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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

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Above: Hubble Awaits Atlantis Repair Crew

Feature Articles in This Issue

No more External Tanks?

Ever since the current "Space Transportation System" aka ""The Space Shuttle," reached its final design, the External Tank carrying liquid oxygen and liquid hydrogen has been criticized. But there has been even more criticism for NASA's insistence on dumping the ET once it has reached 98% of orbital velocity and while it still had enough fuel left to make it all the way. There have been countless designs for valuable ET reuse in space. Now all those already shattered dreams will be lost for good by the scrapping of the tooling that makes the ET. See p. 8

IN FOCUS ◎ NASA Authorization Act of 2008 could direct NASA to establish a Ghost Town on the Moon

That's quite a claim. Here is what lies behind it.

In the House, **H.R.6063: National Aeronautics and Space Administration Authorization Act of 2008** (Referred to Senate Committee after being Received from House) includes this language.

SEC. 403. LUNAR OUTPOST.

(a) Establishment - As NASA works toward the establishment of a lunar outpost, ***NASA shall make no plans that would require a lunar outpost to be occupied to maintain its viability.*** **Any such outpost shall be operable as a human-tended facility capable of remote or autonomous operation for extended periods.** [=> p. 2, col. 2]

Moon Miners' Manifesto

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• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first eighteen years have been re-edited, reillustrated, and republished in 15 PDF format volumes, for free downloading from either of two locations:
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• **MMM's VISION:** "expanding the human economy through off-planet resources"; the early era of heavy reliance on Lunar materials; early use of Mars system and asteroidal resources; and establishment of permanent settlements supporting this economy.
• **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
• **MMM retains its editorial independence.** MMM serves several groups, each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test.
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• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.
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⇒ In Focus Editorial continued from p. 1.

The House bill goes on to declare that "the first human-tended outpost established on the surface of the Moon shall be designated the `Neil A. Armstrong Lunar Outpost'," and does state the intent of congress that "NASA shall make use of commercial services to the maximum extent practicable in support of its lunar outpost activities."

The Senate version? Currently S.3270 does not include such language, and does not even address the lunar outpost except in the most vague of terms.

> "Congress hereby affirms its support for--
> (1) … including the eventual return to and exploration of the Moon and the important national imperative of independent access to space;
> (2) the utilization of lunar exploration, including development of habitation capabilities, life support, mobility systems, and in situ resource extraction, processing, and utilization for future expansion beyond the lunar environment;"

Indeed, that part goes further than the House bill, but is, by omission, neutral on whether it should be a goal of NASA to deploy an outpost that is permanently occupiable, if not occupied. What is behind this timidity, and should we be concerned.

We do not fault NASA for not wanting to be held to goals for which the Administration and the Congress have repeatedly provided insufficient funding. And no one know what the next Administration will do either in reaffirming the country's intent to return to the Moon, or in providing realistic funding.

NASA designs for the Orion vehicle and Altair lunar langer have been criticized for being short on the capablility side, incapable of doing the job – a criticism that in our opinion is well grounded. But NASA has been forced into "minimal designing" because there simply is not the money to do otherwise in current budgets.

We have repeatedly stated, that in establishing a permanent presence on the Moon, each phase must be pregnant with the next, that is, have features supporting an open-ended build-out. We are concerned that if this design philosophy is not followed we will end up with the "Neal A. Armstrong Lunar Ruin", a testimonial to NASA hubris.

We continue to believe that as the goal of establishing a human exclave on the Moon is more important than any "national pride" considerations, that a sounder foundation for such a comprehensive effort is not to be found in a "go it alone" attitude, but in establishment of an International Lunar Campus, open to facilities contributed by other nations, as well as by major aerospace contractors and other enterprises seeking to provide services that will enable a vigorous and timely build-out towads a first lunar settlement.

In making our plans in consultation with other partners, both international, and commercial, the last thing on our minds should be catering to the self-image of current NASA leaders. The cut of the nose (collaboration) to spite the face (success) mentality has to go.

The Moon Society is working on a policy statement in this regards, and and input by other organizations and individuals are most welcome.

Send your feedback to kokhmmm@aol.com
We don't need another false start, another retreat! <**PK**>

LUNAR ENTERPRISES AND DEVELOPMENT

Especially prepared for *Moon Miners Manifesto*.
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Installment 2

EXHIBIT 4 - Japanese Lunar Macroplanning

For over fifteen years, Japan has been calling for an international lunar initiative to include projects such as pictured here related to astronomy, habitat studies, and solar power. * *Source*: Boeing Corporation's artistic rendering by Jack Olsen.

But the Japanese found that there was a big gap between their ambitions and planning, as against actually doing and performing in outer space. The Japanese Aerospace Exploration Agency (JAXA) has had a series of launch postponements for two lunar missions, *Lunar- A* and *Selene,* costing some $400 million. The former is designed to hurl missile-like impactors on the Moon's near its far side, so as to study the Moon's inner make-up. The later mission is designed to gather more scientific data on the Moon's origin and make-up – it consists of a main orbiting satellite and two smaller ones. *Selene* was launched from its Tanagashima spaceport, to provide serious remote sensing data. The largest lunar mission since *Apollo*, the Project Scientist Hitoshi Mizuani told *Space News* 7/20/04) that lunar exploration goes beyond its scientific value: *it provides inspiration, human extension to other worlds*. Thus, Japan is actively seeking international partner beyond NASA and including cross-Pacific ties, so as to carry out its aspirations for the high frontier. Even its activities with the annual Japan-United States Science, Technology, and Applications Programs involve the private sector in North America. JAXA's focus now seems to be upon perfecting lunar instrumentation., so *Selene* will make use of 14 such science instruments. Whether there will be a "space race" between Japan, China or India, their engagement in lunar enterprise should also include alliances among progressive Asian nations within that region, such as Indonesia, South Korea, Thailand and even Vietnam.

China has a three-phase plan underway through its China Lunar Exploration Program (CLEP). Their China National Space Administration initiated the first step in a one year Moon probe in 2008 using their *Chang'e 1* orbiter. This mission, named after a Chinese goddess who lives on the Moon, originated from the Xichang Satellite Launch Center in the southwestern province of Sichuan. Laun Enjie, chief commander of CLEP, reported that *Chang'e 1* carries eight primary instruments to photograph and map the lunar surface, probe its depth, study regolith chemical composition, and analyse the environment around the Moon. A payload data management system even includes 30 songs popular in the country, while the whole mission is estimated to cost about $180 million. That is a serious investment in lunar exploration, so Laun stated that if the first mission, is successful, the Chinese hope by 2012 to land a lunar rover, and by 2017 return a lunar sample. Ouyang Ziyuan, a leading lunar scientist, elaborated that their automated lander would land on the Moon, so robots could snag and return soil samples…. For manned missions to the Moon, the Chinese are depending upon improvements in its heavy-lift *Long March 3-A* rocket which was used in this mission. They are planning to build such a spacecraft with 3-4,000 tons of thrust at a new launch site on Hainan Island in the China Sea. The new booster may be ready in eight years, and be able to lift up to 26 tons into orbit. Meanwhile, CSNA's third manned spaceflight, *Shenzhou 7* is scheduled for 2008.

India is an active player in the multi-nation movement toward lunar missions. By 2008, its Satish Dhawan Space Center expects to launch *Chandrayaan-1* atop their *Polar Satellite Launch Vehicle – XL*. The satellite will be placed in orbit around the Moon for possibly up to two years, and contain a deep space antenna system. Its devoted to high-resolution remote sensing of the lunar surface, including gathering infrared, X-ray and low energy gamma ray imagery of the Moon. Its payloads are coming from Indian experimentors, as well as from ESA, Bulgaria, and the U.S.A. Also incorporated is a Moon impact probe to test a future lunar landing; the device is designed to hit a predetermined location on the lunar surface. This will be a technology demonstration of a highly sensitive mass spectrometer, a video camera, and a radar altimeter. Together these instruments hopefully will detect possible gases in the exosphere and provide video images of a prospective landing site. This unmanned Indian mission will carry two NASA scientific devices to find minerals and ice on the Moon. The Indian Space Research Organization has an agreement with the Agency to carry this payload on its 1,160-pound spacecraft, along with three instruments from European research centers. The international partnerships evident in this mission likely will lead to more scientifically and technically challenging cooperation on future lunar undertakings! At least that is the aim of ISRO chairman, K. Kasturirangan, after *Chandrayaan-1* ends its two-year mission.

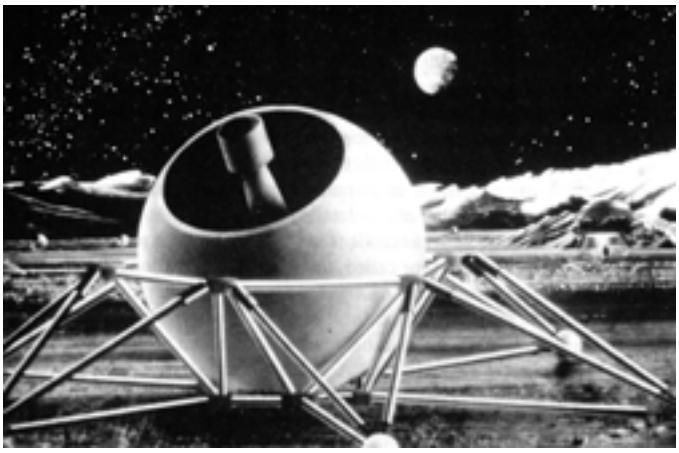
All of the above Asian lunar missions are unique, and while there is some overlaps in coverage, they all advance lunar science and exploration. Combined data obtained and its analysis contribute to advancing human knowledge

1.3 European Lunar Initiatives

As previously discussed, European space organizations have been pursuing lunar studies for about 20 years, especially in conjunction with colleagues at international space conferences [13]. For example, the European Space Agency's International Lunar Workshop concluded on June 6, 1994 that both logic and timing make it apparent that the Moon is "a natural, long-term space station" and the "testbed for any plans

of human expansion into the solar system," as long as such endeavors protect the lunar environment. Along with international delegates to those discussion in Switzerland, the consensus was that the world's space agencies must coordinate their lunar plans in a phased evolutionary approach The ESA declaration that year observed optimistically that "current international space treaties provide a constructive legal regime within which to conduct scientific exploration and economic utilization of the Moon, including establishment of scientific bases and observations." The "Beatenberg Declaration" that emerged endorsed the four-phase lunar initiative, which we explained in the chapter on macrothinking. Exhibit 5 illustrates two such science prospects.

