

Moon Miners' Manifesto

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In FOCUS: Crew Exploration Vehicle

When NASA designed the Space Shuttle Transportation system, It was an integrated package that left little room for private enterprise to offer competing components that would plug into the system at various points. Only SpaceHab, which designed and built an "extra pressurizable space" module that could fit inside the Orbiter's payload bay, was successfully able to piggyback on the System.

Yes, there have been many designs for "shuttle-derived" vehicles, the new parts of which might have been provided by private enterprise, but despite a host of suggested uses and applications, no company succeeded in coming up with a business plan that was workable enough to attract the necessary venture capital.

The Shuttle was supposed to be reusable and economical. After it went through the political meddling and design by committee, we had neither. It was "overhaulable" and extremely expensive to fly and turn around.

Now that a decision (yet to be seconded by Congress) has been made to replace the aging shuttle fleet with a "Crewed Space Exploration Vehicle, the CEV, we have the unique opportunity to design the CEV infrastruc-

Modularity Brings Opportunities

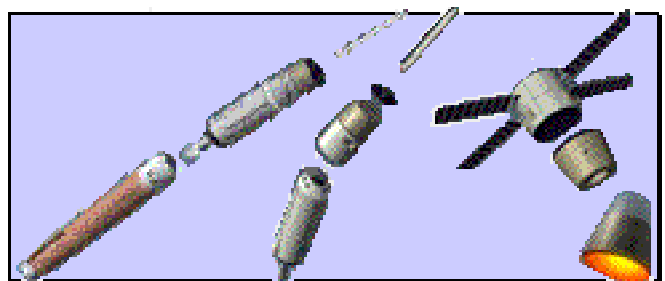
ture in a way that would invite private enterprise to plug in at various points with new and improved designs for the various CEV modules..These include the two-stages of the expendable launch vehicle, and the modular parts of the Crew Vehicle itself. To make this possible, NASA must:

- **carefully design the interfaces** between the various components to make it easy to substitute, new and improved modules at every point
- **publish the specifications** of this interface infrastructure so that any company capable of designing and building alternative vehicles with greater capacities, and more attractive design features, could do so.

What are the possibilities? More powerful launch boosters, enabling larger and heavier Crew Cabin modules for more ambitious missions. Bigger Crew Cabins could carry larger crews and/or more supplies and provisions for longer deep space missions. Such developments would lead to for-profit missions with vehicles configured with fully compatible hardware, something essential for repairs, rescue, and salvage. By this design route and strategy, a CEV common infrastructure could lead to for-profit missions to the Moon and nearby asteroids. - Editor

The Proposed Crewed Exploration Vehicle

Lockheed-Martin's Crew Exploration Vehicle will include a Crew Cabin with no attached payload space - cargo would fly separately. The wingless capsule would return to Earth much as did the Apollo Program's Mercury, Gemini, and Apollo capsules, using a ballistic trajectory, simple replaceable ablative heat shields, and parachutes for at-sea landings. Well-proven technology..



Sub-Selene Aesthetics and Lunar Resource Usage

by Dave Dietzler < Dietz37@msn.com >

[**selene**: Greek equivalent of Latin Luna]
[**sub-selene**: below the lunar surface, as in lavatubes or regolith-shielded habitats]

Finding the elements in the regolith to perk up habitats

Having studied the element abundances reported in the moon rocks sampled from several locations explored by the Apollo Astronauts, I have the utmost confidence that we can get volatiles (Hydrogen, Carbon, Nitrogen, Sulfur, Helium, Neon) and iron [Fe], Titanium, ceramics (titania, cast basalt), glass, cement, Calcium metal, Aluminum, Magnesium, Manganese, Chromium, sodium [Na], potassium [K], Phosphorus, and traces of Zinc, fluorine, Chlorine and a few other elements from regolith using processes that I and others have described. We can make steel from iron, magnesium, chromium and carbon extracted on the Moon.

Polished steel can be shiny, but most of these materials are rather gray. What about materials that are pleasing to the eye? We can use the Mond process to get traces of nickel and cobalt from iron fines. We must have cobalt to tint glass blue and make sodium silicate based azure paint for artworks. If there are Sudbury [Ontario] type impact sites on Luna we can get copper [Cu], gold [Au], Platinum, Selenium, Nickel, etc. Many of these metals can be used to tint glass and serve as paint pigments. Copper and gold have a beauty of their own.

The problem we might run into is a shortage of hydrocarbons to make chemicals and paint. Many decades after our first outposts, we will build sub-selene towns in lava tubes with bricks and cement blocks, pour concrete floors, make glass walls and windows (some of tinted glass), glass and metal doors, glass fiber cloth drapes tinted with metals, sheetrock and plaster walls.

Our need for a good range of colors

But what about color? We don't want the place to look like an underground prison or hospital. Peter Kokh has suggested flowers, green plants, birds, small fruit trees, goldfish ponds, aquariums, etc. He has also experimented with sodium silicate ("waterglass") based paintings done on glass. [see MMM #s 77, 80 - July, Nov. 1994 "Waterglazing" - www.lunar-reclamation.org/page15.htm] These and some tinted glass could really brighten the place up. Just a little bit of tinted glass is needed to make colored flood lights and light diffusers, so we should be able to create a variety of color effects covering large areas with lights. Neon signs and lights are also possible. [MMM #43 March '91 "Nightspan"] The world within the Moon might have the flavor of nightlife as well as the energizing effect of bright sunshine funnelled in through light pipes. [MMM #66 June 1993 "Let There Be Light"]

Brick and cement blockwalls don't need to be so grim. They can be covered with plaster. We all like stucco. We can also take clear glass, aluminize it and make mirror tiles to cover inner and outer walls. Steel and glass skyscrapers, like the Equitable building here in St. Louis, are often made of mirrorized glass and they look terrific. We could build mirrored palaces within the Moon.

We can still produce latex paint with volatiles harvested while He-3 mining. From 30 billion tons of regolith, an area about 100 kilometers square mined to a depth of one meter, we can get 300 tons of Helium-3, a fusionable isotope scarce on Earth but relatively abundant on the Moon, enough to power the Earth for a year. As byproducts of that mining process, we can also get 1.2 million tons of hydrogen, 3 million tons of nitrogen and 6 million tons of carbon. That should be enough to make quite a lot of plastic, paint, dyes, and other products.

If we emphasize the use of polished metal, stucco, mirrors, tinted glass, colored lights and living things to add color and make attractive interiors and ("middoor" exteriors), we won't have to make so much paint and we can use our precious H, C, and N for more important purposes. Latex paints formulated with a high percentage of volatile organic compounds (VOCs) for fast drying, cause many indoor pollution problems. Fortunately, in the past decade, Low-VOC paints have become available everywhere from the web to your local paint or hardware retailer. Manufacturers of low-VOC paint include Benjamin Moore, Sherwin Williams, Martha Stewart, Dutch Boy, and many more. Such paints might be used in lunar habitat interiors where others would pose major headaches, literally and figuratively.

We could use colored ceramic tiles on walls and floors as well as previously described ways of adding color. [see MMM #76 June 1994] As a clue to what elements we would need for metal oxide-based ceramic glazes, see:

<http://digitalfire.com/oxide/oxprops.htm>

We may not want to go overboard with color and become gaudy. Overall, blocks, mortar, concrete, sheet metal and glass will create a sort of industrial decor like that found in pricey loft apartments built in old warehouses and factories. [MMM #s 146, 147 (June, August 2001 "Urban Lofts & Settlement Style")]

Until we return to the Moon and explore some sub-selene lava tubes, we won't know what charms nature has in store for us that will help us make things interesting. But we already know enough to be rather optimistic.. <DD>

From Back Issues of MMM

Back in 1994, we took up many of these topics in MMM #s 74, 75, 76, 77 - April, May, June, August - *not yet online*.
#74 Visual & Solar Access #75 Modular Hab Architecture
#76 Interior Walls and Surfaces (available materials & treatments) & "Trimwork" (substitutes for woodwork)
#77 Upholstery fabrics, what to hang on walls

Experimental Lunar Rockets

by Dave Dietzler < Dietz37@msn.com >

Burning Lunar Aluminum in Liquid Lunar Oxygen

Several ways to burn lunar aluminum and LOX in rocket motors have been proposed. Some have suggested a roll of sheet aluminum or foil, wire mesh or a hexagonal array of aluminum bars in a hybrid motor. Aluminum dust and LOX have been mixed up to form a monopropellant.

My suggestions have been aluminum beads fused together at the edges or aluminum dust in a binder of metallic calcium in a hybrid motor. The calcium makes the aluminum more "friable" - able to remain in powder form.

