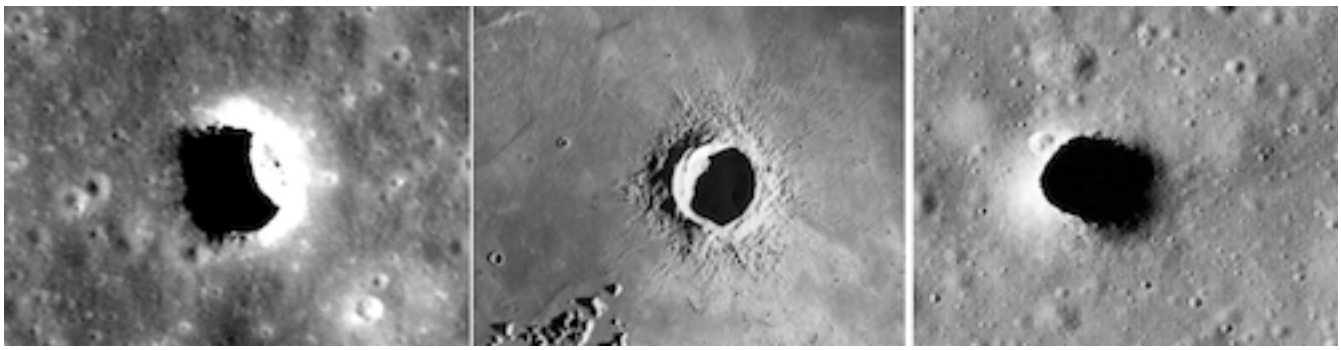
"Towards an Earth-Moon Economy – Developing Off-Planet Resources"

Moon Miners' Manifesto

& The Moon Society Journal www.MoonMinersManifesto.com

Space-X tests its "Grasshopper" – A demonstrator of a vertical takeoff, vertical landing "reusable" rocket

Feature Articles:



Skylight openings into lavatubes below – **The Moon's hidden, protective "Netherworld"**

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- **MMM's VISION:** "expanding the human economy through off-planet resources"; early heavy reliance on Lunar materials; early use of Mars system and asteroid resources; and permanent settlements supporting this economy.
- **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
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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.

• **NSS chapter**s and **Other Societies** with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.

• **Publication Deadline:** Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the 15th, Sooner is better! – **No compensation is paid.**

• **Submissions by email** to KokhMMM@aol.com – Email message body text or MS Word, Text files, and pdf file attachments or mailed CDs, DVDs, or typed hard copy [short pieces only, less than 1,000 words] to:
Moon Miners' Manifesto, c/o Peter Kokh, 1630 N. 32nd Street, Milwaukee, WI 53208-2040

In Focus Buzz Aldrin, a wiz at Orbital Mechanics, flunks the Moon Test

By Peter Kokh

In a recent statement, the 2nd person to set foot on the Moon remarked that while the Moon has an inconvenient 29+ Earth day long daylight-nighttime period, and extreme temperature swings, Mars' "day" is only 39 minutes longer that what we are used to. True enough! But he fails to see the advantages in the lunar situation.

- The long "dayspan-nightspan" cycle means that Lunan pioneers will concentrate on energy-intensive tasks during the solar-energy-rich dayspan, and energy-light tasks during the nightspan, using stored energy. This will be a welcome monthly (better, "sunthly") "change of pace" rotation, most pioneers will come to love.
- By the same token, Lunans can keep the 24 hour day we are used to, whereas Mars settlers will experience a perpetual jet-lag, starting each day 39 minutes later. The team operating the Curiosity rover on Mars tried this and after a month, revolted. I suspect that "night people" will have less trouble adjusting than "morning people" who "can't wait" to get each new opportunity-packed day started.
- The Moon's 29.5 day long thermal cycle from very high dayspan heat to very low nightspan cold, allows geothermal temperature control: storing up excess dayspan heat to warm habitat areas during nightspan, and storing up excess nightspan cold to cool habitat areas during dayspan. On Mars, temperatures are always on the cold side, and the seasons cycle is 2+ Earth years long.
- On both worlds, habitat and activity areas must be adequately shielded from cosmic rays and solar flares. That means making use of the available radiation proof shelters in lavatubes, or covering surface structures with an adequate layer of moondust or marsdust, which will also provide thermal equilibrium.
- One day there will be thriving human settlements on both worlds. **There is no point to "either-or rivalry," especially since neither world may be economically viable without both being trading partners.** PK

Golden Spike Presentation – Lunar & Planetary Science Conference 44

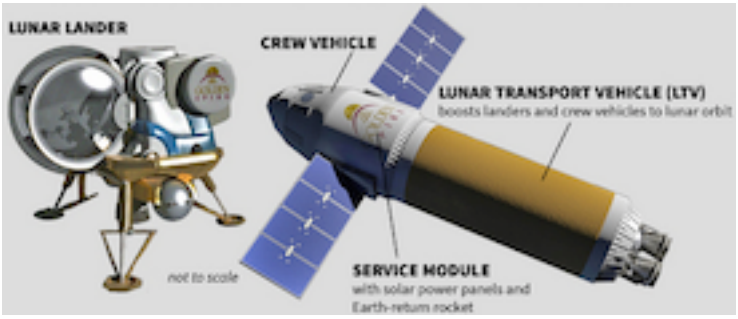
By Larry Jay Friesen

Here are notes from a presentation I heard at the 44th Lunar and Planetary Science Conference (LPSC) on Monday, March 18, 2013, in the Marriott Hotel and Conference Center at the Woodlands (north of Houston, Texas).

Golden Spike. At noon on Monday, Alan Stern made a presentation about Golden Spike, a company he has founded for the purpose of getting human missions to the Moon. Dr. Stern was at one time head of the NASA Science Mission Directorate, and is the principal scientist for the New Frontiers mission, on its way to investigate Pluto and the Kuiper Belt, so I take him quite seriously. Alan Stern is CEO and President of Golden Spike. Gerry Griffin, who i. s well known to many in the Johnson Space Center (JSC) community, is Chairman of the Board. The company has on board people with scientific, media, and government expertise.

Stern believes he can get people back to the Moon for 6 to 8 billion dollars for the first mission, with repeat trips for much around 1.5 billion dollars – about the cost of a NASA flagship class unmanned planetary mission, such as Cassini. The company will use a commercial business model, which relies on advance flight and media sales, not on a billionaire.

The reason for the low development cost is that they plan to use existing hardware wherever possible, including existing launch vehicles. That means much of the development cost has already been paid. Rather than develop a heavy-lift launch vehicle, they plan to use multiple launches of existing vehicles to get everything they need to orbit and to the Moon: two launches or four launches, depending on what launch vehicle they select. They plan not to develop but to buy vehicles. Atlas and Falcon Heavy were two possible launch vehicles discussed.



In response to a question of mine, Dr. Stern stated that Golden Spike does not plan to put orbital propellant depots in place. It would be an added expense to their development costs, and not needed for their mission model.

They aim to put in place an affordable turn-key Earth-to-Moon transportation system, to enable human lunar expeditions for science, commerce, etc. They envision two people to the Moon per mission. They envision a major market to be what they call "mid-level" countries, who would like to take part in spaceflight to the Moon, who have the scientific and technical abilities to take part, but who lack the budget to develop a lunar transportation system on their own. They think they have identified 25 to 30 such countries. Corporations may be another market.

They are in the process of a lunar lander system study. In this area. they likely will have to develop their own vehicle. They expect to be able to bring back a minimum of 50 kilograms of lunar samples per flight. They also plan to have lunar surface experiment packages to deploy at each landing site. They call them "GoldSEPs" in analogy to the Apollo ALSEP packages. They will offer a suite of scientific instruments from which customers can choose. If a customer wishes to supply an instrument of their own, that's fine, as long as it is compatible with the GoldSEP interface requirements.

Readers will note that this is a "sortie" mission mode. This is terrific for lunar science. Not so great for those who want to put long term human settlements on the Moon. One can imagine that one customer, be it country or company, might not necessarily choose to go to the same lunar landing site as the one before. They might prefer the novelty and the honor of being first to explore a new lunar location. However – and it's a big "however" – can we not imagine that once such transportation system is up and running, those who wish to settle could figure out ways to leverage it and piggy-back off it? For instance, if settlers were to come up with the financing to put a propellant depot into Earth orbit, would not the transport costs to the Moon for both settlers and Golden Spike come down? Everyone would benefit.

