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

Moon Miners' Manifesto

& The Moon Society Journal www.lunar-reclamation.org/mmm/

178 September 2004

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

In FOCUS: How much can we really Privatize "Moon to Mars?"

The Aldridge "Moon to Mars" Commission Report, tasked by the Bush Administration with getting input from the scientific, industrial, business, and public sectors on how we ought to go about realizing the President's Vision for a human-led expansion beyond Low Earth Orbit, LEO, had one "listen to us!" conclusion: this vision, this dream will not be realized without maximum input and participation from private enterprise and from the non-government sector in general. This was heartening for most of us. But how can we go about best implementing that sweeping advice?

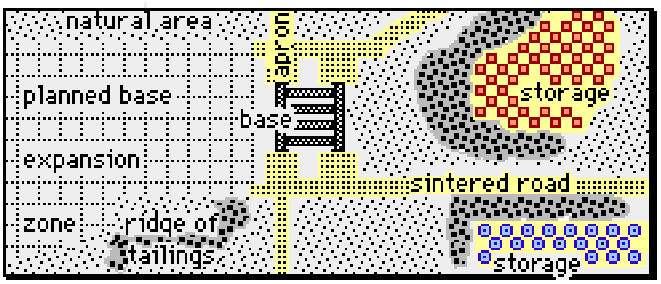
NASA will react, as it always has, by seeking "proposals" from private industry, and by finding high profile but minor ways for industry and enterprise to take charge of tidbits of the plan. DBAU, *doing business as usual*, will not cut it this time. The commission pointed out that what is at stake is the public-paid price tag, and the requisite congressional support, for implementing the program. Where a design or system originates is not the issue. Who pays for it, is. Will it by the tax-weary citizen? Or will it be the willing consumer? Yes, us - in both cases, but with one very big difference that has the power to make or break the plan. We need to turn over whole sections of the plan to private enterprise, not just tidbits!

In the April 2004 MMM #174 In Focus essay "CEV Modularity brings Opportunity" we pointed out that if NASA concentrated on carefully defining the interfaces between the modular components of this new space vessel, it could leave the supply of the various modules up to private industry and competition. This would guantee that we would get the most vehicle for the least money, and a vehicle that would keep evolving as industry upgraded the various modules or module options. While our confidence level that NASA will choose such a pathway is low, this would get the program off on the right start, to be sure.

Indeed, when it comes to designing outpost habitat modules, NASA ought to tack the same tack: *defining the interfaces* -- how the modules would connect together, including plug-in utility runs -- and leaving the design of the various habitat modules up to competing enterprises. Here there is the added requirement that the modules must be transportable in payload bays and farings that are either on the shelf or budgeted enterprise projects. That the two-level "tuna can" of the Mars Direct design is best, rests on the assumption that the **Ares** shuttle-derived vehicle will be the vehicle of choice. But industry may come up with another vehicle, another faring container. [⇒ p. 2, col. 2]

Frontier Storage Chaos Solutions

In MMM # 90, November 1985, two articles, one on "Site Management," the other on "Warehousing" took a first stab at the problem In this issue, we take up the topic afresh in "Storage, Storage, Storage, on pages 5-8. Tackling the storage problem will help lift up frontier settlements "by their bootstraps," improving their viability and survivability.



Moon Miners' Manifesto

Moon Miners' MANIFESTO/ Moon Soc. Journal is published every month except in January and July.

• **Moon Miners' Manifesto CLASSICS :** Beginning with 'July 2004, we have begun an effort to re-edit, reformat, re-illustrate and republish the timeless articles of MMM's first ten years, with the intention of publishing two issues, each covering one year, in PDF format only, for free downloading, each January and July.

• **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 and lunar settlement.

• **MMM retains its editorial independence.** MMM serves several groups each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test. Any presumption that participating organizations can be labeled by indirect mutual association is unwarranted.

• For the current space news and near-term developments, read *Ad Astra*, the magazine of the **National Space Society**, in which we recommend and encourage membership.

• **The Lunar Reclamation Society** is an independently incorporated non-profit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. LRS serves as NSS' Milwaukee chapter

=> www.lunar-reclamation.org

• **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 40 chapters, dedicated to the creation of a spacefaring civilization.

The National Space Society, 1620 I Street NW, Suite 615, Washington, DC 2006; Ph: (202) 429-1600 <= NEW HQ

FAX: (202) 463-8497; nss@nss.org => www.nss.org

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

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

• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges necessary to establish a permanent, self-sustaining human presence on the Moon." — See contact information on page 9.

• **NSS chapters** and **Other Societies** with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.

• **Publication Deadline:** Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the **15th**, Sooner is better! - No compensation is paid.

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

√ **Mac diskette / CD / typed hard copy** to:

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

⇒ IN FOCUS Editorial continued from p. 1.

In either case, the design of the principal outpost habitat structure *to fit that payload bay or faring volume* should be left open to enterprise competition, *observing the module-module interface standards set by NASA.*

Beyond vehicles and habitat modules

But there is more to opening the human space frontier than modular transportation and habitat systems. The wild card in opening the space frontier, and NASA's biggest weakness despite a lot of effort and spending (most of it without private enterprise input) is whether or not we can come up with reliable, hardy systems to maintain air and water quality as well as food production - all three integrated as far as possible, and with all the supporting equipment consisting of modules (yes, the interface thing again) - so that the result is a working mini-biosphere that can grow, *in modular fashion,* as the outpost grows, adding one habitat and/or function module at a time. Again, at every stage of this plan, there is prime opportunity for private enterprise to produce the best systems, and to keep improving each, so that as the Lunar and Martian outposts expand, we are not locked into outmoded and inferior modules and components. Again, this desirable vision is the primary goal of the effort *to get the infrastructure right the first time!* Infrastructure tends to last forever (think the 17th-18th century street grid of Manhattan) and is the one physical aspect of civilization that has consistently proved the most resistant to change. It is vital to get it right, right from the start. In our opinion, NASA's role in the realization of this human space frontier vision, is just this, designing infrastructure, and no more. Let private enterprise come up with everything else. In other terms, let NASA come up with the grammar for the language of human expansion beyond Earth orbit (boundary space) and let enterprise choose the nouns, verbs, and adjectives!

New technologies

There is one more way, and a major one, that NASA can guarantee that this vision will be realized both at the lowest possible taxpayer cost and in the shortest time frame. NASA should be tasked by Congress with defining the technologies, not yet on the shelf, that will be needed to open the human frontiers on the Moon and Mars. Then Congress should enact an incentive program to encourage private enterprise to pre-develop these technologies ahead of time, *for any potentially profitable terrestrial applications that can be identified.* In this manner the needed technologies, or close precursor analogs of them, will be put "on the shelf," paid for by customers rather than by taxpayers and at less R&D expense (no NASA crash programs) and in a "just in time" fashion. This is the route of "spin-up" that we first proposed back in 1987 (MMM #16) as opposed to the time-honored but bankrupting "spin-off" route.

We can do it, for less, and sooner! - **PK**

The Lunar & Martian Frontiers will have Much in Common

by Peter Kokh, President of the Moon Society,
and Mars Society Member, Wisconsin Chapter

We are in this together

While the Mars Society and the Moon Society are each properly focused on a different future human frontier, there are many areas in which their interests coincide, overlap, or come together. It is in the interests of both Societies to work together in these areas.

The basic reasoning is this. As different as the Moon and Mars are from one another, *in comparison to our homeworld,* Earth, they are in several ways quite alike:

Neither world has a breathable atmosphere - we must establish self-contained mini-biospheres on both to house and support our outposts and settlements. We need a modular approach, one that provides primary waste treatment at the point of source, to allow our biosphere encradled settlements to grow without trouble. There is no one-size fits all biosphere approach. Modular biospherics is the most promising approach.

Neither world is well protected from "the cosmic elements" - cosmic rays, solar flares, solar ultra-violet, etc. While Mars has significant protection from the incessant micro-meteorite rain than the Moon, it is much more exposed than Earth, with its much thicker atmosphere. As a result, outdoor surface activities such as construction will be hazardous duty. Construction and assembly methods which minimize man-hours spent on the surface will be at a premium.

Both worlds experience very cold temperatures. Lubricants and fuels and materials which hold up under those conditions are needed on both worlds. Of course, the Moon has extreme heating to deal with as well, but to a much lesser degree, so do Phobos and Deimos, also without atmospheric heat sinks.

Both worlds have dust management problems. Whether the fine dust on Mars is as intrusive and abrasive as that on the Moon is not sure. But dust control measures are needed on both frontiers.

Safe and reliable modular nuclear power units, add-a-unit-as-needed, will be a big benefit on both frontier, though both worlds have solar power access, the Moon much more so than Mars. And Mars. with good luck and little reason for optimism, may have some geothermal hot spots that can be tapped.

If a treaty banning shipment of nuclear fuels through Earth's atmosphere should ever be enacted, fuel for nuclear power plant modules, and for nuclear propulsion space ships, can tap substantial Thorium deposits on the Moon, using fast breeder technology to process this into fissionable U-233. Such an industry on the Moon would be a big boon to both frontiers.

Both worlds are without road networks – infrastructure is expensive and labor intensive - on both we will need pressurized ATVs, all terrain vehicles, that can travel fairly fast of boulder strewn stretches.

Lavatubes for ready made shelter are expected to abound on both worlds. They could be used for settlements, warehousing, industrial parks, etc. Construction inside them offers the advantage of substantial regolith shielding already in place. Workers can use lighter-weight, lighter duty, unhardened space suits, and will not have to worry about "outdoor radiation exposure times."

Areas of subsurface ice, or frozen soil, are expected to exist on both worlds

Both worlds are more economically challenged by themselves than if they trade goods and services and work together to develop other in space markets to further the rise of an interplanetary economy that could withstand interruption of support from Earth. Mars, Phobos & Deimos will be cheaper sources than Earth for things the lunar frontier cannot provide for itself, while the development of markets on Earth for these same items is unlikely. And the Moon can probably supply the Martian frontier with some items at a lower expense than they can be shipped from Earth. In short, the Economic Case for Mars, presently mostly wishful thinking, gains a boost from the Moon being a customer. The reverse is also true.

The hardships and challenges of life on the Lunar and Martian frontiers will bear many similarities, along with some obvious differences.

