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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

#249 | OCTOBER 2011

Given Urban Night Sky Pollution, its no wonder our young people are oblivious of the Universe at large. pp. 9-10

Feature Articles in This Issue

The Gross Economic Product of GEO

The figure for 2009 is $250 Billion, and it is growing at 9% a year with Satellite-to-Home TV the top earner. With basic building materials produced on and shipped from the Moon "downhill" gravity-wise, to make giant multi-satellite platforms, solar power satellites and a global power relay grid, the economic significance of GEO could grow exponentially. Without the Moon, GEO's economic future would be limited. The Moon and GEO are the team of the future. In this issue we tackle "the giggle factor" head on. Pages 7-8

GUEST EDITORIAL Impossibly High NASA System Development Costs

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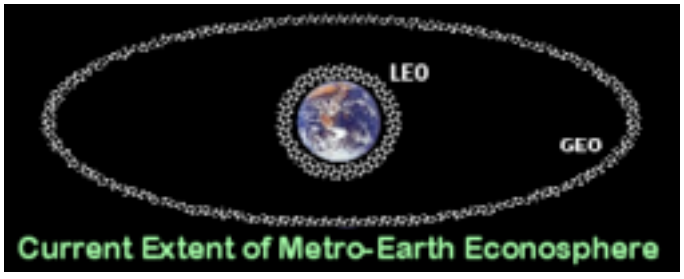
Impossibly high NASA system development costs are the heart of the matter. We will ignore for the moment the arguments over whether the old-line NASA human spaceflight establishment is at this point capable of putting together an effect- [=> p. 2, col. 2]



Moon Miners' Manifesto

Published monthly except January and July., by the **Lunar Reclamation Society** (NSS-Milwaukee) for its members, members of participating **National Space Society chapters**, members of **The Moon Society**, and individuals worldwide.

• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first twenty years have been re-edited, reillustrated, and republished in 21 PDF format volumes, for free downloading from this location:

www.MoonSociety.org/publications/mmm_classics/

• **MMM Glossary: new terms, old terms with new meanings:**
http://www.moonsociety.org/publications/m3glossary.html

• **MMM's VISION:** "expanding the human economy through off-planet resources"; the early era of heavy reliance on Lunar materials; early use of Mars system and asteroidal resources; and establishment of permanent settlements supporting this 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 many 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.

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• **The Lunar Reclamation Society** is an independently incorporated nonprofit 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 the Milwaukee chapterof both NSS & Moon Society: http://www.moonsociety.org/chapters/milwaukee/

• **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization. National Space Society, 1155 15th Street NW, Suite 500, Washington, DC 20005; Ph: (202) 429-1600 - www.NSS.org

• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.

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• **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.***

• **Submissions by email** to KokhMMM@aol.com - Email message body text or MS Word, Texr files, pdf attachments

√ CDs, DVDs, /or typed hard copy must be mailed to:

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1630 N. 32nd Street, Milwaukee WI 53208-2040

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⇒ Guest Editorial continued from p. 1.

effective exploration program at any cost. The indisputable fact is that their costs for making the attempt have risen to unsupportable levels.

A NASA study last spring applied government project-cost estimating models to a recent commercial booster development. The result was a cost estimate for the same booster done the established NASA way of ten times the actual commercial development cost. This study also looked at the effect of a hypothetical streamlined version of traditional NASA system development methods, and came up with a cost estimate of "only" three or four times the actual commercial cost.

Note that these extreme cost ratios came from the type of tools used to come up with initial NASA project cost estimates. In another recent study, the GAO found that a dozen or so recent high profile NASA development projects actually cost on average over fifty percent higher than their initial estimates.

In other words, **NASA major project development costs in recent years demonstrably ran roughly fifteen times higher than equivalent commercial project costs.** Even with a streamlined "modified" version of traditional NASA procurement practices, costs still would run as much as six times the commercial equivalents.

In the current fiscal climate, this is a big problem for those of us who'd like to see NASA doing useful space exploration and technology development. It's apparently not at all a problem for those who see NASA primarily as a hometown jobs program. But that's a short-term outlook – in the long term, the ongoing expensive lack of results will inevitably bring NASA down. Ultimately, the real choice is, a new reformed NASA with a new and very different way of doing business, or no NASA at all.

SLS "Senate Launch System

NASA HQ just gave in to prolonged Congressional pressure and announced a vehicle configuration for the SLS "Senate Launch System" heavy-lift launch vehicle project. The project will be run under traditional NASA practices; the cost multiplier over doing the job commercially will thus presumably start out on the rough order of fifteen times as expensive.

Note we said "start out." We see indications that the NASA organizational dysfunction that causes that huge cost multiplier is not a constant, but rather has been growing in recent years. We thoroughly expect that SLS project cost will grow and schedule stretch, just as Constellation program costs and schedule did.

We predict that at some point, it will be as obvious that SLS will never fly usefully as it was obvious that Constellation was going nowhere, and SLS too will be expensively cancelled. We hope that SLS will go away before it has wasted even more scarce dollars (and impacted even more actual useful NASA projects) than Constellation – but we wouldn't bet on it at this point.

Commercial Crew Vehicles

Back in July, when the Commercial Crew Program announced that they planned to abandon the

previous successful COTS/CCDev project approach (non-traditional Space Act Agreements where NASA had strong insight and influence, but NOT control, over commercial developers) for a new, somewhat streamlined version of traditional NASA procurement that would give NASA control over commercial project details.

CCP management have stated that they must do it this way, because their lawyers told them they have to. In July they were asked repeatedly for the detailed legal brief from their lawyers, and also for the requirements they gave their lawyers that led to that brief. Months later, as best we know they still haven't answered either question. We hope someone asks them again in the short-notice CCP briefing happening tomorrow, and we hope that this time CCP management provides real answers.

We suspect that won't happen though, because our best guess is that the reason NASA's lawyers told CCP management they have to dump the SAA's that had been working well, in favor of a variant of traditional NASA (high cost) procurement, was because CCP management first told NASA's lawyers "we must control the details".

It's an obvious circular argument, given both halves: "Our lawyers told us we have to use contracts that let us control all the details, because we told our lawyers it's a requirement that we control all the details."

All of which misses the basic fact that *by their own admission* NASA costs for "modified, streamlined" versions of their normal procurement process are still up to six times equivalent commercial costs.

COTS, and CCDev till now, succeeded because their non-traditional Space Act Agreement contracts *prevented NASA from imposing their normal procurement practices*, and allowed the commercial partners to get things done at far lower commercial cost levels.

If CCP management gets away with abandoning what's been working and switching to modified traditional procurement, all the arguments over whether the results will actually be any better or safer are moot. There will be no results, because *the money isn't there.*

The Senate appropriators reportedly just came back with $500m for CCP next year, somewhat more than the House, but still far less than the NASA request. $500m may be just barely enough to support multiple competing commercial crew projects - if done under the old arrangements.

Under anything like traditional NASA procurement practice, $500m will barely pay for the viewgraphs. If CCP management goes ahead with their current approach, they will be effectively killing the program, absent money miraculously raining from the skies.

It is in the strong interest of this country to have multiple viable commercial orbital passenger transport services. We hope that all concerned will recognize the budget-climate implications: That the only practical and affordable alternative now (regardless of the understandable old-line NASA organizational compulsion to control every detail of any potential astronaut carrier) is to stick to the existing successful project model.

Project insight, yes. Project influence, very much so, with NASA as the effective anchor-tenant customer. Project oversight, no - there simply isn't enough money to pay the known huge costs of traditional close NASA project oversight.

Safety will inevitably be cited - but it is not inherently obvious that NASA's traditional process will produce any safety improvement at all over the commercial/FAA process now coming together, let alone enough improvement to justify the many times higher NASA costs.

Human spaceflight will remain a risky business for a long time no matter who is in charge, the industry and FAA, or NASA. The only way it will become completely safe in our lifetimes is if it is made so expensive that we no longer do it at all. NASA getting their way on changing how CCDev is run may ultimately produce exactly that result. ▲

Note: The Moon Society has taken no position on this issue, but it goes without saying that our vision and mission cannot be realized if there is a signify-cant bureaucratic cost multiplier of any level. **PK**

MMM salutes Steve Jobs

Without his contributions, MMM may have become history over two decades ago!

The first 18 issues of Moon Miners' Manifesto were done on an **IBM Selectric™** Typewriter (still a fond memory) along with cut & paste illustration. With issue #19 October 1988, we graduated to our first computer, a **Commodore 64** ("64k, all the memory you could possibly want!") Then in the Fall of 1990, Milwaukee native Morris Hornik gave me his retired **Mac Plus**, on behalf of the Space Frontier Foundation, which had strongly promoted and supported MMM from the start.

I get a Migraine the moment I open a manual, and it won't go away until I throw the manual away! With the intuitive Mac, one doesn't need a manual. We are still on Mac to this day (currently Macbook laptop) and MMM issues have been put together on Macs since issue #41. ***Our deepest thanks to Steve Jobs!*** - **PK**

And to the Space Frontier Foundation!

Prelude to Space Industrialization

By Dave Dietzler

In the last issue of Moon Miner's Manifesto I wrote about industrializing space for only ten billion dollars. The money would be raised by selling 20-year zero coupon bonds with a 4.7% interest rate. To pay off the bond holders and make some profit, the Moon mining base would have to be bootstrapped-up and mass drivers would need to be built by year five or sooner. The construction shack complete with automated beam-builders would have to be up and running by year ten or earlier. And 10 GWe of SPS capacity would have to be finished by year 15 at least. Of the $10B about $5B would be for rocket launches and $5B for operations, hardware and R&D.

But there's the kicker. On this schedule there would be no time for R&D. That would all have to be done before selling bonds and embarking on this project! Money for research & development preceding the project would have to come from far-seeing space corporations that launch rockets, operate space hotels and factories in LEO, and other space companies like satellite broadcasters and companies that have launched GEO power relays or SPS from Earth like Solaren, which plans to launch a 200 Mwe SPS and sell power to Pacific Gas & Electric. Money for R&D could also come from governments and private contributors like multibillionaires. The latter is called "angel-l funding." Perhaps large numbers of private citizens would be willing to donate a few dollars each if their names were to be inscribed on sintered basalt bricks used for walls and walkways on the Moon.

