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

Moon Miners' Manifesto

& The Moon Society Journal

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Above: McMurdo Sound Antarctica (US)

Feature Articles in This Issue

What? Skip the Moon? Flyby Asteroids & Mars? >

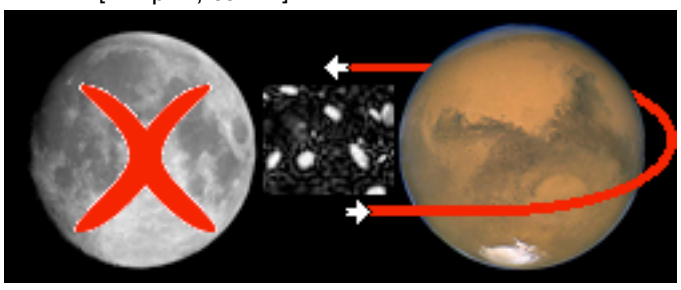
So proposes the Augustine Commission in its endeavor to match doable goals for NASA's Manned Space Program with realistic current & projected funding levels. Many are outraged. But Tom Heidel suggests this may be just the course correction NASA needs to keep the public enthused while allowing a new International Lunar effort proposed by Buzz Aldrin to take root and lead to a more robust presence on the Moon. See page 7.

Guest Editorial ISS Safe Thru 2020

By David A. Dunlop dunlop712@yahoo.com

The Augustine Commission Executive Summary provides options which extend the use of the ISS to 2020. The report also indicates that abandonment of the ISS would seriously damage the relations between NASA and its international partners. That this is true is so obvious that it is curious that the commission felt the need to so state. However, since this "ISS abandonment position" was cooked up during the Bush/Griffin administration perhaps the commission members thought some sort of stated rationale for a change of policy was necessary.

[=> p. 2, col. 2]



Moon Miners' Manifesto

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⇒ In Focus Editorial continued from p. 1.

And so I think that abandonment of the ISS is unlikely given the more internationally-oriented Obama administration, and given the fact that almost all of the ISS partner nations, plus the ISRO [India], will have new manned systems coming on line after the 2016 timeline mentioned by NASA. If there is no ISS, where would these new manned systems go, pray tell? NASA was hard pressed to have a shuttle with no space station program and I think it will be similar with the other countries.

I think the comments of ISRO Chairman Nair are also interesting in that he connects the potential of India's use of the ISS as justified on the basis of scientific requirements. Now the ISS is designated as a US national laboratory and in addition ISS now has the Columbia lab contributed by the ESA, plus the Japanese Kibo lab which has just been completed. So Indian participation in any of these facilities and with these agencies can provide both a ready made destination and purpose for ISRO manned capacity. Similarly the use of India's Mark III or IV Launchers could provide a cargo delivery function for the ISS and a test bed for manned operations. Both JAXA and ESA are also looking at building their unmanned HTV and ATV cargo delivery capacity into a manned system that can reach and return from the ISS.

ESA is looking at a manned system development timeline around 2020. Similarly, Roscosmos is also developing a next generation manned system by around 2015-2016. The ISRO timeline therefore is fairly consistent with the plans of the other ISS partners. *The ISS supply chain now has much more diversity than before* and the US timeline for replacing US manned access after the shuttle may not be much in advance of 2015 unless the Space-X Falcon-9 Dragon system can be brought online faster.

This concurrence of manned capacity on the part of ESA, ISRO, JAXA, Roscosmos and the US COTS contractors almost begs for an additional purpose and destination than the ISS. The CNSA [China] has already demonstrated manned capacity and they have stated they are planning a manned lab facility in orbit. They are also developing a Long March 6 HLLV with a projected delivery date of 2015-2016 to increase their lift capacity.

This increase in supply chain capacity makes added destinations and projects beyond the ISS both more cost feasible and schedule feasible.

The advent of an international lunar research park would be an appropriate next generation project for a partnership focus expanded beyond that of the ISS. The growth of both the Chinese and Indian economies over the next decade also makes it more feasible for both countries to take a stronger leadership and financial position in space projects such as:

- A lunar program,
- Construction of a demonstration solar power satellite
- GEO platforms
- A large Solar System space exploration missions
- A new Equatorial Space Station better positioned to support additional science labs, crew support for lunar missions, and the capacity to refuel "stacks" of components sent up by multiple launches.

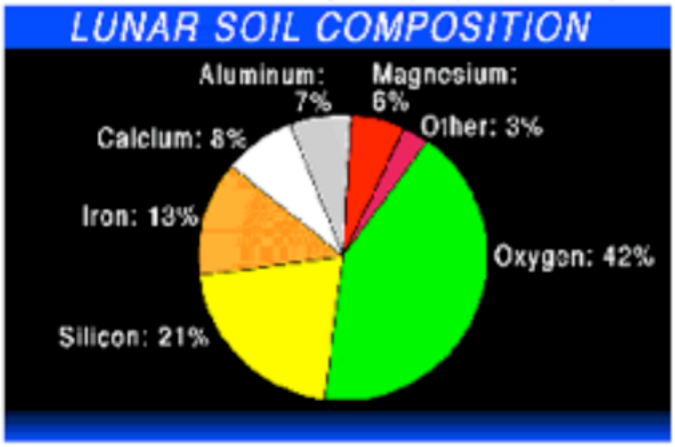
I would not bet on the shut down or deorbit of the ISS. It is too central to the justification of expanded manned launch capacity in too many countries. **DAD**

Defining the Lunar Industrial Seed: What Comes Before How?

By David Dietzler pioneer137@yahoo.com © 2009

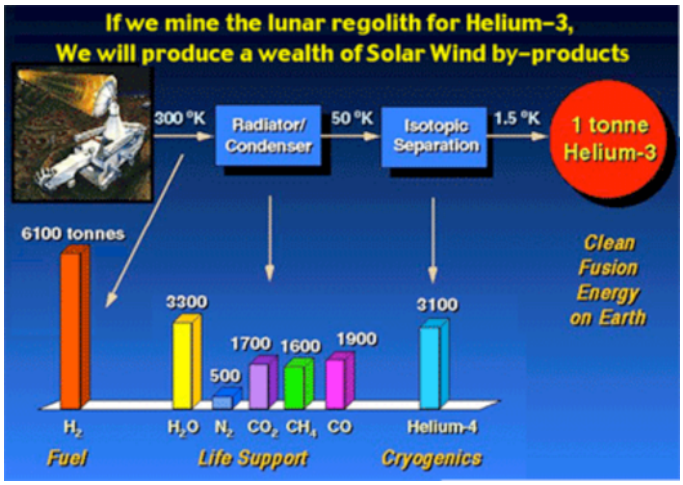
Part 2) Lunar Materials

The Moon: "Pie in the Sky!" But, oh, what a recipe!



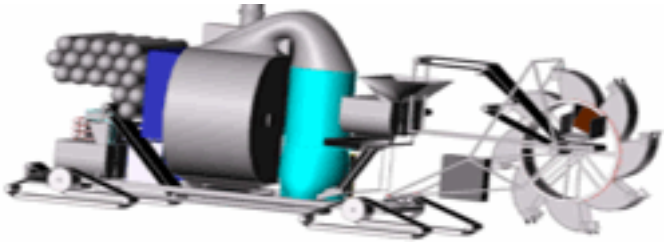
http://nsschapters.org/hub/pfd/MoonPieChart.pdf

Solar Wind Implanted Volatiles Those Precious Light Elements



Perhaps the first job to be tackled on the Moon will be mining for solar wind implanted volatiles- hydrogen, carbon, nitrogen and helium. These will be needed for life support and industrial processes. Mining robots will shovel up regolith, load it into onboard furnaces, and roast out the volatiles at about 700 C. Hydrogen will come off as is and some will react with oxygen in the silicates of the regolith to form H2O. Carbon will form CO, CO2 and CH4. Nitrogen is almost inert and will come of as is and so will helium, both helium 3 and normal helium 4. Hydrogen is needed for ilmenite reduction and CO and CO2 will be reacted with H2 over a nickel catalyst to form CH4 that can be decomposed with heat at about 900 C. to yield carbon and recover hydrogen. Carbon will be needed for life support systems when agriculture begins, steel and for carbonyls of iron and nickel for chemical vapor deposition processes. Until agriculture begins and closed ecological life support systems are at work, CO2 will be a nuisance removed from cabin air with physio-chemical systems and dried food will be upported and rehydrated with recycled water. Once CELSS is going, the top priority for carbon will be life support rather than industrial processes. Fortunately, industry won't demand much carbon since there are substitutes for steel and CVD won't require much either. Also, all carbon used for CVD will be strictly recycled. Nitrogen will have uses for CELSS. Helium can be used as an inert gas for work chambers where vacuum and oxidiation are undesirable and as a rocket fuel tank pressurant.

Storage and processing systems for these gases and water must be upported. Hydrogen can be stored in solid media and room temperature. Carbon monoxide, dioxide, methane and nitrogen can be liquefied with pressure and cooling. Helium must be cooled to near absolute zero so this element must be stored in high pressure gas tanks since it might not be practical to upport heavy multistage cooling equipment; however, if the helium is piped through shielded space radiators exposed only to the ten degrees Kelvin temperature of outer space, it might be possible to liquefy helium on the Moon without excessively heavy machines.



The Mark 3 miner designed at the University of Wisconsin, Madison, is projected to amass ten tons and could produce over 200 tons of hydrogen, 16.5 tons of nitrogen, 82 tons of carbon and about 100 tons of helium every year [1]. That's an incredible bounty from a ten ton machine, not counting the solar power systems needed to energize the machine, when it will cost thousands of dollars per pound of mass sent to the Moon. One of my associates has calculated that with the Apollo system it cost $30,000 to send a pound to the Moon. If the cost of upports drops to say $10,000 a pound with the success of rockets like the Space X Falcon 9 then we would still pay $4 billion to send 200 tons of H2 to the Moon. A pound of 1% carbon high grade steel for drill bits or milling heads would contain $100 worth of carbon. That's a high price for steel. Better to use lunar carbon for lunar steel. The value of mining for solar wind implanted volatiles on the Moon is clear.