Golden Spike is planning a workshop at the Lunar and Planetary Institute (LPI) in Houston, October 3-4 of this year. Information about that workshop can be found on the LPI web site. Golden Spike also has a web site, and they invite interested people to learn about the company. **LJF**

VIDEO: http://www.youtube.com/watch?v=DWI5S9RejrY

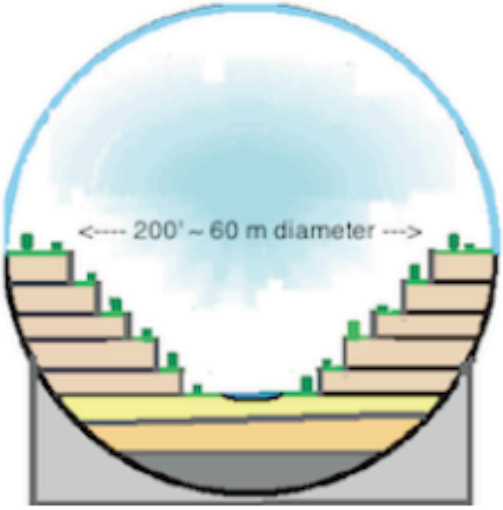
Surface vs. Lavatube Settlements: Pros & Cons – a place for both

By Peter Kokh

Designing and Assembling a "Lava Tube Exhibit" leads to new insights and questions

As the Moon Society is hosting a "Lave Tube Track" at this year's International Space Development Conference ("ISDC") hosted by our affiliate, the National Space Society, in San Diego, May 23–27, I decided to create a "Lava Tube Exhibit. The constraints I set for myself were: occupy half of a standard display table, lightweight, made of inexpensive materials and post-consumer items when feasible, have a lighting system, compacts for shipping, etc. Now lavatubes can be many miles long, but here we are talking about a short, typical section. Thus, I could not model all the many things we could do inside these spacious tubular volumes, but had to highlight some key ideas:

- **Housing:** a pressurized cylinder that could house say 500 settlers
- **A tower** set on the tube floor that rose above the lunar surface through a "skylight" opening. It would provide surface access through airlocks, personnel and cargo elevators, an above surface "conning tower level" and shielding for the portion that rose through the skylight above the surface. The tower's base would be connected to the "town" housing unit by pressurized walkway tube that could also handle airport type open
- A warehouse area: I chose to model containers of various kinds of liquids



Concept for Small Lava Tube Town (500 people 100 units)
(Cross section illustration at left)

- Construction materials – not specified
- Musts: blue sky, green spaces incl. private gardens

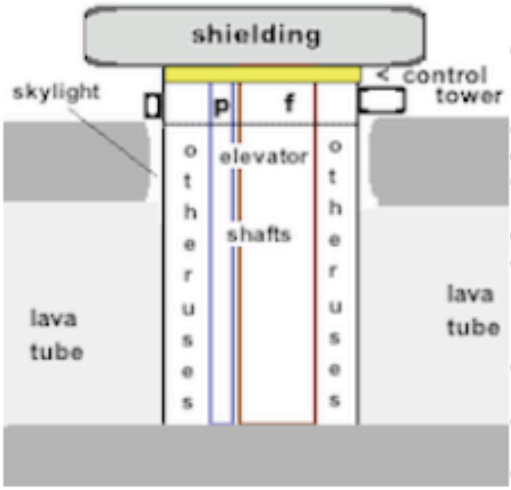
Concept particulars:

- Uplit sky blue bright "firmament"
- multiple tiers stacked atop one another in step back fashion so exposed "roof" of one tier is garden space for one above
- Each unit has windows opening to garden space, valley
- Curved side wall elevators at intervals, access to rear doors
- Trout stream, lagoon, picnic space, play grounds, in plaza
- Yellow level: commercial space, shopping
- Pale orange level schools, meeting rooms
- Gray level utilities, maintenance, subway to other in-line towns

Pressurized walkway (airport type 3-6 person carts?) access to multipurpose tower with surface access via existing skylight

Nb: Residential space can have various architectures.

- The one illustrated suited the scale of this exhibit
- Design by Peter Kokh, Editor Moon Miners' Manifesto`



Lava Tube Skylight Control Tower

- First, the "talus" rubble pile from the collapsed part of the lava tube roof must be cleared away, and/or used for other construction purposes
- Next in importance are personnel and freight elevators
- A conning tower observation room above surface level
- This activity area should be adequately shielded with moon dust – and have a generous overhang.
- Airlock-docks for people/freight form the tower support core
- Extra space surrounding the elevator core can be divided into floors for operations offices, and other management operations. Extra space can be rented to trucking firms, and other companies doing business with this outpost
- Skylights can be quite large, and the original tower is unlikely to occupy all that space, but be placed against one side
- Power transmission lines from surface solar power arrays will also enter the tube through the skylight.
- Here, the width is exaggerated, the height minimized

The exhibit plan: a section of a lavatube with a bend in it, with just enough of the bend cut off to allow views inside at mid-point as well as from each side of the exhibit. **Notice** the "town" area at left, the skylight/tower area to right of center, and the warehouse area at far right.

Exhibit Construction materials

- A 24" x 36" lightweight white dry erase board for the base (a cork board would do)
- 11 layers of standard 14" x 48" x 3/4" insulating foam board
- PL 300 construction caulk for foam board
- Gray latex flat paint (first coat) followed by gray tone "Fleck" spray paint (Krylon)
- Complete instructions available on request to kokhmmm@aol.com

What more I would have liked to do

For personal reasons, I was not able to attend this year's ISDC. But in retrospect, if that were not the case, I would have liked to have conducted an all morning, or all afternoon brain storming workshop with breakouts for 3-8 persons each, each group tackling something different:

- **Design and construction options for "towns" inside lava tubes**,
- **Design options for a lava tube skylight tower,**
- **Design options for lava tube industrial parks and comprehensive warehouse areas, etc. etc**.

We have conducted such workshops at ISDCs and science-fiction conventions past and the results were amazing. Perhaps we can do something like this at a future ISDC.

Insights gained from this exhibit planning and construction exercise

Of course, I attempted to design something within which I could picture myself living. I tried to identify aspects that were gratifying, which left me cold, and which would have frustrated me as a "tube-dweller." And as a result of this exercise, identified some advantages and some drawbacks of Lava Tube Living.

Advantages of Living and Working in a Lava Tube Settlement

- Temperatures are stable, relatively moderate
- Maximum Shielding from Cosmic Radiation and micrometeorite rain and impacts
- Earth Calendar 24-hour-day-friendly
- Three job shifts with neutral day/night schedules (no reason to want one over the others) unless the tube itself was lit, and not lit on a schedule that favored a "day shift."

Disadvantages of Lava Tube Environments

- Loss of benefits of a "lunar" calendar: the unique 14.75 day "Dayspan" and equal "Nightspan" with welcome twice a "sunth" change of pace (energy-intensive activities during dayspan; energy-light tasks during nightspan)
- Less opportunity to personalize habitats (lot size, design and shape, other things). Looking like a "company town"
- Town architectures are constrained: long narrow towns in lavatubes many, many times longer than they are wide)
- The basalt surfaces are very dark and light absorbing. It would be difficult to uplight the overhead portion of the tube to create a semblance of "daylight" without installing a hanging "sky blue" faux ceiling fabric or screens.

A More Ideal Arrangement? Splitting 'what goes where' might give better results

- **Lava Tubes:** Acreage-hungry manufacturing industrial parks, warehousing operations, agriculture, archiving
- **Surface Moondust-Shielded:** Settlements and Outposts that blend into the moonscapes, open to the stars

Surface towns could arise around the entrance to a lava tube: integrating residential and industrial areas.

Lava Tube "Networks" are certain to be established and grow

The Moon's maria, or frozen lava seas, are likely to be doubly riddled (horizontally and vertically in successive lava flow layers) with lava tubes and we can expect various kinds of interconnections, such as artificial (bored) lateral connections as well as elevator shafts where a tube in one layer overlays a path crossing tube in the lava sheet below. Just as on Earth where two rivers join, or fork as in deltas, such spots are more likely to become metropolitan tube complexes, attracting more residents. Some lower level tubes may have collapse created blockages.

Surface roads will also connect neighboring lava tubes as surface access will be much cheaper to build than boring connections through fractured but otherwise solid basalt.Those such confluences nearer to neighboring highlands will have the advantage of access to complementary sets of resources, and likelier to become major industrial centers. ###

Saving the Earth with Lunar Materials

By Dave Dietzler

Overpopulation, energy shortages, water shortages and environmental calamity threaten the existence of human civilization. In the near term we foresee **fracking*** for natural gas, nuclear fission and renewables like winds, ground based solar, biofuels and geothermal, as well as conservation thru building and vehicle efficiency improvements. Coal is the major contributor to global warming and we want to get away from coal despite its abundance and low cost if the environmental cost of it is not considered, in which case coal is costly. Fifty years ago nuclear fusion was predicted to be our primary source of energy, but now we are hearing that fusion is another fifty years away and many people quip that fusion is the energy source of the future and always will be.

