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

Moon Miners' Manifesto

& Moon Society Journal

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In FOCUS: Blackouts "Inconvenient" on Earth, "Catastrophic" in Space

To many people, in many ways, the recent major blackout experienced in parts of the U.S. Midwest, Northeast, and in much of Eastern Canada, was an eye-opener. We leaned that in this advanced day and age, now in the early 21st Century, much of our electrical power transmission grid system is vulnerable to "accidents" caused from within, a symptom of aging infrastructure. No one seemed to think it could happen, but it did.

How we should address the situation, or whether we will just let it slide hoping that it was a one-time quirk, is not our topic. For those of us who want to see human civilization transplanted to various locations on the space frontier, there are more immediate lessons.

It struck us how our lives have changed since the last great northeast blackout: we have become, not just as a society, but as individuals and families, computer-dependent. The Internet looms as the "noosphere" foreseen by the Jesuit philosopher of evolution, Theilhard du Chardin. Many of us would consider ourselves naked and helpless without our cell phones. Not only did the lights go out, and the refrigerators grow warm. No television, no computers, no Internet, diminished cell phone service. Egads!

How dependent we had become on systems plugged into the power grid was for many of us, even more of an eye-opener than that our power transmission grids might be woefully inadequate to meet today's growing power demands. It was not just inconvenient. It was something we are not willing to tolerate again. It stopped too much of our day-in, day-out taken-for-granted activities. The blackout dared stop us in our tracks.

For all that, it was still no more than a temporary inconvenience for most involved. Some things went on. We could still breath the air - it didn't get stale. At least some people in the blackout area still had tap water. Air-conditioners stopped, but it neither got unbearably hot nor very cold. We were temporarily thrown back to a pre-electric age, and age where once people everywhere carried on quite well, thank you.

How would a similar incident play out in a space settlement, in a lunar outpost, in a Martian frontier town? The air would stop circulating, for one thing. In these small closed mini-biospheres, where everyone will live essentially downwind of themselves, the air would quickly grow foul, saturated with carbon dioxide, suffocating. [➪ p. 2, col. 2]

Redesigning the Artemis Moonbase EVA Module

The currently favored design for the proposed Artemis Moonbase™ starter module, a triple SpaceHab unit on a footing with an attached EVA-Docking Module, has rested on the shelf collecting cobwebs for a few years now. Editor Peter Kokh takes a second look at this latter module in this issue, and finds some major problems that need attention. For details, see pages 10-11..

Moon Miners' Manifesto

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• **MMM's VISION:** "expanding the human economy through off-planet resources"; the early era of heavy reliance on Lunar materials; earliest use of Mars system and asteroidal resources; and the establishment of the permanent settlements necessary to support such an economy.

• **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space/lunar settlement.

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

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

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

• **The National Space Society** is a grassroots pro-space membership organization, with over 25,000 members and 80 chapters, dedicated to the creation of a spacefaring civilization.
The National Space Society, 600 Pennsylvania Ave. SE, Suite 201, Washington, DC 20003; Ph: 202-543-1900; FAX: 202-546-4189; 202-543-1995 NSS Space Hotline; nss@nss.org => www.nss.org

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

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

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

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

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fi IN FOCUS Editorial continued from p. 1.

If the event happened during sun-up hours, sunlight funneled in through heliostats and "light pipes" would make the loss of artificial light a mere inconvenience. During nightspan or sun-down hours, it would be more of a problem. Candles would quicken the rate of air quality deterioration. Obviously, backup "off-grid" power sources would have to snap into action, turned on by the very loss of current, much as emergency generators here on Earth.

The principal point is that here on Earth, the biosphere keeps on ticking. On the space-frontier, artificially established mini-biospheres would be totally dependent on electrical power. Any blackout would be a potential catastrophe from which there might be no recovery, if it lasted more than a relatively short time. Our concern is that on the space frontier, we cannot allow a blackout to happen at all. "Rarely" will not be good enough. That has implications for how we design our space frontier power systems.

Space activists are no different in their lack of agreement from other persons who have strong opinions on energy matters. There are the pro-nuclear, antinuclear, and balanced systems proponents. Hey, time-out! Number one consideration is to eliminate the possibility of a blackout in a space frontier community, baring a direct asteroid impact or other "act of God." Posturing must come second.

Nuclear energy has a place, especially given the absence of in-place biospheres and ready quarantine. But reliance on nuclear power alone seems stupid. Show me the nuclear system that has never gone "down!" There is abundant solar power available everywhere in the Inner Solar System, including Mars, and it will be foolish not to tap it when and where available. It will also be foolish not to store excess sun-up solar power to use as back-up and extra power for periods when sunshine is not available. Let us harp once again: we must learn how to overnight on the Moon. Placing an outpost in one non-typical spot, to avoid the challenges of overnighting, risks "beaching" the effort to open the Moon in a cul de sac. More on this soon.

Posturing increase the risk a catastrophic blackout in space frontier settlements. Let's get on with the no nonsense planning of well-rounded energy generation infrastructures for big and small frontier outposts alike! - PK

Asteroid to be named after NSS' Chris Pancratz?

[see MMM #167, AUG. '03 p. 17, "Death of Chris Pancratz"]

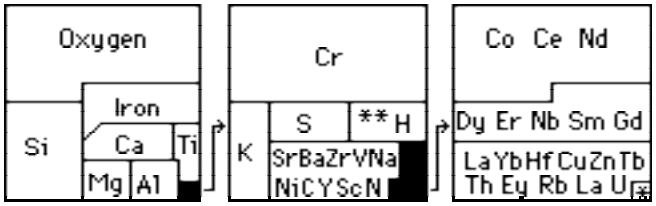
August 30, 2003 -- At its August 27 Telecon, the National Space Society Executive Committee passed without objection the following motion: (Mark Hopkins, NSS Secretary)

It is moved to thank Rich Godwin for arranging with the International Astronautical Union, to have an asteroid officially named after Chris Pancratz and spend up to $150 to have the brass plaque recommended by Godwin made for Pancratz's family, with a diagram of the orbital parameters and characteristics of the asteroid.

Smelting Moondust:
seeking a Simpler Process to produce the stuffs for Lunar Industry from Regolith

by Dave Dietzler < pioneer137@yahoo.com >

Various processes have been described for extracting pure silicon, cobalt, nickel and other elements from regolith. These usually use fluorine, carbon monoxide and other reagents. In this article, a simpler yet still speculative system is described for production of large masses of useful materials like glass and cement from lunar regolith. The simplest process involves using solar heat to produce cast basalt or fused regolith for bricks, pipes, tiles, road paving slabs, and everyday items like bottles or flower pots.



Most Abundant, Less Abundant & Trace Elements
in the Lunar Regolith (surface dust & rubble blanket)

Cast basalt: early lunar workhorse material

Cast basalt could be the cheap lunar material that does almost everything. It may even be possible to 'weld' cast basalt items together with a hand held electron or microwave beam gun. A mason could take a cast basalt brick, heat one side until it glows red and stack another brick on top of it which then fuses together. In this way, brick walls could be erected inside pressurized habita-tions. The only drawback is that this type of wall may be much harder to remove than one made of mortaar-bonded bricks.

Materials other than cast basalt are also desirable. The nuclear powered automated Helium-3 mining machines will produce a steady supply of volatiles [a]. Similar machines that are fully automated or teleoperated by humans will shovel up regolith and deposit it in onboard furnaces that roast out the volatiles. The roasted regolith will then be sent to an onboard electrostatic belt separator to remove free iron and iron oxide fines and illmenite grains. The rest of the regolith will be dumped.

Iron, titanium, and other alloys

When the machine's hold fills up with iron and illmenite it will head back to base. It will transfer its load to a furnace where hydrogen and solar heat are used to reduce the oxides of iron and illmenite. Iron, titania and water will be the main products. Iron will be separated from titania simply by using magnets. The water will be electrolyzed to recover hydrogen and obtain oxygen. The titania (TiO_2) will be sintered to make heat shields and high temperature refractory items including rocket nozzles perhaps. Titania will also be refined through electrolysis to get titanium metal and oxygen.

Iron will be cast into many different forms. Iron products will not be very heavy in the low lunar gravity. There will only be the strange feeling of inertia when massive but seemingly light iron items are moved around. Outside in the vacuum, iron will never rust. Steel is still much more desirable than iron. It is far stronger and more corrosion resistant. Imported carbon will be combined with iron in a solar or electric furnace to make pure steel. A ton of carbon can make 300 tons of steel, so expensive imported carbon will go a long way [b]. Since 95% of the metal used on Earth is steel, we can expect to use the same percentage on the Moon [c].

Most of our Moon mining might consist of mobile mining machines rolling around gathering up volatiles and iron. We will also dig huge pits into the deeper volatile-poor layers of regolith with drag lines and 'steam shovels,' separate the iron with electrostatic belt separators and fill the pits back in with 'de-ironed' regolith. Then we will follow the procedures described previously to get iron, steel, titanium and oxygen.

Glass Production

Transparent glass rather than dark cast basalt, pourable cement, plaster, concrete, grout and other materials are also desired. 'De-ironed' regolith will be conveyed to a tank in which it is leached with sulfuric acid. The acid will break up the silicate minerals. Metallic sulfates will form in the solution. Silica, which resists sulfuric acid, and slightly soluble calcium sulfate (gypsum, plaster of Paris) will be filtered out through an asbestos or glass fiber filter. The silica and $CaSO_4$ will be dried. This mixture will then be separated either through washing or unmixing in the molten state to get pure silica for glass and $CaSO_4$ for plaster and a minor cement ingredient.