Real situation testing is needed

All these ideas need extensive testing not only here on Earth but in the vacuum and weightlessness of space and in the low gravity of the Moon. Fire burns differently in microgravity. Solid fuels that might slog out of the rocket nozzle on Earth might stay in place in low lunar gravity or in space. LOX / aluminum mixtures might separate in a gravitational field but remain suspended in "zero-G."

Rocket motors using aluminum dust suspended in crystalized sulfur, molten sulfur and LOX or molten sulfur and aluminum dust slurry are also worth investigating. A number of small experimental rockets should be tested at the ISS and at the future lunar outpost. Model rocket enthusiasts should get a thrill out of that!

Hydrogen assisted aluminum / oxygen combinations

Also of interest are rockets that burn a slurry of liquid hydrogen and aluminum and/or magnesium powder. A slurry of silane [SiH_4 , a liquid quasi analog of Methane CH_4 , silane could serve as a "hydrogen-extender"] and aluminum and/or magnesium is also of great interest.

We need hydrogen to make silane and there isn't much of it in regolith. From 100 million tons of regolith, enough to get one ton of 3He , we could get 4,000 tons of hydrogen. That's enough to make 32,000 tons of silane which would be burned with 64,000 tons of LOX. That's plenty for an early mining base, but it won't be enough for tourism! If we can make a slurry of SiH_4 , Al and Mg that is perhaps 25% to 30% silane by mass, we could greatly extend our hydrogen resources. If you compare two rockets, one using LH_2+LOX at 450 seconds and the other using SiH_4+LOX at 340 seconds you will find that the silane rocket uses as little as half as much hydrogen.

If there really is six billion tons of water at the lunar poles we don't have to worry about a hydrogen shortage for a long time, but it would be wise to extend our

hydrogen resources by making silane anyway. If we could make a slurry of silane and metal based fuels we could slash hydrogen demands even more. Silane has a much higher boiling point than LH_2 (-112 C. versus -253 C.) and is much denser (0.7 g/cc versus 0.07 g/cc), so it will be easier to handle, liquefy and store. Rockets running SiH_4 will have smaller fuel tanks than rockets on LH_2 and this will allow a better mass ratio.

I wonder about the reliability of Al+LUNOX burning hybrid motors. The aluminum fuel could literally fall apart and that would be catastrophic. If we use alloys of aluminum and magnesium which have much lower melting points than either of the two metals they are composed of, things will be entirely different. Since there is so much magnesium in regolith we want to burn it if we can.

Iron, silicon, and other fuel options

Iron is plentiful and available in powdered form. But it has a very low heat of combustion and the exhaust product is very heavy so iron may not make a good rocket

fuel for space vehicles. But powdered iron has been proposed by several investigators as a rocket fuel for lunar "hoppers" shuttling in ballistic hops from one location on the Moon to another. Iron oxide

powder would be the rocket exhaust from such an engine.

Silicon is abundant and it burns with as much heat as aluminum but is harder to ignite and keep burning. Alloys of magnesium, aluminum and silicon must be investigated. So we have a variety of substances to experiment with.

The silane plus LUNOX rocket should be reliable even in a gravitational field. The SiH_4 , Al, Mg slurry might sludge out in the Moon's gravity. It might do the same thing under acceleration in space. Maybe an in-tank agitation system could prevent that. Perhaps a system using metallic powders flushed into the motor by gaseous silane rather than a slurry fuel would be superior.

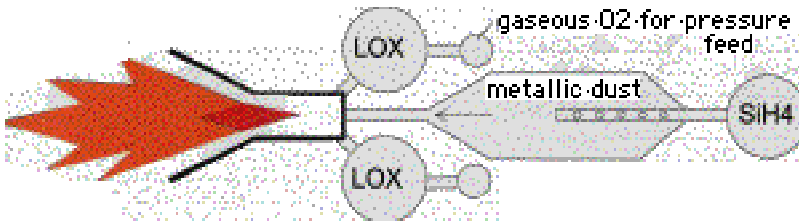
Time for down and dirty homework

The rocket jocks have a lot of research ahead to keep them busy in the future. Perhaps some of these fuel combinations could be safely investigated as part of science projects, certainly in College and University Engineering Departments. Now if only we could come up with an X-Prize type incentive for the most promising demonstration! Availability of all lunar fuels minimizing hydrogen would advance the attainment of economic breakeven . < DD >

Back Reading from MMM issues past:

"Bootstrap Rockets" MMM #6, June 1987

<http://www.asi.org/adb/06/09/03/02/004/bootstrap.html>



Silane carrier gas / powdered metal base fuel rocket motor

A Return to the Moon the Right Way: to Set up a Self-Sustaining Settlement

by Bill Avery <avery6709@comcast.net >

It's all about Financing

A lunar civilization will be financed through the work of the individuals living there. Initially, a self-sustaining settlement must be able to survive and grow utilizing 90% of the labor available from the inhabitants. The remaining 10% will provide labor for products and materials to be exported in exchange for Earth specific items and materials.

Preparing the way for success

Creating this type of settlement will require some preparation work. First there needs to be an infrastructure created that will allow for self-sufficiency. A private industry or a government industry can create this infrastructure. Until a clear profit motive is realized, the private industry probably will not fund such an endeavor. The government, on the other hand, has deep pockets to create such an infrastructure. In fact, NASA's new directive by President Bush should lead to the development of this initial infrastructure.

The infrastructure needed includes transportation to and from the Moon as well as on the surface. Pressurized and unpressurized living and work areas need to be constructed along with regenerative life support systems for the settlers. An assortment of tools and manufacturing equipment would be needed to repair and create all of the required machinery. Finally, a means to utilize raw lunar materials in the expansion of the settlement will be required.

A Critical mass of pioneers

My estimate is self-sufficiency will be practical with as few as 150 individuals. These people would be highly trained and motivated. From a financial viewpoint, people are the ultimate currency. They are the ones creating the products and services civilizations operate on. Money is something you need when you cannot create the products or services on your own. Given the skills, tools and raw materials any settlement can be self-sufficient and grow.

Details can be worked out with settler input

The details of the settlement buildings, the life support, the work areas, the tools, etc. are not discussed at this time. These details are not needed to discuss the 'why' of going to the Moon. They provide the 'how' of going to the Moon. In my life as an engineer, project manager and reactor operator, I could spend years on these types of details. However, concentrating only on these details will not get humanity to the Moon. This article answers some questions regarding the funding of such an endeavor.

When the initial infrastructure is in place and the settlers can maintain a good life style on the lunar surface,

the settlement can then begin to grow and prosper. Remember that people create wealth through the application of knowledge to resources. To maximize the use of the established infrastructure, operations need to be conducted around the clock. This results in five (5) crews being dedicated to a specific activity working 40 hours per Earth week. This will allow the settlers 128 hours per week for personal time, which may include the creation of personal wealth through moneymaking projects.

The settlement will utilize a small percentage of service personnel to maintain the life support, facilities, and general infrastructure. Working around the clock in 8 hour shifts will require 5 crews of 3 people each, or 15 Engineers/Technicians. Generally, power production and life support will be highly automated. The technicians will provide troubleshooting and repair with little operational duties.

Manufacturing and construction will require the lion's share of the personnel. A crew of 10 individuals can produce building materials in a small steel/glass/aluminum mill. Another crew of 5 individual would turn these materials into products needed by the settlement or for sale to other parties. These two groups would add 75 settlers to the lunar settlement population.

The addition of a staff of 10 administrative personnel would round out the settlement to an even 100 people. To perform science on the Moon, explore for new resources, and create an export aspect to the settlement, I propose an additional 50 settlers. These 150 highly trained and motivated people will provide a large labor pool to draw on to ensure the success of the settlement. Individuals can be diverted to emergent issues as needed to ensure the survival of the settlement. In worse case situations, the entire settlement could work 12-hour days for several weeks to address emergency conditions. This would provide 12,600 person-hours per week, per shift to address any problems.

From Survival to Prosperity through Enterprise

After the maintenance of the settlement and the expansion of lunar infrastructure are addressed, there is the opportunity to create wealth in Earth terms. By this, I mean provide goods and services to the people of the Earth. An example of this would be to create a hotel for visiting scientists, explorers, government officials, and yes even tourists. The creation of additional infrastructure to support specific science projects for governments and private industry would also bring in Earth currency. The credit earned by these activities would be used to purchase items only available from Earth. An example of this might be electronics.

On the Moon, any type of industry could be set up. Many dangerous or undesirable manufacturing processes could be moved to the Moon. These could include genetic,



chemical, biological, and weapons research, manufacturing and testing. As the settlement grows, the construction of spacecraft and support equipment could also become a major industry. The settlers would use the ships for expansion on the Moon, resource retrieval and travel to Mars. They could also sell the ships to governments and private industries.

An additional source of income would be in the form of electronic information. Discoveries on the Moon could be patented and beamed back to Earth. Internet connections could be easily established between the Earth and Moon providing a number of services to both the settlers and Earth. On their own time, settlers could use the Internet to 'work from home' on the Moon and provide services to Earth bound industries.