Peter Kokh has suggested that some of the needed R&D could be financed on the expectation of profitable terrestrial applications. See: "Spinning-up" Glass-Glass Composites Technology ©1987
www.moonsociety.org/publications/mmm_paperrs/glass_composites_paper.htm

Presuming we find the money to do the R&D, one of the first things we need to build and test are reusable rockets that I call Moon Shuttles that burn metal powder and LUNOX monopropellant for flight between the lunar surface and L1 space depot. The Falcon-9 launch vehicle was developed by Space-X from a blank sheet to first launch in four and half years for just over $300 million. The Dragon spacecraft was developed from a blank sheet to the first demonstration flight in just over four years for about $300 million. See: http://www.spacex.com/usa.php This proves that space can be done for much less than the enormous multi-billion dollar government projects that we are used to and intimidated by.

An interlunar ferry for flight from LEO to L1 like Peter Kokh's Jules Verne Moonlooper[1] would have to be built and proved out. This vehicle could be built before Moon Shuttles and used to make profits by taking wealthy tourists on round-the-Moon cruises. It would be a test bed for novel propulsion technologies like metal powder and LOX burning engines, attitude control flywheels, cold gas thrusters, in space cryogenic propellant transfer technology and reusable heat shields. Naturally the first flights would be unmanned but once demonstrated there would be plenty of takers for several million dollars per trip. I don't doubt that both these rockets could be built for the same price as Falcon and Dragon were.

[1] "Earlier than you think: Lunar Overflight Tours" MMM Classics #3 pp. 4-8
http://www.moonsociety.org/publications/mmm_classics/mmmc3_Jan2005.pdf

Other technologies we'd need are NEP or SEP tugs to move cargoes from LEO to L1. These could be sold to national space agencies to propel deep space probes. For that matter, Moon Shuttles and Interlunar Ferries might be rented to national space agencies planting research bases on the Moon—more about that later. We'd also need regolith refiners like Dr. Peter Schubert's Lunar Dust Roaster[2] and All Isotope Separator. Plenty could be invested in that including Moon-make-able versions.

[2] **How Moon Rocks Can Save The Earth**
www.moonsociety.org/presentations/pdf/UsingMoonRockstoSavetheEarth.pdf

I mentioned a 100 ton monopropellant making system. This might use high efficiency GaInP/GaAs stretched lens array solar panels, magma electrolysis, vacuum metal powdering atomizers and monopropellant liquefaction, mixing and pumping systems. With magma electrolysis the propellant would be iron-silicon powder and LUNOX. This might not be as efficient as aluminum and LUNOX but it could be easier to produce as a single electrolysis cell of about one cubic meter could process five tons of regolith every 24 hours with 600 kWe of power to produce about a ton of oxygen and over a ton of iron-silicon. See:
www.nss.org/settlement/nasa/spaceresvol3/oflsmse1c.htm

To quote the authors: "The total electrode surface area would be about 30 square meters each (because each electrode is divided into fins, as in a car battery), and the total cell volume about 1 cubic meter. The operating temperature would be between 1300°C and 1600°C depending on the type of container and electrode materials that are ultimately developed. The cell would produce 1.4 tonnes iron-silicon metal, 1 tonne oxygen, and about 3.5 tonnes slag in 24 hours, with an energy requirement of c. 13 MWhr (or 47 GJ)."

The 100-ton monopropellant making system would have about 20 electrolysis cells and produce over 500 tons of propellant every lunar day. This would be enough to land perhaps one hundred tons of cargo arriving at L1. Millions of dollars would have to be invested in the development of this machine.

Inflatable space stations like the ones envisioned for the L1 depot and construction shack could be in orbit and making money in a few years. Already, Bigelow Aerospace has orbited unmanned inflatable modules. This part of the project would not require a lot of R&D by the powersat company. If Solaren succeeds with its plan to launch a small solar power satellite from Earth we'd already have a commercially available and proven powersat for the L1 depot that beams power down to the Moon mining

base during night-span. We could build on the success of other enterprises.

Even with all this, an International Lunar Research Park [ILRP] becomes essential before any company dares go into the "solar-power-satellite-built-from-lunar-materials" business. Nobody with common sense jumps into unfamiliar waters. Let's hope the ILRP is directed towards the establishment of SPS rather than a dead end polar science base promising ice and sunshine. If a base is built at the poles, it should be geared towards ice-mining and selling rocket fuel to future industries instead of pleasing only curious scientists and providing corporate and bureaucratic welfare. A north polar location closer to the nearside mare-plex is preferable to the south polar region if the base is to have any commercial future.

An ILRP in western Mare Frigoris or north-western Mare Imbrium on a mare/highlands coast near KREEP terranes would be a first step towards a growing lunar and space industrial infrastructure. I would hate to see a base with no real mission that is scrapped after a short period of operation. This seems to be the fate of the ISS. After eliminating a centrifuge to study the effects of partial gravity on animals, rejection of the TransHab, dumping electric thrusters for reboost and cutbacks in scientific research aboard the ISS, present plans are to de-orbit it in 2020. What a waste! At the very least it might be sold for in-orbit scrap metal or rehabbed and turned into an LEO staging station where astronauts tcould ransfer from Dragon and other capsules to Inter-Lunar ferries, as part of a Moon base program. Chances are the fate of the one hundred billion dollar ISS will be to burn up over the Pacific in nine more years. If an International Lunar Research Park is built with the same mentality I won't even pay attention to the whole taxpayer funded fiasco.

A private venture to propel a Moon Shuttle with NEP or SEP (nuclear-electric or solar-electric) or even tethers to L1, land it and deploy a robotic mono-propellant making system, refuel and ascend to L1 would be far more interesting. I don't doubt that such a project could be done for less than a billion dollars with private money. To make this more interesting, an Inter-Lunar ferry could be propelled to an L1 depot with NEP or SEP, fueled up with monopropellant from the Moon, make a brief retro-rocket burn, aerobrake into LEO and have enough propellant left over to return to L1 with a crew bound for the Moon.

Proving that we can get there without spending enormous sums of money to rocket fuel up from the Earth at great cost is step one. Proving that we can live and work on the Moon using local resources and robonaut/human synergies is the feat we must really achieve. This will require life support system development and also the development of machines and tools that can work in the vacuum and thermal extremes of the Moon. *Designs must be robust, simple and economical.* This is a challenge that we must not shy away from. If R&D for a Moon mining base began today and the 20 year project began in 2020 with 10 GWe of SPS capacity going to work in 2035 then only about 0.03% of the world's energy demand (est. 30 TWs) at that time would come from outer space. It would be many decades before exponential growth of space industry led to the creation of an energy source that could seriously compete with fossil fuels at a time when fossil fuel production is on the down slide. That's something the Oil and Gas Barons of the world should think about.

So far I have talked mostly about getting to the Moon. So much more could be said about construction on the Moon and in space. Building 10 GWe of SPS capacity will not be easy. A powersat this big would amass about 200,000 tons and be ten kilometers on a side. One hundred powersats rated at 100 MWe would each be one kilometer square, assuming 100 watts per square meter and very high efficiency of electricity to microwaves conversion.

How will we build such large structures in space? One of the keys to this will be a device called a beam-builder. From T.A. Heppenheimer's Towards Distant Suns (1979) chapter 6: Large Space Structures we read: "So it was that NASA's Marshall Space Flight Center awarded a $635,000 contract to Grumman to build a "Space Fabrication Demonstration System"; that is, a beam-builder. The first such device was completed and delivered to Marshall in 1978. On May 4, 1978, it produced its first beam in ground test.

The beams it fabricates are both lightweight and strong. A one-hundred-foot length weighs only 85 pounds, yet will support a load of 1,260 pounds. The beams are triangular in cross section and a meter deep. (The depth of a triangular beam is the distance from one corner to the opposite side.) They are made up of long strips of angle aluminum supported by cross-braces. The long aluminum edge members are formed from rolls of sheet aluminum; the machine pulls out aluminum strips from the rolls and forms them into the proper angled shape. The cross-braces are made beforehand and packaged in magazines, which fit to the side of the beam builder. They are withdrawn automatically, somewhat like giant staples, and the machine automatically welds them to the edge members. With one supply of rolls of sheet aluminum and of full magazines of cross-braces, the machine can turn out a thousand feet of beam in as little as two hours."

This is quite impressive. A beam 3000 feet long, about one kilometer could be built in only six hours. With several of these machines at work attached to a large fixture at the construction shack we could churn out the frames for powersats in just days or weeks. However, this has never been done in space; not even experimentally as was proposed by the early space colonization people. Grumman already built a beam-builder for less than a million dollars. It seems that before we embark on our low budget ten billion dollar plan to get into the space energy business we should test beam builders and other robotic systems in space. What would it cost with Falcon rockets to build a large GEO telecommunications platform to prove out this technology? Would the project turn a profit? We can only hope so. Perhaps the thing to do would be to build a robotic construction shack in LEO and propel it with electric drives to GEO and produce large telecommunications platforms for sale. This would be

rather expensive because materials would have to be launched from Earth, but there's a lot of profit to be made in the satellite business and the number of slots in GEO is shrinking.

It would take a lot of nerve to work out all the technology on paper and on computers and on the ground then risk ten billion dollars to tackle the challenge of building one hundred powersats each a kilometer square or an enormous powersat 10 km by 10 km.

Large quantities of aluminum and silicon would have to be produced on the Moon after bootstrapping up the mining base to the point at which it could produce the necessary amounts of materials and launch them into space with mass drivers also built on the Moon. The construction shack too would have to be built up with parts made on the Moon. Could it all be done by a crew of about 35 workers and ten times as many robots? Preplanning of a million details would be necessary. Certainly, this would be an adventure in capitalism that many would scoff at and recommend better uses for their money.

Manufacturing silicon solar panels for the powersats is another challenge that must be met. This has never been done before and would have to be demonstrated at the ILRP and construction shack. The same aluminum sheet rolls used to build the frame with beam-builders could be used as back plate for the solar panels and reflectors to increase solar panel output. Silicon layers might simply be vapor deposited on the aluminum sheets. To produce one hundred square kilometers of silicon panels in five years would be a challenge like no other. One problem that is faced is the degradation of solar panels in space due to radiation. This might force a rethink of the whole powersat design. Solar thermal SPS might be the answer. Heat engines in space could reach very high efficiencies. The SPS would be smaller and consist mostly of a frame, reflectors, boiler tubes and a turbo-generator using hydrogen or helium as working fluid. What will be more of a challenge-producing vast areas of silicon panels or manufacturing parts for turbo-generators on the Moon mostly with robotics and 3D printers using titanium and electron beam melting in the vacuum? Or would the frames, reflectors and boiler tubes be made in space using lunar materials and the complex turbo-generators built on Earth and rocketed up to GEO? This would increase costs. Solar thermal systems have reached 25% efficiency on Earth. In space 50% at least should be possible; thus, a powersat getting about 500 watts per square meter would only have to have a reflector about 450 meters by 450 meters to generate 100 MWe.

