$98,000." For that sum, two tourists and their "pilot" will get a 60-90 minute flight to a minimum altitude of 62 miles, highlighted by five minutes of weightlessness, and a look out their porthole at the blackness of outer space and Earth's curvature.

Making this possible is a partnership that includes Space Adventures Ltd., the Virginia firm that brokered both the Tito and Shuttleworth flights, and Russia's Myasishchev Design Bureau, designer of the now-defunct Russian Buran space shuttle. The vehicle will be a new three person craft, currently dubbed the *Cosmopolis XXI* (twenty one), a mockup of which has already been previewed at an Air Base outside Moscow in mid-March.

The smaller-winged C-21 passenger rocket module would be affixed atop a traditionally jet-powered carrier aircraft, the M-55 "Geophysika." The flight will begin with a conventional runway takeoff, carrier and its passenger module climbing to

an altitude of 10 miles (16 km) before accelerating into a steep climb. At nearly 13 miles (21 km), the aircraft carrier separates so the passenger module can ignite its rocket engine to propel it to 62 miles and separate. The Cosmopolis XXI and its passengers keep gaining altitude in a zero-g trajectory, then steer in a glide back to Earth and a runway landing.

Flights aboard the 3-person Russian shuttle, still-in-development, would begin in 2005. As of mid-March, more than a hundred people have sent in their $6,000 down payment reservations.

SOURCE: HoustonChronicle.com *March 15, 2002*
www.chron.com/cs/CDA/story.hts/space/1296550

Meanwhile, not everyone has been content to wait patiently. A growing number of civilians have experienced a half minute or so of weightlessness aboard the KC-135A "Vomit Comet" used by NASA to conduct zero-gravity testing and experiments. Now, for $5,400, anyone can get a ride on the KC135A's commercialized Russian counterpart, the Ilyushin-76. Space Adventures, Ltd., offers the 2-hour flight from Star City, the Russian cosmonaut training center outside Moscow. Passengers experience a half minute of free fall during each of about 10 dives. As the plane reaches full throttle headed up at a 50° angle, the engines are cut and it coasts to the top of its aerial roller coaster run. Weight return as air friction begins to slow the plane on its descent.

From the bottom of the Ladder back to the Top

Starting at the top of the ladder, as illogical as this development would seem to be, has served its purpose in whetting the public appetite for first hand experience of "Space." Now, while the rich-set flights continue, the momentum will shift to the more humble threshold of space ventures. How big is the market for this? It would seem inexhaustible. Note:

- the around-the-world cruise market has proved quite sustainable at about the same price range
- a surprisingly large number of people, at least in North America, could pay for the ticket with a second mortgage on their homes (unfortunately, that doesn't include the writer, nor perhaps, the majority of MMM readers.)

If this three person craft can take only two passengers at a time -- and the turnaround time before it can fly again is unclear -- it would seem that considerable demand would remain unsatisfied. It will only be a matter of time before additional C21's are built. If the market proves to be as strong as most of us expect -- and if there are no untoward disasters to dampen enthusiasm -- the incentive will be there to produce larger capacity shuttles to meet assured demand.

On to the next rung in the ladder -- longer and higher flights. We could start to see Intercontinental flights, and that would certainly jump start demand for hypersonic airliners, bringing the price down to somewhat above that of a transAtlantic flight on the Concorde.

Rung Three: up into orbit and back to the starting point (a distinct logistical advantage over Intercontinental flights). Around the world once in 90 minutes, repeating the first ever space flight of Yuri Gagarin in 1961. These tourists will coast much higher up, over a hundred miles, and see much more of the beautiful Earth below. Yet this remains a modest endeavor, with minimum hygiene and food or drink provisions, no need at all for the recreational diversions of much longer flights. We can expect to see "Yuri Flights" by the end of this decade.

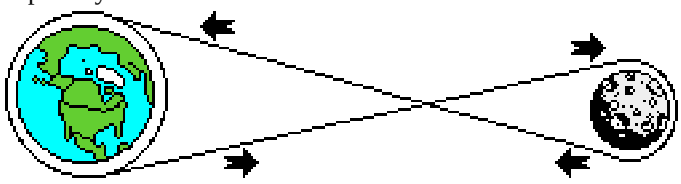
By that time, it is not clear in our crystal ball that working vacations for guest astronauts aboard the Space Station will still be going on. A lot depends on if and how the Space Station grows and evolves along with its support infrastructure. That is another topic. Hopefully, U.S. cutbacks will lead to other nations and commercial enterprises stepping up to the plate to fill the vacancy. A less dominating position for NASA might provide a more favorable climate for the emergence of an independent multi-national Space Station Port Authority, tasked, beyond politics, with growing the station to become "all it can be" -- which is a lot.

Beyond simple orbits - Orbitels & Moon Looping

The next step is providing "places to go," a "cruise ship stop" or two in orbit. Bigelow Aerospace and others are already researching and planning for the time when the market makes dedicated orbital tourist facilities inevitable. Involved are two things:

1. Larger space than a shuttle cabin provides - space to support additional activities: hygiene, exercise, dining, socializing, and more
2. More provisions than are needed to support suborbital and one-orbit flights of a few hours.

Many will be surprised to hear that an orbital hotel may not be the only, or even the cheapest way to realize this quantum leap in support and services. For virtually the same amount of money as a week long stay in the "Cloud Nine" or "Terra Heights" resort complexes, one could transfer in orbit to a larger freshly refueled craft, and rocket off on a six-day loop the Moon trip on much the same trajectory as that of the suspense filled flight of Apollo 13, but hopefully without the drama.



The amount of provisions needed for the Moon loop would be about the same, with the spaciousness of the cabin facilities fuel-conservingly less, than for an orbitel week long stay. What we are predicting is startling, perhaps. You will be able to loop the

Moon without landing, cruising low over the farside terrain, at about the same time in history as the first orbitels and space resorts open for business!

There is one fly in that ointment - space sickness. The larger orbitels will probably be much better able to cope with guest indisposition than will tight-quartered Earth-Moon coastal cruisers. One possibility is that the Moonliners will require their passengers to have previous zero-g experience, in order to filter out those likely to weather the experience badly. There is an old sailors' poem which goes "Sail, Gale, Pale, Rail." Well, there won't be a handy rail on those early Moon-loopers!

We wrote a two page article on "Lunar Overflight Tours" in MMM # 21, December 1988. You will find it online at:

http://www.asi.org/adb/06/09/03/02/021/lunar_overflight.html

So when do we get to go?

The answer to that "bottom line" question depends upon a number of things:

- the success of the Cosmopolis XXI suborbital venture - its real cost, its safety record, and positive passenger experiences
- the entry of competitors who will try to do that excursion "one-better"
- the general state of the national and global economies
- the construction of commercial orbital facilities unconnected with the ISS
- and any number of unpredictables

Despite the unknowns which are always present in any forecast of future developments, the long anticipated dawn of "real space tourism" would seem to be upon us. By the end of the decade, the number of actual space tourists should be over a hundred, perhaps well over that figure. Beginnings are the hardest. Once the threshold is crossed and experience on the other side grows, momentum and crescendo would seem likely. *Engage!* **<PK>**

"An American Odyssey"

A Proposal for the Next Step in Commercial Space Tourism

With the adoption of liberal crewmember criteria for the International Space Station (ISS), new NASA Administrator Sean O'Keefe has an opportunity to go where no NASA administrator has gone before -- to the forefront of space visitation and space commercialization.

Human space activities eventually must generate products or services that people will pay for. The most promising area for commercially profitable space venture is tourism. Christa McAuliffe, Barbara Morgan, Jake Garn, a senior John Glenn and Dennis Tito have shown that average citizens *can* travel in space, without significantly disrupting the activities of professional astronauts and cosmonauts -- *and* that people will get excited about space when vicariously sharing off-world experiences of one of their own.

How can we build on that momentum and jump start pay-as-you-go space visitation? *The key is not just to sell space station visits to a few wealthy customers, but to also involve the rest of us in the ride.*

Antecedents: Consider these precedents:

- 1980s, Americans excitedly followed the selection of 10 Teacher-in-Space candidates from each state, eventually winnowed down to McAuliffe and Morgan. Likewise, we followed a pool of would-be Journalists-in-Space being winnowed down to several dozen.
- 1980s and 1990s, state lotteries have proved wildly profitable.
- 1990s, half a million persons sent their names to ride Cassini to Saturn; more than a million sent their names on the Stardust comet-sampling mission.
- 1990s, Apollo 11 astronaut Buzz Aldrin introduced his comprehensive "ShareSpace" step-by-step plan for a national lottery for rides into space.
- 2000s, each week, millions watch 10 persons vie to sit in the "hot seat" on ABC's "Who Wants to Be a Millionaire."
- 2000s, millions avidly watch 16 average persons winnowing themselves down to a single "Survivor, an exceedingly profitable venture for CBS.
- 2001, Thousands signed up within weeks for NBC's proposed "Destination Mir" television program, whereby 10 Americans would have undergone a "Survivor"-like competition to fly to the Russian space station.