Slag cement and other products?

At this point, I confess to going out on a limb. Molten silica and $CaSO_4$ might react to form slag-$SiCaO_3$ and sulfur trioxide gas. Sulfur trioxide can be simply mixed with water to reform sulfuric acid and ground slag is actually a good cement ingredient. Slag cement is used commonly these days[1]. Washing would remove the $CaSO_4$, but because only a few grams of this compound dissolve in a liter of water and we can't just pipe river water through the mixture as we can on Earth; we' would have to use recycled water and this would require lots of energy and time. Waste heat from nuclear reactors or free solar energy might make this feasible.

Glycerol will dissolve calcium sulfate up to 1% of its mass. This is several times better than water[2]. Glycerol could leach out $CaSO_4$ and then be distilled and used again to leach out the $CaSO_4$ until all the 'gypsum' was removed and pure silica remains. Glycerol is distilled all the time in the soap industry so there is nothing unconventional about this. There may be other solvents to employ. Catechol (1,2

dihydroxybenzene) and basic ethylene glycol have been shown to dissolve silica. [3] It might be possible to leach the silica out of the mixture with one of these organics.

The silica and "gypsum" can also be mixed with carbon powder and roasted in a solar furnace to reduce the CaSO4 to CaO or lime as is done in the Muller-Kuhne process. [4] The mixture of silica and lime when water is added will make mortar. The addition of 5% gypsum, gravel and raw dirt when water is added will produce concrete. Some sodium oxide could also be added to the silica/lime mixture and solar heat could be applied to make transparent conventional soda-lime glass. More work needs to be done involving the manipulation of the silica and gypsum mixture to get materials in the desired proportions.

The remaining solution of sulfates will be roasted, boiled down and dried with solar heat. Water, unreacted sulfuric acid, phosphoric acid formed by the reaction with phosphate rocks, HCl and HFl formed by the reaction with fluorapatite and chlorapatite, will be distilled and decomposed to obtain phosphorus, fluorine and chlorine.

The sulfates of aluminum, magnesium, manganese, chromium, sodium, potassium, any titanium not combined with iron in the form of illmenite, and trace metals will be mixed with carbon dust and heated in a solar furnace. This will reduce the sulfates to oxides and generate SO2 and CO that will be recycled to maintain acid and carbon supplies. The next step will be to reduce the oxides with carbon and even more heat to get free metals. Temperatures of 2000-2300 °C will be required. The solar furnace reactor vessel will be made of tungsten or an exotic ceramic that resists attack by the molten substances and gases it contains.

Alumina has been carbothermally reduced with solar heat experimentally on Earth at the Colorado School of Mines [5]. Although there are challenges for this process and electrolytic production of aluminum is cheaper, the use of solar energy for carbothermal production may become competitive. On the Moon, solar energy is reliably available and more intense than on Earth beneath our hazy atmosphere. The Sun moves across the sky more slowly on the cloudless Moon and this makes aiming mirrors easier. Moreover, aluminum only costs about one dollar per kilogram on Earth. Importation on the Moon would cost hundreds or thousands of times more than this, so processes deemed uneconomical on Earth will be worthwhile on the Moon.

Although carbothermal reduction requires a lot of energy, sunlight is free and this process is much less compli-cated than electrolysis and it doesn't require any cryolite which is unavailable on the Moon. It takes less energy to reduce the other metal oxides in the mix than alumina and just a bit more heat to reduce the magnesia.

Sodium, potassium, zinc, cadmium, selenium and other trace elements will be boiled out of the metallic mass and distilled at 907 °C (the boiling point. of zinc) and lower temperatures. Zinc is purified typically by distillation so there is nothing unusual or untried about this. Magnesium metal will evaporate at 1120 °C and manganese will boil at 2095 °C The Pidgeon process and the Magnetherm process use silicon to reduce magnesia and the magnesium is released as a vapor which is then condensed to get the pure metal, so there is nothing too far-out about distilling magnesium. Some aluminum vapor will also form. Recovering aluminum vapor, manganese vapor and preventing carbide formation in the solar furnace will be a challenge for engineers in the future. [see footnote A] The remaining mass of aluminum with some magnesium and small amounts of chromium, manganese and titanium will form an inexpensive lightweight alloy that can be used for low stress applications like cans, bottle caps, jar lids, small parts, toys, furniture, sheet metal, and possibly hybrid rocket fuel.

If pure Al, Mg, Cr and Mn are desired, it should be possible to boil off all the magnesium at 1120 °C and use carbon monoxide to form carbonyls of Cr and Mn that can then be extracted with organic solvents. Chrome and manganese are good for alloying steel. Zone refining, a process that doesn't require any reagents, could be used to purify the aluminum even further. Aluminum with 99% purity may be desirable for wiring; however, it will be much cheaper to simply end the process with a multipurpose alloy as described in the previous paragraph for use when something lighter than steel, more corrosion resistant than iron and easier to work into shape is desired as is the case with a food or beverage can. [see footnote B] Lots of cheap aluminum for rocket fuel is also desirable, considering that enormous tonnages of it will be burned. Magnesium is also a candidate for rocket fuel. Purity isn't so important for stuff we intend to burn. These metals could be vaporized and sprayed from a nozzle to form fine droplets that cool by radiation in the lunar vacuum. The powders of aluminum and magnesium could be mixed with LOX to form a monopro-pellant. There may be other ways to burn Al and Mg in rockets too.

There are several bright spots in this process. Fluorine, chlorine, phosphorus, sodium, potassium and zinc are acquired without any great difficulty. Very few reagents are needed-just sulfuric acid, carbon, hydrogen, water and perhaps glycerol or another organic solvent-all which will be recycled with rather ordinary technology. [see footnote C] Of these chemicals, only sulfuric acid poses any dangers, but it is much less troublesome than hydrofluoric acid or fluorine gas which have been suggested for use in regolith refining. Sulfuric acid leaching of anorthosite is a prelimi-nary step in aluminum production by electrolysis, so this has already been explored.

The technology is fairly straightforward. A few solar furnaces, electrostatic belt separators, an acid resistant vat and some accessory items are basically all that's used. Plenty of cement, plaster, glass, iron, aluminum alloy and magnesium could result and massive quantities of

oxygen will be extracted from simple lunar soil. The Sun can supply free energy directly to the furnaces and smelting pots without the inefficiency of conversion to electricity and then heat. Even zone refining could be done with solar heat application. Large scale zone refining should be possible in the vacuum and low gravity of the Moon and it may find many new uses there. For these reasons, I believe that this process will be more energy efficient, involve less time and lower temperatures than magma electrolysis and alumina electrolysis. Mere solar reflectors and lenses will be needed rather than large areas covered by photovoltaics and heavy complex electrical equipment.

Other processes have focused on pure silicon and pure aluminum while discarding valuable feedstock for glass, cement and plaster as silicate slag. That's wasteful and dangerous when we consider that silica and calcium constitute over half of the regolith by mass, and that survival on the Moon will depend on efficient use of available resources. Large quantities of cement, glass, plaster and cast basalt will be used to build sub-selene cities in lava tubes someday.

Early lunar bases could be made of steel pressure shells buried under several meters of regolith for radiation shielding and thermal insulation, so the focus at first will be on lunar steel production which is already well thought out. Due to the low gravity of the Moon, over 60 feet of regolith would have to be placed over a concrete shell pressurized to 14.7 psi to keep it in compression. Steel will be the material of choice for the first moonbases. When we find lava tubes or build steel domes the size of football stadiums on the surface of the Moon, we will pour concrete floors, build brick walls, spackle them with plaster, lay down tiles, install plumbing, etc.

Some Notes:

• A. Carbide formation is undesirable as it will remove carbon from the recycling loop. Adding silica to the melt could reduce the carbides. It would also add silicon to the aluminum alloy.

• B. I don't know what the properties of this alloy will be, but silicon, magnesium, manganese and chromium are common aluminum alloy ingredients. Titanium, zirconium (a major regolith trace element at 311 ppm) and vanadium present at 114 ppm are also used in aluminum alloys. Serendipitously, this alloy may have surprisingly good properties.

• C. Carbon monoxide and sulfur dioxide will result during reduction of sulfates and oxides. The CO will be converted to methane and water by reacting it with hydrogen in a Sabatier reactor. Solar heat will be used to pyrolize methane to recover carbon and hydrogen. Water will be electrolyzed to recover hydrogen and obtain oxygen. This process would have to be used if alumina was reduced electrolytically because the carbon electrodes react with oxygen released from alumina and burn up at the rate of 3/4s ton of carbon per ton of aluminum. Either way you look at it, we have to process CO to recycle carbon. Sulfur dioxide will be separated from CO by fractional liquefaction, combined with oxygen in the presence of a platinum or vanadium oxide catalyst to get sulfur trioxide which will then react spontaneously with water to reform sulfuric acid. These reactions are highly exothermic. The heat released when regenerating acid can be used to drive electrical turbo-generators for efficiency. **‹ DD ›**

Author's Footnotes: Works Cited: [1], [2],
[1] see ‹http://www.slagcement.org/›
[2] "Glycerin" Kings American Dispensatory ‹http://fddisunsite.oit.unc.edu/herbmed/eclectic/kings/glycernium.html›
[3] Stephen Gillett. "Organic-based Dissolution of Silicates as an Approach to Element Extraction from Lunar Regolith." Return to the Moon II Proceedings of the 2000 Lunar Development Conference. Space Front Press: 2000. [d]
[4] "Gypsum:" Van Nostrand's Scientific Encyclopedia 8th ed.
[5] See ‹http://www.solarpaces.og/SolAl.htm› and Jean P. Murray. "Solar Production of Aluminum by Direct Reduction of Ore to Aluminum-Silicon Alloy." ‹http://wireO.ises.org/wire/doclibs/SWC1999.nsf/id/5DF399DEE020E9A5CI256920003D617B/$File/089.pdf›

Editor's notes:

[a] Volatile harvesting need not wait for Helium-3 mining. Volatiles can be scavenged from all regolith handling operations including surface mining, road construction, transformation of regolith into starter agricultural soils, etc. See MMM #23 MAR '89, pp 4-5 "Gas-Scavenger" (online at: www.asi.org/adb/06/09/03/02/023/gas.html and see also MMM #38 SEP '90, p 4 "Primage")

[b] Significant amounts of solar wind-derived carbon will be harvested as byproducts of Helium-3 mining and other regolith handling operations. More carbon may be harvested from carbon oxide ices immixed in lunar polar water ice reserves. While the primary need for carbon will remain the lunar biosphere and food production cycles, some should be available for industry.