EXHIBIT 5 * - Lunar Science Oppotunities



ESA studies identify specific astronomy/astrophysics prospects on the Moon's surface, such as illustrated above in the lunar telescope and below in the solar interferometer.

* *Source*: ESA reports, *Mission to the Moon* (SP-1150, 1992) and *International Lunar Workshop* (SP-1170, 1994). Also refer to N. A. Budden's *Tools of Tomorrow: Catalog of Lunar and Mars Science Payloads* (RP-1345) available from NASA/JSC (Mail Code SN2, Houston, TX 77058, U.S.A.)

The Europeans announced that their approach to the Moon is (ESA BR-101):

- founded on long-term objectives and a phased approach;
- would substantially increase scientific knowledge and exploit advanced technologies;
- afford wide public participation through advanced communications;
- would preserve the lunar environment.

Their 4-staged program includes (1) lunar explorers; (2) permanent robotic presence; (3) use of lunar resources; (4) lunar human outpost. ESA expects to use its upgraded *Ariane-5* transport system to deliver both lunar orbiters and landers, as well as to support possible geostationary transfer orbit.

The most recent ESA lunar accomplishment was *SMART-1,* a spacecraft that punched into the Moon's barren soil in September 2006. On a volcanic plain near the Lake of Excellence, thus ended a three-year mission of testing space technology while examining our celestial neighbor. At CFHT atop Mount Mauna Kea, Hawaii, their brand new WIRCAM recorded the impact site with its infrared mosaic. ESA coordinator on this Small Mission for Advanced Research Technology (SMART), Detlef Kochhny, operated from the project's ESOC in Darmstadt, Germany.

The purpose of the mission was to take a close look into the permanently shadowed lunar craters of the Moon's south pole, scanning it for possible ice. That resource would be needed not only for lunar dwellers, but when broken into hydrogen and oxygen, it provides breathable air and drinkable water, as well as being useful for making rocket fuel. Its launching on an *Ariane 5* rocket in September 2003, used ion propulsion for this ESA lunar probe. Project scientist Bernard Foing emphasized the *SMART-1* data was being shared with other countries as a first step in collaboration for future missions to the Moon. The information gained includes surveys of lunar resources, polar illumination data, and characterizations of future landing sites. One aim is to develop common technical standards for future landers and orbiters. The next ESA reconnaissance missions are the *Mars Sample Return* in 2011, and the *ExoMars* in 2013, which would involve rover exploration. Are such missions simply replications of what other space agencies have underway, and should limited resources be combined and concentrated initially on lunar development?

(For further ESA information, contact Bernard.Foing@esa.int.)

_ Russia has been engaged in lunar research some fifty years. [14] After Soviet scientists shocked the world in 1957 with their first orbiting satellite, *Sputnik*, they began to devise plans the very next year for sending a small spacecraft to the Moon. Under the leadership of their great rocketman, Sergei Korolev, plans were even drawn up to fly to Mars and Venus! When their first moonshot missed in 1959, they followed up with the unmanned *Luna 2* which hit the middle of the lunar surface. A decade ahead of the Americans, this research lead to a soft-landing on the Moon of *Luna 9* in the Ocean of Storms I, January 1966. For four days that spacecraft sent back pictures of the rocky and cratered lunar surface!. That same year, *Venera 3* hit the planet Venus, while *Luna 10* continued the automated survey of the Moon. With the death of the "great designer," Korlov, the driving force went out of this stunning venture into outer space.

For Russia, the Moon race had 2 sequels, according to author, Brian Harvey – the unmanned program which concluded in 1976, was a great success! In 1970, a year after *Apollo* landed the first men on the Moon, the Russians soft landed *Luna 16* in the Sea of Fertility, extending a robotic arm that drilled into the lunar surface and scooped up rock, and three days later returned it to the "motherland." In 1972, *Luna 20* brought back more samples from the crater Apollonius, and

later *Lunar 24* brought back a core rock sample 170.1 grams from the Sea of Crisis. But the robotic missions that were the most impressive were *Luna 17* and *21* – their 760 kg. rs *Lunokhods* rovers were solar powered with cameras, lasers, and other special equipment. These crafts were steered a ground crew back in Moscow's mission control!

They accepted commands to drive, swivel, cross craters, and explore the terrain. *Lunokod 2* spent five months roving some 37km miles before using up its power… Unfortunately, the Russians manned lunar endeavors did not land cosmonauts on the Moon. Since 1964, their government set a goal of putting one of their citizens on the lunar surface. A giant Moon rocket was built, the *N-I,* which had 30 engines to fire the immense rocket. A second powerful rocket, *Proton,* was also built to send Russians to the Moon. The preliminary flights were beaten when the Americans *Apollo* program put two of their astronauts on the lunar surface in 1969. Russia never again gained the lead in the space race between the two superpowers, and so turned their attention away from the Moon to Mars missions. With the collapse of the Soviet Union in 1991, their space scientists shifted from research on space mirrors, to the big *Energiya* rocket, and the *Mir* space station.

In the 21st century, Russian space scientists are again turning their efforts back toward the Moon, especially in terms of international partnerships for lunar development. The Russian space agency's budget has gradually increased, along with consultation with China and India on their lunar exploration plans. Both the head of Roscosmos, Anatoly Perminov, and chief of RSC Energiya, Nikolai Sevastianov, have made bold lunar statements in 2005, especially about putting humans back on the Moon. For instance in 2006, the latter talked about a Russian lunar base intended to mine helium-3 on the Moon as a rich source of energy. Energiya's director spoke of a new spacecraft design, *Klipper* in partnership with ESA, which could possibly serve to transport helium, also proposed building a space ferry, *Parom,* that could be useful in assembling elements of a Moon mission. But their government has yet to fund their plans for further lunar exploration, nor has any other foreign government expressed interest in financing such ventures. Thus, the focus of Russian space missions is presently on cooperation in *International Space Station* missions which produce income via NASA contracts ($1 billion annually). One Agency project scheduled for 2008 is the Robotic Lunar Exploration Program (RLEP) Then Russians to launch a *Lunar Crater Observation* instrument – LRO will have aboard its spacecraft, a U. S. observation and sensing satellite. It remains to be seen how much of the $104 billion that NASA plans to spend for a permanent return of humans to the Moon by 2020 will be shared with Russian space scientists and engineers, or how much the Russian Federation would be willing to invest in a world lunar enterprise. But whatever the global space community agrees to do together on the Moon, there is much to learn from Russian space and lunar technologies. .

In an essay on "Space Travel – Sealing Wax and String," *The Economist* (January 13th, 2007, pp. 71-2) refers to the "junior partners" in achieving American space goals. Lead by the European Space Agency, these include Australia, Britain, Canada, China, France, Germany, Italy, India, Japan, Russia, South Korea and Ukraine. The ESA strategy is to launch more robotic and science missions to the Moon and Mars. This London-based magazine favors the construction of and array of astronomical telescopes on the Moon, plus support for United Kingdom's small satellites and miniaturized space instruments. The latter capability might then be used to build and launch *MoonRaker,* a lander intended for the lunar surface to date geological samples found there, as well as *MoonLite* to listen to noise of missiles fired into the Moon!

1. United States Lunar Initiatives

The United States of America has had two great lunar initiatives. The first was the seventeen Apollo missions to the Moon, begun in 1961 when President John Kennedy committed the country to lunar conquest within a decade, and prematurely terminated by President Richard Nixon in 1972. (Refer back to chapter 8.2). 15 Unfortunately, there was no follow-up on this magnificent milestone in human accomplishment, in terms of lunar industrialization and settlement. Many, like your author, argued that the American taxpayer deserved a return on their enormous *Apollo* investment – nearly $20 billion! As one columnist, Charles Krauthammer, lamented:

*"**Ours was the generation that first escaped gravity, walked on the Moon, visited Saturn—and then, overtaken by an inexplicable lassitude and narrowness of vision, turned cathedrals of flight into wind tunnels**."*

Apart from media feats like Tom Hanks' *Apollo 11* and his IMAX film, *Magnificent Desolation,* there were some hopeful signs during the past 36 years of lunar hiatus that the U.S. government would seek ways to provide a return on the public sector's original expenditures for the *Apollo* missions to the Moon. These positive actions toward ROI were:

(a) Since going back to the Moon permanently requires a robust, less expensive *space transportation system* with capability in both LEO and GEO, R&D funding was spent on new rocket technology which utilizes composite materials that will lower the cost to orbital access. ….