Concept: It only remains to combine these precedents in a creative and comprehensive new way. For such a next step, it is proposed that the aero-space community and the American entertainment industry join together in a commercial Venture to send one citizen each year to the ISS by combining:

(i) Buzz Aldrin's national lottery plan with
(ii) a national "Teacher-in-Space"-like winnowing process with
(iii) a "Survivor"-like television game program.
Call this Venture, perhaps, "An American Odyssey"

Basic mechanism: Here is the basic way "An American Odyssey" could work:

- Anyone could enter a lottery each year, say for $25 per entry.
- In each state 10 semi-finalists would be drawn and, after they passed the physical, a contest

would determine the selectee. The contest might be a cross between that of "Who Wants to Be a Millionaire" and "The Weakest Link," with participants answering questions about space, or it might have a jury select the person who best answers "Why I Want to Go," or it could be a "Survivor"-like winnowing process. The process could be drawn out, so it receives appropriate media and human interest attention, as did NASA's "Teacher-in-Space" selection process.

- Then state winners would be brought to a central location, e.g., Johnson Space Center, or a Los Angeles TV studio, where after a similar or different televised selection process, Finalists -- perhaps 10, with 2 alternates -- would be selected.
- Then Finalists would compete in a final selection process, similar or or different, perhaps an actual training program with grades or "Survivor"-like de-selection, with the winner flying on the shuttle to the ISS.

Options: Each of the various elements of "American Odyssey" has alternatives. Examples:

- Most obviously, internationalization, to allow participation by citizens of our ISS partners. Maybe that would include sharing the revenue or internationalizing the name.
- If NASA simply cannot part with one seat per year on the shuttle, the Venture could subcontract that ride to a Russian Soyuz, as Tito did.
- Lottery tickets could cost $100 each, or $0, depending on just how commercial the Venture wants to make it.
- Even more could be charged, if buyers received tangible memorabilia.
- Entries could be limited to one per person, or as many as you want to buy. A winner at any stage of the process could, or could not, be allowed to give or sell the winner's place.
- As with State lotteries, tickets could be sold through organizations like the National Space Society or commercial outlets, with winners' sellers getting special benefits.
- Each state contest could be built on first drawing winners from each county. Or there could first be county-wide semifinalists.
- The selection of State winners and Finalists could use the same or a different process.
- If selection is based on knowledge, it could be based on what a person already knows, or, to equalize age, opportunity and economic advantage, questions could be selected from those supplied to the contestants in advance.
- The extent to which State and Finalist selection is covered by all media or just exclusive packagers can be varied.

Key Ingredients: The Venture would rest on three elements:

1. Congress authorizing a lottery superseding state lottery laws.
2. NASA contracting with the Venture, as it did with companies sponsoring "Payload Specialists," for the Finalists to receive a period of NASA training and a shuttle seat.
3. The Venture selling broadcast and ancillary rights, advertising, product placement and media tie-ins at all levels of the competition, as selection occurs and as packaged (a la "Survivor").

What is needed now is for NASA to encourage television networks and experienced people (like Buzz Aldrin, "Survivor" producer Mark Burnett and film director James Cameron) to form such a Venture that would craft the most viable and profitable version of such "An American Odyssey."

Expectations: Robert Heinlein's fictional entrepreneur D.D. Harriman, then Olympic hosts, and now "Survivor," have demonstrated the profitability of selling rights to riveting popular events. Conservative lottery income projections sugggest an "American Odyssey" Venture can generate substan-tial revenue, possibly even enough to pay a trip's full incremental cost (if not the bookkeepers' amortized cost).

But even if it does not pay the full cost, the fact that it could pay a significant portion of it would be major advance in showing how space can eventually pay for itself. It certainly would be an improvement over the status quo of generating no income.

Other Advantages: An "American Odyssey" would get the public intensely and personally involved in space. It would show taxpayers what they get for their money, and, like tourism at other American National Science Laboratories, would boost interest in and support for the work of the ISS.

The ISS can be regarded as a national lab for BOTH scientific AND sociological results -- and the education that the Venture gives the public about space may ultimately be the most important contribution ISS makes to our society.

The Venture would give every taxpayer a chance to be the one to visit ISS personally, and all the others a chance to participate vicariously. It would put NASA in the forefront of space visiting and space commercialization, the appropriate place for a forward-looking agency.

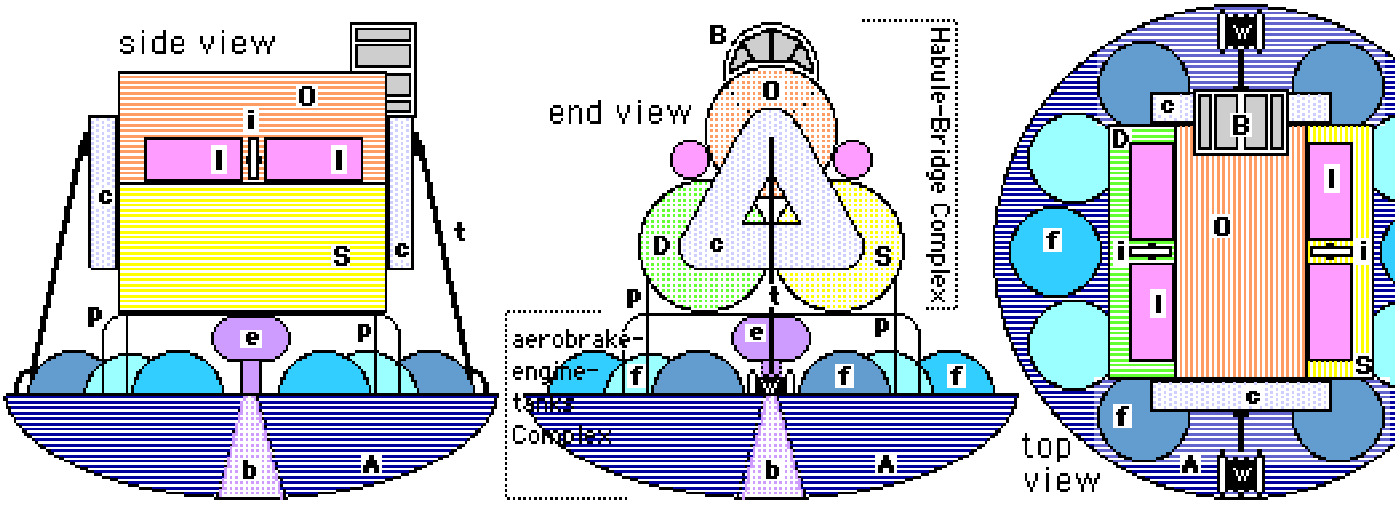
Whatever the particular details, the "American Odyssey" concept is both desirable *and* workable. The time is ripe for it.

After Tito and with "An American Odyssey," the tourism rocket is straining to leave the launch pad; we have but to release the clamps. **<JGL>**

[Jeffrey G. Liss is a space activist and general business lawyer in Chicago, IL. His views do not necessarily represent those of any organization with which he is affiliated. A version of the "American Odyssey" concept was circulated at the 2001 ISDC.]

