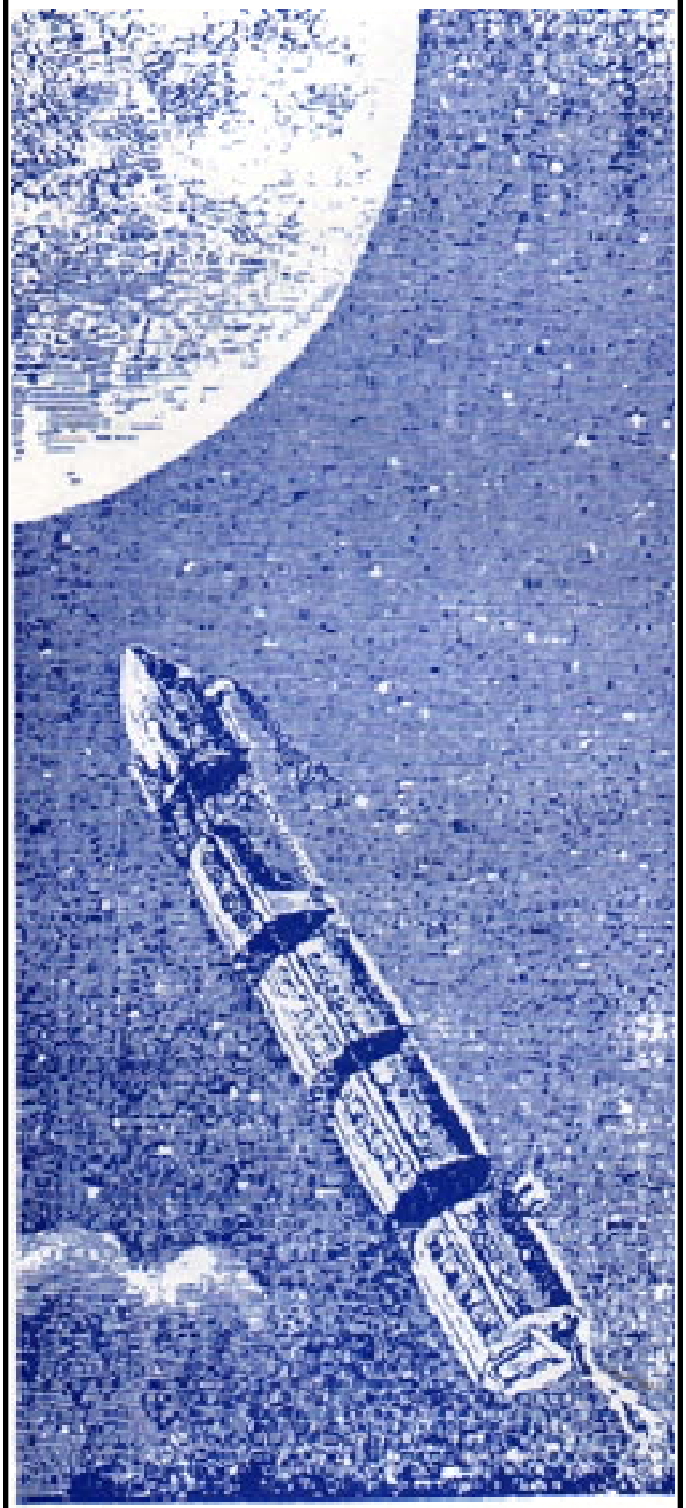
Moon Miners' REVIEW
& Moon Society Journal



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In This Issue

Moon Society Journal

The **Moon Miners' REVIEW** is published semi-annually each January and July by and for the members of the **Moon Miners' Manifesto** family of **National Space Society** chapters, for the members of **The Moon Society**, and for individual subscribers worldwide.

The REVIEW provides the Editor with a semi-annual burnout prevention and regeneration break for the editor of **Moon Miners' Manifesto.**

Moon Miners' Manifesto will return next month (February, 2003) with issue #162.

E-mail: KokhMMM@aol.com

E-mail submissions preferred *with text in the body of the message,* not *as an attachment.*

Hardcopy submissions: MMM, c/o Peter Kokh,
1630 N. 32nd Street, Milwaukee WI 53208

The Byzantine Road to Luna and Beyond

by Dave Dietzler <Dietz37@msn.com>

Given # 1

We can be certain that any project in space as big as solar power satellite construction, power relays, telecommunication space stations packed with supercomputers and high power radio equipment, alloy manufacturing, pharmaceutical labs, high purity electronics, astronomical research; tourism for thousands, even millions of travelers annually, and advanced missions to Mars and other destinations in the solar system, will require the resources of the Moon.

Hard-core Zubrinites, myself included, may insist that direct throw to Mars with an advanced HLLV does not require lunar resources, but nobody can be in favor of launching 25,000 Mars Direct style missions to move 100,000 colonists to Mars for a terraforming project! That is absurd and it is bound to be costly and wasteful. If these people are to have any hope of returning to Earth after a number of years on Mars they would need ERVs, so another 25,000 flights are called for. Some extra ERVs, HABs and heavy cargos will be needed, so the total number of direct throws to Mars would be well over 50,000! That's a heck of a lot of external tanks and expendable upper stages, is it not? Remember, the Ares launch vehicle does not orbit the E.T., but that may be remedied with more powerful boosters. Reusable ships that use lunar aluminum and LOX for propellants, large cycling stations built of E.T.s and nuclear powered ships loaded with uranium, thorium or plutonium produced on the Moon rather than launched from Earth will be essential to colonize Mars.

Given # 2

We can also be certain that some nuclear power for rockets and electricity production will be necessary to industrialize the Moon.

Several nuclear steam rockets like Dr. Anthony Zuppero's "Zuppmobile" and the Mark Maxwell tanker in addition to some nuclear powerplants like the General Atomics Star-C thermionic system will be keys to success. Reactors and rockets can be orbited without nuclear fuels loaded. The uranium could be launched sepa-rately in vaults wrapped in ablative heat shield material that can even survive a Challenger like explosion. It could even be launched from a remote sea-base for added safety. The reactors and rockets would then be loaded in space. We can be certain that some of the Moon's ice resources will also have to be sacrificed to plant heavy industry on the Moon. To land several thousand tons of machinery, far less than one percent of the ice will be lost in rocket exhausts if six billion tons is really present.

The first step (after creating a low cost reusable heavy lift launch vehicle through standardization, automation, mass production and even the use of cheap foreign labor that orbits payloads for <$1,000/kg.), would be the establishment of *a solar powered space station in LEO* capable of assembling large spacecraft, cryogen storage and transfer, water electrolysis and liquifying of hydrogen and oxygen. Water will be ferried to LEO and stored until rocket fuel is needed at which time it will be electrolyzed and the gases liquified.

The second step will be to establish *another space station at the Earth-Moon L1 point.* This station would be made of the same kind of standard modules, inflatables, solar panels and life support systems that the LEO station was. This station would also be capable of spacecraft assembly or more exactly, the docking and undocking of spacecraft modules, cryogen storage and transfer, etc. It would be very similar to the LEO station. It would also have radio and television devices for relaying messages across the Moon. Satellites at L5, L4 and L2 would provide global telecommunications on the Moon. A constellation of GPS microsatellites could also be deployed in orbit around the Moon.

Step three involves *tapping the lunar ice. A* cargo of nuclear teleoperated mining rovers, regolith roasters and water filters, water tanker trucks and a couple of nuclear steam rockets will be landed. This will entail landing much less mass than would be required if LH2/LOX burning rockets were used. That would require solar powerplants, heavy refrigeration machinery, cryogen storage tanks, etc. The rovers and steam rockets will be propelled from LEO to L1 with LH2/LOX burning rockets along with payloads of space storable water. The water will fuel the steam rockets that land the cargo. The mining rovers and trucks will be teleoperated by crews at the L1 station. Ice will be mined, water produced, and the nuclear steam rockets will ferry loads of water up to the L1 station and depot.

Step four consists of *transporting water down to LEO from L1.* The nuclear rockets will travel from the lunar surface to L1, but they will not approach Earth or aerobrake in her atmosphere. Getting permission to launch nuclear rockets and rovers to the Moon will be hard enough in the first place, but the potential benefits for the environment (e.g. space energy) outweigh the risks. The L1 point is 85% of the way from the Earth to the Moon. From a rocket energy perspective, it is also 85% of the way from the Moon to the Earth. The steam rockets will get the water to L1, most of the way back to Earth, and a small chemical rocket burn will send payloads of lunar water on their way to LEO where they will aerobrake and be recovered at the space station. Heavy heat shields will have been rocketed to L1 for the water carrying modules earlier, unless some kind of low mass inflatable system is perfected. At this time, no more propellant will be rocketed up from Earth at great cost. It will all come from the Moon.

Step five will be the *establishment of a small lunar surface base* similar to the Artemis project base. This base will be composed of those same kinds of modules, solar powerplants and LSS that the space stations were. By standardizing our equipment and producing it in quantity, costs can be slashed.

Spaceships and pressurized surface vehicles will have the same kinds of standard physiochemical LSS that the base and stations use. The base might be located on the slopes of Malapert Mountain or near crater Shackleton in the south polar region where sunlight is available throughout most of the lunar cycle and ice deposits are nearby. The base will also have a nuclear power plant for survival in the dark and extra power when needed. A crew of four to six people will man the base.

More earthmoving equipment for ice laden regolith mining and furnaces that use solar heat and waste heat from the nuclear reactor to roast the water out of the dirt will be landed at the base. Solar powerplants and cyrogenic fuel production and storage devices will be landed. There will also be chemical rockets for transporting workers to and from L1 and for suborbital hops across the Moon. Robotic explorations far more advanced than the Surveyors or Russian Lunakhods will have been completed before men return to the Moon, but some manned prospecting will also be called for.