The creation of products for sale on Earth is a real possibility. The discovery of resources not easily found on earth could provide a justification to ship products to earth for profit. Products could be packaged into a container and sent to earth by using an O'Neil mass driver.

As a final note, the Moon could become the retirement paradise of the solar system. At 1/6th Earth's gravity, elderly people could find a new life in settlement building. Their bodies would no longer be a hindrance in maneuvering around and contributing to the expansion of human civilization.

The Facilitating Role of Governments


The creation of the initial infrastructure is the key to the development of the first permanent human settlement on the Moon. The governments of the world should provide the initial transportation system, habitats, manufacturing equipment, tools and talented settlers for this great endeavor! The return to the world will be beyond expectations as humanity moves out into the solar system.


I urge you to contact your political representative and ask them to support this new goal oriented mission for NASA as set forth by President Bush. If we do not push for a lunar settlement now, we may not get the chance again in our lifetimes. Remember, humans have not been to the Moon for 32 years. There is no guarantee we will ever make it there again. We must make our own future.

You can contact your President, Vice-President, Senator and Us Representative at the following web sites:


- <http://www.house.gov/>
- <http://www.senate.gov/>
- <http://www.whitehouse.gov/>

BIO: Bill Avery is a registered Professional Engineer in the State of Ohio and has supported space development most of his life. He is also one of the founders of the Midwest Space Development Corporation (MSDC), The Cuyahoga Valley Space Society (CVSS), and EXITUS, Inc.

 PASADENA, CA. An unnamed source connected with the NASA-Caltech Jet Propulsion laboratory, has leaked that the Mars MER Rover **Opportunity** has stumbled upon markings on a flat piece of exposed bedrock that at first blush look like Rune inscriptions. NASA mindful of the hullabaloo over the Mars Face, now shown to be an optical illusion, points out that it would be an incredible coincidence that we landed at an inscription site, ("Why there out of 57 million square miles") unless they are everywhere, which would of course suggest a natural explanation. Opportunity 's instruments do not include any that could shed light on the age of the markings.

 GOLDSTONE, CA: Operators of the NASA radio telescope here, are now certain that **Voyager I's** trajectory is being perturbed - the deviation from the trajectory it had been on was first detected in May 2003 but by early this year had become clearly larger than any margins of error. Narrowing down the "focus" of the perturbation and hence mass of object requires triangulation, and there is not yet enough data to do this. There is an infrared object in that direction but no one is sure if it is relatively near to the probe or in distant background - the infrared object has not been known long enough for observers to track its proper motion (motion perpendicular to our line of sight, though its radial velocity in the direction of sight is low enough for it to be a solar system object. But then, to give off that much heat it would have to be a gas giant which we should have detected.

Still functioning, Voyager 1 is now 13.5 billion km (8.4 billion miles) from the Sun, or 90 times the distance separating the Earth from the Sun."if nothing breaks, we can continue till 2020. Voyager 1 is speeding away from the Sun at 3.50 AU/year toward RA= 262 °, Dec=+12 °in the constellation Ophiuchus. On 17 Feb. 1998, Voyager I became the most distant man-made object from the Sun

 **Burt Rutan/Scaled Composites (Pegasus, Voyager, Space Plane One)** has announce its intention to bid on any Lunar outpost habitat modules, should the Bush Moon/Mars plan be approved by Congress. The company believes it can offer lighter weight per volume, allowing fuller outfitting and/or larger modules. It is also interested in bidding on any inflatable structures involved in the outpost, including **TransHab** types.

In preparation, Scaled Composites is brainstorming potential terrestrial adaptations of these structural technologies.

MMM's 18th Annual Happy April Fools Day News

Modular Container Factories

to Industrialize Early Lunar Settlements

by Peter Kokh

[Thanks to Bryce Walden, Oregon L5 for the heads-up lead]

A fairly new project in aimed at Third World Development offers a model for systematic and relatively painless industrialization of early lunar settlements: mini-production plants in mobile containers, transportable anywhere, and ready to go once hooked up to the necessary utilities. This makes time consuming construction of production plants on location unnecessary, along with the inevitable delays in getting all the needed parts, and shaking down the system operations. It also obviates the expense of time-consuming custom plant design. Most importantly, it saves labor time from plant construction and speeds up availability of product production both for the local (lunar settlement) market and for income-earning export, in the case of products in demand at other in space locations (low Earth orbit, Mars-bound freighters, etc.)

The plants use tested fully debugged designs, can be test-operated before shipment, and are modular. If you need to double production, you just gang another module alongside or in series. And they are sized just right for adaptation for shipment to the Moon and other space locations: 40 feet (13 meters) in length, and on wheels - just right for a shuttle-sized payload bay or cargo hold. Worldwide Partners SN World Foundation is the outfit responsible - www.world-foundation.org.

We'd want to do some brainstorming to get our priorities right in designing the plants needed first, i.e which are prerequisites for others. But the whole container plant idea seems quite versatile given the list of those already being manufactured for Third World use. There are an amazing 700 different portable units currently in use.

Just a few of the many varied container factories

Give an idea of the great versatility of this system:

Biosphere & Prepared Foods - Water purification

Bakeries - Dehydrated food - Fruit juice preparation

Construction Materials - Aluminum Buckets

Reinforcement Bar Bending for Construction Framework
Steel Nails - Sheeting for Roofing - Ceilings and Façades
Construction Electrically Welded Mesh - Plated Drums

Synthetics - Injected Polypropylene Housewares

Pressed Melamine Items (Glasses, Cups, Plates, Mugs, etc.)
Plastic Bags and Packaging

Vehicular Equipment - Tire Retreading - Mufflers

Medical & Health Equipment

Medical assistance mobile units - Sanitary Material
Hypodermic Syringes - Hemostatic Clamps, etc.

Adapting the Container Plant Concept for the Lunar Frontier

What seems especially appropriate about these mobile modular container factories are these two features:

- a uniform compact size, one that would fit in a shuttle orbiter payload bay or could ride to space in a faring atop many of today's expendable launch vehicles.
- that you need only plug it into the needed utilities, feed in the needed raw materials, and start producing

Lunar Industrial Parks Made for Container Factories

That the plant comes in a container is logical, as the walls are attachment points and support for equipment. For lunar adaptation, you could provide a pressurizable container, but on reflection there seems a better idea: use the containers as they come, but place them in a host pressurized industrial park volume, outfitted with utilities and stalls and aisles for service vehicles, supply of materials and removal of products. If we take this approach, some of these mobile container factories might be usable on the Moon as they are. After all, it is clearly inefficient to duplicate systems that can easily be shared.

Situating these container factories within such a host complex offers additional advantages:

- Container Factories requiring the same raw materials can be clustered together
- Clusters could also be based on similar by-products that need to be stored separately for recycling / reuse
- Clusters could be based on a thermal cascade with the plants running at the highest temperatures at one end, the coolest at the other, so that waste heat from one can be used in the next.

The host "industrial parks" could be modular in themselves. As the settlements diversify their industrial capacities, there will be need for more such parks.

Shielding these sizable and expandable industrial parks could be a challenge. If the settlement was placed with foresight near an intact lavatube, that would be ideal. Such a volume could easily house inflatable and other "less-fortified" structures safely, as well as the supply infrastructure needed to keep everything running, plus, and this is a big plus, all the sheltered warehouse space for products waiting shipment to market, whether that be for domestic settlement use or somewhere off the Moon.

A supporting consideration is that lavatubes are most frequent near mare/highland coasts where both the most common suites of lunar materials are readily found. Locating a settlement at one of the poles would almost certainly squelch any chances for industrialization and thus for export-import breakeven, the key to permanence.

What Container Factories should come first?

There are several guidelines here in developing a plan for quick and timely industrialization of the lunar settlements - and timely is the operative word. Until the

frontier economy reaches a point where the pioneers can earn enough from exports to Earth (other than energy products and souvenirs, not much) and to other "in-space" markets (low Earth orbit space stations, industrial parks, and tourist clusters - and the early Mars frontier) to pay for the importation of those essential goods and materials that they cannot yet produce for themselves, the lunar settlements will remain "tentative" and vulnerable to the vagaries of economics and politics on Earth. The longer that "permanent human presence" remains subject to such outside irrationalities, the more likely it is that something will develop to force an end to the dream.

The guiding considerations would seem to be these, and *they do not neatly coincide*:

- those products needed for domestic lunar use in the largest per capita total mass, will be most helpful in reducing the cost burden of importing them.
- some products / capacities are prerequisites for the production development of other products / capacities
- products that help build habitat space and utility infrastructure should have priority over those that supply only creature comfort.
- tools production is more important than product
- arts & crafts tools and materials are essential for overall morale because of their capacity to generate a feeling of being "at home" on this challenging world.