[c] That might be so "all else being equal," but all else is not equal. On the lunar surface, pure magnesium which will actually burn in air, will work fine. I expect that magnesium products might gain a bigger percentage of the "work load" on the Moon than they have on Earth. Alloys which need a smaller percentage of exotic (uncommon on the Moon) additions may be cheaper and get the edge when their performance is "good enough."

[d] Stephen Gillett had previously presented a paper on these ideas at ISDC '98 Milwaukee entitleed "Molecular Nano-Technology, Space Resources, and the Moon" The ISDC '98 Prodeedings have not been published (as of2003) and this paper is not online. **‹‹ PK ›**

"Working Vacations"

An Ideal way for Lunan Pioneers to get a Change of Pace and a Change of Scenery

by Peter Kokh

Not a New Idea

While not common, the idea of spending one's vacation pursuing another line of work, whether just for the change of pace and change of scenery, or to see if one likes the new "job" better than one's current dreary drudge is not new. I've done it more than once to make sure that I wasn't making a big mistake switching jobs. But here we are talking more about working during vacation just for the chance to enjoy new, perhaps even exotic experiences.

Indeed, here we are talking about being willing to *pay for the privilege* of indulging in the temporary job, when that is the only way to get a timely chance. We do not know who was the first to suggest a "working vacation" but these days one can sign up, and pay a registration fee, to go along on an archeological "dig" or man the sails and do other duties on a "Windjammer" cruise aboard an ancient sailing vessel. The organizers get more than free labor, *paying labor!* The eager-to-pay recruits get in exchange, an experience of a lifetime.

Archeological digs can be in prosaic Illinois, or in storied Mongolia. Either way, the work, to the temporary novice, seems exotic and engrossingly interesting. One typically works under a competent university staff capable of answering an endless flow of questions. Not quite Indiana Jones stuff perhaps, but close enough. Recruits willingly pay hundreds of dollars for the chance.

Think of it as tuition, a reasonable fee for a precious learning experience. How is it different from an apprentice paying to work under a master?

Fast Forward to the Moon

Consider these points:

- On any frontier, there is always more work to be done than people to do it, let alone the money to pay them.
- Many endeavors can be pursued at a relaxed pace, *when there is money and people available*
- People need a vacation less to collapse into dormancy than to enjoy a change of pace, a change of scenery, an escape from everyday pressures and work-related problems and irritating persons

On the Moon, we do not currently expect that there will be any archeological expeditions - *unless* we stumble on a hoard of alien artefacts, carefully deposited for us (anyone) to find someday, in a lavatube where they could lie undisturbed by the cosmic elements for millions, even billions of years. But there are other worthy expeditions whose findings may someday improve the life and prospects of lunar settlers:

- prospecting for unusual concentrations of strategic or rare elements
- Expoloring Lavatubes
- Building roads or cableways into "new territory"
- Erecting radio telescopes in deep Farside, etc.

Working Volunteer Vacation Programs

A Google search will show that whether you want to dig for fossils or ruins or gold, or help restore a building that has fallen on hard times, or participate in building a timber-frame home or barn, or man the sails of a windjammer - if it means enough to you that you are willing to pay for the experience, you can do it!

Some Examples

www.crossculturalsolutions.org/

Cross-Cultural Solutions is a not-for-profit international volunteer organization that operates volunteer programs in Brazil, China, Costa Rica, Ghana, Guatemala, India, Peru, Russia, Tanzania, and Thailand.

The U.S. tax-deductible program fee for three-weeks is $2,315 (£1,475), with each additional week of stay only $220 (£140) per week.

www.voluntarywork.org/go.htm

International Directory of Voluntary Work

www.globalcitizens.org/whoweare.html

"The program cost of $600-$1,650 covers in-country travel and lodging, most meals, orientation materials, a share of the team leader's expenses (team leaders are not paid) and a donation to the village project. Airfare is additional. All trip-related expenses are tax-deductible in the U.S.

"Many people ask why they have to pay to volunteer. GCN receives no outside funding or grants and other than two part time time staff people is completely volunteer driven. Also, while individuals may be able to travel for less to many of these places, GCN provides the entrance into a village and exposure to a culture that one could not receive if traveling solo to these places. Through the long-term partnerships that GCN has established with communities around the world, volunteers gain a unique perspective into life in a Guatemalan village or on the Navajo Reservation."

www.wwoof.com.au

Working on an Organic Farm in Australia pays for your room and board while there.

www.parentspress.com/ffdinosaurdigs.html

Dino Digs, guided fossil-hunting for a fee

http://charityguide.org/charity/vacation/archeology.htm

Archeology Digs and Restoration Projects

www.robeks.com/Library/Document01.asp?PT=D&PID=68

A general article on the subject.

Lunar Working Vacations Spent Prospecting

Field work prospecting on the Moon will be tedious and monotonous work whether or not most of it is done from within the comfort and safety of a pressurized rover. For that reason, as well as in the interests of thoroughness, accuracy, and timeliness, most lunar prospecting will be done from orbit. But even with great improvements in resolution, orbital surveys risk missing the unusual find.

The surface regolith effectively samples the host crust. There is nothing within the upper kilometer or so of the crust that does not lie exposed on the surface in the debris blanket.

But what about deep mining? What about small nuggets of concentrated elements or minerals that are not widespread enough to show up from space? It is likely that there will be some surface prospecting, whether it is led by university staffs, treasure hunters, or clubs of prospecting enthusiasts. In all of these cases, paying for help will be a problem. But why do that if there is a supply of volunteers who would willing pay for a 2 week experience?

The ultimate prize for prospectors would be the discovery of a Sudbury*-like "astrobleme" rich in iron, copper, nickel and other elements rare on the Moon, a gift of some impacting asteroid. (*Sudbury is in Ontario, 100 miles east of Sault Ste. Marie.) Such a find would soon lead to a new settlement and much industry. The economic viability of the Moon would receive quite a boost.

Another prize, for drill-prospecting would be the tapping of underground pockets of gases such as carbon monoxide. Such a reserve of carbon would be the lunar equivalent of an oil field, giving rise to a host of new organic chemical industries. Until we find the first such pocket, we can't be sure that any exist. The find of just one would touch off a flurry of additional drilling ventures.

Lunar Working Vacations Spent Exploring – Lavatubes

Again, almost all lunar surface exploration will be more thoroughly, accurately, and quickly done from orbit. But we believe that there is much to explore below the surface, the lunar lavatubes, and possible remote instrumentation is not likely to do more than identify promising areas for on site exploration. The various maria may be laced with these subsurface features, possibly multiple layers of them. Work galore for many generations of volunteer explorers to come. Lavatubes a hundred meters across and many kilometers long are thought to be garden variety.

Some of these ventures will be organized by Luna University Geology Department staff. Other expeditions will be put together by clubs of "tubing" enthusiasts who hope to pay for their own equipment and expenses as well of those of volunteers with the fees paid by volunteers to participate. It will be exciting and promises to be significant. Lavatube networks may someday host industrial parks, warehousing and archiving complexes, lunar agriculture, and spacious lunar settlements.

Lunar Working Vacations Spent in Construction

You may work in the lunar farms, or in materials processing operations, or in a hospital or school, or have a job concerned with exports and imports. Whatever, when it gets to vacation time, you may welcome a chance to roll up your sleeves and spend a few weeks in construction work, "helping to build the Moon."

There will be plenty of teams to join as a paying volunteer. There will be construction of additional housing, of commercial and agricultural facilities, spaceport expansion, highways and cableways. You might even get in on construction of a major Farside radio telescope array.

Lunar Working Vacations Spent Establishing New Outposts

One town does not establish a lunar civilization. A real lunar domestic economy will require some variety of towns, each with their own advantages of location, be they scenic, mineralogical-industrial, logistical or other.

Any number of secondary outposts will also be established. Over time, the vast empty regions "in between" will be filled in. It could be just the shot in the arm you need to spend your vacation helping establish a new outpost in some remote region. And it would not be surprising if you or some of your fellow volunteer pioneers after returning to your regular day job, put in for a permanent transfer to the new outpost.

For Tourists from Earth: Working Cruises

The working vacation is a paradigm that bears consideration in a much earlier era. It is quite possible that before the first human returns to the Lunar surface, tourists will skim above its surface in loop-the-Moon tours, never landing, but getting the visual experience of a lifetime. Perhaps there will be two classes of passengers. Those who are just along for the ride and experience will pay (a) full(er) fare. Those willing to crew the tourist ship itself, becoming cooks, stewards, entertainment organizers, etc. will get a discount (to be made up for by the "fuller" fares of plain passenger-tourists.)

