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

Moon Miners' Manifesto

& The Moon Society Journal

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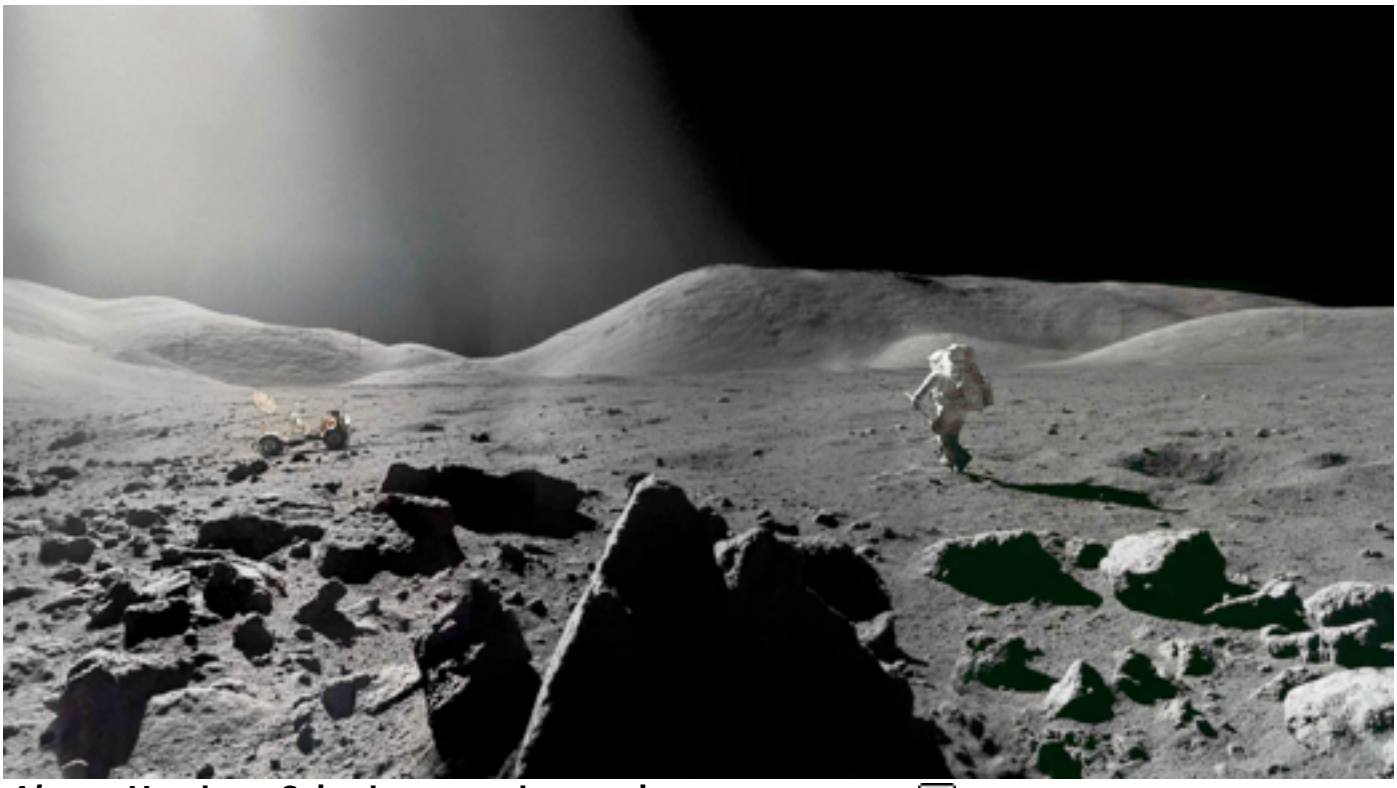

Above: **Harrison Schmitt returning to the A17 LM: *"The End of the Beginning"***

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20 Questions about Resources on the Moon
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Lunar Rovers: Grandfather & Grandson Portrait

NASA's "D-RATS" team has been testing a new electric lunar rover loaded with great features: it can dock with a habitat, as well as with other similar rovers; it offers great visibility to all sides; the cab rides forward of the front wheels to avoid dust; and it sports a rear-mount "suit port/airlock system" that minimizes dust inside the rover as well as air loss with each "air-lock" cycling, something we've long proposed. See page 15.

IN FOCUS Water Confirmed on the Moon! But *Beware* of the Ice Sharks

The joint NASA-ISRO announcement that NASA's Moon MIneralogy Mapper aboard India's Chandrayaan-1 lunar orbiter, had confirmed water, not only at the poles, but virtually everywhere on the Moon, came as quite a welcome surprise. The global presence is largely in the form of the hydroxyl radical, OH, chemically bound in a significant portion of surface silicate materials. Similar, findings by Cassini's VIMS instrument a decade ago, had gone unannounced, perhaps because, going against contemporary wisdom, [=> 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 twenty years have been re-edited, reillustrated, and republished in 20 PDF format volumes, for free downloading from either of two locations:
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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 interpretation seemed to be a fluke.

"When we say 'water on the moon,' we are not talking about lakes, oceans or even puddles. Water on the moon means molecules of water and hydroxyl that interact with molecules of rock and dust specifically in the top millimeters of the moon's surface. "

Note this is not "a lot of water," but, *carefully harvested and carefully husbanded,* it could support industrial settlements on the Moon.

Those of us who look forward to such a scenario, and the assistance in tackling stubborn energy problems on Earth that tapping lunar resources to build solar power satellites in geosynchronous Earth orbit could support, must not rejoice too soon. Others, with no such interests are also rejoicing. Why? Because they see the Moon as a fuel depot, with water harvested to produce cyrogenic fuels for use of ships headed elsewhere.

Now, cryogenic fuels produced on the Moon *and shipped to LEO and L1 to fuel ships laden with Moon-bound cargo and personnel* **is** a development that would support the opening of the lunar frontier. Use of such fuels to open Mars or the asteroids, however could constitute a rape of this resource.

That the "water resource," though global, is quite limited, means that ***as much of it as possible must be reserved to support lunar frontier biospheres***. *Every ton of hydrogen burned for other purposes lowers the size of lunar frontier population that could be sustained.*

For future Lunans, water conservation will be of absolute importance and priority. *Every drop used must be recovered and recycled back into the biosphere.* If some water is used as an industrial reagent, it too must be religiously recycled. Some losses are unavoidable, and that is all the more reason to reserve lunar hydrogen for the support of the lunar frontier

Again, we must not be so naïve as to think that everyone who applauds this finding by the M3 instrument and by Cassini's VIMS instrument, is on the side of lunar development. There are "ice sharks" in these waters!

Again, using Moon-harvested hydrogen to fuel *Moon-bound* ships and thus reduce the cost of capital imports needed to create a lunar industrial complex is legitimate. As to Mars-bound traffic, we need to be developing nuclear thermal propulsion for this purpose, as even cryonic chemical fuels are too slow for the job.

It is important then, for those of us who support "Development of the Moon to help Save the Earth," also strongly support dusting off NASA's shelved research on nuclear thermal propulsion. *We too need to support the opening of Mars, as a potential primary trading partner, and nuclear thermal is the best way to ensure such a development.* Burning lunar hydrogen instead is hard to characterize as anything other than criminal.

So how do we tell friend from foe? Easy, if they see the Moon as a fuel source, they are foe. But let's court them, rather than fight them, by winning their support of a crash NASA program to bring nuclear thermal propulsion online. Cryogenic fuels may be the best chemical propellants, and may allow exploration of Mars, but not the opening of a Martian Frontier. We "Lunans" are better friends of the Martian Frontier than those who would burn tons of lunar hydrogen per second in order to get to Mars in months rather than weeks.

Let's not be afraid to oppose this rape of lunar hydrogen by the "ice sharks." **PK**

Resources of Mare Imbrium and Oceanus Procellarum

By David Dietzler 2009

The Ocean of Storms and Sea of Rains offer interesting possibilities for resource utilization on the Moon. These resources might be of great value to lunar and Earth orbital industry as well as Mars colonization in the future.

1) KREEP terrain:

[Potassium (K), Rare Earth Elements, and Phosphorus (P)]

Some of the richest KREEP terrain exists around the rim of the Sea of Rains (Mare Imbrium) and in the Ocean of Storms (Oceanus Procellarum). This could be a source of potassium and phosphorus, the two major fertilizer ingredients with nitrogen being the third, needed for agriculture. Potassium hydroxide could serve as a caustic for chemical processes. Phosphorus is indispensable for making solar panels. While p-type solar panel material might be made by doping silicon with aluminum instead of boron (which is rare on the Moon), n-type material must be doped with phosphorus.

We won't get very far on the Moon without electricity and we can't get solar panels without phosphorus so it seems reasonable that industrial bases should be located near KREEP terrain. However, it might be argued that solar thermal electric generation systems with aluminum or magnesium reflectors and titanium or steel boiler tubes and turbogenerators could be made anywhere on the Moon where Ca and Al rich highland regolith and Fe-Mg-Ti rich mare regolith are available such as a (mare/highland) coastal location. Solar thermal electric systems reach 25% efficiency while silicon PVs are 10-15% efficient. Solar thermal systems are more complex therefore they require more maintenance. Presently it is not known whether silicon PVs or solar thermal systems offer more practicality and economy when it comes to making them on the Moon. Lunar manufacturing is still in its infancy. Hard data will be required to make this decision.

KREEP also contains rare earth elements. These REEs might be used for alloying iron, steel, aluminum, magnesium and titanium since many of the elements commonly used for alloying on Earth are lacking on the Moon. REEs are also used in many electronics applications and as catalysts. Their industrial uses are too many to be listed here. For more information, see:

http://www.rareelementresources.com/s/Uses.asp

Thorium and uranium are also found in KREEP. These elements might be used as nuclear fuels for space ships built of lunar materials in the future. Thorium itself is not fissile, but it can be converted to U233 in a breeder reactor primed with U235 and eventually plutonium. While thorium and uranium are only present at parts per million, proposals have been made for extracting uranium from granite on Earth that contains only 4 ppm U and seawater where uranium is present only in parts per billion. So the extraction of thorium and uranium from KREEP is not totally unrealistic.