The lunar industries dependent on the pulverized regolith surface blanket for raw material that seem easiest to jump start are sintered powdered iron products and cast basalt production parts some of which will find immediate service in materials handling systems. Earliest possible oxygen production is also essential. Beneficiation systems that produce "regolith extracts" enriched in various needed elements will have to be right up there. Surely, glass-glass composites industries requiring less refined raw materials will be an early mainstay. Beyond that, the paths of industrial diversification merit big time ongoing brainstorming by diverse teams of exports.

Humans do not live by Processing & Manufacturing alone

We can also make immediate use of Container Water Recycling & Purification "factories." And to supplement early garden to mouth menus, container factories that produce bread and other basic prepared menu and recipe products will be in demand as soon as the number of people in the settlement is large enough to benefit.

Early domestic products will include glass, glass composite, cast basalt and ceramic tableware and furniture items to furnish new homesteads and make them livable. And this is not a trivial goal. Everything that can be used domestically, can probably be exported at a profit and at a competitive cost advantage to space markets such as LEO and elsewhere, especially if it is well and tastefully designed..

Other early products will be spare parts for vehicles and equipment in common use - certainly those parts that are not complex or sophisticated and do not have critical tolerances - dust fenders, to give one example.

Container Factories and Manpower Needs

While for their original purpose, industrializing Third World communities, automation would certainly be a low priority, for use on the lunar frontier, the opposite is true. On all frontiers in human experience, there has always been more work to do than people available to do it. Any of this container operations that can be automated will free pioneers to work that cannot be so easily disposed of.

Container Factories and Energy Needs

Some operations - cast basalt products, glass and glass composite products, ceramic products, and metal alloy production - require a lot of heat. Heat can efficiently be produced in dayspan by using solar concentrators. All operations will require some electricity, and the amount will vary greatly. Operations that are highly energy-intensive may have to be reserved for dayspan when more total energy is available whether the settlement has a nuclear plant or not. Those operations that have a labor-intensive element that can be conveniently separated out, can run in dual mode throughout the sunth, energy-intensive tasks done during dayspan, labor-intensive ones, such as routine maintenance, changeouts, packaging, inventory, etc. can be done during nightspan. Of course, not all operations will lend themselves so neatly to such an alteration of tasks.

Container Factories and Water Usage

If the settlement is located where the greatest percentage, tonnage-wise, of needed materials can easily be sourced, it will be along a mare-highland coast. Water can be produced by solar wind gas scavenging performed religiously as a part of all regolith handling operations: road construction, site grading and preparation, gathering material for processing plants, transforming regolith into soil for those crops that do better with soil buffering, etc. The regolith would be heated and the gas, mostly hydrogen but appreciable amounts of carbon, nitrogen, helium, neon and argon would be collected and separated. This operation is called "primage" and it sets the settlement up with resources it would not otherwise have.

If the settlement was placed as close as possible to the nearest polar permashade areas (craters over 20 km in diameter as far as 30° from the pole will do, such as the north coast of Mare Frigoris, it will be situated well for earliest possible start of those operations that there is no other way to do than with intensive water usage.

Summing up

It is clear that the Container Factory concept brightens the prospects for lunar settlements. We need to study this existing model, factory by factory, for adaptability to lunar settlement conditions. <MMM>

The Moon Society



JOURNAL

<http://www.moonsociety.org>

Please make NEWS submissions to KokhMMM@aol.com

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

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

PROJECTS:

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

- Artemis Reference Mission
- Artemis Data Book

Project LETO™

<http://www.projectleto.org/>

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

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

Join/Renew Online at

www.moonsociety.org/register/

Or mail check or money order to:

PO Box 940825, Plano, TX 75094-0825, USA

Please send all mail related to Memberships to:

The Moon Society Membership Services

at address above.

2004 Moon Society Elections

from Moon Society Elections Committee 2004 Chair

Amy McGovern < elections@moonsociety.org >

Dear Moon Society members:

It is time once again for annual elections of the Moon Society Officers and Directors. Both officer and director terms are for two years. The current list of Officers and Directors along with term expiration dates is found at:

www.moonsociety.org/about/officers.php3

The officers and board of directors would like to open the floor for nominations for the following positions:

- President - currently Gregory R. Bennett (retiring)
- Secretary - currently Amy McGovern (retiring)
- 4 Director positions -- currently Gregory Bennet, Peter Kokh, Michael Mealing, and Arthur Smith (retiring)

The responsibilities for each of these positions are described in the Moon Society bylaws (specifically pertinent are Sections V, VI, VII and IX) at:


www.moonsociety.org/organizing-documents/bylaws.html

For those choosing to step aside to regenerate and refresh, or simply to retire, we thank them for their years of dedicated service. Their decisions may encourage other talented persons to step forward. If you are interested in running for any of these positions, please do nominate yourself! If you know another member that you think would do a good job in one of these positions, please contact him/her to ensure that they are interested in the position before sending in the nomination. Alert the person in question to the need to compose a statement to be submitted to elections@moonsociety.org by June 15th.

The requirements for prior membership in Artemis Society International no longer apply. What does apply, is the requirement that a nominee have been a member of the Moon Society in good standing for at least two continuous years by August 1, 2004. Members with membership numbers of # 1211 or lower are eligible. Twice in recent years, the board has voted to waive this requirement for a member who has been an extraordinarily active contributor to the growth and development of the Society.

To nominate yourself or another, please send the following to elections@moonsociety.org (or mailed to "Moon Society Elections, P.O. Box 94082, Plano, TX 75094-0825, by June 15, 2004:

- Name of person being nominated
- Member number (if known)
- Position nominated for

Candidates should compose brief statements (less than 200 words) about the talents and vision they would bring to the position; to be included with the ballots. 

Outpost Indiana Travels to a Moon, Mars & Beyond Public Hearing

hwww.moonsociety.org/news/MMB-Dayton-2004-03-04-ms.html
By Board Member John R. Schrock

It was a 4 hour drive in the misty morning of Thursday, March 4th, to the Air Force Museum in Dayton, Ohio for a public hearing of the Moon, Mars and Beyond of the President's Commission on Implementation of United States Space Exploration Policy.

The second day had the Air Force panels, private industry, Senator and former Mercury astronaut John Glenn, Lennard A Fisk, Chairman of The Space Studies Board of the National Research Council and others.

This second meeting had 30 minutes in the time line for general public comments. While I saw only 20 or so slips in the bowl of people wanting a chance for a two minute slot, the luck of the lottery of 12 others, kept me on the sidelines.

One item that struck me the most, was Hewlett Packard Chairwoman and CEO Carleton Fiorina's comment and question on the concern of of some citizens when the military gets involved in any endeavor.

As I looked upon the commission members as they listened to the witnesses, I wondered if they shared one thought I had. On Wednesday March 3rd while I was at ASI-/MOO (on another rained out work day).

why we want to be included in any government big ticket spending program -- rather than what the charter of the commission was asking for, answers to the Presidents questions.

Maybe those of us who are more interested in the use of private commercial ventures may yet get a chance to to get a word in at one of the remaining hearings. <JRS>

John R. Schrock is in the building industry, a team leader and board member in The Moon Society, and A Scout Leader in central Indiana.



Getting "Plymouth" released to DVD

That is odd about non distribution by Disney of the video version because that is how I saw it - I wonder if someone else owns the video rights.

I hope to try from this end, perhaps other NSS members are interested in a DVD version - would be a great collectors item, as well as a Space Ed item.

Noel W. Jackson, Interim President
Queensland Space Frontier Society (Brisbane)

Volunteering for the Outreach Committee

"I am Robin Berlin. My husband is a Moon Society member and I have now joined also. I have volunteered for the Outreach Committee.

"I am a graphic designer with 14 years experience. I have worked on Mac, PC and Linux platforms. I am proficient in all major design programs including: Quark, Indesign, Pagemaker, Photoshop, Gimp, Illustrator, Freehand, and Acrobat.

"Though most of my experience is in print media, I have worked on website design and television commercials. I also am capable producing illustrations and artwork. In addition I am a professionally trained photographer.

"I have an office set up at my house to work from, and I am looking for projects to volunteer for, that I feel will make a difference. I can be reached by email at robinberlin@c-gate.net."

Thank you, Robin L. Berlin



Introducing a New Moon Society Flyer & Poster

http://www.moonsociety.org/spreadtheword/moon_society_flyer.pdf - 176.5 KB
[flyer_display_poster.html](http://www.moonsociety.org/spreadtheword/flyer_display_poster.html)

From Gregory Bennett < grb@asi.org >

The basic idea is to display the main body of the flyer on a poster about 2 feet wide and 3 feet high. I used the Cafepress large poster as a guideline as it is 23 inches by 35 inches. The picture, Fig.1, shows what the basic unadorned poster looks like.