(b) Further, the low cost *Clementine 1* mission sponsored by the U.S. Department of Defense's Ballistic Missile Agency, in conjunction with the Navy and NASA, took 1500 pictures in February/March 1994. This produced the first global digital map of the Moon—multispectral imaging data of 34 million square kilometres. This automated exploration also found a mountain top that might sometime be valuable for the first human settlement aloft—in this plateau the Sun never sets and a future colony would have full-time solar power by building a high collecting tower there …. [16]

After more than 25 years from the *Apollo* missions, NASA launched *Lunar Prospector* into polar lunar orbit in June 1997 where it crashed landed on the Moon's southern region in September 1999 (refer to Exhibit 130). It is part of the Discovery Program, a new way to do smaller, faster, cheaper innovative missions via competition among private contractors—in this case the award went to Lockheed Corporation, whose Dr Alan Binder conceived, designed, and developed the proposal for using a new LLV2 spacecraft. Supplementing previous automated lunar data collection missions, this one provided a global, low-altitude mapping of the lunar surface composition, gravity fields, and gas release events. The *Prospector* payload collected information that

significantly improved our understanding of the evolution of the lunar highland crust, basaltic volcanism there, and lunar resource mapping. Mission adviser Dr. James Arnold, University of California—San Diego, noted that the new, simpler approach contrasts with previous NASA solar system exploratory missions, which often took too long and were too costly[17] **<MMM>**

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>>>> CONTINUED NEXT ISSUE, MMM #218

Extra-Terrestrial Engineering

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April 17, 2008 – Abstract

1 Introduction

Whether you look in Moon Miners' Manifesto, or other places, for ideas and inspiration about exploring, living or working off of Earth, the same kinds of problems come up. I suppose most people would claim that what is required is to think out of the box.

The problem is that our feet are anchored in the wrong box, not which box our head is in. For most of mankind's existence, what has defined us? Whether it is the Stone Age, the Bronze Age or the Iron Age, we have mostly been defined by the materials we use. Even advances in computers have been driven by our ability to understand and use materials.

2 The Moon

If we are going to explore the Moon, live on the Moon, or work from the Moon; we need to work with the materials we have there. And almost every article one sees assumes at least some of what we are using to do this, is drug out of the Earth's gravity well.

If you are a mechanical engineer on the Moon, you have no iron or steel. If you are a civil engineer on the Moon, you not only have no iron or steel, you have no water and you have no bitumin. If you are an electrical engineer on the Moon, you have no copper.

But what about how easy it is to recover iron from regolith? Surely we will have iron? The iron of lunar night is not the iron we know on Earth. It may be easy to recover iron from regolith, lunar night is cold enough that iron is more or less a ceramic. The easy way to get usable iron and steel at those temperatures is to alloy with significant amounts of nickel. About the only easy use we will have for lunar iron is as a conductor in place of copper.

It should be possible with some effort to produce aluminum and titanium. We can probably cast aluminum into molds of wrought aluminum. No rolled aluminum, no extruded aluminum, no forged aluminum. Why? No iron or steel. Maybe we build a rolling mill out of our fragile iron, and only use it during the lunar afternoon, when things are warm enough for the iron to not be too brittle. How often are we going to show up at the mill to find that our iron parts broke during the night?

What about titanium? Molten titanium, "the universal solvent." Common around molten titanium on Earth is copper, something heat can be removed from fast enough so that a skin of solidified titanium protects the copper from the molten titanium. No copper.

Powder metallurgy is likely to be important for both of those metals on the moon. Has anyone ever built CIP, HIP, or other kind of metal powder equipment out of aluminum or titanium? We typically build all that stuff out of iron and steel.

The mechanical engineer will have it bad with no iron or steel, and no wrought products. Or, should lunar afternoon metalworking become available, the price for wrought products will be considerably higher, since the amount of time the plant can be open is so small compared to the casting and powder metallurgy operations.

What about the civil engineer? While not everything they do revolves around iron and steel, we have no water to make concrete and we have no bitumin to make asphalt. They too will be working with materials they have not worked with before.

The electrical engineer will have a conductive metal to work with in iron. Brittle when cold, but the cross section might be small enough that elastic buckling will occur in preference to brittle failure. Small enough that thermal insulation might help to keep it warm, especially if it has current flowing in it and has internal heat generation. Again, it is a different material than they are used to using.

Above I have pointed out that those that design "things", will have to work with different materials, the effects are not limited to design. All of the trades are used to working with iron and steel (concrete, asphalt, copper wire, ...). Perhaps the largest effects will be the tools that people will be using. A stone hammer is going to work differently than a steel hammer.

The designers typically operate in an environment where learning is expected. They will have an easier time of adapting than others who are not expected to be learning on a constant basis.

One source of difficulty for all people, is that this very common material of today on Earth is anomalous. The effects of ferromagnetism on the properties of iron and steel are extensive. The replacement materials will tend to behave differently in many ways, some small and some large. For most people, "moving" to some environment off of Earth is very much like taking people and moving them back into the Bronze Age or the Stone Age. Many assumptions about how to do this, what to do things with, what tools to use, etc. will need to change.

3 Railroads

MMM #213 had articles about railroads. Materials assumptions abound. Nothing I don't think that can't be allowed for. Railroads are possible. I suspect that their similarity to those on Earth will be limited to 2 "rails" separated by some distance. With gravity being about 1/6t h of Earth, downward forces will be much lower. Forces on cornering will be the same as Earth, as they are dependent on momentum, not gravity.

In the near term, we are not going to have wrought rails. Powder metallurgy seems like a reasonable way to produce rails, for reasons I'll get into. The thermal expansion problem mentioned in MMM #213 exists (on Earth) for two reasons: thermal expansion does happen, and the metal is highly incompressible.

On the Moon, we probably can get away from the incompressibility part of the problem. If we are making rails via powder metallurgy, our final product is a mix of whatever metals we are working with (which is quite incompressible) and void (which is very compressible).

If we build the rails by drawing them out of a forming press/oven, we can produce rails much longer than the press/oven. Which is similar to what we have now, long rails. Via powder metallurgy, we should be able to arrange that the green density (and the finished density) along the rail's length is actually modulated, alternating regions of high theoretical density and lower theoretical density. =Ideally we design this modulation to take up all the thermal expansion stress. We do want the distance between higher theoretical density peaks to be small enough, that ride characteristics do not see the modulation. With such a rail, it is likely that we want to install rails when they are coldest (and hence shortest). If a rail fails, we need to wait until some time between midnight and morning to replace them.

It is possible that we may need to run fiber reinforcement along the sides of the rail, or incorporate extra traction in fastening the rails to the "ties" to provide stability with our less than theoretical density rail solution to thermal expansion. One idea for producing solar cells on the Moon's surface, had a robot build the solar cells from native material as it traversed the sruface. Such an idea might work for railroad ties.

I would expect that the properties of regolith at any given point are not ideal for making ties. What would be nice is if we can augment the local regolith properties with lunar derived materials, and then sinter "in place" a railroad tie. Depending on the sintering conditions, we may be able to incorporate fiber or bar reinforcements along the length of the tie (perpendicular to the rail direction). It may be that our railroad ties end up being ceramic reinforced (residual regolith) sintered aluminum with titanium "rebar " sintered into the tie. Aluminum certainly has properties which compare with wood (a common railroad tie material), and should sinter at temperatures which will not compromise any "titanium" fibers or rebar which is present.

On Earth, oxygen is pretty much everywhere. Our railways are steel wheels (with an oxide surface) rolling on steel rails (with an oxide surface). It is an oxide rolling on an oxide. If the wheels are locked up in an effort to stop the train, there is still enough oxygen around, to keep a metallurgical bond from forming between rail and wheel (once stopped).

This is not true on the moon. Our metal rails and metal wheels will likely have metallic, not oxide contact. Metallurgical bonding will be of concern at all times, not just emergency stops. As far as braking is concerned, we have 3 options on the Moon.

- We can incorporate magnetic braking, since our rails are likely to be something paramagnetic (like aluminum).
- We can incorporate linear generators into the track at locations where braking is known to be needed, and hence possibly recover braking energy by turning it into electricity.
- We can put retrorockets on trains. For planned braking, the second option is the best one. For unplanned stops, we will need the first option, and for safety we probably need to have the third one. The option not listed, is the normal one on Earth, mechanical brakes acting on the wheels. We cannot afford to have the wheel "weld" itself to the rail just because the brakes were applied. Possibly this option is used at low speed, or with minimal force. As a general solution, I don't believe it is viable.

4 Extra-Terrestrial Materials Science and Engineering

Engineering on Earth has been severely effected by its surroundings. Iron is abundant, and useful. We often do not think about what material to make anything out of, we just find what kind of iron based material we have available. Excessive use of iron coupled with economies of scale, has made iron and steel less expensive than it should be. Which makes it doubly difficult for any other material to be used for any given application.

With iron and steel used so much, there is a scarcity of people who have used anything other than iron and steel. To move into space, we need to become material neutral, and use the best material that is available. And best needs to move away from definitions based on up-front, installed cost. Life-cycle costs would be a reasonable thing to work with; there are others. **<GH>**

Gordon Wayne Haverland is a founding member of The Moon Society (#794), having joined Artemis Society International in September 1999, ten months before the Moon Society Founding Convention.

Gordon currently lives in Grand Prairie, Alberta, Canada, about 260 road miles WNW of Edmonton, not quite the same distance NNW of Jasper, and almost 500 miles NW of Calgary, home of the *Calgary Space Workers* and *Calgary Space Society.*.

His area of expertise is Materials Science, making him especially qualified to write about the topics in this abstract.

Website: **http://www.materialisations.com/**

The External Tank: End of an Era?
A Call to Action

From James W. Barnard <trailrdr@ecentral.com>
Denver Space Society, NSS

It has been reported in several places (Orlando Sentinel, Stephen Metschan's article on The Space Review website, posts on Space.com, etc.) that NASA will begin dismantling/destruction of the tooling used to manufacture the 8.4m diameter Space Shuttle External Tank (ET) at Michoud, NEXT MONTH! The ostensible reason for beginning next month is to clear room for production equipment to build the 10m dia. tankage for the Ares V heavy-lift launch vehicle.

