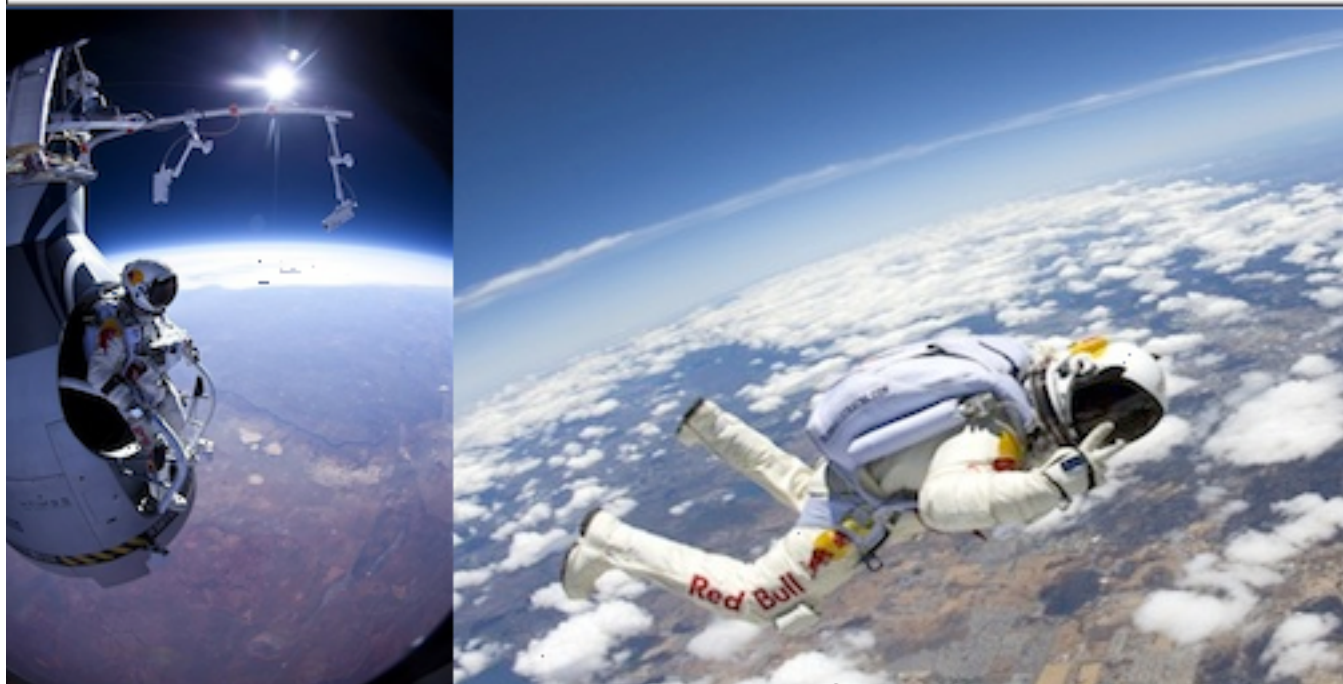


"Towards an Earth-Moon Economy – Developing Off-Planet Resources"

# Moon Miners' Manifesto

& The Moon Society Journal

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**McMurdo Station** is Antarctica's "metropolis." The US station shares a harbor (the world's southernmost) and airfield and power grid with New Zealand's Scott Station. International collaboration in Antarctica is a model to follow. McMurdo was established in 1956 and has grown by leaps and bounds, much of that growth unforeseen and inadequately planned.

The 2nd largest station is **Amundsen-Scott** at the South Pole. There will be some parallels on the Moon, but also many significant differences.

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## In Focus Is Competition Bad for Space Development?

Guest Editorial by Al Anzaldúa, Tucson Space Society

Western society tends to look fondly on competition. Perhaps this idea first sprang from the world of sport, where competitions like the Greek Olympics provided us with athletic ideals. Much later, Adam Smith's 1776 book, *The Wealth of Nations*, showed us how business competition can provide an "invisible hand," making products cheaper and companies more productive, thereby increasing the wealth and prosperity of all.

In Charles Darwin's 1859 book, *On the Origin of Species*, we see credit given to competition among organisms and "survival of the fittest" as explaining the evolution of species. Certainly today in the United States, competition is lauded in sport, business, politics, academics, and elsewhere.

But is competition always good? Does competition always bring benefit, or is something missing from our understanding of the role competition plays within the natural sciences and human society? Whether one is speaking of economics, evolution, politics, or space development, close examination shows that cooperation can also play a crucial role in the advancement of a given sector.\* And there are times when competition alone can be downright counterproductive or even destructive.

Our reasons for landing and walking on the Moon in 1969 are now an old story. Also old are the reasons given for our failure to advance into space significantly after Apollo. The United States was in high competition with the Soviet Union at the time. The moment we landed on the Moon, we won that competition, and therefore nothing more needed to be done on or with the Moon. In hindsight, it is even surprising that the United States even went on with Apollos 12 – 17.

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With a more thoughtful Apollo program, we could have laid down the first stage of Solar System infrastructure and human prosperity. By now we could be living and working in Space and reaping its rewards. But it didn't happen because we went to the Moon for the wrong reason. We went to the Moon with an expensive crash program based on competition instead of reason.

Are we making similar mistakes even today? China, which has already vowed to build a space station and put astronauts on the Moon, has just announced an ambitious five-year plan for space exploration. Some in the space advocacy camp are cheering this development thinking that more space competition with China will spur our leaders to give better funding to NASA. But if competition with China does indeed produce more funding for NASA, to what end would this funding be used? Will we again plant our flag somewhere and then feel we have "won" the competition and need do no more?

Perhaps competition to lay down permanent space infrastructure would make sense? But would cooperation with China on space make even more sense? Granted China at this stage would not likely accept any offer of cooperation on space. Also, there are deep fears in Washington that technological cooperation with China would allow that country to steal secrets with military applications. On the other hand, unbridled competition and increased rivalry with China could lead to a more dangerous world for all of us. For this reason alone, we should keep our collective eyes open for opportunities to cooperate -- even small ones. We should not forget that it was ping-pong games that thawed relations with China, in the first place!

Finally, space advocacy is another area where competition is sometimes counterproductive at least and downright destructive at worst. Within the space advocacy community separate groups chauvinistically push for apparently separate goals. Against a backdrop of scarce resources, one group sees lunar settlement as the most feasible goal and is convinced that lunar resources will help prevent further degradation of Earth's environment.

Another group sees Mars as the only logical place to establish another human civilization and insure the survival of humanity. A third group, believing that near-Earth asteroids (NEAs) represent both an existential threat and huge repository of natural resources, wants to make the deflection of NEAs into safe yet accessible orbits the highest priority.

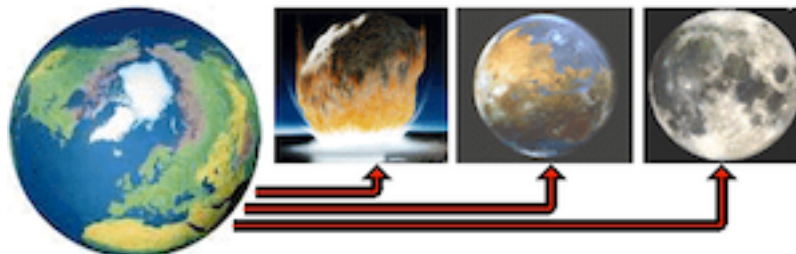
Unfortunately, chauvinistic competition among these three groups for government and public support does little to garner that support and instead tends to discredit the whole space advocacy movement. What are the public and our leaders to think if we cannot agree among ourselves as to space priorities? If instead there was more cooperation and collaboration among these three groups, what Peter Kokh has called the "Triway" (2) approach, these advocates might then be able to agree on an integrated vision of space development -- one which could garner support for all three goals simultaneously.

Now that private space companies like Orbital Sciences, Space X, Virgin Galactic, Bigelow Aerospace, and Stratolaunch are making serious efforts to bring down space launch costs and develop credible plans for various space activities and destinations, the time is ripe for the space advocacy community to get its act together and present a unified front for the benefit of all major space-development players. After all, in the long run, reaching all three goals will create infrastructure and synergies, which will make each goal more viable and sustainable. Triway collaboration could be carried out through joint position papers and by urging NASA to invest in R&D that will advance all three goals simultaneously, while it continues to facilitate private space development. Certainly the infighting and denigration of the other camp's priorities has to stop. Let us look for opportunities to collaborate instead. This would show the general public and our government leaders that we indeed have our act together and have ideas worthy of serious consideration -- and even funding.

(1) A good example of the crucial role cooperation plays in evolution is laid out in the 1986 book, *Micro-Cosmos*, by Lynn Margulis and Dorian Sagan. Dr. Margulis, building on earlier work by the Russian Konstantine Mereshchowsky, is responsible for the modern theory of symbiogenesis, which describes how symbiotic cooperation among life forms is crucial to evolution and even human existence.

(2) <http://www.moonsociety.org/presentations/pdf/Triway1.pdf>

Al Alzandua – Tucson Space Society.