There are several ways of mounting the poster all of which effect the manner in which the flyers are secured to the front. Probably the simplest way would be to use a flipchart easel and mount the poster on the easel with some carefully applied (and later, more carefully removed) tape. Then, using some cardboard, fashion a pair of open top, open front boxes to hold the flyers. Mounting these boxes on the pen tray of the flipchart easel should work adequately.

[EDITOR: I have had best luck mounting posters on light weight 1/4" foam core board available at your local office supply store (Office Depot, Office Max, Staples, etc.) or Artist Supply Store, and using Spray Adhesive rather than tape. These same office supply stores sell acrylic stands that are sized to hold a bunch of flyers - you could get two, one for the Moon Society Flyer, the other for a flyer on other Moon Interest topics such as upcoming Moon Missions, Lunar Resources, information about your chapter or Outpost and its projects, etc.

Hints for an effective Moon Society / Artemis Project Display

<http://nsschapters.org/hub/exhibits.htm>
----/hub/storyboards/sb_artemismoonbase.htm
----/hub/flyers.htm

Buy Moon Society Logo Items at www.cafeshops.com/moonsociety

The growing list of available items includes the following:

Apparel: Fitted T-shirt, tJr. Raglan Logo Shirt, Jr. Hoodie Logo Item, Baseball Jersey, White T-Shirt, Ash Grey T-Shirt, Golf Shirt, Long Sleeve T-Shirt, Jr. Baby Doll T-Shirt, Women's T-Shirt, Jr. Spaghetti Tank, Hooded Sweatshirt, Sweatshirt, Camisole, Infant/Toddler T-Shirt, Infant Creeper, Bib, Trucker Hat, Baseball Cap, Black Cap

Housewares: Large Mug, Mug, Stainless Steel Travel Mug, Stein, Mousepad, Wall Clock, Lunchbox

Print Items : Journal, Moon Society Wall Calendar, Mini Poster Print, Moon Society Small Poster, Large Flyer Poster

Surfing The Moon Society Website Be sure to visit the following

- Moon Society News
- Space News Links to top stories
- Information about the Moon
- Upcoming Conferences
- Mission Updates

MOON MISSION UPDATES

Keeping abreast of the Status of Current, Planned, and Proposed Missions is Easy

Thanks to Board Member Arthur Smith keeping up to date on what's in the works or on the drawing boards so far as Moon Missions go, is now easy. Simply go to the Society's website at www.moonsociety.org and look in the right hand menu bar for this link:

Missions @04-2004 (i.e. April 2004)

www.moonsociety.org/2004-kb/missions-2004-04.html

At the top of this page there are two links:

- Moon Society Lunar Mission Update (new and updated information highlighted)
- Previous versions of this update

Next are three handy tables to give you a quick synopsis of the available information

1. Missions Currently in Progress (1)
[mission | launch date | details | latest]
2. Missions Planned or Proposed (20)
[mission | launch date | details]
3. Completed Missions (2)

Get your Brainstorming Juices flowing! Visit "The Moon Miner"

<http://www.moonminer.com>

This site is the baby of Moon Society St. Louis sparkplug, and frequent MMM contributor, Dave Dietzler. The site's Main Menu Page is called the "L1 Space Nexus" and is the jumping off spot for Dave's brainstorming and imagineering of these vectors:

- RESOURCES
- SPACESHIPS
- SPACE TOURISM
- LUNAR TOURISM
- SPACE COLONIES
- STARSHIPS
- TERRAFORMING
- ROCKET PHYSICS
- POPULATIONS
- FUTURISM
- BEYOND MONEY

The test is accompanied with great illustrations. Dave welcomes any constructive comments, and you can reach him at < Dietz37@msn.com >

Moon Society Outpost Frontier Report

Brigham Young Univ. (Provo) Outpost dba BYU Space Development Club

from Jonathan Goff < jag42@et.byu.edu >

Just wanted to give a recent update of what's been going on. For the past month, we've mostly been focused on getting our catalytic torch igniter project started. This project is to design, build, and test a small, reusable rocket engine igniter. We're hoping to soon have a webpage up with some pictures and progress reports. In addition to the igniter project we've also had a fun discussion meeting two weeks ago talking about some of the current events in commercial space.

We've recently been made aware that student donations to the college are matched 5:1 by outside funds. This includes donations to clubs in the college. The club leadership did a fundraising project a week ago, and raised \$60 that we're going to donate to the club for the igniter project. With the matching funds this should give us \$360, which is enough to get a good amount of the raw material, plumbing, and some of the valves needed for the project. We're hoping to have all the rest of the funding needed to complete the project in place within the next two weeks.

So, if you haven't been able to come for the past little while, now's the time to come back! We're moving forward with the design, and will actually be making parts and putting this thing together. For more information, or to make a donation for the project, contact me.

NEWS: March 18, '04 - Today has been a very exciting day for the BYU Space Development Club. We received \$550 worth of funding from the BYU Engineering & Technology Student Council to help in the development of a restartable catalytic torch igniter system. Combined with funds raised by the club presidency, this brings our available funds to over \$600, which should be sufficient to finish the project.

In addition, Armadillo Aerospace offered to send us a few of the small catalytic rings that they had just bought to help us with the project. This had been looking like it would be the most expensive piece in our system, and this generous donation will greatly help. I'd like to personally thank Jeff Herschel of ETSC and John Carmack of Armadillo for the help, without which we'd still be spinning our wheels. Someone commented a few years ago when many of the small RLV startups started going under that most of them "had never even received enough money to even have a chance of failing technically." Well, after a lot of hard work, we've finally raised enough money to have a good chance of pulling off this project, so let's make sure that we do at least as well in building and testing this igniter as we did in raising funds for this!

Jonathan Goff, Space Development Club President

Indiana Outpost launches Website, seeking more members

<http://www.moonsociety.org/chapters/indiana/>

Still just an Outpost of one-looking-for-more, the Indiana Outpost, John R. Schrock of Poland, south of Terra Haute, has launched a new website in hopes that this net will catch some new fish, for a chapter-to-be and for the Moon Society. Members of the Society in Indiana and adjacent parts of East Central Illinois, can contact John at < schrock@ccrtc.com > or go to their MyMoon webpage and follow the prompts to join the Indiana Outpost Team.

John recently attended the second public hearing of the Moon, Mars and Beyond of the President's Commission on Implementation of United States Space Exploration Policy, held in Dayton, OH on March 4th. John is responsible for the Society's greatly improved front page at www.moonsociety.org - and for much more. He was elected to the Society's Board of Directors last year.

One of John's projects is to produce a trailerable mockup of the Artemis Moonbase to take to various space conferences and other public outreach opportunities. An outpost or chapter can get involved in many varied kinds of projects, depending on the interests and talents of its members. Of course, while one person can find ways to do quite a bit, more members can definitely have more fun!

Moon Society St. Louis Meets Often

www.moonsociety.org/chapters/stlouis/

The Society's most active chapter, Moon Society St. Louis, which received its charter last year, continues to set a dizzying pace. MSStL meets three times monthly!

The following are regularly scheduled monthly meetings:

- 2nd WED, monthly 7:30 PM - Buder Branch Public Library 4401 S. Hampton, basement conference room
- 3rd THUR, monthly 7:30 PM - Borders Books in Brentwood, just south of highway 40 on Brentwood Blvd.; a little just west of 170.
- 4th TUE, monthly 7:30 PM - Schlafly Branch Public Library: 225 Euclid (at Lindell), in the conference room.

Moon Society Mid-Atlantic Chapter Event

from Randall Severy < severy@severy.net >

The Mid-Atlantic Chapter of the Moon Society will be exhibiting at the annual Rockville Science Day show, April 18, 2004 from noon until 5 pm at Montgomery College in Rockville, MD. Details on the Rockville Science Day:

<http://www.rockvillescience.org/rcsday.html>

Our exhibit at last year's show was very successful, and attracted a lot of interest from people of all ages.

<http://www.rockvillescience.org/Photos03/moon1.html>

A flyer that can be passed around is available at:
<http://www.rockvillescience.org/rcsday04announce.html>

"Magnificent Desolation"

First IMAX Film "Shot" "on" the Moon! for release in 2005

Tom Hanks & IMAX Team for Magnificent Desolation
IMAX Corporation Wednesday, March 3, 2004 [abridged]

IMAX Corporation in association with Tom Hanks' and Gary Goetzman's Playtone today announced that the newest IMAX 3D space film, Magnificent Desolation, will be sponsored by Lockheed Martin. The highly anticipated film, ... shot in giant 15/70 format using IMAX 3D cameras, will [let us] experience walking on the Moon alongside the extraordinary voyagers who have stepped upon its surface.