One of the first jobs we should do on the Moon is mine for volatiles and stock up a supply of them pending later development on the Moon. This could be done with teleoperated robots years before a manned base is constructed.

That Essential Oxygen

Oxygen is necessary for breathing and producing water, but also for rockets. A reusable robotic Moon Shuttle might tank up with LOX on the lunar surface and rendesvouz with spacecraft arriving in LLO with just enough fuel for landing on the Moon. The Moon Shuttle carrying enough LOX for descent will dock with the cargo

craft and take on fuel then descend to the lunar surface. This system will increase the amount of cargo that would otherwise consist of oxidizer upported from Earth to the Moon and reduce costs. If the system is reliable enough it could be used to land humans on the Moon too and supply LOX for return to Earth.

Fuel for the Moon Shuttle's ascent would have to be produced on the Moon. If one Mark 3 miner can produce 200+ tons of hydrogen a year, a small fleet of them could produce enough H2 for fueling Moon Shuttles as well as other purposes. It might be possible to stretch the hydrogen supply by combining it with lunar silicon to produce silane-SiH4. Naturally, we'd have to upport the silane making equipment. Keep in mind that oxygen is 6/7 to 8/9 of the propellant mass in a hydrogen/oxygen fueled rocket, depending on mixture, and 2/3 the propellant mass of a silane/oxygen fueled rocket.

Not only must we produce oxygen, but also storage tanks, piping systems, pumps and space radiators to liquefy oxygen. We will need a system for producing oxygen, probably molten silicate electrolysis or vapor pyrolysis. These systems could also produce silicon for making silane. . Lander tanks might be used for the first LOX storage tanks.

In the early years we will upport insulated LOX storage tanks and associated piping, compressors and space radiators. To make foil shielded space radiators exposed only to the ten degrees K. temperature of outer space we will need metals production on the Moon, and this will require upporting some small smelting furnaces and making some large furnaces on the Moon from cement, silica and/or titanium dioxide bricks.

Cast and Sintered Basalt - This simple and general purpose material can be made just by putting some mare regolith which is just hardened lava pulverized by eons of meteoric bombard-ment into a fine powder into a furnace and heating it up to 1250-1500 C. The molten regolith will be poured out into sand molds dug in the soil to cast bricks, blocks and slabs. To make sintered blocks we must put the Moon dust into trays to size the blocks and heat them up just enough to get the edges of the particles to fuse. This simple black glassy material, cast basalt, has been used for centuries to make pipes, tiles, blocks and even fine table ware. It is very hard and abrasion resistant.

Mobile robots could use microwaves to melt mare regolith as they roll over it to make roads after the stuff hardens that vehicles and robots could roll over without kicking up dust. Landing and launching pads could also be made this way. Entire areas surrounding Moon bases where manufacturing and construction are going on might be treated this way so that dust isn't kicked up by wheeled vehicles and robots.

Silicon and Iron - These can be produced by serial molten silicate electrolysis also called magma electrolysis [2]. In the same way that an electrical current can be passed through water to break it down into oxygen and hydrogen, a current can be passed through molten regolith to partially break it down into its constituent elements. This also yields oxygen and a ceramic that melts at about 1500 C. The ceramic might be used to build more magma electrolysis furnaces. Sodium, potassium, phosphorus and sulfur might be produced as impurities in the oxygen that could be filtered out in cold traps. Silicon will probably need purification in vacuum distillation furnaces and by zone refining before doping to make solar panels.

Iron could also be extracted from regolith where meteoric iron fines are present at up to 0.5% by weight. Low intensity magnetic separators and grinders to bust up the silicates adhering to the fines will be used [3]. This meteoric iron contains 5% nickel and 0.2% cobalt.

Iron might be combined with some upported or Moon mined carbon, preferrably Moon mined carbon, by using the old blister steel or cementation process to convert it to stronger steel. see:

http://www.moonminer.com/blister-steel.html

Titanium and Titanium Dioxide - The mineral ilmenite can be concentrated by magnetic and electrostatic processsing of mare regolith where it is about ten times more abundant than in highland regolith [4]. Ilmenite can be reduced to titanium dioxide and iron particles with hot hydrogen gas in a fluidized bed. Water forms and is condensed, electro-lyzed to recover hydrogen and gain oxygen. The fused TiO2 and iron particles can be sepa-rated by roasting in the vacuum or by treatment with CO gas to produce iron carbonyls. Titanium dioxide particles could be sintered to make a high temperature ceramic that melts at 1800 C. Since cast basalt (molten regolith) melts at 1250-1500 C., iron at 1200-1500 C., silicon at 1400 C. and silica at 1700 C., these materials could be melted in titanium dioxide lined furnaces. Titanium metal could be obtained by deoxdizing TiO2 in FFC cells filled with upported CaCl2 flux. The FFC process will also gene-rate oxygen. Sponge titanium from FFC cells would be melted with electron beams instead of arc furnaces and cast into into slabs, ingots and billets or atomized to get Ti powder without adverse reaction with hydrogen, nitrogen or oxygen in the free lunar vacuum.

Magnesium - It might be possible to concentrate magnesium bearing olivines and pyroxenes from mare regolith by magnetic and electrostatic means. These could be reduced to magnesium metal in furnaces with silicon from magma electrolysis and a calcium aluminate ($CaAl_2O_4$) flux at about 1500 C. The magnesium metal boils off and is condensed. If olivines and pyroxenes don't take to silicothermic reduction, then magnesium oxide obtained by roasting regolith at 1500 C. and hotter will be used. Silicothermic production of magnesium has now all but replaced magnesium chloride electrolysis.

Aluminum - Three processes stand out for aluminum production. All will involve concentration of anorthite by magnetic and electrostatic means.

A) 1) Sulfuric acid leaching of anorthite.
   2) Roasting aluminum sulfate to aluminum oxide
   3) Carbochlorination of Al_2O_3 4) Electrolysis of $AlCl_3$ in a flux of lithium and sodium chloride [5].

B) 1) Direct carbochlorination of anorthite
   2) Distillation of $AlCl_3$ and $SiCl_4$
   3) Electrolysis as in step 4 above [6].

C) 1) Roasting anorthite at up to 2000 C. to get $CaAl_2O_4$
   2) Electrolysis in a lithium fluoride flux [7]

Process A will yield a lot of $CaSO_4$ and silica by-product. If the $CaSO_4$ is not useful, it can be decomposed with heat to recover sulfur. Process C seems simplest but it will require a very high temp. furnace, upported lithium fluoride since these two elements are lacking on the Moon, and special alloy electrodes. Carbon and chlorine will have to be carefully recycled. The only likely lunar source of chlorine is pyroclastic glass.

Cement

This all purpose material can be produced by roasting highland regolith at 1800-2000 K. to drive out SiO2 and enrich CaO content [8]. The SiO2 can be condensed and used for glass. Glass fiber reinforced concrete will be very strong. Typical Portland cement contains 5% CaSO4 to slow setting time. I don't know if this will be necessary for lunar cement but if aluminum process A above is used there will be plenty of CaSO4 available. Cured cement does not have to absorb CO2 to set as does lime and sand mortar and it contains about 5% water by wieght. Cement things could be cast in pressurized inflatables to recover H2O as it dries. Sulfur can also be used to make cement. Habitat modules made of concrete will be buried, thus not exposed to thermal extremes and will not expand and contract so much that they crack. With thick enough walls and glass fiber reinforcement they will stand up to internal air pressure well.

Glass

Glass is yielded by H2SO4 leaching, roasting regolith to get cement and by roasting regolith to get MgO. Molten glass can be drawn through dies to get glass fibers. These glass fibers can be mixed with molten glass that has been mixed with lunar sodium, potassium and perhaps even lead, if any from uranium decay on the Moon, to lower its melting point and the result is a glass-glass composite material. This material needs more study. It might even have Earthly applications.

Sulfur

Regolith contains c. 500 to 1700 ppm sulfur. To the best of my knowledge most of this is in the form of the meteroic mineral Troilite-FeS. This mineral could be extracted electrostatically from large masses of regolith by machines similar to the ones that mine for volatiles and iron fines. It could be decomposed with intense heat in a solar furnace to get sulfur and some iron too. Molten sulfur can be used instead of water to make cement. We might be more willing to sacrifice sulfur than water if we must cast large concrete objects out in the vacuum.

References Cited Part 2

1] A Lunar Volatiles Miner by M. Gadga et al.

www.nasa-academy.org/soffen/travelgrant/gadja.pdf

2] Oxygen From the Lunar Soil by Molten Silicate Electrolysis_Russell O. Colson and Larry A. Haskin* 1990 http://www.belmont.k12.ca.us/ralston/programs/itech/SpaceSettlement/spaceresvol3/oflsmse1.htm

3,4] Pilor Production at the Moonbase 2015, H.H.Koelle

http://www.highfrontier.org/Archive/Jt/Koelle%20PILOT%20PRODUCTION%20at%20the%20MOONBASE%202015.pdf

5,6] Extraction Processes for Production of Aluminum, Titanium, Iron, Magnesium, and Oxygen for Nonterrestrial Sources. D. BHOGESWARA RAO, U.V. CHOUNDRY, T.E. ERSTFELD, R.J. WILLIAMS AND Y.A. YANG

http://www.nas.nasa.gov/About/Education/SpaceSettlement/spaceres/V-5.html

7] Processing Lunar Soils for Oxygen and Other Materials Christian W. Knudsen and Michael A. Gibson http://www.belmont.k12.ca.us/ralston/programs/itech/SpaceSettlement/spaceresvol3/plsoom1.htm

8] Cement and Concrete. Gene Corley and Larry A. Haskin http://www.belmont.k12.ca.us/ralston/programs/itech/SpaceSettlement/spaceresvol3/cemncon1.htm **<DD>**

The Lunar Industrial Seed, Cont.