2) Pyroclastic glass.

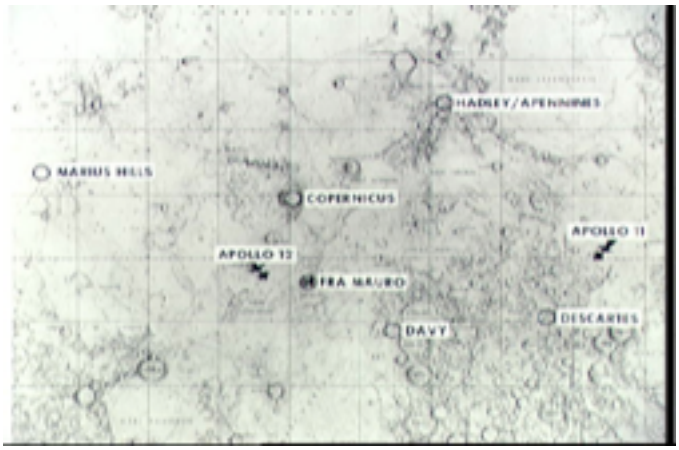
Volcanic glass, also called pyroclastic glass, is found in many places on the Moon. The largest deposit is in the Ocean of Storms just west of the Aristarchus Plateau (area 37,400 km^2.) Glass from volcanic fire fountains contains more chlorine, nickel, copper, zinc and gallium than is common in regolith and these elements can be obtained by roasting the glass particles [1]. The glass can also be reduced with hot hydrogen to gain oxygen.

The Aristarchus Plateau as seen from the NW Deep, bright Aristrachus at left, Herodotus at right, Schroeter Valley winding below

Chlorine is needed to extract aluminum by electrolysis, make silane and silicones, form silicon tetrachloride to obtain pure silicon for PVs, and table salt when combined with lunar sodium. Nickel is useful for iron and steel alloying and as a catalyst for shifting hydrogen and carbon monoxide to methane and water. Copper and zinc are used for alloying aluminum and magnesium respectively. Gallium can be combined with arsenic to make high efficiency solar panels.

3) Volcanic gas?

This one is highly speculative. The Marius Hills in the Ocean of Storms contain over 200 low volcanic domes. Could there be intact chambers of volcanic gas there? Could this gas contain carbon monoxide, sulfur compounds, even water? Subduction zone volcanoes on Earth, like the famed Mt. St. Helens, emit lots of water vapor from the ocean drawn under by geological processes. Hot spot volcanoes like Hawaii also emit water vapor from deep within the Earth though not as much as subduction zone volcanoes. The domes of Marius Hills will be more like hot spot volcanoes. Some of the same elements found on pyroclastic glass particles like chlorine and copper might be concentrated below these domes. If so, they could mined in shaft mines.



We will need lunar orbiters with powerful ground penetrating radars to investigate below the surface of the Moon. We will also need landers with geophones, sort of like underground sonar systems used to hunt for oil on Earth, and explosives or inert projectiles collided with the Moon to set up vibrations in the Moon that might reflect off of sub-selene formations including volcanic gas pockets. Then we will need robotic landers with drills to tap this gas, should it exist, and analyze its composition.

If we found large quantities of CO, S compounds, even H2O beneath the Moon, this might be easier to tap by drilling than mining for ice in near absolute zero cold trap craters in polar areas. Carbon monoxide gas could be combined with lunar oxygen obtained by molten silicate electrolysis perhaps to make CO2 for CELSS. It could also be used for carbon for steel making, other metal extraction processes, even metal matrix composites like graphite/magnesium or silicon carbide/aluminum. Hydrogen from water could be combined with carbon to make some plastics. Sulfur could be used for sulfur concrete and sulfuric acid for metal extraction.

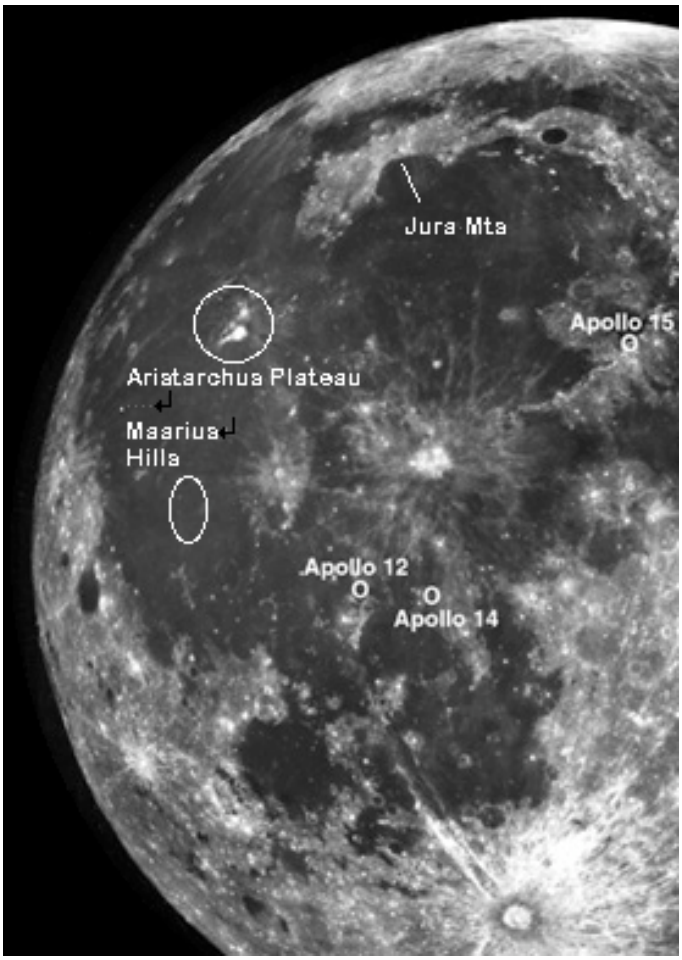
There is also the possibility that the Moon is "burping" radon from its interior. While radon is not very useful, its presence, should it exist, indicates the decay of uranium. Could the domes of Marius Hills exist because of large quantities of uranium below the surface decayed and released heat? Could there be more uranium and perhaps thorium too down below in richer deposits than KREEP which only contains about 4ppm U and 10 ppm Th? Since uranium decays to lead, could there be lead down there? Lead might not be useful as an industrial metal but it can be used to stain glass and get real red colored glass thus it would be valued by lunar artisans. Further, lead could also be used as a dopant superior to Sodium and/or Potassium to lower the melting point of mare regolith for use as a matrix in glass-glass composites. Perhaps shaft mines could be dug with cabled teleoperated robots to get at these speculative deposits of uranium, thorium and lead. While these sub-selene resources of volcanic gas, other elements and radioactives are mere conjecture at this time, the possibility of their existence is so tantalizing that we must investigate.

Location of a mining base or mining bases within the range of ground vehicles for access to the KREEP terrain, pyroclastic glass deposits and volcanic domes of Oceanus Procellarum will require more study. I don't have the required tools to measure distances on the Moon, but by simply eyeballing a map it looks like Aristarchus and Marius are much closer to the KREEP terrain of Mare Imbrium on the coast of the Jura Mountains that form the NW ramparts of Sinus Iridium (Bay of Rainbows) than to the KREEP terrain of Procellarum to the east near the Sea of Clouds (Mare Nubium). The base or bases should be located near a coast so that Fe-Mg-Ti rich mare regolith as well as Al-Ca rich highland regolith can be mined.

Off road vehicle convoys and railroads will be needed; perhaps pipelines too. The base, or bases, would initially consist of an "industrial seed" of robotic mining, regolith refining and manufacturing devices that could self-replicate using only lunar resources and small cargoes from Earth. Small human crews would supervise the robots. As the seed grows into full-fledged smelters, factories and larger habitats, more humans will go to the Moon. Industrial production will have to reach a scale at which millions of tons of materials were produced every year for a solar power satellite-building project.

Thousands of large helium 3 mining tractors would be built also. Scientific research, tourism, Moon made ships for asteroid mining and asteroid deflection forces to repel asteroids on collision course with Earth or our bases on the Moon, support for Mars colonization efforts in the form of metal for spaceships and propellant as well as equipment to be used on Mars mined and made on the Moon, and probably unforseen uses of lunar materials, will all emerge.

1] Cooper, B.L. (1994) Reservoir estimates for the Sulpicius Gallus region. Space 94: Engineering, Construction and Operations in Space, pp. 889-896. American Society of Civil Engineers, New York.



Defining the Lunar Industrial Seed: What Comes Before How?

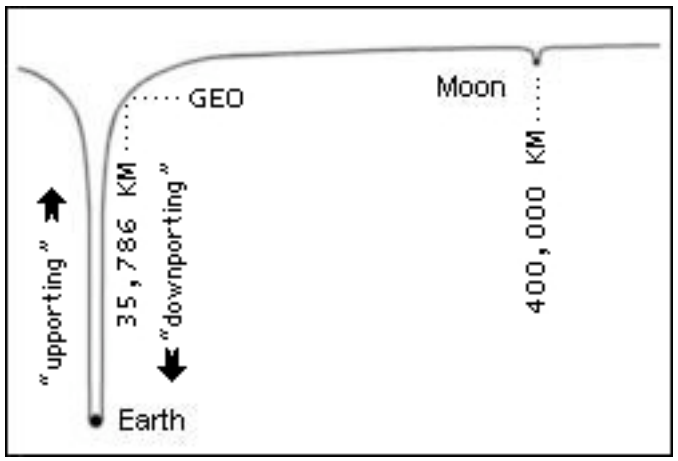
By David Dietzler pioneer137@yahoo.com © 2009

Part 1) What We Need

Seed Products and Mass Production

Given the high cost of space transportation it is necessary to minimize upported* mass to save money and make a solar power satellite project economically feasible. The mass of the lunar industrial seed must be kept as low as is possible while still making it possible for the seed to mine, produce materials, self replicate and manufacture everything from bricks to mass drivers on the Moon. Before we can determine the components of the seed we must ask, "What are we going to make?" Before we answer the question, "How are we going to make it?" we must design before we manufacture and we must design for manufacturing. In other words, we must design things that can be made simply and economically with limited lunar materials.