So, what's the big deal? Don't we want the big Ares V that will take us back to the Moon? The answer is, "Yes…but!" The facts are as follows:

The Space Shuttle system is due to be retired not later than September 2010 (possibly as early as May 2010, according to NASA).

The Orion/Ares I portion of the Constellation system is supposed, by Congressional edit, to fly the first manned mission no LATER than September 2015. NASA's schedule was originally supposed to move that date in to September 2013. In the last week or so, that date has been moved back one whole year to 2014, due to budget shortfalls, and developmental issues! If that slips, it means that the United States will have NO launch capability to the International Space Station (ISS) of its own.

Originally, we were to depend on the Russians for Soyuz spacecraft and launch vehicles to provide the U.S. and other countries access to the ISS, until at least Ares I/Orion is available. Although the Russians have *not* given any indication that the current international situation will affect their willingness to provide such services, Congress must, in the next few months, approval an extension to the waiver of the ITARS ban on paying money to anyone doing business with Iran (which the Russians do). Although I can't quote the source, it is reported that a senator or congressman has said that waiver will be "dead on arrival"!

There is a possibility that the Shuttle's retirement date could be extended to cover the gap between it and Initial Operational Capability (IOC) of the Constellation hardware. But there might not be enough external tanks available to fly the orbiters, once the current inventory of ET's are used up.

In addition, there could be considerable problems with the Ares V design. It has already grown from five (5) to six (6) engines on the first stage, necessitation rear-rangement of the engine positions to avoid exhaust impingement problems with each other, and the SRM's! And the Systems Requirements Review won't even be held for awhile, let alone a Preliminary Design Review (PDR).

If it should turn out that the Ares I/Ares V concept proves impracticable, it might be necessary to turn to other options that could utilize the 8.4m diameter tankage tooling at Michould. But, if that option is forecloseed by destruction of the tooling, we may be left with *no options at all!*

Please keep in mind that this situation will apply regardless of who wins the November Presidential election. If the tooling is destroyed in September, the next President will have NO options to utilize it, regardless of who is the winner of the election! Congress will not be in session before the destruction of the tooling begins, and probably wouldn't be able to come to any agreement on legislation to prevent the action! Note, that the tooling can always be dismantled at a later time if it becomes clear it is no longer needed.

It is imperative, therefore, that we, who believe in the advancement of space exploration by the United States of America, contact President Bush, requesting that he issue an Executive Order prohibiting dismantling/destruction of the ET tooling at Michoud, and also to stop continuation of other, similar activities that support continued Shuttle flights, if it is decided by the next Administration and Congress to do so.

How to do this: You may e-mail the President at the White House at comment@whitehouse.gov . You can also FAX the President at 1-202-456-2461 or phone 1-202-456-1111.

What to say: Above all be courteous! *Do not demand* anything! *Respectfully request!* Site the *facts,* as you know them. If you can uncover additional confirmation of the dismantling of the tooling, do so. Leave politics out of this! I am undecided if group signatures, such as identifying yourself as a member of the Moon Society, NSS, etc., will be helpful or not. If one has a technical background, you might want to identify yourself as such. You will (and I have) probably need to identify yourself including name, address, phone, e-mail, etc.

If we can get this information out to a maximum number of people, we may get action by President Bush … although there is no guarantee the word will even reach him through White House "filtering".

All we can do is try!

Ad Luna! Ad Ares! Ad Astra!

James W. Barnard

<trailrdr@ecentral.com>
Denver Space Society, NSS

The Moon Society www.moonsociety.org

An international nonprofit 501(c)3 educational and scientific organization formed to further the creation of communities on the Moon involving large scale industrialization and private enterprise

Objectives of the Moon Society

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

The Moon in its natural beauty, empty and deceptively barren, waiting for human settlers to shelter and to mother as their adopted second human home world. We have work to do!

Masthead Design: Charles F. Radley, Society Vice-president\

September 17th, 2008

9-11 pm ET, 8-10 pm CT, 7-9 pm MT. 6-8 pm PT

Curtain Call on the Moon Society's

First Annual Membership Meeting

On the **ASI-MOO** chat room environment

From Society President, Peter Kokh

If you downloaded this issue of MMM as a pdf file when you were notified that it was ready, you may read this in time. But all the instructions for participation were in last month's issue. In case you are a new member and this is your first download of MMM, **go to the following web page for the instructions to attend & participate.**

www.moonsociety.org/reports/1st_annual_meeting.html

In preparation for this event, we expect to have published an **Annual "State of the Society" Report 2008** also online in the members only area of our website:

www.moonsociety.org/members/reports/annual_report2008.pdf

This event is an effort by the Society's Manage-ment Council to increase the dialog between leaders and members at large in the expectation that an increase in productivity and effectiveness will follow.

We are always open to member input on how we are doing, what projects interest them and which do not, and to fresh ideas of how a small underfunded organiza-tion such as ours can continue to play a significant role in hastening the day when civilians will live on the Moon, working in industries and services which will help our home world better manage an increasingly complex burden of problems, specifically relating to energy and environment.

Our recent reorganization of our many efforts into specific Project Teams is aimed at efficient coordi-nation of efforts on many complementary fronts. See:

www.moonsociety.org/projects/projectteams/index.html

In last month's notice, we pointed out an obvious hard fact: the time above is not convenient for everyone. Indeed, only a fraction of our membership may be free at the set time slot. But it would be no different if we picked any other time. This time slot is convenient for Society Leasers, who need to be on hand.

For those of you who will not have been able to attend and participate, we hope to give a full report in the October issue, MMM #219.

What do we expect of this meeting? Certainly not to be told we are doing a good job. We want constructive input on how together we can do our jobs better and more effectively. We do not need laurels to rest upon. Nor do we need suggestions that only a much larger organization could possibly pursue. Yet, we have already earned the nickname, *"the little engine that could,"* and with your help, we will keep surprising everyone! <**PK**>

Society Annual Report 2008 Released

http://www.moonsociety.org/members/reports/annual_report2008.pdf

By Society President, Peter Kokh

NOTE: *any pages our documents in the /members/ area of our website require a current Moon Society username and password to access. We are not trying to hide information. Rather, access to information in this area is a privilege and benefit of membership.*

Additonal background material, also published in the /members/ area, includes:

Moon Society Strategic Plan for Growing the Society
http://www.moonsociety.org/members/reports/TMS_StrategicPlan2008.html

A Project-Organizing Focus & Game Plan for The Moon Society
http://www.moonsociety.org/members/reports/lunarSPS_gameplan.html

This report was prepared as an introduction to our 1st Annual Membership Meeting held online, in the ASI-MOO chat room environment, Wednesday evening, September 17th. A digest of the discussions of this meeting will be released.

The Report covers the following areas:

- **Changes in the way the Society manages itself**
- **Membership Growth & Trends in the past year**
- **Chapters & Outposts**
- **Introducing Project Teams**
- **Conferences & Exhibits**
- **Finances & Funding**
- **Moon Miners' Manifesto**
- **Monthly updates: "Frontlines"**

The Society is growing, boasting a 25% growth in membership in the past year. But that growth brings growing pains. With too small an unpaid staff, we are failing to deliver membership services in the way our members deserve. We are finding ways to deal with these problems, but not as quickly and thoroughly as we would want. We need more volunteers to help in this area!

We are taking on more projects, a sign of great vigor and energy in our society. But that means we need to recruit more project leaders and project managers.

While low name recognition continues to be a problem, recent success with the Solar Power Beaming Demonstration Project, and publicity from it, are helping. We have drafted a Strategic Plan to grow the Society, which has identified many action items. Action items need someone to carry them out. Again, growth brings growing pains.

We have also identified a unifying project focus and goal for our efforts: *Promoting a vision of a network of Solar Power Satellites largely built from Lunar Materials* - the contribution of retiring director Dr. Peter Schubert. This plan has numerous line items and suggests a good number of initial action items. Again, we need to recruit more leaders and volunteers to make this happen.

We are having problems. But that is because we are growing. The prospects for next year and the future in general are great *if we can count on you!* **<PK>**

Now Ready for Download by Society Members
The Spring & Summer 2008 issues of
Selenology Quarterly
From our Affiliate Organization
The American Lunar Society
www.moonsociety.org/members/selenology/

Have trouble downloading issues of MMM?
Username/Password not working/forgotten?

We think we have the problem solved.

The message sent out to all members with current email addresses in our database, that the next issue of Moon Miners' Manifesto is ready to download, suggests emailing webmaster@moonsociety.org about your problem. Unfortunately, this address stuffs your email plea in an overwhelmed electronic box that gets neglected (another tragedy of the commons: if it belongs to everyone, no one cares).

Adding insult to injury, the person who created this message and arranged for it to be sent out automatically, is not around anymore, and no one seems to be able to find where this message is stored so that we can go in and edit.

But now we have arranged for the automatic system to copy ever piece of mail sent to that email address to the personal email address of the President. Yes, that means some spam will get through as well, but putting up with a bit of spam becomes trivial if we can do a much better job taking care of your access problems. The president can set you up with a new username and password, one that you can remember and which is pre-tested. And should you forget, he can reset it to whatever you like.

Remember, if the automatic system does not get your problem fixed, send it to us. The buck stops here. You can email me at either of these addresses (the first is redirected to the second in an instant.)

president@moonsociety.org
kokhmmm@aol.com

Of course, when there is a new president, the latter personal address will change, but not the former official one.

We regret that it has taken so long both to realize that we had a serious problem here, and then to find a work-around.

If you have found something else that irks us about our automated systems, or about other promised services which do not live up to billing, let us know about it. We're here to take care of problems just like this one. Hopefully, we will get better at it, to the point where society leaders spot and recognize problems before members get irritated. Remember, you can help by alerting us. We can't fix what we don't realize is not working as it should.