## Space Precedents for an International Lunar Research Park

By Peter Kokh

Despite the Cold War rivalries between United States and the Former Soviet Union, and now the one-sided rivalry between the friendly International Space Station Partners and a suspicious China, International cooperation in space has a strong history. We will not try to provide a complete list. Examples will do.

### The Apollo Era

Several nations around the world helped by monitoring the paths of US spacecraft and relaying messages so that NASA had a global link. Jodrell Bank in the UK, Murchie in Western Australia. But perhaps the classic example was **Apollo-Soyuz in 1975** when a NASA Apollo and a Soviet Soyuz docked together, with the Americans speaking Russian and the Russians speaking English, a failsafe way (the only way) to avoid misunderstandings as each side would only use words native to the other. Another example was the setting of a world-wide standard for docking apparatus design so that crews of one nation could come to the assistance of those of any other nation in space. Unfortunately, China has not followed suite, perhaps paranoid about being boarded, an adolescent attitude.

[http://en.wikipedia.org/wiki/Apollo-Soyuz\\_Test\\_Project](http://en.wikipedia.org/wiki/Apollo-Soyuz_Test_Project)

### MIR and NASA's Shuttle-MIR program

[http://www.nasa.gov/mission\\_pages/shuttle-mir/](http://www.nasa.gov/mission_pages/shuttle-mir/) <http://spaceflight.nasa.gov/history/shuttle-mir/>

Mir was not the world's first space station, but it was the first to be long-lived. Here the shining example was the highly successful **"Mission to MIR" program**. We had the Space Shuttle, but nowhere for it to go. For several years, American and Russian astronauts worked together. Mission to Mir was very popular with US Space enthusiasts and the public. By all means get the IMAX video. Delightful! <http://www.imax.com/mission2mir/>

### The "I" In "ISS"

At first a NASA Program, the proposed US Space Station was on the verge of being shot down by Congress until Bill Clinton proposed that a joint station might be the only way to keep Russian scientists and Engineers productively busy in the wake of the collapse of the Soviet Union, rather than selling their services to the militaries of other nations. Adding the I to SS, convinced enough congress people to save the program. The Russian contributions to ISS, both in modules and in supply missions and periodic reboosting (to higher orbits) has been essential.

But the European Space Agency (ESA) joined the effort as did Canada (CSA) and Japan (JAXA). Canada and Japan added modules and/or other hardware. ESA and Japan contributed Freight modules. International crews man the station and work together.

**Note that not all nations participating in the International Space Station program are "spacefaring" in their own right**, at least not in the sense of having the capacity to send humans into space on their own vehicles. ESA, Canada, and Japan have relied on US or Russian crew transports. The lesson here is quite clear. Nations that are not spacefaring by themselves can certainly play a big role in any future International Lunar Research Park.

Brazil and India, both invited, have yet to accept a role in ISS, though three astronauts of Indian origin have been in space as well as one from Brazil. Astronauts from other nations can train either with NASA or Roscosmos.

### One ILRP core component is missing: Commercial contributions

Once Bigelow Aerospace's BA 330 inflatable modules are ready, we could see the first commercial contribution to ISS. That is an event that many of us in the space movement have pushed for over the years. Such a unit could be unstructured within and used as a free fall gym for the station crew. A structured one could be a sort of space hotel annex for VIP and other visitors. Adding berth space to allow expansion of the crew beyond 6 is also an option. The proposal for such an addition predates the launch of ISS. NASA itself thought of adding an inflatable TransHab unit to the proposed station. Congress nixed TransHab and NASA licensed the technology to Bigelow.

<http://www.ilcdover.com/Transhab/>

[http://farm1.static.flickr.com/195/512805504\\_5d3504e3db\\_o.jpg](http://farm1.static.flickr.com/195/512805504_5d3504e3db_o.jpg)

### ILRP Phase I on Hawaii Island

Already several nations are involved, US (NASA, State of Hawaii), Japan, Germany, Canada. Others are invited and most welcome. Corporations are involved as well (Boeing: a key member of the world's largest international research Park in Stratford, England, UK.) A commercial company could provide supplies and key services (waste management, warehousing, transportation, etc. as well as house VIPs and other guests.) Contractors could provide all the habitats and other structures. Corporations are very much involved in the Antarctic, demonstrating their value. This writer will not be convinced that ILRP Phase I on Hawaii is on the right track until contractors and other commercial concerns are involved.

NASA already relies on contractors for many things. While some designs originate within NASA, often enough they are just suggestions to guide contractors in putting together concrete proposals. PK

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## Antarctica as a Model for International Moon and Mars Outposts

By Peter Kokh

In many ways, a hundred years of human experience in Antarctica can be seen as a prelude to human exploration of the Moon and worlds beyond. And the cooperative spirit that pervades human activities at the bottom of our world is a good recommendation for following suite on the Moon. We will more thoroughly explore the Moon together, than as rivals. And that collaboration will be most essential in learning how to make practical use of lunar resources: the number one goal of the proposed International Lunar Research Park.

In Antarctica, many national stations are isolated from one another, but not all, and it is those exceptions we are interested in. See this map: [http://www.scar.org/information/Antarctica\\_stations\\_map.png](http://www.scar.org/information/Antarctica_stations_map.png)

The hub of activity in the continent is the 56 year old US **McMurdo Station** (100+ buildings, summer pop. 1,200+). Built on the bare volcanic rock of Hut Point Peninsula on Ross Island, it is the farthest south solid ground that is accessible by ship. **McMurdo** has a close neighbor just next door: New Zealand's **Scott Station**. They share an airport (Pegasus) and the power grid. **Scott** Station recently added three high power wind mills to create the southernmost wind farm in the world. The two stations undoubtedly share other resources and services, and they have been close partners in Antarctica from the start. The US supports McMurdo out of Christchurch, New Zealand.

<http://www.antarcticanz.govt.nz/image-galleries/category/12-windfarm>

**Concordia** Research Station, which opened in 2005, is a **research facility shared by France and Italy**, 3,233 m above sea level at a location called Dome C on the Antarctic Plateau. On the coast south of South Africa, in an ice-free rocky area known as the Schirmacher Oasis, the **Russian station Novalazrevskaya** and **India's Maitri station** are neighbors, sharing the Russian built airport. Elsewhere on the continent, there are several locations where different national stations are located close enough together to share resources and services, at least in emergency situations. This is especially true in the Antarctic Peninsula where many outposts are clustered.

Where possible and practical it makes sense to share infrastructure and services needed in common.

**ShareSense:** Logistics (airfield/spaceport); warehousing (fuel, supplies) Power grid and sources and power storage; construction equipment; hospital and other medical facilities; shared recreation and assembly space; final stage waste treatment facilities; tools and equipment used infrequently; unusual talent pool; "SuperPerk" facilities and retreats; manning joint expeditions. Such a plan and philosophy of sharing anything not needed by each full time makes economic sense.

If we can do this in Antarctica, why do so many space enthusiasts see our future in space of one of rivalries? In the light of our experience with the International Space Station and in Antarctica, that makes no sense. No country can afford to throw away money out of spite or rivalry. We are in Antarctica together. We can be on the Moon together! Ditto for Mars. Moreover, international facilities will more quickly lead to local autonomy and eventual home rule as international settlements grow. Nationalists, and there are still many in the US, are living in the past as a hundred years of collaboration in Antarctica demonstrates. Finally, international efforts are notably more resistant to government budget shrinkage or cancellation than purely national programs.

There are many things done in Antarctica which could be done much better: another story.



**Above: the extensive dormitory residential buildings at McMurdo:** Insulated but without visible protected pedestrian passageways between them. Built underground or at skywalk level, they would not interfere with surface vehicle access. This is the perfect place to demonstrate the merits of an interconnecting "**Middoors**" environment. McMurdo could be a much nicer place, but most people are there on temporary tours of duty and have enough perks to endure. And this "oversight" is understandable as the station has grown well beyond the vision of its first planners in the mid 1950s. Growth has been haphazard and often without effective planning. McMurdo's history is lesson to be learned by planners of an International Lunar Research Park. Warehousing and storage of discarded items got very bad, but has been mitigated after a GreenPeace expedition called the "shameful mess" to the world's attention. Now the station is much more sensitive to its environment. PK

**Virtual Tour – McMurdo Station, Antarctica** <http://astro.uchicago.edu/cara/vtour/mcmurdo/>

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## The Big Role of Sports in Antarctica (and on the Moon and Mars)

By Peter Kokh

One might think that “sports” on remote bases here on Earth as well as in space, might consist of chess, checkers, and computer gaming. Wrong! In Antarctica, at least at McMurdo Station, indoor and outdoor sports that task one’s body, not merely one’s brains, are a very big thing: essential in maintaining both morale and health.

<http://sports.espn.go.com/espn/thelife/news/story?id=5761185>

We all need time to unwind from our assigned work, whether that be purely mental, or mostly physical or a mix of both. And that unwinding is more complete if it involves the body as well as one’s mind. Now we can work-out in a gym, or engage in other solitary exercises. But “sports” and “sporting activities” that involve others serves a double purpose. We keep our bodies in shape, unwind from work-related stresses, and we build extra-professional relationships with other shipmates or station-mates. Thus planning for sports activities, while something that outpost designers may tend to overlook, is vitally important to the overall continued success of the outpost mission.