Once a permanent outpost is established on the Moon, costs of expansion can be kept down if interested capable persons pay to belong to the crews involved. After all, the demand to be on the great adventure will be great. Demand creates supply - there will be little need to "hire" pioneers at any level, even the most demanding.

If people pay or partially defray the cost of their own passage and maintenance, then mission costs become largely those of equipment. Yes, it is naive to think that all personnel costs can be reversed in this way. But it is a paradigm worth pursuing and pushing as far as it will go.

If the lunar, Martian, and space frontier in general are anything like frontiers of the past, much of the "front wave" in every aspect of this grand venture can be managed by paying volunteers on work vacations. It wouldn't be the first time. **<MMM>**

Luna City Yellow Pages

Work Vacation Contractors

Exploration Organizers

Mare Crisium Tubers, LLC. is a Lavatube Exploration Club operating in the southwestern quadrant of the mare. We currently organize six exploration ventures a year. Prospective volunteers must undergo rigorous physical and mental tests. Those who pass are invited to join us.

Venture fees are currently ∓3000 Tanstaafls per person. Fees cover equipment rental and amortization, food and supplies, and other venture costs. Veterans of three or more expeditions will be invited to become regular members of the club.

MCT's staff includes faculty members from the University of Luna Geology Department.

To see a video of our activities, simply log on to our website: **www.mc-tubers.com.lu**

Please feel free to drop in at our Club House at:
32 Arne Saknussemm Lane **- 344-6666**

Photographic Expeditions

MoonSnaps, LLC

MoonSnaps organizes several photographic sorties each year to craters, rilles, and other moonscape features of special scenic beauty. We have several slots open to paying tourists willing to do support duties. For information on upcoming expeditions, current openings, fees, and how to apply see our website: **www.moonsnaps.com.lu**

57 Alan Bean Drive #18 - **867-4668**

Prospecting Expeditions

Astrolode Prospectors, LLC

We have a backlog of some 137 "sites of interest" to investigate as possible "Sudbury" astroblemes, formed on impact by metal-rich asteroids, and thus atypically rich in iron, copper, nickel and other strategic elements vital to our growing lunar economy.

Our expedition staff includes faculty from the University of Luna School of Mineralogy & Mines. Two or more expeditions are always in some stage of planning, and we have openings for physically qualified working volunteers. For opportunities, special skills desired, fee schedules and a gallery of photos from recent expeditions, see our website at:

www.astrolode.com.lu

650 University Circle - **783-2879**

Regional Contractors

Luna City and Northwestern Cableway

LCNW is extending its passenger and freight cableway line from Luna City, along the Mare Crisium north coast, and through the highlands into Mare Frigoris and the North Junction Settlement. This work will take us several years to complete. We always have some openings for qualified work vacation volunteers. For a photo gallery, progress updates, information on current work stretches, special talents of interest, and fee schedules, see our website at:

www.lcnw-cableway.com.lu

150-180 Enterprise Road - **222-5227**

Government Departments

Lunar Frontier Republic Dept. of Highways

The DoH has openings for work vacation volunteers on the East Interpolar Highway Project. We are now working on the Mare Humboldtianum-Marginis-Smithii-Austale stretch, laying road in both directions from Mare Marginis. Modest fees scaled to qualifications and expertise. More information online at:

www.doh-luna.gov.lu
- 444-9297

Lunar Frontier Republic Dept. of Commerce
Office of Transportation Logistics

The DoC-OTL is charged with deploying self-service stations along Frontier Republic class 3 minimally improved trails to enable the establishment of remote outposts. These solar-powered stations can recharge batteries and fuel cells, and provide emergency communications. These modular units include a sheltered garage space equipped with tools to be used on the honor system. Those interested in work vacations in rugged, minimally touched terrain may apply for two week openings. More information online:

www.doc-otl-luna.gov.lu
- 782-8466

Work Vacation Brokers

Bid-4-it.com is a registered broker for dealers and suppliers of goods and services in slack demand situations. On occasion we have work vacation packages available for bidding. You place your price bid, state your availability dates, and give your credit card data. If the provider accepts your bid, it becomes a legal contract. Successful bids of half price and lower are not unheard of. Visit us online at:

www.bid4it.com.lu/workvacations/

http://www.moonsociety.org

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

The Moon Society was formed in July, 2000 as a broad-based membership organization with local chapters, to spearhead a drive for further explor-ation and utilization of the Moon in cooperation with other like-focused organizations and groups.

Artemis Society International was formed in August 1994 as a forum for supporters and participants in the **Artemis Project™** quest to establish a commercial Moon base as a first step to a permanent, self-supporting lunar community. **ASI** does not engage in any form of commercial business directly, but seeks to build a Project support business team. Registered trademarks of the **Artemis Project™** belong to **The Lunar Resources Company®**

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

- $35 USA/Canada + MMM hardcopy
- $60 elsewhere + MMM hardcopy
- $35 anywhere + MMM electronic PDF file
- $20 student/Senior + MMM electronic PDF file

Questions? email: membership@asi.org

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

- Artemis Reference Mission
- Artemis Data Book

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

Please send all mail related to Memberships to:
The Moon Society Membership Services
PO Box 940825, Plano, TX 75094-0825, USA

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

Moon Society Sets Student/Senior Registration/Renewal Rates at $20

From Board Member Peter Kokh < kokhmmm@aol.com >

At the November 20th, 2003 Moon Society Leadership Meeting (we meet on the 1st and 3rd Wednesday evenings of each month on the ASI-MOO electronic conferencing site) the subject of setting reduced rate dues for students was discussed. The Society's bylaws allows this, but it had never been done.

With the blessing of Society Treasurer, Scotty G. Gammenthaller, the idea won broad approval and was quickly extended to cover senior members as well. There was considerable discussion over the particulars, "the fine print" qualifications and disclaimers, etc.

The Society's Board members all belong to the Leadership Council and a quorum was present. The Board convened and voted to waive notice of the meeting. Those present then unanimously approved the following motion:

Motion: "The Moon Society hereby establishes Student and Senior class memberships with an annual dues of **$20.00**.

- These classes are available only with electronic newsletter subscription (pdf file).
- Senior status requires the attainment of age 65 or above on or before the date of original membership or renewal.
- Student membership requires full-time enrollment in an accredited educational institution.
- Verification of member status shall be at the discretion of the Membership chairman."

Credit for this suggestion goes to Jonathan Goff who has established the Society's Utah Outpost and is endeavoring to get the Society's first student-run campus chapter off the ground at Brigham Young University's Provo, Utah campus. The Society wishes to do all it can to encourage this new venture in the hopes that the BYU Outpost will become a model for others to follow.

The Society also values its senior members and recognizes that many of them may be living with fixed income, reduced below what they enjoyed before retirement. Seniors are a potential source of invaluable talents along with increased leisure time to exercise them in various volunteer endeavors for the benefit of the Society.

We will be watching the numbers closely in the coming month, looking too for any shift in membership demographics (increased youth and senior participation.) We hope that this experiment will be a successful one and that the new membership classes will be permanent ones.

The fine print? Any qualifications and restrictions will be posted on the web at
www.moonsociety.org/register/

Artemis Moonbase™: Correcting Design Flaws in the EVA Module

by Peter Kokh

Last November, as an outreach aid for the Moon Society Milwaukee Outpost, we designed and built a storyboard about the Artemis Moonbase™ [1], and built a scale model of the Moonbase' original Habitat module along with its attached EVA-Hatch-Docking Module{2]. along with a moonscape diorama for it to sit upon [3]. All three display components were designed so as to be easily replicated by others, with complete instructions on the web.

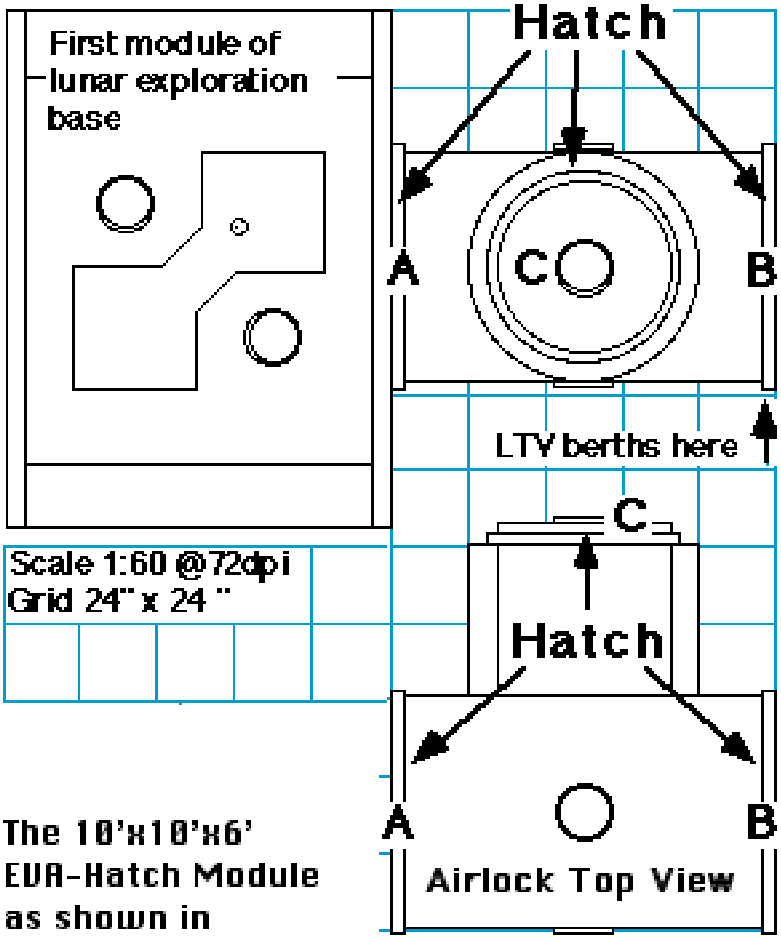
[1] http://nsschapters.org/hub/storyboards/sb_artemismoonbase.htm