The pioneers will have left behind much, forsaking Earth for a fresh start on a brand new world.

- The ability to go outdoors without a spacesuit and enjoy the sunshine under an open blue sky.
- Many outdoor forms of recreation that attempting to do in a spacesuit would have comic results.
- An endless and ever increasing variety of consumer goods
- Many "favorite" food and beverage specialties
- Many hobbies, even indoor ones, that cannot be supported on the frontier, at least not yet.
- An endless list of tourist destinations when it is time to escape for a while
- A still very diversified biosphere rich with special niches for plants and animals
- A much wider and more varied list of occupational options and opportunities

They will be chasing similar dreams

- a chance to pioneer a virgin, unspoiled, pristine world
- a chance to get in on the beginnings , on the ground floor
- a chance to try new ways of living
- a chance to start over, fresh
- a better chance to rise to the top rather than be lost in an enormous pile
- a chance to find oneself
- a chance to appreciate more deeply what life is all about.
- the chance to pioneer new ways to be human, *"to be all that one can be"*
- the chance to take a barren world and make it fertile, something it could never be (again or at all) on its own
- the chance to learn to be "at home" in a setting where no man could ever have felt "at home" before
- the chance to take a step in spreading human and terrestrial life to the stars
- the list goes on, and for both the Moon and Mars

They will face similar challenges to their resource–fulness, ingenuity, and adaptability

- Having to make do with a different set of resources and tools
- Having to make substitutions when the material of choice on Earth is not available
- Having to make do without when substitutions are not feasible
- Having to learn to respect the alien, mindless dangers of life on the new frontier
- Having to learn to express one's artistic creativity in new ways
- Having fewer distinctively different changes of scenery available for getaways
- Having to raise children where they have never been raised before, and without access to all the variety and glitter of Old Earth they will inevitably learn too mush about.
- Having to develop new sports that play to the new gravity level
- Having to learn new ways to dance in the lower gravityl

They will need to be made of the same "right stuff"

- resourcefulness, ingenuity, creativity, and adaptability
- willing to make sacrifices
- willing to try new ways to do old things
- accepting the frontier as "home" at the very core of their souls

UPSHOT

The Moon's sky may be black while Mars is bright. They have different color pallets, different gravities, their own special landscapes, and different suites of commonly available elements.

Underneath, the Moon and Mars, and the people who will pioneer them, will have much in common. **< MMM >**

Passing from Outpost to Settlement

The Tell–tale Signals of Passage

by Peter Kokh

We all realize that a tentative, toe-in-the-water (or regolith!) base/outpost/beachead must come first before real settlement can begin. Some believe that there will be a public policy decision to go for "the next stage." But the transition could come by itself, in many seemingly minor changes of procedure and policy. The baby does not become an adult overnight, after all. Here are some of the things that will give us a clue that the process is underway.

- Operations transition from "mission-driven construction & exploration" to outpost growth and development
- Rigorous sterilization and quarantine procedures are abandoned as unnecessary ritual
- Operations slowly transition from "by the book" to experimental pragmatism -- individual initiative is allowed, then encouraged, in experimentation with processing, manufacturing, even with arts and crafts using local materials to give the outpost a "down home" facelift.
- Crew members are given permission to go outside alone
- Deaths occur from natural causes, and burial (of the body or cremains) is permitted
- Crew members are permitted to "re-up" indefinitely, giving them "vested rights" so to speak
- Relationships between crew members are tacitly accepted, even if official policy is unchanged.
- Permission for pregnancy is given *after the fact* and the pregnant crew member is allowed to carry the fetus to term without having to return to Earth.
- Someone "retires" from official duties, but is allowed to remain on location and tinker to his/her heart's delight.

We welcome your suggestions to other "subtle" clues that the transition is underway. Such a shift in gears may not be planned. It will happen on its own, in due course.

Anecdotal Signs

- The first MacDonalds, Starbucks, Walmart, etc.
- The first Lunar Olympic Events
- The first Lunar Soap Opera broadcast to Earth

It is fun to list things that will broadcast that the outpost beachead "has arrived." These things will come in time. But we are looking for the subtle first signs.

Critical Mass - The indications that the outpost-in-transition has become a settlement with "critical mass" to support "ignition" such as population size, diversity of factories, tools, vehicles, talent pool, reserves, etc. and the amount of vital needs and supplies in storage is another question. Here we are just looking for those first easy to miss clues that a historic phase shift has begun. **< MMM >**

sToRaGe StOrAgE sToRaGe

The art and science of putting everything where it can be found and retrieved in good condition, suitable for use, reuse, or put to a new application.

by Peter Kokh

To many "full steam ahead" fans of progress and development, *Green Peace* is a dirty word. This counter-productive attitude arises from inborn human impatience. We want to get things done. We are impatient with "collateral casualties." Over the long haul, that impatience can only bite us in the but, to put it colloquially. *Green Peace* is the activist environmental organization that is known the world over for its efforts to save the whales, disrupt French nuclear bomb tests in the Pacific, and much more. The organization has also concerned itself with changing public policies and business practices that have led to marked degradation of water quality in the Great Lakes.

But how many know of its work in Antarctica. In a fact-finding (busybody, some would say) mission to the main U.S. outpost at McMurdo Sound, *Green Peace* found a real mess. As our Antarctic operations expanded at this location over the years, the area became an unsightly sprawl of outbuildings, storage areas, and dumps - all with little or no preplanning. While our operations on the ice-bound continent had expanded markedly, the visual effect was one of a "trashed environment." While the impact on local living systems may have been negligible, the impact on operational efficiency was major. We didn't know where everything was: there was no rhyme nor reason to where things were stored. The negative impact on our operations was clear. Our lack of well-thought out storage policies (or philosophy) led to things not being stored in a way that they could be easily found and retrieved in good condition, suitable for use, reuse, or put to a new application. We had not thought ahead to develop a sound storage management plan. The "trashing" that *Green Peace* found was but the tell-tale "symptom." To the government's credit (and *Green Peace!*) this situation was corrected. We are all happy campers now.

Lessons for future Outpost frontiers on Moon and Mars

This is not off-topic. Without careful, thoughtful pre-development of a sound storage philsophy and management systems, we could end up with trashy surroundings. Much worse than the embarrassing publicity sure to be generated, we would be self-saddled with outpost operations that cannot function, much less expand, efficiently and in a timely way. Many of us are all too familiar with disorganization syndrome on a domestic level. We had tackled this general topic in two articles in MMM # 90 November 1995, "Site Management" and "Warehousing on Luna':

www.asi.org/adb/06/09/03/02/090/site-management.html
www.asi.org/adb/06/09/03/02/090/warehouse.html

Things we need to store

Our first step is to develop an open-ended list of the things we may need to store outside our outpost proper. These things will fall into the following general categories:

Incoming from Earth

- Consumables from Earth: fuels and other chemicals; food reserves and rations; initial and backup water reserves
- Replacement parts for structures, systems, and equipment
- Manufacturing supplies
- Modules to be installed, vehicles on standby
- Other items not needed yet

Accumulated on Location

- Samples (for mineralogical analysis and other scientific study) and for use in processing experiments
- Sorted samples by class: highland material, mare material; mantle material, KREEP soil (potassium, rare earth elements, phosphorous); asteroid fragments
- Tailings from processing operations
- Other manufacturing or processing byproducts
- Assorted trash and detritus of operations including discarded and broken items & things no longer needed
- Human wastes and gray water
- Standby storage for items needed intermittently

In transit from/to Earth or in space usage areas

- locally produced fuels (liquid oxygen, silane, etc.)
- manufactured products & sales inventories
- Artifacts created by local artists and craftsmen
- Incomplete assemblies (waiting for parts, etc.)

"Cross–classification" by storage requirements:

- Items that can be placed on the surface, out in the open, exposed to vacuum.
- Items best placed under a ramada or canopy to protect from solar UV, micrometeorites, or constant cycling between dayspan heat and nightspan cold.
- Items already carefully sorted that should be placed in bins or containers to avoid cross-contamination
- Items that should be stored in pressurized conditions
- Items requiring temperature controlled environments

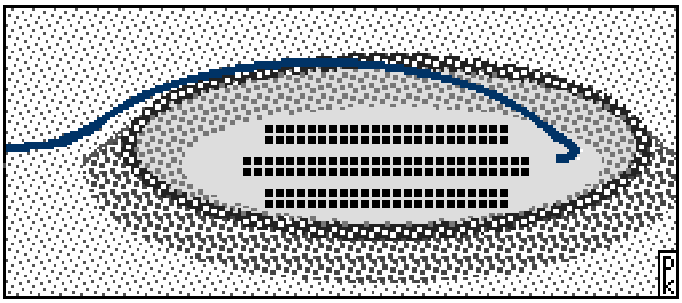
"A place to put everything and everything put in its place"

It should be clear from the brief analysis above -- we make no claim that it is exhaustive -- will convince anyone that we cannot make do with just "a" storage location, and "additional overflow locations" as needed. While proper double bar-coding procedures can find anything no matter how disorganized the storage areas, witness the eventual remedy for Mir's storage nightmare, efficiency in retrieval will obviously increase if things are physically stored in segregated locations, each with substantial room to grow. Site Management will identify areas, out of sight of regularly used trafficways, where things can be properly

stored. Then double bar-coding, of the item to be stored, and of the storage location or bin, will make everyone smile.

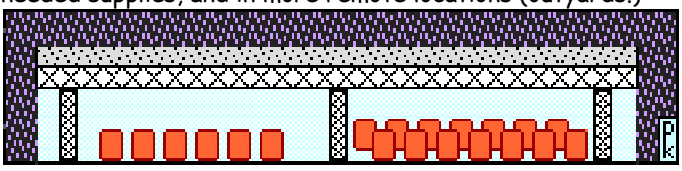
Unique locations for storage

Some natural surface features offer scenic segregation (though not from overflying craft) such as craters and the shadows of East-West running escarpments. Polar "permashade" areas offer permanent "out-of-sight conditions as well as stable very low temperature storage, ideal for items subject to decay at higher temperatures. Lava tubes offer all this and one thing more, an environment protected from the cosmic elements of cosmic rays, thermal extremes, ultraviolet, solar flares, and meteorites.