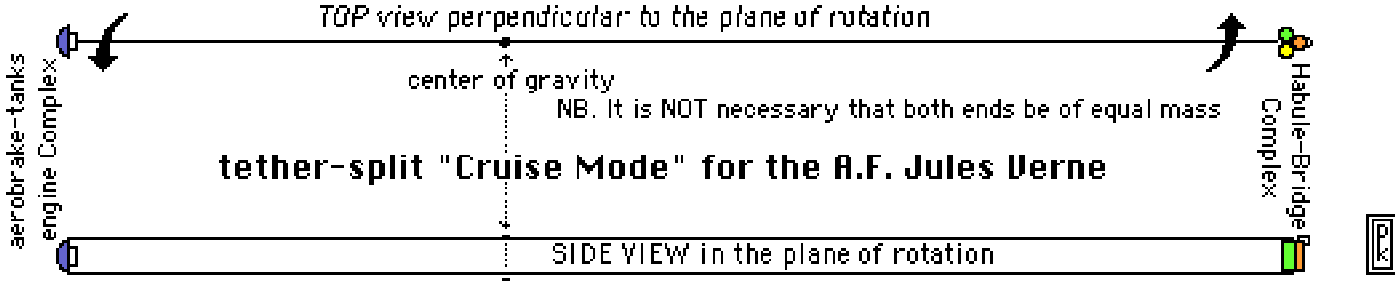
Space Tourism Crystal Ball Gallery of the Future "Journeys of Imagination"

the "A.F. Jules Verne" Moonlooper -- a rough conceptual sketch



KEY: **A** Aerobrake -- **B** Bridge -- **b** engine bell -- **c** inter-habule concourse -- **D** Diner-Lounge Habule -- **e** rocket engine -- **f** fuel tanks -- **i** anti-twist inertial orientation flywheels used in cruise mode -- **l** life support equipment -- **O** Observation-Lounge Habule -- **p** platform to nestle the Habule complex -- **S** Sleeper-Lounge Habule -- **t** tethers -- **w** winch reels for tether-deployment in cruise mode.

from MMM # 21, DEC '88, "Lunar Overflight Tours"



The A.F. Jules Verne would be designed to separate into two components in cruise mode, bound by tethers, and set rotating at a low speed to provide artificial gravity at the 1/6th g "lunar" level, both for passenger comfort and to maximize the "lunar experience." It could be outfitted with furniture and furnishings similar to what we'd expect could be manufactured locally in an early settlement. The A.F. stands for "aerobrake ferry" -- on returning to Earth orbit, the Verne would shed its excess momentum by braking off the top of the Earth's atmosphere.

The sketch above is only conceptual and the various components might well be differently sized in their relative proportions.

Flights around the Moon could be timed at first or last half moon so that part of nearside and part of farside would be sunlit, or at new moon, so that the entire farside would be sunlit for the close skim-by portion of the trip. **<PK>**

Russian X-Prize Entry **C-21** with pilot & two tourists hitches ride on jet booster

Nearer term than flights around the Moon are $100,000 rides on **Cosmopolis XXI**, joint American-Russian venture being designed by the only X-Prize team with a proven record. The aim is to have it up and carrying tourists sometime in 2005, three years from now. More on this in our feature essay, pp. 1-4.

Abstracts of Papers Presented at the 2002 Space & Robotics Conference by members of the Oregon L5 Society Lunar Base Research Team.

Gecko-Tech in Planetary Exploration and Base Operations

http://www.OregonL5.org/docs/sr2002a.pdf

Thomas L. Billings, Robert D. McGown, Cheryl Lynn York, Bryce Walden

Abstract

Geckos can walk straight up walls and across ceilings. Dr. Kellar Autumn and colleagues have discovered their secret: gecko feet have hundreds of thousands of hair-like "setae" with hundreds of submicroscopic pads ("spatulae") at each seta tip, which appear to cling by van der Waals forces to almost any surface. Unlike suction or traditional adhesives, this adhesion works under conditions of vacuum and particulate contamination, making it potentially ideal for use on the Moon and Mars. It is also remarkably strong (10 N per 100 mm2 in vivo), yet quickly and easily released.

Lavatube caves, on any world, can be one of the most extreme terrains in which to operate. The caves consist of raw, unweathered lava. Cave floors covered with random piles of large boulder "breakdown" make exploration difficult for humans or robots. The ability to traverse lavatube walls and ceilings would make such exploration much easier; this could be accomplished by using gecko-derived biomimetic technology. "Gecko-Tech" can greatly enhance efficiency and effectiveness of cave exploration and development. These technologies can also find many other uses outside of lavatubes.

Gecko-footed robots could climb to the lavatube roof and emplace permanent anchors for suspension of utilities, transportation, or even entire lunar bases. Tethers tipped with gecko-tech pads can extend the reach of robots and humans. Humans wearing a flexible skin-tight spacesuit with gecko-tech pads could climb over large rocks on lavatube floors, or up lava walls. Such a garment would be useful to climb the red cliffs of Mars or to perform maintenance work on slippery habitats.

Gecko-tech will increase the capabilities of emergency and rescue operations. It will enable new forms of sport and recreation.

Gecko-tech enhancements of human and robot mobility expand the range over which humans and robots can work, becoming an effective productivity multiplier. **<ORL5LBRT>**

Lavatube Entrance Amelioration on the Moon and Mars

http://www.OregonL5.org/docs/sr2002b.pdf

Robert D. McGown, Cheryl Lynn York, Thomas L. Billings, Bryce Walden

Abstract

To explore and utilize lavatube caverns, a negotiable entrance is vital. Lavatube entrance amelioration includes clearing debris, establishing a transportation right-of-way, and preparing for and installing various access aids. There are four main types of entrances to lavatube caves: a "rille entrance," a "skylight," a "hornito," and an engineered, artificial skylight.

A rille entrance should be easiest to improve. In rare cases it may be possible to simply walk or drive into the lavatube. More likely, the rille entrance will be choked by initial rille collapse and eons of weathering. A mucker and cable assembly used to clear the entrance might become a cablecar. Later, a suspended road may be built.

A skylight forms when a small portion of the cave ceiling collapses. The skylight entrance is prone to further collapse. Given their great age, unstable areas will probably have collapsed already. Beneath the skylight, there is most likely a chaotic pile of collapse debris ("breakdown"), covered with regolith. Dangerous slopes of regolith lead into the hole. Survey and stabilization are the first steps of entrance amelioration. Mechanical aides from nets and ladders to A-frame pulleys and small elevators can then be emplaced. Later development could include large freight elevators up to a skylight-spanning "Maxivator" suitable for lowering entire ships into the lavatube shelter.

Hornitos occur where temporary blockage within the active lavatube causes molten lava to burst out to the surface, leaving a surface cone of solid basalt with a central hole leading to the cave. There may only be minor debris below this hole. A hornito provides a strong lip and solid foundation for devices to lower material and people into the cave.

Where a cave lacks a handy entrance, an artificial skylight could be created. The edges of the hole would be engineered, and the roof is not necessarily weak in its vicinity. Utility holes of various sizes could be drilled directly. Larger holes could be created by direct blasting, or precision blasting to result in a removable plug.

The improvement of lavatube entrances will require a range of engineering solutions. Since lavatubes on the Moon or Mars are expected to be vast, the effort of entrance amelioration is small relative to the sheltered space it makes available. The cost is low compared to the payoff. **<ORL5LBRT>**

Moon Lighting: Illumination for Lunar Base Construction and Operations

Robert D. McGown, Thomas L. Billings,
Bryce Walden, Cheryl Lynn York

Abstract - www.OregonL5.org/docs/sr2002c.pdf

Lunar bases will need lighting for exploration, construction, mining, industry, life support, operations, and maintenance. In many respects, lighting on the Moon will involve adaptations of familiar methods. Efficiency, robustness, and serviceability will be required.

During the lunar day, sunlight is available using heliostats, lenses and light tubes. Some of these items can be used for distribution of artificial light as well. Illumination may be augmented by using transparent, translucent, light-colored or reflective walls and panels.

Moon lighting presents special challenges, such as dust amelioration, heat management, and lavatube illumination. Spectrum manipulation can promote or inhibit living organisms, as desired.

Using lunar resources to manufacture lighting equipment will save money over Earth sourcing, so designs should be compatible with lunar sourced components as these become available.

"As long as we're here...": Secondary Profit Generators for Moon and Mars Bases

Bryce Walden, Cheryl Lynn York,
Thomas L. Billings, and Robert D. McGown

Abstract - www.OregonL5.org/docs/sr2002d.pdf

Lunar and Mars base planners concentrate on one or two economic drivers to justify a base. This is like the "killer app" in the computer world, the single indispensable application that justifies the computer purchase. "Secondary profit generators," numerous economic activities that make a complex lunar or Mars base work, have received less attention.

Trade with Earth is a special case. Due to Earth's deep gravity well, transportation costs are far from reciprocal. Earth industry produces vital items unavailable elsewhere; however, Earth's large population represents a huge market for offworld products.

Space commerce among bases on the Moon, Mars, and elsewhere in space brings opportunities in transportation, sales, legal services, and trade in minerals and volatiles, to name a few.

As bases specialize, an interbase economy will develop. Bases can specialize in power production or construction, for example. Precious volatiles could be traded, as long as they remain onworld.