The first step in holding us accountable for how the system works is to notify us of glitches big and small. You too are part of a team effort.

From Peter Kokh, Moon Society President

A New Conference Display System

Report by Peter Kokh, experienced "dumpster diver"

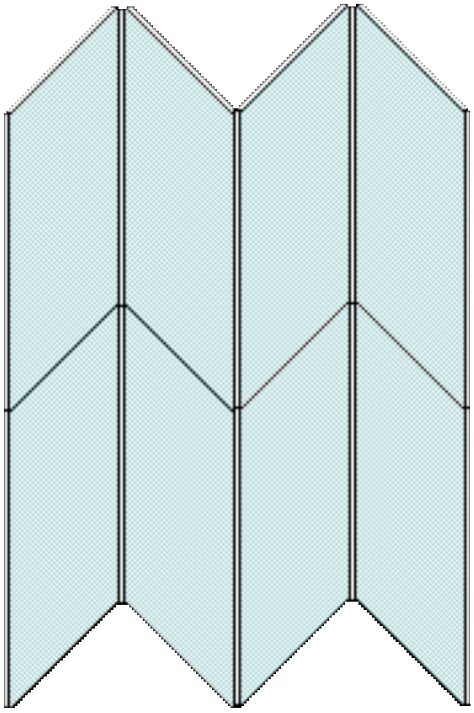
One day this past July, we gained a used **Nimlok™ Display System** from an anonymous donor, unknown even to myself, at no cost to us other than a small bottle of dry cleaning fluid. It had been "dropped off" in the grass and tree covered field across the alley out my back yard gate. The various panels lay in a helter-skelter pattern. It was clearly a case of dumping something no longer wanted, at the closest available spot, instead of taking it to the Milwaukee city yard several miles away. That it should be dumped precisely where it was most needed was a case of sheer good fortune. It was also good fortune, that I found it while picking up litter in the alley, in time to prevent further exposure to the elements. Talk about a "eureka moment!"

The system has two tiers of 4 panels each. Each panel is covered with a light blue-gray velvet or velour on both sides, and measure 22" w by 41" h. That's 16 panel sides in all for a total of 100 square feet of display space!

Two plastic shipping containers, complete with straps and handles, were found alongside. Of course, it will cost us to ship these containers to conferences. But they were free! A comparable unit could cost hundreds of dollars, possibly even a thousand. And despite their "used" status, they look a lot more professional than our home made display unit that has been the Moon Society exhibit at the last several conferences.

A floor exhibit would use both tiers, a tabletop display just one. That makes this system quite versatile.

For a small but growing Society trying to do great things on a shoestring budget, this was a much appreciated and unexpected find!



Each 4-panel tier weighs 20 pounds = 9.1 kilos. Each of the 2 shipping containers weighs 14 lbs = 6.36 kilos.

Packed, each container will weigh 34 lbs = 15.4 kilos, and measures 24" wide, 44" long and 6" deep.

The containers are secured with attached straps, and have handles on the side.

This "gift" is right on time, as we are planning a major expansion of our exhibit material, focusing on Solar Power Beaming, and Solar Power Satellites built with lunar materials, and the economic and environmental benefits of clean energy from space. **<MSJ>**

How about a

Lunar Analog Research Campus

or Mall, or Condominium?

By Peter Kokh, Commander MDRS Crew #45,
the first Moon Society Moonbase simulation exercise

Since our 2-week exercise at the Mars Desert Research Station in south central Utah in early 2006, we have been regularly revisiting the idea of having our own Moon Society Lunar Analog Research Station. We soon identified major natural differences in research goals between a Mars and a Moon lunar analog research program. We have also given considerable thought to where such a facility might best be located.

This brainstorming activity by myself and by my principal brainstorming cohort of the last nineteen years, fellow Wisconsinite David A. Dunlop, proceeded in spite of the fact that neither of us had a clue as how to handle the most challenging aspect of all: funding & financing!

In the meantime, Dave and I had come around to the idea that on the Moon, a better, more-pregnant scenario for a Moonbase than a NASA-only facility, would be an "International Lunar Campus" which might include bases built by various national space agencies, but also support facilities built by contractors and private enterprise, each owning their own.

It took a while, but finally we both came to realize that this might be the answer to our financial dilemma as well. We would build not a stand-alone, solely owned facility such as the Mars Society's MDRS, but build a Lunar Analog Research Campus, in which other organizations and institutions and enterprises would have their own lunar-research facilities.

The financing breakthrough would come by signing up one or more of these other partners as anchor tenants. That is precisely how most major shopping malls are financed. We, the nominal owner, get to tag along for free, financing our own phased in complex with rent from other partners.

Who might these partners be? NASA, of course, would be invited, along with other national space agencies intent on setting up shop on the Moon; those research institutions with strong lunar involvement such as the University of Arizona and ASU; contractors working for NASA or competing for NASA contractors; various other enterprises; even tourist facility providers.

Such a plan would guarantee that more mutually relevant lines of research would be pursued, and insulate the stability of the complex from budget crises of any one partner. It would also provide a compelling argument for setting up shop on the Moon itself in like manner.

The Moon Society has a token treasury surplus, and no enterprise connections to leverage, as well as no leaders or members with known fundraising experience. As much as we would like to get into Lunar analog research activities, this will remain a pipe dream unless we can leverage the assets of others in the fashion mentioned above.

Now if I really knew how to make a dime, I would not be going back to work part time to supplement my insufficient pension/SS income. The above project must be directed by one who has major real estate development experience. Interested persons may apply – no guarantee of salary compensation provided! **<TMS>**

Chapters & Outposts

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>

Meetings **2nd Thursday** monthly, Buder Branch Library 4401 S. Hampton, in the basement conference room

Next meetings October 9th, November 13th

We are preparing for our annual outreach event at **Archon 32, October 3-5th** held at the Collinsville, IL Gateway Center (convention center) and adjacent Holiday Inn,just off exit 11) on I-55/I-70. (11 miles east of St. Louis/Mississippi River.

Moon Society Phoenix Chapter

http://www.moonsocphx.blogspot.com/
Contact: Craig Porter <portercd@msn.com>

Meeting the 3rd Saturday of the month

Moon Society Phoenix' next meetings are on Saturdays **Sept. 20th, Oct. 18th, Nov. 15th** at 1056 S Country Club Dr, Mesa, AZ at 3: PM.

Ben Nault has registered the following domains for our potential future use**: Moonsocietyphoenix.org** and **TranquilityCommunityCollege.org**– *see the note (*) below the Tuscon Outpost Listing at right.*

Moon Society Phoenix was at CopperCon 28 Fri-Sun August 28th – 31st. We had two 6' tables for outreach. On Friday, Chuck and Bonnie spoke on Space Solar Power. On Satgurday, this dynamic duo presented Dennis Wingo's fine book "Moonrush" about the economic incentives of lunar resources. On Sunday, Craig joined in on a panel "Meet the Moon Society." And later Chuck was on a panel "Would you go into space?" And Craig presented the University of Luna Project.

Moon Society Houston Chapter

http://www.moonsociety.org/chapters/houston/
Contact: Eric Bowen <eric@streamlinerschedules.com>

Monday, September 22nd Meeting Cancelled

The meeting, which was to take place at the Freeman Branch Library at 16616 Diana Lane, has been cancelled in the aftermath of Huricane Ike, which did substantial damage in the Greater Houston Area. Chapter president Eric Bowen was without electric service for several days and had Society President Peter Kokh email all Houston chapter members about the cancellation. Check our website for further information.

Moon Society DUES with ***Moon Miners' Manifesto***

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

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions

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

Projects, Chapters, Volunteers, Information, etc.

Moon Society Program Services
PO Box 080395, Milwaukee, WI 53208, USA

Check out our Chapters & Outposts Map

Bay Area Moon Society Outpost

http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates <hcate2@pacbell.net>

BAMS Meets monthly on 4th Thursday evening, 7pm at Henry Cate's home, 6708 Landerwood Lane, San Jose

Moon Society Tucson Outpost

Contact: Ben Nault <bnault@comcast.net>

Ben registered these four domains for future use:

Moonsocietytucson.org
Tucsonmoonsociety.org

* **Arizonamoonbase.com**
* **AZmoonbase.com**

** Indeed, the Phoenix-Tuscon area is currently at the top of our list of candidate locations for a Moon Society-led Lunar Analog Research Campus that would also involve enterprises and research institutions such as U-AZ and ASU. Another advantage is the availability of support from a very vigorous society chapter, with another on the way!* – TMS President, Peter Kokh

Moon Society Green Bay Outpost

Contact: David A. Dunlop <dunlop712@yahoo.com>

Meeting some Friday afternoons at the College of the Menominee Nation, 2733 South Ridge Rd, Green Bay, WI

MSGB Outpost (currently 2 members) is working towards full chapter status as well as spinning off a student chapter at CMN. Our project focus is Lunar Agriculture.

Moon Society Chapter Photo Gallery

Moon Society Phoenix at Yuri's Nite 2008 Party

For news of our NSS Partner Chapters in Portland, Milwaukee, Minneapolis/St. Paul, see p. 18

Why not start a Moon Society Outpost in Your area?