* Hydraulic fracturing, or **"fracking,"** is the process of drilling and injecting fluid into the ground at a high pressure in order to fracture shale rocks to release natural gas inside.

Ground based solar and superconducting power grids could help, but to power the USA we'd have to cover the state of Arizona with solar panels and that isn't practical, especially when we will be diverting rivers and irrigating deserts to feed everyone. Deserts are barren sand. The topsoil blew away long ago. We will need ammonia, phosphate and potash as well as water and trace minerals to make the deserts arable in the future. Once the deserts have been artificially fertilized and irrigated we will recycle wastes for organic fertilizer to keep them producing. This new farmland will sink CO2 but it will also change climate in unpredictable ways. This is a risk we will have to take.

All this will require energy. Space solar power could supply that energy. We will need 60TW by 2050 if we rely on combustion, but only 20 TW if everything goes electric because two thirds of our energy from combustion becomes waste heat. We will need one thousand powersats rated at 20GWe apiece. I don't think we will have them by 2050 because we'd have to build twenty powersats per year for 50 years to get a thousand of them and we still need to do a lot of R&D on the Moon and in orbit. Fossil fuels including fracked natural gas, fission and ground based renewables will still be used in 2050 A.D. What ever happened to L5 by '95??? Looks like we are going to wait until 2095 instead of 1995, which has passed obviously. We will also have to rebuild the power grid to handle loads from electric furnaces, stoves, hot water heaters, cars, etc. Industry will have to evolve over coming decades as we shift away from combustion power to electrical power.

The time to start is NOW. We must build an International Research Park on the Moon to figure out how to use the resources of the Moon and build a high orbital space shipyard and construction station to figure out how to build powersats and we need space fueling infrastructure to transport cargo from LEO to the Moon. SpaceX Falcon rockets are here and now. To really lower the costs of space launches we need to mass produce rockets and that means we need a high launch rate to justify this financially. The ILRP and projects beyond it could supply that demand. So could space tourism. Get on board a Dragon capsule and launch with Falcon rocket to an inflatable space station! Save the upper stage, move it to a higher safer orbit with electrodynamic tethers and use it later on the Moon for scrap metal. If the cost of launch to LEO comes down 10x or 100x then we will have no trouble affording the shipment of thousands of tons of equipment to the Moon for an ILRP and beyond that mining bases and mass drivers to supply millions of tons of material every year to powersat builders in GEO.

Lunar Materials

We must make the best use of what the Moon has to offer. I envision the use of plentiful basalt fiber reinforced basalt and/or glass fiber reinforced glass composite materials for power satellite frames instead of aluminum. These materials won't require upported chemical reagents from Earth as aluminum production will and they will require far less energy to produce than aluminum. Magnesium produced simply by mining mare soil, magnetic separation to remove irony minerals and increase magnesian mineral content, and hot reaction with ferrosilicon from magma electrolysis followed by vacuum distillation of magnesium metal, will be used for powersat reflectors that concentrate solar energy onto upported gallium based solar panels. Instead of millions of tons of aluminum and silicon we will need millions of tons of more easily produced basalt, glass and magnesium from the Moon.

How will we mine up all this material? We will need fleets of digging machines to mine mare and highland regolith. We will base on a mare/highland "coast" to access calcium and aluminum rich highland regolith because we will still need aluminum for mass driver coils, power cables and high horsepower electric motors windings for powering digging machines and other lunar surface vehicles, even trains someday. We will also need highland regolith for cement to build mining bases complete with farms, habitat, factories and foundries. The mare are very important. They offer:

- smooth plains, some boulder strewn, some not so much...unlike the hilly highlands, so digging thru vast areas for meteoric iron-nickel particles and solar wind implanted volatiles is easier....
- composed mostly of iron and magnesium bearing minerals combined with silicon and oxygen
- cast, sintered and fiber basalt have many uses.
- titanium is in the mare
- KREEP is in the mare
- volcanic glass deposits

To build digging machines we will not use magnesium wheels and aluminum frames. These metals are not that strong without alloying and we lack alloying ingredients on the Moon. Also they will soften up during the heat of lunar day and are not as fatigue resistant as the metals that we will use--steel and titanium. To make steel we will harvest millions of tons of mare regolith and separate the iron-nickel meteoric iron fines with electromagnetic separaters. We will melt and cast this iron powder into sheets or rods, or we might use powder metallurgy and just compress and sinter the stuff. We will pack it in carbon powder from solar wind implanted volatiles mining or even use imported carbon and bring it up to red heat for a few days to make crucible steel. This steel will contain 5 to 10% nickel and a trace of cobalt. Nickel makes steel harder and stronger without making it more brittle, so this steel will be tough and impact shock resistant even at low carbon contents.

Titanium production is more complex. We need to locate high titanium mare regolith, dig it up and separate the ilmenite electrostatically. Then we must reduce the ilmenite, FeTiO3, with hot hydrogen gas which forms water that we recycle and decompose with electrolysis to recover hydrogen. The mixture of iron and titanium dioxide that results must be separated somehow; perhaps simply by boiling off the iron at high temperature in the vacuum. The TiO2 is then reduced to titanium metal in FFC cells using imported calcium chloride electrolyte and non-consumable calcium ruthenate electrodes.

Titanium will be alloyed. Some alloying elements raise the alpha-to-beta transition temperatureHYPERLINK "http://us-mg205.mail.yahoo.com/neo/" \l "cite_note-1"[1] (i.e., alpha stabilizers) while others lower the transition temperature (i.e., beta stabilizers).

Aluminum, gallium, germanium, carbon, oxygen and nitrogen are alpha stabilizers. Molybdenum, vanadium, tantalum, niobium, manganese, iron, chromium, cobalt, nickel, copper and silicon are beta stabilizers.[2]

If you look at a list of titanium alloys you will see that they use some real exotic elements not had on the Moon. Will lunar applications require exotic Ti alloys?? Ti6Al4V is the workhorse but vanadium is lacking on the Moon. However, do we need it??? Why can't we make a lunar alloy with some Al and some Mn, Fe, Cr, Co, Ni or Si???? It's like the Al and Mg situation...We don't have copper and zinc....but Al primary use will be for wires and those are pure Al, because alloying reduces conductivity and Mg will be used for sheet metal reflectors, explosives, nothing real high stress or high temp. Al and Mg alloys might be desired to make vehicles....but rovers could be steel and Ti, and spacecraft will be coming from Earth...and it will be a long time before we are able to manufacture sophisticated spacecraft on the Moon....We gotta have the ILRP first, then commercial ops and that means mining and a market for mined materials, hopefully SPS, and we could build the frames for those out of basalt fiber reinforced basalt or glass fiber reinforced glass composites, with Mg reflectors and high efficiency gallium based PVs from Earth....And perhaps high power vacuum tubes for the electronics...Also we need lots of pure Al cable for the mass drivers....So the lack of alloying ingredients for these three metals; titanium, aluminum and magnesium, is not that critical!!!!

Heat Treating

Since our machines could be made mostly out of commercially pure titanium and mild steel it seems like we won't need to do much heat treating, but some alloyed titanium and higher carbon steel parts will require heat treating. Also, cold worked steel will get strain hardened and this could be undesirable. We could anneal it in black cast basalt solar ovens. Titanium could be hot worked so we don't need to anneal it. If we need to harden steel parts we could heat them up in solar ovens then quench them in water inside a pressurized foundry where the steam is recovered from the air. What if a part needs oil quenching? We could quench it with high pressure helium gas instead. See: http://americanmachinist.com/technology-trends/vacuum-heat-treating-eliminates-distortion

A Mark 3 volatiles miner could produce 102 tons of normal helium every year. Let's hope this machine works as predicted. We might build parts for the Mark 3 miner on the Moon to reduce import costs. But where are we gonna get a huge pressurized foundry on the Moon? We will build one out of concrete. See the 300 person concrete Moon base at the bottom of this page: http://www.nss.org/settlement/nasa/spaceresvol3/cemncon1.htm

This would make an excellent foundry where we can cast metals and heat treat them. Perhaps it would have a window in the roof thru which we can concentrate solar energy into black basalt ovens. This structure is very large so it will tolerate quite a heat build up from hot metals, but we will still need cooling. If we can use air conditioners to move the heat from the interior to big slabs of cast basalt out in the vacuum we could have thermal wadis to park digging machines and vehicles during the lunar night. The wadis would cool down slowly when the Sun sets and spare the machines from the shock of rapid cool down. Whenever you can make use of waste on the Moon you are ahead of the curve.