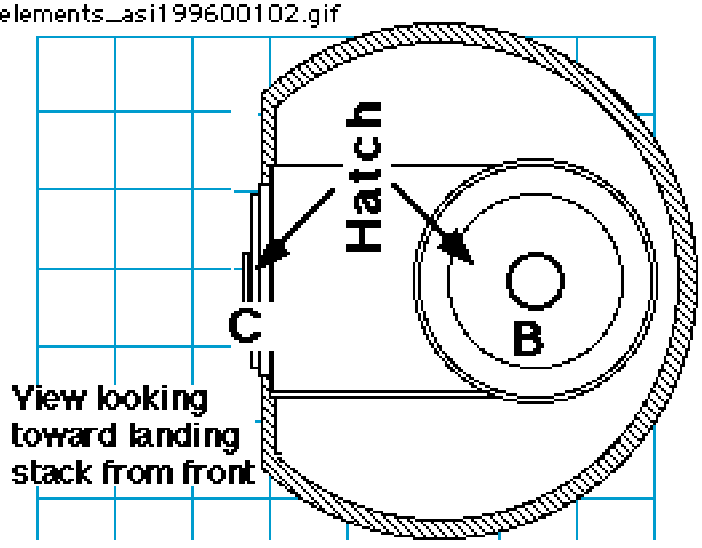
[2] http://nsschapters.org/hub/exhibits/artemismoonbase_model.htm

[3] http://nsschapters.org/hub/exhibits/moon_marsscapes.htm

While I used minimally modified off-the-shelf commonly available components, every effort was made to have the finished Moonbase model as like that shown in the Artemis Poster as possible. A photo of the finished product can be seen at:

http://nsschapters.org/hub/photos/amb_exhibit.JPG





Design problems noted

It is one thing to design something in your head. The followup exercise of sketching it out on paper often reveals flaws in the original concept that need to be addressed. But that is not the end of the "reality check" process. Building a three-dimensional model often in turn reveals additional problems with the improved design.

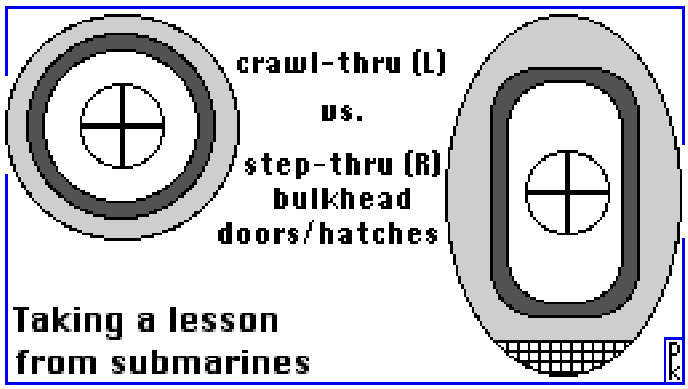
The first thing I noticed is that in the original artwork, the EVA-Hatch-Docking module is cantilevered out from one end of the main habitat module, a triple-ganged SpaceHab unit, without any additional support. Albedo is shown, but that clearly does not provide any support for this massive module. In the model I produced, I added an adjustable foot at the far (right) end of the module. And probably this would not be sufficient. At least a pair of adjustable feet are needed.

But there is a bigger problem with the EVA-Hatch-Docking Port Module itself that does not show up in this modeling exercise. Take a close look at the original design sketches at right. Clearly this module was designed as if attached to a space station module i.e. for a gravity free environment. One "flies" or "swims" through the round hatches to the inside or outside space beyond.

Ease of Function follows Proper Form

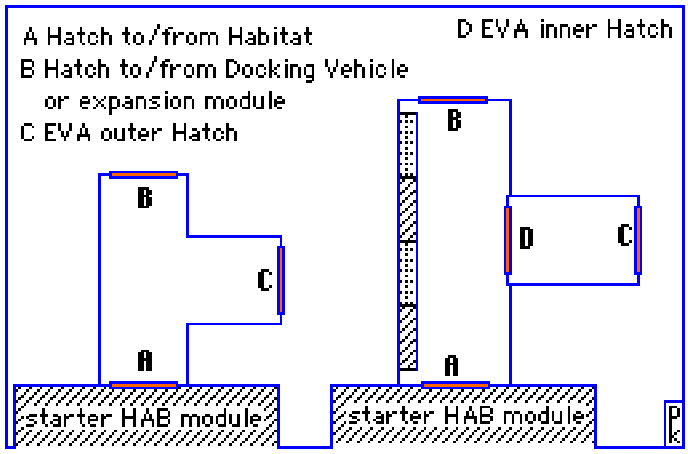
Used in a gravity environment, even a reduced one-sixth Earth-normal one, flying or swimming through hatches is out. One would have to crawl through them, a cumbersome exercise that can be tolerated for a short time perhaps, but which will quickly become a major gripe and cause of resentment towards the designers. Even at the penalty of greater weight, and thus of shipping costs from

Earth, it would be better to redesign the module in an oval fashion, with vertically elongated hatches that one could "step through" as in WW II submarine bulkhead doors.



It is essential to realize that this module serves as the "growing point" of the infant outpost. The far end serves as docking point for now, but will soon become the attachment point of an additional, possibly larger module of a design similar to the starter SpaceHab triple module or perhaps something altogether different: say a retro-fitted space shuttle external hydrogen tank, or an inflatable sphere or torus. Either way, if the complex is to serve as one integrated outpost, passage from one part to another should be easy and natural and not laborious and annoying. We don't need this EVA-hatch/docking module to have a "mickey mouse" design. Ergonomics are important for both crew morale and crew productivity.

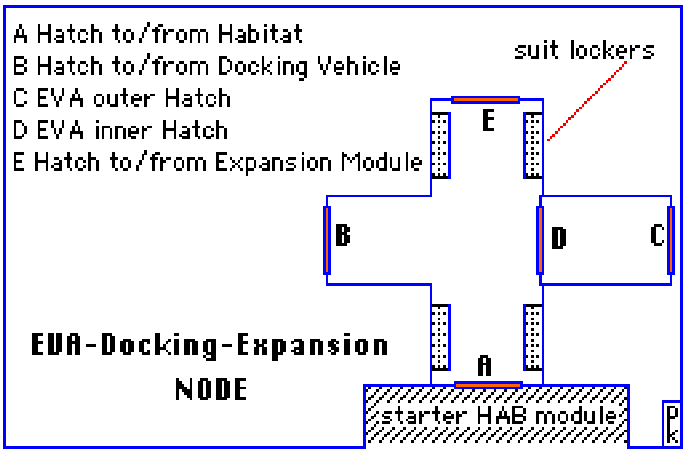
Second the EVA-Hatch-Docking Module should be designed so that the EVA port can be sealed off from the main passage from the SpaceHab module to whatever is docked at the far end. It's simply a matter of common safety. If that means that the module must be extended in length etc. to provide this isolation, then we must bite the weight and bulk penalty bullet. Further, lockers for space suits should be a built-in feature.



But these two improvements are not enough. It is vital if this "connector" or "node" module is to be part of a larger outpost complex that functions well, that one port should not serve both as docking vehicle access and growth module expansion port. Four ports are necessary:

1. access from original module
2. EVA port to surface
3. Docking port for visiting vehicles
4. Expansion port for attaching new module

We will need an X shaped module if the starter habitat module is going to indeed be the start of a larger, fully functional outpost.



We do not need such a node every time we add an expansion module. A third module could connect directly to the second, for example. Until the outpost is much larger, a second EVA port and a second docking port might not be needed to handle the "traffic." Nonetheless, I'd recommend a second such node be added at the far end of the first expansion module, just for safety sake, i.e. backing up one's access to the surface and to incoming vehicles, should the original EVA port or docking port be disabled.

Actually, it would be helpful to develop a whole "language" of modules by which the outpost can develop and expand in an orderly fashion. The various possible modules will be "words" that the outpost decision makers will put together in "expansion sentences" as seem to fit the expansion needs of the moment to provide orderly growth of the outpost and its capacities in just-in-time fashion as outpost activities, crew, and opportunities for economic milestones unfold.

Artemis Project™ Reference Mission: It is our opinion that the "Reference Mission should remain open, be ever "tentative." I propose that ASI should adopt as a goal to improve the reference mission including optional directions with the purpose of helping prepare the ground for TLRC [The Lunar Resources Company who holds the trademarks on the names "Artemis Moonbase" and "Artemis Project"] *or for whomever* can put together the capital and economic plan to make the improved multi-option plan work. **< PK >**

Mail for MSJ

Consolidated Lunar Atlas available on CD

Thought you all might like to know about this great new resource. I just ordered it, and the shipping and postage is $7, but even at $17, it is still a good value.

BTW, ALS is the American Lunar Society, a group of active lunar observers. If you have a telescope and camera, you might want to enter their various contests. http://www.otterdad.dynip.com/als/index.html

Marianne Dyson < www.MarianneDyson.com >

-----Original Message-----

From: Eric Douglass, American Lunar Society

I've been working with the LPI (Lunar and Planetary Institute) on both reproducing and making the Consolidated Lunar Atlas available on CD-rom. It has finally happened!!! You can order the 2 CD-rom set from LPI:

https://www.lpi.usra.edu/store/products.cfm?prod=41&cat=5

Paul Spudis wrote the introduction, and I wrote the preface. The best part is that this magnificent atlas is only $10.