All it takes is one person – you!

write: chapters-coordinator@moonsociety.org

< End Moon Society Journal Section >

GREAT BROWSING

Wrap threatening asteroid in foil to change path?
http://news.ninemsn.com.au/article.aspx?id=619410

Majority of Near Earth Objects are stony.
www.astronomy.com/asy/default.aspx?c=a&id=7293

Constellation Architecture vs. DIRECT
http://www.thespacereview.com/article/1188/1

Fate of the Ariane 5 Booster
http://www.thespacereview.com/article/1185/1

The "What is a Planet?" debate continues
http://www.thespacereview.com/article/1184/1

Gallery: White Knight II Unveiling
http://www.thespacereview.com/gallery/21

Space Policy & Presidential Politics
http://www.thespacereview.com/article/1192/1

Hitching a ride to the Oort Cloud
http://www.thespacereview.com/article/1189/1

The legacy of DC-X
http://www.thespacereview.com/article/1196/1

TEMPO^3: the Mars Society's newest project
http://www.thespacereview.com/article/1194/1

The spacecraft and the submarine
http://www.thespacereview.com/article/1202/1

Alternatives for human ISS access
http://www.thespacereview.com/article/1201/1

Falcon I: Optimism in the face of failure
http://www.thespacereview.com/article/1207/1

A space junkie at AirVenture, Oshkosh, WI
http://www.thespacereview.com/article/1206/1

Visionaries of commercial spaceflight
http://www.thespacereview.com/article/1203/1

A step forward for Space Solar Power
http://www.thespacereview.com/article/1210/1

Space solar power to prevent future energy wars?
http://www.thespacereview.com/article/1209/1

Mars Reconnaissance Orbiter finds interior of Mars colder than expected
www.marsdaily.com/reports/Mars_Reconnaissance_Orbiter_Finds_Interior_Of_Mars_Is_Colder_999.html

Shutting down the Shuttle
www.spaceref.com/news/viewsr.html?pid=28974

Orion 606 CEV paper & resin models
http://jleslie48.com/littlejoeiii/Orion_SM606.pdf

Son of astronaut Owen Garriott to be space tourist
http://www.physorg.com/news136653597.html

"Austin, we have a problem"???
www.chron.com/disp/story.mpl/hotstories/5994578.html

Titan Lake is confirmed to be liquid
www.chron.com/disp/story.mpl/hotstories/5994578.html

Mars Express snaps sharpest pix of Phobos yet
www.esa.int/SPECIALS/Mars_Express/SEM5H48N9JF_0.html

Moon Observatory to hitchhike on Odyssey Moon
www.spaceref.com/news/viewpr.html?pid=26022

Mars Analog Research on Svalbard (Spitzbergen)
http://amase2008.arc.nasa.gov/

GREAT SPACE VIDEOS

MOON COLONY VIDEOS – The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) can be found at.
http://www.moonsociety.org/video/
or at:
http://www.mooncolony.tv/
http://www.stickymedia.com/

ASSORTED SPACE VIDEOS

SR 2020 – *Space Race 2020*
http://www.youtube.com/watch?v=mIxUlI06YDU
http://apps.facebook.com/causes/sharings/131343?m=5d2fd

Solar Power from Space
http://apps.facebook.com/causes/sharings/131030?m=e93f4

European Space Agency Video on Solar Power Sats
http://www.nss.org/settlement/ssp/esavideo.htm

More Videos on Space Solar Power
www.nss.org/settlement/ssp/index.htm#sspvideos

Message (on SPS) **for the next U.S. President**
http://www.nss.org/settlement/ssp/presidential.htm

ISS Assembly Movie
http://www.tietronix.com/anim/movies/assembly640x360.swf

Griffin's NASA Update September 12th
http://www.spacevidcast.com/

Help us put MMM in a Library near You!

Whether you are a member of an NSS Chapter or of a Moon Society Chapter or Outpost, or a Moon Society member at large, you all get Moon Miners' Manifesto as a membership benefit.

A library subscription to a library in your community will help spread the word, whether about local or national or international Moon-focused programs and projects.

For chapters and outposts such subscriptions will be good advertising for your local efforts.

For Moon Society members, as all copies of MMM include the Moon Society Journal centerfold section, community library or school library copies of MMM will help grow name recognition and invite readers to join.

As no membership services are not involved, the cheapest way we can do this is by submitting these subscriptions directly to the publisher at a cost-minus rate of $10 a year, available for libraries only.

How to participate in this program

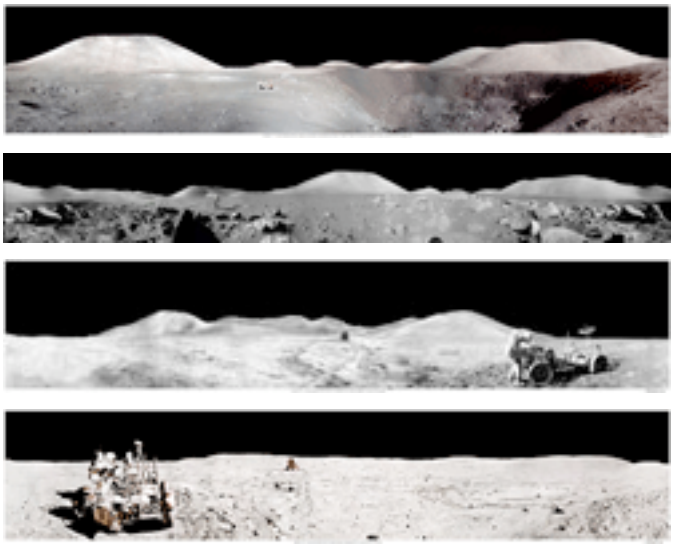
- Send *by postal mail only*
- Your check of money order for $10.00/per year
- With the complete name and address of the Library,
- Made out to

"Lunar Reclamation Society"
Attn: Library Subscriptions
PO Box 2102
Milwaukee, WI 53201

MMM PHOTO GALLERY

Bigelow Aerospace **Sundancer** in Orbit – Artist Rendering
Sundancer will be the first Bigelow module in orbit capable of human occupancy, and is planned for launch early in the next decade.

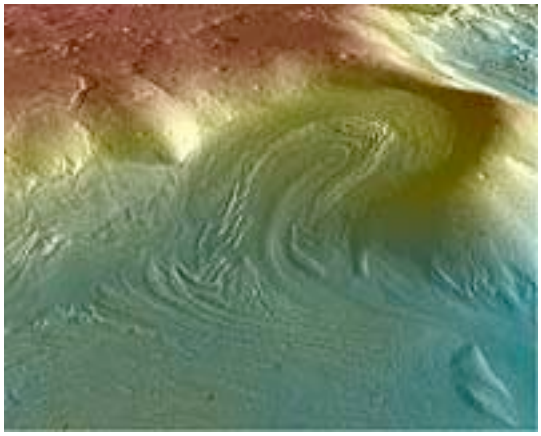
19 NASA 40"X8" print MURALS for sale $59 each
(larger sizes up to 90"x18" for $299)
http://moonpans.com/prints/fullpans.htm



And 15 more! – Thanks to Bob Perry, St. Louis MS
Imagine one of these over your bed, desk, or sofa!

Air-launched 14 passenger space tourism vehicle being considered by Russia's Myasishchev Design Bureau

Phobos, in greatest detail to date by Mars Express
http://www.marsdaily.com/reports/Mars_Express_Acquires_Sharpest_Images_Of_Martian_Moon_Phobos_999.html



Moraine Box Canyon on Mars: MRO hi-res Photo

Virgin Galactic rolls out mother ship "Eve"

Hubble Repair Mission

STS-125

Atlantis

Set for October 10th 208

Mars Society Prepares for 8th Season at MDRS

Mars Society Bulletin September 10, 2008

The Mars Society is now seeking crewmembers for the 8th season of field operations at the **Mars Desert Research Station** in Utah, scheduled to run between November 2008 and April 2009. Come and join one of the world's longest-running and most successful space simulation projects!

Interested parties should send a resume to mdrs-applications@marssociety.org, and then fill out the optional online application (which will help speed the review process) before the September 30 deadline.

Applications should include your full name, contact information, and all crew rotations that you would be available to participate in, and the crew position (engineer, biologist, geologist, journalist, etc) that you are seeking. Note that not all the crew rotations listed as options will be approved; therefore it is very important that you list ALL slots that you could participate in. Potential rotations are as follows:

#72 Nov 22 – Dev 7	#78 Nov 22 – Dev 7
#73 Dec 6 – Dec 21	#79 Dec 6 – Dec 21
#74 Dec 20 – Jan 4	#80 Dec 20 – Jan 4
#75 Jan 3 – Jan 18	#81 Jan 3 – Jan 18
#76 Jan 17 – Feb 1	#82 Jan 17 – Feb 1
#77 Jan 31 – Feb 15	#83 Jan 31 – Feb 15

After the application deadline the selection committee will decide which rotations will be approved, and which applicants will be invited to participate. All applicants will be informed of the committee's final decision as soon as possible after it is made.

Please note that while previous MDRS crew experience will be a bonus on your application, it is by no means mandatory. Additionally, a proposed plan of research during your rotation is a strong bonus, but is not required, particularly if your skills would be useful in support of other crew members' research operations.

Also, a good command of the English language, both spoken and written, is beneficial. If your English is not that good, please be honest about that, and mention your primary language, in order to give the selection committee the chance to team you up with someone who speaks your primary language.

This season every crew will collect extremophile samples for an ongoing science research project and therefore biologists with the proper experience of sampling in the field are especially invited to apply for the position of crew biologist. A precise description of the responsibilities of the crew biologists can be found on the application page.

Anyone applying for the position of crew engineer, a vitally important job for the station as a whole and your crew in particular, needs to have a varied background in many engineering / handyman duties, and needs to be willing to be trained on the systems of the station by the Engineering Team.

Questions? Write mdrs-applications@marssociety.org

[**Editor:** *we were surprised at this announcement as earlier indications were that last year's season would end this bold experiment and that MDRS would be turned over to an Educational foundation of which the Mars Society would be a charter member. These plans evidently did not materialize. As an MDRS veteran of two crews, #34 and #45, we are delighted at the news.* <**PK**>

Tom Hill's TEMPO^3 Micro-satellite

To test artificial gravity generation techniques

Announced Winner of Mars Project Challenge

More: http://www.thespacereview.com/article/1194/1

Mars Society Bulletin August 19, 2008

After receiving the highest number of votes cast by members of the Mars Society and the endorsement of the Steering Committee, Hill's concept to launch a micro-satellite that will test artificial gravity generation techniques – which will be of immense value to the crew of a six-month flight to Mars – was named the winner of the MPC Saturday evening at the 11th Annual International Mars Society Convention.