So we can see that billions of dollars of research and development must precede any grandiose plans to build solar power satellites, even for the rock bottom price of ten billion dollars. Once the process is worked out robots that can work 24/7 will outpace humans in space and construction will involve a lot of repetition. Robots are good at rapid repetitive work and they are reliable. I have put forth a rather arrogant proposal to industrialize space for only ten billion dollars in capital, but we can see that this will cost much more than that. The risks are great and must be minimized. Nothing like SPS construction has ever been done. Bootstrapping up a Moon mining base will only be a matter of fairly standard construction and manufacturing techniques modified for work on the Moon, but building large structures in space is a challenge we know little about. In weightlessness with no wind or rains this should be possible. Even so, as the powersats are rotated to track the Sun they will endure stresses and strains and weak structures would break apart. There will be thermal stresses with the Sun side heating up and the dark side of the structures exposed only to the super cold of outer space.

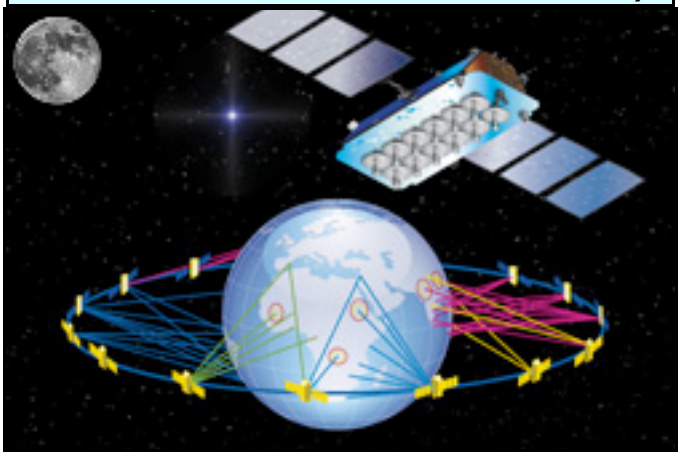
In conclusion, the challenge of space energy is a huge one. There is far more to this than low cost launches to LEO, transportation to the Moon which will just be an extension of existing rocket technology, and manufacturing on the Moon. Government research can proceed at a leisurely pace, but private ventures relying on interest accumulating capital must work fast, and that adds to the technological problems faced. It also places more demands on the humans working in space as well as the designers. Sixteen-hour days and eight-day weeks might not daunt the most enthusiastic space entrepreneurs, but it will take a special breed to live up to the job ahead. **DDz**

(Clip art modified by the editor)

Dave Dietzler ("Dietz") has been the MMM Editor's ***principle partner in brainstorming and illustrating how we can open the Lunar Frontier***, since his first article in MMM # 157, 2002.

A full list of his articles to date is online at:
http://www.moonsociety.org/publications/mmm_classics/Dietzler_MMM_articles_list.html

The Moon: What's in it for Earth? Part II: Lunar Materials to Grow Earth's Economy

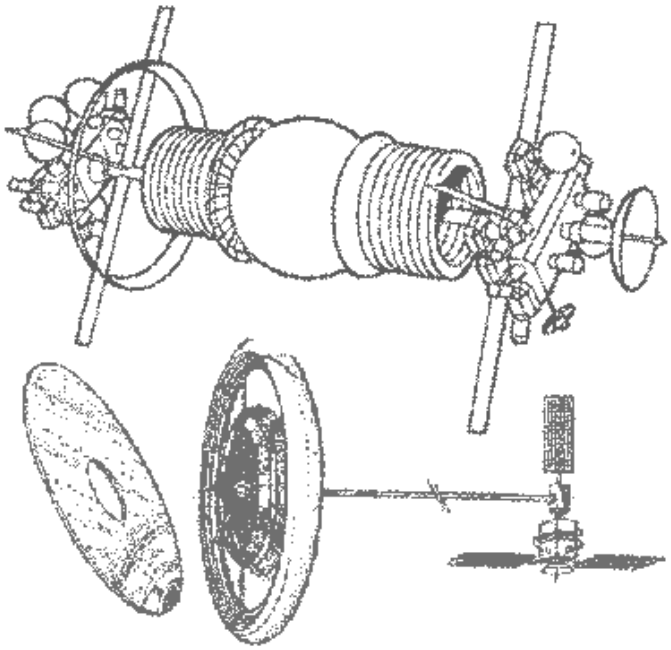


(Photo Credit: Briot/Thales Alenia Space), *Moon image added*

By Peter Kokh

How the Dream began

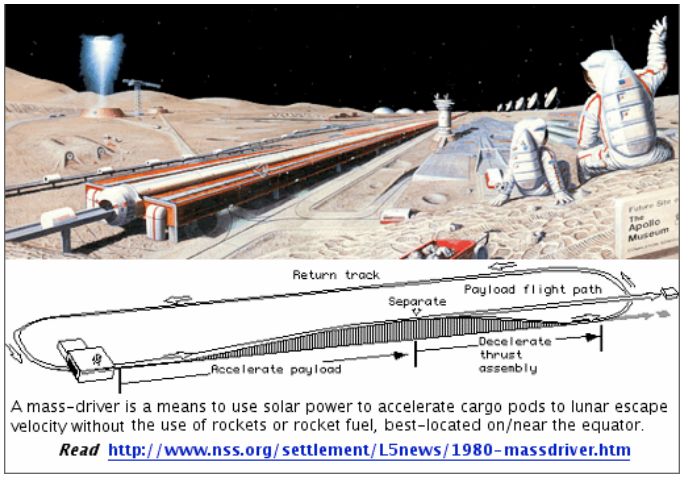
In the early 1970s, Princeton physicist Dr. Gerard K. O'Neill publicized a scenario in which we would go to the Moon, mine lunar materials near the equator and sling them into space with an electomagnetic "mass driver." There they would be used to build space settlements to house workers in comfortable and pleasant surroundings, workers who would use more lunar materials to build hundreds or thousands of gigantic solar power satellites to feed our planet's ever more voracious appetite for energy. Thus began the L5 Society. "L5 by '95" was a battle cry.



Bernal Sphere (Island 1) and Torus (Island 2, above

In response to Congressional requests, NASA even produced a comprehensive "**Space Resources and Space Settlement**" report in 1977 on the scenario and related ideas for Congress. It is still worth reading and belongs in every space enthusiast's library.

While the scheme was logical, too many of the needed technologies were still in the conceptual stage. To their credit, O'Neill's Princeton team produced successively three working model mass-drivers, each progressively more powerful and convincing.

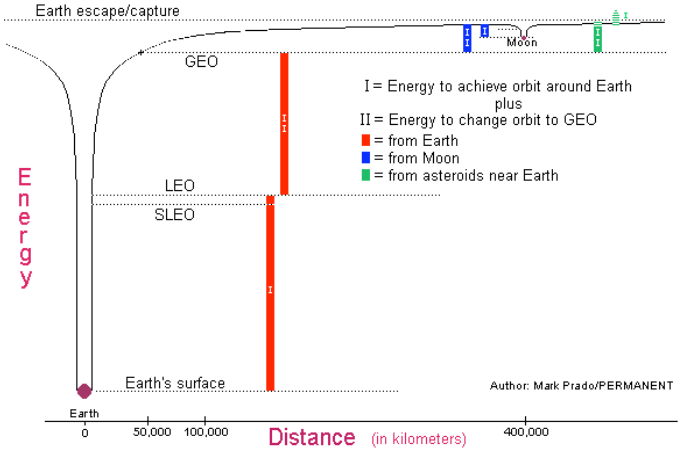


A mass-driver is a means to use solar power to accelerate cargo pods to lunar escape velocity without the use of rockets or rocket fuel, best-located on/near the equator.

Read http://www.nss.org/settlement/L5news/1980-massdriver.htm

The logic of using "lunar materials" to build giant structures in Geosynchronous Orbit is impeccable: it would take only 1/23rd the fuel to "downport" (down the Earth's gravity well) material's from the Moon on the gravity well's shoulder down to Geosynchronous Earth Obit as it would to "upport" them up that steep slope the much shorter distance from Earth's surface. And this, goes the logic, would make solar power sats much less prohibitively expensive.

It is the unique economic potential of Geosynchronous Orbit (Economic Gross Product as of 2010 c. $275 Billion) that makes the existence of potential construction materials on the shoulder of Earth's Gravity Well so significant. The Moon and GEO are a natural team literally "made in heaven." This is a 2-way economic case of **"Location, Location, Location."**



http://www.permanent.com/images/t-gravity-wells.gif

Enter The Giggle factor

Many of those old "L5ers" are still around, including this writer. But others, also convinced that Earth's future depends on Solar Power Satellites, but not spiritual descendents of O'Neill, are reluctant to back plans that call for lunar sourcing of materials. It will take too much of an effort, gobbling up too many years of lead time, to industrialize the Moon to the point where lunar raw materials could make a signify-cant and timely difference. And on the NSS Space Solar Power Committee, this division between O'Neillian

believers and those never caught up in the L5 Space Settlement dream is quite obvious, with both sides talking past each other.