Intrabase economy, or commerce within a single base, opens up a range of small business possibilities including repair shops, laundry, professional services, and others.

The more secondary profit generators a base can develop, the stronger and more resilient the base economy will be. Settlements initiated as "company towns" will transition to diversified economies.

Ultimately, the aggregate of secondary profit generators could dominate base balance sheets and do away with the need for a single economic driver to make a base a viable, going concern.

Lunar "West Pole" Prime Meridian

Bryce Walden, Robert D. McGown,
Cheryl Lynn York, Thomas L. Billings

Abstract - www.OregonL5.org/docs/sr2002e.pdf

We impose coordinate systems on planetary surfaces to define locations, compute distances and areas mathematically, and give us a control grid for mapping. The poles, equator, and parallels of latitude are defined by the planet's intrinsic property of rotation, but placement of the Prime Meridian of longitude is arbitrary. Proper placement and use of the Prime Meridian can make the coordinate system easy and intuitive, or difficult and confusing. Current systems in use for the Moon (more than one are used) are awkward and out of date. We propose the Prime Meridian bisect a prominent feature close to the Moon's "West Pole": Mare Orientale (20°S, 95°W); and, that longitude increase from 0° to 360° in the direction of rotation. We call this the "Lunar West Pole Prime Meridian" system.

Today's "Mean Earth / Polar Axis" system dates from 1775 when mariners used the Moon to find longitude at sea. The mean sub-Earth point, in the center of the nearside, defines the Prime Meridian. Meridians are referenced in degrees east and west, or + and –, from this point. No significant lunar feature marks this Prime Meridian. This system is still used, with one major change: "east" and "west" were switched by international agreement in 1961. Earth's Prime Meridian has changed several times.

The lunar coordinate system should be convenient for those on the Moon and in space as well as those on Earth. It also should be referenced to an endogenous lunar feature, not another planet. The Lunar West Pole Prime Meridian system is an improvement over the present system for all users. Longitudes roughly from 0° to 195° are on the lunar nearside (includes libration) and 195° to 360° span the farside. Adding 5° to Earth's angle from the eastern horizon gives longitude directly. The all-positive numbering system makes computation of change or distance in longitude easier, and removes sources of error. This location of the Prime Meridian is clearly discernable from space: a naïve observer might easily pick Mare Orientale as a marker. The Lunar West Pole Prime Meridian system is useful, simple, elegant, intuitive, endogenous to the Moon, and conforms to modern standards. **<ORL5LBRT>**

http://www.moonsociety.org

Please make NEWS submissions to
David Wetnight at newsmonger@asi.org
Other submissions: KokhMMM@aol.com

The Moon Society was formed in July, 2000 as a broad-based membership organization with local chapters, to spearhead a drive for further explor-ation and utilization of the Moon in cooper-ation 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/
- $35 USA/Canada + MMM hardcopy
- $60 elsewhere + MMM hardcopy
- $35 anywhere + MMM electronic PDF file

Questions? email: membership@asi.org

The Artemis Project™ http://www.asi.org/
- Artemis Reference Mission
- Artemis Data Book

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

Please send all mail related to Memberships to:

The Moon Society Membership Services
PO Box 940825, Plano, TX 75094-0825, USA

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

2002 Moon Society Elections

from Gregory R. Bennett, President Moon Society

Dear Moon Society member,

It is time again for the annual election of officers and directors in the Moon Society

Terms for two of the Society's elected offices and three Director slots expire this year. Nominations are open to everyone who is qualified to hold one of these offices under the Moon Society's Bylaws.

To be eligible to stand for election as Directors or Officers, individuals must be members of the Society at the time of the election and must have been a member of the Moon Society or a member of Artemis Society International for an uninterrupted period of two or more years prior to the election or one year prior to the Society organizing meeting on July 21, 2000, whichever is less.

The requirements for prior membership in Artemis Society International will go away next year. Those provisions are included in the Bylaws to accommodate the transition period from the time the Artemis Society formally established and funded the Moon Society. Obviously it would not be possible for someone to have been a member of the Moon Society for two years until the Moon Society itself is more than two years old.

You can nominate yourself, and in fact are encouraged to do so. All you need do is write the names and membership numbers on the form on the back of this letter and return to the Moon Society at the Plano address.

You also may nominate more than one person for a given office.

You can copy the following form and mail it to the address below. Your signature and membership number are required.

2002 Nomination for Officers and Directors

To the Board of Directors of the Moon Society,

Please accept my nomination of the following individuals for the respective officers in the Moon Society:

President _____

Treasurer _____

Board Members (2 vacancies)

_____

_____

Nominator's Signature_____

Membership Number #_____

Mail ballot to:

The Moon Society
P.O.Box 940825
Plano, TX 75094-0825, USA

Artemis Society International & The Moon Society

Frequently Asked Questions

[http://www.moonsociety.org/about/]

Q. What is the relationship between the Moon Society and Artemis Society International?

A. **Artemis Society International** [www.asi.org] is a separate organization but is affiliated with the Moon Society. Members of the Moon Society can automati-cally become members of ASI at no additional charge. The focuses of the two organizations are somewhat different; the Moon Society is a non-profit member-ship organization focusing on all aspects of the Moon. Artemis Society International is returning to its original charter as the meeting ground for Artemis Project [development of the reference mission for the first commercial Moonbase] program participants.

Q. If I was previously a member of the Artemis Society International, am I now a member of the Moon Society?

A. Yes, if you were a member of ASI as of June 22, 2000, you are now a founding member of the Moon Society! ASI will continue to exist and is now open to all members of the Moon Society.

Q. What about Artemis Society chapters around the world?

A. All chapters previously belonging to the Artemis Society are now part of the **Moon Society Chapters** system. New chapters of the Moon Society are also being formed.

Chapter Information

Chapters Council - [http://www.moonsociety.org/chapters/council/] Currently being formed, the Chapters Council will represent the Moon Society's chapters & members. Each recognized chapter can elect a representative to the council.

Chapters Coordinator - Tim Cadell, the Chapters Coordinator is responsible for coordinating chapter efforts and promoting development of chapters worldwide.
Email:<chapters-coordinator@moonsociety.org>

Chapter Rules - [www.moonsociety.org/chapters/ChapterRules.html] These are the official requirements for creating and maintaining a Moon Society chapter.

Chapters & Local Contacts List - [http://www.moonsociety.org/chapters/] *Please do volunteer to be a local contact* if there is none in your area or community!

The Lunar Night Power Game

© 2002 Richard Perry <rperry@dial.pipex.com>

Our efforts to refine practical plans for colonising the Moon have revealed a small number of long-standing issues put in our way:

1. How to make it pay commercially
2. Where to live safely
3. How to survive the lunar night.

These really are the Big Three Nuts to crack, and having seen a lot of progress made so far on the first two (space tourism now exists for real, lava tubes appear to offer an almost ideal natural living resource), it is time to have a look at the lunar night problem.

There is no prolonged twilight or graceful start to the lunar morning. The sun goes down rapidly and with it all currently foreseen sources of radiative power. During the lunar day we potentially have access to so much power that long term economic plans for luna always invoke the concept of selling power back to Earth.

In the interim however, we have this very real problem of how to survive a lunar night without our solar power systems. The solution appears obvious - store power generated during the day for use at night. The practicalities of doing this are what we need to address.

The option that is the subject of this article, using flywheels, has often been mentioned and nothing more. I should like to present the findings of a closer look at this subject area, and you may find these quite a surprise.

Flywheels are mechanical masses spun at high speed to store energy. With the flywheel in a vacuum and low-loss bearings, they are able to store energy for when it is required and deliver it instantly.

For a detailed overview of flywheel physics, go to http://www.geocities.com/dfradella/basics.htm

Research identifies three kinds of flywheel user, and three kinds of design solution:

1. Present-day user (representing the off-the-shelf technology available right now)
2. Space users
3. Future users

User #1 is often a computer company or power company wishing to maintain power free of large dips in capacity, or to provide emergency power to allow computers to be shut down safely at short notice. Flywheel energy storage systems (FES) are presently limited by their very low storage capacity (Kilowatt minutes), and the dangers associated with the very high speeds of rotation required. Obtaining high

storage capacities using denser materials is offset by their tendancy to fail at lower rotational speeds.

Designs are limited to power systems capable of delivering a few tens of kilowatts for a few dozen seconds, and obviously nothing like what is required to power a moonbase for several weeks.