Vacuum Advantages

Vacuum means no rust and corrosion. Stainless steel? We won't need it!!! If we do want stainless steel there is a small amount of chromium in the regolith so we could make small amounts of stainless steel. Shield gas for welding Al and Ti even Mg???? We won't need it !!!!! Will we need tungsten welding rods??? Or just use electron beams in the free wide open vacuum....yes electrons hitting metal generates X-rays, so use teleoperated robots instead of going outside in a spacesuit!!!

So although the Moon lacks many elements had on Earth, it offers other things in the form of free vacuum, plentiful and reliable solar energy, low gravity, easily obtained nickel, basalt, etc. We have to use what the Moon offers. Also, there is a synergy between steel and titanium production. Titanium production results in pure iron also and that iron can be used as is for low stress interior parts that have as much strength as wrought iron essentially. That iron could be carbonized to make more steel. Steel supply will be limited by carbon supply and it is predicted that a single Mark 3 miner could make about 82 tons of carbon per year; enough for 8200 tons of 1% carbon steel or about 24,000 tons of 0.33% carbon mild steel.

Rocket Fuel

One last problem; where do we get rocket fuel? Proposals have been made for the use of aluminum powder, silane and hydrogen from polar ice mining. Polar ice mining might not be that practical. At super- scold temperatures metals will become very brittle. If an ice miner hits a rock it could break a wheel. How will power be delivered to ice miners in shadowed craters? These problems must be solved. Aluminum and silane will be complex and costly to produce. Ferrosilicon from simple magma electrolysis could be burned with LUNOX also produced by magma electrolysis for a combination that's about as powerful as solid fuel, and that's all you really need on the Moon. Magma electrolysis is done at 1300 to 1600 C. but electrolysis cells could be made of fused silica, mp 1700 C., obtained as a byproduct of cement production. Since we'd be working close to the melting point of silica we'd want to drill cooling passages in the container and cool it with cheap sulfur dioxide gas and space radiators. Sulfur is easily roasted out of regolith. Electrodes would be made of a high temperature refractory like CaO, Al2O3 or TiC since these become conductors at high temperatures.

Closing Remarks

It seems as if we don't need what we don't have on the Moon. With a little ingenuity the job can be done. Are solar power satellites the long term energy source of the future? They will last for centuries in the rust and corrosion free vacuum of outer space. I do not know. A breakthrough in nuclear fusion could occur. Deep rock drilling technology could yield an everlasting source of geothermal energy. No matter what happens we must cover all bases. DDz

Lunar Powdered Materials

By Dave Dietzler

The Moon is covered with powdery regolith that will be easy to mine. You could call it "pre-mined." In the process of converting this Moon dust to useful materials we will often end up with solids. After magnetic removal of irony minerals, roasting anorthositic highland regolith at 1500 to 2000 C. in solar furnaces to boil out SiO2 and MgO and increase contents of CaO and Al2O3 to make cement will melt the regolith. When it cools it will be solid. It will be necessary to take this glassy material and crush it up in rod mills and ball mills to make cement powder that we can mix with sand and gravel and either water, imported polymers, molten sulfur or molten sodium silicate to make lunar concrete. Rod and ball mills could also be used to crush up ceramics and glass to make powders for 3D printers. We will also want powdered ceramics to slip cast them into various forms like molds and furnace crucibles.

http://en.wikipedia.org/wiki/**Anorthosite**

Powdered metals are also desirable. We can compact them into forms or dies then heat them to make metal parts as an alternative to melting and casting. Powdered metals are needed for 3D printing, particularly titanium. We also need these to make Mg/LOX slurries for explosives and Al/LOX or FeSi/LOX for rocket monopropellants. It will be possible to powder metals by melting them and spraying them thru a nozzle with an inert gas like helium. A single Mark 3 miner could produce 102 tons of helium annually. Even so, it will be wise to recycle the helium. Helium atoms are rather small and tend to leak at every opportunity. There might be some solar wind implanted neon recovered, but not much. Nitrogen is less abundant than hydrogen, helium and carbon and to make matters worse, titanium will burn in nitrogen. Carbon dioxide is rather inert and less likely to leak, but magnesium burns in CO2. Sulfur dioxide would be cheap, but I suspect that it will react with molten metal particles.

It is also possible to powder metals without a gas spray. A spinning rod of metal is heated with an electric arc from a tungsten electrode. As the metal melts and vaporizes, centrifugal force throws particles to the sides of a circular container. The particles cool by radiation and powder forms. We might be able to use focused solar energy, hot enough to melt anything, instead of an electric arc and imported tungsten electrodes.

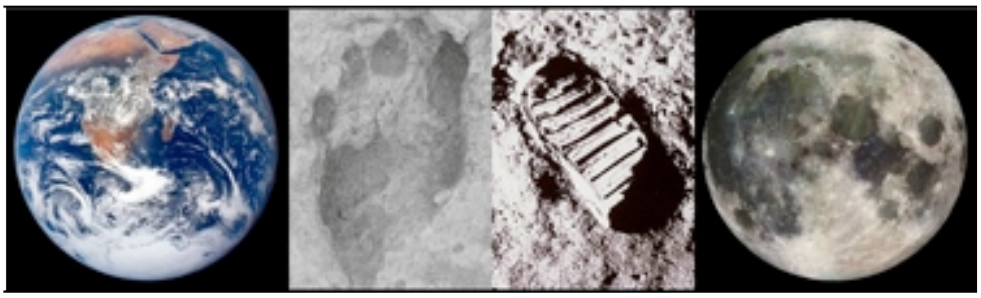
Here are three good webpages about powdering metals with excellent illustrations:

http://en.wikisource.org/wiki/Advanced_Automation_for_Space_Missions/Appendix_4C

http://www.mpif.org/apmi/doc4.htm

http://en.wikipedia.org/wiki/Powder_metallurgy DDz

From Africa to the Moon, the Human Epic, told in footprints, Continues to the Stars!



Our Goal is Communities on the Moon involving large scale industrialization and private enterprise.

The Moon Society Journal Section (pages 9-12) **About the Moon Society**

From Moon Society President Ken Murphy

A Waxing 21st Century Moon: Introducing our new Website: http://www.moonsociety.org

Welcome to The Moon Society's upgraded website! Or at least our new home page, more to follow. After some phenomenal work from our web team, James, Scotty, Rose & Mike, we've got a new website design to better work with the myriad ways that people now access the World Wide web.

This home page is but a start. We've also been quietly working on securing our financial position, including an audit of our finances. We've been putting together theme issues of Moon Miners' Manifesto that we'll soon be releasing for e-readers. We've been putting together "Lunar Laboratory" STEM exercises that bring a Moon theme to science projects. We're revisiting our marketing materials to update them and make them more appealing. Our ISDC tracks are attracting attention by focusing on near-future aspects of our Moon like the Cislunar Econosphere and Lunar Lava Tubes.

And we've got some science projects we're working on, like a Lava Tube Field Exercise to test communications architectures for robotic explorers* that will be ramping up subsequent to this year's ISDC track. A longer term science project is the use of a Solar Sail* to provided communications with Lunar polar locations.

*Relevant links: http://www.moonsociety.org/competitions/engineering/

Leadership of The Moon Society also continues to be active in Lunar Outreach & Education, not just through the ISDC, but also in their communities and in publications. Educating the citizenry of Planet Earth about the value and uses of our Moon for the benefit of us all is one of the key ways that The Moon Society can pave the way for humans living and working on the Moon.

In the near future we will be launching a membership development campaign. A key issue faced by all space advocacy groups is the ongoing aging of our membership bases. While youngsters are happy to "Like," or "Share" or "+1," or "Thumbs Up," this does not translate into membership. We need to change this.

If you know someone who is interested in the Moon, make them a member. Trying to think of a gift for someone? Give them a Moon Society membership. Do you know a bright youngster with the potential to make a difference, point them to our new website.

It is our membership that makes things happen. Let's grow that membership, so that we can achieve greater things. Ken Murphy

Early Report on our Lunar Lava Tube Track at ISDC 2013 in San Diego

Th. May 23, 2013: **Lunar Lava Tube Exploration and Analog Workshop "Lava Tubes Earth, Moon and Beyond"**

The Challenges of Earth Lunar and Mars Lava Tube Exploration push existing capabilities and are worth doing, as JFK said, "not because they are easy but because they are hard."

The presentations of this Lava Tube Workshop include discussions on:

- Planetary Science • Astrobiology • Planetary Protection and Cave Protection
- Engineering Architecture and Design • Terrestrial Research and Commercial On-Ramps
- Instrumentation and In situ Data Processing, Analysis and Artificial Intelligence
- Analog and Precursor Activities • Education and Public Outreach

This track represents a community of interest involving a number of organizations that share research ambitions. Recent constraints on Federal funding have encouraged us to blend our traditional mode of personal presentations with virtual presentations and the use of a simultaneous "webinar" format.