Long overdue critical distinctions

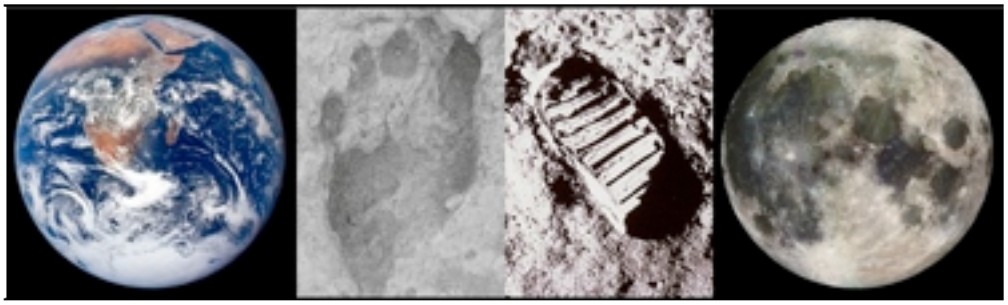
1. **Distinction between parts made on the Moon and those made here on Earth** – this part of the puzzle's solution is something I contributed way back in MMM #19, September 1988, pp. 3-4, "**A Strategy for Following up Lunar Soil Processing with Lunar "M.U.S./c.l.e."** – In this plan, we would seek to produce on the Moon everything needed there that was **M**assive, **U**nitary (we need many of the same), and **S**imple. We would produce on Earth for up-shipment, things that are **c**omplex, **l**ightweight, and **e**lectronic. Now there are sure to be many things that do not fall neatly into one of these two divisions. But if they can be divided into "MUS" and "cle" subassemblies, then we have the problem of sourcing solved neatly. : Basic simple lunar industries will produce the lion's share of what is needed weight-wise while terrestrial industries will provide the rest. This article is online at: http://www.moonsociety.org/publications/mmm_papers/muscle_paper.htm
2. **Lowering the expense of developing "in situ" lunar resources into usable building materials** – this is a challenge we addressed even earlier, in MMM #16, June 1988, pp. 3-5, "**Glass-Glass Composites**" in we suggested that just the opposite of the "spin-off" process, "**spin-up**" would yield prototypes of technologies needed on the Moon or elsewhere in space at much less research and development cost. Here, instead of a high-cost NASA crash program, entrepreneurs examine the list of needed technologies and examine each for possibly profitable terrestrial applications, then pre-develop those technologies precisely for those terrestrial uses. This article is also online at: http://www.moonsociety.org/publications/mmm_papers/glass_composites_paper.htm
3. **Pairing the use of lunar materials with the construction space habitats for workers** – giant hollow structures with artificial gravity provided by rotation makes the combined concept a gargantuan one: attractive, yes, affordable maybe not. We must keep in mind the enormous progress made in robotics and teleoperated systems in the past forty years. We will need people on the Moon and in space, but perhaps at least an order of magnitude (factor of 10) if not two (factor of 100) fewer. That changes the economics already. Dave Dietzler brought this up recently in **MMM #242**, February 2011, pp. 7-8 "**O'Neill's High Frontier Revisited**" – in short, many labor-intensive tasks in space will be performed by robot avatars, partly automated and partly teleoperated from elsewhere.
4. **Building up the needed Lunar Industries** – even given the above distinctions and novel approaches that greatly reduce the challenge of creating an industrial complex on the Moon capable of contributing the major fraction of the mass of Solar Power Satellite construction elements, the idea of lunar industrialization remains "science-fictional" to many. Well the Moon Society has addressed that as well, in our concept (Peter Kokh and Dave Dietzler) for an "**International Lunar Research Park**" – see MMM-India Quarterly [M3IQ] #2 February 2009 p. 20 and MMM pp. 5-6, #224 April 2009. The M3iQ article is online at: http://www.moonsociety.org/india/mmm-india/m3india2_Winter09.pdf
   The ILRP would be fully international, and thus quite resistant to any one nation's budgetary pressures or waning of resolve, witness the International Space Station. The basic enabling parts (spaceport, warehouse, recycling operations, and more would be constructed by a contractor consortium, so that individual national space agencies could ship up their outpost modules and plug in, free to concentrate on the science and research they came to so. Other corporations and enterprises would be welcome. This is the kind of critter that could in time morph into the first industrial lunar settlement.
5. **Identifying feasible lunar materials and how to produce them** – This is a task to which Dave Dietzler and his "ILRP Team" has dedicated itself. What alloys of iron, aluminum, titanium, and magnesium, the four "engineering metals" are feasible on the Moon, given the low abundance of the usual alloy ingredients for each? So far, the team has identified several feasible options and how we can go about isolating the needed components from the mish-mash of moondust in which minerals have not been concentrated into mine-worth lodes, absent the geological processes that work on Earth in the presence of water. If you have been a reader of MMM over the past few years, you will have seen much of Dave's work.
6. **Switching to more efficient, cheaper space transportation systems** – We have written often over the years about the flawed philosophy of NASA space transportation architectures. First we need orbital refueling. Second we need to design all components for salvageability and reuse, all the way up the line from Earth orbit to lunar landing. The Apollo and Apollo on Steroids approach of Constellation and now its disguised reappearance as "SLS" are insane. Getting into space has to be about getting into space, not providing money for the constituencies of key Senators and Representatives, or catering to the current stable of industrial-military complex providers. The Commercial Route alone holds hope.

But is anyone listening!

MMM's circulation is worldwide but in very small numbers. We try to make our presence and work known at the annual International Space Development and other Conferences and have used our "University of Luna Awards" to persons doing research along the needed lines, to help call attention. It is an uphill struggle, but slowly, some of these concepts are being talked about. If we are not mentioned that does not matter as it is the ideas that are important.

There is more work to be done, especially in deciding trade-offs between what can be most cheaply made and shipped from whence to where. We are convinced that we are on the right track. **PK/DDz**

From Africa to the Moon, the Human Epic, told in footprints, Continues to the Stars!



Our Goal is Communities on the Moon involving large scale industrialization and private enterprise.

Objectives of the Moon Society

Our objectives nclude, but are not limited to:

- Creation of a spacefaring civilization which will establish communities on the Moon involving large-scale industrialization and private enterprise.
- Promotion of interest in the exploration, research, development, and habitation of the Moon, through the media of conferences, the press, library and museum exhibits, and other literary and educational means
- Support, by funding or otherwise, of scholarships, libraries, museums and other means of encouraging the study of the Moon and related technologies
- Stimulation of the advancement and development of applications of space and related technologies and encouragement their entrepreneurial development
- Bringing together persons from government, industry, educational institutions, the press, and other walks of life for the exchange of information about the Moon
- Promoting collaboration between various societies and groups interested in developing & utilizing the Moon.
- Informing the public on matters related to the Moon
- Provision of suitable recognition and honor to individuals and organizations which have contributed to the advancement of the exploration, research, development, and habitation of the Moon, as well as scientific and technological developments related thereto.

Our Vision says Who We Are

We envision a future in which the free enterprise human economy has expanded to include settlements on the Moon and elsewhere, contributing products and services that will foster a better life for all humanity on Earth and beyond, inspiring our youth, and fostering hope in an open-ended positive future for humankind.

Moon Society Mission

Our Mission is to inspire and involve people everywhere, from all walks of life, in the effort to create an expanded Earth-Moon economy that will contribute solutions to the major problems that continue to challenge our home world.

Moon Society Strategy

We seek to address these goals through education, outreach to young people and to people in general, competitions & contests, workshops, ground level research and technology experiments, private entrepreneurial ventures, moonbase simulation exercises, tourist centers, and other means.

Interested in having input? Any member may ask to join the Leadership Committee and attend our Management Committee meetings held twice monthly. You may even express opinions. Decisions are often made by consensus, so this input has value. Write president@moonsociety.org

Chapter/Outpost Outreach

Leveraging the Sky

By Peter Kokh

It's a fact: there are far more local astronomy clubs than space interest chapters. While astronomy buffs and space enthusiasts may have differing goals and interests, there is clearly some overlap, and it makes sense to leverage that. Doing so makes sense even for established chapters in large metro areas. But it could be especially helpful for those with small chapters, and especially so for local contacts who would like to start a chapter, but are still at the Outpost stage (one or more persons looking for others to start a full chapter, and serving as local contacts.)

The splendors of the nighttime sky include Mercury, Venus, Mars, Jupiter, and Saturn, not to forget the brightest asteroid Vesta, – but above all, the Moon! While many amateur astronomers are focused on stars, double stars, variable stars, star clusters and nebulae, and faint galaxies, most also are interested in the planets when they are in good observing position.

What can one Lunie do in a local astronomy club?

1 **Give talks and presentations** about the Moon, and its resources that could change our future; focus on areas of special interest such as sinuous rilles and the lava tube networks they imply. Divide your topic into a series of such talks for monthly meetings.

2 **At observing nights** open to the public, volunteer to be the one to show the planets that happen to be up, and the Moon, while other club members focus on showing visitors the stellar sights. Prepare to answer questions and to talk about past & future probes and what we have learned and hope to learn from each.

3. **Download pamphlets** and flyers about the Moon Society, its vision, mission, and goals, and how to join with a pitch about your chapter or outpost. http://www.moonsociety.org/downloads/

Astronomy-based Outreach 2.0

Sidewalk Astronomy has become increasingly popular around the world. While many astronomy clubs engage in this form of outreach, it is also something a lone enthusiast can launch by oneself.

Here are some Sidewalk Astronomy websites and you can find more through a simple Google Search (never forget companion Google Image Searches@!)

www.flickr.com/photos/iyacalgary/4417678906/
www.sidewalkastronomy.com/ (New Orleans)
www.sidewalk-astronomy-club.com/chicago/

A Sidewalk Astronomy kit should include a small portable telescope, and a collapsible free-standing rack to hold literature about the Moon Society (and your local Chapter/Outpost, sample copies of MMM with sign-up forms, and so on. A 12" globe of the Moon ($50 if you look hard) would be great.

What: select all equipment to fit in a car trunk or large shopping cart and be taken out in the field whenever clear skies, a volunteer and the Moon are all available. *You do not want or need a high power telescope to view the Moor* A good pair of binoculars would work. A small lightweight backpack-portable **Astroscan™** would do quite well*!*

Where: busy urban places are fine as dark skies are not needed to see the Moon! A cinema parking lot (when a good sci-fi film is showing) might be promising. Choose safe, busy spots (not secluded parks!)

When: the eight day stretch, from four days before half moon (first quarter) to about four days after, offers the most satisfying views, showing craters and mountains in good relief and contrast in prime time evening hours. The dates will shift with each month.

Why: most people have never looked at the Moon through a telescope and are amazed to see craters and mountains so clearly. This drives home the realization that they are looking at more than a bright light in the sky, but at ***another world.***

The *American Lunar Society* connects people interested in observing the Moon, whether arm-chair enthusiasts or seasoned researchers, through its quarterly journal, ***Selenology***.

For a one-year membership, make checks for $15 US payable to: Andrew Martin, American Lunar Society, 722 Mapleton Rd., Rockville, MD 20850.