Part 3A: Manufacturing

The "MUS" part of the Industrial Development MUS/cle Strategy*

* http://www.lunar-reclamation.org/papers/muscle_paper.htm

Massive, **U**nitary and **S**imple things that will be costly to upport but easy to make on the Moon due to their simplicity will be manufactured during the early stages of lunar base development lasting from several months to a few years. **C**omplex, **l**ightweight and **e**lectronic (or expensive) items will be upported until the base grows to a point at which large numbers of small to medium sized parts are needed.

Furnaces

Some of the heaviest pieces of equipment used on the Moon will be furnaces for refining regolith and minerals, melting metals for casting, making cement and melting glass for fibers and other uses. A 70 tons magma electrolysis furnace would use 3 MWe and produce about 1000 tons of oxygen, several hundred tons of silicon and iron, and over a thousand tons of ceramic in a years' time [1]. If the mass of the industrial seed is several hundred tons this will really make a dent in our mass budget. We will need to upport a much smaller furnace and use it to get some ceramic for constructing more furnaces as well as provide some oxygen, silicon and iron. The ceramic could flow out of the furnace and into sand molds to make blocks that are welded together with electron beams or microwaves to build another larger furnace. The platinum electrodes would have to be upported. There would also have to be systems for piping away and storing the oxygen and solar panels to energize the furnace.

Other furnaces could simply heat regolith or metals to melt them down and cast them into ingots or plates and slabs. Some furnaces will use electrical heating elements, probably upported in the early years, and others will use concentrated solar energy. Since some materials reflect light electric furnaces will be preferred to heat these. Solar furnaces will also need large Sun tracking reflector systems to collect enough energy to super heat materials. The use of titanium dioxide brick or block linings that are also e-beam or microwave welded together must be considered. The linings would not have to be thick enough to give structural strength to the furnace, but only thick enough to insulate the surrounding concrete that makes it sturdy enough to contain tons of molten materials.

Liquid Gas Storage

We will need to store liquefied CO, CO2, CH4 and N2 from volatiles mining. Hydrogen could be stored in solid hydrides or carbon nanotubes. Helium might require high pressure gas tanks. Since commercially pure titanium is strong enough for LOX storage systems, and is more corrosion resistant than stainless steel, it might be best to make the tanks out of titanium although titanium production is more complex than iron and steel production but less tricky than aluminum production. Some aluminum and tin to alloy the titanium might also be required.

Lander tanks might be used for the first LOX storage tanks. To make more tanks and accessories we will need to produce metals. The first metal to be

produced on the Moon might be iron from magnetically extracted iron fines of meteoric origin that compose up to 0.5% of the regolith. This iron might be combined with some carbon, preferrably Moon mined carbon, by using the old blister steel or cementation process to convert it to stronger steel. The steel would probably be alloyed with nickel The tanks would be lowered into trenches where they rest on cast basalt supports. Cast basalt is a good thermal insulator. The trenches will be covered with foil solar shields. It should stay good and cold down in the trenches. Will heat radiation from the regolith at minus 4 F. be a problem? That's warmer than LOX at minus 183 C. The walls of the trench could be covered with shiny low heat emitting foil and the vacuum will insulate more.

Solar Panels Needed Early

Initially, power willl come from solar panels landed on the Moon. These might be GaInP/GaAs/Ge stretched lens array panels that get 300 w/kg to 500 w/kg and 300-400 w/sq.m.[2]. One metric ton of these could generate 300 kilowatts! More solar panels will have to be produced to replicate and grow the seed. We don't have exotic elements like gallium and indium on the Moon. Solar panels will require silicon, aluminum, phosphorus and glass. Some boron for doping p-type silicon and some phosphorus for n-type material could be upported and combined with silicon produced on the Moon to make more solar panels to power more equipment as needed.

Eventually we will have to produce aluminum on the Moon to make p-type silicon and produce phosphorus too, so we will need devices for producing Al and P on the Moon as well as devices for producing silicon. We will also need devices for rolling aluminum slabs or ingots into sheets for the solar panel backing, extruding them into wires and devices for producing aluminum mesh for the top electrode to make solar panels.

Certainly, the MUS/cle strategy is needed here because rolling mills will be very heavy. It might be possible to make aluminum sheets by depositing vaporized aluminum on glass plates in the vacuum. Glass will also be used to cover the panels. Robots to assemble the solar panels, deploy them and wire them up will also be necessary. All expansion of the lunar industrial seed will depend on electricity so it will be necessary to produce solar panels in large numbers within just a few years' time after the manned and robotic initial base is built.

Basic Bricks

Brick making will be essential. I envison solar or electric furnaces loaded with regolith and molten regolith pouring out into simple sand molds dug in the lunar surface to cast bricks, blocks and slabs. Hopefully, the molten material will cool off and solidify before too much evaporation into the vacuum occurs. Iron molds with silica linings might also be used to cast bricks as they will cool down faster in such molds than they would in sand molds. Bricks will be needed for interior walls, walkways, and retaining walls that hold up regolith over buried modules. Slabs will be needed for short roads that robots can roll over without kicking up dust near the equipment. Cast basalt or pressed and sintered basalt possibly with metallic reinforcements will be used to make bricks and slabs. Molten silicate electrolysis also produces a spinel and silicate rich ceramic in addition to iron, silicon and oxygen with impurities most probably sodium, potassium and phosphorus that could be condensed from the oxygen.* The ceramic will melt at around 1500 C. and might be very useful. See:

http://www.moonminer.com/Moon-bricks.html and
http://www.moonminer.com/Magma-process.html

Metal Plates

Metal ingots and slabs from simple sand molds will have to be rolled into plates and sheets. A rolling mill is a very heavy piece of equipment. Since aluminum and pure iron are softer than titanium, a rolling mill for these metals might be made of lunar titanium. While the electric motors will be upported at first, the titanium rollers and frame could be cast on the Moon. Graphite molds or copper molds with cooling passages, inert gas coolant and space radiators would be needed to cast titanium in the vacuum.

To roll steel and titanium plates we will need hard steel or cementite (Fe3C) rollers. This would demand some carbon; even so, a 5000 pound rolling mill made of 1.5% carbon steel would only contain 75 pounds of carbon, so the sacrifice will not be great. I don't think we will be rolling steel plates on the Moon. We might be rolling titanium plates for pressurized vehicle cabins. It might also be possible to pour titanium plates _" to 1" thick in shallow molds made of TiO2 that are covered with a slab of glass to prevent evaporation of metal into the vacuum. Metal plates will be welded up to make buckets for mining shovels as well as other things.

Contour Crafting

A promising method of manufacturing and construction with cement/concrete is called Contour Crafting. This is similar to 3D additive manufacturing but on a much larger scale. It might be possible to "print up" concrete buildings and other items. See:

http://www.contourcrafting.org

Cement will be needed for floors in chambers where molten metals are handled and cement or concrete cylinders several feet thick could be used for habitat modules. It can also be used to make cement board for walls, plumbing and furnishings. The lunar industrial seed must include solar or electric furnaces for cement making, sealed cement mixers and hoses, inflatables for working with cement in which we can recapture water vapor from drying cement items, and fuel cells for combining oxygen and hydrogen to make water as well as electricity.

To make plaster molds and sand molds, inflatable Kevlar work chambers filled with an inert gas will be needed. As the wetted plaster or sand dries precious water vapor will be recovered by dehumidifiers. The inflatable chambers will have concrete floors in case molten metal is spilled. The cement powder will be mixed with water in airtight devices and the wet cement will be pumped thru hoses into the chambers where it dries and the water vapor is recovered. Casting robots must work in pressurized chambers to prevent evaporation of molten metals in the vacuum also during casting operations. see:
http://www.moonminer.com/Casting_Chambers.html

Cement and concrete production will not involve any upported chemical reagents as will some metal production processes and the equipment needed to make it will be comparatively simple. If concrete is exposed to the intense thermal cycles of the Moon it might crack; however, pressurized habitat modules made of concrete

will be buried and the sub-selene temperature just a few feet down is a constant minus four Fahrenheit. Concrete could be strengthened by mixing it with glass fibers made from the SiO2 that boils off when highland soil is roasted to make cement.

Extrusions

Extruders will be part of the lunar industrial seed. Rods, bars, rails, wires and pipes can be made by extrusion. Rods can be used for axles, bars for vehicle frames, rails for railways, wires and pipes for obvious uses. Lunar extruders will not use hydraulics. Their rams will be powered by electric motors and large screws or augers. It should also be possible to extrude hot soft glass or basalt into fibers for use as sound deadener, thermal insulation, concrete strengthener, and glass cloth. Special looms and sewing machines will be needed to make glass cloth items. Glass cloth will not be used for clothing because it is abrasive (although it might be coated with plastic-see:

www.asi.org/adb/02/16/01/01/glass-fiber-textiles.html

but it could be used for tents that protect equipment from the heat of mid-day, spacesuit outerwear, curtains, drapes, rugs, mildew resistant wallboard, insulation for electrical wires and runners that lunar workers can walk across out-vac without kicking up lots of Moon dust. It might also be possible to use glass cloth sealed with silicones to make inflatables on the Moon.

*Phosphorus is needed for n-type solar panel material. Along with potassium it is one of the three major fertilizer ingredients with nitrogen being the third. Potassium and sodium can be reacted with water to make potassium hydroxide and sodium hydroxide-caustics for soap making by mixing them with vegetable and/or animal fats. Soap will be an essential for humans on the Moon. Sodium is needed to make table salt, another essential for humans, and sodium hydroxide reacted with silica can make sodium silicate, an inorganic adhesive with many uses.