Tom Hanks commented, "We went to the Moon. Everyone knows that. We -- by proxy in the form of the Apollo Astronauts -- flew up into the sky, sailed to the Moon, and landed on Luna Firma. "What we know too little of is what we did while we were there. 'Magnificent Desolation' takes the audience to the surface of the Moon -- to the Ocean of Storms, the Fra Mauro Highlands and the Taurus Littrow Valley, as well as Sea of Tranquility -- as only IMAX can. Exploring the Moon was humankind's most incredible roadtrip. Our film will bring along anyone who wants to take that giant leap for themselves.

'Magnificent Desolation' holds the potential to be extremely successful given the exciting subject matter and Tom Hanks' passion and creative vision. [It] will play at both commercial and institutional IMAX theatres for many years. ... a new generation will be enticed by the excitement and drama the Apollo astronauts brought into our homes as they dared to ... set foot on the lunar surface."

Magnificent Desolation, to be produced by Messrs. Hanks and Goetzman of Playtone and by IMAX, will detail the life-changing experience of the 12 men who walked on the Moon by showcasing what these men saw, heard, felt, thought and did while on the lunar surface. The 45-minute IMAX 3D feature documentary will be directed by Mark Cowen. ... Magnificent Desolation will [include] never before seen photographs, CGI renditions of the lunar landscape and previously unreleased NASA footage. Content will be based on "The Lunar Surface Journals," a massive archival database compiled over the last decade by Dr. Eric Jones, ... chronicles the Moon walks as recounted by the astronauts, brought to life in both IMAX and IMAX 3D on screens up to eight stories tall with 12 kw of pure digital surround sound for exclusive release to IMAX theatres in 2005.

Magnificent Desolation is a continuation of IMAX's space film legacy ... IMAX space films have been seen by more than 85 million people and played in more than 15 languages worldwide. The most recent collaboration between Lockheed Martin, NASA and IMAX was the very successful release of Space Station, an IMAX 3D film released in April 2002, which has grossed nearly \$70 million in box office and continues to play in theatres worldwide.

"Envision the Human Economy through Our Planet Resources"



MMM #1's "M" is for "Mole" is now hopefully moonbound!

from the Editor

The wellspring of inspiration that continues to fuel MMM articles comes from a personal experience that is described in issue #1 in the maiden issue's sole article.

illustrated - http://www.lunar-reclamation.org/mmm_1.htm

text only:

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

On March 11, 2004, an illustrated pdf version of this article was uploaded to TransOrbital Corporation's Archive of Personal Messages to fly around the Moon aboard TrailBlazer 1 in a canister designed to survive the eventual impact on the Moon's surface.

[view pdf] www.lunar-reclamation.org/pdf/mmm_Mole.pdf

[from] <http://www.transorbital.net/personal.html>

The essay describes the author's "eureka" experience upon touring [May 1985] a very unique underground home, one without the usual south exposure window wall, but with inventive periscopic "picture windows" which opened the home to the surrounding Kettle Moraine countryside of SE Wisconsin, and, thanks to sun-following mirrored hoods topping many sun-shafts through the ceiling and 8 foot thick overburden of soil, flooded the interior with sunlight.

That insight that "while we may have to live underground on the Moon (for protection from cosmic radiation and extremes of hot and cold temperatures), we won't have to live like 'moles,'" has resulted in a continuing cascade of brainstorming on how pioneers could make themselves "at home" on the Moon and live in reasonable comfort.

TransOrbital' TrailBlazer™ lunar imaging spacecraft will be the world's first commercial mission to the Moon. After returning unique still and motion images of the Moon, the Earth, and the voyage, TrailBlazer will end its travels by impacting on the Moon's surface. A specially hardened time capsule in TrailBlazer containing messages and memorabilia will remain on the Moon's surface as a permanent message to the future.

We wrote about this impact-resistant canister in MMM #154 April 2002, p 16. "TransOrbital's TrailBlazer Mission Plan with Time Capsule Surviving final impact."

To make its TrailBlazer mission economically viable TransOrbital is depending on up-front money from a number of products including its Messages Archive Capsule. We wanted to do our little part, in hopes that others may be inspired to follow.

<PK/MMM>

NASA delays MESSENGER launch 2+ Months And its Arrival at Mercury by 2 years

www.spacetoday.net/getsummary.php?id=3D2272

24 Mar 2004 NASA will delay the launch of the MESSENGER Mercury mission two and a half months to give the project more time to complete launch preparations, a decision that will delay the spacecraft's insertion into orbit around the planet by nearly two years.

The spacecraft had been scheduled to launch on a Delta 2 Heavy from Cape Canaveral on May 11, but is now scheduled for launch no earlier than July 30, at the start of a launch window through August 13. A NASA status report states that the delay was caused by several factors, including the need to conduct additional testing of spacecraft fault-protection software and provide for a "more comfortable" schedule for overall spacecraft processing.

MESSENGER (MErcury Surface, Space Environment, GEochemistry, and Ranging) is NASA's very first Mercury orbiter mission and the first mission to the innermost planet of any kind since Mariner 10 flybys thirty years ago.

The launch delay will delay MESSENGER's arrival at the planet significantly. Had the craft launched in May, it would have entered orbit about Mercury in July 2009 after making flybys of the planet in October 2007 and July 2008. Now, according to the project web site, MESSENGER will perform flybys in January 2008, October 2008, and September 2009 before entering orbit in March 2011.

Prizes for Amateur Astronomers

Charles 'Pete' Conrad Astronomy Awards Act

House of Representatives Science Committee Press Release

WASHINGTON, D.C., 3-03-04 - H.R. 912, the Charles "Pete" Conrad Astronomy Awards Act, named for the third man to walk on the Moon, establishes awards to encourage amateur astronomers to discover and track near-earth asteroids. The bill directs the NASA Administrator to make awards, of \$3,000 each, based on the recommendations of the Smithsonian Minor Planet Center. Earth has experienced several near misses with asteroids that could have proven catastrophic. The scientific community relies heavily on amateur astronomers to discover and track these objects.

"Given the vast number of asteroids and comets that inhabit Earth's neighborhood, greater efforts for tracking and monitoring these objects are critical. That is why I introduced H.R. 912, the Charles 'Pete' Conrad Astronomy Awards Act, which is a tribute to Pete Conrad for his tremendous contributions to the aerospace community over the last four decades," said bill sponsor, Space & Aeronautics Subcommittee Chair Dana Rohrabacher (R-CA). "Asteroids deserve a lot more attention from the scientific community. The first step is a thorough tracking of all sizeable Near Earth Objects. HR 912 is a modest step"

*Attention all past members,
speakers and participants of*

The MSDC

The Midwest Space Development Conference (& Corporation)

Join us at the

MSDC REUNION

July 23rd - 25th 2004

Mohican State Park and Resort

(east of Mansfield, Ohio)

You can see more information about the resort at:

<http://www.mohicanresort.com>

Contact Bill Avery at avery6709@comcast.net or
call (440) 357-6709 for more information

H.R.3752 - The Commercial Space Launch Amendments Act of 2004

Introduced in House of Representatives 2/03/2004

Approved by the House 03/04/2004

Next Step: to be Considered by the Senate

Sources: House Science Committee Press Release
www.spaceref.com/news/viewpr.html?pid=13774

Major provisions of the legislation would

- Eliminate jurisdiction confusion about who regulates flights of suborbital rockets carrying humans, - with authority for all commercial space flights to be under the FAA (Federal Aviation Administration) Office of Commercial Space Transportation (AST)
- Allow AST to issue experimental permits that can be granted more quickly and with fewer requirements than licenses so that it will be less difficult to test-launch new types of reusable suborbital rockets
- Extend government indemnification for three years to the entire commercial space transportation industry (including licensed, non-experimental commercial human space launches)
- No indemnification for flights conducted under experimental permits, to be more lightly regulated
- Require a study on how best to gradually eliminate indemnification for the commercial space transportation industry by 2008 or as soon as possible thereafter.

Mars Society Convention #7
August 19–22, 2004, Chicago, Illinois
Palmer House Hilton Hotel
Conference Sessions

1. The Search for Life on Mars
2. Latest Findings from the Mars Probes
3. Plans for the Missions of 2005, 2007 and 2009
4. The Cross Contamination Threat—myth or reality?
5. Concepts for Future Robotic Mars missions
6. Piloted Missions to Mars
7. Advanced Propulsion
8. Launch Vehicles for Mars Exploration
9. Long Range Mobility on Mars
10. Life Support technology
11. Biomedical and Human Factors Issues in Mars Exploration
12. Options for Producing Power on Mars
13. Methods of Martian Construction
14. In Situ Resource Utilization
15. Water on Mars – Accessing the Hydrosphere
16. Concepts for a Permanent Mars Base
17. Colonizing Mars
18. Terraforming – Creating an Ecology for Mars
19. Analog Studies Relating to Mars Exploration
20. The Flashline Mars Arctic Research Station
21. The Mars Desert Research Station
22. The Mars Analog Rover project
23. The Translife Mars Gravity Mission
24. The Value of Mars Exploration to the Earth
25. Public Policy for Mars Exploration
26. Concepts for Privately Funded Mars Missions
27. International Cooperation in Mars Exploration
28. Law and Governance for Mars
29. Social Systems for Mars
30. The Significance of the Martian Frontier
31. Philosophical Implications of Mars Exploration.
32. Mars and Education
33. Mars and the Arts
34. Outreach Strategy for the Mars Society
35. Proposed Projects for the Mars Society
36. Open Mike Martian Literature Reading, songfest, & gallery

The Mars Society

P.O. Box 273,
Indian Hills 80454,
or via email to: msabstracts@aol.com.
(e-mail submission preferred.)