User #2 is the more visionary, who still see a future for flywheels if only they could be developed to the same state of maturity as say batteries or solar cells. Specifically, NASA is a sponsor of such research, with a small number of commercial companies contributing to the development of the technology.

Unfortunately, the goal is to investigate the capability to power satellites when they enter Earth shadow, rather than a more fundamental re-think of the technology. As such, the technology is very over-engineered, expensive, and on a slow road to meeting the needs of a single government agency customer. With their sights set on providing power for highly power-efficient satellites for less than an hour, the technology (once developed) will again be short of our needs.

User #3 (other future users) only exists in the plans of companies like Regenerative Power & Motion, who are by far and away the most visionary of the design solution providers. Having identified a market value of hundreds of billions of dollars for their technology, they are racing ahead with product development.

They are going back to scratch with the technology, and have already demonstrated designs that can produce storage capacities of tens of kilowatt hours with comparitively low cost and maintenance solutions. Whilst this company clearly hints at how our demands can highlight promising markets for environmentally friendly technology back on Earth, those same demands are ahead of our Earth-based technology development priorities.

For full information on Regenerative Power & Motion, including their 2001-issued startup business plan, go to

http://www.geocities.com/dfradella/homepage.htm

So we start with a simple problem - how to store power for the lunar night, and come to realise that back on Earth we are so un-environmentally friendly that the technology for such a simple and sensible concept is just not there yet. If we were in the game of using technology development to spin-on capital for the exploration of space, then perhaps flywheel energy storage (FES) systems could be just the ticket. However, 'development' is not a word which fits in with the Big Three Nuts issue mentioned right at the start. The commercial strategies have to be based on proven technology that is so mature that it is available off the shelf at a good price. FES technology appears to exist in such a form, but as the above has shown the present form falls far short of where it could or should be.

So we have to take flywheels off our list of possible technology to power us through the lunar night. Alternatives like nuclear power and batteries are out of the list of options for present, so allow me a little re-think of the original problem - how to survive the lunar night.

To be blunt, I think our goal is difficult enough to achieve without making it harder for ourselves.

Stay in the light - avoid the nighttime issue altogether. This means placing our base close enough to a lunar pole to allow us to tap power from solar arrays. Now this may still mean being a few hundred (or thousand) miles away from a pole in order to utilize lava tube resources, but photovoltaic arrays permanently in sunlight and microwaving the power to our lunar base seems to make more sense than trying to solve a problem which has no off-the-shelf solution.

For an example of solar power designed for used by very remote manned facilities (Antarctica):

http://powerweb.grc.nasa.gov/psi/DOC/ant.html

So perhaps the problem should be re-defined as a lunar power "transmission" rather than storage. With long term power storage a very immature technology, the better characterized technology of power beaming using microwaves could be a more promising alternative.

That said, we are still talking emerging technology - "To date there have been no commercial implementations of microwave power transmission beyond feasibility study." - University of Alaska Fairbanks, from their Semi-Autonomous BEam Rider webpage.

For a brief but comprehensive overview of the history of microwave power transmission, go to:

http://www.kurasc.kyoto-u.ac.jp/
plasma-group/sps/history1-e.html

For a much longer overview of microwave power technology history, go to:

http://engineer.tamu.edu/tees/CSP/
wireless/homepage.htm

The pages describe a demonstration in 1975 of beaming power over a distance of one mile to a rectenna which captured a portion of the microwave beam and converted it back to over 30 kilowatts of DC power with an efficiency of 82%.

The above page also links to a biography of William C. Brown, who perhaps performed some of the most practical work in proving the viability of mirco-wave power transmission until his death in 1999. He

published over 90 papers and had 50 patents in microwave tube technology and wireless power transmission. A demonstration of the technology in action is described at:

http://www.tsgc.utexas.edu/tadp/1996/general/wpt

html which indicates that whilst the systems are reasonably simple in architecture, the actual physics (particularly interactions with space plasma) involved still require a great deal of research before they can be considered anywhere near off-the-shelf for our needs. The good news is that they report the ability to transmit (radiate) power at up to 95% efficiency.

A number of "demonstrations" of microwave power beaming have been undertaken during the period from 1888 to 1975. Over that time the demonstrated efficiency of wireless power transmission was improved from 13% to 54%. Ref.:

http://engineer.tamu.edu/tees/
CSP/wireless/articles.htm

Since any base would be 100% reliant upon such a system, the reliability issues now take precedence over the "does it work?" and "is it available now at the right price?" ones associated with storing power.

The Lunar Night Power Game continues, since whilst we may be able to go around a fundamental problem associated with the lunar night, we now have to confront other issues which have always been there. Life support systems require power, and the reliability of that power will be as fundamental as air supplies and food.

Epilogue:

The NASA beamed power web page at:

http://powerweb.grc.nasa.gov/psi/DOC/beams.html

reveals a history of very alternate thinking in the past. We've all heard of the concept of space-borne power systems beaming power to Earth, and even of plans to supply Earth's power needs from the Moon itself.

Although no longer funded (the research is continuing on beaming power from space to Earth), this department considered the possibilities of beaming power to space, and in particular to Moonbases using very high power lasers. Specifically, they claim "Performance of conventional solar cells, when illuminated by laser light, show a potential efficiency improvement of a factor of 2".

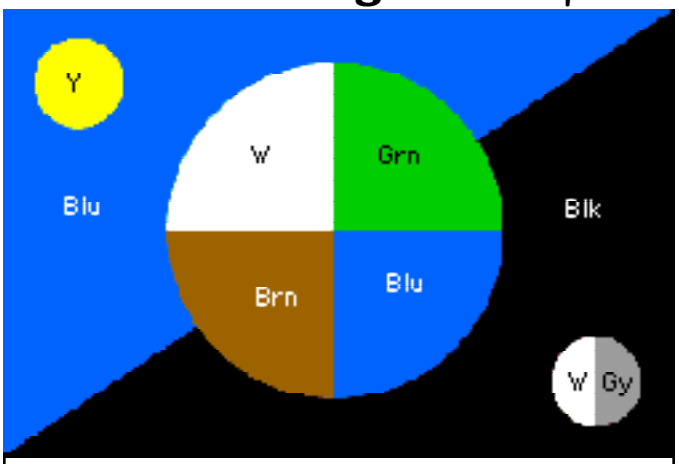
Specifically, they offered beamed power from Earth surface to lunar surface as a solution to the lunar night power problem. This is insane. Whilst they were also looking in terms of not transporting the power transmission mass into space (and reusing the facility for multiple mission customers), perhaps their concept for powering a Moonbase directly from Earth-based stations was a little offbeat. The concept of beaming power to a moonbase is however clearly a possibility, whatever the source (Earth, low Earth orbit lunar orbit, lunar pole).

A related office of theirs published this page:

http://powerweb.grc.nasa.gov/
pvsee/ programs/solarmoon.htm

which is directly concerned with lunar photovoltaic power. Note the use of solar arrays as basic sunscreens in initial lunar base concepts very close to that of the Artemis Reference mission. **<RJP>**

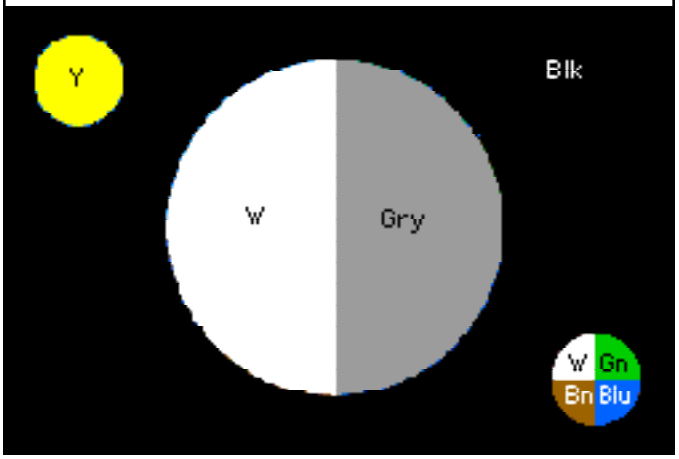
Earth / Moon Flag Pair Proposal



EARTH: Shaun Moss <shaun@MarsEngineering.com> "This design is a stylized representation of Earth in space. The four colors of Earth {clockwise from upper left) white, green, blue, brown) are shown in the form of the quartered cross, which is the atrological symbol of Earth. The upper-left half of the background shows the golden sun in the blue sky of day, and the lower-right half shows the silver Moon in the black sky of night."

members.aol.com/kokhmmm/earth_moon_flags.htm

MOON FLAG: Peter Kokh working with Shaun Moss.