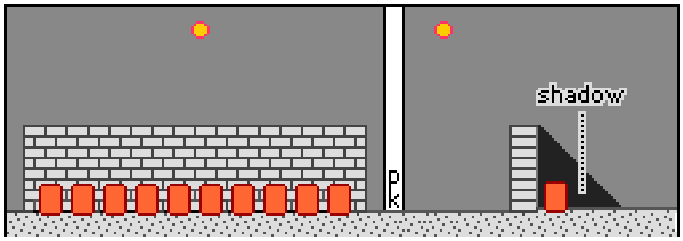
A graded road climbs up the shoulder of a stadium-size crater, across the rim and slowly ramps down the inner wall to the relatively smooth crater floor. Crater storage is attractive to hide stored items from view and also for storage or radioactive wastes. With no atmosphere to worry about, only line-of-sight radiation would pose a problem, and the crater walls would block that.

A similar "lee" or "soft" vacuum environment can be created by building ramada canopies or hangers for storage where lightweight, unhardened space suits can be worn, and glare-free, bright sky conditions maintained. "Underyard duty," if one can call it that, will be much more pleasant and less stressful than similar duties out on the exposed surface. Ramadas can be built immediately adjacent to the outpost complex (inyards) ideal for storage of routinely needed supplies, and in more remote locations (outyards.)

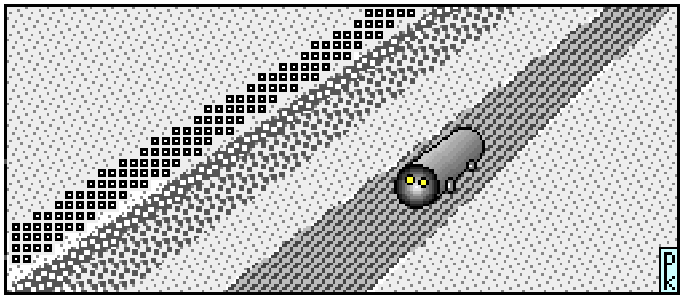


Here a space frame canopy covered with a meter or two of regolith provides protection from the cosmic elements of lunar "weather" including cosmic rays, solar flares, ultra-violet light and the incessant micrometeorite rain as well as providing thermal equilibrium -- protection from the monthly cycling of high dayspan heat and low nightspan cold -- all the while leaving the space underneath this "ramada" open to the vacuum. Ramada storage facilities will be ideal for items needing such protection, too sensitive or valuable to be left fully exposed. Ramadas extend that same protection to any storage management workers involved.

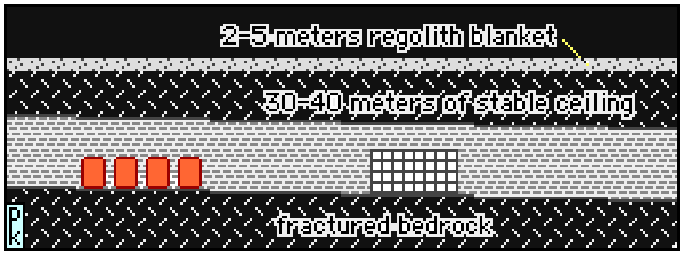
In addition to ramadas, well away from the equator, block walls can provide dayspan long protyective shade.



In this illustration, drums containing liquid and sludge wastes remain frozen and inert behind an east-west shade wall. This idea will work in the Moon's "temperate" zones, north or south of the equator, where the sun is never overhead (the Moon's axial tilt is negligible, 1.5°, the seasonal variation of the shadow angle is very low.)



A berm along a highway provides both out-of-sight storage and the convenience of highway access.



Storage in a stable lavatube with its gently sloping profile is the ultimate in lunar and Martian storage options. Enough protected and stable storage volume for all of the storage and warehousing needs for frontier civilization for generations, perhaps millennia to come. Even enough room to completely archive all of human history and civilization in a setting that should remain stable for billions of years to come. Freight elevator shaft access from the surface would do the trick. Lava-tube storage is also the ultimate solution for radioactive materials, toxic chemical wastes, and virulent biological pathogen collections. The Moon's lavatubes are an asset rivaling anything else the Moon has to offer, including farside radio silence and helium-3. Lavatubes are a naturally occuring feature in lava sheet flows such as the Moon's maria or seas, and in shield volcanoes.

On Mars, storage immediately behind walls built perpendicular to the prevailing winds, will provide some harbor. Properly designed, they will reduce the accumulation of fine dust and sand.

Preventative measures

On the Moon, with resupply windows virtually open around the calendar, the need to maintain a large inventory for replacement parts, equipment, and commodities will be much less severe than on Mars, where windows open up every 25-26 months. On the Moon, a "just-in-time" inventory system should be doable. Not so on Mars.

When it comes to inventories of reusable materials embodied in discarded items, "having it in storage' is not the same as "having it ready to fetch and use." Whether it is a discarded appliance or vehicle or anything else manufactured of multiple, individually reusable parts, it makes sense to maintain a "just-in-time" inventory of dissassembled items, properly sorted by material ready to reuse. Whether it be a routine chore of youngsters after school or on the local equivalent of Saturday morning, or of universal service work corps, the pioneers would do well to be handling the proper disassembly of discarded products *as it comes in.*

On the frontier, a lot of things will be in short supply, and losing track of things, or having things misplaced, or mixed and unsorted only exacerbates the problems and greatly handicaps the "resourcefulness" that is the pioneers' main trump card, the "ace up the sleeve." Honing their resourceful abilities be a frontier preoccupation.

Storage Management starts with a philosophy, capsulated in a vision statement, and a comprehensive organization and logistics strategy, summed up in a vision statement, with periodic reviews and adjustments,

- *common sense* - its where you put it when you need it - organization & logistics & efficiency & resourcefulness
- *respect for the environment*, lifeless perhaps, but with a beauty not to be marred senselessly, but with art & plan.
- *a plan for what should be stored, and stored separately* so that it is a resource, not a waste nor a loss

On the frontier, the necessity of making the most of everything will be the mother of invention in storage, tracking, and fetching systems. One can even foresee a Byproduct Trade Exchange, all computerized and bar-coded, integrated with fetching & shipping systems, and automated order/import just-in-time software & distribution systems.

Incentives to help maintain discipline

The most brilliantly crafted system is only as good as the discipline with which it is followed and respected. Tax and fine incentives are a time-honored way to increase the percentage of compliant "good behavior." While on the Moon, where nothing can be taken for granted, citizen awareness of the need to exercise individual responsibility for keeping things working will be high. Yet the temptations of laziness, combined with probably all too frequent inconvenience of making the needed effort are sure to also guarantee that compliance will slack off with time. Help from the tax and fine codes might not be bad insurance.

For individuals and companies alike, one good idea might be a tax on undisassembled discarded items, no tax on things properly separated and sorted. For companies with a need to remove byproducts and processing and manufacturing wastes off the premises, there could be a prohibitively steep fee for illegal "dumping," a medium fee for taking to an approved storage location for unsorted materials, and no fee at all for storing items and materials properly sorted. To work, the fees would have to be higher than the costs of employing people or equipment to do the proper sorting and/or disassembly. Mechanization, containerization, and computer software will ease the burden and minimize both full- and low-exposure man hours. .

Promoting reuse and use of sorted materials
And the GST "Gross Settlement Throughput" Index

If there were a tax or price paid by manufacturers and processors on all use of virgin regolith, but no or a significantly lower fee or price for using tailings and other stored byproducts and any beneficiated materials or wastes, the total "throughput" or gross natural material consumption index of the settlement would be lower.

> The lower the ratio of virgin raw materials used to new products produced, the more efficient a civilization is in minimizing its impact on its host world.

Our impact on the lunar or Martian environments, while certain to grow, would grow more slowly in comparison to population growth. Again, prices have to be set at a level to encourage the desired corporate and individual activities, and should be adjusted regularly to fit changing conditions.

Making sure

Government policies do not work unless they affect indivi-dual behavior. It is the net change in total individual actions that makes a difference one way or another. Incentives are helpful, but not enough. "Correct" action has to be made easy, easier in fact than lapsing into the behavior we are trying to remedy or eradicate. Nature, human nature too, tends to follow the past of least resistance. Individual economic decisions rule. Here is where most well-intentioned official policy legislation falls down and becomes ineffective.

Thus a properly designed storage management system and coordinated recycling program must avail itself of helpful tricks. Color, pattern, and texture coding of the various receptacles will make choice of the right one easier. A computerized "Yard Guard" that recognizes a correct placement and notes that on the record of the person making the drop, rewards effort to "do it right." Docking pay, or hours, for wrong choices will help too. "Anything worth doing, is worth doing right."

Implications for early frontier industry

The "Storage Industries"

To begin this program at the outset of operations of the first outpost, all that will be needed is a vehicle that can pick up items to be stored, take them to an initial

storage area that has been identified, and set them on the ground in an orderly fashion, separating them by type, and using a bar coder to tag both item and exact storage location. Such barcoding had been in use for at least a decade on Mir, with great success.

Then as each new industry comes up to speed, iron, steel, aluminum, cast basalt, glass, ceramics, glass-glass composites, and concrete it can use slack time from producing products for domestic consumption and export by making drums, bins, boxes, and stalls to hold items, especially regolith samples, and sorted discarded items, in a way that helps prevent cross-contamination.

Tailings from materials processing can be put to work in storage by piling them up as berms to visually fence off storage areas as they expand. Regolith that needs to be moved out of the way can be tamped into molds and sintered into construction blocks to make shade walls.

Eventually, as we are able to make spars for space frames, probably from glass composites, we can start making hangers or ramadas covered with shielding for storing things that could be damaged by prolonged exposure to the cosmic elements, but do not need pressurization. In short no "new" industry is needed to get this program going.

University Involvement

Long before the first outpost-becoming-a-settlement sprouts an infant university, a University of Luna - Earthside will have become involved in brainstorming the industrial and commercial expansion and diversification of the settlement, endeavoring to keep several steps ahead of reality, least growth be haphazard. The University, first from Earth, then on location, will take the lead in Storage Management Science, recycling systems, shepherding new storage related enterprises, aggressively developing new products that can recycle the many types of discarded items and materials, and working on marketing strategies. Marketing the storage management systems, know-how, and software that the University has developed and licensing of the manufacturing of field-tested storage related equipment and systems to other settlements, *and to to municipalities on Earth as well,* help provide the University with some research and development income.