Amphibious rockets with detachable wheeled vehicles dubbed FROGs will be especially useful for long range manned surveys at ground level. The base will be completed by devices that magnetically separate iron and illmenite from regolith, furnaces for hydrogen reduction, oxygen storage and sintering of rutile to make heat shields. A safe estimate for the mass of the base, including vehicles and production devices, would be 1,000 tons. Hydrogen and oxygen burning rockets that derive their propellants from lunar water at the LEO station will move all this to L1.

Step six will involve putting everything into operation and using *chemical as well as nuclear steam rockets to transport water to L1.* The nuclear rockets will eventually wear out and their uranium will be spent. Chemical rockets will take over. The rockets that ferry water to L1 will carry it in large plastic bladders that allow a very high mass ratio. I presume the bladders will be made of plastic, but we must wonder if spider silk protein from genetically engineered animals will be available in quantity at a reasonable price in the future. Spider silk fibers are stronger than steel and might supersede Kevlar. Imagine a spacesuit made of spider silk. Heat shields made of rutile on the lunar surface will go up to L1 along with the water. Water bladders will be filled with 100 to 1,000 tons of water.

At L1 the water bladders and heat shields will be assembled and small rockets powered by hydrogen and oxygen produced at L1 will fire and send the water payloads Earthward where they will aerobrake into LEO. The rocket power to move these payloads out of the unstable L1 region will not be very great. The propellant mass for this will only be a few percent of the payload mass propelled down to LEO. No nuclear rockets will approach Earth and alarm her inhabitants. Heavy heat shields will no longer be rocketed up to LEO and then to L1 at great expense also. The Moon made rutile shields will be smelted to supply titanium and oxygen to LEO industrial activities. A fairly constant supply of metal and oxygen to LEO and GEO will result.

Step seven involves *launching 20,000 tons of cargo* to LEO* where cargo modules and upper stage stacks are assembled. The lunar water stored at the LEO station will be electrolyzed. The hydrogen and LOX will fuel reusable rockets that will push the cargo to L1 and return from L1 empty, or loaded with water, by hitching a ride with the aerobraking water transporters. The propellant mass needed to move 20,000 tons of cargo to L1 with 450 second hydrogen/oxygen rockets will be about 21,000 tons. Subsequently, the use of lunar propellants will cut launches from Earth and costs in half.

The LEO, L1 and lunar surface stations will all be essential to interlunar space transportation for decades, so we can't really say that their cost makes the cost of this project excessive. These investments will be good for a long, long time. There is no rust or corrosion in outer space, no storms, earthquakes, floods, malaria, terrorists, civil wars, or endangered wildlife to block our activities. The LEO, L1 and surface stations will operate long enough to pay for themselves and turn a hefty profit.

Work crews will travel by Shuttle or advanced spaceplane to LEO, board rockets fueled with lunar hydrogen and oxygen, fly to L1 and then land on the Moon in "Moon Shuttles" that look like big LEMs. Ships will also be refueled at L1 for return to LEO. Eventually, lunar ice will not be used and lunar aluminum and oxygen will be burned in the rockets. The ice is too valuable to waste, but too useful not to take advantage of. On the lunar surface, crews will teleoperate mining machines and set up a regolith refinery to produce oxygen, silicon, aluminum, iron and other metals as well as glass, cement, plaster and ceramics. Helium 3 miners will also acquire valuable volatiles, carbon and sulfur. The walls of lava tubes will be sealed with cement and bricks will be stacked within pressurized lava tubes. On the surface, inflated plastic domes consisting of several layers of material like the Trans-Hab module will be sprayed with concrete on the inside. After the concrete sets, the thick plastic will be removed. The concrete dome will then be covered with regolith for radiation shielding and compression, and the dome will be pressurized. A mass driver will be assembled and payloads of regolith and refined metals will be launched into space to provide construction materials and propellants. When nuclear fuels are produced on the Moon,

it will be possible to operate magnesium vapor "fueled" nuclear VASIMR freighters that transfer payloads from LO to L1, L5 and GEO (if it's legal to come that close to Earth with a nuke).

A space colony like Island One will not be built right away. Most work in space will be done with robots and tele-operation by ground crews. Space tourism and helium 3 mining should rake in the money. Several solar power satellites will have to be built and electricity sold before the luxury of a Bernal Sphere or similar structure is seen. Family life will be possible in the lunar lava tube cities. Large ships and cycling stations to Mars built and fueled by the Lunans will also provide opportunity to pioneer families yearning for the Martian frontier.

* 20,000 tons is a guesstimate based on numbers from O'Neill and Heppenheimer. Since a similar amount of LH2 and LOX would be needed to propel this mass to L.O. via WSB trajectories or to L1, a savings of $20 billion is had if costs to LEO are $1,000/kg. and $200 billion if the cost is $10,000/kg.

Moon Rockets

by Dave Dietzler <Dietz37@msn.com>

It will take decades of progress on the Moon to reach a time when large nuclear-electric space luxury liners are possible. Ships made from shuttle external tanks powered by lunar aluminum and LOX could cruise between Earth and Luna in the meantime. Thousands of travelers could fly every year.

Experiments have shown successfully that aluminum dust and LOX can be mixed to form a monopropellant.1 My only problem with this is that the monopropellant might be dangerously explosive. I prefer a hybrid rocket that uses solid aluminum and LOX. The hitch is, there isn't much hydrogen, carbon and nitrogen on Luna to make rubber or plastic to bind the aluminum grains in a solid fuel charge. I suggest a solid mixture of 80% aluminum grains bound with calcium that composes the remaining 20% of the fuel. The aluminum grains will be mixed into molten calcium in the free vacuum of space. This mixture would burn intensely in air. The aluminum grains will cool the molten calcium which will solidify and bind the powdered aluminum.

Originally, I considered using glass as a binder, but calcium is certainly superior as it is combustible and will contribute to thrust, unlike glass, has a lower melting point and is less brittle. Calcium has a higher melting point than aluminum and this may be a problem. I don't want the aluminum grains to melt and form an alloy or "marble cake" in the calcium. The aluminum must be granular because tiny grains have lots of surface area to contact oxygen and burn thoroughly. This is one reason gunpowder is a powder. The charcoal, sulfur and potassium nitrate (saltpeter) grains must make contact for rapid combustion. Hopefully, the aluminum will cool the molten calcium quickly when mixed; otherwise some kind of "quick freezing" system must be devised. This technology has not been developed, but theoretically, it should work. No space warps are required!

LOX could be pressure fed with gaseous oxygen since helium and nitrogen are so precious on Luna. Hybrid rocket nozzles could be lined with ceramic and replaced when necessary. Steering will be accomplished with exhaust rings, vanes and thrust modulation of multiple engines. Hybrids can be throttled (thrust modulated) by varying LOX flow rates. The rocket tubes will not have cooling jackets as LOX would hot corrode the lining in no time. The rocket tubes could be made of lightweight high-strength glass fiberglass composites. They won't melt because the solid fuel will insulate the walls during the burn. A thin layer of silica, like the Shuttle heat shield tiles could also line the tubes. In any case, the Shuttle SRBs have never burned up so I doubt that these motors will either. The Shuttle SRBs burn aluminum and reach an ISP of 270 seconds. Our hybrids will certainly muster 200 to 250 seconds.

So how do we fuel these rockets? Lunar mines to mass drivers. Mass catchers to space refinery. Sounds terrific. The only catch is the low ISP of LUNOX. A 150 ton ship based on a 33 ton ET hull with 250 second motors will need a mass ratio of 26:1 and about 3700 tons of propellant for a LEO to LO to LEO roundtrip with retro-rocketing into LEO rather than aerobraking. If we aerobrake, the MR comes down to 7:1 and only 900 tons of lunar aluminum and LOX are needed. Aerobraking is not out of the question, but it really changes the ship's design.

If fuel is available on both ends, at LEO and LO, we don't have to lug fuel along for return and each one-way flight only demands a 5:1 MR and 600 tons of propellant for a total of 1200 tons for the roundtrip. Getting the rocket fuel to LO is easy. How do we get it to LEO economically? Will fuel efficient NEP freighters that aerobrake be permitted?

The L1 spaceport is the solution. We simply follow this formula: lunar mine to mass driver, mass catcher to NEP freighter, freighter to space refinery and fuel depot at L1. From L1, a tiny chemical rocket burn could send a massive load of LUNOX aboard another non-nuclear freighter towards Earth where it aerobrakes into LEO. About 98% of the propellant the freighter leaves L1 with will make it to LEO. The freighter can fly back to L1 light, that is with empty tanks by firing chemical motors with minimal fuel expenditure. If we really want to be efficient, we don't send refined aluminum and LOX down to LEO, but just crushed alumina in a big plastic bag which is then broken down into aluminum fuel and LOX at a station in LEO. The empty freighter will amass next to nothing! Its heavy heat shield of rutile or silica will remain in LEO to be cannibalized. Rutile could supply titanium and oxygen to LEO for spaceship and space station construction.2

If rocket fuel is available on both ends and rockets just fly from LEO to L1 (a 3150 m/s DV maneuver), the 150 ton ship only needs a MR of 3.6 to 1 and 390 tons of LUNOX one-way; and just 780 tons for roundtrip. We can keep the sleek sharp nosed ET based hull design and retro-rocket upon return to LEO. If maximum efficiency is desired, a ship like the Jules Verne could aerobrake and use only half as much rocketfuel.3

From the L1 spaceport our passengers just fly down to Luna in LUNOX powered amphibious Moon Shuttles, then drive off in FROGS-wheeled land vehicles that detach from the Moon Shuttles - to places of scenic natural beauty and thriving human culture!