LATEST DEVELOPMENTS IN SPACE INDUSTRIALIZATION, SATELLITE SOLAR POWER, AND SPACE HABITATS

L5 NEWS

A NEWSLETTER FROM THE L-5 SOCIETY

http://www.L5news.org/

The purpose of this website is to provide free download of back issues of the *L5 News*, the publica-tion of the L5 Society – an organization devoted to making space settlements a reality in our lifetime. The *L5 News* was published from September 1975 until April 1987, at which time the L5 Society merged with the National Space Institute to create the National Space Society. Readers are referred to the National Space Society for current membership information.

Contents:

Basic background info:

- What is L5?
- Brief history of the L5 Society
- L5 scenario in a nutshell

L5 space colony artist renditions:

- O'Neill Cylinder, courtesy NASA
- Stanford Torus designs
- Bernal Sphere designs
- O'Neill Cylinder designs

Back issues of the L5 News: L5 News issues are provided here for free download. They are in PDF format and are fully searchable. To read the files you will need the free Acrobat Reader program. NOTE: Informational or merchandise items offered by the L5 Society in these publications are no longer available. Do not contact the L5 Society at the address used in these publications. For current membership information, please contact the National Space Society.

- L5 News index for 1975
- L5 News index for 1976
- L5 News index for 1977
- L5 News index for 1978

This site is under construction. If you would like email notification each time an additional year of the L5 News is added to this site, please contact the webmaster <webmaster@L5news.org>.

Related Links

- Space Settlements: A Design Study - NASA Publication SP-413 - Complete online copy of the 1975 NASA Summer Study
- Space Resources and Space Settlements - NASA publication SP-428 - Complete online copy of the 1977 NASA Summer Study
- Space Colonies - CoEvolution Quarterly - Complete online copy of special 1977 CoEvolution Quarterly book
- The High Frontier - Human Colonies in Space - The landmark book by Gerard K. O'Neill, available for sale from the Space Studies Institute. Expanded third edition.
- Space Settlements - Online Resources - Links to other online resources
- Space Solar Power - NASA's Solar Power Satellite information page
- Sunsat Energy Council - More information on space solar power
- National Space Society - The successor to the L5 Society
- Space Studies Institute - Research organization founded by Dr. O'Neill
- Space Frontier Foundation - Where the L5 dream is still alive

In Memoriam - Bill Weigle 1952-2001

L5 News.org evolved from a proposal by Bill Weigle, who unfortunately did not live to see its fruition. Bill was one of the founding Directors of the L5 Society, and his name was often listed in the L5 News during its early years.

Born December 21, 1952 in Nashville, TN, died April 11, 2001 in Tucson, Arizona. Bill graduated from Atherton High School in Louisville, KY, moving to Tucson in 1969 to attend the U. of Arizona. He was on the Student Union Activities Board, had a pilots license and was a member of the Flying Club, and graduated with a degree in Public Administration. He remained in Tucson, working 25 years for Southern Pacific, for two years chairing their United Way campaign, raising over $100,000.

Besides being a founding Director of the L5 Society, Bill was President of the Tucson Space Society and Chair of ISDC 2000, Tucson, May 2000.

Dear Reader: This website is a tremendous resource. We hope that all of you who are online will delve into its treasures. It is a legacy to all of us from the pioneers of the Space activist movement, and a tribute to Bill Weigel whom I knew personally, as well as to David Brandt-Erichsen, the webmaster. Enjoy and soak up the inspiration! -- Peter Kokh, Chair ISDC 1998 and MMM Editor

Meandering Through The Universe

A Column on the Cooperative Movement on the Space Frontier © 2002 by Richard Richardson

Risks of Thinking Outside the Box

For the last few months I've discussed a rather controversial example of "thinking outside of the box": steel rockets — that is to say, making many rocket parts which are currently usually made of aluminum out of steel instead. I can well imagine the hoots, Bronx cheers, and dismissive interjections this idea may have received. Although such negative reactions, when and if they occur, don't necessarily indicate that an idea is unworkable, useless, or in any other way bad, they don't guarantee that an idea is significantly useful in any way, either.

What in tarnation am I talking about? I'm talking about the steam train, the bicycle, the automobile, the airplane, rocketry, electromagnetic broadcast media, the relativity theories, computing machines, the personal computer, and many many more innovations. All of these fields of technological innovations and many of the social and economic innovations which were developed because of them or which developed in parallel with them were fiercely opposed as impossible, unworkable, unnecessary, undesirable, or even evil. Those who stood in opposition always included experts in the field, as well as any number of other interested persons.

The lesson to be extracted is not that every idea has merit, not even that every *controversial* idea has merit. The lesson to be learned *IS* that what is *obviously* true ... isn't.

Of course, recognizing that the off-the-cuff pronouncements of even the greatest experts cannot be absolutely trusted does *NOT* mean that, for example, viable rockets can be made of steel. So far as I am aware, nobody has made that claim. I present the idea only because it is an interesting one which was proposed by a moderately experienced rocket engineer/designer/flight tester. It is important to us and our goals to discuss ideas originating from reasonably credible folks. To facilitate those discussions is one of the principle motivations of this column. Now that we have that out of the way, let's move on.

The Importance of Standardization

One thing that will be critical to the efficiency, safety, and economic viability of space settlements and space industries will be standardization. Take batteries, for example. As recently as the last time I checked (maybe a couple years ago) almost every (if not in fact, every) laptop/notebook computer had a battery which was unique to that particular brand and model. A battery from one *could* be used to power another model, in most cases, but only if a person was willing to jury-rig a couple wires between the battery terminals and the battery docking connector terminal. In most cases it would be necessary to leave the new battery outside the case of the computer because of differences of shape and size. Of course, the reason for this is that it has been necessary to squeeze in all the "juice" possible, meaning that the battery has been shaped and sized to take up all available space, thereby providing the maximum possible energy storage.

Now, consider boom-boxes, flashlights, and oodles of other battery-powered equipment and appliances. Very large numbers of different items can operate off of exactly the same batteries. The only difference may be in the number of batteries required. There are a number of different standard shapes and sizes made to deliver different amperages, voltages, or both. But in nearly every case there are many different items, from many different manufacturers, which all use the same standardized battery power source.

Here on Earth, battery standardization is usually nothing more than a convenience and/or a factor contributing to economic success and efficiency. In space, however, it will not only be a matter of convenience and economic importance but will, frequently, be a matter of life and death.

Say you are out on an excursion for some reason and through carelessness or unavoidable mishap you have to rely on your Pee-G (Personal Extreme Environment Garment — aka space suit) for a considerably extended length of time if you are to survive to tell the tale to your grandchildren. Without standardized batteries powering the Pee-G your chances of finding a replacement source of power when the batteries in the suit begin to run down are likely to be slim. But with standardized batteries you might easily have packed spares before leaving the base.

Of course, you might do that as well even if your battery happens to be unique to your Pee-G. At least you might *IF* the stockpile at the base hasn't run out and you took care to stow it before leaving. [Ooops, I forgot, those scenarios *couldn't* happen because people are perfect, don't make mistakes, and always follow the rules ... Yeah, right!] And what happens if you are out wandering around somewhere just a little further from your excursion vehicle than you meant to be, out of radio contact for some reason and become trapped or your Pee-G battery chooses that point in time to fail? Gonna send Lassie for help? Wouldn't it be nice if you could rob the power packs of your tools and equipment to restore power to your personal life support system? And wouldn't it be handy if after arriving at a remote location only to discover that the battery of the single most essential piece of equipment failed, you could take batteries out of your flashlight or drill, put them in the lifeless piece of equipment and save hours or days by not having to return to base for new batteries?

Okay, so all of that seems fairly obvious. But (if anything remotely like this concern is relevant), how far should standardization be taken?

- Should all domestic use microwave ovens draw the same power and be the same size and the same shape? Or should there be, say, three different size/shape/power standards for microwave ovens, or should microwave ovens be allowed to come in whatever size/shape/power configurations the manufacturers choose?
- How about air lock parts? Should residential quarters be constructed of standardized modules?
- Will there be standardized domestic power supply parameters? If so, what will they be?
- Will individuals be allowed to order their own domestic equipment? If so, will it matter if they order things which won't work because of incompatibilities with some community infrastructure standard?
- Will it matter if space and weight on a supply ship from Earth is taken up with equipment which won't work because of some such incompatibility?
- Will it matter if some critical component of the community support infrastructure won't work when it arrives because it is incompatible?
- Will it matter if there are five different airlocks whose parts are not interchangeable?