Some recreational sports are easier to support than others because they require less space and volume. Table Tennis or Ping Pong is an example. Wrestling is another. In Antarctica, with breathable air outside, one can engage in Nordic skiing, and other outdoor activities in the world’s freshest air, on snow in ice-free areas. Sports let us unwind from the stresses of the workday and help us bond with our crew mates. Of course, we can compete against our own previous performance records, but competitive sports have a strong value too – and we don’t mean watching others compete while we drink beer. They feed our need for competition, and they let us keep fit while we blow off some steam and frustrations.

McMurdo is not as isolated as the Moon or Mars, but is the only community of size on a continent as big as the U.S. and Mexico put together. The Shackleton-Scott station at the south pole is next in size and a thousand miles away. Here there are no “lawns to mow, children, pets or parents to care for.” So crew personnel have more time and energy on their hands and need other ways to channel all this unspent energy. Of course, one can pursue one’s hobbies or personal self-education in off hours. But that does not take care of the social needs and outlets. To avoid both boredom and a sense of being incomplete, inter-personal recreational outlets are essential.

McMurdo’s gem, the “Big Gym,” has a climbing wall, as well as courts for basketball, volleyball, soccer and dodgeball. The “Gerbil Gym,” offers cardio equipment such as treadmills, bikes, and weightlifting equipment.

Can we plan for something of the sort at a multi-national Lunar Research Park? Surely, larger “shared, common facilities” will be more economically feasible at such a facility than at individual isolated one-nation outposts. And that adds to the attractiveness of the ILRP concept. Not only do several nations get to share seldom used equipment, the spaceport, warehousing, etc. but besides their own individual limited recreation spaces, they will have access to a larger shared “Commons” with recreational space being one of its assets.

At an ILRP, not only will scientists and technicians be able to work with others in their field on larger joint projects, they will have access to larger joint labs, and talent pools. Such a “metro” base will be a much more attractive one, and not just for the many things that will make it more livable. It will also be much more attractive for individuals as well as national crews, because there will be much more going on, with new cross-enabled projects and experiments and explorations made possible by the “critical talent and facility mass” an International Lunar (or Martian) Research Park will allow. TV spectators on Earth could encourage by time-delayed cheering and applause.

Besides a McMurdo style big gym complex, an ILRP should be able to support a variety of experimental out-vac and lee-vac sport activities. A corner of a shielded but unpressurized warehouse would allow individuals and “teams” in less cumbersome pressure suits try their hand at a great variety of new types of sports tailored to the lower gravity as well as airless conditions. Most of these experiments will lead nowhere. But some team sports might be developed and matured in such conditions that are worth televising to Earth on the Sunday Afternoon “Wide Worlds of Sports.” In indoor gyms, new 1/6th g sport forms could be perfected as well. And why not dance forms as well? If they look good on TV, this kind of exo-sport and exo-dance experimentation could grow support and interest among Earthlubbers.

The mission of an ILRP is to develop and advance manufacturing and production techniques for building and manufacturing materials made out of moondust to use not only in space construction projects but also for expansion of habitat and settlement space on the Moon itself. Anything made on the Moon for use there, is a potential money-making export for similar or analogous uses in space. This mission is a big challenge, and a multi-national shared site approach seems to be the most promising way to realize such an outcome, with economic self-sufficiency as the goal. At that point, lunar settlement will grow quickly, free of massive economic support from Earth. In the process, significantly more exploration of the Moon will occur, and in greater depth and detail, than it would if we had no such economic “ISRU” local resource utilization plan as a driver.

We can see now how recreation and sports will help both develop and explore the Moon. Better yet, such ILRP experiments in sport and recreation activities will boost the “itinerary options” for lunar tourists from Earth. It all works together!

PK

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## In Processing Lunar Materials, the Devil is in the Details. Or The Case for an International Lunar Research Park

By Dave Dietzler

### Free Lunar Vacuum: Asset or Challenge?

Molten titanium can be poured and cast in a vacuum. Titanium can be electron beam welded in a vacuum and 3D electron beam sintering of titanium powders is done in a vacuum. Metals can be melted, atomized and sprayed in a vacuum to form powders for pressing and sintering without oxidizing. Nothing rusts in a vacuum and there is no moisture to contaminate materials like titanium or iron aluminides which can react with moisture and absorb hydrogen when casting. Processes like forging, rolling and extruding, cold or hot, can be done in a vacuum.

Experiments with regolith simulants have shown that at 1200°C. FeO will volatilize and at 1500 C. + SiO<sub>2</sub> and MgO will volatilize, in a vacuum of course. Samples of anorthite have been roasted at 2000 C. to drive off SiO<sub>2</sub> and the result is calcium aluminate which can make a refractory cement [1]. It seems likely then that if we can obtain rather pure anorthite on the Moon, we should be able to roast it at 1500 to 2000 C. to drive off SiO<sub>2</sub> and enrich CaO and Al<sub>2</sub>O<sub>3</sub> contents to make cement.

Now we encounter some devilish details—Can we find pure anorthite on the Moon or purify anorthositic highland regolith to make cement by simple roasting? How long and at what temperature do we roast it? Can we recover the silica for other uses by condensing it on a cold plate? What's the best and strongest cement formulation? How much energy will we need? If we work out a process on Earth with simulants in vacuum chambers, what will happen with real regolith in low gravity? The concept is simple enough and has some bench top laboratory support, but to really figure out how to make cement on the Moon we will need an International Lunar Research Park where intensive experiments are done.

Free vacuum offers same advantages, but it also creates problems. Vacuum welding of metal parts in contact is one problem. Aluminum is welded with a shield gas to prevent oxidation in air, a problem that won't exist in a vacuum, but molten aluminum in the weld will probably evaporate! Most molten metals will boil away so casting will not be so simple. Casting is not so simple to begin with. In principle it is but in practice it is not.

### Casting a simple Basalt part might be a devilish project

The first thing we have to get right is the chemical composition of the basalt. It's easy to say just shovel up some mare regolith, melt it in a solar furnace and pour it in a mold; maybe just a sand mold dug in the ground! There are low and high titanium mare "soils." What's best? We could adjust the sodium and potassium concentrations to effect the melting point of the basalt but then we have to have Na and K production. Backing up a little further, we have to shovel the stuff up and that means a rather complex machine just to do that job and the machine must work in extremes of temperature as well as survive temperature extremes when it isn't working, as during the super cold of lunar night. It has to endure the abrasive moon dust also. We have to have a power source for the machine; probably solar panels. This machine alone will set us back millions of dollars.

Bootstrapping is believed to be essential to the industrialization and colonization of the Moon and Mars, so we have to be able to replicate this machine on the Moon after metals production is demonstrated and becomes routine. The design must be robust and simple, and it's a lot easier to say that than design it.

So let's say we have a lunar digging machine that works and we have good mare regolith and control of its chemical composition. We have to melt it. The specific heat is 840 J/kg K. So if we want to make 100 kg. of cast basalt bricks and we are starting with a temperature of about 100 C. during the lunar day we have to raise this by about 1100 C. to melt it so we need 92.4 megajoules or about 25.7 kWhrs. of energy. If we use a solar furnace made from a sort of aluminized Mylar reflector shipped up to the Moon it would need an area of at least 25 square meters (270 sq ft) to melt all 100 kg, in an hour, but that assumes nearly 100% absorption of energy by the basalt.

Some energy will be reflected and some will radiate away. To make matters even more difficult, the reflector has to be aimed at the Sun and some kind of optical arrangement with a secondary mirror made of solid polished chromium perhaps is needed. Then we have to have a crucible to hold the basalt and this has to be sealed so the molten basalt doesn't just evaporate into the vacuum. It will need a pure silica window. The window could foul as windows often do in solar furnaces! My hunch is that an electric induction or microwave furnace and solar panels for power will work better. Next we have to pour the molten basalt, so the furnace has to be a ladle furnace along with the mechanical devices needed to move it over to the molds and pour the stuff. So the furnace, be it solar or electrical, is going to be a complex device too that sets us back millions of dollars when we consider R&D and rocket transport to the Moon.

Some engineers have suggested that the cooling basalt will stratify. This can be prevented by running the molten basalt through a homogenizing drum before pouring. So we need another piece of equipment. What about boil off in the vacuum? A fellow Moon Society member has informed me that basalt, at or near its melting point, has a very low vapor pressure and another pointed out that lava sheets have flowed on the Moon without boiling away.

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Even so, there is likely to be some boil off. That won't matter much in pouring simple bricks, tiles or slabs where the loss of a little basalt won't matter—there's plenty of it. If we want to cast complex parts or draw fibers we might have a problem.

Now the molds: simple trenches dug in the regolith might not work. Regolith is an excellent insulator and the only way the molten basalt is going to cool is from the exposed surface. Given the insulating properties of regolith we must ask, how long is this stuff going to take to solidify? And won't the product be rather crude? We will need imported iron molds that might sit on an iron slab heat sink with iron lids placed immediately after pouring to prevent evaporation. Heat will be radiated into the vacuum from the iron molds and the iron slab they sit on. We might even print up iron molds with magnetically harvested iron fines via the processes of electron beam sintering or selective laser sintering. But I am only guessing.