Works Cited Part 3A

1] **Development of the Moon**. Michael B. Duke et al. section 4.3.5.1 pg. 40 http://www.lpi.usra.edu/lunar_resources/developmentofmoon.pdf

2] http://www.stretchedlensarray.com/Papers/SLASR-WCPEC4.pdf

Note, this paper in its entirety is online at:
http://groups.google.com/group/international-lunar-research-park/web/lunar-industrial-seed?hl=en

About the Author

Dave Dietzler is a founding member of the St Louis Moon Society chapter and a major contributor to Moon Miners' Manifesto over the years, as well as the principal "co-braintormer" with the editor on many technical issues that pertain to the establishment of a viable lunar frontier.

What I Like about the Augustine Commission Recommendations for our Future Manned Space Program

By Tom Heidel

Yes, I have read a lot of the "Oh, woe is us" editorials and commentaries. I understand how long time supporters of NASA's exciting plans to return to the Moon feel. The rug has been pulled out from under them. But has it? Don't kill the messenger if you don't like the message! The single pertinent fact is that NASA's Moon program was underfunded from the gitgo, and, to that extent, a political ploy. Given the current economic times, it is unrealistic to expect that funding level to be increased substantially, much less left at the current level.

But I am not at all sure, that the recommendation that we fly manned missions to some asteroids and maybe even a manned flyby of Mars is a bad alternative. I have a plaque in my office that reads, *"the contented man is one who enjoys the scenery along the detours."* This alternate plan for manned space activities may seem like a detour. But is it?

First, the rockets and other equipment to support such missions will be ready sooner, so we will get to visit some neat places in the interim. Meanwhile, with NASA detoured from the Moon, the agency may be able to pull off a badly needed "attitude adjustment" to collaboration with other national space agencies.

A NASA only Moonbase effort would be much less robust than one mounted by the **Lunar Infrastructure Development Corporation** proposed by Buzz Aldrin. [p. 9, below] NASA could join a more robust international effort with multinational corporations as partners as well, at much less expense than would be incurred by carrying the current sometimes-occupied not-fully-functional "shelter" it has been planning.

And it would not surprise me that such an international beachhead could become fully functional before NASA's first Altair lander would have killed its descent engines. There is a time for national pride and there is a time for getting the job done right. And that means establishment of an industrial resource-using beachhead on the Moon in a location where all the Moon's resources can be tapped, not just a sexy subset.

What asteroid(s) would a NASA manned crew visit? What science could be done in a mere flyby? What would be gained in sending men around Mars without landing? We've got some suggestions, but NASA will come up with its own, so ours don't matter. Meanwhile, *NASA will be doing something,* and in the meantime, the alternative International lunar effort, one that could be much more robust, would be taking shape.

I think these "sideshow missions" could be very interesting. And I plan to enjoy the scenery along these detours. Meanwhile, NASA's Moon plans, without enough money to do in robust fashion, were really much ado about nothing. Sometimes we need a setback to get ourselves on a more secure path forward.

The Moon belongs to all of Earth. Humans will get there, and stay, and our world will have cloned itself. Too many chefs? Well, I am looking forward to tasting the soup! **<TH>**

Antarctica's McMurdo Station:
A Preview of Growth & Expansion of A First Lunar Industrial Settlement?

By Peter Kokh kokhmmm@aol.com

The maze of McMurdo Sound Station from above:
A harbor, 3 airfields, a heliport and over 100 buildings

With a summertime population of 1,300, this outpost is a functioning city. The only difference with conventional cities is that its population consists of only temporary residents: no families making the continent their home. But that is another story. The Antarctic Treaty discourages settlement, private property, and development of local resources to support a viable economy. Those provisions are a powerful reason not to look to the Antarctic Treaty as a model to apply to the Moon.

McMurdo is about 55 years old and its growth to its present state has been steady, driven by the ongoing expansion of the research programs supported there. Is there a pattern to that growth that suggests how an outpost on the Moon could morph into a settlement over time? From one angle the answer is a resounding "no!" We would expect a lunar outpost's growth to be acceleratied by a steady shift in reliance on imports to basing growth on locally produced materials and goods. That would be reflected in the appearance of added structures and their furnishings trending toward a definite made on luna look and feel. A lunar outpost would sink roots as it grows. McMurdo's growth is supported by an insatiable appetite for ever more imported supplies. This pride of Antarctica would die a cold death in a minute were the supply chain cut. In the battle to keep supplies flowing, icebreakers and cold-hardy cargo planes are the workhorses.

Nor does McMurdo produce any goods or exports other than knowledge and reports of real interest but of no economic value. As big as the outpost has grown, it has made no progress towards self-reliance or economic viability. Again, not a model to be inspired by.

Science is the reason McMurdo exists but the scientists are outnumbered by providers of support for operations, logistics, information technology, construction, and maintenance.

After a visiting Greenpeace ship documented haphazard littering and apparent lack of appreciation for the host environment, the outpost was forced to cleanup and rethink the way it expands and the way it deals with discarded and used items. This catharsis has been all for the good. Waste not, want not. But this is a lesson a lot of are learning in cities and towns wherever we live.

We have pointed out that for a lunar outpost, a prior plan for warehousing incoming supplies as well as replaced items, together with a plan for site management and planned vectors of growth are essential if the outpost complex is to grow in an orderly and efficient manner. Historically, most towns and cities have grown by one "afterthought" after another. Planned growth need not mean cookie cutter replications. Variety, inventive-ness and individuality are what make towns attractive.

McMurdo is Antarctica's principle hub, both for supplies coming by sea and for those arriving by air. A sector of the population is occupied entirely by these logistic activities. But it is also a departure point for many overland exploratory excursions. If McMurdo did not exist, we'd have to invent something quite similar.

There is no manufacturing district, no farmers market, no schools for children. A city it may be, but a parody of what we mean by city nonetheless.

If a lunar outpost is to focus on weaning itself of total dependence on imports from Earth, it must grow industries and enterprises and farms and trade partners. In this sense, the smallest African village is perhaps a better model of growth to follow than is McMurdo.

Most of the growing tourist trade to the continent skirts its perimeter, exploring off-shore islands along the Antarctic Peninsula below the tip of South America. McMurdo is half an Earth-turn away, below the tip of New Zealand. Tourists are not encouraged. If you want to go, join the Navy, become a scientist, or find employment with one of the station servicing suppliers.

Albert P. Crary Science and Engineering Center, 1991

Many space enthusiasts look for the day when we have something similar on the Moon. Yes, humans would be there in force. But no, this would not be a genuine human settlement paying its own way with a mix of industry, agriculture, and trade, growing its own work force family-style rather than by temporary assignment. McMurdo's growth drivers and growth vectors are not the natural ones of real cities. It will never be "home" to anyone, just a place to pretend is home. Despite its location on a previously uninhabited continent-world, it is not a model for lunar settlement developing local resources to become economically independent. **PK**

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\

Monthly Moon Society Progress Reports: visit our Homepage http://www.moonsociety.org and scroll down the center of the page to the prominent yellow **Frontlines** link. This report has been issued monthly since April 2008.

"To Exercise Real Power, You Must Give it Away"

By Peter Kokh, President, The Moon Society

One of my many deficiencies is an ability to remember a quote along with an inability to remember who said it. Many of you will recognize the quote above and remember just who said it. It does not matter.

The point is, the advice is right on target. The Moon Society is now engaged in at least two initiatives that, if successful, will take on a life of their own, and not necessarily under our close direction:

- **The Moon Society of India**
- The **Moon/Mars Atacama Research Station** in Chile

Both of these projects are exciting and bear much promise. But in large measure, both efforts, in order to succeed, must be carried out by others whom we inspire, but do not direct. To my way of thinking, that is as it should be.

Pradeep Mohandas of Mumbai (formerly Bombay) who previously served two years as President of SEDS India (Students for the Exploration and Development of Space) with five chapters at various technical universities in southern India, is now a member of the Society's Leadership Council. Mohandas has already undertaken two very ambitious initiatives.

First he proposed to set the ball rolling on a long course that would result in India developing its own Lunar Analog Research Station. Now he has assembled a team of several other young Indian leaders (known to us) with the intention of founding The Moon Society of India. Of necessity as well as practicality, this entity must be incorporated in an Indian state. Its focus will be on public outreach and support for ISRO (Indian Space Research Organization) projects and programs. "Commercial space" is a sector that does not yet exist in India. Of course, MS-India will also support International efforts in collaboration with the (International) Moon Society. But they will have their own organizational charter, bylaws, chapter rules etc. In guiding this first societal offspring, we have the model of the National Space Society's ener-getic "National Space Society of Australia" to follow.

To the south, the organization that forms to operate the Moon/Mars Atacama Research Station will be independent. But we expect that a Moon Society Advisor or two will be on its board. This too, is as it should be.

"So what's in it for us?" That's easy. Our goal is to do what we can to advance the day when the Moon will become a civilian frontier with industries exporting goods mostly to LEO and GEO (e.g. Solar Power Satellite parts) that help solve endemic problems on Earth. *This has to be an International effort,* and like any parent, we expect to be very proud of both of these offspring. **PK**

Moon/Mars Atacama Research Station News

By Peter Kokh, Moon Society Advisor to MMARS & TATA

We (TATA: The Astronaut Teacher Association) have now secured 3,600 square mile tract of land in the Atacama desert of northern Chile, anchored by the three points (1) **Diego de Almagro** (city of 8,000 with airport and hospital. This city is the seat of the commune which includes all the land in question. (2) **El Salvador**, once a thriving copper mining town of 15,000, now a ghost town with an extensive mine complex, (3) **Inca de Oro**, a small community which hosts the Observatory by that name and which would host a future visitor center for people interested in MMARS.