We plan to archive these presentations on both the National Space Society and Moon Society web-sites so that are a resource for this community.

Moon Society 2013 Elections – Ballot

From the Moon Society Elections Secretary

Dear Moon Society member,

We are now conducting the annual election of officers and directors of the Moon Society. This election is being conducted by both email and paper mail ballots. You may vote either way. Your ballot must be received (email) or postmarked by August 1, 2012.

Two Officer positions of Vice-**President, Treasurer** and **Secretary** are up for election or re-election as usual in odd # years, for 2-year terms. In addition, the Officer position of Secretary, having been vacated by Peter Kokh is open for the remaining year of a 2-year term that ends in 2014 **Two Directors** will be elected or re-elected this year: all for 2-year terms

An electoral statement for each candidate is included at the end of the ballot [pages 10-11]. Please consult these statements for guidance in voting.

We have sent an email ballot out to all current members with valid email addresses on file. If you did not receive this ballot, it may mean that we do not have your current address or it was blocked by your spam filter.

If voting by email, please include your membership number, if you know it, and email your completed ballot to this email address: mailto: elections@moonsociety.org

If you vote by mail, send the paper Ballot to: **Moon Society, PO Box 940825 Plano, TX 75094-0825** Postmarked by August 1, 2011. Do not forget to sign the ballot and, if you can, enclose your membership number

OFFICERS VOTE

Vice-President (Vote for one) for 2-year term ending in 2015

[ ] Paul J, Banyai #1126 (member since August 22, 2003)

[ ] write in candidate _____

Secretary (Vote for one) for remaining year of term ending in 2014

[ ] James Gholston #929 (member since July 31, 2000) currently serving in this position

[ ] write in candidate _____

BOARD OF DIRECTORS VOTE (in order of seniority) **Two openings** for 2-year terms ending in 2015

[ ] Rosealie Dieteman # 1340 (member since October 19, 2004)

[ ] Phillip Crume #1623 (member since May 13, 2011)

[ ] write in candidate _____

Voter's Signature_____

Membership # (if known) _____

Email your ballot to elections@moonsociety.org or mail it to Moon Society, PO Box 940825 Plano, TX 75094-0825

Moon Society 2013 Elections – Candidate Statements

OFFICER POSITIONS

For Vice President: Paul J. Banyai #1126, 2 year term ending in 2015

It is time to enter the 21st Century. We need to keep up with the times in order to keep growing and improving. We need to become a single united social network representing the dreams and hopes of an age of true space colonization.

I have been a member of the Moon Society since 2001. While I was aware of the Artemis Society for several years before joining the Moon Society, I did not join it because it was already starting to look outdated and ineffective. When I originally noticed the statement about "Our **Virtual** Lunar City" my first thought was "how awesome that this group is so tech savvy that they have something like Everquest or Ultima Online." However, I soon learned that instead of a cutting edge representation of lunar colonization it was instead an 80's style text game with some basic instant chat included in it.

I joined both the Moon Society and the Mars Society a few months before graduating college with a bachelor degree in geology with a personal focus on space. I kept my membership in the Moon Society since it was more focused on what individuals can.

We need to expand our connection to lapsed/non-subscribed members and to new potential members. Our presence on Facebook is in fact almost double that of the Mars Society with over 2800 people familiar with us which makes me wonder why we have less than 200 active subscribed members out of at least 1600 enrolled members. Assuming that a quarter of our enrolled members are on Facebook we could have over 2000 potential new members. We need to give them an incentive to become paid members, to stay paid members, and to invite

(continued from previous page) their friends to become members. I would revitalize our social network pages with current Moon Society events and activities as well as teasers of membership benefits and how volunteers can help get us back to the Moon. I would also bring our internal communication system into the 21st Century and bring back the eye catching **wow** factor that the Moon Society can actually lead the way to lunar settlement.

Outside of online social networks there countless individuals who only show their interest in space by purchasing space related items i.e. books, magazines, DVDs, etc. For example we have "endorsed the Space Settlement Initiative as the most realistic and achievable method for encouraging private enterprise in outer space", yet there are countless people who are purchasing Virtual land deeds without any true forum for representing their interest in space colonization. These people are essentially stuck with the same archaic situation as our text-based Virtual Lunar city. There can be no Space Settlement without first real representation.

For Treasurer, Dana Carson #10, 2 year term ending in 2015

I'm a computer consultant dealing in web-based systems. Previously I worked for Westinghouse Aerospace building tools for the embedded systems developers. I've been a space enthusiast since Apollo and had served on the board of the Moon Society since its founding, until taking over the Treasurer position.

For Secretary, James Gholston #929, 2nd year of 2 year term ending in 2014

I first became involved with the effort that includes The Moon Society in early 1999. My membership number is one of the last assigned by Artemis Society International prior to the establishment of the Moon Society.

I served for three years (2006-2009) on the Moon Society board of directors and achieved my major objectives, including Lunarpedia, before stepping down to make room for newer members with fresh objectives. I have continued to regularly attend meetings of the management committee and board ever since.

I spent most of the first half of this year creating our new website with Rose Dieteman and Scotty Gammenthaler.

We have had a historical problem keeping the Secretary position filled, and I have accepted appointment to replace the outgoing secretary in the hope of avoiding a vacancy. As secretary I will primarily be concerned with providing minutes. As a member of the management committee I expect to focus on our long term financial stability in a dangerously uncertain monetary and economic environment.

For Director Phillip Crume # 1623, Current Chairman of the Board

There is nothing more powerful than an idea whose time has come. To become great, become part of a cause greater than yourself. The Moon Society is more than just a place where a bunch of like-minded individuals come together to do something, we're adding momentum to a cause that is far more important than our own lives. When considering the grand arc of human history, the most important transition points that stand out are the development of agriculture and the industrial revolution. Our entry into space is the next major transition for our species.

Most people join the Moon Society because they already understand this. The role that I wish to serve as a board member is to communicate this understanding to our society at large and to show people how they can be part of the process. We are lifting up our entire industrial system into space, we're going to need more than just rocket scientists. We're going to need to translate our existing industrial system for the space environment. It really is the province of amateurs. So join us! I ask for your vote.

For Director Jim Keravala #1677

"The longest journey begins with a single step". In that capsule of wisdom Lao-tzu articulated not only the human drive that for thousands of years has driven us relentlessly to venture beyond our horizon, but also the truth of how we should do it. Today, save for a few robotic craft with remote sensors, our horizon remains firmly at Low Earth Orbit. The urgency for taking the next step is mounting geometrically as population growth, energy, resource and fresh water utilization put Earth and its ecosystem under ever increasing demands. By reaching out to the bounty of the solar system and opening Earth's closed economic sphere, we secure the future of humanity. The next step to take beyond LEO is the Moon. It is our neighbor, our nearest port of call in the stormy oceans of the cosmos that will provide us with a foothold to the stars. I've dedicated my life's work to achieving that step and am proud to be part of the Moon Society helping all of us better share in that journey.

For Director Rosalie "Miros" Dieteman #1340

I became involved with the Moon Society in 2001, brought in by The Lunar Resources Company's SimsHost project. I headed the development of a new web site for the Moon Society, which went live in time for the 2013 International Space Development Conference. I plan to join outreach efforts to increase membership.

Chapters & Outposts

ORGANIZING "OUTPOSTS"

Bay Area Moon Society, CA Outpost – **South San Francisco Bay** – http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net Meeting the 1st Tuesday of the Month at Henry's home

Moon Society Milwaukee Outpost (MSMO) – **http://www.moonsociety.org/chapters/milwaukee/msmo_aboutus.htm**
Contact: Peter Kokh kokhmmm@aol.com – http://www.moonsociety.org/chapters/milwaukee/msmo_output.htm
May 11th Meeting Report: Peter previewed the Lava Tube Exhibit he is working on for ISDC in San Diego. We discussed some options for a summer field trip – a possible 2 hr cruise on the Dennis Sullivan Lake Schooner.

ORGANIZED CHAPTERS

Moon Society St. Louis Chapter - http://www.moonsociety.org/chapters/stlouis/
Contact: Robert Perry surfer_bob@charter.net – Meetings 3rd Wed monthly at Buder Branch Library, 4401 S. Hampton, in the basement conference room – Next meetings – **JUNE 19 – JULY 17**
May 15th Meeting Report: Present were David Heck, Karl Strassman, Mark Rhode, Dave Dietzler, Tom Kulmann, Rufus Anderson, Keith Wetzel and Bob Perry. Mark had purchased a DVD of documentaries about the Apollo program, "Moon Machines" and brought along his new projector. We use it, Karl's laptop and Bob's powered speakers to watch the "Saturn 5" segment. Recommended.