Employment

On any frontier, "there are always more jobs needing to be done than people to do them. The Moon and Mars will be no exception. When it comes down to priorities the nod must go to jobs that produce saleable exports to earn credits to buy what cannot yet be produced locally, and for production of domestic goods, so that such items no longer need to be imported. That means, that as important as our storage endeavor is, we will need to rely as much as possible on mechanical and robotic systems for placement and retrieval of storage items, the cost of that equipment being far less than the real cost of diverting manpower to these task. People that must be involved will use automated and teleoperated equipment.

However, some tasks involved will be automation-resistant, such as disassembly of items so that individual components can be properly sorted and stored according to material composition. Some of these menial chores can be assigned to the settlement youngsters as after school or "Saturday morning" type chores. We're all in this together.

California Closets Goes to the Moon?

Think of a disorganized storage area on the Moon as one big outdoor closet, jam-packed with assorted stuff in helter-skelter fashion, with no real way to find anything inside. The all-too-common domestic version of this chaos is what gave birth to the *California Closets Company,* the brainchild of a seventeen year old California youth who was soon employing both his parents. The company's many novel solutions have all had their budget imitators, of course, many of them designed for the do-it-yourselfer. But this kind of left-to-itsef disorganization is precisely the market on the Moon, Mars and other space frontiers for well-thought out and practical storage management systems.

The Holy Grail

The Holy Grail of Storage Management *and Reuse Systems* is "to landfill nothing." But once we adopt the principle and experiences some real time benefits, pioneers will be encouraged to reach new heights. Items that remain on the discard pile represent a loss of the energy invested in their original production. Replacing them means using ever more fresh regolith, when that may not be necessary. Of course such a goal will never be reached. But "we must aim high to hit the mark.

Meanwhile, what would have been landfill becomes organized invested storage. Properly done, little energy will be required to maintain this stored potential wealth indefinitely. Nor will the cost of land be a problem for some time.

We'll plan ahead for our storage islands, our "storage parks" integrating them into the planned frontier urban landscape, just as we do industrial parks. Properly screened with pleasant berms and other devices, storage parks will be good neighbors.

The Upshot

Useless Diversion or an "investment in resource availability for the future? Nothing less than the settlement's viability and survivability are at stake. Storing things so that they can be efficiently put back into use is but a concrete application of our pioneers "lifting themselves up by their bootstraps." Not with the plan? Stay home!

Storage is not just about efficient housekeeping. It has environmental and economic significance. Establishing and maintaining the viability of settlements will be a constant uphill battle. The settlement that has its storage act together, will stand a better chance of still being around generations and centuries to come. **< MMM >**

The Moon Society

J O U R N A L

http://www.moonsociety.org

Please make NEWS submissions to 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 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 Moon base as a first step to a permanent, self-supporting lunar community. **ASI** does not engage in any form of commercial business directly, but seeks to build a Project support business team. Registered trademarks of the **Artemis Project™** belong to **The Lunar Resources Company®**

PROJECTS:

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

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

Moon Society DUES include **Moon Miners'Manifesto**

- **Electronic** (pdf) **MMM $35** **Students/Seniors**: **$20**
- **Hardcopy MMM**: U.S. & Canada **$35** Elsewhere: **$60**

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

Or mail check or money order to:
PO Box 940825, Plano, TX 75094-0825, USA

Please send all mail related to Memberships to:
The Moon Society Membership Services
at address above.

OUR LOGO above, shows the Moon in its natural beauty, empty and deceptively barren, waiting for human settlers to shelter and to mother as an adopted new human home world. We have work to do!

It's time to toss the "Catch 22" out the door!

President's Message

From the very founding of the Moon Society, the leadership has been faced with this conundrum:

"To encourage members to renew, and to attract new members, we need exciting, productive projects."

"Until our membership and talent base are larger, we can not carry out exciting, productive projects."

We must not allow ourselves to remain paralyzed by this Catch 22. To escape it, we must think outside the membership box. It is a fact of life today, a fact that it makes no sense to waste time bemoaning, that all space activist societies are undergoing membership downsizing. We lose members to old age, to other preoccupations, to discouragement with the long, long road it appears we must travel before we begin to see concrete evidence that the space frontier is indeed "opening up." At the same time, none of the space-enthusiast societies are successfully pushing the buttons of young people *in sufficient numbers* to make up for losses by attrition, with exceptions rare enough to prove the point.

How do we proceed? *It's easy!* We get over the fruitless "turf-protectionism," and *start collaborating.* At the recent Mars Society Convention held in Chicago August 19-22, officers of the Moon Society and of the National Space Society were on hand: we, to get things started; the NSS reps just to observe. Our own effort to get discussions going on *a whole menu* of possible collaboration projects between the Moon and Mars Societies was welcomed with great interest by President Robert Zubrin and Executive Director Maggie Zubrin. We kept the NSS leaders present informed about what we were doing, and it appeared to be infectious. Before the event was over, limited-scope collaboration talks were underway between the Mars Society and NSS also.

By collaborating, we do these three critical things: (1) we gain access to a larger talent pool with more depth; (2) we avoid duplications, reinventing axles (and wheels); (3) we have a better chance of getting the media and the public to take notice that we are no longer a deeply divided front. *We are in this together!*

You can read the 2-sided "collaboration flyer" we gave to the Zubrins by downloading this pdf file:

http://www.moonsociety.org/reports/mars_conv04/MS_TMS_Collaboration.pdf

And with this issue, we are introducing the first fruits of this effort. Read all about it in the article immediately below. Or you can read about it online at:

http://www.moonsociety.org/projects/mm_homestead_proj.htm

Collaboration on this first project was approved by the Moon Society Board 9/1/2004.

Peter Kokh

The (Moon –) Mars Habitat Project

"To Arrive, Survive, & Thrive" [™ MarsHome.org]
from Peter Kokh 8/24/2004

A description of the Mars Habitat Project

(Interested Moon Society Members can Participate)

"Researching the technologies needed for permanent habitation" -- Utilizing concepts and designs from the past several decades, the Mars Homestead Project seeks to develop a unified plan for building the first habitat on Mars utilizing local materials. The ultimate goal is to build a growing, permanent settlement beyond our homeworld, allowing civilization to spread beyond Earth.

Mission Statement: To design and build the first permanent settlement on Mars. [from www.marshome.org/about/]

The initial goal for the Mars Homestead Project is to identify the core technologies needed for an economical, growing Mars Base built primarily with local materials. Later phases will involve increasing levels of prototyping, either selecting existing equipment which could be used on Mars, or building prototypes of new equipment leading up to an entire simulated Mars Base.

The initial study is being conducted by a small Program Team, whose members have professional or academic experience in applicable engineering areas. Areas of expertise include: Materials, Structural, Mechanical, Architectural, Agricultural, Nutrition, Process/PSSS, Electrical, I&C, Data/Telecom, EHS, IE, Mars Geology/ Topography, Space Transportation, Spacesuits, Systems Integration, and others.

There is also need for occasional advisors in specific areas, and a general "brainstorming" discussion group is open for anybody interested in the project, regardless of technical experience.

While we want to entertain all ideas and don't want to be locked up into using specific materials too early, some of the materials we will probably consider are: locally produced fiberglass - wound on site; metals; masonry - either for unpressurized shelter or covered with regolith to hold the pressure, polyethylene & other polymers made from ethylene from the CO2 atmosphere; and any plant products - especially if a byproduct of food growth.

Divide & Conquer, Phase by Phase

- Brainstorming Internet Group launched to discuss key needed technologies: structural materials, habitat layout, food, clothing, etc.
- Program Study Team to develop a Mars Homestead Reference Design (HRD) similar in structure to the NASA DRM. One outcome of this effort will be identifying areas for further research
- Individual Prototyping Projects: follow-on equipment research projects will be based on that study. Help select and/or design equipment and furnishings suitable
- Full Scale Prototype Research Base: Eventually, a complete analog research facility to provide for integrated research and public outreach.

Our Guiding Belief -- "Settlements can be built for little more than the cost of round trip exploration missions, and provide for long term science missions (10+ years) significantly reducing launch costs." - www.MarsHome.org.

[Ed.: Missions should be designed to put these enabling technologies in place. From long term missions, permanent settlement is an easy step. In the long run, we will learn much more about Mars (and the Moon) if we are living there - as happened in North and South America and Australia.]

Welcome Moon Society Members!

[from Bruce Mackenzie, The Mars Society,
and Peter Kokh, The Moon Society]

08/21/04 - The Mars Homestead group has just started to explore how we would get beyond an outpost by building modular settlements, with all the technologies that may involve. Other than the color of the regolith and the sky, and the added benefit of atmosphere mining on Mars, just about everything else will apply to the Moon at well.

Project cofounder Bruce Mackenzie welcomes our official cosponsorship and welcomes any Moon Society members who want to join in. The results of this virtual simulation will enrich us as well. This collaboration has the blessing of Mars Society founder and President, Robert Zubrin, as well.

Most of the Challenges facing the Mars Homestead Project will apply equally to design & construction of modular settlements on the Moon:

- Habitat space must be pressurized with breathable air
- Building materials processed from local regolith: metal alloys; glass, fiberglass, glass-glass composites, ceramics, fiberglass reinforced concrete
- Shielding habitat space with regolith for full protection against the cosmic elements as well as an aide to thermal management
- Means of providing solar and scenic access to shielded habitat spaces
- Air, water, and human waste recycling systems
- Integration of food production into mini-biosphere maintenance
- Furnishings and clothing need to be provided locally
- Transportation networks
- Diversifying the frontier economy to meet ever more domestic needs, to cut down on imports

And so on. Some things, however will apply only to homesteads on Mars, or only to homesteads on the Moon:

- On Mars, the thin carbon dioxide / nitrogen atmosphere is a source of chemical feedstocks for agriculture and manufacturing. On the Moon, such resources are minimal, although carbon and nitrogen oxides may be found immixed with water ice in polar cold traps, as the suspected source of these volatiles, impacting comets, contains ample amounts of these elements
- On the Moon, the month long dayspan-nightspan cycle will affect all operations on the surface and, because of cycling energy availability, within habitat and industrial spaces as well.