"I'm just honored to have my project selected, when so many other excellent projects were up for consideration," said Hill, who will be the project lead. "I'm really looking forward to helping advance the state of the art here. NASA carried out tethered artificial gravity generation experiments during the Gemini program in the 1960s, but never got back to it in the Apollo, Shuttle, or Space Station eras. Artificial gravity is important for a Mars-bound crew, so we will take the concept forward."

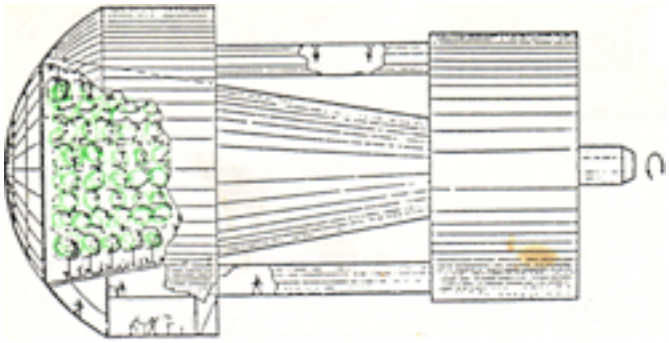
While the full details of the project are still being worked out, TEMPO^3's broadly stated goal is to use an inexpensive nano-satellite to conduct research into the feasibility of generating artificial gravity during the six-month journey to Mars.

Proving that artificial gravity can be generated for a crew flying to Mars will help remove one of the major technical barriers to human exploration of the Red Planet.

"Similar problems were encountered during the early part of World War II, when aircrews flew at high altitude and low oxygen levels," said Mars Society President Robert Zubrin. "The technological solution of providing oxygen through enigneering techniques was frowned upon by aviation doctors in favor of trying to 'negate the effect' of the low oxygen through medication. Today, flight crews use oxygen at high altitudes, and we expect astronauts to travel with gravity."

Hill expects to work with the broader membership of the Mars Society in order to produce the best possible system. He is currently seeking "team leads" for the technical, fundraising, and public relations aspect of TEMPO3; interested parties should send a half-page summary of their relevant experience, along with contact information, to tomhill@marssociety.org. Additionally, Hill envisions multiple software development efforts for the satellite, with the best-performing entry being selected to fly into space.

Details on the project's timeline will be released, along with regular updates, as the project progresses.



Konstantin Tsiolkovsky's early 1900's concept for a space station with artificial gravity through centrifugal

NSS and Hadley Rille Books Announce Winners of RETURN TO LUNA Short Story Contest

From NSS Downlink September 7, 2008

The National Space Society (NSS) and Hadley Rille Books have announced the WINNERS of the RETURN TO LUNA Short Story Contest! The contest awards the writers of science fiction stories that show the adventure of lunar settlement.

The contest prefers near future (50-150 years from now), realistic stories about human lunar settlement that make the reader feel the romance of life there, the wonder of the lunar frontier, and of its magnificent desolation.

All winning stories will be published in the anthology RETURN TO LUNA; the book was submitted to well-known science fiction editors to consider each of the stories for inclusion in their "best of the year" anthologies, and the book was sent out for review.

All winning authors are eligible for royalties and will receive free membership to the National Space Society for one year. The Grand Prize Winner will also have a review of his or her winning short story featured in NSS's magazine *Ad Astra*, and on the NSS and Hadley Rille Books websites.

The winners of this year's contest are listed at Hadley Rille Books' Web site, here:

http://ericreynolds.livejournal.com/31377.html.

For more information on the RETURN TO LUNA Short Story Contest and NSS' participation, click here: http://www.nss.org/news/releases/pr20080229.html.

SPACE EXPLORATION EVENTS THRU - 04/09

by Ron Hobbs - <rhobbs@museumofflight.org>

Sep. 5: Rosetta - Flyby of asteroid (2867) Steins
Sep. 19: Chandraayan-1 - Launch of Indian lunar orbiter
Oct. 6: MESSENGER - Second flyby of Mercury
Oct. 8: STS-125 - 4th/final servicing mission to Hubble ST
Oct. 12: Shenzhou 7 - Third Chinese crewed mission; 1st Chinese spacewalk, 3-man mission
Oct. 14: Soyuz TMA-13 - 100th launch of Soyuz spacecraft; ISS Expedition 18
Oct. 31: Planck - ESA's mission to study the cosmic Microwave background
Nov. 10: STS-126 - SS Endeavor to deliver Multi-Purpose Logistics Module to ISS
Dec. 1: Solar Dynamics Observatory - 1st mission in "Living With a Star" program
Dec. 26: Equinox on Mars- beginning of northern autumn /southern spring
Early 2009: Herschel/Planck ESA Infrared T-scope launch
Jan 15: Orbiting Carbon Observer Launch (Earth Science)
Feb 16: Kepler Launch (searching for Earth-like planets)
Feb 17: DAWN (Vesta, Ceres) Mars gravity assist flyby
Feb 27: Lunar Reconnaissance Orbiter/LCROSS Launch
April 15: Ares I-X First test launch of Ares I from Pad 39B at KSC
May 15: STS-127 SS Endeavour to the ISS

LUNAR PROPERTY RIGHTS

The Debate Advances

From **The Space Calendar** Vol. 26, No 34, August 25-31
Space Publishing Company, 2008
news@spaceagepub.com, www.spaceagepub.com

'Possession is nine-tenths of the law' is a popular saying, but would it pertain to the first private Moon explorer? From resource claims to land ownership, the legal quandary surrounding owning property in space and on the Moon remains a contentious topic, yet one that must be resolved to allow the commercial expansion into the cislunar frontier.

The issue was discussed last week at the Yahoo! Brickhouse in San Francisco CA. Steve Durst of Space Age Publishing Company and William Marshall of NASA Ames Research Center led a discussion on 'Who Owns the Moon?', presenting various views on extraterrestrial property rights from industry, United Nations, and the US Government.

Two extreme views on the subject are the Moon Treaty of 1979, which bans any ownership of outer space or planetary property by any organization or person, and the Lunar Embassy, which has claimed ownership of the Moon and sells lunar lots commercially under the auspices of the Galactic Government.

The Moon Treaty was never ratified by the USA or other major spacefaring nations. The 1967 Outer Space Treaty was signed by the USA, and about 100 other countries, and it prohibits any government from owning the Moon or other celestial bodies - but not enterprises or individuals. With the International Lunar Observatory, Google Lunar X Prize and Lunar Lander Challenge spurring private lunar vehicle development, the matter of owning a piece of the Moon could soon end up in international courts if it is not resolved within this decade. (Credit: NASA, SPC)

[Editor: Moon Society member and friend, Alan B. Wasser is one of those pushing this debate with ardor. He has launched The Space Settlement Initiative and The Space Settlement Institute www.space-settlement-institute.org/

On August 28, 2008, there was an excellent article in The New York Times on this topic.

http://tierneylab.blogs.nytimes.com/2008/08/29/for-sale-moon-and-mars/

In the Winter 2008 editon of The **Journal of Air Law and Commerce**, there was an extensive treatment of this topic by Wasser and collaborator Douglas Jobes,

"SPACE SETTLEMENTS, PROPERTY RIGHTS, AND INTERNATIONAL LAW: COULD A LUNAR SETTLEMENT CLAIM THE LUNAR REAL ESTATE IT NEEDS TO SURVIVE?**"**

We have uploaded the PDF file of this 40 page treatise to the Moon Society website for all to study.

www.moonsociety.org/publications/papers/jal73-1Wasser

The authors have taken great pain to investigate all the nooks and crannies of this legal area, and there conclusions demand respect.

And, yes, they answer their Title Question in the affirmative! **<MMM>**

Contract Incentives for an Open Architecture International Lunar Network

(A standardized set of sensors and other instruments [1] to be determined, to be set up at the touch-down locations of all landers and rovers reaching the Moon in the coming years - DD)

By David A. Dunlop <dunlop712@yahoo.com>

Introduction

There is a lunar community of interest in how an "open architecture" can be designed into "infrastructure" to increase opportunities for entry by commercial providers. This community of interest includes those who would wish to see costs of going to the Moon reduced, the pace of scientific and commercial projects accelerated, and the flexibility of planning and contracting for lunar missions increased.

Now there is interest in creating a commercial paradigm of space transportation providers. The Google Lunar X-Prize competition is the most visible expression of this movement. According to Dr. Pete Worden, Director of NASA AMES Research Center, the cost challenge is to pioneer "micro" lunar lander missions that can perform useful functions "in the low tens of millions range from "perhaps a low of $ 28 M to $ 48M to $ 68M at the high end." [2]

As one example, the NRC final report on the Scientific Context for the Exploration of the Moon mentions the utility of an increased network of laser reflectors on the lunar surface. [3] It would make economic sense for agencies such as NASA, ESA, JAXA, ISRO, Roscosmos, and CNSA to provide potential contracts to any Google Lunar X-Prize teams that would deliver, in this example, a laser retro reflector to the lunar surface. A variety of scientific instruments that are recognized as elements of a lunar science network might be contractually placed in this manner on private landers.

Google Lunar X-Prize Contracts:

Under the Google Lunar X-Prize there are the first and second prizes to be won. When those prizes are won the remaining teams would remain without the financial incentive from the Google Lunar X-Prize. Many teams might simply disband once the financial prizes are gone, and even the prestige and recognition of having won the competition are secured by others.