Conference Registration Fees:

\$150 for MS members if paid before May 31st,
2004, \$210 for non-members. After June 1, 2004:
\$210 for members, \$270 for non-members.
Students and Seniors: \$40 for members, \$75 for
nonmembers before May 31st, \$70 for members,
\$105 for non members after June 1st 2004.

The 2005 Convention will return to Boulder, CO

GREAT BROWSING !

NASA to look at 'Weird Life' beyond Earth

http://www.space.com/scienceastronomy/nasa_astrobiology_031212.html

NASA is assessing support for a look into the limits of organic life in planetary systems.

Earth-Like Planets Common, Simulation Suggests

http://www.space.com/scienceastronomy/earth-like_planets_031211.html

A new computer model designed to explore the range of possibilities for planet formation around other stars had no trouble coming up with worlds similar to Earth

**Soldier a Stranger in a Strange Land
(at the Mars Desrt Research Station in Utah)**

http://www.armyspace.army.mil/index.asp?NID=933&HL=2&#HL_Mark

Concept of a Space Taxi Port

from Dave Dietzler <Dietz37@msn.com >
http://www.moonminer.com/Taxi_port.html

Translucent Concrete for the Moon?

<http://optics.org/articles/news/10/3/10/1>

“What is a Planet?”

astron.berkeley.edu/~basri/defineplanet/Mercury.htm

Sign the Moon to Mars Petition

<http://www.space.com/goformars/>

Visit “The Moon Miner”

<http://www.moonminer.com>

This site is the baby of Moon Society St. Louis sparkplug, and frequent MMM contributor, Dave Dietzler. The site's Main Menu Page is called the "L1 Space Nexus" and is the jumping off spot for Dave's brainstorming and imagineering of these vectors:

- RESOURCES
- SPACESHIPS
- SPACE TOURISM
- LUNAR TOURISM
- SPACE COLONIES
- STARSHIPS
- TERRAFORMING
- ROCKET PHYSICS
- POPULATIONS
- FUTURISM
- BEYOND MONEY

The text is accompanied with great illustrations. Dave welcomes any constructive comments, and you can reach him at < Dietz37@msn.com >



Using Lunar Ice for Rocket Propellant

I just had an interesting discussion the other day about lunar ISRU propellant generation. The topic of mining the poles for water ice to make rockets was bandied about again, and I made a knee-jerk reaction that doing so would be a waste, however I've heard something that made me begin to question that position.

Ken Murphy points out that there was an estimate 2 billion tons of H₂ at the lunar poles. If bound up in the form of water ice, this would be about the equivalence of the Great Salt Lake, about 20 billion tons of water.

When you do the numbers, something surprising comes out: If you mined 27,400 tons of hydrogen per day, it would take 100 years to deplete half of the lunar polar hydrogen deposits. But when you think about how much hydrogen that is, it turns out to be a really large amount! 27,000 tons of hydrogen burned in a 6:1 Oxygen/Fuel ratio LOX/LH₂ engine like an RL-10 would be 189,000 *tons* of propellant per day. This is enough to ship around 20-50 kilotons worth of cargo to and from Luna daily! That is the equivalence of 100 International Space Stations!

Realistically speaking, this means that we will mostly likely never be able to pull that much hydrogen out in a given day, and hence are very unlikely to go through even a few percent of the lunar polar hydrogen reserves before better sources like NEAs [Near Earth Asteroids] are accessible. So it looks like there really is some benefit to going after lunar polar ice if it exists, as it will speed up the day when we can access the NEAs, and will also greatly reduce the cost of colonizing the Moon. And by the time that we start even putting a small nitch in the total hydrogen reserves, better, lower cost sources will have displaced it, and the rest can then be used for purely luna-centric purposes.

Jonathan A. Goff, Provo, Utah

EDITOR'S Reply: Thanks. But some points to consider:

1. We need ground truth probes to learn the percentage of frozen moisture in the soil, whether or not it contains other frozen comet volatiles (nitrogen & carbon oxide ices?) and how feasible it is to mine the stuff and recover (produce) separated purified liquid or gas.
2. IMHO, NEA's will never be more than sporadic targets of opportunity with very infrequent launch windows.
3. We still need to take a long term view. If we are only going to have small outposts - say a total of a few dozen to as much as a thousand people on the Moon, I guess we can be generous with the stuff. I am more optimistic and can see the day when hundreds of thousands of people may be living on the Moon. Why put a ceiling on their future by squandering what is really theirs?

[As Cassini-Huyghens Nears Saturn]

Titan, The Ideal Lab for Oceanography and Meteorology

www.eurekalert.org/pub_releases/

2004-02/uoa-tii021004.php

14-Feb-2004 - Ralph Lorenz <rlorenz@lpl.arizona.edu

ABRIDGED by MMM:

After a 7-year interplanetary voyage, NASA's Cassini spacecraft will reach Saturn this July and begin what promises to be one of the most exciting missions in planetary exploration history. After years of work, scientists have just completed plans for Cassini's observations of Saturn's largest moon, Titan. The spacecraft will deploy the European Space Agency's Huygens probe to Titan for a January 2005 landing.

Nearly half the size of Earth, frigid Titan is the only moon in the solar system with a thick atmosphere. Smog has prevented scientists from getting more than a tantalizing hint of what may be on the moon's amazing surface. There will be 44 flybys of Titan in only four years.

Scientists have long thought that, given the abundant methane in Titan's atmosphere, there might be liquid hydrocarbons on Titan. Infrared maps taken by the Hubble Space Telescope and ground-based telescopes show bright and dark regions on Titan's surface. The maps indicate the dark regions are literally pitch-black, suggesting liquid ethane and methane.

Last year, data from the Arecibo telescope showed there are many regions on Titan that are both fairly radar-dark and very smooth. One explanation is that these areas are seas of methane and ethane, both compounds present in natural gas on Earth, are liquid at Titan's frigid surface temperature, 94 degrees Kelvin (minus 179 degrees Celsius).

Cassini/Huygens will answer many questions, among them:

- Are the winds strong enough to whip up waves that will cut cliffs in the lakesides? Will they form steep beaches, or will the strong tides caused by Saturn's gravity be a bigger effect, forming wide, shallow tidal flats?
- How deep are Titan's seas? This question bears on the history of Titan's atmosphere, which is the only other significant nitrogen atmosphere in the solar system, apart from the one you're breathing now.
- And do the oceans have the same composition everywhere? Just as there are salty seas and freshwater lakes on Earth, some seas on Titan may be more ethane-rich than others.

The Schedule of Events:

- 7/01/04 Cassini settles into orbit around Saturn
- 10/26 & 12/13/04 Cassini-Hughens Titan Flybys
- 12/25/04 Huyghens Titan Probe separates
- 1/15/05 Huyghens lands on Titan



The Lunar Reclamation Society, Inc.