Some specific areas in which Moon Society Members could Contribute – and there may be more!

- The development of Modular Biospherics - by incorporating primary waste treatment in every toilet and sink equipped module, the biosphere would expand in modular fashion along with the pressurized habitat ecosphere that contains it.
- Examination of the needed technologies identified by the group for potential profitable terrestrial applications; doing preliminary business plan sketches for terrestrial enterprises that would pre-develop such technologies for profit from terrestrial applications here and now - the "spin-up" plan, that unlike "spin-off" relies on consumer purchase funding rather than NASA requested crash programs paid for out of taxes.
- Developing the concept of modular "container" factories sized to fit common cargo holds and payload bays, for integration in plug-in-and-operate industrial park complexes not unlike marinas.

This is the first of what we hope are many projects in which cooperation & collaboration will further the goals of both the Moon Society and the Mars Society. We are delighted to offer this opportunity to our members.

MoonSociety members interested in any of these topics are urged to participate. Our participation will increase the talent pool working on this project, guaranteeing a more mature product, and one very relevant to our own needs as well of those of the Mars Society.

Meanwhile, to whet your appetite, check out Jim Lowe's Index to the Martian Pattern Language Dialect

http://www.sy napse.net/jlowe/

Jim's How to Build Your Own Space Habitat is a course in basement workshop space station modeling.

http://www.synapse.net/jlowe/HowToBuild.html

‹ TMS ›

Gregory R. Bennett named Moon Society President Emeritus

At the August 18, 2004 Leadership Council and Board Meeting, Moon Society founder Greg Bennett, who recently retired as President after completing his second term, was unanimously voted "President Emeritus" on a motion by incoming president, Peter Kokh.

Photo (detail) by MarianneDyson, 1990

Greg's past work service and on-the-side organizational efforts ground his considerable knowledge, wisdom, and know-how, a resource the Moon Society hopes to continue to draw from for years to come, and our continuing source of inspiration. *Thanks!*

Founder of the Artemis Project, today Greg serves as president and a board member of Artemis Society International, president emeritus and member of the board of directors of the Moon Society, and chairman of the board and president of The Lunar Resources Company.

- **Life Work Summary:** Greg has more than 30 years of experience in aerospace engineering, with responsibilities ranging from management to detailed technical analysis; the founder of several successful non-profit organizations (including the Artemis Society), and writes science fiction under the cleverly disguised pseudonym of Gregory Bennett.

Now working full time as President of The Lunar Resources Company, headquartered in Plano, Texas, he previously served as VP for Spacecraft Development at Bigelow Aerospace in Las Vegas, Nevada. Prior to that, Greg worked in manned space flight engineering at Johnson Space Center for 20 years. He was the Houston lead for operations and responsible for EVA engineering on the International Space Station program. He had worked for McDonnell Douglas (now part of Boeing) since 1972 in Space Shuttle astronaut and mission controller training, space station operations planning, and then as manager for space station EVA assembly and maintenance development.

- **Biography:** www.asi.org/bios/bennett.gregory.html
- **Personal interests & hobbies:** space flight, history, philosophy, psychology, private pilot, backpacking, computer programming, astronomy, photography, astrophysics, ecology, geology, FRP games, graphics design, foreign languages, all kinds of music, and of course, surfing the net.
- **Writings:** www.asi.org/bios/grb/grb-bibliography.html
- **Awards:** www.asi.org/bios/grb/grb-honors.html

How familiar with the Moon are you *really?*

How to painlessly expand your familiarity with the Nearside face of the Moon

All of us are interested in the Moon, that goes without saying. Why else would we be getting *Moon Miners' Manifesto* or belong to the Moon Society? And yes, all of us are familiar with the naked eye "Man in the Moon" face of the hemisphere of the Moon always turned Earthward, with the pattern of light and dark shadings. How could we not? The Moon, full and its phases, is a familiar to anyone with fair eyesight, even in Earth's most polluted urban areas.

But just don't ask us to name names! Oh yes, we all know the "Sea of Tranquility," and some of us know the names of the places where the manned missions that followed Apollo 11 landed. But don't ask us to point them out on a Moon map or globe.!

Face it, for most Americans, geography is not a strong point. Be that as it may, it isn't that hard to make slow steady improvements in your LFQ, your Lunar Familiarity Quotient. There are quite a few tools out there, aimed at beginners.

Tools for becoming more familiar witht the Moon

Moon Society Member, Marianne Dyson, author of the award winning children's book, Home on the Moon, has a website called "**The Animated Moon**." Just move your cursor over a feature that catches your attention and its name pops up. http://www.mariannedyson.com/moon.htm

The American Lunar Society has a great program that teaches a lot about basic lunar geology and at the same time familiarizes you with nearside features that illustrate the lesson. Make your way through this program and get an ALS **Lunar Study & Observing Certificate**! You can procede at your own pace, in your own free time.

A great book is "**Welcome to the Moon: Twelve Lunar Expeditions for Small Telescopes**" by Robert Bruce Kelsey (Paperback - June 2003) $11.95 from Amazon.com. A well written 'how to' for novice astronomers; describes pieces of the telescope to seas of the Moon in a organized fashion. Chapters are broken out as views of the Moon and each attraction is mapped with directions. Historical anecdotes accompany each chapter and give good perspective to what we are viewing. The author respects the reader- there are no excessive words and he assumes intelligence.

One painless way to learn more is to buy a map of the Moon - make sure it is one that lists the named features in alphabetical order and gives their latitude and longitude coordinates. Then, whenever you read or hear about a place on the Moon you can look it up on the map (or globe). Do this faithfully, and over the years your knowledge of the Moon will expand surprisingly! *To the Moon, Alice!*

Moon Society St. Louis Plans Info Table at Archon 2004

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

Every year in the St. Louis, Missouri area, this time early fall, one of the great grand daddy science fiction conventions is put on - Archon - named after St. Louis' famed Gateway Arch, of course. This year it is Archon 28, held from Thursday, Sept. 30th through Sunday, Oct. 3rd.

And this year, Moon Society St., Louis is taking the plunge with an information table, for Saturday only (everyone has to work on Thursday and Friday!) This year's event will be held across *the* river (the Mississippi, of course) in Collinsville, IL. Notable Guests of Honor will be author Alan Dean Foster and media star George Takei (Sulu, in the original Star Trek series.) The Con website is:

http://www.archonstl.org/28/index2.html

But the St. Louis Moon Society Chapter will have its own special guest, chapters coordinator (and now president) Peter Kokh is coming down from Milwaukee by Greyhound and crashing at the pad of frequent MMM contributor Dave Dietzler. Peter has been wanting to pay the vigorous local group a visit for some time. Two years ago, Burton Sharpe, a a MSStL member, paid a surprise visit to Milwaukee, coming to the Lunar Reclamation Society meeting. Sharpe was one of the co-authors of the book "The Moon: Resources, Future Development and Colonization, Ed. David Schrunk.

But the real reason for Kokh's visit is to pay overdue respect to this first Moon Society chapter to get past all the hurdles needed to get a Chapter Charter. He would like to visit any and all Outposts who graduate to full chapter status.

Changes in Chapter & Outpost System and Rules Under Discussion by Moon Society Leadership Council

by Chapters Coordinator, Peter Kokh

In our ongoing effort to reinvent the Society to better be able to make the most of its assets, some of the standing rules of the Chapter System are due for a fresh look. The minimum number of five is an threshold that seems set too discouragingly high. We need to make it easier for chapters to form, to recruit new members, and to get busy doing their thing.

We also want to take a fresh look at the job description for "local contact" or "outpost" to better empower individuals who have something to contribute - chapter organizing may not be their cup of tea - and giving them the resources they need to make a contribution.

"Empowerment" of our members is the goal!

Mars Society Issues Chapter Challenge

August 25, 2004 - At the 7th International Mars Society Conference in Chicago a new contest was announced: an International Chapter Challenge to raise money. These funds are essential for continued operation and upgrades of our Flashline Mars Arctic Research Station on Devon Island and the Mars Desert Research Station (MDRS) in the southern Utah desert, and to allow us to launch our planned European Mars Arctic Research Station in Iceland.

The prize for the Chapter that raises the most?

3 Crew Slots at MDRS!!!!

(slots can be used together or separately)
with Air Fare Paid to Salt Lake City, Utah

[MDRS: the Mars Desert Research Station in SC Utah]

Here's how it works:

- Collect monetary donations (check, credit card, or money order are accepted) or in-kind contributions (counted at retail value)
- Send the donations to HQ via mail to:
  The Mars Society, P.O. Box 273
  Indian Hills, CO 80454 USA

Haver cash donations sent via the secure website at:
http://www.marssociety.org/secure/register2.asp

- Collect donations, in cash (check, credit card or money order accepted) or in-kind contributions (which will be counted at retail value)
- Be sure to include a note with every donation as to which chapter should get the credit for the donation.
- Report all activity to Patt Czarnik (pattczarnik@hotmail.com) who will keep the tally and update progress monthly on the Mars Society website
- Make sure that contributors clearly state which Chapter gets credited for their donation

Contributions began at this year's Conference and the first tally will be available shortly. Over $32,000 was raised at the banquet so we are off to a great start!!!!! The contest will end early August 2005 (depending on date of Boulder Conference).

Good Luck to Everyone!!! Questions?
Contact Patt at pattczarnik@hotmail.com

GREAT BROWSING !