What if we throw some hydrogen into the mix? Spaceplanes from Earth could haul "hitchhiker" payloads of 10 to 20 tons of LH2 up to LEO with each passenger flight and stock up orbital depots. By using a hydrogen-aluminum-LOX "tri-fuel" system specific impulse can be increased and MR plus total fuel mass reduced. What if we toss in some lunar silicon and combine it with hydrogen to make silane? Since a pound of hydrogen has 60,000 BTUs and it can make eight pounds of silane which has 137,000 BTU, it seems we can get some leverage as does Zubrin's Mars Direct ISRU methane production scheme. Silane could be mixed with aluminum dust to make a gel fuel that can be pumped or pressure fed with gaseous silane into a conventional rocket motor and burned with LOX. This gel fuel could also cool the engine's walls and nozzle. At the very least, terrestrial hydrogen and the silane we make from it could power thrusters on our Moon Rockets and Moon Shuttles.

The Moon Rockets could carry 100 passengers in the ET hull with twice as much volume as a 747. They would have bunks but not cabins. A shield of polyethylene surrounding the bunk section will provide protection from solar flares. Space food warmed in microwave ovens will be eaten. There might be three minute zero-G showers and recycled water. It takes four days to fly from LEO to L1, so showers will be necessary at least once for everyone onboard. There will be TVs, DVDs, audio CDs, games and an observation dome with a small telescope. Power will come from solar panels, rechargeable batteries and fuel cells. There will be a radio system that picks up signals from personal cell phones aboard the ship and connects with communication satellites in GEO so that passengers can call home or check their reservations with the lunar resorts conveniently. **<DD>**

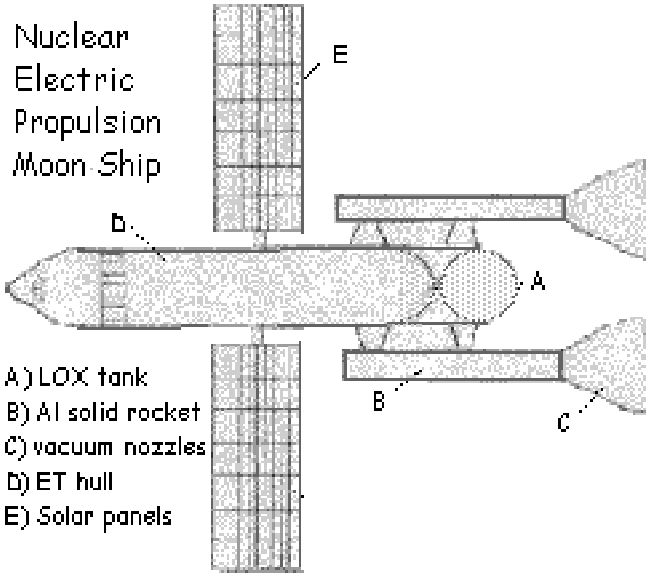
WORKS CITED

1. Wickman Spacecraft & Propulsion Company <http://www.space-rockets.com/Wickmans.html>
2. John S. Lewis Mining the Sky. Helix Books: 1996
3. Peter Kokh The A.F. Jules Verne Moonlooper . MMM #155 May 2002

ILLUSTRATION

http://groups.msn.com/DaveDietzler/photoalbum1.msnw?action=ShowPhoto&PhotoID=107

Before we build NEP Moonships, vessels like these can burn lunar Al and LOX for inter-lunar travel. This rocket carries 50 to 100 passengers, amasses at most 150 tons and gets power from solarpanels, rechargable Ni-H batteries and fuel cells. The ship is small, so passengers just get bunks instead of cabins.



hybridMoonsolarpanels.bmp Posted by Dietz37 on 11/16/02

Lunar Cyclers

by Dave Dietzler <Dietz37@msn.com>

Using the Quick Orbits program (download for free at: http://www.delta-utec.com/delta-utec_download.html) I found that an orbit with a perigee of 500 km and an apogee of 469,275 km. will have a period of 13.65 days (13.6501895 days), or exactly half of the Moon's 27.3 day cycle.

Since the Moon is 360,000 to 400,000 km away and L2 is 80,000 km beyond that or 440,000 to 480,000 km from Earth, the apogee of this orbit is real close to L2. A cycling station would rip around Earth at nearly escape velocity but it will just be creeping along at apogee.

If we use LUNALOX powered rockets like the ones I described in the "Moon Rockets" paper above, as taxis to haul 200 people or more at a time on short flights to and from the cycler, and rendesvouz with a station at L2, then take an amphibious Moon Shuttle down to the lunar surface, well, the only limit is the imagination. >>> A nice big rotating hotel with "1/6G artificial gravity" and roomy cabins, fresh lettuce and tomatoes grown on the station, coffee bar, ballroom, you name it, would be the way to travel. **<DD>**

Mail For MMM

Soil Farming vs. Hydroponics

Just read Richardson's piece in the last MMM regarding 'soil' vs. hydroponics. This site GRAPHICALLY CONVEYS why soil on the Earth works much better than hydroponics:

http://ens-news.com/ens/nov2002/2002-11-29-02.asp

However, it also indirectly shows why, at least initially, a soil-based approach WILL NOT work off planet. The reason is simple: You can't just plop down seeds in Martian or Lunar regolith and expect them to grow. Soil is defined as the interaction of biological processes within the dirt. 'Soil' in these places does not YET exist, and will need to be created from scratch, a long and complex process. Once that is done, then yes, you can grow plants in them. You still will not get the same yeilds as from hydroponics.

Hydroponics will be essential for many of the reasons you pointed out, mainly the growing space vs. produced biomass. His arguments about system failure problems would actually be worse in a soil-based system relying on manufactured ET soil. WAY MORE variables to juggle.

I think what happened, is that Richard talked to some commercial grower who tend to be biased towards hydroponics, (especially here in Oregon! I know many myself). Yes, if you have unlimited soil and space, it is 'easier' to grow in 'regular' dirt. But in a limited, enclosed situation, this is not the case. That said however, I use a process that is hydroponics, but relies on an inert substrait for root support, in our case, we use volcanic cinders:

http://beta.open.k12.or.us/mars/etag/marsoil.html

A close analog to 'raw' Mars regolith, (minus the aledged super-oxides*). Basically an inert material. Four times a day, a pump floods the substrait for 60 seconds, then stops. The nutrient solution then drains by gravity back into the holding tank until the next cycle. Basically an inert material. But the nutrients the plants need are actually provided in solution, and not within the material that the plants are 'growing in.'

I would like to write up a piece on this topic, and purhaps incorporate some 'Mars Light Levels' information which relates to a piece Terry Kok wrote awhile back.

R.D."Gus" Frederick
Caves of Mars: A NIAC P-II Study
http://www.HighMars.org/niac/

* These Super-oxides have never been positively identified, but rather suggested as a non-life explanation as to why the VLR experiment returned positives results. The oxides themselve have never been detected, and experiments to do so have never been successfully landed. Yet.

"Moon Power"

In connection Dave Dietzler's article, "Moon Power" in MMM issue # 159, you may be interested to learn that the Houston Chronicle ran an article by Mark Garreau about mining the Moon for helium 3. It made the front page on Sunday, December 8 of this year.

I would also like to refer you to an article by Dr. David Criswell that appeared in the April/May 2002 issue of a journal called The Industrial Physicist, titled "Solar Power via the Moon". Dr. Criswell's variation on the solar power satellite concept, in case readers have not heard of it before, is not to build solar power satellites, but to place the solar collectors and microwave transmitters on a satellite we already have, i.e. the Moon, building them largely from lunar materials. Relay satellites in appropriate Earth orbits could redirect the power beams as needed to the desired Earth surface locations.

I've known Dave Criswell from back when we were both grad students at Rice University. He is presently working at the University of Houston. He knows what he is talking about. His scheme appears to me to be able to return energy to Earth for less up-front expenditure than other proposals I've seen, and doesn't require us to wait until we've mastered fusion technology.

Larry J. Friesen

A pragmatic approach to ISRU

I was checking out a technical approach to ISRU [In Situ (= on site) Resource Utilization] at:

http://www.islandone.org/MMSG/aasm/AASMIndex.html

That's an interesting study -- fascinating from a scientific philosophy/logic standpoint. A less purist, more pragmatic and to-the-point approach would be to

a. emplace a capable suite of general purpose machine tools on the Moon, all tele-operable from Earth
b. start trying ISRU things (moving soil, beneficiation, materials creation, prototyping, manufacturing, etc.) to find new materials and processes that work well
c. gradually amass software *on Earth* that supports and controls the promising operations
d. keep updating and refining the software on Earth until the original machine tools, attached to an integrated computer which can contain all the Earth-based software, can be created on the Moon.
e. gradually transfer operating software to the Moon -- first small macros for routine tasks; then more and more comprehensive executive functions.
f. finally: end up with machine self-replication (the machines, and the smarts) on the Moon, complete with Earth-based overrides.

I've thought about this quite a bit. What would really be cool would be to find a way to do all this from

earth in a distributed, not particularly centralized, way--so that people and organizations all over the world could participate -- maybe own the intellectual property rights for parts of processes, etc. Looking for a foolproof, sure-thing financial widget to make it irresistable.