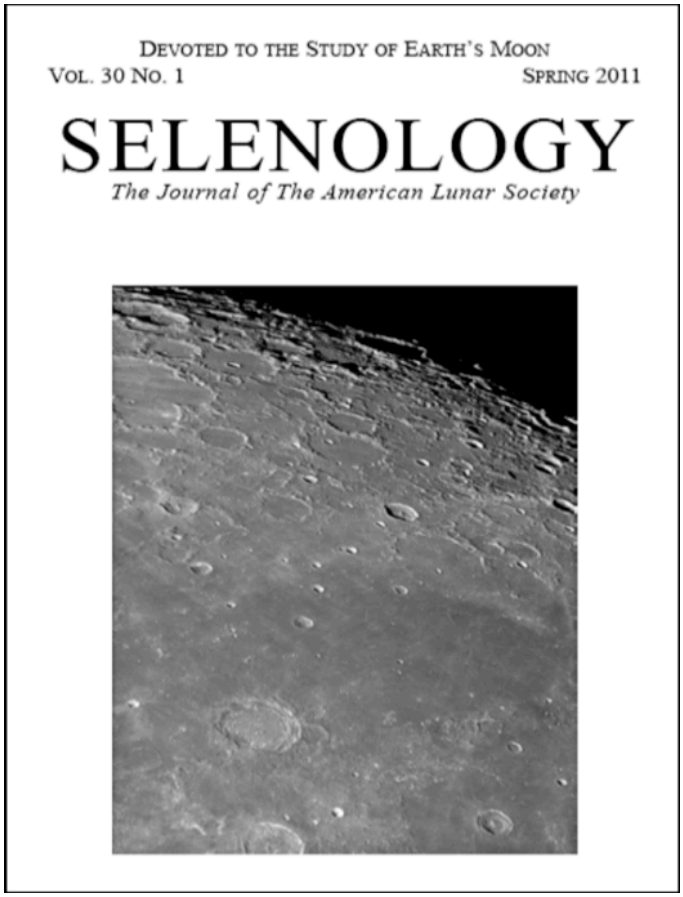
Check out these ALS websites:

http://eselenology.offworldventures.com/
http://www.amlunsoc.org/

Quarterly issues of ***Selenology*** can be freely downloaded by Moon Society members using their Moon Society username and password at:

http://www.moonsocety.org/members/selenology/

Sample cover:



The Moon Society and The American Lunar Society have been mutually affiliated since 2005.

Programs for our members? Check out:

www.moonsociety.org/reports/certificate_report.html

Chapters & Outposts

Moon Society Phoenix Chapter's Tranquility Community College Project

http://www.msphx.org/index.php/tranquility-community-college/

"Faculty:" Craig Porter, Don Jacques, Felix Polz

Departments: Astronomy, Geology. Life Sciences, Robotics, Energy, Library

"Here we make available articles, presentations, proposals relative to the exploration and perhaps, settlement of the moon. Each department focuses upon the knowledge, experience, and tasks faced by their respective disciplines."

Astronomy – Materials relative to the study of celestial objects in the space around and beyond the earth.

Geology – Materials relative to the moon's surface and sub-surface. Methods of identifying, study, and use of the materials found there.

Life Sciences (Craig) – Materials relative to the study, introduction, and maintenance of life on or under the surface of the moon. This includes habitats, air, water, and waste recycling. We take the study of preparedness to heart and include disaster preparedness and response here as well.
http://www.msphx.org/index.php/tranquility-community-college/department-of-life-sciences/
This grew out of a Panel at CopperCon 31 last year. The response to the panel was so good that Craig converted the information into a **Disaster Strikes Manual** and a **Workbook**. Both cover First Aid, Self Protection, and Hoarding to insure that there is enough food and water to survive for a minimum of 15 days, stressing having more available. Readers are encouraged to develop a liking for camping and gather the equipment to make camping enjoyable, then if the time comes that they have to survive they will have what they need to get by comfortably.

Robotics – Materials relative to the study and development of operated, tele-operated, and autonomous robots for various tasks on or in the moon.

Energy – Materials relative to the study of sources of energy, mechanisms and devices for the production of energy, and the implementation of that energy.

Library – Documents supporting the departments, and general information of history, government, and other related areas not covered in a department.

Courses "Under Construction"

Surface transportation for the Moon to link the different settlements together and provide commuter-style transit, cargo carrying capability and transporting tourists to different places on the Moon – Craig

A course on industrialization of the Moon – Felix

Don is also adapting his pamphlet **"The Homestead Project"** for a course.

Contributions by other Chapters welcome – anyone wishing to contribute should send Don Jacques – djmitzlplick@yahoo.com a "PDF" file of the course and request an upload. Don will assign a department for it and upload it. Note: anything uploaded in TCC is free to download and use in the education of the public. All we require is that the original author and chapter be credited with the course.

September Reports

Moon Society Phoenix Chapter

http://www.msphx.org

Contacts: Craig Porter portercd@msn.com

Meeting the **3rd Saturdays of the month**

At **Denny's**, 4403 South Rural Road, Tempe

NEXT: Oct 15th, Nov 19th, Dec 21st

Our September Meeting was held as scheduled 3 pm September 16th at Denny's. Five members were present.

Items discussed:

1 Our website and improvements on it.
- **a**, Applying for a PayPal account – approved.
- **b**, Dues button for paying Chapter Dues and helping track payments – approved.
- **c**, Affiliate Agreements with various stores investigation for income – approved.
- **d**, Adding our Logo Shirts and other items to sell on the website – approved.

2 Second item of business was the announcement that Patti Hultstrand is the new Editor of the Central Arizona Speculative Fiction Society Newsletter "***ConNotations***". The Chapter voted to help Patti in anyway that it can and Patti would allow us to run book reviews on our website.

3 The Moon Society Phoenix Chapter has it 's own Facebook page. The page is currently a closed page but members have been asked to make comments on the page whether or not to open the page to non-members. Nonmembers may e-mail me at portercd@msn.com with their thoughts.

4 A discussion on the Local "Space Forum" with information from Mike Mackowski, but Mike was unavailable. Any decision on the forum and our participation was tabled for now.

5 A discussion of what our participation in LepreCon would be other than a information table. Panel options, demonstrations and other items discussed.

6. Presentations for "Tranquility Community College" on the MSPHX website. Two presentations can be downloaded currently, and used by others. Also planned for future presentations are "Lunar Ground Transportation", "Industrialization of the Moon", "Military Presence on the Moon", "Settlement of the Moon and the Planning", and "Lunar Gardening for Settlements". If you have a presentation to add to the Website please contact me at the above e-mail address or on the Moon Society Facebook page you can also leave a message on the website.

7 Projects in work or in design, "Telepresence Racing", we now have three race cars and will set up a "wet run" of a race at our October meeting. The "wet run" will be taped and broadcast on our website after the race is over. Future races may be broadcast live. Next is a small demonstration "rail gun, low powered and safe to use designed to spark interest in young people. Also in the pipeline are dioramasof Lunar Settlements, Lunar Craters, Apollo Landing Sites and others to be determined at a later date . – Craig Porter

Clear Lake NSS/Moon Society Chapter (Houston)

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

Contact: Eric Bowen eric@streamlinerschedules.com

The Clear Lake Area NSS/Moon Society chapter next regular meetings is set for **Mondays, Nov 14th** and **Jan** (date TBD) **at 7:00 pm** in the conference room of the Bay Area Community Center at Clear Lake Park. Our most recent meeting was held September 19th. Items of interest include:

Our November 14th meeting will be our annual business meeting and election of officers. Nominations for chapter officers will be accepted via return email to eric@streamlinerschedules.com and at the meeting. You must ensure that your chosen nominee is willing to serve and is, or is willing to become, a member in good standing of *both* the National Space Society and the Moon Society. Officer & board positions open are:

- President – currently held by Eric Bowen, who is eligible for re-nomination.
- Treasurer – currently held by Marianne Dyson. Marianne has served as the Clear Lake Area NSS treasurer since 1992 and has indicated that this is her final term; she will be stepping down at the end of this year. We wish her all the best.
- Secretary – currently vacant.

Nominees elected at the November meeting will take office effective at our January meeting (date TBD).

Upcoming events of interest to our members:

- September 22, 2011 (Thursday): Science writer Dava Sobel speaks on "Humanity's Changing Relationship with the Solar System" in the Bayou Theater on the University of Houston-Clear Lake Campus at 7:30 p.m. as part of LPI's "Cosmic Explorations" speaker series. FREE. See the Lunar & Planetary Institute Website for more details. **http://www.lpi.usra.edu/**
- October 8, 2011: SpaceUp Houston is holding an event they bill as an "E2E (Engineer to Entrepreneur) Connection". Clear Lake Area NSS/MS is listed as an event partner. See the SpaceUp Houston website for more information. **http://spaceuphouston.org/**
- November 7-9, 2011: Annual meeting of the Lunar Exploration Analysis Group at the Lunar & Planetary Institute in Clear Lake. Registration event. See the event website for details. http://spaceuphouston.org/?cat=4 ----Eric.

Moon Society St. Louis Chapter

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

Contact: Keith Wetzel <kawetzel@swbell.net>

Next meetings – Aug 17th, Sept 21st, Oct 19th

Meetings 3rd Wed monthly at Buder Branch Library 4401 S. Hampton, in the basement conference room

The St. Louis Chapter of the Moon Society held its regular meeting on the 3d Wednesday of September at the Buder Branch Library – Rufus Anderson, Dave Dietzler, Tom Kullman, Jim Merriman, Mark Rode, and Karl Strassman attending. After relearning how to get Bob's laptop to talk to Rufus's projector, we enjoyed "Man and the Moon" from 1955, a Walt Disney Treasures Tororrowland DVD. Several of von Barun's predictions were right, but not all, and that deserves a detailed writeup.

Our activities at Archon 35 went well and will be written up on our chapter web page. On Saturday the 8th of October we will have a booth at the Youth Gateway to Aviation at St. Louis University Parks College's Center for Aviation Science, and that will be written up, also. Robert Perry

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Chapters & Outposts Map (North America)

www.moonsociety.org/chapters/chapter_outpost_map.html

Chapters & Outposts Events Page

www.moonsociety.org/chapters/chapter_events.html

===== Moon Society Outposts =====

Bay Area Moon Society, CA Outpost – South Frisco Bay

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

Contact: Henry Cates hcate2@pacbell.net

Meeting the 1st Tuesday of the Month at Henry's home

Moon Society Nashville Outpost – Central Tennessee

Contact: Chuck Schlemm cschlemm@comcast.net

Moon Society Knoxville Outpost

Contact: Jason Tuttle

Rockford, IL Outpost

Contact: Bryce Johnson lesausl@sbcglobal.net

Moon Society Milwaukee Outpost (MSMO)

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

Contact: Peter Kokh kokhmmm@aol.com

Meeting monthly with the Lunar Reclamation Society (NSS) on the 2nd Sat. afternoon except July, August.