The Mars Movie Guide
http://marsmovieguide.com/

LPOD - Lunar Photo of the Day
http://www.lpod.org/

Lunar Photo of the Day Archive
http://www.lpod.org/LPOD-Archive.htm

Your own Apollo Guidance Computer
http://www.sandroid.org/Apollo/index.html

Migrating Martian Elephants? Not Quite
http://www.msss.com/mars_images/moc/2004/08/17/

Sand Worms on Mars? Not Quite
http://www.space.com/imageoftheday/image_of_day_040831.html

Mars Convention 2004 Photo Galleries
http://www.freemars.org/mnfan/MarsSociety/2004/

Follow the *Cassini-Huygens* Mission
http://www.planetary.org/saturn/

Follow the *Spirit* Mars Rover
marsrovers.jpl.nasa.gov/mission/status_spirit.html

Follow the *Opportunity* Mars Rover
marsrovers.jpl.nasa.gov/mission/status_oportunity.html

Award Given for Children's Book "Home on the MOON"

from Marriane J. Dyson < mjdyson@swbell.net >

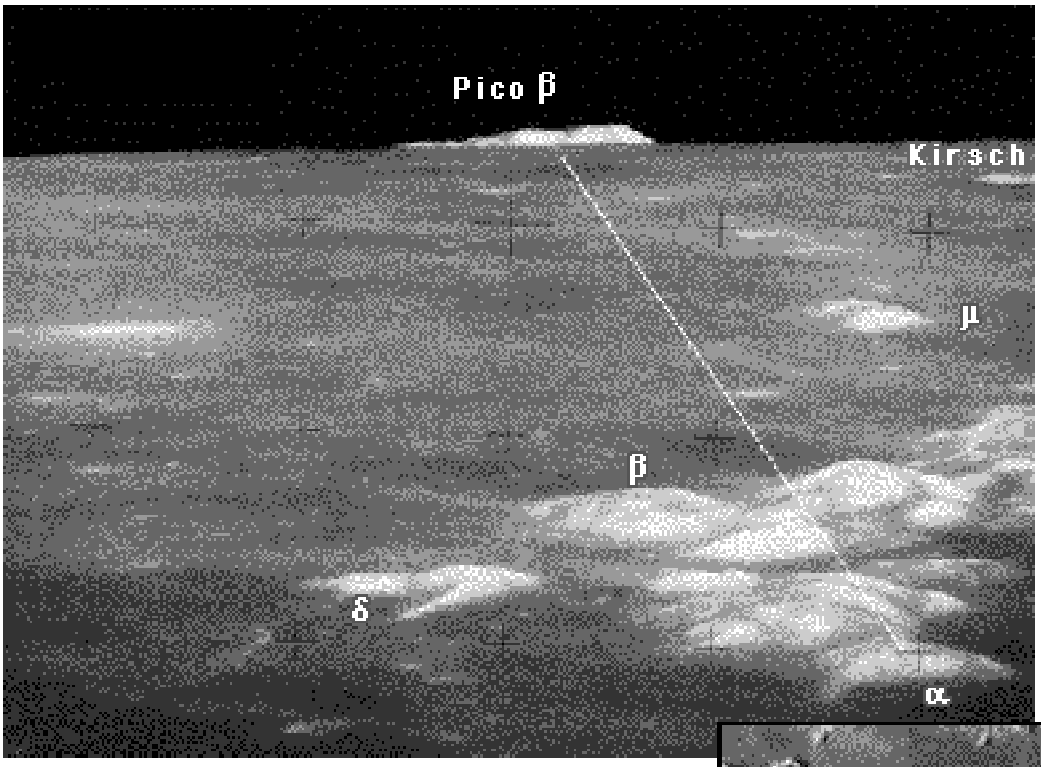
My book, **Home on the Moon*** (reviewed in the October 2003 issue of Moon Miners' Manifesto, #169), has been selected to receive the 2004 American Institute of Physics Science Writing Award in the children's category. This award consists of a $3,000 cash prize, an inscribed Windsor chair (a classy black wooden chair with gold trim) , and a certificate.

The National Geographic Society will also receive a certificate of recognition (as the publisher of the book). I will receive the award at the 2005 American Association of Physics Teachers Winter Meeting in Albuquerque, NM on Monday, January 10, from Vice President of the Physics Resources Center, Dr. James H. Stith.

* List $18.95, new from Amazon.com $13.27, used from $4.99. Average customer rating per amazon.com is 5 stars.]

[The following is reprinted from the web as a readers service to publicize the Lunar Photo of the Day website at **www.lpod.org.** It deserves to be on your brouser toolbar - at the very least, conspicously bookmarked.]

Lunar Photo of the Day



September 11, 2004

Image Credit: Apollo 15 (AS15-81-11022) and CLA B14

A Steep Spot on the Moon

A Detective Story

(editor's subtitle)

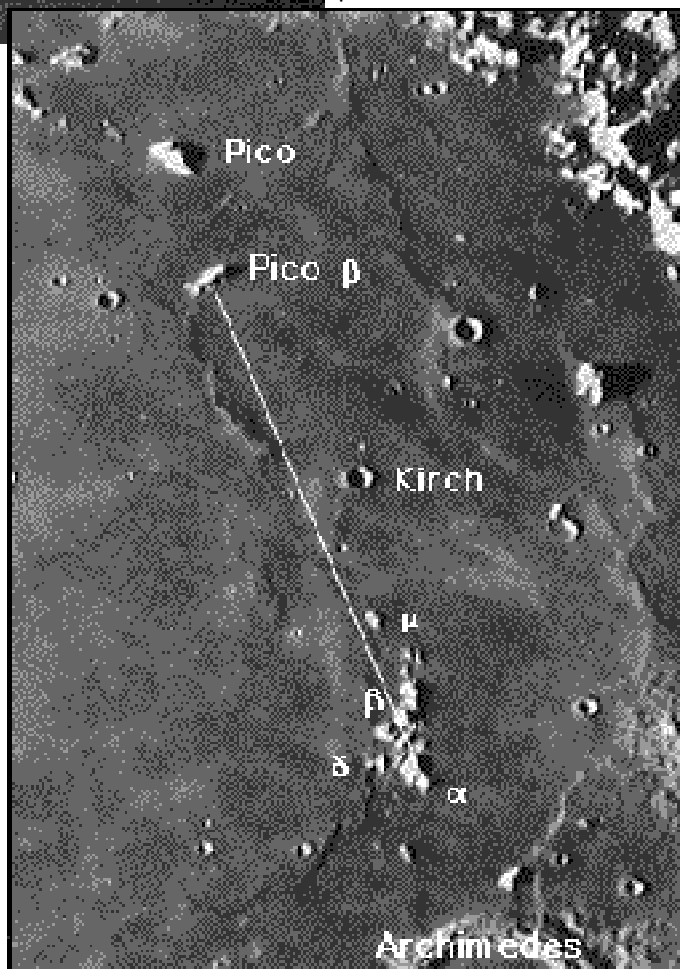
by Chuck Wood

Looking at even the best images from Earth or Lunar Orbiter we seldom get a feeling for the actual heights and slopes of lunar features. But while orbiting the Moon, Apollo astronauts used Hasselblad cameras to take some spectacular low oblique shots and even a few profiles. Here is one I stumbled on that provided some pleasant minutes as I tried to identify the peak on the horizon. The only catalog information was that this image is of the Spitzbergen Mountains north of Archimedes.

Comparing this image with the Rukl Atlas sheet 12 didn't help, but when I compared it with a Lunar Orbiter IV image and then a Consolidated Lunar Atlas photo I could finally say, "Aha!" The Apollo 15 command module Casper was actually south of Archimedes when an astronaut (Mattingly?) took this shot looking north and a little west. In the foreground is the south half of the Spitzbergen Mountains.

Since most modern maps lack the Greek letter designations for topography I had to also pull out the System of Lunar Craters catalog and map (of which I was a coauthor 40 years ago!) to identify each peak. Drawing straight lines between two foreground landmarks and the 220 km distant peak (mouseover) I could finally identify it as Pico Beta. The larger peak Pico is not visible because it is directly behind Beta. According to the LAC 25 chart, Pico Beta is 2010 m high [6,600 ft.] at its northeast end. Using my son's plastic compass I measure the slope on the right side as 31 degrees; the average slope of the rest of the peak, from the southwest end to the summit is 7 degrees.

Thirty-one degrees is a steep slope for a peak on the Moon. Many interior crater rims are as steep but few peaks are known to be. But maybe the issue is we don't really know the slopes of many peaks! **‹ CW/LPOD ›**



CALL FOR PAPERS

SPACE EXPLORATION 2005

An International Conference and Exposition on Science, Engineering & Habitation in Space & 1st Biennial International Space Elevator Workshop

Albuquerque, NM – April 3–7, 2005

HOSTS: The Space Engineering and Science Institute, National Space Grant Foundation, The Institute for Scientific Research and the Los Alamos National Lab.

Topical discussions in areas of interest to the exploration and habitation of space, including alternative methods of access to space. The complementary themes of science, engineering, and human habitation in space will draw together an international array of scientists, engineers, educators, managers, and entrepreneurs.

The first Biennial Space Elevator Workshop will be held in conjunction with the conference. We invite you to participate in the proceedings.

Abstracts : Abstracts must be in English, one page or less, and summarize a paper suitable for presentation at the Conference. The nominal length of the final paper should be about 7-10 pages. Abstracts will be evaluated as they are received and authors will be notified of acceptance. See our website for the preferred procedure and format for abstract submittals: **http: www.sesinstitute.org**

Also on this site is an on-line abstract submittal form.

For all submittals, please include the title, authors and affiliations, mail address, e-mail address, and phone number of the corresponding author, and up to 10 key words. Abstracts are due by 1 June, 2004. All acceptance notices will be sent by 15 July, 2004 and drafts of the accepted paper will be expected by 1 September for peer review.

A list of topics for the conference, by all means non-inclusive, is available on our web site. There will be a University Student Robotics Competition. Student Papers will also be considered. Student Papers which are accepted will be published in the Proceedings.

SE 2005 abstracts and technical program inquiries to:

Technical Chair:
Dr. J. Allyn Smith
phone (505) 667-0425.
Email: jasman@lanl.gov

Technical Co-chair:
Dr. Robert Nemzek
phone: (505) 667-0822
Email: nemzek@lanl.gov

Mailing address for both:

Los Alamos National Laboratory
ISR-4, MS D448
Los Alamos, NM 87545

Dr. Bryan Laubscher, Chair: (505) 667-1804
blaubscher@lanl.gov

Dr. Phillip Richter Admin. Chair: (505) 661-2688
filipi@aol.com

David Klingler Bus. Chair: (505) 255-0653
davek@commercedata.com

UPDATE on Tom Hanks' 2 IMAX Projects

• Magnificent Desolation featuring footage shot by Apollo Moonwalkers

We reported on the "Magnificent Desolation" project in MMM # 174, April 2004.