For the remainder of the meeting we discussed space in general and the moon in particular. PISCES (Pacific International Space Center for Exploration of Space), research labs at the University of Hawaii, is well established and growing and the Google Lunar X-Prize has several contestants. David is in communication with the people at Shackelton Energy and distributed a handout of some of the considerations that must be addressed. He proposed that we do some research, discuss them at our next meeting, and pass our recommendations on to them. Note that our meetings are now scheduled for the second Wednesday.

In emailings after the meeting Bob pointed out that two organizations briefly discussed at our meeting, Planetary Resources Incorporated and Deep Space Industries, both participated in Spacefest V over the Memorial Day weekend in Tuscon organized by Nova Space Art. Mike Mackowski, who was a member of The St. Louis Space Frontier / L5 Chapter decades back, he moved to Phoenix in the early 80's, attended the event and posted a report on nssphoenix.wordpress.com

Greater Fort Worth Space Chapter c/o Patricia Ferguson tricia3718@gmail.com

Clear Lake NSS/Moon Society Chapter (Houston) - http://www.moonsociety.org/chapters/houston/
Contact: Eric Bowen eric@streamlinerschedules.com – We will hold our next regular meeting in the conference room of the Bay Area Community Center in Clear Lake Park at 7:00 in the evening of Monday, JUN . Everyone welcome.

NSS/Moon Society Phoenix Chapter - http://nssphoenix.wordpress.com/ – c/o Mike Mackowski .
Meeting the **3rd Sats monthly at HSGP Community Center, Mesa** **Next meetings – JUN 15 – JUL 20 – AUG 21**

May 15th Meeting

May 15th Meeting Report: The turnout for the May meeting was very good. I counted over twenty. They all enjoyed the video and had a good time before and after socializing. They clapped and laughed and was very engaged in what the seven people in the video was saying and doing. All in all, it was a fine meeting. – MM

Mike's report on **Spacefest** in Tucson over the Memorial Day Weekend: http://nssphoenix.wordpress.com

Our **next meeting** will be Saturday, **June 22** at the Humanist Community Center, 627 W. Rio Salado Parkway, Mesa, AZ. **Note:** the meeting will s**tart at noon** rather than the usual 11 am. Our guest presenters will be the ASU **Lunabotics** Team who recently participated in a lunar resource competition with their robotic surface excavator.

GREAT BROWSING LINKS

SPACE STATIONS + COMMERCIAL SPACE

NASA seeks coders to help Robonaut 2 on ISS "see better" First flight 4-29-2014
http://www.nbcnews.com/id/51407519/ns/technology_and_science-space/#.UV924L-0Lww
http://moonandback.com/2013/01/13/**ride-along-view-of-spacex-grasshopper/**
http://www.space.com/73-**orion-capsule**
http://arstechnica.com/science/2013/04/how-**nasa-brought-the-monstrous-f-1-moon-rocket-back-to-life/**
http://www.space.com/20869-**spaceshiptwo-first-rocket-test-photos**.html **- 1st flight 4-29-2014**
http://www.space.com/20412-**soyuz-one-day-spaceflight-infographic.html**

MOON

http://www.space.com/20865-**soviet-moon-rover-lunokhod-laser**.html
http://www.space.com/21306-**moon-craters-asteroid-impacts**.html
http://www.space.com/21197-**moon-crash-meteor-impact-explosion**.html

MARS

http://www.space.com/20512-**mars-comet-crash-2014-odds.**html
http://www.space.com/20669-**mars-rover-curiosity-top-discoveries**.html
http://www.space.com/21064-**nasa-donated-spy-telescope-mars.**html
http://www.space.com/21034-**mars-space-telescope-spy-satellite-infographic**.html
http://www.space.com/21295-**coldest-temperature-bacteria-found-in-permafrost**.html
http://www.space.com/20680-**mars-one-colony-astronaut-selection**.html
http://www.space.com/20758-**private-mars-one-colony-astronauts**.html
http://www.space.com/20757-**private-mars-mission-night-vision**.html
http://www.space.com/21270-**private-mars-colony-scam-china**.html
http://www.space.com/20775-**mars-life-search-manned-missions**.html
http://www.space.com/20500-**mars-moon-mission-student-challenge**.html

ASTEROIDS + COMETS

http://www.space.com/21181-**bring-some-asteroid-to-earth-osiris-rex-2023**-video.html
http://www.space.com/20636-**private-asteroid-space-telescope**-b612.html
http://www.space.com/20439-**moon-asteroid-vesta-violent-history.**html
http://www.spacedaily.com/reports/**Beer_Cans_For_Deep_Space**_999.html
http://www.spacedaily.com/reports/**How_to_Target_an_Asteroid**_999.html
http://timesofindia.indiatimes.com/home/science/**An-Indian-to-plan-collision-course-to-catch-asteroid**/articleshow/19607189.cms
http://www.spacedaily.com/reports/**How_to_Target_an_Asteroid**_999.html
www.esa.int/Our_Activities/Space_Science/**Herschel/Herschel_links_Jupiter_s_water_to_comet_impact**
http://phys.org/news/2013-04-**herschel-links-jupiter-comet-impact**.html
Planetary Resources Co: http://www.youtube.com/watch?v=h5fwjsOOGm4

OTHER PLANETS + MOONS

http://www.space.com/20426-**mercury-meteorite-discovery-messenger.**html
http://www.spacedaily.com/reports/**Where_are_the_Best_Windows_Into_Europas_Interior**_999.html
http://www.spacedaily.com/reports/**NASA_Team_Investigates_Complex_Chemistry_At_Titan**_999.html
http://www.space.com/20706-**saturn-moon-titan-methane-lakes**.html
http://www.spacedaily.com/reports/**Blame_it_on_the_Rain_from_Saturns_Rings**_999.html
http://www.space.com/20727-**iapetus-moon**.html
http://www.space.com/19183-**titan-saturn-largest-moon-infographic**.html
http://www.space.com/21291-**titan-topographic-map**.html

ASTRONOMY + ASTROBIOTICS

http://www.space.com/20513-**sun-heartbeat-cycles.**html
http://www.space.com/20566-**exoplanet-debate-astrobiology-nasa-part-2.**html
http://www.space.com/21318-**mars-size-exoplanets-brown-dwarfs**.html
http://weburbanist.com/2012/07/08/**watch-out-10-eerie-abandoned-observatories/**
www.huffingtonpost.com/2013/04/12/**green-nebula-video-eso-milky-way-ghostly-gas-cloud**_n_3063665.html

1. http://www.space.com/20495-**exoplanet-debate-astrobiology-nasa**.html
2. http://www.space.com/20566-**exoplanet-debate-astrobiology-nasa-part**-2.html
3. http://www.space.com/20627-**alien-planet-debate-habitability**.html

For past articles, Visit **http://www.moonsociety.org/publications/mmm_classics/ or /mmm_themes/**

GREAT SPACE VIDEOS

http://www.space.com/21009-**buzz-aldrin-mars-exploration-video**.html
http://www.space.com/21195-**56-000-mph-space-rock-hits-moon-explosion-seen-video**.html
http://www.space.com/20616-**astronaut-space-life-video-guide**.html –by Chris Hatfield
http://www.youtube.com/watch?v=KaOC9danxNo&feature=youtube_gdata_player Chris Hatfield sings!
http://www.space.com/21365-**will-radiation-kill-mars-astronauts-video**.html In the news!
http://www.space.com/20250-**curiosity-finds-ancient-mars-habitable-opportunity-not-so-much-video**.html
ARKYD The Crowd-funded Space Telescope http://www.youtube.com/watch?v=RupT5wmucc0

THE book WORM

"Men Into Space"
By John Fredricksen
Publisher: BearManor Media
(March 25, 2013) 328 pages
Available for Kindle from Amazon.com
Reviewer: Ken Murphy

Television has not always been a desolate wasteland devoid of quality and realistic depictions of space exploration. Over the years there have been shows like Moonbase 3, Star Cops, Space Island One and Jupiter Moon, but the original science-fact TV series would have to be "Men into Space", which ran for one year from 1959 to 1960. In that time frame it followed more fantastical shows like Tom Corbett, Space Cadet and Rocky Jones, Space Ranger, and so entered a culture sensitized to ray guns and atomic rockets. At the same time, television was still defining itself as a medium, adapting elements of film and theatre into the new medium while evolving its own identity, and reflected in the staging and dialogue.

The author's preface notes the intensely personal nature of the book, having watched the series obsessively as a child, and seeing therein that the future was not some distant future of galactic space opera, but rather something that was happening in the present! The introductory essay "Space was New/The Future was Now" develops the context of where space exploration stood at the time, but also the development of a scientifically rigorous show and the challenges faced therein.