[* One frequently hears that there is no “up” or “down” in space. That is a half truth, as space is sculpted by gravity which affects the motion of everything. Earth, being 80 times as massive as the Moon, has a much deeper “gravity well,” and it is proper to speak of ‘upporting’ items from Earth to the Moon, and ‘down-porting’ things from the Moon, to GEO, LEO, or to Earth itself. The difference in fuel costs is consider-able and greatly effects the economics involved. – Ed.]



At first we will upport complete inflatable habitat modules with electrical and communications systems, life support systems and interior furnishings. We will also upport vehicles, mining machines and robots. Once we get a small base established we will start making things by the use of human/robot synergy.

If we are to grow a lunar industrial seed massing from several hundred to several thousand tons into lunar industrial complexes amassing millions of tons we will have to engage in mass production. Standardization is one of the keys to mass production. We need to figure out, or somebody else does, how to make in no special order standardized lunar products such as:

LOW TECH ITEMS

- a brick (interlocking?)-cast basalt, glass and ceramic from magma electrolysis
- a block-same materials as above and possibly from concrete also
- a slab-ditto
- various tiles-ditto
- a sewer pipe-ditto-this could also be used for air ducts
- a water pipe-ditto, and metal pipes too
- elbows and Ts for both pipes-ditto*
- water faucets, plumbing parts like shower heads, etc.*
- a steel or pure iron rail
- a tie, unless we go with monorails _various steel, pure iron and titanium bolts, rolled threads*
- various nuts*
- various iron plates
- an iron beam
- an iron stud
- a cement board and maybe a drywall section**
- various gauges of aluminum wire with glass cloth insulation
- various electrical parts-a switch, connectors, junction box, etc.*
- a door frame that can have either glass or metal plate in it
- a door knob*
- a hinge*
- a non-insulated water and sewage tank
- metal pipes for conveying high pressure gases
- a toilet***
- a bath tub or shower stall
- a planting box-made of bricks or blocks i guess
- a sink
- various pieces of furniture made of CB, metal or AAC
- a glass fiber cloth sand bag for piling up regolith sand bags around modules for rad and therm protection. this bag could also be used for cement and groceries, etc
- a bottle* that can also be filled with various beverages
- a half gallon milk bottle*
- a canning jar that can double as a foodstuffs jar*

* **[bottle, jar]** These items will be small, lightweight, and not needed in very large numbers during the early base construction stage lasting perhaps six months to a few years, so they will be upported until lunar manufacturing capacity grows and these parts are needed in large numbers and high total masses. While some might say, "What? a water faucet when it costs thousands of dollars per pound to the Moon?" I can only say that the machines and manpower needed to make these in the early stages when there is low demand for these might far outweigh the items themselves; and since time is money we need to get a base built and expand it rapidly. Upported bottles could be made of lightweight plastics and even plumbing parts too. When we get metals and glass on the Moon, old thermoplastic parts could be ground up, melted down and turned into more valuable products.

** **Cement board** is preferred to drywall. Cement can be made simply by roasting and steaming highland regolith; while making drywall will require sulfuric acid leaching. Drywall is more fragile than cement board; and it can be made by laying plaster between two sheets of glass fiber cloth, so facing paper is not needed. It’s easier to saw,

but that produces lots of dust. We might be leaching regolith is sulfuric acid during aluminum extraction and this will lead to lots of calcium sulfate, which is plaster, and silica for glass. There are aluminum extraction processes that don't require acid leaching but it's too soon to tell what process will be used. If we do acid leaching that plaster by-product should be put to use. If not drywall, then for aluminum and magnesium casting molds and medical casts.

***Flush mechanisms would be upported for toilets. If anything has to work right, this does (lol).

MORE COMPLEX ITEMS

- a silicon solar panel
- an airlock and hatches etc._various electric motors-these might be among the more complex lunar manufacturing jobs we must do. Mark R. has pointed out that large motors will need cooling systems
- a high pressure gas storage tank
- an insulated cryo liquid storage tank_valves for hp gas pipes
- a heliostat
- a fiber optic bundle
- an electric stove
- a refrigerator
- a ventilation fan
- a cooling unit _compressors? _space radiators?
- a solar furnace, therefore a reflector system
- Vehicles-two-a van and a truck made by stretching the van and sticking 4 std wheels on the back end with std electromagnetic brakes and std motors in each wheel. Std batteries wired in paralell. see:

http://www.moonminer.com/Lunar_Model_T.html

Heavy equipment:

- one volatiles harvestor model
- one mining shovel model
- one small crane model and
- one large crane model that can also become a drag line

Standard vehicle and heavy equipment parts, frames, etc. will be necessary. This will get complicated. We will have to keep designs as simple as possible and leave out frills.

Machine tools: drill presses, lathes, milling machines, CNC machines, perhaps something like the Multi-Machine will be central to machining products on the Moon. see:

http://groups.yahoo.com/group/multimachine

Mass drivers: these will be the crowning achievement of lunar industry, allowing the export of lunar materials into space for construction of powersats, telecomm platforms, colony ships to Mars, robotic asteroid mining ships, etc. Many of these items will be very complex and require an advanced manufacturing capacity on the Moon.

We will follow Peter Kokh's MUS/cle strategy [www.lunar-reclamation.org/papers/muscle_paper.htm] and make the Massive, Unitarian and Simple parts like refrigerator casings on the Moon and upport the guts of the machine-coils, compressor and motor [1]. The complex, lightweight and electronic (or expensive) parts of compressors, cooling units, fans, valves, etc. will be upported and the MUS stuff like iron casings will be Moon made. Machine tools will be very complex and demand exacting tolerances. At first, during the early years of base development, we will upport them. We will have to upport 3D additive printing machines like Direct Metal Laser Sintering devices to make the finer parts and we will upport the finer parts like the precision motors of lathes until we get the ability to make them on the Moon, while heavy metal bases and frames could be Moon made. We will also upport lots of solar panels of the highest efficiency and lowest specific mass available because nothing will work without power and expansion without power will be impossible.

The list above is certainly incomplete. I welcome others to modify and add on to the list.

Works Cited Part 1

MUS/cle Strategy for Lunar Industrial Diversification
© 1988 The Lunar Reclamation Society
www.lunar-reclamation.org/papers/muscle_paper.htm

Note, this paper in its entirety is online at:

http://groups.google.com/group/international-lunar-research-park/web/lunar-industrial-seed?hl=en

Yet to come (future installments):

Part 2: Lunar Materials

- **Solar Wind Implanted Volatiles-Those Precious Light Elements**
- **That Essential Oxygen**
- **Cast and Sintered Basalt**
- **Silicon and Iron**
- **Titanium and Titanium Dioxide**
- **Magnesium**
- **Aluminum**
- **Cement**
- **Glass**
- **Sulfur**

Part 3A: Manufacturing - "MUS"

- **Furnaces**
- **Liquid Gas Storage**
- **Solar Panels Needed Early**
- **Basic Bricks**
- **Metal Plates**
- **Contour Crafting**
- **Extrusions**

Part #3B: Manufacturing - "cle"

- **3D Additive Manufacturing**
- **Chemical Vapor Deposition**
- **Spinning Metals**
- **Blacksmithing**
- **Nuts and Bolts**
- **Electrical Parts**
- **Glass Working**
- **Sand Mold Casting**
- **Robots and Electric Motors**

Part 4: Conclusion

- **Timeline**

Dave Dietzler of the Moon Society St. Louis chapter, has been contributing quality technical articles in MMM since #158, August 2002. Besides his many articles, his input has improved many pieces written by the editor. Dave is also a member of the Moon Society Board of Advisors.

20 Questions about Resources from the Moon

Q. What is the Moon made of?

A. Tests on Apollo Moon rock samples showed that they contain high percentages of Oxygen, Silicon, Iron, Aluminum, Titanium, Magnesium, and Calcium with lesser amounts of many other elements

Q. Are not these elements common enough of Earth?

A. Yes, these same principal eight elements are the major constituents of Earth's own crust.

Q. Then what is the advantage of extracting such commonplace resources from the Moon?

A. There is no advantage at all if the idea is to bring them to Earth itself. But because of the Moon's much lower gravity, $1/6^{th}$ that of Earth's, it would take only $1/20^{th}$ the fuel or energy cost to transport these raw materials all the way back to Low Earth Orbit (LEO) or to Geosynchronous Earth Orbit (GEO) rather than rocket them up the short distance from Earth's surface. In LEO and GEO, we could then afford to use building products made from these raw materials to do a lot of interesting things.

Q. What sort of useful building products could be made from these few elements?

A. Eventually, we should be able to make high-quality metal alloys such as steel (from iron), aluminum, titanium, and magnesium – the four "engineering metals." But this would require an elaborate industrial complex. In the short run, it would be relatively easy to make serviceable sintered iron products, glass, fiberglass, and a glass-glass composite on the analogy of fiberglass-reinforced plastics. We can also make some ceramics and even concrete (on Earth, the #1 building material by far.)

Q. What things in particular would these cheaper lunar resources allow us to build in space?

A. Much larger "space stations" than we can now afford to haul up from Earth module by module is one example. And only with these "cheaper" raw materials could we ever afford to build orbiting factories to take advantage of vacuum and micro-gravity to make things that can't be made on Earth's surface, or orbiting hotels and resort complexes for tourists to enjoy spectacular views of Mother Earth, or the large orbiting Solar Power Satellites to provide Earth with inexhaustible clean power.

Q. Given Earth's two most pressing problems, our deteriorating environment and poverty in developing nations, how can we justify the high up-front costs of tapping lunar resources?