"In the history of mankind, only 12 men have stepped on the surface of the Moon ... MAGNIFICENT DESOLATION is their story. From 1969, the year of the first lunar exploration by NASA, to 1972, the last time a manned mission was sent to the Moon's surface, only 12 men have experienced the feeling of walking on extra-terrestrial ground. In those three short years, man spent almost 300 hours (approximately 12 1/2 days) exploring and documenting the surface of the Moon, and has not returned in over 30 years. Buzz Aldrin, of the Apollo 11 NASA mission and the second man to walk on the Moon, uttered the now famous descriptor "Magnificent Desolation" to express the sensation of being on the Moon as well as the landscape he observed." - *bigmoviezone.com*

This documentary is still listed for a 2005 release date and is expected to have a run time of 45 minutes (the usual for IMAX features) and will be in 3D.

• "Apollo 13, the IMAX Experience"

This film was released two years ago in 2002, but has not yet made the rounds except to a few scattered locations. (You can see it now for the added price of a round trip airline ticket to Malta, Shanghai, or Singapore.)

The catch seems to be that not all IMAX theaters are equipped to show this film. Currently (9/14/04) the Milwaukee IMAX is closed for renovations which will include the capability needed to show this film.

The same was the case with "Space Station 3-D."

Check with your local IMAX theater for their plans and capabilities. Maybe it's *petition time!*

SOLAR SYSTEM AMBASSADORS

www.jpl.nasa.gov/ ambassador/

Michelle Baker
Princeton/Philadelphia
chaos@cybernet.net

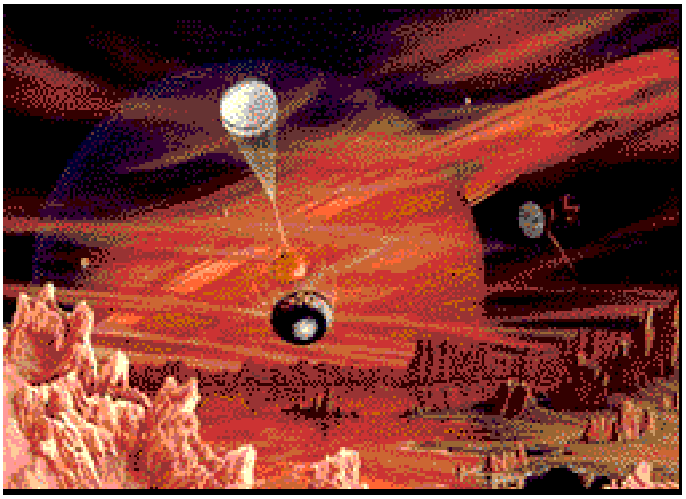
Bill Higgins
Chicago, IL
higgins@fnal.gov

Harold Schenk
Sheboygan, WI
hschenk@excel.net

Bill Hensley
Kenosha, WI
hensley@acronet.net

Rendezvous with Titan

Mission to Saturn's Moon of Mystery



Credit: JPL

Cassini-Huygens will fly by Titan on October 26th, one of many flybys designed to use Titan's gravity to tighten and redirect Cassini's orbit to allow the investigation of as many of Saturn's major moons as possible before Cassini itself plunges into Saturn's atmosphere, ultimately to be crushed by the quickly increasing pressure. But while Titan will play Orchestra Conductor, it will also be the Star.

Cassini-Huygens entered orbit around Saturn last July 1st. Now it begins to get interesting.

[*from* www.planetary.org/saturn/huygens_mission.html]

December 13 - a flyby of Titan will put Cassini-Huygens on a collision course for Titan!

December 25 - Three million kilometers from Saturn and Titan at the furthest point of its current orbit, Cassini will release the Huygens probe with a spring mechanism that pushes Huygens just ahead of Cassini in their mutual orbit--the spring gives Huygens 30 centimeters per second more speed than Cassini has. The spring mechanism also gives a gentle spin to Huygens, turning it at 7 rotations per minute. The spin stabilizes the spacecraft's course toward Titan.

Shortly prior to separation, Huygens will be given exact instructions as to the time that all of her systems must be powered on. For the 22 days between separation and entry, the only part of Huygens that is 'on' is this coast timer. So, for 22 days, the probe will be completely silent.

December 30 - Cassini will fire her engines to deflect her away from her collision course with Titan and put her on a path that will take her 60,000 km above Titan, so that she will be able to point her High Gain Antenna toward Titan for the entire period of Huygens' operations. The Titan Mission is a full partnership between Cassini and Huygens.

January 16, 2005 - The timer (or one of the three backup timers) will wake up Huygens 15 minutes before she is expected to enter Titan's atmosphere, at an altitude of 1270 km (790 mi.)above the surface.

The moment that Huygens senses that she has begun to encounter the atmosphere, her science instruments will be powered up and prepared for operations. This is predicted to take place when Huygens has reached an altitude of about 600 km (c. 373 mi)

Huygens will descend very quickly through Titan's upper atmosphere, reaching a peak speed of Mach 20 (that is, 20 times the speed of sound). Her forward heat shield and aft cover will take the punishment, protecting the instruments and electronics from the searing heat that will be generated by the friction of Huygens' descent.

The only science instrument that will be operating during this time will be the accelerometer. The accelerometer data will yield new information about the density, pressure, and temperature of the upper atmosphere.

Descent and the Atmospheric Science Mission

During this time, Huygens will capture and relay to Cassini 1100 images, and all the other instruments will continuously be performing direct measurements to determine he atmosphere's composition and physical properties. At T+40 minutes, the Gas Chromatograph Mass Spectrometer will begin analyzing the atmosphere's composition.

The descent is expected to take 137 minutes in total, plus or minus 10 minutes. The spacecraft will continue to spin at a rate of between 1 and 20 rotations per minute, allowing the camera and other instruments to see the entire panorama around the descending spacecraft. The greatest science return is expected from the last few minutes of the descent, when Huygens is closest to the surface.

Reaching the Surface of Titan

What will happen when Huygens hits the surface? A lot depends upon what it hits. The landing will take place at 5-6 m/s (1.4-1.7 km/h)(16-19 ft/s)(c. 1 mi/hr). This doesn't sound like a lot, but it is the same speed that an object would be moving if it were dropped from a height of about 1.5 meters (5 feet). The probe is built to take more punishment than your average computer, but still, if she impacts a hard surface of rock or ice (at Titan's temperature, ice is as hard as rock), she may not survive. We may never hear from her again, if she lands on a rough surface that tilts her antenna in a direction away from Cassini.

Huygens cannot be steered, so she can't choose to land on a liquid surface as opposed to a hard one, but if she does, she is designed to float!

Just three minutes to learn as much as possible

Huygens' Surface Science Package is designed to capture every piece of information about the surface that can be determined in the three remaining minutes that Huygens is designed to survive after landing. She even carries an acoustic sounder to determine the depth of whatever body of fluid she may land in. **</TPS>**

The Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

New list – 2004 LRS OFFICERS / Contact Information

PRES. / MMM Editor - *Peter Kokh**NSS**
< kokhmmm@aol.com > 414-342-0705
VICE-PRES. Doug Armstong **NSS** 414-273-1126
SECRETARY. - James Schroeter **NSS**
< James_Schroeter@excite.com > . 262-675-0941
TREAS../ Database - *Robert Bialecki 414-372-9613
Newsletter Mailing - Carol Nelson 414-466-2081
(* Board Members, & Ken Paul < kenpaul@cape-mac.org >

LRS NEWS

• **August 14th**, Peter manned our exhibit table at Discovery World Museum for Secret Lab Saturday for the 3rd time this summer, improving the exhibit items each time.

• **August 19th–22nd,** Peter manned the Moon Society table at the Mars Society Convention in Chicago. He gave a talk on his "Mars Pulse" Calendar proposal.

LRS OCTOBER Events

Saturday, OCT. 9 th, 1–4 pm

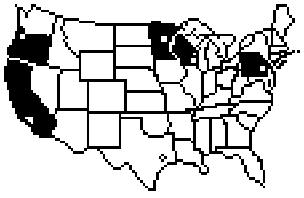
LRS Meeting, Mayfair Mall, Garden Suites Room G110
AGENDA: www. lunar-reclamation.org/page4.htm

✓ Discussion of possible repercussions of a board coup in NSS. We're told that it's all legal, and necessary. Treasured values are at risk. We'll know more when the dust settles.

✓ Moon Society - new projects of interest to us.

✓ Planning a big Holiday event for our December 11th Meeting slot. We plan on inviting quite a gang

U.S. CHAPTERS



NSS Chapter Events MMM 6 Chapters Strong

Space Chapters HUB Website:
[http://nsschapters.org/hub/]

MINNESOTA

Minnesota Space Frontier Society

c/o Dave Buth 433 South 7th St. #1808
Minneapolis, MN 55415

Tom Greenwalt (w) 763-784-6244 (h) 763-442-6015
David Buth (w) (612) 333-1872, (h) (763) 536-1237
Email: tomg@mnsfs.org **[www.mnsfs.org/]**

• **Mars Convention 2004 Photos**
http://www.freemars.org/mnfan/MarsSociety/2004/

• **Lunar Eclipse Event** - On October 27th, we'll be iat the Eisenhower Observatory, 1001 West Hwy 7, Hopkins, that Wednesday, to witness a total lunar eclipse. We'll be there from 8pm to 11pm. Join us if you like or watch it from your own backyard. **Eclipse Times:** Partial Eclipse Begins: 8:14 pm

Total Eclipse Begins: 9:23pm; Ends: 10:45 pm
Partial Eclipse Ends: 11:54 pm

OREGON

Oregon L5 Society

P.O. Box 86, Oregon City, OR 97045

voice mail / (503) 655-6189 -- FAX (503)-251-9901

[http://www.OregonL5.org/]

Allen G. Taylor <allen.taylor@ieee.org>
Bryce Walden <moonbase@attbi.com>
(LBRT - Oregon Moonbase) moonbase@attbi.com

Meetings 3rd Sat. each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**
Sept 18 - Saturn from the Casinni, by Lamont Brock
Oct 16 - Celestial Navigation Work Shop, by Bob McGown
Nov 20 – TBA

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042–1034

c/o Will Foerster 920–894–2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@excel.net>
>>> DUES: "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020

[http://www.tcei.com/sss/]

We meet the **3rd Thursday** of the month at **7–9pm**
SEPT. 16: UW-Sheboygan, Sheboygan Room TBA
OCT. 21st: Stoelting House, **Kiel**
NOV. 18th: UW-Sheboygan, Sheboygan Room TBA

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105

c/o Earl Bennett, EarlBennett@erols.com
215/633-0878 (H), 610/640-2345(W)

[http://pasa01.tripod.com/]

PASA regular business luncheon/formal meeting from **1–3 pm**, the **3rd Saturday** of every month at the **Liberty One** food court on the second level, 16th and S. Market. Go toward the windows on the 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th St.