The question is, in space, early on, what are the appropriate parameters and applications of standardization? Where will standardization offer significant advantages and where will it be nothing more than unnecessary interference? Furthermore, who will decide? How will they decide? And when will they decide?

These are important questions. After settling space begins, it will probably be quite some time before there will be enough storage volume, enough local manufacturing, enough quantity and promptness of remote source cargo delivery, and enough of financial resources to make it convenient for a space based community to maintain sufficient surplus inventories to be able to replace unique parts immediately or draw on stored reserves while waiting for replacement parts or imported supplies to arrive. The survival of one or more space businesses, the viability of an entire space community, and even lives could be threatened by the lack of a simple replacement part. Standardized and therefore interchangeable parts help to ameliorate this bottleneck because it reduces the number if items which must be held in local inventories in order to cover critical needs to a reasonable extent.

Too much or inappropriate application of standardization *might* result in decreased economic and/or social viability or even increase risks to life. But too little standardization is certain to do so — no question about it! **<RRR>**

TransOrbital™ MMM Readers-only page

http://www.transorbital.net/asi_mmm.html

Order any TransOrbital "Time Capsule" product and receive a free **Rockets of the World poster**, Special Edition, from Saturn Press. This poster shows 156 U.S., Russian/Soviet, and other rockets to scale, including the mighty *N1*, the Soviet manned lunar mission rocket.

These special offers are our way of saying "thanks" for the support that we've received from the Artemis Society International and the Moon Society and the readers of Moon Miners' Manifesto. They will be available only to ASI/Moon Society members and others who subscribe to the Moon Miner's Manifesto.

This page will not be linked to from any other page on our website, but only listed in MMM.

To take advantage of these offers, put your Moon Society (and TMS membership #) or MMM Chapter affiliation into the "affiliations" slot on the on-line catalog sign-in information form, *along with* the letters "MMM".

Proceed to our Secure On-line Catalog Site to find out how *you can deposit your personal message on the Moon!*

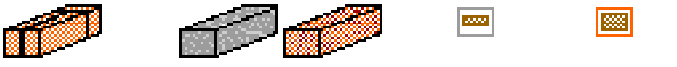
http://www.transorbital.net/asi_mmm.html

NOTE: MMM has ordered a Time Capsule page which will include the text of "'M' is for Mole" with new illustrations. This is the article from MMM #1, December 1986, which details the seminal inspiration behind Moon Miners' Manifesto. You can find this article online at:

http://www.asi.org/adb/06/09/03/02/001/special-forward.html

LAST CHANCE for your organization to buy our Earth - Mars - Moon "GRAVITY BRICKS"

*We have materials left to make **4 more** sets. That's it!* Same size "bricks" are differing combinations of brick & styrofoam with special coating and handles. Pick up any two and instantly understand the difference that has thousands have dubbed "cool!"



A standup acrylic flyer holder and flyer is included. $15 plus $10 Shipping & Handling, payable to Peter Kokh, 1630 N. 32nd St., Milwaukee, WI 53208.

♂ Mars Society Updates ♂

BioSatellite to Study Life in Mars Gravity

[http://www.marssociety.org/news/2002/0416.asp

April 17, 2002 -- The Mars Society has announced a landmark private space mission to help researchers understand the long-term effects of living on Mars. MIT (Cambridge, MA), the University of Washington (Seattle, WA), and the University of Queensland (Brisbane, Australia) are leading the project.

Mission highlights include:

- The first privately developed biosatellite
- The first mammalian births in space
- The first in-depth study of mammals in a partial-gravity environment
- The first student-led launch and recovery of a spacecraft

The privately funded, pioneering mission will study the effects of prolonged exposure to Martian gravity on mammals, a vital step on the road to human exploration of Mars. Student teams at three leading universities will design, construct, and launch a satellite with a payload of mice on board. The mice will experience Martian gravity---3/8 that of Earth. While in space, some will give birth to a second generation, who will grow and develop entirely in this new environment. After nearly two months, the craft will return to Earth, where teams of scientists will study the crew and their offspring to obtain the first clues about life and development in reduced gravity.

The **Translife Mars Gravity Biosatellite**, as the mission will be called, will fly the mice aboard a spinning spacecraft that generates artificial gravity identical to that on the surface of Mars. The satellite is scheduled to launch in mid-2005, orbit for about 50 days, and then return the crew safely to Earth. The team is considering a number of launch vehicle options. The mission will conduct basic scientific research necessary before humans can safely explore Mars. Astronauts living in space stations have encountered serious health problems, such as bone loss, due to the weightless environment. The first crew on Mars could experience similar effects, and scientists do not yet know whether Martian gravity is sufficient to prevent these long-term health hazards.

The mission's crew of mice will provide the first answers to this important question, and the equally important question of whether higher life from Earth will ever be able to settle Mars. During the seven-week mission, their offspring will grow from birth to nearly adulthood in Martian gravity. At the end of the flight, the satellite will re-enter the atmosphere, bringing the original crew and their progeny safely back to Earth for scientific study.

Three universities will collaborate to develop this complex spacecraft: MIT will manage scientific objectives and the mission payload; the University of Washington will design the carrier spacecraft; and the University of Queensland (Australia) will devise the re-entry and recovery systems.

The Mars Gravity Biosatellite is expected to cost nearly $10 M. The students are seeking financial and in-kind support from both public and private sectors to complete the project. An anonymous donor has pledged to match all contributions at 50%.

Before we can explore and settle the planet Mars, we must determine whether mammals can live, function, reproduce, and develop normally in its weak gravity field. This mission's groundbreaking research will provide the first insight into humans' ability to one day travel beyond the Earth and inhabit new worlds.

More information about the Mars Society's Translife Initiative is available at:

http://www.marssociety.org/translife/.

[A 3rd Mars Analog Research Station!]

Fabrication of Euro-M.A.R.S. Begins!

April 22, 2002 -- The fabrication of the European Mars Analog Research Station (EuroMARS) has begun in earnest. The work, led by Project Architect Frank Schubert and funded by Starchaser Industries and the United Association of Plumbers and Pipefitters (UA), is being done on the premises of the Rio Grande company in Denver, Colorado. Fabrication is expected to be complete by the end of May 2002, after which the station will be put on display in a major public exhibit in the United States. It will then be shipped to Europe for deployment in the field in Spring 2003.

Matt Lowry, Illinois North Shore Mars Society chapter, has ordered a set of Earth>Mars>Moon **Gravity Bricks** from Peter Kokh, who produces them in the basement of his Milwaukee home, for delivery to the Euro Mars facility which will be regularly open to visitors from the public. [see p. 15. col. B]

A Chapter Science Demonstration

First of a Series of Writeups from Earl Bennett, President of PASA: Philadelphia Area Space Alliance

The Kilogram of Science: Payload weight and its relation to launch costs is discussed with a 1 kg (2.2 lbs) mass of modeling clay in a coffee can as the object starting the discussion (you pick the lead-in to relate the ultimate goal, access to space for people, to present costs and why so much work is put into the art of payload design). I often use the figure $30,000 /kg. for launch costs, sometimes allowing several guesses and leaving orbital launch or escape as a separate question. Kids look at the clay and If the audience seems intent, I explain that most of the material in clay could be used in some way in space. Its a good mental link. Nothing exotic to clay. **<EB>**

The Lunar Reclamation Society, Inc.

PO Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

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(* LRS Board Members)

LRS NEWS

• **Aviation Career Day at Mitchell Field:** Our booth and exhibit "Fly the Skies of Mars" was a big hit. The 2002 Aviation Career Fair reached over 2000 young people and job seekers. Many who stopped at our table were fascinated by Mars in general. Others, obviously news-challenged, asked if I (Peter) had been to Mars, or if we were hiring anybody at this time. But it was fun and we had lots of time to chat with lots of people. Quite a few took handouts either for themselves or a relative or friend. We hope to do this again next year (as always, on the last Thursday night/Friday morning of April) with the same theme with more exhibit eye-catchers and other goodies.

Rockets for Schools: At this annual rocket launch event in Sheboygan, an hour north of Milwaukee, Peter will be speaking on "Tourism in Space" at 2 pm on Saturday May 18th.

LRS MAY / JUNE Events

Saturday, May 11th & June 9th, 1-4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G11** (lower level, NE part of Mall) near the ground-level entrance below General Cinemas.