A. Many things are contributing to our deteriorating environment, but easily the number one villain is electrical power generation from coal and oil burning plants that fill the air with acid rain and greenhouse gases that will eventually destroy the climate. Even if the more developed nations would switch to all nuclear power generation, an option with its own unwanted consequences, people in the developing nations would have no way to catch up in standard of living except by burning even more fossil fuels tha we do today, specifically coal. Space-based power generation is ultra-clean and there is no end to the amount available where the Sun provides it free full-time. Without such spade-based electrical power generation, Earth's environment and the World's developing populations will share the same death sentence.

Q. Besides the more abundant elements mentioned, does the Moon have truly strategic resources?

A. A big surprise was that the Apollo Moon Rocks contained 600 times as much of a rare form of helium, helium-3, as is found on Earth. This endowment is not native to the Moon and is only to be found in the upper meter or so of the ubiquitous rock powder blanket (regolith). It was apparently put there by eons of buffeting of the Moon by the wind or particles streaming out from the Sun's hot atmosphere, the "Solar Wind." If we ever succeed in engineering workable fusion power plant, Helium-3 would be the ideal fuel as burning it produces no radio-active particles, not even neutrons, only charged particles that can produce electricity directly. There is enough of this "ultimate fuel" in the Moon's dust blanket to provide Earth with all the power we want for thousands of years.

Q. What chance is there of unhappy side effects of generating our electrical power in space?

A. Power from orbiting Solar Power Satellites will have to be beamed down to Earth either by laser or by radio waves in the microwave range – *but not the same as those in your oven, which would be dissipated by water vapor in the atmosphere!* Tests to date deliberately using insect and bird species that might be most vulnerable to such waves have encouragingly shown no ill effects. There are fail-safe ways of controlling the beam and keeping it on target to ground-receiving stations (rectennas.) But some economic dislocation of coal miners and petroleum workers is the unavoidable price we'll have to pay for either a Solar power Satellite Network or a Helium-3 fusion plant system Yet putting these systems in place could employ even more people than those put out of work, especially in developing countries. A clean Earth and a decent standard of living for all are the reward.

Q. Where on the Moon is this wealth to be found, and just how would we go about extracting it?

A. On the Earth, long and powerful geological processes in the presence of water have worked to concentrate much of the mineral wealth in scattered veins and lodes of ore. On the Moon this did not happen and these minerals lie everywhere in similar concentrations. The dark maria or Seas are richer in iron and titanium, the light highlands richer in aluminum, magnesium, and calcium. There need be no race to "stake out claims." Eons of meteorite bombardment have pulverized and "gardened" the Moon's surface into a powdery blanket 2-10 meters deep. All we need is here, and much of the "mining work" has already been done for us.

Q. Won't mining operations scar the Moon with open pits and unsightly piles of unwanted tailings?

A. As we've just seen, the mineral wealth of the Moon is lying loose on the surface. In essence, we just need to rake the top meter or so of the moondust to harvest what we need. We will want to do this in generally flat areas, going around big craters, etc. So there will be neither deep mines nor open pits, and the minerals not needed will be left in place. A visitor would have to come very close to tell that anything had been done. There will be no insulting eyesores. From Earth, even with the most powerful telescopes, there should be no visible clues.

Q. How large a crew would be needed on the Moon?

A. Simple resource recovery operations could begin with perhaps a dozen people using tele-operated equipment where feasible. Liquid oxygen to use for air, and to combine with hydrogen to make water, and for rocket fuel would be the first product. With a few more people we could begin making things from cast basalt, and sintered iron; concrete objects and glass-glass composite products would be next.

Q. How could people live in such a barren place?

A. The first shelters will be compact space station type habitat modules and inflatable structures brought from Earth, covered with 2-4 meters of moon dust for protection from cosmic rays, solar flares, micrometeorites, and thermal extremes. Essentially this dust blanket will do for Lunan pioneers what our atmosphere blanket does for us. But fairly soon, crews should be able to move into much more spacious structures built from raw materials on hand. These roomy quarters could be flooded with piped-in sunlight and filled with plants to keep the air clean and fresh as well as providing fresh fruit and vegetables.

Q. Would miners sign up for short tours of duty? Or go on to stay and bring their families along?

A. Certainly, the first volunteers will only stay a few months at a time. But as the outpost grows, a point will be reached where it is cheaper to provide the facilities a permanent population will need rather than to keep shuttling personnel back and forth from Earth. As soon as possible, it will be helpful for some crew to volunteer as trial settlers, even raising some children. For until we can see how native-born children grow up, we cannot be absolutely sure that genuine settlement an long be maintained. To find that out, we need to take the plunge.

Q. What long-term consequences will there be for permanent pioneers and their children?

A. We can expect some loss of muscle tone and mass in adjusting to a lower gravity, but this loss should level off at an acceptable, healthy plateau. The longer we put off allowing volunteers to stay long-term, the longer we will have to wait to find out if this expectation is correct.

Q. Wouldn't a settlement of any real size need a continuous infusion of very costly imports?

A. The Moon has very stingy amounts of hydrogen to make water by combining with abundant local oxygen, and stingy amounts of carbon and nitrogen, all essential for growing food and fiber. These elements are present in the loose dust blanket, again as a gift of the Solar Wind, and we can harvest them by heating the dust to about 600 °C. If we do this religiously whenever we handle moondust as in road construction, site preparation, and mining and manufacturing methods, and recycle, again religiously, we should manage. The alternative is to import these elements at great expense. Eventually, richer sources of these "volatile elements" can be mined on nearby asteroids, even from the two small moons of Mars.

Q. To build a healthy, diversified economy, what else could the colony export besides building materials, rocket fuel, and fusion fuel?

A. Almost everything the pioneers would make for themselves to avoid unnecessary imports, will also find a ready export market in space-based installations in Earth orbit and elsewhere, "killing two birds with one stone."

Q. Even if all this development does not scar the Moon, won't it cause pollution there?

A. The settlement will need to operate as closed biosphere, recycling its air, water, and biomass. As settlers will have to live "downstream and downwind of themselves," they will have to keep their little oases of life fresh and clean. The host Moon itself has no atmosphere, groundwater or ecology of its own to pollute.

Q. What about the suggestion that the Moon might be used as a dump for Earth's problem wastes?

A. Even if waste disposal authorities on Earth become desperate enough to pay the high freight charges to send some problem wastes into space, it will be cheaper to let the Solar Wind slowly blow them out of the Solar System altogether than to land them on the Moon. If however in the toally safe, sterile vacuum and biological isolation of the Moon, it proves possible to "mine" such wastes for elements rare on the Moon, the settlers may welcome them.

Q. How far off in the future is all of this and how much scarce money will we have to invest?

A. The first genuine Moonbase is still on the drawing boards. Genuine settlement will require technologies NASA is neglecting such as closed biospheres and manufacturing under lunar conditions. It will be essential to get private enterprise involved. A lunar settlement could eventually become a very profitable undertaking, especially considering the limitless potential for electrical power sales. The up-front costs, admittedly high can be borne by utility energy consortiums rather than by public taxes.

Q. How inevitable is such an Earth-Moon economy?

A. Before private enterprise can get involved, the "infrastructure" to get us "back to the Moon to stay" must be in place whether through government or corporate funding. Tax monies "invested in the future" rather than "spent on present itches" may be needed. Earth-bound enterprises must be enticed to pre-develop technologies needed later, on the Moon and in space, for any profitable terrestrial applications that can be identified, now. This is called "spin-up" the very reverse of the much-heralded "spin-off" process about which most taxpayers could care less. Spin-up addresses the "What's in it for me?" question.

We can do it! ###

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\

Coming Soon – Wednesday, Nov. 11th

Our 2nd Annual Membership Meeting

By Peter Kokh, President

Our first Annual Membership Meeting was held on September 17th, 2008. Why the later date this year? That's simple. We were not paying attention to the calendar and didn't see it coming! We've been very busy and preoccupied with other things.

The arrangements will be identical to those for our first such meeting last year, as stated in MMM #217.

The meeting will be online, in the ASI-MOO special chat room environment, 9-11 pm ET, 8-10 pm CT, 7-9 pm MT, 6-8 pm PT. We realize that this window will not be convenient for many members, especially for those outside the Americas. But no other slot would be better. This is the time and day slot in which the Society's Management Committee and Board of Directors meets.

Practice now! If your schedule makes attendance at this event possible, and you have never been on the ASI-MOO, you will save yourself a lot of frustration that evening, if you first practice loging on. It is quite simple.

1 Go to our homepage www.moonsociety.org

2 Scroll down the left hand menu column until you come to the ASI-MOO image link. Click on this link

3 Ignore the preliminary information on this page (for advanced users) and scroll down the page until you see the dual links: **Java MOO client: Framed Popup**

4 Click on either (Popup is my personal preference)

5 Wait for the window to fully open. Some browsers are faster than others. Below the preliminary introductory text, you will see a line, below which you can type.

6 Type these three words: **connect** {your) **username** {your) **password** all in lower case, each word separated by a space with no quotation marks. Hit carriage return

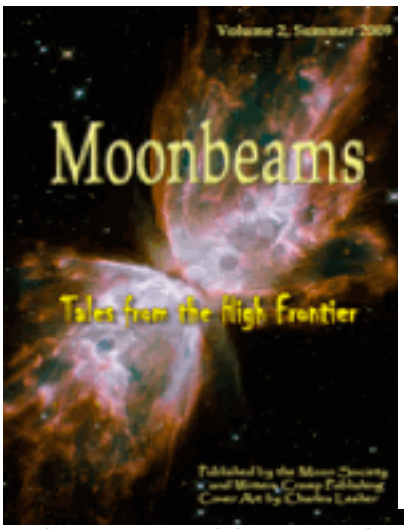
7 You will find yourself in the "Commons" Now you want to go to the "Auditorium" where the Members Meeting will be held. The instructions in the Commons say that the Auditorium is "NorthWest" so type NorthWest without quotes and with capitals as indicated, then hit carriage Return, and you should be in.