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Milwaukee
WI 53201

www.lunar-reclamation.org

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

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LRS NEWS

• **Aviation Career Fair at Mitchell Field Canceled** due to concession mall renovations this year. The April event attracts hundreds of young people in school groups. In 2003, the event was also canceled, due to the outbreak of war in Iraq. In 2002, LRS' "You can fly on Mars!" which was cosponsored by the Wisconsin Mars Society chapter was a big hit. We've been eager to try out our improved exhibit. The annual two day event will return in Spring 2005

LRS MAY / JUNE Events

 **Saturday, MAY 8th, JUNE 13th 1-4 pm**

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA(s):

www.lunar-reclamation.org/page4.htm

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

U.S. CHAPTERS



NSS
Chapter Events
MMM
6 Chapters Strong

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

WISCONSIN



**Sheboygan
Space Society**

728 Center St., Kiel WI 54042-1034

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

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

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

 We now meet the **3rd Thursday** of the month at 7-9pm

MAY 20th: UW-Sheboygan, Sheboygan Room 120A

JUNE 17th: Stoelting House, Kiel

JULY 15: UW-Sheboygan, Sheboygan

MINNESOTA



**Minnesota Space
Frontier Society**


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

Tom Greenwalt (w) 763-784-6244 (h) 763-442-6015

David Buth (w) (612) 333-1872, (h) (763) 536-1237

Email: tomg@mnsfs.org

[www.mnsfs.org/]

 **MEETINGS:** 3rd Saturday of the month from 1-4 pm

at the: **St. Anthony Park Library's** Meeting Room

2245 Como Ave. St. Paul, MN

- **Pictures from the Twin Cities Regional Science Fair**
<http://www.freemars.org/mnfan/tcrsf/2004/>
- **Pictures from MarsCon**
<http://www.freemars.org/mnfan/marscon/2004/>
- **MN SFS is on Mars!** <http://spacekids.hq.nasa.gov/2003/getcert3.cfm?uid=3248693>
- **Bailey Science Night Pictures**
<http://www.freemars.org/mnfan/BESN/2004/>
- **Pictures from Minicon**
<http://www.freemars.org/mnfan/MiniCon/2004/>
- **MN SFS Rover at Minicon Party**
www.freemars.org/mnfan/MiniCon/2004/DSC04796.JPG



**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: May 15th, June 19th



**OASIS: Organization for the Advancement
of Space Industrialization and Settlement**

Greater Los Angeles Chapter of NSS

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

Events Hotline/Answering Machine: (310) 364-2290

Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com

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

oasis@oasis-nss.org

Odyssey Newsletter Online

<http://www.oasis-nss.org/articles.html>

☉ **Regular Meeting 3 pm 3rd Sat.** each month

Microcosm, 401 Coral Circle, El Segundo.

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

- **May 15, 3:00 p.m.** --OASIS Monthly Business Meeting, Microcosm, El Segundo. At 5:00 p.m. there will be a public lecture - "Interplanetary Superhighway", by Dr Martin Lo of NASA's Jet Propulsion Laboratory (JPL)
- **June 19, 6:00 p.m.** -- OASIS Monthly Business Meeting, Microcosm, El Segundo

Ongoing Projects

- **MER (Mars Exploration Rover) full-scale model construction project** is seeking volunteers. Contact oasis@oasis-nss.org

Recurring Events

- **Mike Hodel's Hr 25 webcast.** - Fridays -- science fact & fiction with interviews, news, radio dramas, artists, writers, stories, reviews, and much more. Information: <http://www.hour25online.com/>.



**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: Our April meeting will be at the Liberty One Food Court on Sunday, the 18th, to allow members who work Saturdays to come. **NEXT Meetings: May 15th and June 19th.** Call Earl or Mitch 215-625-0670 to verify all meetings

• **March 20th Meeting Notes:** We had a good turn out. I would like to welcome several new members to our group: Jim Karcher met us at the Philcon Science Fiction Convention in December and decided to join our active group. We also had a gift membership for our special award winner at The George Washington Carver Science Fair. This gift was donated by Gary Fisher who heads up Independence Mars which is our Mars Society chapter. More on the Fair later.

In attendance this time where our new member Jim and our treasurer Jay Haines who just returned from vacationing in Australia and New Zealand. Jay received a number of membership renewals, both in person and by mail, and reported that we were in the black. Jay also noted that he has not been contacted by, or has seen nothing recent from, The Space Studies Institute in Princeton. New Jersey. As a volunteer at the biannual event he should be contacted if something is planned by that group. After the Columbia disaster S.S.I. has had many of its members tied up in professional activities evolving around the event and preventing a future occurrence. Hopefully this great organization will put out a notice of future direction soon.

Mitch Gordon brought us some good news and notice of a World Future Society event. Mitch, as our public outreach coordinator, has worked on putting our groups expertise and existence to public attention via the great interest in space exploration and Mars in particular. He has contacted various T.V. and Radio outlets and has gotten us an invitation to Channel 48 Update on WGTW a through the air station here. We have to schedule a session time; probably in late April. Mitch also reported that The

National Space Society has joined The National Satellite and Space Alliance as well as some material from N.S.S.s publication Ad Astra. One article was on President Bush's vision for space and the other was on solar power satellites by Arthur P. Smith, President of Long Island L-5. In the future Mitch will have a presentation on Mag-Lev vehicles at Barnes and Noble in center city. This will be a World Future Society event. Details to be announced.

Hank Smith will be Head of Science Programming for the Philcon Science Fiction Convention. Congratulations Hank! Not wasting time; he brought a list of possible topics for panels and talks for the December 2004 convention here. In addition he has several other positions with the Philadelphia Science Fiction Society and noted his planned trip to the Balticon event in Baltimore over the Memorial Day week end. He may have a good deal of company this year. For those who wish to contact Hank by phone note that he has a new number: 215-455-7108. He is also working on a home. "Retired?," we should all be this retired!

Earl Bennett gave a report on part of The George Washington Carver Science Fair wherein he, Mike Fisher and Gary Fisher worked as special awards judges. Mike is really involved in promoting science and technology education as he judged for us and at least two other organizations including Mensa as well as the G.W.C. Fair itself. If he wasn't tied up with other responsibilities I'd nominate him as our education outreach coordinator. Mike and I judged the Elementary Division and selected Devon Huggard as the winner of the 2004 James H. Chestek Award. She received a certificate and a digital microscope. Her research was on the effect of Solar Wind on the weather. Mike, Gary and I did Senior Level judging the next week and saw an impressive number of quality presentations making selection a bit difficult. Our ultimate selection "Deep Impacts: Asteroids and Their Craters" by David Riddell who developed his data by using a uniformly compacted surface and a "potato gun" for driving the simulated asteroid into the surface at a variety of angles. His award included the membership in PASA noted above and a \$50.00 gift card to Barnes & Noble as well as the 2004 Oscar H. Harris Award certificate. I was unable to perform the presentation duties myself, due to a back injury, but Nancy Peter stepped in and acknowledged our special award recipient. Due to the lateness of the request, the day before the ceremony, we could not have one of our people there. Thank you Nancy!

In addition I brought to our meeting material from Nuts and Volts Magazine for February and March 2004 on Near Space Exploration which has subsequently been added as a new column in the April issue. This column will be written by L Paul Verhage a college level electronics teacher and contributor of the above articles. Space on a shoestring.. See www.nutsvolts.com.

We also had several wide ranging discussions on self sufficiency and closed loop life support work due to

visitor Janice bringing information on a biological topic and our new member Jim began asking questions from this. The fate of the Biosphere project(s) and where we might fit in its use came up as did the work of Gary Fisher on the Hanksville C.L.E.S.S. Project and the hydroponics work of Mars Society member Ruddle several years ago locally.

And finally: Mitch Gordon broached the subject of a professional display. His friend Sandra, who works on grant applications, volunteered to write an application for our proposed display grant request. Most of our display material is loose banners and posters stuffed into my apartment. Sounds good to me!

Submitted by Earl Bennett

**SOLAR SYSTEM
AMBASSADORS**



www.jpl.nasa.gov/ambassadors/

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Bill Hensley
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hensley@acronet.net

ISDC 2004 – Oklahoma City, OK

May 27–31, 2004

<http://isdc.nss.org/2004/>

Hotel – Clarion Meridian Hotel & Convention Center

737 S. Meridian, Oklahoma City, OK 73108
(405) 942-8511 Room rate: \$65 + tax, 1-4 people
(suites & adjacent Hilton Garden Inn higher)

Tours

- Cosmosphere Space Museum, Hutchinson, KS (all day)
- Thursday, May 27), with Max Ary
- Oklahoma Spaceport
- (Murrah Building bombing memorial)
- Omniplex (planetarium, space & science museums)
- * Sam Noble Oklahoma Museum of Natural History (world's largest apatosaurus & more)

Registration

- Members of cosponsoring organizations* **\$75 by 5/1/04** - * National Space Society, Mars Society.
- Non-member Adult rates (one banquet included): **\$125 by 5/1/04; \$150 at the door.** Seniors(65+)/Students (one banquet included): **\$100 by 5/1/04; \$125 at the door.**

NAME _____
STREET _____
CITY/ST/ZIP _____
PHONE #S _____

\$38 National Space Society dues includes **Ad Astra**
 \$20 NSS dues if under 22 / over 64. *State age* ____
600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include **Moon Miners' Manifesto**
• **Electronic (pdf) MMM \$35** Students/Seniors: \$20
• **Hardcopy MMM: U.S. & Canada \$35** Elsewhere: \$60
P.O. Box 940825, Plano, TX 75094-0825, USA

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Member Dues -- MMM/MMR Subscriptions:

Send proper dues to address in chapter news section

=>for those outside participating chapter areas <=

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

CHICAGO SPACE FRONTIER L5

\$15 annual dues

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\$25 Regular Dues

OREGON L5 SOCIETY

\$25 for all members

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

\$25 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE

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

SHEBOYGAN SPACE SOCIETY (WI)

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

Moon Miners' MANIFESTO

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

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