Eric Douglass

Lunar and Planetary Institute Resources

The LPI library now has a What's New page.

http://www.lpi.usra.edu/library/whats_new.shtml

From that page links are provided to:

• Recent Additions to the Collection:
http://www.lpi.usra.edu/library/new_additions.html and

• New and Noteworthy:
http://www.lpi.usra.edu/library/n_n.html

We also have an RSS feed

http://www.lpi.usra.edu/library/new.xml

David Bigwood < bigwood@lpi.usra.edu >
Lunar & Planetary Institute

A Moon Society Convention Anyone?

From the Moon Society Conference Committee

Since the Society's "Organizing Conference" in July, 2000 at Caesars Palace, Las Vegas, Nevada, it has proved difficult to organize a follow up. Our resources are limited. We have only a volunteer staff. Our previous best effort was an all-weekend dedicated Artemis Project™ Track at ISDC '98 in Milwaukee. Next Memorial Day weekend, we could organize our own side show at NSS' ISDC in Oklahoma City. Anyone interested contact:

Arthur P. Smith < apsmith@aps.org > and/or
Peter Kokh < kokhmmm@aol.com >

Moon Society Chapters & Outposts
The Outpost Frontier Report

Chapter & Outpost Resources Online

The Moon Society Chapters Coordinator keeps a log (with active links) to resources appropriate for use by Moon Society Chapters and Outposts on the Space Chapters Hub website. This log is online at:

www.moonsociety.org/chapters/milwaukee/msmo_output.htm

Moon Society St.Louis Chapter

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

Moon Society St. Louis is working on a display and information table for the Archon 27 science-fiction convention, October 2-5 - http://www.stlf.org/archon/27/

Moon Society Chapters on Vacation

For chapters of space organizations, summer time usually brings a not-unwelcome lull in activities. With many members on vacation at various times, and with lots of other events going on to compete for one's attention, it is difficult to pull off any kind of group activity during the traditional summer months of July and August.

Okay, guys! Labor Day has come and gone. The respite is however. Hope you all had a great summer! More, hope you all find yourselves renewed, restored, and ready for action. There is lots to do! And opportunities galore.

Fall Opportunities for chapter & Outpost Action

• **The Columbia Commission Report:** Congress will be getting lots of conflicting advice from constituencies hostile to continued Manned Space Operations. We can work to acquaint our representatives in Washington with the reasons to stay the course, and especially promising options. See Robert Zubrin's comments on page 15 under subheading "NASA finds itself at a fork in the road." Also check out NSS statement at http://64.220.250.157/nss/docs/082603_NSS_CAIB%20statement.pdf. Write positive letters to Editors of your local newspaper(s).

• Mars Opposition Fever: The event is over, but interest is still high with three probes nearing Mars. Find opportunities to plug the much nearer Moon -- nearer not only in space, but in time it takes to get there (and back!), in frequencies of launch windows, in opportunities to test new rover and ISRU technologies, life support systems, etc. Have public-invited Moon observing parties - best time before, during, after first half-moon when craters and mountains are clearly visible in early evening hours.

• **Work on creation of displays and handout flyers.** Many suggestions on the Space Chapter Hub at:

http://nsschapters.org/hub/exhibits.htm

Pluto Mission in Danger, Again

From the Planetary Society
http://planetary.org/pluto/bond-mikul.html

09/03/2003 - Dear Planetary Society Member:

Less than a year ago, Congress approved funding for the New Horizons mission to Pluto and the Kuiper Belt. With that crucial vote we thought that, after years of struggle, the fight to preserve the Pluto mission was finally over and won.

But now it is under attack again. In the last days before the House of Representatives adjourned this summer, its Appropriations Committee earmarked $55 million for cuts from the New Frontiers program, of which New Horizons is a part. This action would force a launch delay of at least one year beyond the scheduled 2006 date, and postpone its arrival at Pluto by as many as five years! This is in direct contradiction to the recommendation of the National Research Council, which listed a Pluto mission as its top scientific priority.

Join us in our fight to restore full funding for New Horizons. The action has now shifted to the Senate, where their Appropriations Committee will mark up the NASA bill this Thursday. Please write to the Congressional leaders who can most influence the outcome: Senator Christopher Bond (R-MO) and Senator Barbara Mikulski (D-MD)-- today!

Together we can reverse this short-sighted action and see that a mission to Pluto launches within two years.

Thank you.

Louis Friedman Executive Director
The Planetary Society

Action Hints:

E-mails to Congressmen from people outside their home districts are now being routinely rejected, so a fax is now a more effective way of influencing political actions.

Mail or fax your letter as an individual to the Subcommittee. Please address it to:

Senator Christopher Bond
Senator Barbara Mikulski
Committee on VA, HUD, and Independent Agencies
274 Senate Russell Office Building
Washington, 20515
phone: 202-224-8252 fax: 202-224-4344

About the Pluto Mission

NASA's Pluto Page
http://nssdc.gsfc.nasa.gov/planetary/planets/plutopage.html

New Horizons Pluto-Kuiper Belt Flyby
http://nssdc.gsfc.nasa.gov/database/MasterCatalog?sc=NHORIZONS

GREAT BROWSING !

Mars or Bust

"the only news site for everything about Mars"
www.MarsorBust.com/

Solar System "Nomenclature Wars"

www.space.com/scienceastronomy/names_game_030812.html

more: www.space.com/scienceastronomy/planet_denitions_030227.html

Interlunar Cyclers, Taxis, and Orbits

From Dave Dietzler, the old Moon Miner
http://www.moonminer.com/taxi.html

http://www.moonminer.com/lunarcycler-orbits.html

Vertical Lift Aerial Vehicle Student Design Competition

Sponsorerd by NASA's Minority University Research and Education Program (MUREP)
http://www.integratedspacetechnologies.com/Titan/presentations.html (9 PDF file presentations)

Environments for Life on Europa

http://www.space.com/searchforlife/seti_phillips_europa_030807.html

The Moon Keeps the Same Face Turned Towards Earth --- er, more or less!

http://antwrp.gsfc.nasa.gov/apod/ap030810.html
http://www.astrosurf.com/cidadao/animations.htm

organic-based dissolution of silicates: a new approach to element extraction from lunar regolith. S. L. Gillett

http://www.lpi.usra.edu/meetings/resource2000/pdf/7014.pdf

[on the largest main belt asteroid]

Ceres' Evolution & Current State

www-ssc.igpp.ucla.edu/dawn/newsletter/html/20030822/ceres_evolution.html

Brazil Backs Out Of Station Project

http://www.space.com/missionlaunches/launches/iss_brazil_020816.html

Mail For MMM

From the Inside Out: The 6th Mars Society Conf.

from R.D. "Gus" Frederick – Mars Society; Oregon Chapter

I remember my first exposure to a Mars Society conference. It was the second one, held in Boulder in 1999. I arrived without a motel reservation and not much of an idea about what to expect. After following the Case for Mars conferences from afar, I thought I had a bit of and idea. Of course, I had no clue, as I had never attended one of those conferences either. Indeed, this was my first conference dedicated to something other than science fiction or Oregon education.

I had a seemingly wild idea about Martian caves to talk about. My abstract was submitted and accepted for presentation, so now all I had to do was a minor polishing job and I was all set. I settled into to the opening plenaries and listened as one by one, faces and voices I had only read about got up to talk about the Martian frontier. There were many of the Case for Mars alumni, and others from the pages of the journals I followed. I was amazed and impressed with the caliber of everything presented that weekend. And as it turned out, others were talking about caves too.

In the subsequent years, I attended each new Conference. Before I noticed it, I had transformed into a Martian myself. Each August brought a new suite of ideas and excitement. Some initial disappointment when we lost the two probes in the fall of `99. Over all, it was, and for that matter still is, a personal mindblower to know that I could step up and become involved in such an endeavor as exploring and settling a new world.

As the sands of time drifted like so many marching sand dunes in the ancient deserts of Elysium, I find myself cruising down Interstate 5 towards Eugene on a hot Sunday afternoon. The first of several trips in preparation for the next Mars Society Conference, now coming to Oregon. About 20 miles north of my destination I saw them. Everywhere. Dust Devils. Off in the distance as tall, thin plumes of translucent brown, twisting and turning, eventually breaking apart into nondescript brown clouds. The further I drove, the more devils I saw. I watched as one hugged the highway moving towards me. A large twisting demon about two meters in diameter and at least 20 meters tall. It fell apart as I sped past. I finally pulled off and watched a field of them grow and die, one after another, in a barren expanse of dirt clods.

They're everywhere I thought. Pacific Northwest Martian analogs. Dust devils. Outflow channels. Lava flows. I grew up with all of these features, and never gave them a second thought. Now when I see them, my first though is of the Red Planet.

By Wednesday night, like a swarm of dust devils, the Martians started to arrive in Eugene. This conference experience turned out to be for me much different than earlier ones. The main difference of course was that the Oregon Martians get to play host. Taking our turn at this task at first was a daunting prospect from our chapter, boasting only four active members. Nevertheless, we pressed on, and slowly but surely, volunteers appeared. First from familiar sources like our local NSS chapter. Then other Martian enthusiasts stepped forward to lend a hand. The Eugene contingent of Jim, Tasha and Jean were especially welcome.