This seems to be an excessive amount of land, but MMARS would not oversee all of it. What we have is permission to develop MMARS related primary and secondary sites at which research could take place.

The proposed Research Station would be in the ENE sector of this triangle, anchored by the El Salvador town and mine. The town has a well-planned urban area. See: www.gettyimages.com/detail/82727852/Reportage

Could this town someday host an International Lunar Research University larger than ISU in Strasburg?

The mining complex itself is quite extensive. In the past year or two, there has been damage by neglect but also by sabotage on the part of mine workers who protesting the proposed shutdown. This mine was the least economical copper mine in Chile, and ore reserves were all but exhausted. We would have to do an extensive survey to see which galleries and shafts are still in good condition, and usable as they are or with little modification.

The facilites of the Moon/Mars Atacama Research Station proper, apart from the Operations Center to be built in the wingless fuselage of a decommissioned Hercules C130B from the Chilean Air Force, would all have to be built. This core MMARS facility could get into many valuable lines of research: regolith handling; testing the limits of teleoperation with a 3-second time delay; testing robot-human synergies; field-testing various kinds of equipment; testing various life support systems, for example a variety of designs of "living walls" and blackwater systems.

But one area that could in time become very volume-hungry will be experimental lunar agriculture. Given that the mine complex as an already constructed underground volume in which lighting can be 100% controlled to follow the 14.75 day long lunar dayspan and equally long lunar nightspan cycle, the mine complex may be the ideal place for such research.

We already have a moon-mine analog under development in Sweden by Moon Society Advisor and ISRU (on site resource utilization) expert Niklas Jarvstrat. To learn more about this operation now in preliminary stages, go to: http://www.moon-mine.com. While some of this website is in Swedish, enough has been translated into English to make it well worth your visit. The Swedish analog project is endorsed and co-sponsored by The Moon Society and Moon Miners' Manifesto.

So the inclusion of this recently empty mining site in the MMARS "campus" is a coup which promises to make the MMARS facility perhaps the most significant and productive lunar analog operation in the world.

While the Moon Society has had a big role in the planning of this significant operation, it remains to see if we will remain engaged. For those of us in the US and North America, the logistics of travel to and support of this Chilean operation would be a significant financial impediment. What would appear to be the best way to integrate this operation into the Moon Society's international plan would be to foster **the creation of a family of chapters within Chile,** to help provide support for MMARS, as well as being a potential source of crew members.

A number of Chilean universities are already involved in this effort, notably the University of Concepcion in Chile's third largest urban center, of the same name, south of Santiago. This university involvement ensures high quality of research, as well as of researchers using the complex. But to organize a family of Moon Society chapters in Chile (in nearby Diego de Almagro, area capital Copiapo, the ports of Antofagasta, Ibique, Valparaiso, Concepcion, and in the capital Santiago, and on various university campuses, will take some doing.

We do not have the team to take this on. We have to recruit the team; we need **English to Spanish and Spanish to English translators** to set up a **mirror Moon Society website**, as well as a **Spanish version of Moon Miners' Manifesto**. That will help us in Mexico as well, where we have been working behind the scene for a few years now. Peru, Columbia, Argentina and other nations would become accessible if we were "out there" "in Español!"

Why Chile? The Atacama has already brought Chile to the top of the heap when it comes to world-class observatories. For the same reason, it is ideal for both Moon and Mars analog research activities. Chile is not large enough in population or economy to become a space-faring nation. But it does have the resources to take the lead in lunar and Martian analog research. And apparently, with the Chilean Air Force now pulling the strings, the country does seem to have the political will.

Again, the initial Moon Society role in brainstorming this operation, will, over time, retreat into "footnote status" *unless we clone an Español Moon Society operation.* See article next page. A fringe benefit would be to allow us to access and recruit more of our own growing domestic Latino population. Indeed, that may be where we have to go to find our translators.

Any of our members and readers who would like to help in this effort, preparing a Spanish version of our website and or helping launch an MMM Spanish edition, please contact me *(in ingles, por favor!):*

Peter Kokh
PO Box 80395
Milwaukee, WI 53208
414-342-0705 (7am – 10 pm CT)
888-266-2385 (same land phone, but toll free)
kokhmmm@aol.com
president@moonsociety.org (comes to same mail box

Keeping in touch: join our google groups:

http://groups.google.com/group/moonmars
http://groups.google.com/group/sociedadlunar

La Sociedad de Luna (o Sociedad Lunar?) y El Manifiesto de Mineros de Luna

The Moon Society & Moon Miners' Manifesto Need to be cloned in **Español**.

By Peter Kokh and David Dunlop

The Moon Society in Mexico

For a few years now, we have been working with Jesus Raygoza in Mexico. Jesus is bilingual, and our Director of Project Development, Dave Dunlop, is also. Together they have produced documents to assist Jesus with advocating the establishment of a Mexican Space Agency (AEXA) and a Mex-LunarHab Analog facility

http://www.sociedadespacialmexicana.org/

The Moon Society in Chile

Now, looking at our advisory involvement in MMARS, the proposed Moon/Mars Atacama Research Station in Chile, and looking at how we can stay involved, it may not be possible to have more than a trivial role, both because of the language barrier and because of the high expense of the transportation logistics.

The Moon Society back in Estados Unidos

Instead, it may now be time for the Moon Society to clone an Español version of itself. That is Español versions of our website *and of* Moon Miners' Manifesto This would allow us to build a network of Moon Society chapters in Chile itself, as well as in Mexico, elsewhere in Latin America, and even in the **Estados Unidos** itself!

"What" is easy. "How" is hard.

We will need fluent English-to-Spanish and Spanish-to-English translators to clone the website and MMM. As the website is extensive, our first taks would be to prioritize which pages should be rerendered in what priority, a task in itself. Where to host this site is another question. We may want mirror sites.

A Spanish MMM would include select articles and materials from the main edition as well as contribution from Spanish speaking writers in Mexico, Chile, and elsewhere including the US. It too would have a chapter news section mainly for chapters in Spanish-speaking areas. These are two different projects and need two different teams: web and MMM.

We also need such a team to help prepare preliminary outreach literature for chapters in Chile, Mexico, and elsewhere to use. As the language and expressions differs from country to country there may need to be several editions. In time, they will create their own outreach materials.

This is an enormous undertaking, as is our outreach effort in India (where more people speak English than do in the United States!) Yes, there are many English-fluent persons in Latin America. But there, except for Brazil (and Haiti etc.), Spanish is a common bond. India has no dominant indigenous language, however much Hindi speakers would beg to differ.

I have asked Maria Catalina for ideas and for assistance in recruiting translators and others who can help in this effort. We are considering launching a Google Group to help get this translation program started:

If you want to help or have ideas or input, please contact me at the Milwaukee PO Box (page 12, col B) or by email kokhmmm@aol.com or by phone 414-342-0705 7 am - 10 pm Central Time

Moon Society *Endorses* Aldrin Initiative

"A Different Kind of Moon Race"

Lunar Infrastructure Development Corp.

By Buzz Aldrin

Excerpts Below: Full text at:
http://www.huffingtonpost.com/buzz-aldrin/a-different-kind-of-moon_b_317786.html

- "I propose instead America call the world to the Moon. In a new global effort to use the Moon to establish a global space consortium with a lunar surface facility as its epicenter, "
- "... competition, in an Apollo-style race back to the Moon, would be a fruitless exercise in national hubris whose rewards, if we "won" again, would prove fleeting"
- "I am proposing a different way back to the Moon: international collaboration. "
- "... the goal of creating a new public-private partnership to develop the Moon. I call it the **Lunar Infrastructure Development Corporation (LIDC).** The purpose of the LIDC would be to enable the nations of the Earth joint together and return to the Moon as an international cooperative venture. The LIDC will pool the financial, technical and human resources of its member **nations to build the lunar communication, navigation and transportation systems needed for human exploration of the Moon.** It would be **a public/private global partnership** to make the Moon accessible to all humanity. The LIDC will build the communication and navigation satellites needed by future lunar travelers, develop fuel depots using lunar LOX – perhaps derived from the recently discovered lunar water-and construct habitats that will shelter space travelers while on the surface. It will enable **a sustainable human presence on the Moon that will be accessible to all the nations on Earth**."
- "Unlike the International Space Station (ISS), which is governed by complex treaties, the LIDC will have the same flexibility as an NGO in working with different nations and private entities to finance build and operate the facilities & equipment needed for lunar exploration."
- "To do so [i.e., honoring the astronauts of the Apollo Era Missions] doesn't require rerunning a long-ago Cold War race in which America plays the role of a space-going Colonial power.

The Moon Society received a heads up on the morning of October 12th from Buzz himself, along with a request for endorsement and sponsorship. Acting quickly we polled the Society Officers and Directors and the response was unanimouly in favor.

Writes Ben Nault, Director from Tucson, AZ: "Probably the main reason the ISS is still "alive" and supported by Congress is that it is part of a number of international agreements. Backing out of these agreement would have financial, political and diplomatic repercussions on the US. Therefore, having an international component helps large complex programs survive the transition to different administrations and different congressional moods. The international angle gives long-term "sustainability" to the Lunar Infrastructure Development Corporation. "

This concept fits in nicely with that of our own **International Lunar Research Park** proposal. **PK**

Moon Society Chapters & Outposts Frontier Report

Chapters & Outposts

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>
Next meetings – Oct 21st, Nov 18th, Dec 16th
Meetings **3rd Wed** monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

On Friday, October 30th, Bob Perry attended a public lecture at Washington University by Professor Andrew H. Knoll of Harvard University on his work with the Opportunity Rover studing the sedimentary features of Mar's *Meridiani Planum*. This was in the 2009 Robert M. Walker Distinguished Lecture Series presented by the McDonnell Center for the Space Sciences. Dr. Knoll reported that the young Mars was warmer and wetter and discussed "**Mars as the Abode of Life?**" Bob intends to write a report for the chapter website.