May Agenda: Updates: Space Station; Mars Odyssey; Mars Desert Research Station in Utah & Euro Mars Station under construction; Translife Mars gravity experiment; Field Trip suggestions; Possible picnic

U.S. CHAPTERS

NSS Chapter Events
MMM
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Space Chapters HUB Website:
http://www.nss.ac/hub/

MINNESOTA

Minnesota Space Frontier Society

c/o Dave Buth, 5120 Ewing Avenue North, Brooklyn Center, MN 55429

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

www.FreeMars.org/l5/index.html

Next Meeting -- Saturday, **May 18th** at 1 p.m. at: **Radio City Inc. 2663 County Road I**, Mounds View, Mn. 55122 (763) 786-4475 -- back meeting room. It's north of I694 just off of County 10, between Long Lake and Silver Lake Road, not Hwy. 10, close by, which runs along I-35W. You must be on *County* 10. If you need more directions or want to add to the Agenda call: (612) 333-1872

Report by Dave Buth

Agenda: Website reworking, Convergence, A Display at the Mall of America, our Annual Report, a U of M program and many other topics. See you there!

April 20th Meeting Report: No quorum -- Rich Brown, Kevin Wilson and Dave Buth. We talked about how much fun Yuri night (April 12) was and how we should do a better version next year.

At Yuri Night, April 12, Craig Borchard (Welcome Craig! He's our newest MnSFS member) told us he has a new NSS local mailing list, excellent! With Craig's list we could do a mailing to local NSS folks of the 2001 AR to recruit for local members. We should include a membership form and other promos.

Kevin Wilson's treasury report. We discussed the critical need for our 2001 financial report for maintaining our NSS chaptership and I gave Kevin the info he needed to finish them.

We discussed options for the future of the website and Rich said he'd set the directories for **Personal pages of members** when asked so I got two. Drop him an e-mail if you want web space.

Upcoming Opportunities:

As usual we have no shortage of events to be involved in. Jeff Root tells us the Boy Scouts are having an event Sat. May 4, 2002. Those interesred in

helping, email Jeff or I at jroot@freemars.org or dbuth@freemars.org or call Jeff or me at (612) 375-1539 or (612) 333-1872 respectively. Also, Ben Huset tells us NCRAL (North Central Regional Astronomical League) opens on Sat. the 4th, 3-5 PM, also needs people for their Astronomy Day celebrations. Ben is at benhuset@skypoint.com or (651) 628-9275.

ISDC 2002 is May 23-27 in Denver. Is anyone planning to go? I am rather hoping to do a late May program on Campus to recruit members.

June hosts the Summer Solstice and MAS has invited us to join them in a day long display at the Mall Fri. June 21st. Mark it on your calendar.

CONvergence is coming! This Science Fiction Convention will be held on the weekend of July 5-7, 2002 at the Radison South. The Science Room will probably be Plaza 1 and we will have Programming as well. The big issues are can we afford a Party room and do we have enough people to video? If you want to attend, send in $35 registration to: CONvergence, 1437 Marshall Ave. suite203, St. Paul, Mn. 55104 before May 15 (afterwards it's $50) You don't have to be registered to serve in the Science Room however.

Old Space Week was July 16-24, and we used to have big exhibits at the malls untill liability insurance went through the roof. I want to have a "Neil's [Armstrong] Night" on the 20th at least. Perhaps we can build up to a future Moon Week?

Fall 2002 will see the closure of the Dntwn Library and Planetarium and a Fall Qtr start on Campus. This Fall I want to see a big MnSFS splash, esp. if we can't pull together a spring program.

New Space Week is now Oct 4-10, 2002 so schools can be included. Any ideas what we can do?

We should refurbish our Display Systems, to get back to our big exhibit capability before the summer is over. Remember 2003 is the "Centennial of Flight!" Next year we've got to think big!

To finish up the meeting I presented my *Asteroid Homesteader 'Conestoga Wagon'* that includes 52 Space Shuttle External Tanks. **<DB>**

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

NEW >>> http://www.tcei.com/sss

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

MAY 21st Foerster Academy of Dance, **Sheboygan**
JUN 18th Stoelting House, 309 Indian Hill, **Kiel**

CALIFORNIA

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

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

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

http://chapters.nss.org/oasis

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

> Regular Meeting 3 pm 3rd Sat. each month

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

MAY 18th -- Business Meeting at location TBD
JUN 15th -- Business Meeting at location TBD

● Recurring Events

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

OHIO

Cuyahoga Valley Space Society

3433 North Ave. Parma, OH 44134-1252

c/o George F. Cooper III, Phone 216-749-0017
E-Mail: geocooper3@aol.com [new]

☞ Monthly Meetings, the 4th Thursday each month

7-9:15 pm, Parma Regional Library
NEXT MEETING DATES: **MAY 23, JUNE 27**

You aren't finished
when you fail,
You're finished
when you quit!

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 **3rd Sat.** each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland,
downstairs NEXT MEETINGS: **MAY 18, JUN 15**

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105
c/o Earl Bennett, EarlBennett@erols.com
215/633-0878 (H), 610/640-2345(W)

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 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th St.

NEXT MEETINGS: **MAY 18th, Jun 15th, Aug 18th**

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

• **Scheduled PASA activities:** Regular monthly meetings on Sat., May 18th, June 15th, and #**Sun.** August 18th. Special event: **Mon.**#, July 22nd presentation to the World Future Society Annual Conference. Call Earl Bennett or Mitch Gordon, 215-625-0670, to verify all meetings.
by PASA Secretary Jay Haines <hainesjb@netaxs.com>

• **April 20th Meeting Report:** Larry Pezzuto discussed the PASA web site. Dottie Kurtz discussed the Franklin Institute notice that they will reopen a new space exhibit Oct. 25th that is funded in part with a $1.4M grant from NASA. Dottie also discussed articles in the Jan/Feb 02 *Planetary Report*, including "2002 Shoemaker NEO Grants" proposal; and the Apr/May 02 *Air & Space*.

Hank Smith discussed the recent Jersey DevilCon, which keeps getting better, last Summer's WorldCon in Phila., and the upcoming Philcon. Jay Haines discussed SSI's desire to provide brochures for our May 4th exhibit at the NJ State Museum (Trenton). Earl Bennett discussed the science projects he will demonstrate at the museum.

The NASA International Space Station exhibit, consisting of a two-trailer walk-through traveling exhibit, will be at the NJ State Museum May 2-6. Call Earl if you want to help at the exhibit table.

Mitch Gordon discussed our presentation to the upcoming World Future Society Annual Conference, and the cost of an exhibit table. Art Shostack will present a briefing on the conference on July 10th at 7 p.m. at the Barnes and Noble bookstore at 18th and Walnut Sts. The next WFS chapter meeting is on May 21st at 7 p.m. at the Ethical Society on Rittenhouse Square. The discussion will be "Reshaping the American dream."

Mitch also discussed the recent appearance of John Glenn at the Kimmel Center for a performance of Peter Nero's *Voyage into Space*; the recent appearance of Chris Kraft in Phila. for a book signing; the Mar/Apr 02 *Ad Astra* articles on ISDC, selling the Moon, and next generation rockets; and previewed the May/Jun *The Futurist*, which has an issue focus on virtual reality.

Earl Bennett discussed a recent news article on a Mars Explorer-like "Afgan Explorer," and May 02 *Technology Review* articles on reconfigurable robots at Palo Alto Research Center, and cool x-rays from carbon nano-tubules.

Earl also discussed Apr/May 02 *Industrial Physicist* articles on a Lunar solar-power system for delivering 20 terawatts to Earth using 1970's technology (our current 6.2B people use 2 KW/person continuously, so 20 TW is enough for 10B people); and an x-ray sieve at the Univ. of Kiel in Hamburg.

Finally, Earl discussed a Mar 02 *Technology Horizons* article on using a counter-flow jet to reduce drag on a forward-moving object; and the upcoming SETI League Conference at the College of NJ.

NAME _____ ÷

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600 Pennsylvania Ave SE #201, Washington DC 20003

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

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Send proper dues to address in chapter news section

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

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
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○ $20 Regular Dues

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○ $25 for all members

O.A.S.I.S. L5 (Los Angeles)
○ $18 regular dues

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○ Annual dues for all with MMM $20, due in March or $ times each quarter before the next March

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○ $15 reg., ○ $10 stdnt, ○ $1/extra family memb
"SSS" c/o B. P. Knier, 22608 County Line Rd,
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