You can see how just this one simple job will involve numerous details. I am confident that those details can be worked out. We have seen far more complex things done. The best place to work those details out would be an actual Moon base where materials and manufacturing research was paramount. Vacuum and real regolith, not just simulants, will be abundant and full scale experiments could be done. This might be a second or third generation base. Learning how to isolate basic types of lunar soils is one of things that must come first.

I honestly do not see this ILRP being funded by private enterprise. Governments doing basic research on the Moon in partnership with private business seem like the financiers to me. But if governments are financing major in-orbit projects such as solar power arrays and giant platforms to hold many satellites, that will create incentives to develop the needed lunar processing and manufacturing technologies. Once the cost of lunar production facilities are amortized, lunar components will be much cheaper to ship to LEO and GEO than equivalent items made on Earth's surface. It takes vastly less fuel to ship "downhill" than "uphill" – gravitational hills, of course.

### **More Challenges: the promise of basalt fiber**

Basalt fiber is a very promising lunar material. Molten basalt is drawn through platinum bushings to produce fibers 9 to 13 microns thick. What about evaporation of the fibers? Could we draw thicker fibers and let some volatilize? This will be another project that the devilish details of will have to be worked out on the Moon. We might find that it is necessary to construct pressurized spaces to do this work in. How do we cool the fibers? On Earth a spray of water is used. That would require pressurized chambers where water and humidity are recaptured and re-used. What if there is a way to do it in the vacuum? What if we draw thick enough fibers so that some outer materials of the fiber can volatilize and the final fiber cool by radiation before we wind it on a spool?

Basalt fibers could be used to make "sand bags" which when filled with moondust would provide "removable shielding" in cases where down the line we may want to add to a habitat complex, or need to make repairs or replace external systems and connections. Basalt fiber fabric could make the decking over a space frame structure that could then be loaded with moondust to create shielded but unpressurized warehouses.

### **Casting Aluminum**

What about casting aluminum in plaster molds? Simple in principle. We rocket up some plaster, mix it with water produced on the Moon by volatiles mining and/or polar ice mining, make some molds and pour some molten aluminum. Then we just remove the solidified part, smash up the plaster, wet it and make a new one. Once again, the liquid metal will evaporate unless we have some kind of pressurized foundry on the Moon. And what kind of robots will we need to do the work or will humans do a better job? And how do we construct a foundry on the Moon? Solving one problem seems to raise additional ones. But it has been that way throughout the history of the industrial revolution.

### **The Point**

The point of this exercise is to make you think. The seemingly simplest jobs on Earth (which are in reality never that simple when everything is considered) will be more complex on the Moon. The bottom line to me is that the only way to work out the details of manufacturing on the Moon will be at a Moon base itself. We cannot foresee all the challenges.

But if we jump in over our heads we are doomed to fail. Meanwhile, we can continue to think about these things and pre-troubleshoot basic approaches. The actual doing is going to cost large sums of money and require lots of man hours of work. Much, but not all, of that labor can be done by teleoperation, reducing crew support costs. It all depends upon how important creating a space faring civilization is in the future. If the market for lunar materials (when shipping costs dwarf production costs) is great enough, it will happen. **DDz**

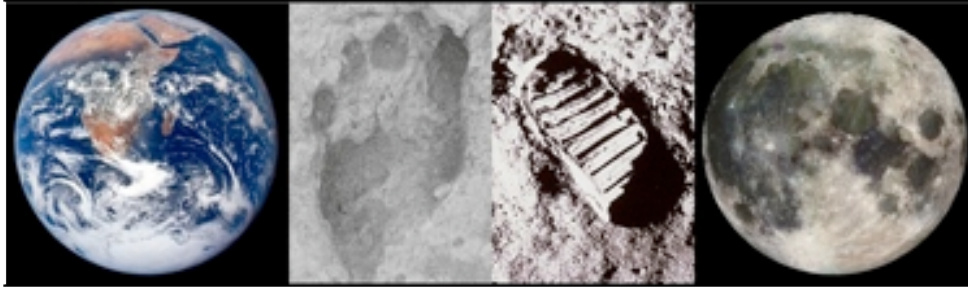
1] Rudolf Keller and David B. Stofesky of EMEC Consultants

" Selective Evaporation of Lunar Oxide Components" reported in SPACE MANUFACTURING 10 PATHWAYS TO THE HIGH FRONTIER Proceedings of the Twelfth SSI-Princeton Conference May 4-7, 1995; pg. 130.



**THE MOON SOCIETY – LUNAR FRONTIER SETTLEMENT – [WWW.MOONSOCIETY.ORG](http://WWW.MOONSOCIETY.ORG)**

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  
industrializa-  
tion and  
private  
enterprise.

**The Moon Society Journal Section (pages 9–12)**

**About the Moon Society**

**Objectives of the Moon Society include, but are not limited to:**

- **Creation** of a spacefaring civilization, which will establish communities on the Moon involving large-scale industrialization and private enterprise.
- **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 and utilizing the Moon.
- **Informing** the public on matters related to the Moon
- **Provision** of suitable recognition and honor to individuals and organizations that have contributed to the advancement of the exploration, research, development, and habitation of the Moon, as well as scientific and technological developments related thereto.

**Our Vision says it all – “Who We Are and What We Do” – [www.moonsociety.org/spreadtheword/whowhat.html](http://www.moonsociety.org/spreadtheword/whowhat.html)**

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, from all walks of life, 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, competitions & contests, workshops, ground level research and technology experiments, private entrepreneurial ventures, moonbase simulation exercises, tourist centers, and other means.

**Interested in having input?** Any member may ask to join the Leadership Committee and attend our Management Committee meetings held twice monthly. You may even express opinions. Decisions are often made by consensus, so this input has value. Write [president@moonsociety.org](mailto:president@moonsociety.org)

**From the desk of Moon Society President Ken Murphy**

**Join us at the 2012 International Space Development Conference**

May 24–28, 2012 Washington, DC – Th–M, Memorial Day Weekend

Grand Hyatt Washington, 1000 H Street NW, Washington, D.C., USA 20001

Tel: +1 202 582 1234 Fax: +1 202 637 4781 – ask for “DC 2012”

<http://grandwashington.hyatt.com/hyatt/hotels/index.jsp?null>

Basic Information: <https://www.nss.org/isdc/2012/>

Registration and Meals, Track Topics, Schedule, Unique Content, Contact Us

Registration form and rates: [https://www.nss.org/cgi-bin/register/tdregister?\\$Origin=ISDC12](https://www.nss.org/cgi-bin/register/tdregister?$Origin=ISDC12)

Circle the dates and keep them open – THE SOONER YOU REGISTER, THE LOWER THE RATES!

**The Moon Society is sponsoring the Moon Track on Sunday, May 27th  
Featuring a Major Presentation on the “Cis–Lunar EconoSphere”**

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/)

**Call for Nominees for Elections 2012 to Moon Society Officer & Board Openings  
Nominations and Candidate Statements due April 20th**

Previously emailed March 1st to **All Current Members** with current email addresses

From Moon Society Secretary Peter Kokh [secretary@moonsociety.org](mailto:secretary@moonsociety.org)

It is time once again to begin the annual Moon Society Elections process. Each year, we vote for two of our 4 officers, and in even # years, such as this one, we vote for 2 of our 5 directors, voting for the other 3 in odd# years. Respond to [secretary@moonsociety.org](mailto:secretary@moonsociety.org) if you wish to run for any position.

**Two (2) Moon Society offices are up for election or re-election.** They are President (inc. Ken Murphy who was elected last year to fill the second year of the term vacated by retiring president, Peter Kokh) and Secretary currently held by Peter Kokh, elected last year to fill the second year of a vacancy. Both may run for reelection.

**Three (3) Moon Society Board of Directors positions are open**, including one formerly held by Fred Hills who has retired. The second half of a 2-year term held by Ron Brooks who is also retiring is open as well. We need at least 2 new people. We have also been operating without a Chairman of the Board for some time,

Any director may volunteer. The Board is scheduled to convene once a quarter, (the 3rd Wednesday of the second month of every quarter (Feb, May, Aug, Nov) but may be convened for urgent business at any time. Board members also belong to the Management Committee (along with officers) and this Committee meets twice a month to take care of all matters not specifically reserved to the Board by the Society's ByLaws.

**Eligibility:** Anyone who has been a member of the Society for a full year as of August 1, 2012 eligible to run for a board seat or officer position. This year all members with a membership number of 1631 or lower are eligible for election. If you are interested but not sure of your eligibility, contact [secretary@moonsociety.org](mailto:secretary@moonsociety.org)

**Recommendations: (1)** Anyone unable to attend our meetings on a regular basis should not run for office. The Management Committee (officers and directors meeting together) meets online the 1st and 3rd Wednesday evenings monthly, 9–11 pm Eastern, 8–10 pm Central, 7–9 pm Mountain, 6–8 pm Pacific. Times will be earlier in Hawaii and Alaska, Times in the Eastern Hemisphere will be on the following Thursday: wee morning hours in Europe, morning in India, and early afternoon in Australia. Our meetings are held in a private and dedicated chat room, in the ASI–MOO environment.