Burt Sharpe
Moon Society St.Louis

Welcome to "MOON"

a $5 B Las Vegas Resort & Casino

"Because you've been everywhere else!"

http://www.moonresortandcasino.com/

Mission: To create the first wonder out of this world

"MOON" is the dream of Michael R. Henderson, Irish-born Canadian entrepreneur working in Vancouver, BC. (info: mrk@moonresortandcasino.com) Henderson's objective is to create the world's most spectacular resort --a $5 B luxury mega-resort: 5 stars, 5 diamonds "like nothing else on planet Earth." MOON is envisaged as a technological and environmental masterpiece that will transport guests to the Earth's closest celestial partner.

Some MOON Highlights:

- 10,000 luxury suites, each a spacious 1,000 square feet
- 18 hole championship gulf course
- large scale cutaway of the MOON itself which houses the world's largest casino at 5000,000 sq. ft. and
- a magical 100,000 square foot Metropolis Discotheque.

MOON will offer an escape into the future with hundreds of attractions, including a giant lunar-themed aquatic center, exclusive shopping complex, terrestrial biosphere, moon buggy rides on a crater pocked terrain under a dome, and its own full scale duplicate of the International Space Station..

Business Plan: "Build it and they will come. "

A number of space authorities are on board the advisory team to ensure MOON"s authenticity and accuracy. Details of the grand plan have been under development at Henderson's Vancouver offices for the past five years. It is hoped that advance publicity and anticipation will yield 60 month's (5 years) worth of advanced sell-out room reservations. And you can go on the website today and reserve a room now, apparently, no money down.

"Stage 2"

MOON is about to come off the drawing boards one phase at a time at a location Henderson has secured in Las Vegas, Nevada, the world's fastest growing and top tourist destination. "Stage 2" is a 6,000 square foot display center in Las Vegas. The MOON team has located suitable premises and is in process of designing the center which will include the current resort scale model, two additional scale models and a full-size mock up of a typical 1,000 square foot suite.

Tour the website!

The moonresortandcasino.com website is one of the most sophisticated and beautifully done that this editor has ever visited. It's worth your leisurely and thorough exploration. Check every link in the Java navigation bar. Check all the image galleries, and be prepared for glimpses of a daring vision that will sweep away any cobwebs in your brain..

Press Reviews:

The press and media reaction to date has been favorable. But if you do a web search, you will have to sort out all the links to an unrelated Native-American owned "Moon Casino." But keep your eyes and ears open and you are sure to hear more. For example:

WIRED Magazine will feature **MOON** in its **March 2003** issue.

Prospects – Editor's comments

Will MOON become a reality? Or will it die on the drawing board or at the "stage 2" public model complex? The first press release on October 17, 2002 was greeted with enormous interest and enthusiasm. Yet the scale of the complex dwarfs such well known Las Vegas attractions as MGM Grand, the Bellagio, and New York New York. Face it. Five Billion dollars is a lot of money up front. As yet, no one seems eager to bet against Henderson's ability to pull it off.

Even if MOON doesn't open its doors as presently designed, but just in a scaled down version, or even not at all, the very scale and imagination of the concept has already raised the bar for all future casino-resort complex developers.

What's in it for us?

As individual space and Moon-enthusiasts, many of us will be attracted to check out the new resort, once (and if) it becomes a reality. It may provide depth and breadth to our imaginations and a shot in the arm for our energies.

But how can we piggyback our own space outreach efforts on such a facility? How can we reach even a fraction of the people who will flock to MOON as visitors?

We can dream of a partnership deal whereby our literature will be included in guest room welcome packets or at least in lobby brochure holders. We will need some kind of link to make it work for our ends.

The Moon Society has its own "Moon" Complex, also in Las Vegasland, in early stages of concept option brainstorming: **Project LETO**, a combination tourist and research facility supported by tourist dollars. If MOON becomes real, the Society's "Project LETO" will have more of a chance of piggybacking a ride to reality as well. -- **<MMM>**

http://www.moonsociety.org/projects/leto/

[Thanks to Birger Johansson. Moon Society member, Sweden]

Bag End 2: a Concrete "Hobbit Hab" as a Construction Model for Modular Homesteads on the Moon or Mars

by Storm Bear Williams <webmonkey@stormbear.com>

Build your own "Hobbit hole"

http://www.stormbear.com/bagend2/

"If you have seen [the recent J.R.R. Tolkien movie] *The Fellowship of the Ring*, you have probably fantasized about living in a Hobbit Hole and lazing about in the shade. I know I have. That is when I started expressing my inner architect and wondering of easy, bio-friendly ways to build a Hobbit Hole. These pages are what I have come up with.

"The largest expenses in building a home (not counting the flat screen TV and indoor lap pool) typically are the walls, exterior and roofing system. Obviously, the roof and exterior are done away with for Hobbit Holes. However you have some staggering stress and loading issues with underground housing. The weight of the soil and flora growing on it can produce tremendous loads on a structure. It is even worse when it rains.

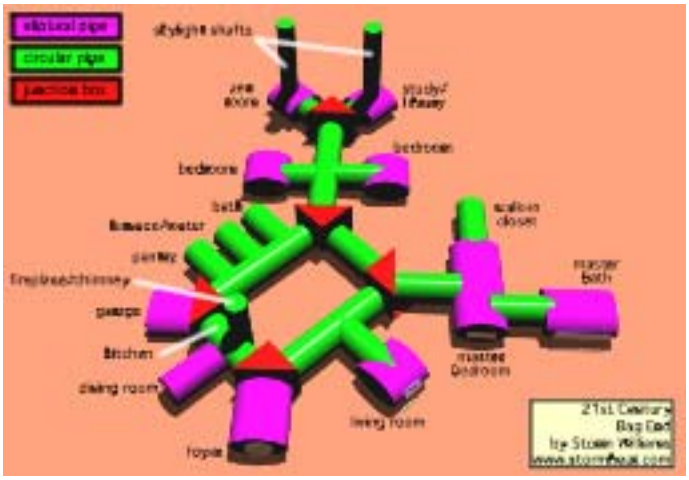
"Once you start doing the math for wooden structures, the cost quickly skyrockets. On top of high costs to support such loading, you have to deal with water seepage, insect vulnerabilities (termites) and wood rot.

"That leaves us the two building materials. Steel and concrete. With the circular nature of Hobbit Holes, one could use large steel pipe, but no source exists that makes low cost steel structures that I could find. But concrete... yes... concrete is the ticket."

http://www.stormbear.com/bagend2/prototype.html

{The URL above gives a larger 640x442 pixel illustration]

The structure uses 3 types of precast concrete modules. The main rooms use elliptical pipe. Hallways and smaller rooms use circular pipe and the junction boxes are triangular boxes. The floor plan for my design, fitting the aerial view illustration above follows:



Large elliptical precast concrete pipe (Smaller size)

http://www.hansonconcreteproducts.com/elliptical.asp

Comments from Birger Johansson

This [type of construction] would make it possible to build high-quality housing in the third world without the energy expenditure of making bricks. The more robust versions with precast concrete pipes might be good for building your own proof-of-concept "Marsbase". (You could not build with adobe if you had a 1 Bar pressure differential between inside and outside.)

Moon and/or Mars simulations: It would be cool if you could make precast concrete modules made locally, and then link together the modules in the manner shown in the images. And if you could actually make it robust enough to handle a pressure differential of 200 m Bar or more, you could thumb your nose at NASA for not thinking of it first.

Yours *Birger Johansson*

{Editor: It was in fact my own personal experience in visiting just such a "Hobbit Hole" that provided the "eureka" that continues to fuel Moon Miners' Manifesto. I talk about this experience in MMM #1. For a complete online account, go to: http://www.lunar-reclamation.org/mmm_1.htm

This personal "Hobbit Hole" vision is also behind the LRS Lunar Homestead display I built for ISDC 1998. See: photo, text, and diagram links on web page cited above. **PK**}

http://www.moonsociety.org

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

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

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

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Questions? email: membership@asi.org

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

- Artemis Reference Mission
- Artemis Data Book

Project LETO™

http://www.projectleto.org/

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

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

Lunar Observing: Easier, More Accurate with Lunar Map Pro Software

http://www.riti.com/prodserv_lunarmappro.htm

A new software program developed by Reading Information Technologies Inc, is garnering rave reviews from lunar astronomers. RITI, a Reading MA-based technical service and software engineering company founded in 1992, combined images from the Clementine mission along with its own vector maps to generate the software. It is the first attempt to apply Geographical Information System technology beyond the Earth's surface.

Lunar Map Pro 1.5 gives users a more accurate representation of the appearance of the Moon than other lunar maps because it uses orthographic projection to more closely match the visual distortion caused by the curvature of the Moon's surface. Vector based images allow for extensive enlargement without exhibiting loss of resolution.

LMP has a database of nearly 13,000 lunar features including 7,372 named features such as craters, mountains, valleys, plains and volcanic peaks. Features can be searched, displayed, zoomed, panned, measured and plotted on a computer screen or printer. A surveyor tool lets users accurately measure lunar features and surface distances.

The software retails for $89.95. System requirements are a 300 MHz or faster PC running Windows 98 or later and 96 MB ram. "We wanted to create an interactive lunar software product that would increase user interest and enjoyment in lunar observing," said Dr. F.K. Sun, founder of RITI. With a database of thousands features, Lunar Map Pro can maintain your interest in lunar exploration for a lifetime." Info: www.riti.com

Lunar Map Pro version 1.5 Advantages:

- Highest-resolution image (raster) maps
- World's first GIS lunar vector maps
- Maps flip and reverse to match your telescope view
- Simulated eyepiece field of view (FOV) maps
- Largest lunar feature database
- Easy image organizing and observing note linkage
- Navigator Window for Easy Access to Map Features
- Customized printing to suit your personal needs
- The most flexible feature labeling available
- The most accurate feature measuring tool

LMP 1.5 system requirements:

- 300 MHz
- 96MB RAM recommended
- Windows 98 and later
- 160 MB (minimum 85 MB) of free disk space.