Moon Society Phoenix Chapter

http://www.msphx.org
http://www.moonsocphx.blogspot.com/
Contacts: Don Jacques djmitzlplick@yahoo.com
Chuck Lesher: chuckmiester999@yahoo.com
Meeting the **3rd Saturday of the month**
Moon Society Phoenix' next meetings are on
Saturdays **Oct 17th, Nov 21st, Dec 19th**
Our Meeting on Sat., Sep. 19th was cancelled. We are discussing plans for our October meeting.

Moon Society Houston Chapter

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

The Houston Chapter's next regular meeting is scheduled for **Monday, November 16 at Coffee Oasis at 4650 NASA Road 1 in Seabrook;**

The Moon: "Houston, Tranquility Base Here. The Eagle Has Landed" at the Museum of Fine Arts, Houston

Through January 10, 2010 the Museum of Fine Arts, Houston will host a special exhibition dedicated to the past 500 years of humanity's fascination with the Moon. The exhibit will feature art ranging from Renaissance paintings up to and including some of artist/astronaut Alan Bean's very recent work. Alan Bean himself is scheduled to give an opening day lecture at the museum. In addition, there will be early scientific instruments, books, moon globes, maps, Galileo Galilei's 1610 treatise on the moon, and objects from NASA on display. We have been extended a special invitation to view this exhibition, with a discounted group admission. More information at http://www.mfah.org/moon. – Eric

College of the Menominee Nation-Green Bay* Student Chapter (*Formerly, Green Bay, WI Outpost)*

Contacts: Dan D. Hawk hawkd_0212@menominee.edu
David A. Dunlop dunlop712@yahoo.com

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

Activities: We are working on **a lunar agriculture experiment** that would be designed to fly on a Google Lunar X-Prize lander. The proposal has received much interest and attention from several respected authorities, including Dr. Lawrence Taylor, U-TN.

News: A working prototype of this experiment is set for a test flight at Wallops Island, VA next July!

Representatives from several other tribal colleges met at CMN for a **workshop on amateur rocketry** conducted by Dan Hawk October 23rd, as CMN endeavors to spread its enthusiasm for space.

Mission Statement of the Five Clans Rocket Team:
"to provide a venue to increase aeronautic STEM technologies by allowing students to design, build, test, and launch their own high-powered rockets."

Team Rocketry Research Experiment:
www.menominee.edu/RocketWebsite/5clans/experiment.htm

Chapters & Outposts Map (North America)

www.moonsociety.org/chapters/chapter_outpost_map.html

Chapters & Outposts Events Page

www.moonsociety.org/chapters/chapter_events.html

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

www.moonsociety.org/chapters/chapter_outpost_map.html

Moon Society Nashville Outpost – Central Tennessee
Contact: Chuck Schlemm cschlemm@comcast.net

Bay Area Moon Society, CA Outpost – South Frisco Bay
http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net
Informal meeting at Henry Cate's home in San Jose
The 4th Thursday every month

Moon Society Longview, TX Outpost
Contact: James A. Rogers jarogers2001@aim.com

Moon Society DC Metro, DC-MD-VA Outpost
Contact: Fred Hills Fredhills7@aol.com

Milwaukee, WI Outpost (MSMO)
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com
The monthly Lunar Reclamation Society meeting on the 2nd Saturday afternoon every month serves MSMO also

The Victorian Space Alliance (Melbourne, Australia)
Contact: Shaun Moss shaun@starmultimedia.biz

NSS Partner Chapter News – pp. 17-19

Oregon L5 (Portland), **Lunar Reclamation Society** (Milwaukee), **Minnesota Space Frontier Society** (Minneapolis-St. Paul), **San Diego Space Society**

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

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions
Moon Society Membership Services:
PO Box 940825, Plano, TX 75094-0825, USA

Projects, Chapters, Volunteers, and Information
Moon Society Program Services,
PO Box 080395, Milwaukee, WI 53208

< End Moon Society Journal Section >

GREAT BROWSING

Paul Spudis: The Not-So-Barren Moon
http://lunarnetworks.blogspot.com/2009_05_01_archive.html ß(written before the recent NASA-ISRO find)

JAXA-Kaguya rotating Moon image
http://picasaweb.google.com/lh/photo/6QKKo25GVCQP-CiJxh53Ow?authkey=Gv1sRgCMqB_pO06K3EEg&feat=embedwebsite

Breakthrough on superior Lunar Simulant
http://lunarnetworks.blogspot.com/2009/05/zybek-boasts-regolith-simulant-at.html

Poll: Moon? Mars? Both? Where should we go 1st?
www.space.com/common/forums/viewtopic.php?f=12&t=20231

Cirque de Solei Acrobat Tourist to Space Station
http://www.space.com/missionlaunches/090930-acrobat-space-tourist-launch.html

How NASA Hopes to Mine Water on the Moon
http://www.space.com/businesstechnology/090930-tw-tapping-moon-water.html

White House Star Party October 7th
www.spaceref.com/news/viewpr.html?pid=29317

The Other 40th Anniversary – Gerard K. O'Neill
http://www.thespacereview.com/article/1482/1

Is Ares 1 too little, too late?
http://www.thespacereview.com/article/1481/1

5 years after SpaceShipOne's maiden flight
http://www.thespacereview.com/article/1480/1

The Speeches of Mike Griffin
http://www.thespacereview.com/article/1479/1

Who is a "contractor?" and who is "commercial?"
http://www.thespacereview.com/article/1476/1

VASIMR Engine could cut Mars trip to 39 days
http://www.physorg.com/news174031552.html

Nuclear Reactors for Space
http://www.world-nuclear.org/info/inf82.html

Reaching further: a vision for NASA
http://www.thespacereview.com/article/1487/1

An alternative Source for Water on the Moon?
http://www.thespacereview.com/article/1485/1

Where might life have formed first? Mars? Europa?
http://www.space.com/missionlaunches/091012-mm-mars-europa.html

Mars Rover FAQs: Spirit & Opportunity
http://www.space.com/missionlaunches/091012-mars-rover-faq.html

Lunar Reconnaissance Orbiter captures images of two LCROSS impacts
http://www.space.com/scienceastronomy/091012-lcross-crater-images.html

Lunokhod 1 & 2 (Soviety moon rovers) panoramas
http://planetology.ru/panoramas/?language=english
http://planetology.ru/panoramas/lunokhod2.php?language=english

Ben Bova: Invest in Space to boost world economy
http://www.naplesnews.com/news/2009/oct/03/ben-bova-investing-space-would-stimulate-earthboun/

Dale Amon: How will it really happen?
http://www.samizdata.net/blog/archives/2009/07/how_will_it_rea.html

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

YouTube – NASA Press Conference, "A New Moon"
http://discoveryenterprise.blogspot.com/2009/09/water-on-moon.html

A 1961 Glimpse of Spaceflight & Space Stations
http://www.archive.org/details/way_stations_in_space

Robotic Astobiology in Chile's Atacama Desert
http://www.frc.ri.cmu.edu/atacama/videointro.html

Masten Space Systems qulidies for 1st place in Northrop Grumman Lunar Lander Challenge
http://spacefellowship.com/2009/10/30/masten-space-systems-qualifies-for-1-million-prize/

"For me the single overarching goal of human space flight is the human settlement of the solar system, and eventually beyond. I can think of no lesser purpose sufficient to justify the difficulty of the enterprise, and no greater purpose is possible."

Mike Griffin, Testimony to Congress, 2003

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 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

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- Made out to

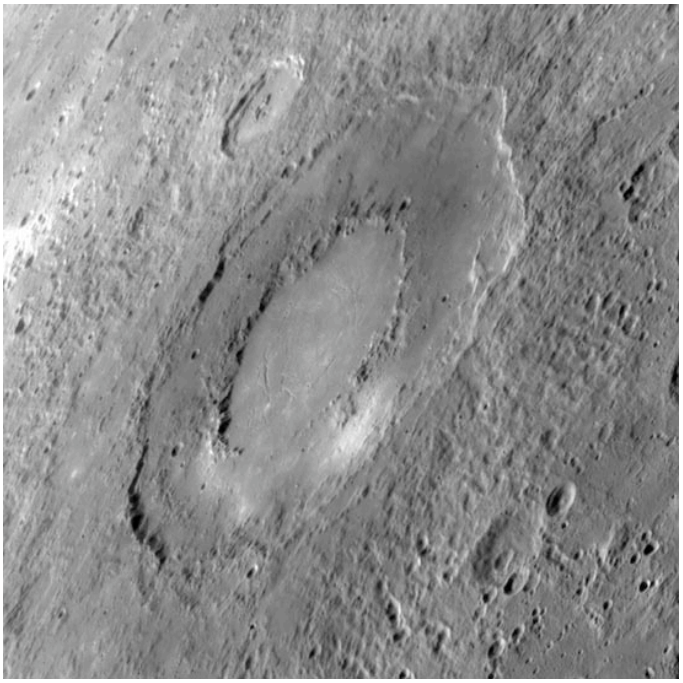
"Lunar Reclamation Society"
Attn: Library Subscriptions
PO Box 2102
Milwaukee, WI 53102

MMM PHOTO GALLERY

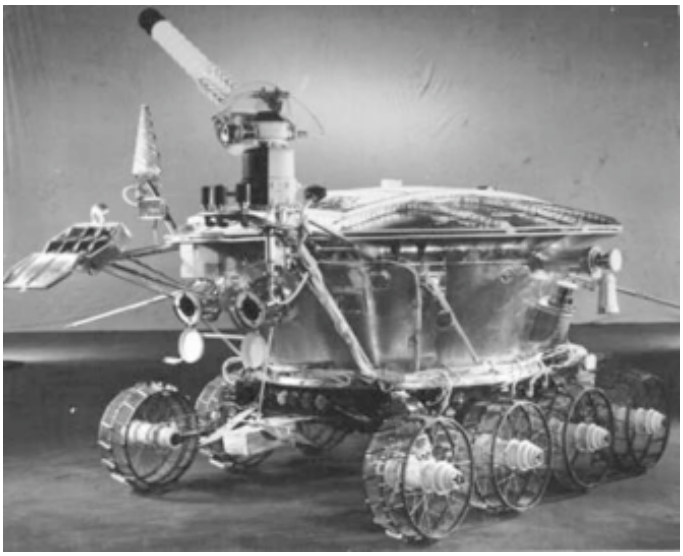
Above: a good shot of Mercury's northern hemisphere Note the volacanic mare-like plains. Photo Sept 29, 2009. MESSENGER is the acronym for **ME**rcury **S**urface, **S**pace **EN**vironment, **GE**ochemistry, and **R**anging.