**Recommendations: (2)** Anyone who has not previously served in a Moon Society leadership capacity and who wishes to run, is encouraged to join us in our current meetings, so that you will be up to speed by election day. To gain access to the Management Committee meetings, please send an email to [secretary@moonsociety.org](mailto:secretary@moonsociety.org) so that access (restricted) can be granted.

**At least 2 new persons are needed!** As we have no incumbent in two board positions, so we need at least two new candidate! Of course, anyone is welcome to run against any incumbent. In total there are 6 positions open. And if we have some contests this year, that will liven things up!

**To all members not running for office:** All members are welcome to give input on matters of any kind that pertain to Society goals and directions, projects and programs, the website or newsletter. Do feel free at any time to send an email to [secretary@moonsociety.org](mailto:secretary@moonsociety.org) sharing with us your concerns, opinions, and suggestions. We enjoy hearing from you, and are encouraged by your taking interest in this way.

Any incumbent eligible for reelection who chooses not to run again, should also so inform the secretary.

**Candidates and their statements will appear in the May issue, MMM #255.**

Accordingly, **nominations are due April 28 th along with a candidate statement** (250 words maximum) stating what you bring to the office in question, background, and so on. **As a rule, candidates nominate themselves.** Nominations by others should be sent to [secretary@moonsociety.org](mailto:secretary@moonsociety.org) early enough to be passed on to the member being nominated, giving him or her the option to accept or decline.

**Ballots will be tallied August 1st** and the election result published in the MMM #257 August issue, with seats taken at the August 1st meeting. TMS/PK

**Calling Younger Members! Do Toss Your Hat in the Ring for a Board Position!**

NOTE: It is necessary for any organization to continually reinvent or refresh itself to stay relevant. Do not think that if you are a younger newer member, that you have nothing to contribute. The Moon Society's number one need is to involve younger members in this continual refreshing. If you are in your 20s or 30s, do not think for a minute that you have nothing to contribute. Your viewpoint is absolutely vital to us. Take the plunge! Nominate yourself! Tell us what you are about! And in the meantime, join our bimonthly meetings on ASI–MOO and feel quite free to offer your 2 cents! If your membership # is 1631 or lower (you joined before August 1, 2011) you qualify. **KM**

### Growing Your Chapter by Peter Kokh <http://nsschapters.org/hub/growth.htm>

You may have the required critical numbers of members to qualify for official chapter status in your national organization. But do you have all the talent you need to undertake all the projects you envision? The answer to that is likely to be "No!"

#### Strive to plan every chapter activity so that it improves your recruiting capabilities.

Membership Forms – Whether you are speaking on a space topic to a non-chapter audience or at an outreach event behind your exhibit table, you should have membership forms on hand so that interested visitors can join your parent organization and your local chapter on the spot. Mailing a form after the event is not as effective. Put these forms where they can be seen, next to your "join our mailing list" signup sheet.

- A form that Moon Society Chapters can use to recruit members.
- pdf file: **Join\_2002.pdf** in the directory [nsschapters.org/hub/pdf/](http://nsschapters.org/hub/pdf/)
- This form has been contributed by Arthur P. Smith of the Long Island Space Society (NSS)
- new – A form that Moon Society Chapters can use to recruit members.  
pdf file: **moon-memflyer.pdf** in the directory [nsschapters.org/hub/pdf/](http://nsschapters.org/hub/pdf/) (contributed by Randall Severy)

**Chapter leaders. please share your ideas on growing your chapter**, things that have worked for you, and those that haven't. Working together, we can create a page to guide new chapters, and new leaders of old chapters.

#### Membership Registration forms on your chapter website

You want to provide the opportunity for the casual visitor to your website to join on the spot. Of course, you want visitors to come to your meetings and other events, but give them a chance to join while they are in the mood!

Even if your website does not have cgi-bin capacity to handle forms, you can have a page that visitors can download and print and mail in. This can be a simple web page or a formatted pdf file, or both.

**Recruiting Strategies** -- The best recruiting strategy is to reinvent everything you do as a chapter so it is designed to take advantage of every opportunity to convert interested fellow travelers into involved members. **Ideas:**

- Have a visitor signup sheet at every event. The act of signing reinforces the pro-space interest of the signer – and it gives you a name, address, and phone number of people to invite to events, to meetings.
- Include a space for email addresses. If your chapter discusses things by email, and not just at the meeting, you can plug in visitors to your information booth who leave their email address. But if you can find a way to put a term on this participation (start-stop dates) as a sort of "trial list membership," that may encourage them to take the plunge and join, if they are getting anything out of the e-exchange. It will also keep the list from becoming top-heavy with nonmembers.
- Have an actual Guest Book where those really impressed with your exhibit and its message can say so. Those who sign it will have self-selected themselves for your further courtship.
- Registration forms should be on hand and in view – always.
- A Chapter Scrapbook on hand and in view will help – Scrapbook Tips
- Ask or suggest that a lingering visitor join. Don't just watch them look at pictures, read the captions, and wait for them to pass on. It is quite common for someone to be really interested, but too shy to ask about joining. A visitor may have only a shallow curiosity, but you should assume that their interest is real and break the ice with an invitation. "We are looking for new members, people who really dig this stuff." At the same time, do not be pushy. Just open the door. Let them walk through it.
- Some incentive/gift for signing up on the spot is not a bad idea. This can be a book or magazine, a T-shirt, an item of chapter-produced merchandise, or simply a month or two extended membership the first year.
- Member Conversion (new member to renewed member.) Keep a record [buy a dedicated notebook and/or keep a Member Data file on your computer] of the dates people join, and of their anniversary dates. It is actually more important to make an effort to get a new member to renew that first time, than to look for new members. Don't ever take new members for granted! A good tactic is to "interview" each new member, find out what his or her special interests are, and what buttons work. Then check your notes through their first year and make sure that you are addressing those interests.
- Invitations: invite guest book signers to your annual holiday potluck or summer barbecue, if you have one, and be sure to have any new exhibits, books, newsletters, etc. on hand to engage their interests.
- Don't get discouraged. Finding a new member is a lot like finding a new significant other. As one girl put it, you have to kiss a lot of toads to find the handsome prince.

Go after former members of your national organization.

To be continued next issue

## March 2012

- **Chapters & Outposts Map (North America)** - [www.moonsociety.org/chapters/chapter\\_outpost\\_map.html](http://www.moonsociety.org/chapters/chapter_outpost_map.html)

### ORGANIZING "OUTPOSTS"

**Bay Area Moon Society, CA Outpost** – South San Francisco Bay – <http://www.moonsociety.org/chapters/bams/>

Contact: Henry Cates [hcate2@pacbell.net](mailto:hcate2@pacbell.net) Meeting the 1<sup>st</sup> Tuesday of the Month at Henry's home

**Moon Society Nashville Outpost** – Contact: Chuck Schlemm - [cschlemm@comcast.net](mailto:cschlemm@comcast.net)

**Moon Society Knoxville Outpost** – Contact: Jason Tuttle – [tuttlepc@gmail.com](mailto:tuttlepc@gmail.com)

**Rockford, IL Outpost** - Contact: Bryce Johnson – [lesausl@sbcglobal.net](mailto:lesausl@sbcglobal.net)

**Moon Society Milwaukee Outpost (MSMO)** – contact Peter Kokh – [kokhmmm@aol.com](mailto:kokhmmm@aol.com)

### ORGANIZED CHAPTERS

**Moon Society St. Louis Chapter** - <http://www.moonsociety.org/chapters/stlouis/>

Contact: Robert Perry [surfer\\_bob@charter.net](mailto:surfer_bob@charter.net) – Meetings 3rd Wed monthly at Buder Branch Library, 4401 S. Hampton, in the basement conference room – Next meetings – APR 18 – MAY 16

**Our March 17th meeting** was held at the Buder Branch library, Dave Dietzler, Mark Rode, Rufus Anderson and Bob Perry attending. Rufus brought his laptop, projector and speakers and showed a DVD of a recent Nova Science Now documentary. Link to PBS page: <http://www.pbs.org/wgbh/nova/space/can-we-make-it-to-mars.html>. The short answer is "no" but the long answer is "we're planning – it's not impossible and we really want to go". In the minutes before we adjourned, Bob handed out red and cyan anaglyph 3-D glasses and showed several JPGs

Due to lunar libration <http://en.wikipedia.org/wiki/Libration> it is possible to photograph the Moon from slightly different angles and use that for a 3D image. <http://www.flickrriver.com/photos/bufivla/3191152679/> That was apparently done by a land-bound Italian. I suspect that an Italian (ESA) astronaut took the following stunning photo of Atlantis docked with the ISS – <http://www.forumastronautico.it/index.php?topic=7241.670> Calvin J. Hamilton used Stardust probe comet flyby photos [http://www.solarviews.com/cap/comet/wild2\\_3D.htm](http://www.solarviews.com/cap/comet/wild2_3D.htm). You can find more at Google Images search <anaglyph NASA> Report by Bob Perry

**Moon Society Phoenix Chapter** - <http://www.msphx.org> – Contacts: Craig Porter [portercd@msn.com](mailto:portercd@msn.com) Meeting the 3rd Saturdays of the month at Denny's, 4403 South Rural Road, Tempe Next meetings – APR 21 – MAY 19

**March 17th Meeting Report:** Eight members and one guest. We began with introductions of new members and guests. New Member: Arthur Fesler-Butts introduced himself and explained that his wife also a new member was not there because of a prior commitment. The guest: Jeff Lu introduced himself.