Meeting Dates: Sept. 18 th, Oct. 19th, Nov. 20 th. Call Earl or Mitch 215-625-0670 to verify all meetings

•**August Meeting Notes:** First the bad news: we had appeared on the T.V. show "48 Update" broadcast in late June and in August. This was good for public outreach and to have our first T.V. venue. We began discussing getting a guest appearance together for authors we know who are space oriented as well as local notables from science and astronautics. However; things are changing at the station. It has been sold and will change focus. At this writing (late August) the show will not go on, at least not here The people who had us on are to be thanked for the opportunity and the intellectual format of the show. Thanks Catherine Pugh and assistant producer Kim Stavisky.

Meeting Notes: We had a visit from a new member Ed Johnson who found us at Liberty One via our "space exploration " material on the meeting tables. He had previously introduced himself by e-mail and came from New Jersey to see us based on our website. He has a long term interest in space exploration and is a member of N.S.S. and, on reflection, remembered our group from a presentation we gave in the mid 90s on the D.C.- X. Welcome Ed!

Our first report was from Hank Smith on several events including the 2005 I.S.D.C. (Memorial Day weekend May 19 to 22) which he plans to attend .For more current events he mentioned going to an event called Androcon which did not involve androids. This was a "furry and fluffy" con for people who identify with animal and fantasy creatures that they dress like (think non threatening) ala a recent C.S.I , Crime Scene Investigation, show. For Labor Day Weekend he will be in Boston at the World Science Fiction Convention and will attend along with Dotti and Larry. Hank also talked on the 2005 Philcon Committee which was just formed and he informed us that The Valley Forge Convention Center site has not definitely been nailed down. Since the committee has just formed, with Tony Feinen as possible chairmen, we will probably find out by or during the 2004 Philcon, in December, if this location will be used.Hank also spoke on visiting Westercon in Arizona and the inconvenience at the location.He was able to get around a little however due to helpful people at the Con. Nice to be part of an intentional community. Thank you Hank!

Larry our Webmaster and developer of our I.D. cards, brought a batch in, most of which went to Mitch to use for publicity on campus. Our new member Ed was impressed by the appearance of the new cards and suggested adding more contact info. as we are considering. In addition, Larry mentioned our site's hit counter and the need to renew it. We voted approval. He mentioned the hit count and multi visit tracking of which we had a few.

Dotti brought The Planetary Report and Smithsonian' Air and Space which where both the current issues. Mitch Gordon had several items including his contact work with Robin Pinel who is an authors agent and his attempts to work out a "tie in" visit for an author mentioned in previous reports or, as an alternative or addition,our members for public outreach. He also brought up several possible events we could be part of at the Franklin Institute in the Sept. - October time frame and the Free Library November event still being discussed. Many balls in play! Mitch also reported on past member Michael Stewart whom he had learned was promoting science education by giving astronomy lessons to inner city children. Mitch lent him some of his slides to use in his "Man in Space" segments along with Michael's own material.

Earl Bennett brought a number of articles and also reported on the SetiCon 04 and E.M.E. Conference which was held as a joint event. The second event is concerned with signal reception and advancing the state of signal transmission and reception, primarily, as I understand this, in the V.H.F. through millimeter wave bands. Thus the discussions ranged from advanced receiver design and test to low signal to noise signal recovery systems to 47Ghz Moon Bounce.

In connection with this conference I asked a prominent microwave scientist, Dr. H. Paul Shuch whether Mars Bounce was possible within the constraints that hams operate under (power in for the transmitter of less than one kilowatt). His reply surprised me in that it turns out Venus Bounce might be easier to do! He has done the calculations in the past for this. As in most challenging scientific activities its not easy but could be achieved after much work and ingenuity.

On that theme: The SetiCon was the primary event that I went to attend, and that persistence and ingenuity was displayed well by several "amateur" and "professional" investigators. Harry Kimball falls into the former category

as someone I have seen over the years move forward with his Seti system from his early system development onward to his present operation with a new analysis package (Spectraview) and a "high bandwidth" sampling system. For home Seti 96 kilo-samples a second is high. As explained by Harry the selection of which data to keep is very important when a nights run gets into giga bytes. Parts of this problem was also brought out in a detailed description of applied statistical analysis by Professor Rob Lodder et al. who is applying research from Biological Activity and Trace Material Analysis to search for life, in this case on Mars. Robs' paper had the descriptive title "Multivariant Response Data Reduction" and a related paper by Harry was "Seti Signal Processing Tradeoffs".Both of these researchers have been developing systems of different kinds for the program of looking for signs of something living in the universe other than our single source.

Another presenter that has been doing ongoing study, in this case using a technique called "Interferometry", where we can measure the properties of radio waves, to build up a map of where signals are coming from and, with sufficient technology, be able to literally map the sky. This and a related talk on precision time and frequency sources, was given by Marko Cebokii from Slovenia who has given several lectures through the years. One of his paperss this year was"The S.I.D.I Digital Interface" with some details on some experiments on fast signal analysis: 600 kilo samples a second!. This system that he produced was a work in progress and the level of detailed signal analysis here is different from the previously noted design. To do the signal reception right you need stable, clean clock sources and that applies to all Seti radio systems thus making Markos' 2nd paper of general interest to all microwave researchers.

Consider this: the mathematical tool often used in Seti is the Fourier Transform and its variants. If a part of the process called "binning" is set finely enough, in this application, the signal could, if it's unstable enough, shift through the bin you have set to contain the energy found in the bin setting thus giving a poor report of what was in that bin space you set. We try to control the drift of our receiver so that we can put the energy from a signal consistently into the right place or integrate the energy over time. This is what we do to get the data all the later analysis is applied to. End of lecture! There was also talk of alternate search strategies from several presenters including Dr. Alln Tough who was both an individual presenter and panel moderator. And much much more.

On the monthly technical front there was a report on the launch of the Echo Satellite this spring in the Summer issue of CQ VHF and the current (August) AMSAT Journal where it is officially designated as Oscar 51. The Journal also reported ongoing work on the P-3 (Earth orbiting) commsat, and mentions progress on P-5 (the Mars orbiter; launch sometime in ~2007). And finally, from The Industrial Physicist, an article entitled "Scramjets Integrate Air and Space" by Dean Andreadis. This cover featured report is on the development of this propulsion system and the successful tests in March of this technology via the X-43A with a Mach 7 (5000 miles an hour) velocity from 10 seconds of engine burn. There is a rather detailed explanation of what a scram jet is that takes up most of the page. Essentially: the air coming into the inlet structure is carefully guided from the airframe "forebody" into an inlet (air intake) that leads into a series of sequentially changing passages where the air, that would normally slow and drag inside these channels and thus require a mechanical compressor to move, is compressed and, after going through a "pre-compression shock structure" just before the fuel injection in the combustor occurs. The scram jet structure is one where the airflow goes to super sonic flow rates and stays there. The flow "scrams" or rushes through the system compared to the conventional process. The article starts on page 24 and is well illustrated.

www.Seetipmagazine.com. Submitted by *Earl Bennett*

CALIFORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS

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

Events Hotline/Answering Machine: (310) 364-2290
Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com

[http://www.oasis-nss.org/]

oasis@oasis-nss.org

Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month
Microcosm, 401 Coral Circle, El Segundo.

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

- **Sept. 18, 2:00 p.m.** --OASIS Monthly Business Meeting at the El Dorado Neighborhood Library, 2900 Studebaker Road, Long Beach. Note: The business meeting is *one hour earlier* than usual to allow time for the post meeting speaker at 4:00 p.m. Robert Kleinberger will tell us about the*Young Rocketeers*. - **That evening, sunset to 10 p.m.** -- Los Angeles Sidewalk Astronomers Star Party. Autry Museum of Western Heritage, 4700 Western Heritage Way (park in the Los Angeles Zoo parking lot.)
- **Sep 24, 8:00 p.m.** -- "Déjà vu Extinctions," by Luann Becker, UC Santa Barbara. Science Lecture Hall 140, Santa Monica College, 1900 Pico Blvd., 310/434-4003

NAME _____

STREET _____

CITY/ST/ZIP _____

PHONE #S _____

❍ **$45 National Space Society** dues includes **Ad Astra**
❍ **$20** NSS dues if under 22 / over 64. *State age* ___
600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include **Moon Miners'Manifesto**
- **Electronic (pdf) MMM $35** **Students/Seniors**: **$20**
- **Hardcopy MMM**: U.S. & Canada **$35** Elsewhere: **$60**

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

INDEX to # 178 SEPTEMBER 2004

Member Dues -- MMM/MMR Subscriptions:
Send proper dues to address in chapter news section

=> for those outside participating chapter areas <=

❍ $18 Individual Subscriptions to MMM/MMR: Outside North America ❍ $50 Surface Mail -- Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CHICAGO SPACE FRONTIER L5

❍ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

❍ $18 reg. ❍ $24 family ❍ $15 student/senior

MINNESOTA SPACE FRONTIER SOCIETY

❍ $25 Regular Dues

OREGON L5 SOCIETY

❍ $25 for all members

O.A.S.I.S. L5 (Los Angeles)

❍ $25 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE

❍ Annual dues for all with MMM $20, due in March or $5 times each quarter before the next March

SHEBOYGAN SPACE SOCIETY (WI)

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

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.
PO Box 2102, Milwaukee WI 53201-2102.

Address Service Requested

==> *Mail Carrier, Time Sensitive Material* <==

Non-Profit Org.
U.S. Postage Paid
Milwaukee, WI
Permit No. 1275

If Expiration date is highlighted, this is your last copy.
Please renew promptly so as not to miss an issue!