Most likely problem you will have is not knowing your **username** and **password**. If this turns out to be the case, just contact me at president@moonsociety.org and tell me what your problem is. If you prefer an answer by phone, give me your phone # and best times to call in your email. We'll get you in, but ***do not wait until the last minute*** as I will be busy with other things!

Format and Topics of the Meeting

In preparation for the meeting, we will post an **Annual Report** in the **Members Area** of our web site:

www.moonsociety.org/members/reports/annual_report2009.pdf



The 4th issue of Moonbeams, Vol. 2, #3 Summer, is now ready for download at: http://www.moonsociety.org/publications/fiction/

Our Moonbeams Editor, Chuck Lesher, is looking for fresh submissions. This is your opportunity to share your vision of what could be or might have been!

Submissions Guidelines **moonbeams@moonsociety.org**

The Moonbeams genre is primarily Speculative Science Fiction, but we will accept nonfiction that is related to space colonization and/or lunar exploration. *You do not have to be a Moon Society member to submit.*

Moonbeams is about two things:

- The authors and getting their best work published
- Making the case for space colonization

Successful fiction submissions must stick to accepted physics: *no faster than light warp drives, no worm holes, no time travel, no transporters á la Star Trek, and no alien monsters. No magic, no fantasy.* Last but not least, *no social, political, or religious diatribes*.

Send us a plausible story about the colonization of space and the moon and we will publish it. But don't stop there. The subtitle "Tales from the High Frontier" indicates that stories can be set anywhere in the Solar System. Nonfiction submissions on science and technology must be thoroughly referenced.

Everyone is welcome to submit pieces up to 5,000 words. We have a micro-story category, *Letters Home*, with a limit of 250 words. We also welcome comments and/or reviews of prior Moonbeams stories. These should be limited to 250 words.

We currently do not accept advertising in Moonbeams and thus, we produce no revenue stream. Therefore, authors cannot be compensated and will retain full rights for republication elsewhere.

Submissions should be in electronic form. MS Word is preferred but we will accept text files or other common word processor formats. *Any submissions that need to be keyed in will not be considered unless prior arrangements have been made.* The preferred method of submissions is via email with subject set to *Moonbeams Submission*. We will accept mailed cd/dvd at this address:

Writers Cramp Publishing
1982 N. Iowa Street
Chandler, Arizona 85225

Exchanging links is ok if your link is clearly space related. Moonbeams reserve the right to say no to any submission.

These guidelines are subject to review and will be adjusted as we go along. Moonbeams is YOUR magazine. Let's have some fun with it, shall we? ***The Editor.***

Where are we on our Proposed Lunar Analog Station Project?

From Peter Kokh

First, let me say that while progress has been slow, it does continue. Our advisory involvement in the design of the proposed **Moon/Mars Atacame Research Station** to be located in Northern Chile, goes on. This project is being financed largely by the Chilean Air Force, and involves universities in Chile (in particular, the University of Concepcion) as well as several entities in the U.S. (The Astronaut Teacher Association, San Diego; the State of California; The Moon Society.)

While the design team includes several people, most of the input has been from us, with very helpful assistance from Don Foutz of Hanksville, Utah, the jack-of-all-trades rescuer-in-chief at the Mars Desert Research Station nearby, whom I have met and worked with on several occasions on MDRS Crews 34 and 45 and in a separate visit in between.

This design process has allowed us a chance to revisit some of the ideas illustrated in our proposal presentation of September 2006, recently updated.

www.moonsociety.org/moonbasesim/proposals/#ppt

In particular, we have been taking a fresh look at crew cabin design, connecting hallway construction, and at "modular biospherics" elements such as "Living Walls" and graywater systems. There is nothing so helpful to brainstorming as having the whip of urgency over your head!

But the question is, "what stands in the way of advancing the realization of a lunar analog facility in the United States?" Two key items jump out:

1. Where could we, should we, build it?
2. How could a small membership organization fund such a considerable undertaking?

Let's look at the Mars Society experience. The suggestion that the Society build a Mars Analog Station and the suggestion of where to put it, came in one neat package from Pascal Lee of NASA AMES who had just visited the 20 million year old, 15 mile wide Haugton Crater on Canada's far north Devon Island.

With the first year's experience there, it became clear that this awesome site came with two major drawbacks: a short field season 6-8 weeks long at best; and a high logistics price tag in terms of airfare and cargo delivery that far north. Thus the search for a complementary site in the US southwest began. The Mars Society was blessed with *an abundance of charged-up members and many took it on themselves to do scouting footwork.* One such effort pointed the finger at a site outside Hanksville, Utah. Bob Zubrin went to check it out and the rest is history.

Let me interject here that there is a considerable difference of opinion about the importance of geological appropriateness of the site between Director of Project Development Dave Dunlop and myself. Yes, you can do some analog research anywhere, even in a warehouse, and we have pointed that out. But if we are going to excite the imagination of the public and of the media, we would do best to look for what Dave calls a "Hollywood movie set location" suggestive of a moonscape. Now the

public and the media *are* important. Without them, the amount of donations we attract will be far lower.

But there is one more reason to seek a proper "setting:" the psychological effect on station crews and field researchers. ***The better the geological setting allows one to "pretend" he or she is on the Moon (or Mars) the more effectively he or she will be able to conduct the research in hand.*** This was very clear, in two opposite ways, in my experiences at M.D.R.S. on crews 34 (Mars crew) and crew 45 (Moon crew.) In the latter case, although the site was barren, almost totally free of vegetation, everyone on our Moon simulation crew complained that they could not get in the spirit of their respective projects. The reason was clear. Both the land forms (sedimentary) and the colors "screamed Mars!"

Now "Marslike" terrain is easier to find in the Southwest than "Moonlike" landscapes. While in Utah, I did look at the Black Rock Desert lava flow immediately west of Fillmore, but it proved inappropriate. I did not get a chance to look at the Sevier Desert area near and south-southwest of Delta, Utah.

What kinds of Analog Research would require such a "moon-reminiscent campus?"

- Testing geological and prospecting tools and methodologies for ease of use while wearing a spacesuit
- Testing soil moving equipment: excavators, drills, bulldozers; sandbagging equipment, draglines, shielding emplacement, etc.
- Testing robot-human synergistic systems
- Testing the limits of teleoperations with a built-in 3-second time delay, and with a less than a second time delay (teleoperation from L1 instead of from Earth)
- Testing various shielding methodologies
- Testing various passive thermal management systems that would use stored dayspan heat to warm the habitat during nightspan, and stored nightspan cold to cool the habitat during dayspan
- If the area is volcanic with ample basalt, development of technologies to make products useful on the Moon out of cast and/or hewn basalt
- You get the idea

Other suggested areas have included the former lavatube location of the Oregon Moonbase, now reverted to the Bend Waterworks Department and no longer available; the Craters of the Moon National Monument in Idaho; El Mapais National Monument outside of Grants, NM. But perhaps we need to look at non-volcanic areas as well. Wherever we look, we need volunteer scouts to find specific promising sites within the general areas, so that we can then visit and make a quick up/down decision. Without volunteer scouts, finding a site could become a very expensive proposition.

Enter financial considerations. The Mars Society got a good start with a substantial donation for "naming rights." *Another way* would be to first erect a well-designed visitors center, showcasing plans and models, and eventually allowing "duck blind" and "webcam" tours of the facility without disturbing crews hard at work.

Now a tourist facility in the middle of nowhere would attract dedicated fans, but not random passersby, of whom there would be few. So the idea of collocating our analog facility in an area that already attracts a lot of space enthusiasts and space-curious persons might be wise. Locations that come to mind are Biosphere 2 thirty miles north of Tucson, Spaceport America, 45 miles north of Las Cruces, NM, and Mojave, California. All of these "desert" locations are in fairly "wet" deserts, in the sense of being generously peppered with sagebrush and other desert vegetation. We would have to create a "campus" from which vegetation had been cleared, and kept cleared, and from which neighboring vegetated areas were out-of sight, beyond a ridge, beyond an artificial berm, or by some other feature or device.

To Dave, the Tucson area is clearly number one. The University of Arizona's Controlled Environment Agriculture Center, CEAC, is in northern Tucson. It is here that the best biological life support research is being done. See the amazing "Lunar Greenhouse" video at: http://www.youtube.com/user/chippro#play/all/uploads-all/0/F4Dbh0nvh-4

I could see a site on Oracle Road, along which all traffic from Tucson to Biosphere 2 must pass, and close to CEAC, as ideal. But again, looking at the vegetation in the area, a "movie set" creation effort would be needed. A bit further up the road, you would also get all Biosphere 2-bound traffic from the direction of Phoenix A significant support asset would be the Tucson NSS chapter and the Phoenix Moon Society chapter.

At Spaceport America, we would want a location near the Spaceport to tap traffic from Las Cruces to the south and west (Arizona, S. California) and El Paso and points east (Texas and points east and northeast) as well as traffic coming through Truth or Consequences, NM (Albuquerque and points north and east.) Again, any site would have to be "devegetated."

Mojave has a lot of space start-up companies as well as the famous Airliner Graveyard, and Edwards Air Force Base. Convenient to Los Angeles, this location seems less attractive than the Tucson area of Spaceport America location. Again, in either location, we would need a lot of footwork on the part of volunteers to locate specific sites for us to come out and look at.

Back to Financial Considerations: recently, we have been looking at the concept of an International Lunar Research Park. A similar concept is the Mall. Real estate tycoon (prior to the 1990 Houston real estate crash) Mitch Mitchell told me that to get the money to build a mall, all you have to show the bank is a signed contract with one "anchor tenant." Now if we built an analog site "to share" with other companies who were interested in testing their products there or doing research there, that may be the way to use up front "rent" or "lease" money to build at least "Phase One" of our Lunar Analog Station.