Join (renew/rejoin) the Moon Society today!

http://www.moonsociety.org/register

International Lunar Conference 2003

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PROGRAM and SCHEDULE (Preliminary)

Sunday 16 November:

Registration 16:00-18:00 -- **Reception** 17:30-19:00

Monday 17 November:

Registration, Refreshments 08:00 * Conference Opening; Aloha Welcome 08:15 * Introductions 08:30 * Keynote 09:00; Apollo Moonwalker (expected) * Break 09:55 * Session 1: 10:15-12:00 -- Lunar Programs of the International Space Agencies: ESA, ISRO, CNSA, NASDA, RSA, NASA * Welcome Luncheon 12:15; Special Presentation:;First Woman on the Moon” * Session 2: 13:30-14:45; Lunar Programs Intl continued, plus Ukraine, Pakistan, Mexico, others * ILC2003 Day One Conclusions 14:45-15:15 -- Recommendations to Intl Space Agencies, ILEWG * Hawaii Space Tour to Onizuka Space Center at Kona Intl Airport 15:30-17:00 * Hawaii Aloha Welcome Reception 17:30-19:00

Tuesday 18 November:

Registration, Refreshments 08:00 * Session 3: 08:25-09:55 -- Science Of, From and On the Moon: Astronomy, Astrophysics * Session 4: 10:15-12:00 -- Science Of, From and On the Moon: Astronomy, Geology * Luncheon: Sponsor TBA 12:15-13:15 *Session 5: 13:30-14:45 -- Science Of, From and On the Moon: Geology, Materials Processing * Session 6: 15:00-16:15 -- Science Of, From and On and the Moon: Habitats; Power/Energy * ILC2003 Day Two Conclusions 16:30-17:00 -- Recommendations to Intl Space Agencies, ILEWG * Reception: Sponsor TBA 17:30-19:00

Wednesday 19 November:

All-Day Hawaii Space Tour of Mauna Kea / The Big Island: Saddle Road, Lava Fields, Astronomy Visitor Station, Summit Observatories, Hilo and Waimea Astronomy Facilities 07:00-17:00 * Luau Sunset Ceremony 17:30, Dinner 18:00 (optional)

Thursday 20 November:

Registration, Refreshments 08:00 * Session 7: 08:25-09:55 -- Pacific Space Access * Session 8: 10:15-12:00; Pacific Space Access; Advanced Space Launch Technologies Luncheon: Sponsor TBA 12:15-13:15 * Session 9: 13:30-14:45; Lunar Commerce, Enterprise and Technology (Robotics) * Session 10: 15:00-16:15; Lunar Commerce, Enterprise and Technology * ILC2003 Day Three Conclusions 16:30-17:00 -- Recommendations to the Aerospace Industry, Intl Space Agencies, ILEWG

Friday 21 November:

Registration, Refreshments 08:00 * Session 11: 08:25-09:55; Space Tourism and Hawaii * Session 12: 10:15-12:00; Who Owns the Moon?: Property Rights * Luncheon: Sponsor TBA 12:15-13:15 * Session 13: 13:30-14:45; Aloha: Hawaii / Global Education and Culture in the Space Age * ILC2003 Day Four Conclusions 14:45-15:15 -- Recommendations to State of Hawaii, Travel Industry, ILEWG * Hawaii Space Tour to Natural Energy Lab / Free Time 15:30-17:00 * Reception 17:30-18:45 * ILC2003 Banquet, Awards and Resolutions 19:00-21:00

Saturday 22 November:

Closing Breakfast Ceremony 08:00-09:00* Kama`aina Open House -- Art and Technical Exhibits 09:00-12:00 * Hawaii Island Space Tour (optional): South Point, Kilauea Volcano, Hilo

"It's not the time we have, but what we do with the time we are given."

J. R. R. Tolkien

Gaming Ideas for Wanna-be Lunans Exiled in Terrestrial Outposts

from Bob Lancaster < fixerbob@worldnet.att.net >

I'd like to share an idea that could be useful for chapter outreach, generating ideas, or just plain fun. A couple years ago, I started working on a 3D Virtual Reality Lunar environment on my PC. The software I used was actually very simple: You might be familiar with "first-person shooter" video games like Doom or Quake, where you have a first-person perspective of walking through an environment. A lot of gamers actually create their own custom "levels" with editing software sometimes included with the games. Such was the case with Activision's "Star Trek Voyager: Elite Force". Using the game software and a couple other freeware programs I'll list below, I was able to make a 3D lunar crater, complete with simulated 1/6th gravity. The game editing software is very powerful and can be used to create any object you can imagine (Artemis Reference Mission site, etc.)

My laptop, however, crashed for unrelated reasons (blown modem, since fixed obviously) and my custom video driver was changed by the maintenance people. I'm at a point where I can start working on it again, but wanted to share the idea with others, if you think it would be useful.

Here's the necessary PC software:

- Activision's "Star Trek Voyager: Elite Force". I initially worked with the first game release, but want to get the version of Elite Force bundled with the expansion pack (search at Amazon.com for ASIN# B00006IINS) so the hand you see in front of you on the screen can either be empty or hold a "tricorder"
- EFRadiant editing software: http://www.fileplanet.com/files/50000/50612.shtml May also come bundled with the new game release, but is available at various locations on the web. With the editor, you can create 3D wireframe objects that you apply appearance "textures" to simulate a metal deck plate or lunar soil. Various "sky boxes" for the 3D environment are also available as used in different parts of the game; other sky boxes (lunar black, martian red, etc.) can be found on line.
- Finally, a custom terrain-generating program called Gensurf: http://tarot.telefragged.com/gensurf/ This takes grayscale bitmaps and translates them into topographical frameworks for the editing software to "map" textures onto.

The software takes some studying and tutorials to see how it all fits together, but is pretty easy once you get the idea. With any luck, I'll be able to get back to work on mine; I'll be happy to answer anyone's questions if they would like to try it.

Online Multiplayers

Another aspect of this gaming software is the online multiplayer part. With the environment running on a dedicated host server, others with the software (and preferably a fast connection) can log on and interact together with the environment. There are multiple player models (and also web freeware for creating new ones) so everyone can choose an appropriate "avatar". Communication is via text lines at the bottom of the screen, but I suppose some type of voice-over-IP program could also be done. When you look at a particular character, their player name appears to identify them.

One use for Artemis I had considered for this would be something like the ASI MOO, but with the visual element of the Luna Sims page of the databook; imagine several of us logging into the environment to walk into a virtual hangar and explore a new hab design.

One thing about the multiplayer version someone would have to address is the fact that the players have no empty-handed option; you start out carrying a hand Phaser. I'm sure someone out there has written a mod'ed level for game play where the player is unarmed. Of course, (tongue-in-cheek, here) discussion moderators could be "armed". Also, other gamers like to search the net for active IP addresses running these games; I think the server could be set up to exclude them, but if not, it could lead to an interesting virtual debate over the virtual right to bear virtual arms.

Bob Lancaster
San Antonio Moon Society Outpost
Mars Society Member

Paper(s) (password-protected):

"**The Need for Police Services in a Lunar Community**"
http://www.asi.org/adb/02/11/01/needcops.html
[published in MMM # with permission.]

The Space Show – Online

from Charles F.Radley <cfr@attibi.com>
http://www.TheSpaceShow.com

The Space Show Program Archives are now available! Check out the website above for 24/7 listening to past shows! You need Windows Media Player which you can download free from the website.

The December 25, 2002 Space Show program features Paul Blase, the Chief Technical Officer (CTO) of TransOrbital, Inc., the company preparing to send private missions to the Moon. Mr. Blase was interviewed in Moscow, Russia on December 22, after returning from the Ukraine and witnessing the Dnepr launch with the mockup TrailBlazer payload onboard.

Moon Society St.Louis Chapter

Few and scattered notes fromthe January 8th meeting.

Attendees: Dave Dietzler, Christie Dudley, Burt Sharpe, Chris Nobbe, Dave Heck Keith Wetzel was recovering from an illness.

We decided to move forward with forming a non-profit 501 (c)(3) organization. The most important benefits cited were better chance for recognition from: Boeing and other local companies (for some later form of corporate support), as well as easier access to the St. Louis Science Center and other educational entities. Chris Dudley will (already has) investigated (as has Keith Wetzel). We discuss again next month.

We elected officers so we could get full chapter status from the Moon Society. Dave Dietzler was voted Finance chairperson and Dave Heck was voted Secretary. There was some talk about naming several of the members as "Charter Members". Members are asked to consider this for next meeting, as well as any other "officers" needed.

We reviewed a proposed mission statement. After several minutes of discussion, we decided to review the proposed statement at home and voted on it next month. Dave will e-mail a copy to all members.

We discussed Chris Nobbe's "Moon Madness" event at her school next Thursday. Dave suggested we take lots of pictures for our web site, and volunteered to drive Chris's digital camera.

We briefly talked about upgrading our website, (http://www.moonsociety.org/chapters/stlouis) once our mission statment was done. Dave Heck will be contacting Keith Wetzel. Dave FORGOT to remind every-body to work on a brief biography of themselves to include in the web site (if we decide to). Dave will be sending his synopsis as well as his first hack at a St. Louis biography to everyone.