Next up is a summary of the cast and crew, starting with William Lundigan, the only individual to appear in every episode of "Men into Space", and noting artist Chesley Bonestell's work with the show. Then there follows short summaries of each of the episodes of the series, followed by an interview with Bill Lundigan's daughter about her life as the daughter of a TV astronaut, a short appendix of product tie-ins, endnotes to the first essay, and a name index.

What quickly becomes evident in reading through the episode synopses is that the show truly is "more science than fiction". All of the usual tropes such as ray guns, interstellar travel and aliens are all jettisoned. Drama comes from the interaction between the characters, human failings, and technological hiccups. Sometimes it works, other times it doesn't.

DVDs of the series are available on the internet, but the episodes are also all available on YouTube. Watching them today in the context of constant visual motion on the TV screen, it is evident that they would be hard pressed to find a wide audience today. In some respects, reading the summaries was more enjoyable than watching the old clips. Nevertheless, one often hears a yearning for realistic sci-fi, and there is likely an audience for an updated remake of something like "Men into Space" showing teams visiting the Moon, asteroids, and Mars, just as they did over 50 years ago.

A solid reference to a unique show, and something likely to be used in future research on space in popular culture, the book "Men into Space" (by Fredriksen, not the Murray Leinster novelization) gets a solid three-quarter Moon. **KM**

The Moon Society moonsociety.org

Moonscapes Fiction

Marshall Mike Moondust and the Sinister Selenian Subterfuge

[MMM Fiction by George von Mond]

Chapter IX: We'll have to wait until the next issue, MMM #267, August, for this. So hang on!

THE THREE ZOMBIE APOLLO MISSIONS

The Cancelled Apollo Missions: 18, 19, 20

http://en.wikipedia.org/wiki/Canceled_Apollo_missions

http://news.discovery.com/space/the-lost-apollo-missions-110902.htm

By Peter Kokh – Quotes from sources above

"The real story of the lost missions of Apollo flights 18, 19, and 20, is a sad blank chapter in American space history. It has eerie parallels with the predicament NASA is now facing.

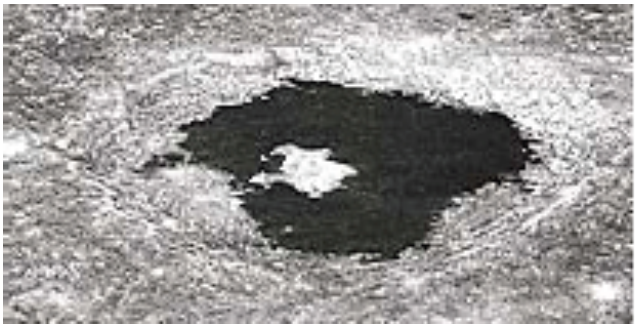
http://news.discovery.com/space/private-spaceflight/**human-spaceflight-cost-politics-priorities**-greg-fish-110831.htm

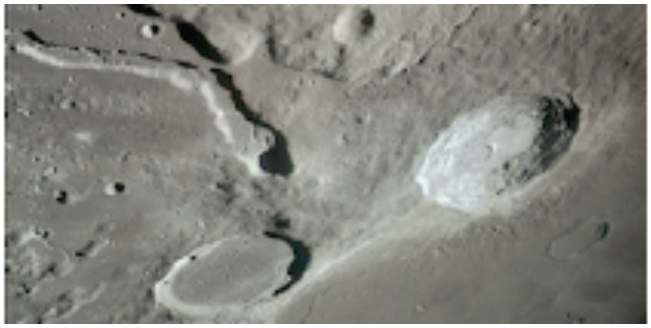
"If the Apollo 18–20 flights were realized, school kids today could be looking at stunning photographs taken from the mountain-rimmed floors of the young impact craters Copernicus or Tycho, or the terrain on the far side of the Moon, or the frozen volcanic lava flows from billions of years ago.

"The tumultuous political climate of the early 1970s pulled these aspirations down to Earth like the tug of gravity. The early 1970s turmoil was fueled by the Vietnam War, soaring inflation, and social upheaval. The counterculture movement had no love for science, which was seen as being at the root of environmental damage. Our country had lost its will and its vision to boldly go deeper into space." "There was also a "less than Right Stuff" fear of losing an Apollo crew. The Apollo 13 mishap was a very close call. The Apollo flights were the space age equivalent of seat-of-pants barnstorming. http://nssdc.gsfc.nasa.gov/planetary/lunar/ap13acc.html

"A fatal accident seemed statistically likely. And, the consequences could be that the nation would lose its will to hurtle more humans deeper into space." (To the contrary, the deadly Challenger and Columbia Space Shuttle accidents actually spurred more public support for space travel.) The timidity of avoiding increasingly risky moon missions is antithetical to the core American value of conquering the unknown frontier.

"Following recommendations of a 1969 presidential task force, Nixon directed NASA to stop building the Saturn V's and instead build the Space Shuttle,the first leg of an as yet realized space transportation infrastructure. **Possible landing sites** for the three cancelled missions were the young and large impact craters Copernicus, Gassendi and Tycho. Their craggy central peaks were thrust upward at the time of impacts, bringing material from deep within the lunar crust to the surface .Astronaut-geologist Harrison Schmitt lobbied for the very prominent unique lava-flooded **crater Tsiolkovsky on the Moon's far side**. (below left.)

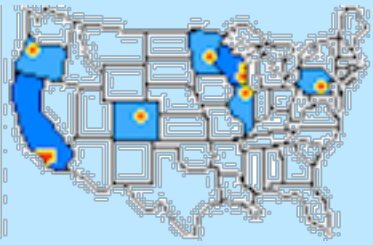




Another site was **Schroeter's Valley (above, right)**, a deep, winding channel, hundreds of miles long, with a smaller inner channel that meanders just as slow rivers do on Earth. It is known to be rich in mineral resources.

Also proposed, and also in this photo, is t**he crater Aristarchus**, the brightest spot on the Moon's nearside. Aristarchus is the brighter of the two large craters below the head of Schroeter's Valley in this photo. Its flat-floored (lava sheet filled) twin is Herodotus. "Today, instead all I can do is wistfully look at the dramatic NASA Lunar Reconnaissance Orbiter photos of the craggy central peak in the crater Tycho. I can only imagine looking at a photo of an Apollo astronaut standing with that towering peak behind him. My imaginary photo fades into the shadows of a lost frontier spirit." ####

NSS Chapters that share Moon Miners' Manifesto



Space Chapter HUB Webiste: http://nsschapters.org/hub/
Feature Page: Project Menus Unlimited http://nsschapters.org/hub/projects.htm

WISCONSIN

MLRS – Milwaukee Lunar Reclamation Society

PO Box 2101, Milwaukee, WI 53201 – www.moonsociety.org/chapters/milwaukee/

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

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Meeting place changes for some dates: For some dates this year only, our regular meeting place (Mayfair Mall Garden Suites East G110) will be unavailable. So on October 12 and November 9 we will meet down the hall in room **G150.** This is because of a temporary problem, and will not be the case in following years.

√ At the May 11th meeting, we discussed options for a summer field trip. It has been very hard to find a weekend when most of us can get together during recent summers. A 2 hr Lake Cruise is one option under consideration.

WISCONSIN

SSS – Sheboygan Space Society

728 Center St. Kiel, WI 54042-1034 – www.sheboyganspacesociety.org

c/o Will Foerster 920-894-1344 (h) astrowill@frontier.com
SSS Sec./Tres. c/o B.Pat Knier dcnpatknier@gmail.org
DUES: "SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020
Meetings are at The Stoelting House, 309 Indian Hill, Kiel WI 53042 - 3rd Thurs even # months
NEXT MEETINGS: JUN 20 - AUG 15 - OCT 17 - DEC 14 (SAT in Milwaukee)

CALIFORNIA

SSDS – San Diego Space Society

8690 Aero Drive, Suite 115, #77, San Diego, CA 92123 – http://sandiegospace.org

The chapter has just concluded a very successful **International Space Development Conference**, held at the La Jolla Hyatt Regency, San Diego, California, May 23-28, 2013. The theme was Global Collaboration in the 21st Century. MMM Congratulates San Diego Space for this achievement.

This came on the heels of hosting San Diego's 2nd S**paceUp Unconference**. The first SpaceUp (anywhere, ever) was held here in 2010.

Visit http://sandiegospace.org/projects/ to check out some of the chapter's other ambitious projects: **KickSat** and **Project Pogo**, both pursued by regular "**Project Build**" sessions.