I have spent my life between poor and broke for a reason. I have no instinct for earning or leveraging money. So all of the above must be taken with a grain of salt. At my suggestion, Dave Dunlop is preparing his own assessment of where we are and how we can progress towards realization of a Moon Society Analog Station. And the Society may do better to ignore my suggestions and look at his.

Whatever the outcome of this exercise, members should realize that

almost every avenue along which we can advance the day when humans are pioneering the Moon, will enormously benefit from many and varied types of research that can be done at a well-designed and equipped Lunar Analog Research Station.

This project then is immensely and intrinsically relevant in pursuit of our shared vision and dreams. **PK**

The Moon Society Chapters & Outposts Frontier Report

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

Fri-Sun, Oct 2-4, Archon 33 Science Fiction Convention in Collinsville, IL – MSStL had an email signup sheet and a percentage of the people at each of our presentations plus quite a few walkups at our "fan table" A con official told us they've gotten favorable comments, glad that there are people like us that do "real science". Actually we do "future science" or "possible with current science". www.moonsociety.org/chapters/stlouis/Archon33.htm Attendance at our talks varied from ten to fifteen people. Talks included these topics: Lunar In Situ Resource Utilization, Can the Moon Save The Earth? & NASA's Return to the Moon: Rovers & Inflatable habitats

Moon Society Phoenix Chapter

http://www.msphx.org
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 **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 members met at Coffee Oasis on Sept. 21st. Our major agenda item was the filling of our vacant position of Treasurer; Ken Sweeney, Sr. volunteered to step back in to this position for the remainder of the unexpired term and was confirmed by a unanimous vote. We also passed a resolution to send a note of thanks to the organizers of the Fly Me To the Moon event this past July for a job well done.

We also discussed the forthcoming exhibition at the Museum of Fine Arts, Houston, which runs from September 27 through January 10, 2010. Craig Beasley volunteered to canvass our local Moon Society members and contacts to see if there is interest in organizing a group tour of the exhibit. Anyone interested in joining us for a group tour (dates still open) may email me at eric@streamlinerschedules.com and I will see that your information gets forwarded to Craig.

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.

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

NEWS! – We now have **four Moon Society members**, but it still makes sense for us to meet in conjunction with the Lunar Reclamation Society, an NSS Moon Society partner.

NSS Partner Chapter News – pp. 17-19

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

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

Committee Review U.S. Human Space Flight Plans
http://www.nasa.gov/pdf/384767main_SUMMARY%20REPORT%20-%20FINAL.pdf

Solaren's Plans for SBPower demo unit for PG&E
http://cleantech.com/news/4361/solarens-plan-outer-space

Bst Sci Fi Flicks of all time?
www.wired.com/underwire/2009/09/scifi-flicks-2/

Dynamic View of Moon's Composition
www.psrd.hawaii.edu/Nov05/MoonComposition.html

Japan $21B 4 km2 SPS to power 294,000 homes
www.inhabitat.com/2009/09/01/japan-plans-21-billion-solar-space-post-to-power-294000-homes/

Wind, not water, may explain Red Planet's hue
http://www.newscientist.com/article/dn17814-wind-not-water-may-explain-red-planets-hue.html
http://www.marsdaily.com/reports/It_A_Grind_To_Make_Mars_Red_999.html

Wave of space probes reveal Water on the Moon
http://www.independent.ie/world-news/americas/new-wave-of-space-probes-reveal-water-on-the-moon-1896494.html
www.financials.com/info/story.cfm?storynum=4055536
http://news.yahoo.com/s/space/20090925/sc_space/watermakesmoonsuddenlyamoreattractivedestination

Space Solar Power Via Prizes
http://space.alglobus.net/papers/sspContest.html

New Colored Solar Panels work on diffused light
www.nanotech-now.com/news.cgi?story_id=34733

Online Guide to Space Tourism
http://www.hobbyspace.com/Tourism/index.html

FALCON 9 PIX
www.wired.com/wiredscience/2009/06/gallery_spacex

Gigapan the Apollo Landing Sites
http://www.universetoday.com/2009/07/30/gigapan-the-apollo-landing-sites/

"COTS-like": the future of space procurement
http://www.thespacereview.com/article/1461/1

The Role of Art in Space
http://www.thespacereview.com/article/1460/1

Can Commercial Launch Co.s meet NASA Needs?
http://www.thespacereview.com/article/1465/1

Why we do human space
http://www.thespacereview.com/article/1472/1

Planet Hollywood, part 1: "Mission to Mars"
http://www.thespacereview.com/article/1469/1

Masten Space Systems makes progress
http://www.thespacereview.com/article/1468/1

Spain's Space Tourism & Analog Research Station
http://www.planetropolis.org/default.asp

Prizes to inspire Space Technology Achievements
http://spaceprizes.blogspot.com/

$35 million for a Whole Week in Orbit ($5m/day)N
http://www.flightglobal.com/articles/2009/09/10/332150/35m-for-excalibur-almaz-week-in-orbit.html

NASA considers Bigelow Module for ISS
http://www.flightglobal.com/articles/2009/09/09/332086/nasa-considers-iss-bigelow-module.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/

GREAT! **– The Lunar Greenhouse at U-AZ CEAC**
http://www.youtube.com/user/chippro#play/all/uploads-all/0/F4Dbh0nvh-4

ASSORTED SPACE VIDEOS

Triton Flyby 1989
http://www.space.com/common/media/video/player.php?videoRef=SP_090902_triton

Short film about the Settlement of Space
http://www.youtube.com/watch?v=e14LDWt-Q1k

NASA D-RATS field test 2 man pressurized rover
http://www.technologyreview.com/video/?vid=435
www.technologyreview.com/computing/23481/article

"In the long run, a single-planet species will not survive," *and* "One day, I don't know when, but one day, there will be more humans living off the Earth than on it."
Mike Griffin, Rolling Stone Magazine, 23 Feb. 2006

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

- 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 53102

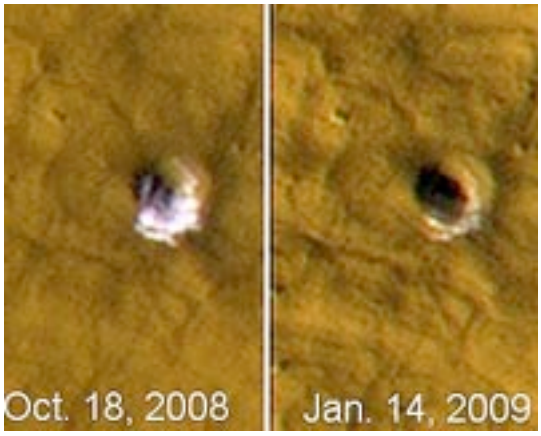
MMM PHOTO GALLERY

The Dragon qualification unit being outfitted with test Draco thruster housings. Depending on mission requirements, Dragon will carry as many as 18 Draco thrusters.

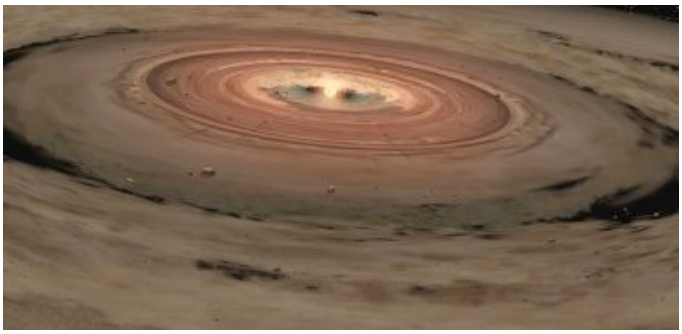
Dragon spacecraft undergoing load testing at SpaceX's testing site in McGregor, TX – Though it will initially be used to transport cargo, the Dragon spacecraft was designed from the beginning to transport crew. Almost all the necessary launch vehicle and spacecraft systems employed in the cargo version of Dragon will also be employed in the crew version of Dragon. As such, Dragon's first cargo missions will provide valuable flight data that will be used in preparation for future crewed flight. This allows for a very aggressive development timeline—approximately 3 years from the time funding is provided to go from cargo to crew.

For more pictures on the Dragon Capsule and on the Falcon 9 vehicle that will take it into space, and on the Falcon 9 engines, see:

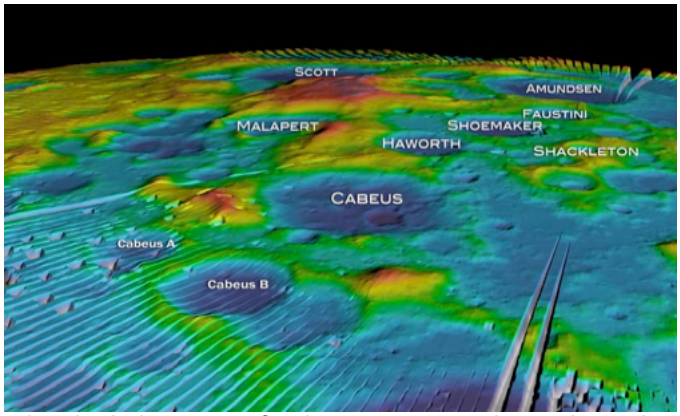
http://www.spacex.com/updates.php



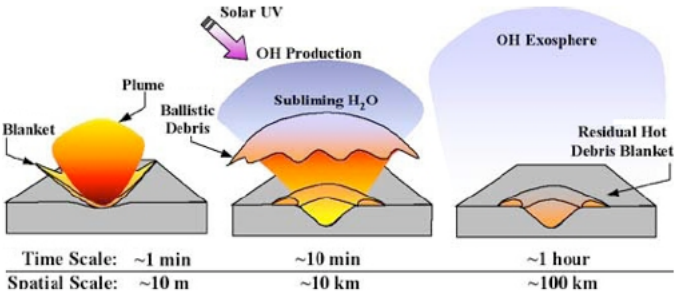
A fresh, 6-meter-wide, 1.33-meter-deep crater on Mars photographed on Oct. 18, 2008, and again on Jan. 14, 2009, by Mars Reconnaissance Orbiter's HiRISE camera. The bright material is ice, which fades from Oct. to Jan. because of sublimation and obscuration by settling dust. We are seeing sub-surface water ice that may be 99 % pure, halfway between the north pole and the equator.