Below is a fresh photo of an unnamed impact basis never seen before. Thw outer ring is 260 km (160 mi) wide. The inner ring is 200 km (125 mi) wide.

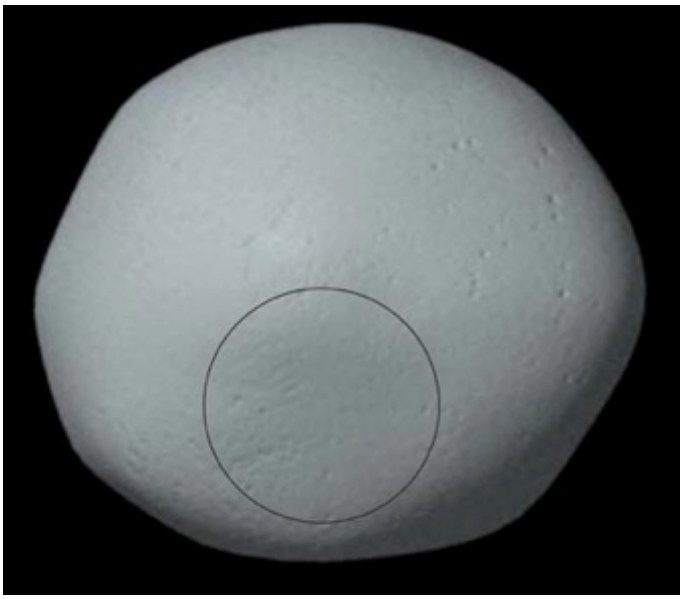
This was Messenger's last (3rd) flyby. It will go into orbit around Mercury in 2011.



Lunokhod 1 (Soviet lunar rover Nov. 1970)
Panorama 19, looking back on its own tracks.



Lunokhod 1, first roving remote-controlled robot to land on the Moon, operated for 11 days in Mare Imbrium
http://en.wikipedia.org/wiki/Lunokhod_1



Asteroid #2 Pallas with a mean diameter of 544 km or 337 miles in digital form; circle around 240 km (49 mi) wide crater. B. E. Schmidt, et al., in Science, Oct. 9, 2009. With an orbit inclined 35° to the ecliptic, Pallas is very much "off the beaten track" ideal for recluse communities

Belgium's new Princess Elizabeth Station in Antarctica opened in February 2009, produces zero emissions with 95% of the energy coming from photovoltaics and wind turbines. This is the kind of approach under consideration for the **Moon/Mars Atacama Research Station** near Diego de Almagro and El Salvador, Chile. It clearly sets the standard for future "off the grid" outposts on Moon and Mars. – http://antarcticstation.org/

New NASA Moonbase Analog to be built in North Dakota Badlands

http://www.geosc.psu.edu/~sschneid/

June 20, 2009: A team led by Irene Schneider Puente has won the NASA proposal to develop a full-scale simulation lunar manned base to be built "within the next 3 years."

The base will be developed in the North Dakota Badlands with NASA funding, and design and construct:

2 pressurized "state of the art" habitats

[Editor: no illustration found by press time]

1 unpressurized rover

1 pressurized rover

2 NDX prototype spacesuits

of NDX-1 type Spacesuit

Video of NDX-1 suit test at Mars Desert Research Station

http://www.youtube.com/watch?v=mUyUoZTTNfs

[Framework of Moon Society-built Heinlein "Tunnel" between Hab and GreenHab visible in background]

North Dakota Badlands (Theodore Roosevelt NP) in Green

http://www.nps.gov/thro/index.htm

Typical ND Badlands Terrain

The Ages of Discovery: Galileo's and Yours

By Earl Bennett earlisat@verizon.net

President of The Philadelphia Space Alliance (PASA)
NSS chapter

Galileo lived during the Renascence and helped reshape the world by his quest for what was true by experiment and reasoning from observation of the results. He did not accept what was said just because someone told him that an authority, particularly those of Aristotle that where quoted to him, where not to be believed because he said them without saying how he checked the reality of what he had said. An example is something everybody sees but doesn't think about most of the time: buoyancy. Things float because they have a different density than the stuff they float in. Aristotle said that the shape was of great importance. Galileo worked with the Venice Arsenal where ships where built and determined that this wasn't so.

We are much better at examining how things work and what we can learn from the experiments scientists do. An example: a scientist in Switzerland found a result in the results of an experiment he did that didn't match what he thought he should get. After carefully checking everything he tried again: and produced the same result. His company, I.B.M., let him keep checking. It turned out that he discovered a new kind of superconductor of electricity that we can use to be more energy efficient. You could be a scientist someday, or an explorer, or other kind of researcher and discover something new! And it could be on the Moon, that Galileo knew as a world.

Local Resources:

The Franklin Institute, www.fi.edu. Duh!

The George Washington Carver Science Fair. You can do science! A yearly Philadelphia schools competition. Elementary and combined Middle and High School divisions.

National Resources:

NASA, The National Aeronautics and Space Administration: www.nasa.gov – spaceplace.nasa.gov – scijinks.nasa.gov and lots more. NASA has tons of neat sites, but go to the main site *first*.

The Moon Society: www.moonsociety.org. Private citizens working for us to go back to the Moon and stay.

The National Space Society: www.nss.org Private citizens working on getting us into Space.

The Mars Society: www.marssociety.org Private citizens promoting low cost ways to go to Mars and stay. They work in simulated Mars like conditions and test how we could live on Mars.

The Society of Amateur Scientists: www.sas.org Lots of neat stuff !.Links to The Seti League .

The Amateur Satellite Corporation: www.amsat.org Private citizens building and using Ham Radio communication satellites. They also do telemetery for various experiments on there satellites.

Sky and Telescope: www.skyandtelescope.com www.skyandtelescope.com/diy (do it yourself).

Masten Space Systems wins $1M 1st prize Level 2 Lunar Lander Challenge

http://www1.nasa.gov/offices/ipp/innovation_incubator/centennial_challenges/cc_ll_feature_lvl2.html

On October 2nd, Masten Space System's "Xoie" (XA-0.1E) vehicle attained an average landing accuracy of 19 cm, besting Armadillo Aerospace flights accuracy of 87 cm., winning 1st place.

"**Xoie**" uses liquid oxygen and isopropyl alcohol as propellants and it has an all-aluminum rocket engine. The vehicle weighs 300 pounds when empty and 850 pounds when fully loaded with propellant.

Two Moon Society Members Involved

Masten Space Systems, based in Mojave, CA is one of a number of promising New Space startup companies. Their team has been greatly strengthened by the services of two members of the Moon Society.

< Michael Mealing

Jonathan > Goff

Michael Mealing, Moon Society Member #579, is the CFO and VP of Business Development of Masten Space Systems. Previously, Michael served as vice-president of Artemis Society International prior to the formation of The Moon Society, which then took over membership operations from ASI. Michael next served as a Board Member of The Moon Society from 2002-2004. He created the Society's first store on CafePress, http://www.cafepress.com/moonsociety/

Michael is also involved with RocketForge.org

Jonathan Goff is propulsion engineer for Masten Space Systems. In September 2003, Jonathan who had already started the Society's Utah Outpost, founded a campus chapter at Brigham Young University in Provo, Utah. Called the BYU Space Development Club. They undertook an ambitious "Igniter" project.

After graduation in 2004 (Goff was unsuccessful in finding someone to take over the BYU chapter, which then dissolved) Jonathan continued his education and ended up being hired by Masten Space Systems.

Jonathan has been a busy blogger, on Selenian Boondocks, http://selenianboondocks.com/ with fellow bloggers Ken Murphy (also a Moon Society member) and John Hare.

Masten Space Systems Ambitious Plans

http://www.masten-space.com/

The website puts the question up front:

"What do you want to fly into space?"

"Masten Space Systems will fly anything you want into space and back for $250/kg"

Masten Space Systems' **XA 1.0** will carry whatever into space and back, with some restrictions. "The cargo must fit into a canister the size of a soda can and weigh no more than 350 grams. It cannot be radioactive or explosive. And if it goes up alive, it must return alive (and well)." But that includes a lot of stuff, even your dear one's ashes.

XA stands for e**X**treme **A**ltitude. A liquid oxygen/isopropyl alcohol-powered VTVL space vehicle, it boasts a published altitude is 100km or 62 miles. Getting back to the website boast, "XA-1.0 will take a 100kg payload to over 100km altitude on a sub-orbital trajectory several times in a single day as part of a line of Masten spacecraft that use vertical landing technology to reduce turn around time and launch site logistics." The maiden flight "as early as 2009" may have slipped.

Masten Space Systems also sells off-the-shelf and custom aerospace flight and ground-service hardware and provides engineering consulting services for rocket propulsion design and analysis and other services. **MMM**

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!