The team slowly gelled. After many meetings, emails, phone calls, hand-wringing and teeth gnashing, it all came together! Here we were, hosting the Martians on our turf. On our watch. The speakers arrived and spoke, the hotel venue turned out to be logistic bonus and while overall attendance was smaller that past conferences, the quality of presenters and programs was a top notch as ever. Indeed, more so in many regards.

Five years ago I could hardly have imagined hosting such a distinguished lot as this. Now I count many of these folks as good friends, and feel a sense of reunion each year we get together. Names I had followed from afar for so many years, I now find myself working with on actual projects -- for the Society as well as the greater whole of Mars exploration. My crazy ideas about Martian caves is now yet another arrow in the quiver of exploration, waiting to be pointed towards that bright red target now glowing in the midnight sky.

The conference is now over. A feeling of relief has settled over me. Relief that my work is over. But there is also a sense of satisfaction that we pulled it off. And a reaffirmation of our mission. My personal mission of helping host the conference was a success. Our group mission to explore and settle Mars is as strong as ever. So once again we glance up and plan for bigger things.

This next year will truly be a cross roads for Mars exploration, with the current flotilla of discovery now enroute. The success of these latest arrows could well determine to course of our work for years to come. I remain optimistic. We will succeed. We will build a new world. Even if we have to jump-start an old one to do so!

Mars Society Info: www.marssociety.org.

Size of the Luxury Tourist Market

from the Queen Mary 2 Web Site

http://www.nzmaritime.co.nz/qm2/

The "Luxury Seeker" currently accounts for 14% of the North American cruise market. *In 2001 this represents more than a million potential passengers who are willing to spend whatever it takes to secure the most luxurious available accommodation and service.*

Sixth Int. Mars Society Convention Report

http://www.marssociety.org.

from Robert Zubrin, Mars Society Founder and President

Over 300 people gathered in Eugene, Oregon August 14-17, 2003 at the 6th International Mars society Convention to map out plans to make the human exploration of the Red Planet a reality. Over 100 talks were given, including plenaries by many Mars Society leaders as well as Mars Exploration Rover Deputy Project Scientist Albert Haldeman, NASA Astronaut John Grunsfeld, planetary scientist William Hartman, and leading science fiction author Greg Bear.

In his opening address to the convention, August 14, Mars Society President Dr. Robert Zubrin outlined the priority for the organization over the next six months:

Political Outreach.

NASA is about to be thrown into crisis by the soon-to-be-released Shuttle report, and priorities of the agency will be subjected to wide and deep reexamination. This will happen at the same time that 5 robotic probes approach Mars, worldwide excitement will be focused on the Red Planet, and the American political science enters its high season. We must seize this unique junction to put humans to Mars on the national agenda.

NASA finds itself at a fork in the road

The Shuttle crisis makes the issue particularly sharp, as the Columbia investigation is certain to recommend against flying the Orbiter much longer. NASA has already begun to respond to this reality by starting the Orbital Space Plane (OSP) program, which will move the human taxi-to-orbit function from the Shuttle to a small capsule or mini-orbiter that can be launched on top of an Atlas or Delta. This however poses the decisive question of what happens to the Shuttle physical, technical, and human infrastructure. This system, comprising pads, high performance Space Shuttle Main Engines, solid rocket boosters, external tanks, and all their human support personnel, is now losing its justification in its original role of Orbiter launch, and therefore it will shortly be at risk for cancellation. That, however, would be a disastrous mistake, since if the Orbiter is removed from the shuttle stack and replaced with a hydrogen/oxygen upper stage, the system becomes a heavy lift vehicle capable of launching 120 tonnes to LEO, or sending payloads in the 40- 50 tonne class on direct trajectories to the Moon or Mars. Such a Shuttle-derived Saturn-V class booster would provide NASA with the primary tool it needs to launch human missions of exploration throughout the inner solar system. But its development can only be justified IF NASA actually initiates such a program. The space agency is thus presented with a choice; either embrace human exploration program, or be forced to throw away a $10 billion asset that will be needed if human exploration is ever to be done later.

If they make the negative decision, and opt to discard the Shuttle infrastructure instead of converting it, they will be making a statement that they really never intend to do human exploration, at which point the OSP and the Space Station will lose their justification as well, and the entire manned space program will implode. NASA is in a box, and the only way out is forward.

A Proactive mission for Mars Society Chapters

Mars Society chapters are called upon to take the initiative, and meet with their congressmen in their home districts and explain these matters to them. The Shuttle catastrophe needs to be answered not with retreat, but with advance. Human space flight will always be risky, but we need to be doing missions worthy of those risks.

At a subsequent meeting with the Mars Society political Task Force led by Pat Czarnik, a goal of 300 home-office meetings with political representatives overe the next 6 months was set.

More on the Convention

Other important plenaries:

- Chris McKay, of NASA Ames Research Center (ARC), introduced his concept of biologically reversible Mars exploration, initiating vigorous debate
- ARC scientist Carol Stoker explained a program for developing technology for water drilling on Mars
- Tom Hill laid out a call for an annual university Mars mission design competition. The competition, to be known as the Kepler Prize, will start this year with competitive efforts by university teams to design an Earth Return Vehicle for use in the Mars Direct mission plan.

Other high points of the conference included a spirited Friday night concert by the Extremophiles rock music group, the banquet and town meeting, and the premier of a film produced by the FMARS 2003 Crew which told the story of their rotation.

A meeting of veteran crew members of the MDRS and FMARS was also held, at which it was decided to form a Science Support group to interact with all future MDRS and FMARS teams, with the objective of developing the art of "telescience" involving collaboration of teams of scientists on Earth with those on Mars.

The conference was covered by msnbc.com, space.com, the Eugene papers and TV stations, and in the Seattle Post Intelligencer.

Much thanks are due to the organizers of the Oregon and Washington Mars Society chapters who made it all possible. **< RZ/MS >**

Failure is not an option!

Mail For MMM

Calling all Space Activists

It is not often that we are presented with a golden opportunity to have our voices heard in the mass print media. However, we do have a window of opportunity in which to influence public opinion by writing letters to the editors of the world's newspapers. The occasion is the release of the Columbia Accident Investigation Board Report Volume 1. Of particular relevance to NSS members is Chapter 9: "Implications for the Future of Human Space Flight." This individual chapter is available at

http://boss.streamos.com/download/caib/report/web/chapters/chapter9.pdf

The main CAIB report can be accessed from

http://www.caib.us/news/report/default.html

Given the high visibility of this news story with the media, editors are going to be especially receptive to publishing letters from their readers dealing both with the report's findings and with the future direction of humans in space. I believe that every chapter leader should seize this opportunity to sit down and compose a letter to the editor of at least one of your local newspapers. I believe that every chapter leader should also take this opportunity to encourage their individual chapter members to do likewise. We do not often have opportunities like this and when we do the window is small so please act promptly!When you and/or your chapter members do submit your letters to the editor, please forward a copy to me for inclusion in a special collection of such letters. If the letter is published, please provide the name of the newspaper that published it and the date it appeared.

Jim Plaxco
NSS Vice President of Chapter Affairs
< jplaxco@astrodigital.org >
Region 6 Director, National Space Society
Director, Chicago Society for Space Studies
NASA JPL Solar System Ambassador
Chicago Mars Society

FMARS 2003 Crew Completes Mission

August 1, 2003 -- The seven-person crew of the Flashline Mars Arctic Research Station (FMARS) completed their record breaking mission on Devon Island July 31st with the safe arrival of all members at the Inuit settlement of Resolute Bay. The mission included pioneering work in the development of telescience methods for exobiology, and an epic 12- hour EVA in which the crew, operating in-sim, overcame incredible obstacles to march from FMARS to the sea.

NSS' statement on the CAIB Report

RELEASE August 26, 2003 WASHINGTON, DC – National Space Society Executive Director Brian Chase issued the following statement following today's release of the final report of the Columbia Accident Investigation Board:

"The National Space Society urges NASA to embrace the recommendations of the CAIB and work diligently to fundamentally reform its decision-making processes and safety organizations so that we can safely return the Space Shuttle fleet to service.

"However, in order for NASA to fully implement the CAIB recommendations and continue the exploration of space, the agency will need appropriate funding to accomplish those tasks. The White House and the U.S. Congress must accept their share of responsibility for the future of our nation's space exploration efforts and provide the necessary leadership.

"Perhaps most importantly, NASA and our nation's leaders need to take this opportunity to foster development of new space transportation systems and renew a long-term commitment to human space exploration. We are encouraged that the CAIB unanimously recognizes in the report that our "future human space efforts must include human presence in Earth orbit, and eventually beyond."

"We are a nation of explorers, and a bold new vision of the exploration of space will be welcomed by the American public and our international partners. No society has ever gone wrong opening up the frontier, and we shouldn't stop now." **< BC/NSS >**

Mars Desert Station gets Telescope

Mars Desert Research Station, Hanksville, Utah

08/08/03 - Thanks to a generous donation from Celestron, the Musk Mars Desert Observatory now has a new telescope to bring the night skies closer for Crew missions and school groups. The new observatory was upgraded by Peter Detterline, John Loomis and Ted Maxwell this past July.

The telescope is Celestrons latest CGE 1400 telescope. A 14" Schmidt Cassegrain design on an equatorial mount; it is capable of collecting more than 5000x more light then the unaided eye. With the ST-2000XM CCD Camera, this system will give people incredible resolution of night sky objects as this image of the Dumbbell Nebula demonstrates. Peter Detterline claims that `the telescope is a smart design blending incredible optics with high precision electronics.'