We finished the meeting by listening to two short presentations from Dave Heck. The first was a brief exchange of ideas for the first lunar garden. During this, Dave mentioned a local company called Worm's Way, which specializes in indoor gardening, hydrponics and .... home-brewing BEER. DAve suggested we contact them and ask for their help with nutrient requirements, system weights, lighting requirements. The second was a discussion of the Laser Additive Manufacturing process, and it's possible applications to Lunar manufacturing (sintering bricks, etc), as well as advancements with electron-beam welding for . Burt Sharpe stated he knew of a Czech study of casting basalt. This led to a discussion of using an e-beam gun to melt regolith and cast it into various shapes. Dave will be in contact with The Welding Institue in Cambridge, England regarding the e-beam gun that the Russians put on Mir. More to come later. -- *Dave Dietzler*

Possible St.Louis/Multi-Chapter Project

One of the things I'd like to pursue with the St. Louis Chapter of the Moon Soc. is to contact several of the chapters and discuss a development project. This seems like a place to start. There's a company here in St. Louis called Worm's Way which specializes in Indoor Gardening, Hydroponics, Recycling/Composting and MAKING BEER.

I plan to ask them to come to our next meeting and help flesh-out some of the requirements of Lunar Gardening. We may be able to get a little corporate help (Worm's Way is a multi-state company) on this effort.

What are your thoughts on: (a) doing a multi-chapter net-meeting or teleconference; (b) setting up development projects to help research some potential Moon activities? Let me know what you think.

David Heck
Senior Specialist Engineer
AMR&D Structures Design
Phantom Works - Metallic Processes
The Boeing Company
(314) 234-8318
email: david.p.heck@boeing.com

Moon Society Outpost Websites

Oregon:
http://www.moonsociety.org/chapters/oregon/

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

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

North Texas:
http://www.moonsociety.org/chapters/nth-texas/

Milwaukee:
http://www.moonsociety.org/chapters/milwaukee/

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

Europe:
http://chapters.asi.org/europe/

Not on this list: Not included on the list above are websites of chapters and outposts that show no sign of recent activity, and for which the local contact does not respond: Las Vegas, San Diego, Dallas, Detroit, Huntsville.

Get a free website for your Chapter or Outpost:

You can get a totally free website on the Moon Society website with total freedom of design and format. Even if you are just one solitary person, you can still serve as a Moon Society Outpost, and having a website may help attract other interested persons in your area. Write chapters-coordinator@moonsociety.org for more info.

Meandering *through the Universe*

Column on the Cooperative Movement on the Space Frontier

Murder and Justice on the Space Frontier

I recently spent about six weeks as a juror on a murder trial. Besides the questions of guilt or innocence, it left me wondering about a few things related to space settlement like, will there be murders in space? I know that is a "duh" question, but it lays a foundation which leads to further questions starting with the more general "duh" question, will there be crime and non-criminal disputes in space? If so (a little less dumb question), will ***early*** space settlements have to face any of these problems? If so, what are our plans for coping with the sudden and unexpected loss of personnel and their productivity, both among victims and defendants?

Remember what an ***early*** settlement is and how it will necessarily have limited resources, including an extremely tight budget of human productivity and similar resources. Not only will the productivity of victims and the accused be lost or reduced, but how will an early settlement spare the productivity of the personnel necessary to conduct a full and fair trial in any specific case and to provide for an always available, proactive, well working justice system?

Or am I wrong in thinking that we want a fair and efficacious justice system? Will lynch mobs, personal vendettas and survival of the "fittest" be all we need and want?

My guess is that we probably ***can*** agree that we want as fair and efficacious a justice system as possible up and running and ready to handle any case big or small. I would also guess, however, that no such system is going to spring up, ready made out of the vacuum. It will require careful planning and a commitment to diligently following whatever plan is designed -- even when that seems extremely inconvenient or esoteric or irrelevant.

So, if we ***do*** want to have a truly good justice system in our space settlements and we really are willing to work to make that happen then, what will be our plan? How are we going to provide for such an expensive thing under the trying economic and logistical circumstances we will be facing? One possibility would be a system based on the justice systems used aboard ships, especially free world military ships.

There are a couple variations of this system. In one, ***all*** cases would be handled locally at the space settlement, by the residents of the space settlement. In the other, certain of the most major, most serious cases would be shipped off to Earth (or a larger more capable space community, if any are available) to be dealt with there.

It seems likely that because of lack of resources, including population, necessity would dictate starting with a military-like system and evolving to a more civilian type as the settlement grows and matures. Nonetheless, it is critical to examine whether it would be possible to actually begin with a normal, democratic nation kind of justice system right from the very beginning (or so nearly the beginning so as to not make any real difference). To thoroughly examine the question is way beyond the scope of this column, but it is an important question.

It would be a shame for space settlements to settle for the second or third best of anything if they could legitimately afford to have something better. That is all the more true in the case of justice. Some questions that pertain are: What is the minimum population necessary to make such a system of justice work? How would judges, lawyers and other staff be provided for? What if no one is willing or able to take on a critical position ... say, judge or defense attorney? Will the taxpayers of the space settlement pay for training of citizens (who may normally hold down other jobs) to serve as court officials so that they would be competent and capable when and if needed and so that the system will work as well as possible? Or will the community merely hope that well educated legal experts will choose to live among them? Or will the space settlers try to lure the needed legal eagles with some kind of incentives? Will there be full-time legal work for such people to do, or will they have to also work in other fields when not needed for trials and so forth? Which would be better: to train scientist, engineers, technicians, laborers, etc., to be able to serve in law and justice capacities when needed or to train legal professionals to do other jobs?

And then there is the big question of whether we should inherit unto ourselves a preexisting legal system or should we create our own system, new and fresh, yet firmly founded in all that is good of what has gone before? This latter is what I personally would like to see happen. And since you asked, here are a few thoughts of what I think (at this moment in time, anyway) about that.

First, whatever else it is, a "new" justice system should make more intelligent use of current technology and a better and more complete understanding of psychology and sociology, not so as to invade privacy in some misguided effort to "increase security" but, primarily, to improve the quality and cost efficiency of forensic investigation. If we do want to "increase security," there is only a single way that has ever been discovered of doing that in any real sense, and that is to increase justice at all levels for all age, race, gender, and creed groups. Anytime people are oppressed and/or abused, whether legally or illegally, and whether by government, business, or other "normal" citizens, crime increases in response in something like a positive feedback loop. No system of punishment has ever proven to be effective in breaking the link between social injustice and personal injustice. I do believe that punishment is an important component of a fair and effective justice system, but when it is the major emphasis the

historical evidence is that the injustice and abuse move into the realm of the legal and/or generally approved, so that the society is wholly crime ridden even though not officially so. That is an extremely critical point to bear in mind as we plan for humankind's future in space, but I am looking beyond that for this column.

Anyway, to continue, a pre-planned justice system could be designed to have stages or an evolving form to meet the needs and resources of a growing and maturing space community. A key advantage of carefully preplanning all of this is that it can reduce (though probably only a little bit) the frequency and intensity of political battles fought in the space communities over what to do about justice.

Naturally, the citizens would have to have the freedom to make "midcourse corrections" or even scrap the whole thing if they felt they needed to. Yet, a well designed and implemented system should save them from feeling the need to mount major battles to obtain a satisfactorily working justice system. And avoiding even a little bit of wasted energy would be a big help to early space settlements. Of course, a poorly conceived plan would only increase wasteful and unproductive political and social distractions and increase the chances that the space settlement would fail. So, if we can't come up with a fair and flexible system, we'd better just bugger off completely. **<RRR>**

Richard's homepage:

http://richardpatricia.homestead.com

New Greenhouse & Waste-Water Recycling System debuts at Mars Desert Research Sta.

http://www.marssociety.org/news/2002/1114.asp

The 2002 MDRS field season has started with a new addition to the station, the H. T. Odum greenhouse. After the first greenhouse succumbed to the 60-plus-mph Utah winds last season, several teams of volunteers from the society's GreenHab group installed a new beefed-up design this summer and fall. The 12' long, 14' diameter cylindrical structure is made of a sturdy steel frame with clear polycarbonate glazing panels donated by Suntuf, Inc. The Suntuf SUNLITE (R) and Suntuf (R) panels are clear, rigid, light-weight and nearly indestructible. Before the new structure was installed, 12-18" of desert soil was excavated, then backfilled into the bottom of the cylindrical structure as a foundation for the insulated floor. In addition to several tons of soil ballast, the structure is secured with steel guy cables on the sides and ends. It was designed as an analog of an inflated Martian greenhouse and houses the 'living machine' aqueous biome component of the new water recycling system.

The GreenHab group formed at the Stanford Mars Society conference and has made formidable progress in recycling the water and solid waste at the MDRS. Primarily utilizing biology, and various supporting physical and chemical processes, the system can treat up to 40 gallons of water a day. The recycled water is currently used to flush the toilet. Treated water will be regularly tested over the course of this field season and the data will be analyzed by the GreenHab group. A major GreenHab goal is to incrementally improve the quality and thus increase the number of uses of the recycled water. The installed living machine uses half the floor space of the H. T. Odum greenhouse leaving the other half available to researchers for future experiments.

The living machine at the heart of the system was designed by David Blersch and Dr. Patrick Kangas of the Department of Biological Resources Engineering at the University of Maryland. A test-bed greenhouse and living machine was previously constructed and continues to operate on the campus of the University of Maryland.

The new greenhouse is named after the noted ecologist, Dr. Howard Thomas Odum, who passed away in September 2002. Dr. Odum was a founder of the modern science of ecology and the field of ecological engineering. He articulated the need for ecological structure and function for life support associated with space travel, with publications on this subject spanning over 30 years. Dr. Odum received his doctorate in zoology from Yale in 1951. He was a teacher at the University of Florida, Duke, the University of Texas, the University of Puerto Rico and the University of North Carolina before returning to Florida in 1970 where he founded The Center for Wetlands in 1973. He wrote 15 books and more than 300 articles.