Second item of business: "Lunar Drag Racing." We added another monitor for the TV Cameras mounted on the Cars, we had two new cars donated and the cars and the equipment will be ready for Easter Weekend.

3rd item of business: Moon Society Phoenix's version of "Stomp Rockets". Don decided that we should have Rocket Launchings for the kids. We had an enquiry about sponsoring a rocket launch for the kids at the Convention but the person requesting the support did not respond to our request for details on safety and equipment. It was decided to have a kids program where they built their own rockets out of paper, tape and glue, using an air pressure manifold, pressurized with a tire pump, to hold the air pressure until time to launch the rocket by pressing a firing switch. Drawings would be made available on the website for those that want pies for themselves.

Moon Society Members with panel assignments for the Convention include, Craig, Felix, Don and Patti. For panel assignments check [www.lepreco.org](http://www.lepreco.org).

Future business, a "Solar Power Demonstrator," a "Free Power Demonstrator" and working model of the "Space Based Solar Power" Demonstrator.

**Clear Lake NSS/Moon Society Chapter (Houston)** – <http://www.moonsociety.org/chapters/houston/>

Contact: Eric Bowen [eric@streamlinerschedules.com](mailto:eric@streamlinerschedules.com) – Meeting 7 pm in the conference room of the Bay Area Community Center at Clear Lake Park – Next Meeting: Monday, May 14th

**Monday, March 12th Meeting Report:** If you couldn't make it to the meeting tonight, we had a very engaging roundtable discussion. One of the topics brought up by Murray Clark was the possibility of coming up with a space-related project which could be offered to local schools for student involvement as both a community outreach and an incentive for students to discover more about space. Any ideas or suggestions along these lines will be welcome at our next meeting.

We also floated the idea of another social get-together to be held later this summer. While ideas and venues are still welcome, the general consensus was along the lines of a BBQ and shrimp boil to be held in Clear Lake Park, most probably on a weekend in late July or early August. If we have a member who would like to take the lead in putting the details together for such a meeting, contact me by return email. -- Eric Bowen

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/)



## GREAT BROWSING LINKS

### SPACE STATIONS + COMMERCIAL SPACE

<http://www.space.com/14638-chris-hadfield-canadian-commander-space-station.html>

<http://www.space.com/14706-virgin-galactic-spaceshiptwo-powered-flight.html>

Japan HTV upgrades to include crew capacity – <http://www.spaceflightnow.com/news/n1202/09jasa/>

NSS Space Settlement Library – <http://www.nss.org/settlement/>

### SPACE TECHNOLOGY

<http://www.space.com/14456-russia-soyuz-space-capsule-infographic.html>

<http://www.space.com/14430-nasa-16-biggest-space-technology-report.html>

<http://www.space.com/14643-air-force-space-nuclear-reactors-power-beaming.html>

<http://www.space.com/14910-robotic-refueling-mission-demonstration.html>

The promise of Common Propulsion Module rocket architectures

[http://www.satmagazine.com/cgi-bin/display\\_article.cgi?number=434853632](http://www.satmagazine.com/cgi-bin/display_article.cgi?number=434853632)

### EARTH

<http://www.space.com/14413-solar-storms-cleanup-falling-space-junk.html>

<http://www.space.com/9708-worst-space-debris-events-time.html>

<http://www.space.com/14466-earth-space-photos-blue-marble-suomi-npp.html>

<http://www.space.com/13049-6-biggest-spacecraft-falls-space.html>

NASA: <http://www.space.com/14445-solar-cycle-climate-change-warming.html>

<http://in.news.yahoo.com/supernova>

Impact of the loss of the night sky on nature and society – <http://www.thespacereview.com/article/2017/1>

How difficult & complex a problem Space Debris really is – <http://www.thespacereview.com/article/2020/1>

### MOON

New LRO photos show features that indicate recent geological activity

[http://www.nasa.gov/home/hqnews/2012/feb/HQ\\_12-055\\_LRO\\_Moon\\_Images.html](http://www.nasa.gov/home/hqnews/2012/feb/HQ_12-055_LRO_Moon_Images.html)

<http://www.space.com/14627-moon-quakes-lunar-activity.html>

The Cis-lunar Ecosphere, Part I, Part 2 by Ken Murphy

<http://www.thespacereview.com/article/2027/1> – <http://www.thespacereview.com/article/2033/1>

Rocket “monopropellant” fuel from Moondust – <http://www.wickmanspacecraft.com/lsp.html>

Using Lunar Soil for Propellants and Concrete

<http://www.wickmanspacecraft.com/moon1.html> – <http://www.wickmanspacecraft.com/lunar.html>

### MARS

<http://www.tech-stew.com/post/2012/03/24/Strange-cloud-formations-on-Mars-a-mystery.aspx>

New NASA Mars Next Generation Mission to replace cancelled missions

<http://www.space.com/14694-nasa-budget-mars-exploration.html>

Jet engines for use on Mars – <http://www.wickmanspacecraft.com/marsjet.html>

### ASTEROIDS, OTHER PLANETS AND MOONS

<http://www.space.com/13948-nasa-comet-harpoon.html>

<http://www.physorg.com/news/2011-12-nasa-europa.html>

<http://www.space.com/14552-antarctica-lake-vostok-europa-life-jupiter.html>

<http://www.space.com/12638-amazing-photos-titan-saturn-moon.html>

NASA Plans for possible landing on Europa – <http://www.physorg.com/news>

Messenger finds hints of water-ice at Mercury's Poles –

<http://www.bbc.co.uk/news/mobile/science-environment-17470151?SThisFB>

### ASTRONOMY + ASTROBIOLOGICS

<http://in.news.yahoo.com/supernova>

<http://www.space.com/14409-photos-nasa-ibex-mission-solar-system-edge.html>

<http://www.space.com/14487-strange-life-underwater-caves.html>

<http://www.ouramazingplanet.com/622-strangest-places-life-found.html>

<http://www.livescience.com/13377-extremophiles-world-weirdest-life.html>

<http://www.space.com/14652-space-soccer-balls-buckyballs-everest.html>

<http://www.space.com/14659-red-dwarf-stars-planets-habitable-zones.html>

<http://www.space.com/14667-nomad-alien-planets-wandering-galaxy.html>

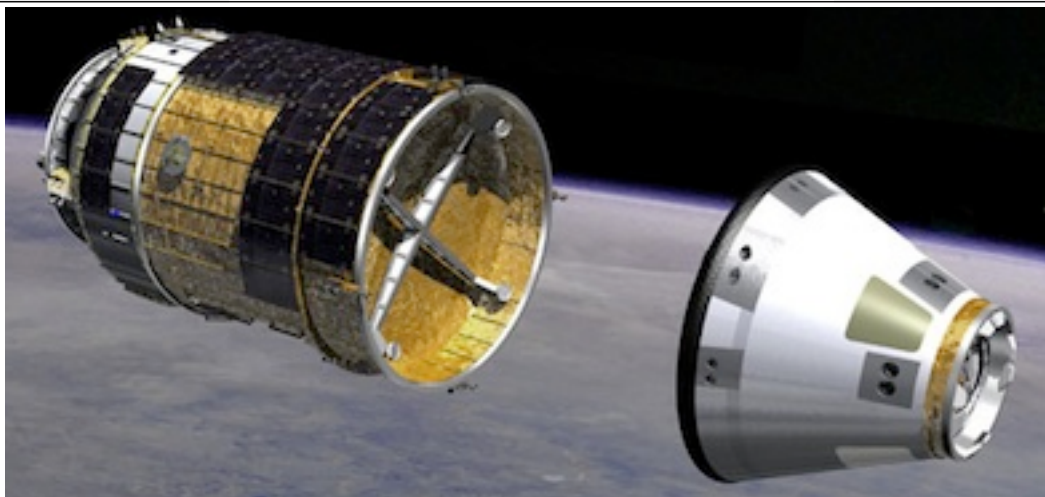
<http://www.space.com/14712-earthshine-moon-light-alien-life.html>

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/)

## GREAT SPACE VIDEOS

Get your own personal jet pack - <http://martinjetpack.com/video-gallery.aspx>  
<http://www.space.com/14908-moon-evolved-video-guided-tour.html> - 5 stars, a must watch  
Dexter, ISS robot, practices pumping gas - <http://www.youtube.com/watch?v=tMlmLh3t2FI>

## MMM PHOTO GALLERY



Japan to upgrade HTV to include crew Capacity - [www.spaceflightnow.com/news/n1202/09jasa/](http://www.spaceflightnow.com/news/n1202/09jasa/)



Exterior-interior of balloon-borne "Red Bull" capsule for highest, fastest sky dive:  
<http://www.space.com/14804-space-jump-supersonic-skydive-capsule.html>



100-foot-wide (30-m) dust devil and shadow on Mars, reaching 2,700 ft (880 m) high  
<http://www.space.com/14827-mars-twister-photo-dust-devil.html>

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/)

**DUBAI, UNITED ARAB EMIRATES:** First TransGlobal Bank of Dubai has mediated and will finance and insure an arrangement between Space Adventures and Roscosmos to pick two space tourists by lottery for the 2nd Space Adventures "Lunar Mission" to fly to and around the Moon, skimming close over the lunar farside. The drawing will be held when the amount collected in the lottery exceeds twice the expected cost of the mission, the profits to be split 40:40:20 between Space Adventures, Roscosmos, and First TransGlobal respectively. The winners must pass a physical, and training classes in Moscow. Two runner-ups will be picked in case either or both winners fail the physical or training exercises. The bank will underwrite the insurance policies covering all parties. The earliest such a flight might be flown is 2017. **AFD**

**QUITO, ECUADOR:** Immense "Sargasso Matt" floating "continent" discovered hidden in the "doldrums vortex" below Jupiter's at least centuries-old "Giant Red Spot."