===== NSS Partner Chapters =====

(Portland) Oregon L5 Society
(Milwaukee) Lunar Reclamation Society
(Twin Cities) Minnesota Space Frontier Society
San Diego Space Society *See pages 17-19*

Other NSS Chapters are welcome to inquire

Either about getting MMM for their members or also about partnering with the Moon Society on projects of mutual interest – kokhmmm@aol.com

Moon Society DUES with *Moon Miners' Manifesto*

Electronic MMM (pdf) **$35** Students/Seniors: **$20**
Hardcopy MMM: U.S/Canada **$35** Elsewhere: **$60**
Join/Renew Online - www.MoonSociety.org/register/

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions

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

Projects, Chapters, Volunteers, and Information

Moon Society President's Office,
5015 Addison Circle #420, Addison, TX 75001

Moon Society Publications - Chapters Co-ordinator

PO Box 395, Milwaukee, WI 53208

< End Moon Society Journal Section >

GREAT BROWSING

US SPACE POLICY

AAA Comprehensive Strategy for Human Exploration
www.spaceref.com/news/viewsr.html?pid=38110

NASA Needs to Preserve Skilled Astronaut Corps In Post-Shuttle Era
www.spaceref.com/news/viewpr.html?pid=34534

NASA's own internal studies show faster/cheaper alternative to its new Space Launch System (SLS)
www.spaceref.com/news/viewnews.html?id=1577

SPACE STATIONS

http://www.space.com/9358-bigelow-aerospace-soars-private-space-station-deals.html

Chinese rocket successfully launches mini-space lab
http://spaceflightnow.com/news/n1109/29tiangonglaunch/

COMMERCIAL SPACE

NASA selects Virgin Galactic for Suborbital Flights
www.spaceref.com/news/viewpr.html?pid=34314

Space Adventures and Armadillo Aerospace Release RFI Solicitation for Tourist Space Suit Development
www.spaceref.com/news/viewpr.html?pid=34404

TECHNOLOGY & ROBOTICS

http://www.space.com/12818-future-spacesuit-astronaut-gravity-rehabilitation.html

http://news.discovery.com/space/grasshopper-rocket-spacex-110927.html

Successful test of 3D Prining in Aero-G
www.spaceref.com/news/viewpr.html?pid=34249

NASA Selects Companies to Study Storing Cryogenic Propellants in Space
www.spaceref.com/news/viewpr.html?pid=34280

Can we journey to the Stars?
http://www.thespacereview.com/article/1946/1

Behavioral Challenges of long stays in space
http://www.thespacereview.com/article/1943/1

EARTH FROM SPACE

First global portrait of greenhouse gases emerges from pole-to-pole flights
www.spaceref.com/news/viewpr.html?pid=34547

NEAR EARTH SPACE

http://spaceinfo.com.au/2011/09/05/space-junk-reaches-tipping-point/

THE MOON

http://hardware.slashdot.org/story/11/08/29/1337258/Developing-Nuclear-Power-Plant-Tech-For-the-Moon-and-Mars

http://www.dawn.com/2011/10/09/titanium-treasure-found-on-moon.html

NASA releases photos showing Apollo evidence
http://spaceinfo.com.au/2011/09/08/in-the-astronauts-footsteps/

Moon Express Gets Thumbs-Up from NASA for Developing New Lunar Landing Technology
www.spaceref.com/news/viewpr.html?pid=34417

Lunar Reconnaissance Orbiter takes sharper photos of Apollo Landing Sites
www.spaceref.com/news/viewpr.html?pid=34522

MARS

www.innovations-report.com/html/reports/earth_sciences/wet_mild_caltech_researchers_temperature_mars_039_s_183734.html

Cold glacial oceans would have inhibited phyllosilicate sedimentation on early Mars
http://www.nature.com/ngeo/journal/v4/n10/full/ngeo1243.html

NASA-ESA 1st Joint Mars Mission picks Instruments
www.spaceref.com/news/viewpr.html?pid=31352

http://www.dnaindia.com/world/report_radar-for-mars-study-can-map-earth-s-freshwater-reserves-nasa_1587806

ASTEROIDS

http://www.asdnews.com/news/38542/NASA_Space_Telescope_Finds_Fewer_Asteroids_Near_Earth.htm

Latest findings on Vesta
http://www.physorg.com/news/2011-10-nasa-dawn-science-team-early.html

Does Asteroid Impact Rate Vary Periodically?
www.spaceref.com/news/viewpr.html?pid=34239

OTHER PLANETS & MOONS

http://www.newscientist.com/article/mg21128303.900-plutos-icy-exterior-may-conceal-an-ocean.html

Mercury not like other planets MESSENGER finds
www.spaceref.com/news/viewpr.html?pid=34822

ANALOG RESEACH STATIONS

International Lunar Research Park proposed for PISCES Analog Research effort on Hawaii Island
https://sites.google.com/site/internationallunarresearchpark/the-international-lunar-research-park-concept
https://sites.google.com/site/internationallunarresearchpark/

ASTRONOMY

http://machineslikeus.com/news/kepler-reshaping-our-understanding-planets

Kepler Mission Discovers World Orbiting 2 Stars
http://www.nasa.gov/mission_pages/kepler/news/kepler-16b.html

ASTROBIOLOGY

http://spaceinfo.com.au/2011/08/11/made-in-space---dna-building-blocks/

Alien Life More Likely on 'Dune' Planets
www.spaceref.com/news/viewsr.html?pid=38216

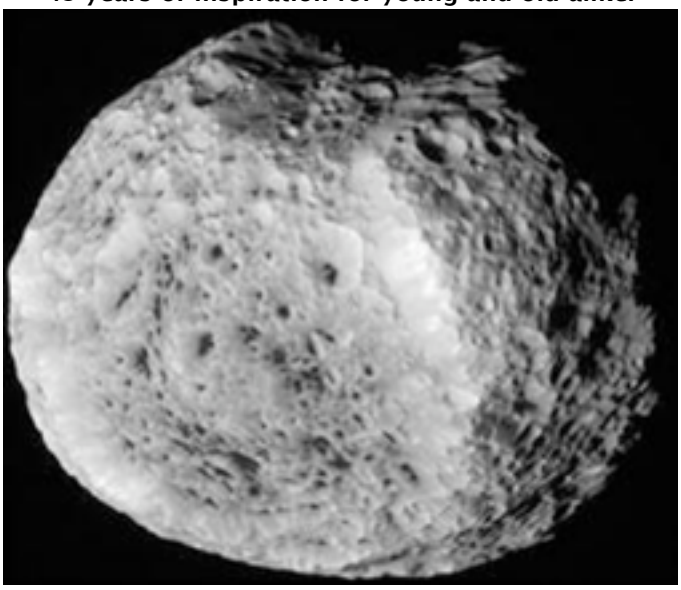
Strange Life forms at Hypothermal Vents
www.spaceref.com/news/viewpr.html?pid=34548

OUTREACH - MEDIA

Astronaut: Moon, Mars & Beyond, The NASA MMO Online Game
www.spaceref.com/news/viewsr.html?pid=38106

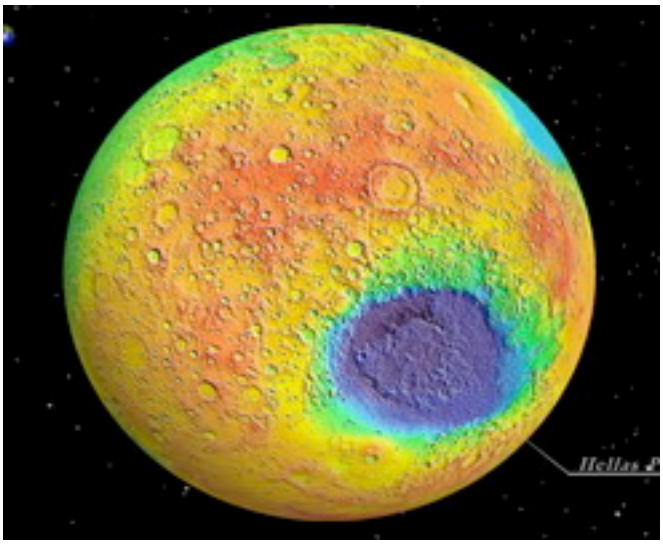
MMM PHOTO GALLERY

45 years of inspiration for young and old alike!

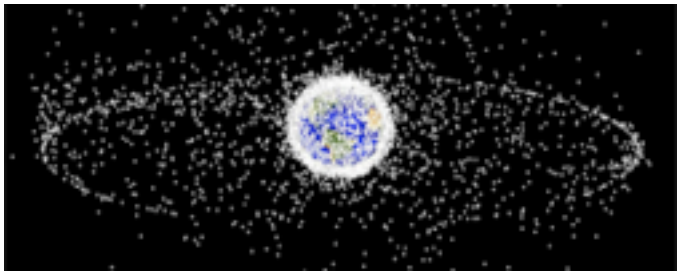


Beyond Titan lies Saturn's moon **Hyperion**, 168 mi = 270 k across, with an irregular, tumbling rotation

http://www.spacedaily.com/reports/**The_first_nuclear_power_plants_for_settlements_on_the_moon_and_Mars**_999.html



Hellas (Greek for Greece) **Planitia** on Mars stands out in this false color image as the deepest impact basin on Mars. At the bottom, "Mars air" is 89% more dense than at the mean ("sea level") elevation on Mars.