The GreenHab Group is led by Mars Society Steering Committee member Gary Fisher. GreenHab members who made major contributions to the MDRS project are: David Blersch, Dr. Penny Boston, Dean Calahan, Dennis Creamer, Gus Frederick, Sherwin Gormly, Dr. Patrick Kangas, Bruce Mackenzie, Kenneth C. Miller, Frank Schubert, Sam Stone, Jeff Zerr, and employees of Firestar Engineering, LLC: Ted Fisher, Greg Mungus, and Ritch Shidemantle.

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www.plesetsk.org

from Ben Huset <benhuset@skypoint.com>

What a difference a few decades makes!

Yester years ULTRA Secret Soviet missile base is now a public web site. Site also includes 'interesting' US Military info. Plesetsk was where Gary Powers was headed in his U-2 in May 1960 when he got shot down.

Planetary Society looks Forward to 2003 New Mars Missions – Solar Sail Mission

From Louis D. Friedman Executive Director

2003 and Mars

We look forward to 2003 with great hope. We'll see five spacecraft set off to explore Mars: NASA's two Mars Exploration Rovers (MER); the European Space Agency's Mars Express, which will carry the Beagle 2 lander; and the Japanese Nozomi orbiter mission. They will join the Mars Global Surveyor and Mars Odyssey now circling the Red Planet.

We will celebrate this unprecedented exploratory fleet ... with a Planetfest on January 2 to 4, 2004, the weekend the first MER lands on Mars. That same weekend will see Stardust fly through the coma of comet Wild 2 and collect samples of its atmosphere for return to Earth. MER and Stardust carry the names of all Planetary Society members who were with us at the time of spacecraft assembly. And to add to the excitement of that first weekend of 2004, Deep Impact, a mission to comet Tempel 1, is scheduled to launch. Look for future Planetfest updates coming soon on http://planetary.org

2003 and SETI

The Planetary Society's own projects are expecting a big year in 2003. We will achieve first light on two telescopes: a brand-new optical SETI telescope in Harvard, Massachusetts will begin looking for light pulses from other possible civilizations in our galaxy; and a refurbished telescope on Kitt Peak, Arizona will start looking for planets around other stars. We hope that both these projects substantially advance our search for extraterrestrial life.

SETI@home now has over 4 million people using their computers to process data collected by the Arecibo Telescope in Puerto Rico. This amazing project, of which we are the founding and principle sponsor, is the biggest distributed-computing experiment ever.

2003 and Solar Sailing for 100th Anniversary of Flight

But I reserve my greatest enthusiasm for Cosmos 1, our solar sail project, which has been a personal dream of mine for nearly 30 years. With Ann Druyan's Cosmos Studios, we are taking the most ambitious step ever for a private space-interest organization: We are launching our own mission. It's fitting that we launch during 2003 -- the centennial of flight. With our solar sail, just 100 years since humanity achieved powered flight, we will be taking the first step to the stars. Our reach may, or may not, exceed our grasp -- but we will begin the journey.

Those of us interested and involved in space exploration have a positive vision of the future and for humankind's achievements.

Visit us at:
http://planetary.org

Mars Desert Station Videos Available

from Bruce Mackenzie <BMackenzie@alum.mit.edu>

MDRS video available on–line

1. Observing MDRS & Mission Support - via e-mail
2. Observing MDRS Mission Support - real time
3. New -info@chapter.MarsSociety addresses and e-lists available

Videos (and photos) from MDRS are now coming in.

Several videos were taken, but they have had trouble converting and transmitting them. Two are at:
http://chapters.marssociety.org/swhab/photos/2003-01-05/

recent still images are available at:

http://chapters.marssociety.org/swhab/photos/2003-01-04/
http://chapters.marssociety.org/swhab/photos/2003-01-03/
http://chapters.marssociety.org/swhab/photos

1. To observe the operation of the MDRS

(the Mars Desert Research Station in Utah) and the Mission Support Crew,

- send a message to
MDRS-Public-Observ-Subscribe@MarsHome.org

You will then receive copies of some of the e-mail sent to/from MDRS.

2. To join Mission Support live

(most evenings about 7 pm MST = 9 pm EST):

a. Go to: http://chapters.marssociety.org/moo/
b. Click on the 5th line: Open the Java MOO Client.
c. Type: connect guest
d. type your name, with no spaces, example: TomJones
e. Type: Observation

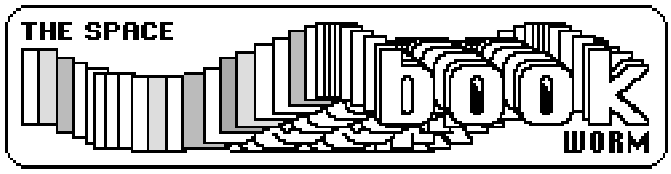
The Moon Holds Secrets About Earth

http://www.space.com/scienceastronomy/topmysteries_2003_021226-5.html

The most profound secret held on the Moon might be rocks launched from Earth billions of years ago by asteroid impacts. This July an attempt was made to quantify these storehouses of terrestrial information; The estimate: 11,000 pounds of Earth stuff sits on or near the surface for every square mile on the Moon.

The rocks could hold information about the composition of the young Earth and its atmosphere, possibly even the origin of life. This information is available nowhere else because, unlike the Moon, Earth continually recycles its surface material, in geological processes.

Nobody is certain this stuff is there, or can be retrieved, but researchers are optimistic. "This [new study] gives us a compelling reason to go back -- to look at the Moon as a window to early Earth," said study leader John Armstrong of the U. of Washington. He added that it would be the fastest and cheapest way to learn about planet's early years and the formation of the whole solar system.



Space: The Free-Market Frontier

Edited by Edward L. Hudgins

abridged by MMM from http://www.cato.org/

"The stagnation of America's space program over the last two decades has had one positive effect--it has motivated and invigorated a growing army of entrepreneurs who understand that the future of space exploration and exploitation will fall not to governments but to the private sector. ... " —Lon Rains, Vice Pres. and Editor, *Space News*

Is NASA lost in space? For years, private enterprise has been poised to explore outer space and deliver benefits to people on earth--from perfecting new life-saving medicines to creating new food crops and operating floating factories for high tech innovations. But NASA's bureaucracy has been floundering, erecting legal and regulatory barriers to entrepreneurs wishing to operate in space.

On July 20, 1969, Neil Armstrong and Buzz Aldrin became the first men to walk on the Moon. At that time, most Americans found it difficult to imagine that the vision presented in the movie 2001: A Space Odyssey would not be in our future ... that by 2001 there would [not] be regularly scheduled commercial flights to orbiting hotels. But no such flights have materialized. Fewer than 500 human beings have ever ventured into space. And the International Space Station is billions of dollars over budget and radically scaled back from its initial design. What has happened in the past three decades to delay mankind's full exploitation of space?

The cause of the problems is found in public policy. Civilian space efforts have been dominated by NASA. [The] agency has retarded activities in space as much as it has facilitated them. [While] NASA has been lost in space, entrepreneurs ... have given birth to the computer, telecom and Internet revolutions. Private markets are the answer.

In *Space: The Free-Market Frontier*, [top] experts analyze how we can move from the current situation of limited access to space {to} space [as] a place where people can work, play, and live. Edited by Edward L. Hudgins, an adjunct scholar for the Cato Institute, this book considers how we arrived at our current situation, what signs hold the promise of a free-market future, and which policy changes might [help] space become the next free-market frontier.

Edward L. Hudgins is director of the Washington, D.C., office of the Objectivist Center and an adjunct scholar of the Cato Institute. He is an expert on the regulation of agriculture, pharmaceuticals, labor, space, and transportation and has appeared on Dateline NBC, NPR, PBS, Fox News Channel, MSNBC, and CNN. **<CATO.org>**

$25 cloth ISBN 1-930865-18-X $15 paper ISBN 1-930865-19-8

Yuri's Night

April 12 th Worldwide Space Party

http://www.yurisnight.net/

The anniversary of Yuri Gagarin's 1961 launch as the first human in orbit. It is also the anniversary of the 1981 space shuttle launch as the first "reusable" space ship.

Excerpts from their web site press kit:

> Yuri's night is a worldwide grassroots effort to celebrate humanity's exploration of space with music, imagery and dance.
>
> The first Yuri's Night celebration was held April 12, 2001in 64 cities in 29 countries on 7 continents.
>
> The April 12, 2002 celebration included over 100 events (ranging from a rave in Los Angeles to messages from the Space Shuttle and the International Space Station to "small" events such as a bookstore party featuring the store's space-related books), in many cases connected "live" over the world wide web.

So far, Yuri's Night celebrations seem to attract younger people, New Age people, and others who would not otherwise gravitate towards organized space enthusiast societies and activities. But some NSS chapters have begun organizing Yuri's Night celebrations in an effort to tap into this younger constituency. Our own established space chapters are notably "graying" and in need of an infueion of fresh blood, so this kind of initiative makes sense.