It would seem to be a tragic loss of capital and intellectual resources to have many teams which have gone in essence through phases A, B, and C of their mission development to fail to realize their goal of achieving a lunar landing and demonstrating innovative technologies by reason of simply not being first.

As the various Google Lunar X-Prize contestants may head for various plays around the lunar globe, this creates a unique opportunity should all of them carry a standardized instrument set to be left behind: the opportunity to put in place the start of an international global lunar network of scientific monitors. But for this to happen, those not coming in first or second must be motivated to continue.

Contract incentives of equal proportion to the Google Lunar X-Prize by the national funding agencies might create many "winners" in the realm of education, science, technology, and the ability to demonstrate greatly improved cost efficiency.

For the national space agencies to offer contracts to establish a lunar sensor network may be a way to quickly and cost effectively "harvest" the capital investment and technology innovations of the Google-X Prize competition and develop a more commercial space model in the process.

National space agencies would have to develop their own criteria in assessing the credibility of potential contractors. NASA has in fact proposed something of this sort in conjunction with its ASMO mission proposal. This is a paradigm shift in the way business has traditionally been conducted by NASA. It is also the paradigm followed by ESA's ESMO [European Student Moon Orbiter mission.

Having a known and publicly described set of such instruments with fixed priced contracts also facilitates planning on the part of those who might wish to include the possibility of such contracts in their mission and financial plans.

To propose science contract packages from national space agencies for ILN sensors would create a financial climate equivalent to the Google Lunar X-Prize, and create a "commercial market" for such micro landers. $ 150 million represents a third of one NASA Discovery mission. A $ 25million contribution by each of the 6 major space agencies would be the equivalent of more than 7 Google Lunar X-Prize Competition First prizes or 30 second prizes. ILEWG might encourage early budget and contract commitments by national space agencies especially if their impact is spread over a 5 or 6 year period or longer.

This contract model could focus on payments for a more complex set of milestones for criteria such as: a. design, b. construction, c. launch, d. deployment, e. data return. Phased contract incentives equivalent to the Google Lunar X- Prize first prize might provide financial sustainability of those teams whose engineering and mission planning credibility warrants contracts and that remain intact after the fist and second prizes have been awarded.

The aggregation of contracts for a variety of sensors defining a ILN network node would fall into the low range of lunar lander costs projected by Dr. Worden but not preclude other private, commercial, or national efforts and projects on these teams. This could also make "national flag" lunar mission commitments from the 14 ILN signatory nations much more likely and foster financial collaborations between such national flag agencies and commercial organizations.

Collaborative commitments by national space agencies in this model result in a mix of successful public science, "national flag", and corporate lunar landing missions.

References:

[1] seismometers, gas sensors, radiation sensors, thermometers, and other instruments to be determined.

[2] Personal communication

[3} The Scientific Context of the Exploration of the Moon: Final Report, NRC, Space Studies Board, 2008, p. 53,65,66.

* **David A. Dunlop** is the Moon Society Director of Project Development, and has recently been elected to a seat on the Board of Directors. Among his many space-related interests is promoting cooperation and collaboration between the various national space agencies planning missions to the Moon.

Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

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< James_Schroeter@excite.com> . 414-333-3679
TREAS./ Database – *Robert Bialecki
<bobriverwest@yahoo.com>..... 414-372-9613

LRS News

• **September 13th Meeting:** Only Peter, Charllotte, and James were able to make our first meeting after our summer break. There was free discussion and an early adjournment.

• **Dave Dunlop is organizing a Moon Society Chapter in Green Bay.** After he found another interested person, Dan Hawk, on the staff of the College of the Menomonee Nation, who was interested in experimental lunar agriculture (Dave's forte) Dave launched Moon Society Green Bay Outpost (MS term for chapter in formation). Prospects look good for a full-fledged campus-based chapter focused initially on lunar agriculture experiments. Many will recall that Dave launched LUNAX, the Lunar National Experiment Corp. in the early 1990s to engage High School Science and Ag-Science teachers in student ground level experiments to determine the best ways of nursing plants through the 2-week long nightspan on the Moon so that they would go on to harvest.

• **Peter finds abandoned professional exhibit system:** see the article on page 11, col. 1. As this system will most likely be kept in Milwaukee while not in use, LRS will be able to use it as well. Peter will be preparing display materials about solar power satellites for the first scheduled use at ISDC in Orlando next May, where Dave will be chairing the Moon Track, but which conference Peter does not plan to attend.

LRS Upcoming Events – October & November

Saturdays: October 11th, November 15th, 1-4 pm

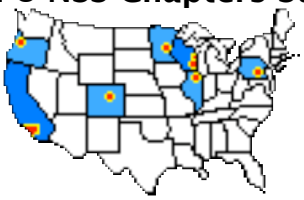
LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA: www. lunar-reclamation.org/page4.htm

• We have no known outreach or exhibit opportunities in the near future but are on the lookout for any as always

• Not to forget: picking out a "Sci-Fi Classic" film to show at our December 13th annual holiday party & Pot-luck luncheon – *Save the date!*

MMM 8 NSS Chapters Strong



NSS Chapter Events

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

OREGON

Oregon L5 Society

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

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

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

Allen G. Taylor <allen.taylor@ieee.org>
Bryce Walden <moonbase@comcast.net>
(LBRT – Oregon Moonbase) moonbase@comcast.net

* **Meetings 3rd Sat. each month at 2 p.m.**

Bourne Plaza, 1441 SE 122nd, Portland, downstairs
Oct 18 – Nov 15 – Dec 20

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

INFORMATION: Larry Ahearn: 773/373-0349

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@charter.net>

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

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

● **We meet the 3rd Thursday of the month 7-9pm**
Sept 18th UW-Sheboygan, Sheboygan, @room 6101
Oct 16th: The Stoelting House, **Kiel**
Nov 20th UW-Sheboygan, Sheboygan, @room 6101

MINNESOTA

Minnesota Space Frontier Society
c/o Dave Buth 433 South 7th St. #1808
Minneapolis, MN 55415
David Buth (w) (612) 333-1872, (h) (612) 529-9871
Email: info@mnsfs.org
[www.mnsfs.org/]

MN SFS News & Pictures

Ben & Producer of Babylon 5, J. Michael Straczynski, at The Mars Convention
http://freemars.org/MarsSociety/2008/Mars-Soc-Conf-2008/Ben-JMS-t.jpg

Ben's ISDC 2008 Pix
www.islandone.org/ISDC/ISDC2008_DC/DMA-Photos-20070527-20070602-All_Rights_Reserved/

CVG 2008 Party Pix
www.freemars.org/mnfan/Convergence/2008/2008-07-Volunteer-Party/

CALIFORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS
P.O. Box 1231, Redondo Beach, CA 90278

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

Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com

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

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

Regular Meeting 3 pm 3rd Sat. each month
Next Meetings Oct 18 - Nov 15 - Dec 20

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

Jet Propulsion Lab "New Wheels on Mars: The Mars Science Laboratory. Richard Cook, MSL Project Manager. Free: no tickets required. Lecture will be webcast; http://www.jpl.nasa.gov/events/lectures.oct08.cfm

- **Thursday, OCT 16** - 7:00pm The Von Karman Auditorium at JPL -4800 Grove Drive, Pasadena
- **Friday, OCT 17** -7:00pm Vosloh Forum, Pasadena City College, 1570 E. Colorado Blvd, Pasadena

Saturday, OCT 18 - 3:00pm OASIS general meeting Details to be announced

No further Event Information available at press time

COLORADO

Denver Space Society
(formerly Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113

http://www.angelfire.com/space/frl5/

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings, every 2nd Monday, 7 PM
Next: October 13th, November 10th, December 8th
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

PENNSYLVANIA

Philadelphia Area Space Alliance
PO Box 1715, Philadelphia, PA 19105

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

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

• **PASA regular business luncheon/formal meeting 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. Call Earl/Mitch 215-625-0670 to verify all meetings.

Next Meetings: Oct 18 - Nov 15 - Dec 20

PASA News: We all regret that we are losing Michelle Baker (Miki) who has moved to Texas to take advantage of opportunities there. We all wish her Godspeed in these new endeavors.

Meanwhile, Earl Bennet is moving across the river to New Jersey to become caretaker of Miki's place.

These events, plus our not having been active during the summer, as usual, mean that there has been little news to repot, and that what we did have to send to MMM will be included in next month's report.

Submitted by Earl Bennett.

Attention other NSS Chapters

Many chapters have elected not to use paper newsletters to spread the news and reports of chapter activity. In these days of email and the internet, there are faster ways to do things. See:
http://nsschapters.org/hub/NSSchapterwebsitelist.htm.

Nonetheless, Moon Miners' Manifesto has been serving a number of NSS chapters, not just to carry their reports, but as a membership benefit that keeps people renewing. Contact us for a quote! kokhmmm@aol.com

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- **$45 National Space Society dues** include ***Ad Astra***
- **$20** NSS dues **if under 22 / over 64.** *State age* ___

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Moon Society dues include *Moon Miners' Manifesto*
Electronic MMM (pdf) **$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 Subscriptions:
Send proper dues to address in chapter news section

=> *For those outside participating chapter areas* <=

- **$12 USA** MMM Subscriptions; • US **$22** Canada;
- US **$50** Surface Mail Outside North America

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

CHICAGO SPACE FRONTIER L5

- $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

- $12 low "one rate"

MINNESOTA SPACE FRONTIER SOCIETY

- $25 Regular Dues

OREGON L5 SOCIETY

- $25 for all members

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

- $28 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE

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

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SHEBOYGAN SPACE SOCIETY (WI)

- $15 regular, • $10 student,
- $1/extra family member

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

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