Guests had a chance to check out the instrument at MARSpectacular - the Mars Party at MDRS over the Labor Day weekend, at the HAB where visitors could tour the MDRS facilities, camp out in the desert under 6.7 magnitude skies, win prizes and take images using the new telescope.

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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(* Board Members, & Ken Paul < kenpaul@cape-mac.org >

LRS NEWS

- **Vacation Time:** No meetings in July or August.

LRS SEPTEMBER Events

Saturday, SEPT. 13 th1-4 pm

LRS Meeting, Mayfair Mall, Garden Suites **Room G110**, which is located on the lower level "Garden Suites East" near the mall entrance below the cinema complex. AGENDA: Discussion of the Columbia Commission Findings and what it means for NASA, for the future of the Shuttle Program, of the Space Station, and for Next Generation Shuttle. Reports on Mars Opposition viewing. Peter Kokh may be out of town for a class reunion. Bob Bialecki will chair the meeting.

Collaborating Milwaukee Area Space Groups

Moon Society Milwaukee Outpost
c/o Peter Kokh 414-342-0705 - kokhmmm@aol.com
http://www.moonsociety.org/chapters/milwaukee/
MSMO currently meets jointly with LRS

Wisconsin Mars Society c/o Matthew Giovanelli
7133 West Wells Street, Milwaukee, WI 53213
414-774-8952 - marsmatt@wi.rr.com
http://chapters.marssociety.org/usa/wi/
WMS usually meets at address above on 3rd Sat. 1pm

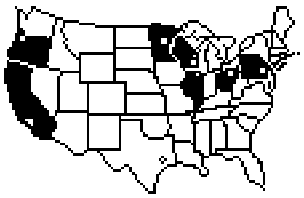
Solar System Ambassadors

PASA - Princeton, NJ/Philadelphia, PA
Michelle Baker - chaos@cybernet.net

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

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

U.S. CHAPTERS



NSS Chapter Events
MMM 8 Chapters Strong

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

MINNESOTA

Minnestoa Space Frontier Society

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

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

[www.mnsfs.org/]

☞ We meet the **3rd Saturday** of the month from **1-4 pm**

at the: **St. Anthony Park Library**'s Meeting Room
2245 Como Ave. St. Paul, MN

NEXT MEETINGS: **SEP 20th, OCT 18h, NOV 15th**

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042-1034

c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@excel.net>

>>> DUES: "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020

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

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

SEPTEMBER 16: Foerster Academy of Dance, Sheboygan
OCTOBER 21: Stoelting House, Kiel
NOVEMBER 18: Foerster Academy of Dance, Sheboygan

http://www.tcei.com/sss/SSSschud.html

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://www.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.

- **Sep 20, 3:00 p.m.** -- OASIS Monthly Business Meeting, location TBD. Info.: the OASIS Hotline, 310/364-2290.
- **Sep 27, 7:00 p.m.** --Roving Around Mars, a presentation by Dr. Steven Squyers, NASA Mars Exploration Rover Program. Location: Boeing Huntington Beach Facility, Building 28 Conference Center, 5301 Bolsa Avenue, Huntington Beach. Admission is free. Look for OASIS event banners.
- **Oct 18, 3:00 p.m.** -- OASIS Monthly Business Meeting, location TBD. Info.: the OASIS Hotline, 310/364-2290

Looking Ahead

- **January 2–4, 2004** -- Planetfest 2004! Pasadena, California. Info: www.planetary.org/planetfest04

Recurring Events

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

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

OREGON

Oregon L5 Society, Inc.

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

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

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

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

☞ Meetings **3rd Sat.** each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**
NEXT MEETINGS: **SEP 20th, OCT 18h, NOV 15th**

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105

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

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

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

Meeting Dates: SEP 20th, OCT 18th, NOV 15th

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

• **Meeting Notes:** Our August meeting was held at The Irish Pub at 20th and Walnut Street in Philadelphia on the 17th (a Sunday) with light attendance. I need to get notices out earlier and check for feedback. More on this later.

Simon Koumjian III reported on a great field trip he took while looking for a possible home site: he and his wife went to Hanksville, Utah! They met Gary Fisher and his son, Ben, who where putting in extensions to The Greenhab System that Gary and Ben took there from Pennsylvania. Although only able to visit for a short time, Simon was very enthusiastic about what they saw; The Mars Desert Research Station really is located in a Mars like terrain. The pictures he brought back looked almost like a movie set due to its barrenness and "cleanliness" (i.e. little vegetation and human litter). Our group had some discussion about how accessible the site was, especially from a non camping member, to casual trespass. Even knowing what to look for,

the location wasn't easy to find per Simons experience. His report also told of simulating entry and exiting the Station by the "Martians," taking 40 minutes each way. This didn't apply when Fed-X brought a needed repair part! Pictures from the visit will be brought by Gary who photographed Simon and Leslie working at the site. Thank you Simon.

Larry the Webmaster gave us a report on net visits which where up with several repeat visitors and a number of curious browsers. He also mentioned the need for captions for our New York trip pictures (from me). He gave an update on spam and e-mail problems and The Computer User (August 2003) article on this problem and cures.

Dotti Kurtz reported on two current articles and one event. In **The Planetary Report**, Louis Friedman wrote on "Propelling Humans Beyond Earth Orbit" (Jul-Aug) and Noreen Griece wrote, in **The Smithsonian** (Aug. issue), "To Touch the Heavens" on teaching the blind about Astronomy and the sky. There was a (Planetary Society?) Solar Sail display, untill the day before our meeting, at Rockerfeller Center. We had some talk of sails because of the exhibit and the upcoming launch of TPS' Cosmos I solar sail, and my own recollection of the late 80s World Space Foundation's solar sail project (I belonged to WSF; have the T-shirt). We may have that race to the Moon and Mars yet!

Mitch Gordon brought several neat things to the table including articles on Mars from both **Ad Astra** {June-July, on NSS' hopes for Mars) and **The Futurist** (Sept-Oct) magazines. In the latter, see Tad Daily's "Mission to Mars" and Liam P. Sarfield's counterpoint article, "Lets Not Rush to Mars." Also "Space: Final Frontier or Battlezone?" by Professor Craig Eisendrath of Temple University.

Also in the **Ad Astra** issue cited: "Lunar Tourism," a detailed article by Dave Dietzler on what is needed to create a lunar tourism business. Also read "The Universal Reusable First Stage" by Kenneth Schweitzer which lifts the space vehicle above most of the atmosphere then flies back to a runway landing for refurbishing and refueling. The illustrations, starting on page 41, include a shuttle-sized craft being carried aloft. Many of us will remember the many variations of this idea that have been discussed in the past including HOTL and Sanger as well as launching of small satellites via modified conventional aircraft. Maybe an incremental design (or scaled prototype?) could be built as proof of concept while still getting flight tests on hardware putting, for example, a ton payload in L.E.O.

Earl Bennett brought diverse collected articles including: from **Machine Design** (July 10th issue), "Mars or Bust" by Stephen J. Mraz, Senior Editor, on a number of competing mission designs. They include Phoenix which includes back-up hardware from the Mars Polar Lander mission and software for some functions of that system [which] could land and look for life using a scraper mounted on an arm to deposit samples into an on craft lab.

MarVEL, the Mars Volcanic Emissions and Life Scout mission, otbiting Mars in a near polar orbit, using sensors similar to those on the previous Mars Odyssey craft as well as a new sub millimeter wave (lessthann ~.04' long) tunable sensor to allow scanning at numerous wavelengths for water and biologic process markers in Mars' atmosphere.

A flying mission called ARES (Aerial Regional-scale Environmental Survey of Mars) would bring a folded up aircraft to the planet with final stage deployment from the still falling parachute entry system assembly. The flyer would unfold and fire rockets to travel over the surface for close-in mapping of magnetic fields to yield compositional clues on material under the vehicle as well as measuring isotope ratios for historic data on Mars' atmosphere. It'd also carry instruments to look for biologic activity via trace gas analysis. There would be several systems on the craft that will have to operate relatively fast: the primary missions are to be completed in one hour although investigators hope the craft will fly and report longer.

SCIM (Sample Collection for Investigation of Mars) is different in several areas: it is a sample return mission that would bring Mars back to the researchers for direct examination (using aerogel as the collecting medium) with a number of clever instruments that would measure mass and other properties of the impacting samples. The mission profile is also unusual: first the craft passes over Mars for sample "site" reconnaissance and then, a year later the actual sampling occurs. As I read this it looks like about 2010 or 11 for the researchers to have samples delivered to a space station or orbital facility. In addition; there is a background sidebar on other missions that didn't,t make the final cut including a multi glider system called "KittyHawk" by a team that includes the company that built the Gossamer Condor and other record breaking, well designed craft. Oh well, as the article says "not this time".

NASA Tech Briefs has a good article on the lab groups working on Nano Technology within NASA starting on page 14 of the August issue with Dr Meyya Meyyappan who directs the effort at NASA-Ames featured.

Also, we talked about going to, or doing a Mars close Approach viewing but did not do so due to weather and other considerations, and learned of an opportunity through a new contact who is part of NSS named Penny. She made several contacts via e-mail and also was in contact with our Mars Society head, Gary Fisher. I will continue contact on future matters such as Super Science Weekend. Simon related information on the Sasakawa Center for Space Architecture at The U. Houston, TX

Here is site information some members may not have: World Future Society is at www.wfs.org , information on the Nasa 2003 Nanotech 2003 conference (Oct. 23 & 24 in Boston) is at: www.techbriefs.com/nano. And our flagship group: nss.org .

Submitted by Earl Bennett

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