2009 LRS OFFICERS | BOARD* | Contact Information

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TREAS./ Database – *Robert Bialecki
bobriverwest@yahoo.com 414-372-9613

LRS News

● **Peter Kokh is recovering well from mild heart attack on October 21st**: A heart catherization procedure at St. Luke's showed no blockage, and his EKG has returned to normal. "Just a bump in the road."

● **New chapter exhibits planned for ISDC 2O10 in Chicago: (a)** Peter is planning an exhibit to show how interior walls of lunar modules can be built with the familiar technology of steel stud framework clad with Duroc™ cementboard. He is also planning to revive his lunar painting efforts of 1994, mixing metal oxide pigments producible from moondust with liquid sodium silicate, the only known inorganic adhesive (instead of a solvent) painting on the reverse side of a glass pane, foreground first. In previous experiments, the paint de-laminated from the glass after some months. This time he will use a pane one side of which has been sand-blasted in Green Bay to produce a "bite" to which, hopefully the paints will cling. He also wants to try painting a section of cementboard.

(b) James Schroeter is looking into the idea of creating a Living Wall exhibit for ISDC. These features, lining one wall of outpost corridors and hallways could increase biosphere mass and keep air clean and fresh.
See: http://en.wikipedia.org/wiki/Living_wall

LRS Upcoming Events

Saturdays: 1-4 pm Nov. 14th – Dec. 12th
LRS Meeting, Mayfair Mall, Garden Suites Room G110

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

December 12th 23rd Anniversary Party: This year, we'll try to spread the word locally and see if we can bring in more of the Milwaukee "curious." Updates on current design ideas for a Moon Society/NSS Lunar Analog Station and the proposed Moon/Mars Atacama Research Station in Chile; Concept of an International Lunar Research Park and of an International Lunar Development Corporation. **Feature Sci Fi Film tbd, showing 2 pm**

Pot luck Luncheon – bring a dish to pass!

News & Events of NSS "MMM" Chapters

Space Chapter 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
Nov 21st, Dec 19th, Jan 16th

MINNESOTA

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

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

Calendar: MN SFS 2009 Past & upcoming chapter events
www.freemars.org/mnfan/MNSFS/2009-12-Review/

Nov 10th, 2009 MN SFS Meeting **Board Elections**
30th Anniversary! & Planning for 2010
Nov 12th, 2009 STS-129 Display
Dec 8th, 2009 MN SFS Meeting
Dec 10th, 2009 STS-130 Display
Ben's Valleycon 35Pix
http://freemars.org/mnfan/ValleyCon/2009/
MN SFS's Video Night pics
http://freemars.org/mnfan/MNSFS/2009-10-Video-Night/

ILLINOIS

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609
Larry Ahearn: 773/373-0349 LDAhearn@aol.com

Host of ISDC 2010 – May 27-31, 2010
http://isdc.nss.org/2010/

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WISCONSIN

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

c/o Will Foerster 920-894-2376 (h) astrowill@tcei.com
SSS Sec. Harald Schenk hschenk@charter.net

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

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

• We meet the 3rd Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI

• December Meeting Date TBA

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

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

Eric Boethin 303-781-0800 eric@boethin.com

Monthly Meetings, every 2nd Monday, 7 PM
Next: November 2nd, December 7th, Janurary 11th
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

PENNSYLVANIA

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

c/o Earl Bennett, EarlBennett@verizon.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. **November Meeting:** we will gather, at a convenient location for members and friends, at the **Philcon** Science Fiction Convention on **November 21st**, unless we chose something else "on the fly". This will be at the **Crown Plaza Hotel**, on route 70, in **Cherry Hill N.J.**

Our **December** meeting, where officers are to be selected, will be on the **19th** at our **Liberty One Food Court** meeting location. January meeting TBD.

Articles of interest and commentary by Earl Bennett

Most of what has appeared lately in Analog magazine has been concerned with other areas of science and not space exploration (in the "science fact" areas of the publication). The January/February issue is slightly different in that the cover art and commentary on it is about a real piece of space hardware. I speak of the recently, successfully, tested Ares launch vehicle. The picture and text are from NASA, and at the time of printing this was a future event. It also was mentioned, when it happened, on the news for a brief period with the spacecrafts planned use being described as "for the return to the Moon in 2020, and future flights to Mars". We can hope that we will actually go forward with this timid schedule.

Why would I say this? Have I been reading my old articles by Harry Stine, or publicity about Spaceship Two or the New Space Race groups described in Ad Astra? No. Or maybe the recent good writing of Martha Adams on "What's not Getting Done". Yes, a part of my description was spurred by this newcomer's commentary (polemic?).

But it was something I picked up at a flea market by chance that reminded me about our vision that we had starting the "space race". It was only by chance that I found an editorial by John W. Campbell Jr. It is in a collection of his stories, edited by Lester Del Rey," The Best of John W. Campbell". The piece is entitled Space for Industry" and in it Campbell comments on what is needed to get us, as a civilization, into space. He "assumes" something "much better than rockets," dismissed in the opening paragraph.

What then? "Some form of true space drive". O.K. if not rockets (in which he included nuclear) then what else but anti gravity of some sort (still waiting on that

one) or "a modified Sky Hook". Ahh! He first describes the job: moving tons of material with the economy of a truck at least. We have talked of "Sky Hooks," even elevators into space, and mining the moons of the outer planets for materials. He mentions hydrocarbons from Jupiter and the outer planets. And metals? Dave Dietzler would like the vision, I think, of having "Mega tons of nickel steel to work with" for real projects as described by Campbell. Many have given the call to go and make a space based civilization and this was another one. Even the particular tool, a sky hook, to lift material out of the close in gravity well of Earth has been described as an alternative to those "inefficient " rockets. But Campbell wrote his editorial in 1960. The Russians and Americans were putting up one-man capsules then. Here we are almost fifty years later saying, "it's not getting done".

It is not that we are not trying. Assumptions often have unspoken details including that of firm support from some influential or powerful force. We had a President and a captivating goal; the Soviet had the government and a different but congruent captivating goal. It is obvious to me, at least that some of us have that goal orientation but not the overall support of that earlier push. Some in our small group have passed on. Others have dropped out having tried but developed different goals or interests. We have a few who have gone into interesting fields that take there time and involve family. Still others are deeply involved in some aspect of the current push for space: working in space business or volunteering for the national space organizations.

So what do the remainder do? Most of us could not go into space for financial or health reasons at this point. No space truck, or elevator being available, and "senior citizen" price breaks! most of us who saw the first flights, up to and including the Moon, where hoping that real Space Exploration was coming soon. We cannot go at the moment, but we can still help push.

PASA has developed into an outreach group. We indirectly assist in achieving the goal we seek by being there at public events and being available to people of all ages, and temperaments, nudging towards learning about the science and technology, and applied reasoning, that will be needed for the civilization to work. As I say in some of my outreach: "what skills will people need? Engineering and mechanical backgrounds, materials scientists, plumbers, accountants, agronomists, and anything else to make things work down here". And what skills does the group need? See above.

Earl Bennett, Pres., The Philadelphia Area Space Alliance.

CALIFORNIA

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

Meeting the 2nd Sunday monthly
Next Meeting: Nov 8th, Dec 13th 2:30 to 4:30 pm
Serra Mesa Branch Library 9005 Aero Dr, San Diego
Quarterly Newsletter: ***The Bussard Scoop***

Thurs. Nov. 21st 5:30 pm Ray Bradbury Book Signing at the **Escondido Public Library** 239 S. Kalmia St. The book, "We'll Always Have Paris" is a collection of 22 never before published short stories.

CALIFORNIA

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

Events Hotline/Answering Machine:(310) 364-2290
Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com
http://www.oasis-nss.org/wordpress/
oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month
Next Meetings: Nov 21st, Dec 19th, Jan 16th
Information: OASIS Hotline, 310/364-2290; website.

Sat., Nov. 21, 3:00 PM **OASIS Board Meeting** at the Home of Steve Bartlett & Tina Beychok, 7108 East Peabody St. Long Beach, CA 90808

Sat., Nov. 21, 10:00 PM OASIS Invites Its Members and their Guests on a Special **Tour of XCOR Aerospace** on Saturday, November 21, 2009 at 10 am at the **Mojave Airport**. On display will be
- the XCOR EZ Rocket and Rocket Racer rocket-powered airplanes,
- the mockup of their Lynx suborbital spaceplane
- Several rocket engines - and MORE!

November 21st is also the "**Plane Crazy**" event at the Mojave Airport, where companies display their flying (or soon-to-be flying) machines. Past participants have included Scaled Composites and Masten Space Systems.

Attendance at the XCOR tour is *strictly limited* to the first 12 OASIS members and guests (one guest per member). Reservations are ***REQUIRED***. First come, first served. If this tour goes well, we'll see if we can arrange another XCOR tour in the Spring for those who missed out this time. (We are in discussions with the people at SpaceX to arrange for a tour of their Hwthorne facility in the Summer of 2010.)

Fri-Sun. Nov. 27-29, 2009 Thanksgiving Weekend **Loscon Science Fiction Convention**, **LAX Marriott** Hotel
OASIS is once again proud to be providing programming, kids' activities, a room party and a fan table for this fun annual event. Please come join us. If you wish to volunteer, you will need to have a paid membership. More information: LOSCON page http://www.loscon.org/36/html/mainmenu.html

Sat. Dec. 12, 3:00 pm - OASIS Board Meeting
Home of Bob Gounley & Paula Delfosse, 1738 La Paz Road, Altadena, CA 91001-3317

Fri-Sun. **Feb. 26-28**, 2010 - **Gallifrey One, Blackjack 21** — LAX Marriott - Our other annual science fiction convention event. We will be providing space programming and a fan table for this fun Dr. Who/Torchwood-based convention. Please join us! Info: Gallifrey One: http://www.gallifreyone.com/

Moon Miners' MANIFESTO

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

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

600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include *Moon Miners' Manifesto*
Electronic 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