In 2002, Minneapolis Space Frontier Society took the plunge. MNSFS's Ben Huset writes:

- May 19, 2002 -- Here in the land of 10,000 lakes, we had a nice small party, held in the party rm of the local NSS/Mars Society Chapter President's Condo (David Buth) with
- Music CDs Provided by NSS and ZIA (www.ziaspace.com/)
- Door Prizes • Munchies • Live NASA TV Audio
- Costume contest (as your favorite cosmonaut / astronaut)
- Videos of Earth seen from the Shuttle viaprojection TV
- handout photos of ISS 4 crew and STS-110 crews
- A 1:144 model of ISS in its current config.
- Computer running http://www.dransom.com/stsplus.html showing current location of ISS/STS-110
- a VERY nice (65° max altitude) ISS/Shuttle pass that was -0.5 magnitude. We needed a pass this bright because just a few blocks away our baseball team (MN Twins) were having a home game and they had their searchlights on, but we were able to see it just fine, as it flew through the big dipper. (Ursa Major)
- Funny captions to some old Yuri photos on the net at: http://www.russianarchives.com/rao/catalogues/gagarin/

A good time was had by All. - *Ben Huset*

Other Space Chapters might want to join in! Visit the Yuri's Night website and follow the links to records of what other groups have done around the worlc. **<MMM>**

Mason's Ego Con

Saturday, April 5, 2003: 10 am - 5 pm
Holiday Inn, **Stevens Point**

Featuring:

- Special Guests
- Huckster's Room
- Costume Contest
- Video Room
- Gaming and Gaming Demonstrations
- Door Prizes
- Discussion Panels
- Annual NEWFoD Auction
- Lunch available.

Volunteers needed!
Dealer/club spaces still available!
Programming ideas still needed!

For further info, send a SASE to:
NEWFoD
c/o Paulette Imhoff
P.O. Box 5065
Wausau, WI 54402

Or call Paulette at:
715-842-3914
Or email Keith at:
wasfen@mywavemail.com

The Lunar Reclamation Society, Inc.

PO Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

LRS OFFICERS (area code 414 unless specified)

LRS PRESIDENT, MMM/MMR Editor - Peter Kokh*
<kokhmmm@aol.com> 342-0705
VICE-PRES/TREAS../LRS/MMM Business & Database Manager - Robert Bialecki*..... 372-9613
SECRETARY. - Charlotte DuPree
<cmdupree@netwurx.net> ..... [262] 677-9149
NEWSLETTER ASSEMBLY - Charlotte DuPree and Carol Nelson 466-2081
(* LRS Board Members, plus Ken Paul ..... 426-0432)

LRS NEWS

• **January Meeting Report:** 7 members present. We discussed current negotiations with the Moon Society over the PDF file version of the newsletter, there being a substantial misunderstanding between us as to whether LRS should be compensated for pdf subscriptions to this copyrighted product. The December MMM pdf file will not be uploaded to the Moon Society website until a satisfactory agreement is reached, which agreement must include compensation for past "losses" by LRS. We also discussed the very real chance that we may soon not have enough hardcopy subscribers to justify bulk mail savings, and what that might mean for the future of our newsletter.

Ken Paul brought in a supply of Zip disks for Peter to back up the LRS/MMM computer.

Bob Bialecki brought in two videos for us to watch:

- This Old House episode in which Steve Thomas and Norm Abrams tour the Kennedy Space center facilities including the VAB, launch pad, and Space Station mockups, and actual docking node prior to launch.
- Discovery Channel Video, "Moon Dreams" featuring several key people in the for-profit back to the Moon arena, including Moon Society President Greg Bennett, Lunar Prospector's Alan Binder, and SpaceDev CEO .

• **Second Computer:** Peter recently acquired a new Mac I-book (from an anonymous donor) so that he can work on MMM and get email when away from home. This new computer will also serve as a backup for all the MMM files. It runs Mac OS X at 600 mhz, with 128 ram and 20 GB.

LRS FEBRUARY & MARCH Events

Saturday, FEB 15th & MAR 15th, 1–4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G110** (lower level, NE part of Mall) near the ground-level entrance below Cinema complex. FREE to public as usual.

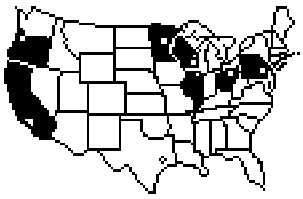
• AGENDA: TBD - check online at:
http://www.lunar-reclamation.org/page4.htm

Collaborating Milwaukee Area Space Groups

Moon Society Milwaukee Outpost
c/o Peter Kokh
414-342-0705 - kokhmmm@aol.com
http://www.moonsociety.org/chapterws/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
contact Matt by phone or email address above

U.S. CHAPTERS



NSS Chapter Events

MMM 8 Chapters Strong

Space Chapters HUB Website:

[http://nsschapters.org/hub/]

MINNESOTA

Minnesota Space Frontier Society

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

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

[www.mnsfs.org/]

MEETNGS: 3rd Saturday of the month from **1-4 pm**
at the: **St. Anthony Park Library**'s Meeting Room
2245 Como Ave. St. Paul, MN

Greetings from Tom Greenwalt <tomg@mnsfs.org>

As the new Executive Director of the MN Space Frontier Society, I thought I should drop MMM a note.

• **New Website Domain** - First we have a new domain name and website. I registered "mnsfs.org" which is easier to find since it better matches our name. The new website is "http://www.mnsfs.org" and while still under construction it is easier to navigate.

• **New Meeting Place & Time** - Second we have established a regular meeting time and place. Society business meetings will be held on the third Saturday of the month, 1-4 pm at the: St. Anthony Park Library, 2245 Como Avenue St. Paul.

• **General Public Meetings** - Third, we're planning on also starting up more general meetings with speakers and stuff geared toward topics for the general membership and the public, probably on a quarterly basis until we can get enough interest to have them more often. Hopefully we will pick a specific date for the first one at the next business meeting.

• **Making Projects Central** - During the past few years MN SFS has mostly been coasting, concentrating on outreach activities. There has been a significant drop in membership. For the future, I'm hoping to refresh MN SFS with a shift in focus. We'll keep doing outreach, but I want to move it down a notch and start doing R&D as the main focus. Toward that goal we're looking at what our members fields of expertise are and what aspects of space we're primarily interested in. From there hopefully we can pick a project that most of us will want to research and prototype.

CALIFORNIA

OASIS

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

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

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

Our Website has Moved. NOTE NEW ADDRESS

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

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

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

Information: OASIS Hotline, 310/364-2290; website.
Microcosm, 401 Coral Circle, El Segundo.
FEB 15th -- OASIS Monthly Business Meeting, location: Microcosm, 401 Coral Circle, El Segundo.
MAR 13th -- OASIS Monthly Business Meeting, location: Microcosm, 401 Coral Circle, El Segundo.

Recurring Events

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

OREGON

Oregon L5 Society, Inc.

P.O. Box 86, Oregon City, OR 97045
voice mail / (503) 655-6189 -- FAX (503)-251-9901

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

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

☞ Meetings **3rd Sat.** each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**
NEXT MEETINGS: **FEB 15th, MAR 15th**

PENNSYLVANIA

Philadelphia Area Space Alliance

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

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

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

NEXT MEETINGS: JAN 18th, FEB 15th, MAR 15th
Call Earl or Mitch 215-625-0670 to verify all meetings

• We .had a good time at Philcon, Dec. 13th - 15th. Our next event will be Super Science Weekend, January 11th - 12th, as previously reported followed by a meeting at our regular location on January 18th (3rd Saturday). - *Earl Bennett*

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042-1034
c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@excel.net>
››› DUES: "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020

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

☞ We meet the **3rd Tuesday** of the month at **7-9pm**
Jan.21: Foerster Academy of Dance, **Sheboygan**
Feb.18: Stoelting House, **Kiel**
Mar.18: Foerster Academy of Dance, **Sheboygan**
APR.15: Stoelting House, **Kiel**

OHIO

Cuyahoga Valley Space Society

3433 North Ave. Parma, OH 44134-1252
c/o George F. Cooper III, Phone 216-749-0017
E-Mail: geocooper3@aol.com

☞ **NEXT MEETING DATES:**

- **FEB 18 th** ? TUE 6:45 pm Bedford Cyber Cafe?
- **MAR 24th**? MON 6:45 pm Fairview Park Library?
- **APR 19th**? SAT afternoon, Great Lakes Science Center

Solar System Ambassadors

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

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

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

The National Space Society

Inivtes you to join fellow Space Enthusiasts at the

2003 International Space Development Conference
San Jose, CA – May 23 – 26, 2003

Experience the Excitement of the people and the organizations pioneering the settlement of Space.

Hyatt San Jose
1740 North First Street
San Jose, California, 95112 USA
Tel: 1 408 993 1234 -- Fax: 1 408 453 0261

ISDC: Annual meeting of the National Space Society for members and Board of Directors, ISDC strives to advance NSS' vision of the human settlement of Space

THEME: "Roadmap to the Stars"

Roadmap to the Human Settlement of Space — experience the excitement of the people and the organizations pioneering the settlement of space.

Main Theme Areas:
- Milestones in the Opening of Space
- Barriers to the Opening of Space
- Space Technologies and Systems
- Exploration and Utilization of Space
- Space Science Education

Special Presentations:
- SETI NASA Haughton-Mars Project
- Experimental Rocket Propulsion Soc.
- Tourism - Space Adventures
- Gene Myers from Space Island Group
- Nanotechnology - Foresight Institute
- XCOR

TOURS
- Chabot Observatory/Challenger Center
- The USS Hornet
- NASA Ames

›› http://nsschapters.org/isdc/2003 ‹‹

NAME _____.

STREET _____.

CITY/ST/ZIP _____.

PHONE #S _____.

❍ **$38 NATIONAL SPACE SOC.** dues includes *Ad Astra*
❍ **$20** NSS dues if under 22 / over 64. *State age* ___
600 Pennsylvania Ave SE #201, Washington DC 20003

Join **The Moon Society** - dues address on page 9

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

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

CUYAHOGA VALLEY SPACE SOC. (Cleveland, OH)

❍ $15

CHICAGO SPACE FRONTIER L5

❍ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

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

MINNESOTA SPACE FRONTIER SOCIETY

❍ $20 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 $16, due in March or $4 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' REVIEW # 32

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

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