The discovery was made by a student at [Universidad Tecnológica Equinoccial](http://www.UTEquinoccial.edu) in Quito - from readings taken at the new Ecuador National Radio Telescope on Sumaco mountain east of the capital. The radio telescope was designed to be especially sensitive to organic molecules, and able to peer below Jupiter's visible cloud tops composed of simple inorganic molecules. The readings were taken between October 27-31, 2011 when Jupiter was in opposition and at its closest to Earth in 12 years. By following the Red Spot as it crossed Jupiter's face and began to rotate out of view, readings showed that an oval patch opaque to the radio scan lay some 74 kilometers below the observed height of the Great Red Spot.

The announcement had been delayed until Ecuadorian astronomers, chemists and students could come up with an explanation that fit the readings and the mapping of the opaque area, also oval, like the Great Red Spot, but 2/3rds the width and length, and centered below it. This mass or "matt" of compounds lies at a critical level in the vortex root that is capped by the Giant Red Spot, even as the Atlantic Ocean's well-known Sargasso Sea formed by the doldrum currents. As a result floating masses or matts of seaweed in the North Atlantic are herded into this area.

Something similar must be happening below Jupiter's cloud tops, where organic compounds are herded by the winds into the Red Spot Vortex at an altitude where they can float without sinking. This Jovian Sargasso likely grows and diminishes along with the Red Spot above it. The University Team proposes a probe designed to hover and navigate below the Red Spot at the "Sargasso level," and equipped to do biochemical analysis over a long period as well as to estimate the thickness of this matter. Could this be a matt of biological or pre-biological molecules? How dense is the matt? If it is pre-biological scum, is it dense enough that if sown with primitive bacteria of various kinds, they could feed on it and turn it into a floating "living reef." Suddenly, Jupiter has become a much more interesting planet! **AFD**



 **Pasadena, CA (Caltech)** Did **Opportunity** find a fossil? This just released photo of a rock that is lying loose on terrain photographed by the Mars Exploration rover en route to its present station at Endeavor Crater looks suspiciously like a fossil trilobite. The photo has scientists scrambling for alternative explanations.



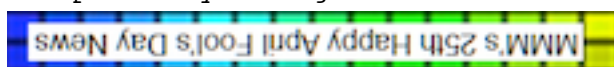
**Left:** curious rock spotted by Opportunity - **Right:** real trilobite fossil (Earth)

Trilobites were an extinct class of marine arthropods that flourished about 530-250 million years ago. The shape also bears some semblance to a King Crab shell.

A JPL spokesman cautioned that the idea that similar creatures might also have evolved on Mars is so wild that until scientists have the rock in their possession, and have either verified this wild hypothesis or found some other more likely explanation, the operating assumption must be that this fossil-resembling rock will be found to have another more "down to Mars" origin.

Easily the most romantic theory to date is that this rock is a "fossil-cast" made by by star-faring visitors to Earth at a time when no life forms higher than trilobites existed. The visitors then took the cast to Mars to leave as a calling card that future sapient Earthlings, should they evolve, would not find until they were sufficiently technologically advanced to be able to explore Mars and would then correctly infer that Earth had been visited hundreds of millions of years ago and that the visitors did not want any future Earthlings to know about this visit until they had matured to a interplanetary-faring level.

AFD



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## SETI Institute Teams with Zooniverse to Launch SETILive.org to Empower Citizen Scientists to Search for Extraterrestrial Intelligence

<http://www.seti.org/node/967>

<http://www.setilive.org>

<https://www.zooniverse.org/>

The SETI Institute, TED and Zooniverse launch SETI LIVE to empower "Citizen Scientists" to Search for Extraterrestrial Intelligence. The SCIENCE Channel Supports Initiative with Month-long Programming on Search for Extraterrestrial Life. As part of the TED Prize Wish made by renowned astronomer Jill Tarter, the TED Prize today launches SETI Live (setilive.org): a site where - for the first time - the public can view data being collected by radio telescope and collectively help search for intelligent life on other planets.

TED, the nonprofit dedicated to Ideas Worth Spreading, set up the TED Prize in 2005, born out of a vision by the world's leading entrepreneurs, innovators, and entertainers to turn ideas into action one Wish at a time.

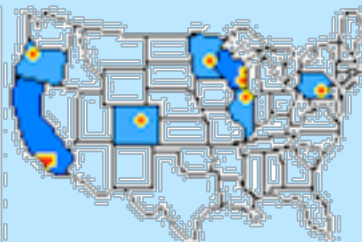
SETI Live was created in collaboration with Zooniverse team at **Chicago's Adler Planetarium** and is the latest development of Dr. Tarter's 2009 TED Prize wish, "to empower Earthlings everywhere to become active participants in the ultimate search for cosmic company."

The launch of SETI Live opens the door for anyone to help search for intelligent life on other planets. For the first time ever, **data being received by the Allen Telescope Array in Hat Creek, CA** will be made public so citizen scientists can scan it for potential signals. Compare to the former effort: <http://setiathome.berkeley.edu/>

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/)



## NSS Chapters that share Moon Miners' Manifesto



Space Chapter HUB Website: <http://nsschapters.org/hub/>

Feature Page: Project Menus Unlimited <http://nsschapters.org/hub/projects.htm>

### WISCONSIN



**MLRS - Milwaukee Lunar Reclamation Society**  
P.O. Box 2102, Milwaukee, WI 53201  
<http://www.moonsociety.org/chapters/milwaukee>  
<http://www.nss.org/chapters/milwaukee>

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

**2012 LRS OFFICERS & • BOARD Contact Information**

PRESIDENT / MMM EDITOR - • Peter Kokh NSS 414-342-0705 - [kokhmmm@aol.com](mailto:kokhmmm@aol.com)

VICE-PRESIDENT Doug Armstrong NSS (414) 273-1126

SECRETARY - • James Schroeter NSS (414) 333-3679 - [James\\_Schroeter@excite.com](mailto:James_Schroeter@excite.com)

TREASURER/Database - • Robert Bialecki (414) 372-9613 - [bobriverwest@yahoo.com](mailto:bobriverwest@yahoo.com)

✓ In a 2-day delayed observance of Yuri's Night, to be held at our regular 2nd Saturday afternoon meeting, 1-4 pm Saturday April 14th, Peter will give a presentation of what's next for space tourism for ordinary citizens and lottery winners: including the development of orbiting hotels and resorts from bare bones to extraordinary.

✓ The above will be the first of an ongoing series of presentations at every LRS meeting based on an article under construction for a future issue of Moon Miners' Manifesto, seeking member input. May 12th Tourism beyond LEO; June 9th Tourism beyond "loop the Moon" tours.

✓ Ideas for our annual summer "field trip" – Can't attend? Email your suggestion(s) to [kokhmmm@aol.com](mailto:kokhmmm@aol.com)

### WISCONSIN



**SSS: Sheboygan Space Society**  
Center St. Kiel, WI 5402-1034  
<http://www.sheboyganspacesociety.org>

c/o Will Foerster 920-894-2376 (h) - [astrowill@charter.net](mailto:astrowill@charter.net)

SSS Sec. Harald Schenk [hschenk@charter.net](mailto:hschenk@charter.net)

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: APR 20 - JUN 15 - AUG 17 - OCT 19 - DEC 8 (SAT in Milwaukee)

### CALIFORNIA



**SDSS - San Diego Space Society**  
<http://sandiegospace.org/>

Members will soon be getting our new Membership Packets.