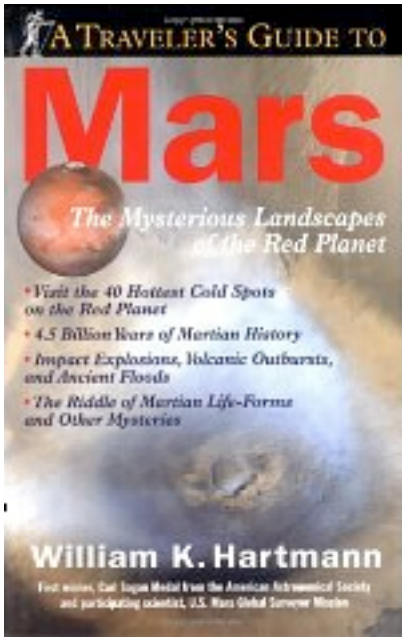
http://spaceinfo.com.au/2011/09/05/space-junk-reaches-tipping-point/

Successful test of a 3d Printer in Zero-G
www.spaceref.com/news/viewpr.html?pid=34249

ASTRONAUT
MOON, MARS AND BEYOND

NASA New Online Game "U.C."
www.spaceref.com/news/viewsr.html?pid=38106

THE book WORM



A Traveler's Guide to Mars:

The Mysterious Landscapes of the Red Planet

- *Visit the 40 Hottest Cold Spots on the Red Planet*
- *4.5 Billion Years of Martian History*
- *Impact Explosions, Volcanic Outbursts, Ancient Floods*
- *The Riddle of Martian Life-Forms & Other Mysteries*

By William K. Hartmann

ISBN-10: 0761126066 - ISBN-13: 978-0761126065

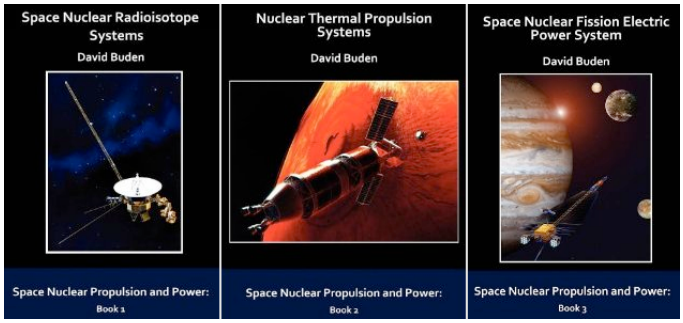
Workman Publishing, New York 2003

Maps and Dozens of Color High Resolution Photographs of various features of special interest

"prodigiously illustrated with photographs from Mariner 9, Viking, Pathfinder, the Hubble Space Telescope, and Mars Global Surveyor spacecraft"

Editor's Comments: most space enthusiasts, even those especially interested in Mars, have a geographic sense of Mars and its features that is skimpy at best. We all know of **Olympus Mons** and **Valles Marineris**. Some of us know the names of some of the other major volcanoes on Mars. Some of us are familiar with the largest and deepest impact basin on Mars, **Hellas Planitia**. By the time you finish reading this book you will be able to talk about Mars as if you had been there. And you will have a good sense of what feature is where relative to one another. It is important to know these things if you want to talk intelligently of where we might want to set up a first outpost, and about how we could tap the planet's resources. Martian landscapes are as varied as those on Earth.

- **I highly recommend this book.** It belongs in the library of anyone interested in opening Mars.
- **I hope that one as familiar with the Moon** will write such a book about its also very varied terrains, which tourists will get to visit far sooner



A three volume series on the history and engineering of space nuclear power and propulsion systems has just been published. Written by 50-year space nuclear program veteran **David Buden**, these books provide a comprehensive look into the space nuclear systems that may play a critical role in enabling human missions to the planet Mars.

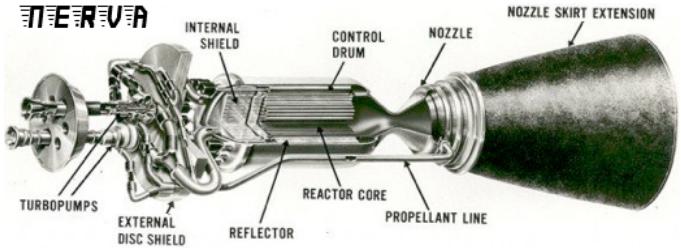
The first book, **Space Nuclear Radioisotope Systems**, describes the technical workings of radioisotope systems, the requirements and safety design considerations of these systems, different systems with this technology that have been developed, and their operational history, including information on the two Viking pobes using radioisotope system technology.

The second book, **Nuclear Thermal Propulsion Systems**, explores the fundamentals of nuclear rockets, including the safety issues, mission requirements, developmental history of various concepts both in the U.S. and Russia, and a summary of the key developmental issues of this technology. This book also includes a comprehensive history of the Rover / NERVA rocket programs, which took NTP systems from the drawing board to the verge of flight tests as part of NASA's post-Apollo plans to achieve human missions to the Red Planet by the 1980s.

The third and final book of this series, **Space Nuclear Fission Electric Power Systems**, discusses the components that make up nuclear fission power systems, the principal requirements and safety issues involved, various development programs, status developments and development issues. Such systems are key for enabling the production of rocket propellants on the Martian surface, thereby making possible mission plans such as Mars Direct.

The author of this series, David Buden, is an engineer whose career spans five decades of space nuclear research and development and was involved in the development and management of various advanced nuclear power systems from the days of the nuclear airplane to the SP-100.

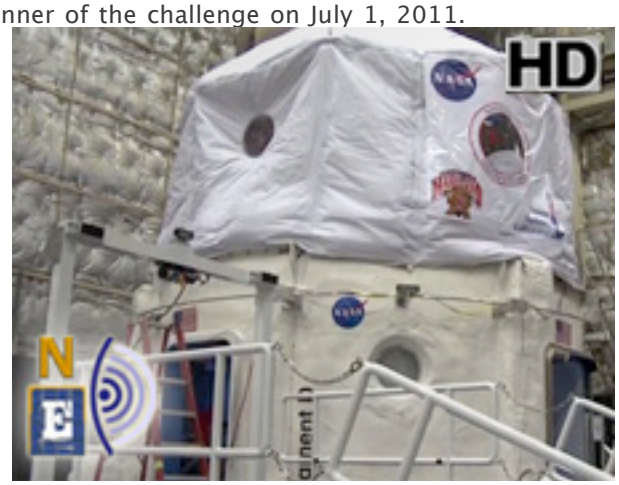
As a technical resource, these books are essential for anyone interested in the engineering of space nuclear power systems. Available at www.amazon.com.



University of Wisconsin-Madison wins 2011 X-Hab Inflatable Loft Challenge

www.nasa.gov/exploration/analogs/uwm_xhab2011.html

The X-Hab loft built by the Univ. of Wisconsin-Madison team is lifted and moved to the Habitat Demonstration Unit (HDU). UW-Madison, the third of three finalist teams in the first annual X-Hab Academic Innovation Challenge, demonstrated their loft for judges at NASA's Johnson Space Center during the week of June 20-24, 2011 and was announced as the winner of the challenge on July 1, 2011.



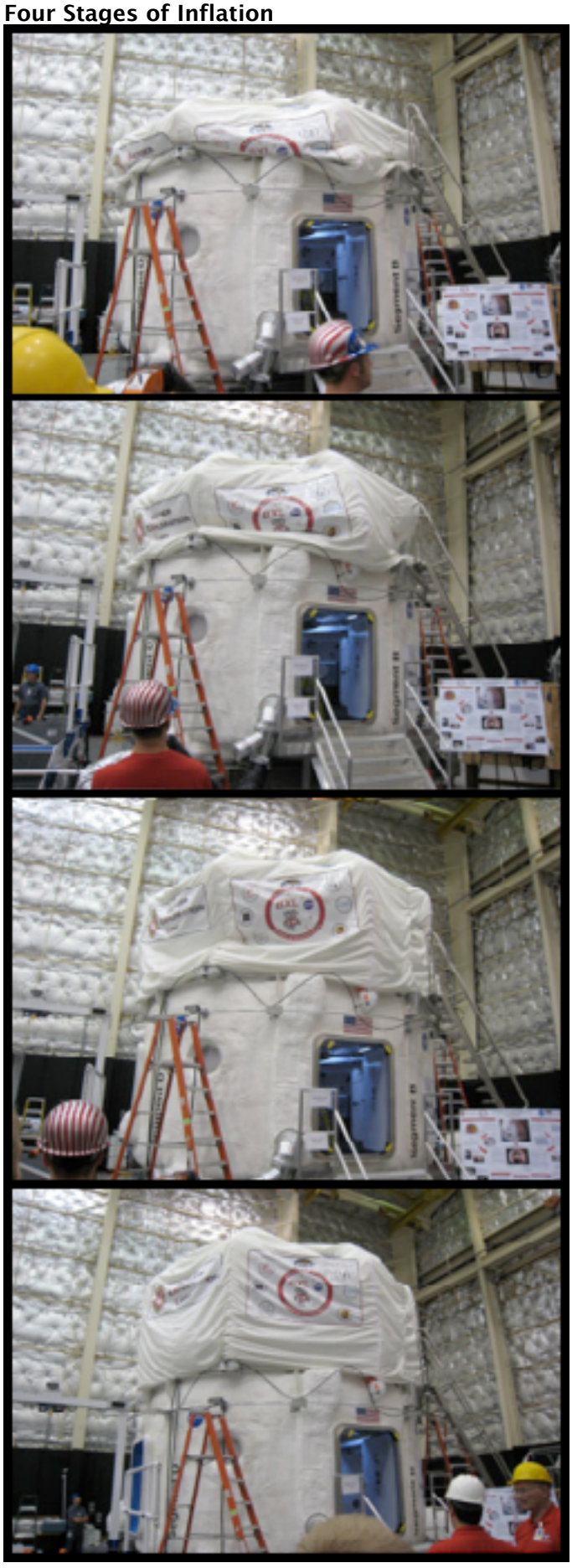
The team will take its inflatable space loft to NASA's annual **D**esert **R**esearch **&** **T**echnology **S**tudies (**Desert RATS**) field test in Arizona in September. It will be tested as part of a simulated astronaut mission to an asteroid. According to the judges, the 14-member University of Wisconsin team's design held promise ***for habitability and application*** to the Desert RATS mission simulation and ***was ready for field use because it had little leakage in the inflatable systems.***

Editor's Note: The habitation unit is basically "big dumb volume" for which the interior outfitting can also be collapsed and compacted for shipping. As a result this 2-story hab ships as a story and a half, so to speak, less volume and less weight, thus in space by a smaller rocket with less fuel. Latest News (9/5/2011:

www.spaceref.com/news/viewsr.html?pid=38298

Now that **Bigelow Aerospace** has demonstrated the **TransHab technology** licensed from NASA, the Agency (and BIgelow Aerospace as well, we suppose) are taking a second look at the considerable adaptability of such a construction architecture, with **hybrid rigid-inflatable combinations showing the most promise** - "the best of both worlds" as well as a way to reduce costs and timelines appreciably. We will see more such combinations in the future. **MMM**

Four Stages of Inflation



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!