51 Ophiuchi – a solar system in early stages of formation
An artist's rendition of inner, outer dust disks with different size dust grains



The Shaded portion of Cabeus (60 mi, 98 km wide) is the currently planned Location of LCROSS Impact Oct 9, 2009



Expected Phases of the LCROSS impact Splashout event

NASA's 2-man Pressurized Moon Rover

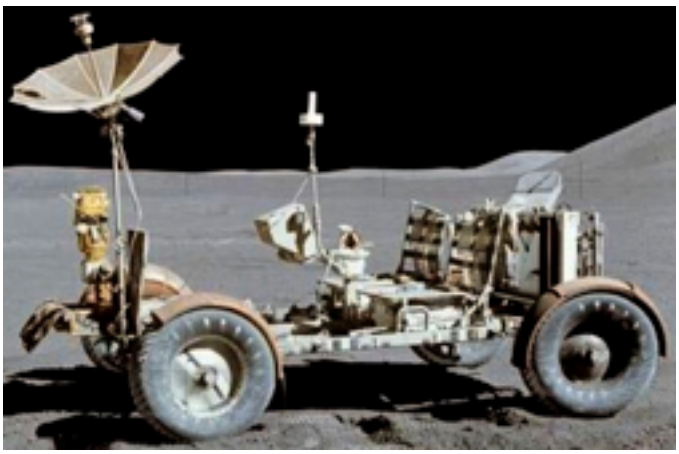
Special MMM Report: Sources: Article & linked Video:
www.technologyreview.com/computing/23481/
http://www.technologyreview.com/video/?vid=435

There are no ifs, ands, or buts; this is one prototype that is right on the money with the kind of features that will let it adapt to all kinds of conditions and situations. Tested recently at the Black Rock lava flow along Rte 89 north of Flagstaff, Arizona by NASA's D-RATS team ("Desert Research & Technology Studies" – should be "Squad," imho), this electric vehicle is loaded with all the goodies a wannabe lunar explorer could want.

First, the window-loaded cap protrudes beyond the wheels to avoid kicked-up moondust, and allows a superb view ahead, and even right below. High mounted cameras to either side offer views further down the way than can be seen from the drivers' seats; and they pull down for lens cleaning.

Then there are two side-mounted "side hatches" – airlocks that provide extra storage when not in use, but which, more importantly, allow an ELR (electric lunar rover) to dock or couple with another ELR (or a habitat) facing in either direction. You could have a convention in the field!

Inside, there is room for the two crewmembers to lie down whether to sleep or just catch a nap; a pull down screen between the two berths provides privacy. With food or water provisions, an ELR is capable of an exploratory excursion lasting a few days!



Three of these prototypes are now parked on the Moon

The aft-mounted "suit port"

Now this has got to be your reporter's favorite feature. The crewmember climbs into the suit through an in-swinging backpack hatch. MMM has been calling for such suits, "turtlebacks" as we dubbed them, for almost twenty years, since we first saw a suggestive illustration done in 1990 by Pat Rawlings as a workup for David Lee Zlatoff as he was planning the ground-breaking science-fiction film "Plymouth," which aired on ABC Sunday Night Movie on the 1991 and 1992 Memorial Day Weekends. We give Rawlings full credit, and the "turtle-back" backpack that includes the back of the helmet, is featured in several of his most memorable illustrations.

The purpose of this "rear-entry" suit-design is twofold: dust control, and limiting the amount of air lost to space in airlock cycling. We are delighted that NASA has finally seen fit to model this long-overdue suit design feature.

To get back to this rover design, it can turn full circle within its own footprint, as both the front and rear pair of its six wheels have full 90° rotation.

Finally, this vehicle has a companion trailer that can either be towed, or move by remote control. It has an appreciable capacity to carry extra equipment needed for whatever purpose: geology work, prospecting, obstacle removal, extra life support supplies, bivouac equipment, and so on.

It is one thing to land on the Moon, another to be able to do what you came to do, and this prototype is a most encouraging sign that NASA is looking beyond an outpost to full "field operations." We look forward to the evolution of this design, and the incorporation of even more sexy features. **<PK/MMM>**

MAIL TO MMM

Steel &/or Titanium

From Dave Dietzler

Here at the Moon Society St. Louis, our engineers have made a convincing case for the production of steel on the Moon. One of them has done lots of work with titanium and favors steel for many applications. Steel is a very versatile metal. It's cheaper than titanium too.

However, making steel on the Moon is a real challenge. At first, I considered direct reduction of iron bearing lunar minerals with carbon monoxide gas, but lunar pryoxenes and olivines have far more silicon in them than Earthly ores like hematite, magnetite, or even taconite. While iron would absorb very little carbon in the conversion to steel, and the CO gas could be recycled in direct reduction furnaces, I never could find a good way to make the enormous amounts of flux needed to absorb the silicon.

So I abandoned DR when I discovered the old blister steel, also called crucible steel or cementation process that dates back to the 19th century and earlier. This process allows iron to be carburized and turned into steel. So it might be a viable method to make *limited* amounts of steel on the Moon.

A couple of months ago, Stuart Scott emailed me and said he didn't think working with titanium would be too tough after i suggested cutting threads in titanium bolts with lasers or electric spark discharges. Today I open the paper, and there is an advertisement from a local hardware chain for a 21 pc titanium drill bit set sizes 1/16" to 3/8" for only $7.97!

They are even making titanium razor blades these days. For the sake of brevity, let me simply say that we know how to produce titanium on the Moon. We also know how to mine for carbon traces. The old blister steel process should work on the Moon as well as it does on Earth.

Very careful consideration will have to be given when making material choices for machines made on the Moon. We won't know what the prices of materials are going to be until we get some real world experience at a Lunar Research Park perhaps; unless a lunar economy can be modeled mathematically on computers! So the steel vs. titanium on the Moon discussion will continue in a gentlemanly way.

Dave Dietzler – pioneer137@yahoo.com

China Shows U.S. Delegation Next Spacecraft

www.aviationweek.com/aw/generic/story_generic.jsp?channel=awst&id=news/china092809.xml&headline=China%20Shows%20U.S.%20Delegation%20Next%20Spacecraft

Aviation Week Article by Frank Morring Jr.
MMM Report and Commentary

Situation: The U.S is scrapped for cash, China is not.

What ifs: Could the two giants finally agree to collaborate with China supplying cash, and the U.S. technology?

To date: China has not been invited to participate in the International Space Station endeavor. The U.S. continues to protect all technologies, even those that China has already duplicated.

Opportunities: "Shenzhou 8 is identical to Shenzhou 7, except that it has a small docking unit on its forward end and video cameras mounted around its circumference to guide final approach. The mechanical docking ring is not compatible with the Russian androgynous peripheral assembly system used on the ISS." – [*in our opinion,* it is in the interests of *everyone, that is, all countries,* that all docking systems be compatible for rescue purposes.]

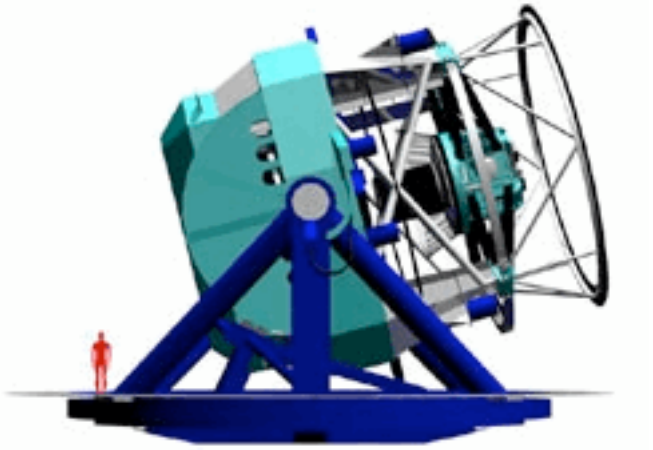
Precedents: The Chinese program is already benefiting from technologies shared by ESA's EADS Astrium corp.

Feelers: Several NASA officials, including incoming Administrator Charles Bolden, have been invited to visit the Jiquan Satellite Launch Center, where all of the Shenzhou missions originated.

The outlook: It remains to be seen if these encouraging feelers being put out by both space powers will lead to more cooperation. There are those who worry about sharing technology to the point where we are stuck with obviously absurd applications of TARP, and those who see everything to be gained, and little to be lost by bringing the Chinese into full partnership in International space endeavors.

We will have to wait to see what happens. We expect that the Obama Administration will at least take a second look at the polarizing current situation. We did so in 1975 with Apollo-Soyuz when the U.S. and Russia were far more mutually antagonistic than the U.S. and China are now. *And we have yet to regret having doing so.* **PK**

Space Tourist Charles Simonyi and Microsoft chief Bill Gates fund unique Asteroid-finding Telescope in Chile



www.newscientist.com/blog/space/2008_01_01_archive.html

Not too long ago, NASA cut all funding for the search for asteroids that could threaten the Earth, citing lack of funds. In a splendid example of "let's us do it anyway," these two well-healed individuals are investing their wealth in an effort that should "be able to find 90% of all asteroids down to 140 meters across that have the potential to threaten Earth. That would reduce the likelihood that such an object could remain undetected until just before a close encounter."

Further, they have enlisted the help of Google Inc. to help digest all the data that this telescope search is expected to generate.

MMM salutes them!

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

LRS News

●: **LRS & a local Moon Society Chapter?** There are now four current members of the Moon Society in the Milwaukee area, including Peter, Dennis Groves, Lee McConaghy, and Kriss Coleman. We could organize a separate Moon Society chapter, but it seems to make more sense meeting and working in conjunction with LRS, which already enjoys Moon Society partnership status.

● **Our 23rd Anniversary Party coming up:** As usual, we will celebrate the event at our December meeting, inviting members of other state chapters.