We are planning for our biggest annual event – Yuri's Night Thursday April 12th

San Diego at night as seen from Space: (also Phoenix and Tucson)

<http://www.utsandiego.com/news/2012/mar/17/san-diego-photographed-space-station/?scquest>

Video clip of SD Space Town Hall Meeting with Bill Nye 3-10-2012 -

<http://www.youtube.com/watch?v=I2fiE2iPNao>

For past articles, Visit [http://www.moonsociety.org/publications/mmm\\_classics/](http://www.moonsociety.org/publications/mmm_classics/)

## CALIFORNIA



OASIS: Organization for the Advancement  
of Space Industrialization and Settlement  
Greater Los Angeles Chapter of NSS  
P.O. Box 1231, Redondo Beach, CA 90278  
<http://www.oasis-nss.org/wordpress/>

Events Hotline/Answering Machine: 310-364-2290 – Odyssey Ed: Kat Tanaka [odyssey\\_editor@yahoo.com](mailto:odyssey_editor@yahoo.com)  
<http://www.oasis-nss.org/wordpress/> - [oasis@oasis-nss.org](mailto:oasis@oasis-nss.org) – Odyssey Newsletter [www.oasis-nss.org/articles.html](http://www.oasis-nss.org/articles.html)

Regular Meeting 3 pm 3<sup>rd</sup> SAT monthly – MAR 17 – APR 21 – MAR 19 – APR 21 – JUN 16 – JUL 21

## OASIS NEWS AND EVENTS:

SAT APR 21, 3 pm OASIS Board Meeting, home of Steve Bartlett and Tina Beychok, 7108 E Peabody, Long Beach

SAT MAY 19, 3 pm OASIS Board Meeting, home of Craig and Karin Ward, 1914 Condon Ave, Redondo Beach

## COLORADO



DSS: Denver Space Society  
(FKA The Front Range L5 Society)  
1 Cherry Hills Farm Drive, Englewood, CO 80133

Eric Boethin 303-781-0800 [eric@boethin.com](mailto:eric@boethin.com) – Monthly Meetings 6:30-8:30 PM on 3<sup>rd</sup> Thursdays  
Englewood Public Library, Englewood, CO 80110 – 1000 Englewood Parkway, First Floor Civic Center

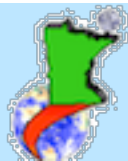
NEXT MEETINGS – APR 19 – MAY 17 – JUN 21 – JUL 19 – AUG 16 – SEP 20

## ILLINOIS



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

## MINNESOTA



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

<http://www.mnsfs.org/2011-Review/>

**MNSFS** Continuing its tradition of putting up 'Current' space displays MN SFS's current space flight ISS-30  
is now on public view at :Radio City Inc., 2663 County Road I. Mounds View, MN 55122  
Display text & Graphics from ISS-30-31 Press Kit @ address above

**Ben's MarsCon Photos:** Thursday-Friday; Saturday 1; Saturday 2; Sunday-Monday respectively

<https://www.facebook.com/media/set/?set=a.10150673794358516.420927.592718515&type=1&l=43ed9922a7>  
<https://www.facebook.com/media/set/?set=a.10150673840378516.420932.592718515&type=1&aft=1015067385793516&l=cce9af964b>

<https://www.facebook.com/media/set/?set=a.10150673863863516.420934.592718515&type=1&l=c387f635cc>

<https://www.facebook.com/media/set/?set=a.10150677452908516.421400.592718515&type=1&l=e72aff939e>

MarsCon Science Room Pix – <http://freemars.org/mnfan/MarsCon/2012/index-sci-rm.html>

## OREGON



OR L5 – Oregon L5 Society  
P.O. BOX 86, OR 97045  
<http://www.OregonL5.org>

(LBRT – Oregon Moonbase) [moonbase@comcast.net](mailto:moonbase@comcast.net)

Meetings 3<sup>rd</sup> Sat. each month at 2 p.m. - Bourne Plaza, 1441 SE 122nd, Portland, downstairs

Regular Meeting 3 pm 3<sup>rd</sup> SAT monthly – FEB 18 – MAR 17 – APR 21 – MAR 19 – APR 21 – JUN 16 – JUL 21

Oregonian Don Petit is on ISS Expedition 30/31 – <http://www.jsc.nasa.gov/Bios/htmlbios/pettit.html>

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PENNSYLVANIA



NSS-PASA: NSS Philadelphia Area Space Alliance  
928 Clinton Street, Philadelphia, PA 19107  
<http://pasa01.tripod.com/>

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

<http://pasa01.tripod.com/> - <http://phillypasa.blogspot.com> - NSS-PASA Report for March 2012

**Pre Meeting note:** We had an unusually large group at this meeting. Besides our regular members and associates, including the region 7 Chapter Organizer Dennis Pearson, we had a founder of our group, Richard Bowers, and a guest (who found us via the NSS), Jay Bagley, who has a wide background that includes occasional work for NASA.

**Meeting Notes:** Jay Bagley described some of the activities he has been involved in, including judging at the Carver Science Fair and being part of a Robots exhibit at The Franklin Institute, and, was part of a Discovery education program that included being in free fall for some of the experiments. He is open to job offers!

Rich Bowers, who founded our group in the mid 1970s, has retired and become involved in politics. He follows the various candidates and the statements they have been making recently, and there past actions, on behalf of the human expansion into the solar system. He noted that Newt Gingrich is a board member of NSS, and has been pro space for some time. This was also noted, by Joe Ingemi, a guest last month. More later.

Larry reported on the website on the possibility of getting a “no commercials” version of the website. We discussed this, and, the possibility of a free NSS site we have been offered. Mitch will check on this and contact Larry with details. Dorothy brought a number of articles on the museum and events scenes. These included the arrival, April 2nd, of The Shuttle Enterprise on The Intrepid. It will join the aircraft fleet already on the carrier. Lots of celebrations and ceremonies starting from the arrival, at JFK airport of the Shuttle Carrier Aircraft. Then we have the Hall of Science, in Queens, and the ongoing “Beyond Planet Earth” exhibit at The A.M.N. Dotty and Larry will be going to this in April. They went to Lunacon as well (March 17) and set up a panel on NSS and space exploration. Since this was a “Poster Session” panel (created at the event) there was a limited attendance. But: they got people who had created the ISDC in New York in 1996, and a former head of an NSS chapter in Northern New Jersey. Excellent!

Hank Smith reported on the P.S.F.S. meeting held the previous night that the Crown Plaza is confirmed. The GoH in November, will be Catharine Valentae. However: there has been no budget for the kind of publicity that Hank does, traveling and distributing flyers and invitations to attend Philcon at different events. If he goes to Baltimore he will be doing talking outreach exclusively (at the Balticon and, possibly, at the ISDC in Washington.).

Mitch Gordon brought several new reports including the same April issue of Discover that I thought were worth while. There was an editorial report by Neil deGrasse Tyson on going “Back to the Final Frontier” discussing the advancement of other countries into space and what has been happening to our underfunded and reduced priority return to manned space exploration. On page 54 is a list of possible space-exploring nations in this and next decade. Japanese on the Moon, and Iranians (yes, Iranians) in orbit. Mitch also had material from the spring Ad Astra, which included a report on Space Solar Power by Peter Garretson ( “Are Things Looking Up for Space Based Solar Power?”). This article is basically about the International Academy of Astronautics report that has been referenced by Dennis Pearson in some of our previous meetings. A very brief summary of the article: there are no show stoppers, and, the final quote “Whoever takes the lead in the development and utilization of clean and renewable energy and space and aviation industry will be the world leader”. This from one of the founders of the Chinese space program, Professor Wang Xiji. NSS agrees. Much other good material. Mitch has confirmed our location for the Super Science Festival on April 21, and, has a goodly number of Ad Astra copies for the visitors.

Earl brought material from a range of sources and discussed the recent early March Coronal Mass ejection. Larry, who is interested in space weather, added to the discussion. Analog magazine from the February NSS PASA report also reported on space weather. No mention in the media of the possibility of harm to the ISS crew, or unmanned satellites, was noted. Also in the previously noted Discover magazine was a short report on a comet impacting the Sun. In other areas: NASA has a medically related publication that I receive, that had several interesting articles including two that may have applications in deep space missions: one was on the rapid fabrication of various pieces of medical components from computer files (using a 3D printer), and, in an ongoing research report, an ultrasonic blood clot disruption technique is described. “UC Berkeley Uses 3D Printing to Speed Development of Lifesaving Medical Device” on the use of the “Z-printer”. Page 14, written by Patrick Goodwill, Research Associate. “Ultrasound Technique Breaks Down Blood Clots,” page 8, work carried out at the University of Michigan, multi member team(s). See the report for more on the application of this technique on deep vein thrombosis.

Finally: our senior Carver Science Fair Winner, receiving the Oscar H. Harris Award, was Rhonda Davis. She reported on using the Kepler Space Telescopes data on Kepler 22 to look for an atmosphere (especially for one like ours) in the photometric data. Her work was titled “How much does the atmosphere affect the temperature of the planet?”. She enjoyed our gifts. Two related notes: Mr. Thomas Anderson received “The Community Service Award” from The Tuskegee Alumni, and, educator Judith A. Summers-Gates was awarded The George Washington Carver Award for her contributions to STEM outreach to young girls, to the blind, and to other underserved communities. Her background began at Drexel University. It would be a good school for Rhonda Davis someday! – Earl Bennett

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**Lunar Reclamation Society Inc.**  
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