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bobriverwest@yahoo.com ... 414-372-9613

LRS News

Our annual December Anniversary/Holiday Party – this year #25! - will be on Saturday December 10th :

√ **A PIZZA POTLUCK:** this year everyone is requested to bring **a 12" pizza (non-rising crust, please!)** of whatever variety they wish – we will have at least 2 pizza ovens on hand, along with paper plates, etc. You may bring beverages also, as you like.

√ **New Exhibits:** Peter's wish list includes a lunar settlement interior wall section made of steel studs clad with fiberglass-faced cementboard – painting experiments using simulated moondust of various natural and steam-rusted shades in a sodium silicate medium – a 3-D model of a lava tube; We will be fortunate if even one of these is ready!

√ Take-home materials as usual

√ The Science-Fiction film "**Paul**" if DVD is out. If not, we will be showing the comedy "**Spaced Out**"

LRS Upcoming Events

Next Meetings Saturdays: 1-4 pm

Oct. 15th – Nov. 12th – Dec. 10th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA:

- Update on new Exhibits to debut as Anniversary Party
- Update on our challenged Non-Profit Status
- Discussion of the usefulness of a Chapter 1-Day retreat to plan outreach and growth for the coming year. This has become an annual event for the San Diego chapter. Granted San Diego has a space museum and several other assets it can leverage that we do not. But our chapter has been stuck in a ho-hum rut for too long, and perhaps some of us might brainstorm opportunities starting with a clean slate.

News & Events of NSS "MMM" Chapters

Space Chapter HUB Website:
http://nsschapters.org/hub/

Feature Page: Project Menus Unlimited
http://nsschapters.org/projects.htm

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@comcast.net
(LBRT – Oregon Moonbase) moonbase@comcast.net

* **Meetings 3rd Sat. each month at 2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, downstairs
October 16th, November 20th, December 17th

MINNESOTA

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

David Buth (w) (612) 333-1872, (h) (763) 536-1237
Email: info@mnsfs.org
www.mnsfs.org/

MN SFS 2011 ñ Year in Review
http://www.mnsfs.org/2011-Review/

Schedule of upcoming MNSFS Meetings
Monday October 10th
Monday November 14th Board Elections meeting of MN SFS 31st Anniversary & Planning for 2012
Monday December 12th

ILLINOIS

Chicago Space Frontier L5
610 West 47th Place, Chicago, IL 60609

Larry Ahearn: 773/373-0349 LDAhearn@aol.com

WISCONSIN

Sheboygan Space Society
728 Center St., Kiel WI 54042-1034

c/o Will Foerster 920-894-2376 (h)
astrowill@tcei.com
SSS Sec. Harald Schenk hschenk@charter.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 Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI ● **October 21st**

Note: In December, in lieu of a meting in Kiel, we will travel to Milwaukee on **Saturday, December 10th** to join the Lunar Reclamation Society for its annual Holiday Party and this year, its 25th anniversary.
(see previous page for party details)ç

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113
http://www.angelfire.com/space/frl5/

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings 6:00 PM on Thursdays
October 13th, November 3rd, December 1st
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

CALIFORNIA

San Diego Space Society
http://sandiegospace.org/
info@sandiegospace.org

Meeting the 2nd Sunday monthly
Next Board Meeting: Sept 22nd 1-3 pm
Space Travelers Emporium
947 30th St. San Diego, CA 92102

Agenda: SD Space winter activities, including the SpaceUp San Diego, the Emporium "2012 Collection" show, SD Space Officer and Board elections and the start of our new space programs and activities.

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/wordpress/

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

Regular Meeting 3 pm 3rd Sat. each month

Next Meetings: Nov 20th, Dec 11th, Jan 21st

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

Nov. 19, 3pm - OASIS Board Meeting at Home of Steve Bartlett and Tina Beychok, 7108 East Peabody, Long Beach, CA 90808

Nov 25-27 - LAX Marriott - LOSCON 38
http://www.loscon.org/38/
"Where's My Flying Car?"
Come join is for this annual science fiction con.
Writer GoH: John DeChancie
Artist GoH: Aldo Spadoni
This year's theme is, of course, *SCIENCE*

Science GoH: Rick Searfoss, USAF Colonel, USAF Retired. Searfoss became an astronaut in July 1991.

He served as pilot on **STS-58 Columbia** (October 18 to November 1, 1993) and **STS-76 Atlantis Shuttle-Mir SpaceHab** mission (March 22-31, 1996), and was the mission commander on **STS-90 Columbia** Final **SpaceHab** mission (April 17, to May 3, 1998).

Searfoss retired from the Air Force and left NASA in 1998. (Prior to the ISS Era)

Dec 10, 3 pm OASIS Board Meeting,
Holiday Potluck to Follow - Home of Bob Gounley and Paula DelFosse, 1738 La Paz Road, Altadena, CA

What is needed is not a one-time sprint to a nearby planet, but a slow, patient expansion away from Earth, a long-term program, perhaps taking a century to complete. - That woud equip us not just for a single interplanetary joy ride but for the coordinated exploration of the deep solar system.

- Isaac Asimov ,
"lost in Space" Discover, January 1988, pp. 18, 20

PENNSYLVANIA

NSS Philadelphia Area Space Alliance
928 Clinton Street, Philadelphia, PA 19107

c/o Earl Bennett, Earlisat@verizon.net
856/261-8032 (h), 215/698-2600 (w)
[http://pasa01.tripod.com/]
http://phillypasa.blogspot.com

● **NSS PASA** regular business luncheon/formal meeting 1-3 pm, the 1st Saturday of every month unless otherwise noted, 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. Call Earl/Mitch 215-625-0670 to verify all meetings.

Next Meetings: Saturdays, Oct 9th, Nov TBD

The NSS PASA Report for September 2011

Name Change and October meeting location: Due to IRS requirements recently passed we had several options to retain our 501C3 status. On weighing the options, and consulting with Michelle and on this (after pointing out the need to members and asking for feedback at a monthly meeting), I chose the middle option of the choices, changing our group name and getting a tax EIN number for our group. Michelle knew how to apply for this and we quickly had what is required to be part of the NSS in good standing.

As to our next meeting: Mitch is working with The Franklin Institute for an October outreach event and informal meeting during World Space Week events. This would be Sunday October 9th that we are working towards.

Meeting notes: we had a good meeting with new member, and technology blogger, Laura joining us again, and Michael Stewart, a former member, attending along with our regulars and Steven, who has recently renewed, in attendance. A wide variety of non-space topics where discussed, pre meeting, and then we had some post meeting catch-up as well. Ecology, Theology, and History, anyone? However: we did also discuss the shuttle's last flight again, and this lead to our regular reports:

Dorothy reported that the Rose Center (in New York) will have "Beyond Planet Earth: The Future of Space Exploration" from November of this year to August of next year. It will include a full size model of a lunar habitat and a model of a Space Elevator (scale?). And lots more! The Rose Center is affiliated with The American Museum of Natural History. And: the shuttle Enterprise is coming to the Intrepid! And the Make Fair will have happened. We may get a report on this next month.

Larry has changed our website to reflect our new name, and has recounted our hit rate average of 500 a month on our site. We had some discussion of the fate of our Facebook page, and, where we have been relocated.

Hank reported on the Philcon coming in November (18 to20). It will be at the Cherry Hill Crown Plaza again. Hank has misgivings on this site due to location problems for non-drivers, and the cost of the venue. As participants we discussed alternatives to suggest to the planning committee, but came to no recommendation for them.

Mitch brought quite a bit of material on a number of topics and free Ad Astras! We had several new people with us so this was timely. He also talked of our October activities at the Franklin Institute and his plans to contact Derrick Pitts, at the Institute, for us. He also told us that we are invited to present at the 2012 Science Festival that the Institute is a major part of. In addition, he told us of his future attendance at The Mufon Conference in October. He has a rather open mind, and, Lauren may go as well. For those members who have not received it yet, he brought in the latest Moon Miners (August) with the Von Braun era habitat and winged, nuclear, space ship. Ah, youth! Lauren asked a relevant question: "What is the overreaching reason that people want to go into space?" Well?

Earl brought a number of technical publications, from NASA Tech Briefs, for articles on 670 ghz imaging radar (pg. 25), 120 ghz low noise (when cooled to 30 degrees K), and a host of other great reports on experiments involving microwave tissue welding (pg. 40) and Robotic Scaffolds for Tissue Engineering and Organic Growth (pg. 43). August issue. Microwave Journal, for August, was a special Sat-Com issue, with articles on very high efficiency microwave amplifiers, using Gallium Nitride, which could be used in space (a Venus probe comes to mind: GaN works at about twice silicon's maximum usable temperature). *And much more …*

Then we have Laser Focus World for August, with "New Adaptive Optics system at Lick Observatory uses MEMS (micro electro mechanical devices, pg. 51). If this is not a familiar technology to you, consider that micro mechanical deflectors are used for digital light projection TV. In the telescope case the problem described is scaling the arrays and shifting hat wavelengths the correction system operates at. The new design will allow corrections into the visible wavelength range (earlier designs where infra red parts).

The only problem with tech material is the range of topics! And finally: I gave a talk for PHACT, on September 17, at Community College of Philadelphia. PHACT is: The Philadelphia Association for Critical Thinking. The topic was "The Search for Extra Terrestrial Intelligence." There where fifty or sixty people in the audience, and Michelle helped me with the logistics of the presentation. Becky, of the PHACT group, introduced me and presented me with a bottle of imported wine as a gift from the group for speaking. I enjoyed the extended Q&A, and after event talks, with the students and group members.

Submitted by Earl Bennett.

Moon Miners' MANIFESTO

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

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- **$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*
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Hardcopy MMM: U.S. & Canada **$35** – Elsewhere: **$60**
P.O. Box 940825, Plano, TX 75094-0825, USA

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Send proper dues to address in chapter section

> *For those outside participating chapter areas* <

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- US **$55** Surface Mail Outside North America

Payable to "LRS", PO Box 2102, Milwaukee WI 53201

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- $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
- $15 low "one rate"

MINNESOTA SPACE FRONTIER SOCIETY
- $25 Regular Dues

OREGON L5 SOCIETY
- $25 for all members

O.A.S.I.S. L5 (Los Angeles)
- $28 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE
- Annual dues for all with MMM $25, due in March or $6 times each quarter before the next March

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SHEBOYGAN SPACE SOCIETY (WI)
- $15 regular, • $10 student,
- $1/extra family member

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