*Can someone keep a lookout on the availability of a DVD of the recent highly rated Sci-Fi film "**Moon**"?*

We'd like to feature it for this event.

LRS Upcoming Events

Saturdays: 1-4 pm

October 10th – November 14th – December 12th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

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

Space News Updates: ISS, News about water on the Moon and water-ice on Mars; updates on the Moon Society's Analog Station planning and on the Analog Station project in Chile, others in Spain, Sweden, India

Chapter Projects: Proposed new displays requested for ISDC 2010 in Chicago: a "Living Wall" & other ideas.

Chapter Outreach: Note that we have not had an LRS outreach since the "horror con" "It Came From Lake Michigan" Halloween 2007. *What can we do to take our message to the local public?* Ideas and discussion.

December 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 of a Moon Society/NSS Lunar Analog Research Station; Concept of an International Lunar Research Park.

Our usual Potluck luncheon, displays, feature Sci-Fi film, camaraderie.

News & Events of Eight 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
Oct 17th, Nov 21st, Dec 19th

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/

Oct 13th, 2009 MN SFS Meeting
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

ILLINOIS

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

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

***Hosting* ISDC 2010 – May 27-31, 2010**
http://isdc.nss.org/2010/

.

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

• Oct 15th – 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: October 5th, November 2nd, December 7th

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@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, 3rd Saturday every month at the **Liberty One food court** on the 2nd level, **16th & S. Market.** Go toward the windows on the 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th. Call Earl/Mitch 215-625-0670 to verify.

Meeting times and locations: We will meet in November at the **Philcon** Science Fiction Convention at the Crown Plaza Hotel in Cherry Hill, N.J. on **November 22nd**, time to be determined. December, election time, will be at The Liberty One Food Court Our usual location, from 1-3 pm, on the 19th.

October meeting: Surprise! We had a very early October meeting to take advantage of the Drawing power of gathering at the Franklin Institute. We missed having Dennis Pearson There but had enough help to cover his absence. We also had one less table and a lot less space than normal due to the addition of a lot of other exhibitors. Robots! Lots of Robots! The Institute commemorated this years International Space Day with a big contingent of various rolling and battling 'bots. Andy, a visitor to our tables, even had clothed and unclothed versions of R2D2 out, with one traveling through the halls.

There were dozens of robot exhibitors, from classic Mind Storms to Battle Bots, to ball collectors & tossers, where from various school and educational organizations. I met one of the Institute's mentors after introducing a young women visitor to The Google Lunar X-Prize of which she had not heard. I shifted my talks to this area, and the upcoming LCROSS Impact (Coming to a Sky Near You! On my handout for this October impact) more than my initial discussion area of using space resources and this helped get more young attendees. I brought the Lunar Lava Tube exhibit and did a good deal of talk on that after the initial icebreaking with robot talk, and Mitch brought his old covers book that he uses for talking points and a new, very good looking, book that he introduced at this event.

Our eager volunteer crew included Hank Smith, who drew in visitors with talks on science fiction and fact, and the upcoming Philcon, and the team of Dotty and Larry on various topics and as back ups for all of us. Larry brought a good digital camera and will select images for our website. I will check my simple cameras for the same. Derrick Pitts, chief astronomer at the Institute, was a frequent visitor at our table and enjoyed our efforts at stimulating interest in science and technology as a serious and fun activity in which to get involved. I brought some stuff on Ham Radio and space exploration that he found interesting. One of the hams on the Cover of the AMSAT Journal had a mascot bearing his call letters AL1EN. All of us had a great time and thank Derrick and The Franklin Institute for the opportunity to participate. And thanks to Mitch Gordon for asking if we could be part of the event.

September Notes: There was a visitor at our table before the meeting who was interested in what we did because he saw our table marker: the latest issue of Ad Astra. Eric Jordan Is interested in space exploration and science as well as education for children as he and His wife have an infant. He pointed out several things that might be of general interest to members and visitors to our area; The Please Touch Children's Museum has a special set of flight toys in the "Flights of Fantasy" play area, and there is a science oriented store in the Manyunk section of Philadelphia, Spectrum Scientifics, whose proprietor can supply a large range of experimental materials on the first floor of the shop with the second floor being exclusively for telescopes and astronomy gear. Eric left as members arrived

Hank Smith gave us a list of possible topics for talks at Philcon, which included The Future of Utilities, Black Holes, and The New Space Race among other possible panel or presentation choices. Hank will be going to an event called **Capclave**, a science fiction convention, in Rockville Maryland in October. He also told us of possible future locations of the World Con: Scotland, maybe, in 2014 for those who plan

ahead! Australia next year. Larry the webmaster asked for questions and this turned into talk on our new business cards (he had a sample at the October event), posting pictures to our photo blog and problems with printing out articles that he and Mitch Gordon had. Larry also talked about using Twitter and message stringing for thoughts of more than 140 characters. Dorothy talked on her visit to the Institute and she was had seen better Star Trek displays at other Museums. She is a Trek enthusiast and has initiated outreach to Star Trek "crews" in our area to be part of that future by involvement in our groups, which are trying to actually create the future we want by our actions. She brought a picture from ISDC 2005 of herself in the space. Her final comment was on how New York NSS chapter had held a great ISDC in 1996, and suggested we get in touch with this chapter about the Lunacon SciFi event in their area. She did like "Journey to the Stars" and recommends it when it comes to your area. I gave a short science and technology report including the new carbon nano tube "cloth" announcement from NASA Tech Briefs, which pictures four people laying alongside the long wide strip of fabricated. There where subsidiary articles on "Functionalizing CNTs for Making Epoxy/CNT Composites," for making castable films of the material, to water purification using nano tubes, to mass fabrication of the tubes. The large sheet of the material was produced at Nanocomp Technologies. See the September Tech.

Also of note was the October Sky and Telescope, which included the LCROSS story ("The Big Gamble" by Charles Wood, a regular contributor to the magazine) and "The New Habitable Zones" on where life may now be possible based on where we have found it on Earth; neat graphics and a Three D chart to show us mammals in proper perspective. Yeah but we drew the chart! The author is Chris Impey, U. Arizona Professor and author of The Living Cosmos. And finally from Earl: Wired magazine had an interesting tidbit on page 26 of the October issue: it is about a maneuver, recently rediscovered, that would cut the fuel use, or travel time, to Mars using a gravity assist technique first thought of by Hermann Oberth in 1929. His idea was to fuel up near the Moon and dive in towards the Earth for a gravity-assisted boost. This is the result of work of NASA's Robert Adams. This looks similar to what has been done in the past, how the Grand Tour of the 1980s happened for example, but it may be a different technique. Even if it were a variation on the billiard ball idea used for the Tour, cutting travel time to Mars or the moons of Jupiter (Mini Tour anyone?) would be great.

Mitch brought in the August 24 to 31 issue of News Week for the cover story "In Search of Aliens" with the storiy's quote: "perhaps half of the 200 billion stars in the Milky Way have Earth-like planets". There is mention of the survey mission of the Keller space probe in the article by Andrew Romano (pages 50 and 51 of the publication). As referenced earlier; Larry is making new business cards with our full http address at Mitch's request. Although we can be found by "Googling," Mitch believes it might be better to have the full address in its hypertext format so that people can go directly to our site(s). Whatever, within reason, works (we do joke about spicing up our reference information to draw hits sometimes). Mitch is working on the new management of the White Dog Café to see if we can get the human perspective of the Overview Institute scheduled as a presentation by our member Alex Howerton. Since Alex is working two jobs and raising a family and is a board member of The Overview Group he is a bit busy, and we hope a mutual schedule can be arranged.

On another subject: there was some confusion in our group about the Spring Ad Astra as to whether it was an on line only experiment or if it was simply "missing in the mail" for some. Mitch is our NSS contact and wasn't sure, but will check. He did not receive a paper copy either.

Added notes: Derrick Pitts of the Franklin Institute was very interested in some of the material in the August Moon Miners' that I was using at our table and may contact one or more of the authors I think, and my recent visit to the Pack Rats VHF Conference and the robots at the Institute reminded me to broach the idea of using ham Moon bounce operators for Google Lunar X-Prize communications as a public service that could be rendered. Pass the idea on everyone! Earl Bennett

CALIFORNIA

SDSPACE.org

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***

LCROSS Impact Party: On Thurs. evening, October 8th, the San Diego Astronomy Association hosted a special star party event at the Tierra Del Sol remote observation facility 90 minutes east of San Diego. The NASA Lunar Crater Observation and Sensing Satellite (LCROSS) is set to complete its mission to the Moon by smashing two large pieces of the satellite into the moon. The impact will eject material from the crater's surface to create a plume that will be visible to astronomers nationwide. The SDAA invited interested members of the public to attend the viewing of this once-in-a-lifetime event.

CALIFORNIA

OASIS

OASIS: Organization for the Advancement of Space Industrialization and Settlement
Greater Los Angeles Chapter of NSS
P.O. Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine:(310) 364-2290
Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com

http://www.oasis-nss.org/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 17th, Nov 21st, Dec 19th
Information: OASIS Hotline, 310/364-2290; website.

Wed. Oct 14, 8pm Lecture: "Exploring the Ultraviolet Universe" by Chris Martin, P.I> for the Galaxy Evolution Explorer (GALEX) mission. Caltech Theater Beckman Auditorium, Pasadena - http://evemts.caltech.edu

Thurs/Fri Oct 15/16 7pm Lecture: "How to Drive a Robot" by Andrew Howard, Robotics, JPL. FREE. Oct 15th Von Karman Auditorium, JPL 4800 Oak Grove Drive, Pasadena. Oct 16th Vosloh Forum, Pasadena City College, 1570 East Colorado Blvd, Pasadena

Sat. Oct 17th 3 pm OASIS Board Meeting - Home of Craig and Karin Ward, 1914 Condon Ave, Redondo Beach

Moon Miners' MANIFESTO

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- **$20** NSS dues **if under 22 / over 64.** *State age* ___

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