CALIFORNIA

OASIS: Organization for the Advancement of Space Industrializtion & Settlement
Greater Los Angeles Chapter of the National Space Society
PO 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 www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd SAT monthly – JUN 15 – JUL 20 – AUG 17 – SEP 21

Sat Jun 15 3:00 pm – OASIS Board Meeting home of Bob Gounley and Paula Delfosse, 1738 La Paz Road, Altadena

Sat Jun 22 3:30 pm – **OASIS Lecture Series:** The **ATHLETE** (**A**ll **T**errain **H**ex-**L**imbed **E**xtra-**T**errestrial **E**xplorer) Rover, Free, Long Beach Public Library, El Dorado Park Branch, 2900 Studebaker Road, Long Beach
By Matthew Frost, JPL ATHLETE Project Chief Engineer and Task Manager.

COLORADO

DSS: Denver Space Society fka Front Range L5
1 Cherry Hills Farm Drive, Englewood, CO 80133

Eric Boethin 303-781-0800 eric@boethin.com – **Monthly Meetings 6:00 PM on 1at Thursdays**
Englewood Public Library, Englewood, CO 80110 – 1000 Englewood Parkway, First Floor Civic Center
NEXT MEETINGS: JUN 6 – JUL ? – AUG 1 – SEP 5 – OCT 3 – NOV 7 – DEC 5

ILLINOIS

CSFL5: Chicago Space Frontier L5 – 610 West 47th Place, Chicago, IL 60609

In conjunction with the Illinois North Shore (Chicago North Suburban) chapter and NSS Chicago Society for Space Studies, we will hold our 2nd free public program on **Sunday, July 21**, on the 44th anniversary of the 1st Moon landing, "**What's Next for NASA**," at the **Winnetka Public Library**, 11:30 am -1:00 pm. 768 Oak St,

MINNESOTA

MSFS: Minnesota Space Frontier Society – http://www.mnsfs.org
c/o Dave Buth, 433 South 7th St. #1808, Minneapolis, MN 55415

OREGON

ORL5 – Oregon L5 Society – http://www.OregonL5.org
PO Box 86, Oregon City, OR 97045

(LBRT – Oregon Moonbase) moonbase@comcast.net

Meetings 3rd Sat. each month at 2 p.m. - Big Dog Coffee, 107 Molalla Avenue, Oregon City, Oregon
Regular Meeting 3 pm 3rd SAT monthly – JUN 15 – JUL 20 – AUG 17 – SEP 21

PENNSYLVANIA

NSS-PASA: NSS Philadelphia Area Space Alliance – 928 Clinton Street, Philadephia, PA, 19107

c/o Earl Bennett, Earlisat@verizon.net - 856/261-8032 (h), 215/698-2600 (w)

http://pasa01.tripod.com/ - http://phillypasa.blogspot.com

Meeting Locations and time: Our next meeting will be at the Liberty One location on **June 8th**. We meet on the 2nd floor in the Food Court, from 1-3 pm Look for the Table Flags that have finally arrived! (If Mitch sets them up).

Event notes: On May 4th we went to Trenton, New Jersey for Super Science Weekend at the New Jersey State Museum. Due to various times being understood by our members we arrived at about 10 a.m. and 11 a.m. and, for scheduling reasons, after 1 p.m. In spite of this, we had a great turn out. Dennis Pearson and Rich Bowers arrived first and held down the fort with nothing but a computer and some NASA material. Actually, that was a good start. Rich was canvassing out in front of the table and Dennis was using the displayed material, on screen, as part of his talking points. After bringing in more display material, and handouts, Earl set up shop with the Lunar Lava Tube and the Space Buckets. Thanks to NSS we had a number of giveaways that Mitch brought when he came in (on public transportation from Philadelphia).

The crowds where gzreat with a mix that was different from that of the Science Carnival: many more family groups with young children than at the Carnival. This was no problem however as the indoor location where we where gave children and parents a chance to do things near each other but that did not restrict them to exactly the same location. But, since we had displays for various ages, many did stay together to play and listen to our talks. The youngsters played with the Space Buckets (sometimes with there parents doing the instructing on what the buckets represented) and, with Mitch having set up on the other side of our space, the adults could listen to Mitch and watch the kids have fun too. Individuals also came up and asked us questions that they wanted to ask in person.

Some of them where about the large space structures they had seen on t.v., and, heard of from parents or on the web. The O'Neill Colonies where real eye openers to many of the young adults, and, the fact that most of it could be done using remote control and robots in coordination was an encouraging point for many. Explaining water on the Moon, and its' discovery by NASA, and the use of lava tubes as habitats (or for putting a nuclear power plant in) where explained to an enthusiastic audience. There was also a display about the use of the far side of the Moon for really large radio telescopes (the model is of a 100km sized low frequency antennae: the borders where labeled "Philadelphia", and, "Atlantic City").

I was able to discuss a number of points with a young women and some other science enthusiasts who loved the idea of living in space and where surprised that the U.S. had done a space station before: I referred them to "A House in Space" by Henry S.F. Cooper jr. This book is about the Sky Lab program with lots of pictures and good text. Speaking of pictures and text: Mitch had a great display with his various illustrated volumes and some stand alone pictures. Seeing the shots of astronauts on the Moon in the rovers, and, the plans for going back, closed the loop from the people of our generation, who saw the landings directly, to this group, two generations later, who could go.

This, and the Science Carnival, where great events and we will be back next year if invited. The invitation to the Science Carnival was managed by Mitch Gordon, while the Super Science event was handled by Dorothy Kurtz and Larry Pezzuto.

On May eleven we had our post event meeting and talked quite a bit on topics outside of space exploration. Since we have a group with diverse interests, and opinions on same, we do go on. Some of it was on the effect of the Boston bombings on local events: Mitch was to go to Astronomy Night in the University City section (specifically at the Drexel University telescope location). But when he approached the area he was blocked by a large police security presence that kept out people not living on campus. Well go again next year.

Mitch gave the first report and included the cool, if tiny, model he found on the Web: an Island 2 O'Neill Colony! This wonderful, delicate, creation was one of several available from a far eastern supplier that had an agent in England where Mitch purchased it. They have other designs, and, Mitch may contact them to make a larger version of this , or, a Bernal Sphere model as something that would be nearer term. He had the model at Super Science and made a great talking point and visual example you could hold. Go, Mitch! He also reported on the summer issue of Ad Astra with Mark Hopkins editorial starting it off, followed by the Bigelow Aerospace inflatable module that will go up "soon. See the issue/ visit the N.S.S. website. And then there is outreach: Mitch and Wallace will try to set up again in the Suburban Station Concourse in Philadelphia with the S.E.P.T.A. transport systems permission.

Larry was up next on the need to test the donation possibilities of Cherry Blossom. He and Mitch are going to try gifting us via the site and see what the result is. He also brought our various web presences and will work on bringing Mitch into Facebook contact with some of the Friends Larry has brought in. He noted that we have a link on the N.S.S. site but has seen no activity form that path.

Dotty brought the activities at the Smithsonian and other museums in with particular emphasis on the Buzz Aldrin book signing in June (the first): "Mission to Mars: My Vision for Space Exploration". On line readers should try to attend. Also: she reported that room 213 of the Institutes Air and Space building on the Mall will now be on "Time and Navigation".

Janice brought in Science for May 3rd for "Planets Galore" on some of the worlds, and the instruments we have, and will build, to explore them (Michelle and I have Science Digest which also discusses this in less detail. It basically has a summary and is more available).

Rich Bowers on our Super Science event and his pleasure at doing outreach, and, he reprised the crowd funded movie idea again, and, talked about "Women in the Moon" and its' availability through Net Flicks. The funding possibilities via Kickstarter that Rich has discussed are not just for small films: Director Zack Braff , has been in long running series and made main stream funded films, has gathered several million dollars for an "Indie" film he is making. Kickstarter is not the only possible source, but, you have to find the other, specialized area/ idea, sites.

Earl commented on this idea as a possible way of funding possible large displays that some of the event visitors thought would be neat. An S.P.S., O'Neill Colony, or Mass driver (functional if possible) could really motivate fence sitters to move to active membership. There would have to be follow though after this build up though. There is much more available, but, I will close with wishes for Hank Smith to be successful in his quest to finish up with Social Security soon, and for the future, that the talk of a real Mars mission, funded by private sources and to go in 2023, will happen. More in the August Moon Miners! – Submitted by Earl Bennett

Wonderful to watch and listen to!

A revised version of David Bowie's Space Oddity,
Recorded by Commander Chris Hadfield
On board the International Space Station.
Gone Viral - over 100 million hits!

Guitar and Vocals: Chris Hadfield
Music recorded on Earth – Published May 12, 2013 – Enjoy!
http://www.youtube.com/watch?v=KaOC9danxNo&feature=youtube_gdata_player

"It is those of us who are 'unrealistic' who will create the future."

"Always Bite off more than you (think you) can chew!"
You may be surprised! All of us have talents not yet realized!

Moon Miners' MANIFESTO
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