

Moon Miners' Manifesto

& The Moon Society Journal

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Above: Earth's Major Space Ports a Multiplying

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Call for a Global Space Revolution ==>>

In this month's feature essay, Shaun Moss, who will be joining the Moon Society's Board of Directors this fall, sounds the call for Global Space Revolution. He sites the profound transformation in public consciousness (the "Overview Effect"), the need to tap abundant resources in space, significant increases in Global Collaboration, and increasing Technological innovations. pp. 3-5 below.

IN FOCUS Hubble Repair Mission Repaired more than just Hubble

At first, the most vocal of public reactions to *Columbia's* disintegration in 2004, just as the initial reaction to the *Challenger* launch failure in 1986, seemed to be clear signs that the public at large had left behind the pioneering risk-acceptance life-outlook of those who toiled to build the American frontier. We've been slowly becoming a risk-adverse population for sometime, fed by tort law lawyers who proclaim that everyone is born with the right to live a hundred years, [=> p. 2, col. 2]



Moon Miners' Manifesto

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www.MoonSociety.org/publications/mmm_classics/

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- **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
- **MMM retains its editorial independence.** MMM serves several groups, each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test.

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• **The Lunar Reclamation Society** is an independently incorporated nonprofit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. LRS serves as NSS' Milwaukee chapter: www.Lunar-Reclamation.org

• **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization.

National Space Society, 1620 I Street NW, Suite 615, Washington, DC 20006; Ph: (202) 429-1600 - www.NSS.org

• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.

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⇒ In Focus Editorial continued from p. 1.

and failing that ("birth right to live to be one hundred") someone needs to be sued. In fact no one is guaranteed to live any amount of time. Further, no one is guaranteed to be born alive. Indeed no one is guaranteed to be born at all, or even to be conceived. This kind of risk-aversion would suggest that we are well on our way to becoming as decadent as the once proud Roman Empire.

Challenger's and Columbia's accidents were not "tragedies." Those killed died as pioneering heroes. The tragedy, in both cases, was the knee jerk reaction of those Americans who had lost the risk-accepting pioneer spirit. But when the dust settled, and the timid have had their say, it became clear that America, and the bulk of its people, *do want to go forward*. "Continuing the exploration and development of space" is what the Challenger and *Columbia* astronauts would have wanted us to do! That is the way to honor their memories. Those who would reject the dreams of those who gave their lives trash their memories, not honor them. Happily, there is little chance that the enemies of Space, nor those of Manned Space, will prevail.

Yet, NASA's own first reaction to the Columbia incident, was to protect what was left of the shuttle fleet. A commission deemed the proposed Hubble repair mission "too risky." It looked as if this rejection of traditional pioneering risk would be the last word, until the astronaut corp got together, polled itself, and protested resoundingly that the majority of astronauts would gladly accept that risk, that the importance of fixing Hubble, the most popular craft ever to fly in space, was much more important.

In many ways, a nation that seemed to be losing its way, and risked losing its soul, is now showing signs of revival of the pioneering "right stuff." Pair this with halting steps to replace a nationalized space transportation system with commercial services, and the prospects seem encouraging.

This last part is going to take a while, as many vested interests (contractors and their employees) are at stake. Perhaps a majority of Americans view NASA as "as American as Apple Pie." But how can a "socialized" anything be "American?" We will get there. It is going to take some time to get the slow-plodding Goliath out of our way, redirected to robotic space exploration and breakthrough Research and Development projects. Once we have done that, with congressional micromanagement and fickle commitment out of the loop, space frontiers will open more quickly than any of us yet realize. PK

No July issue

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To give the editor

A "burnout-prevention" break,

And time to regenerate and refresh.

Call for a Global Space Revolution

by Shaun Moss 2009-03-21 shaun@starmultimedia.biz

The world stands on the brink of imminent global change. The challenges currently being presented to human society by instabilities in the global climate and economy are significant; finding solutions will assuredly occupy much of our attention over the coming decades.

However, in perfect balance, we also find ourselves at the doorstep of the greatest evolutionary leap that Earthian life has encountered since it crawled out of the oceans. We are poised to enter space – not simply as a handful of select persons or machines, but as a species.

The development and implementation of new systems for global environmental and economic management is widely understood to be of the utmost urgency, and, fortunately, steps are already being taken in this direction by great leaders and thinkers around the globe. However, what seems less apparent are the astronomical rewards for humanity that will result from our expansion into the Solar System.

The potential benefits of space exploration and colonization include:

The Overview Effect

By all reports from astronauts, nothing compares with viewing the entire Earth from space. From this perspective the planet appears as a single, whole entity: a shining jewel, a living, breathing organism with no borders or other visible signs of separation between its inhabitants. It becomes more difficult to imagine that one is from any specific city or nation; rather, one sees the entire planet as "home". From space, all people and nations are equal, bound together by the one thing we all have in common – the planet that we are all part of.

This perspective of Earth will lead to a greater unity among its peoples, an effect that will only increase as we colonize other worlds such as Luna and Mars. From space, any place on the surface of Earth is equally accessible; the differences between so-called "developed" and "developing" nations are not apparent, and indeed, from this perspective it becomes difficult to understand why such extreme variations in economic standards exist on the surface.

This profound shift in human consciousness from viewing Earth as a collection of distinct tribes to a single living world, experienced by increasing numbers of people, will automatically lead to the formation of new strategies for global environmental and economic management.

Access to Abundant Resources

Space is infinite, and contains infinite energy and material resources. By developing the necessary technologies and systems, humans can access these resources.

Once you see beyond religious, ideological or other purported reasons, conflict on Earth is almost always about natural resources such as energy, metals or land. Although limited on Earth, all of these are available in extreme abundance in space:

- Solar power, collected in an environment where the sun never stops shining and is never occluded by clouds or dust, can be efficiently and safely beamed to Earth (or anywhere else in the Solar System) to provide continual, limitless and reliable energy.

- Over 400,000 asteroids have been identified in our Solar System, with more being discovered all the time; the estimated total is over 1 million. Many of these orbit near Earth, and many are composed of almost pure metal, while others are plentiful sources of carbon or water. Access to these resources will mean an improved Earthian economy, reduced need to damage Earth's environment through mining, reduced international conflict, and an abundance of the necessary materials for constructing space cities and vehicles in Earth orbit and other locations throughout the Solar System.
- Mars has a surface area approximately equal to the land area of Earth. The colonization and subsequent terraforming of Mars will therefore provide the human race with almost double the territory in which to live. This will only be the beginning; the experience of inhabiting and developing just one such planet will teach us how to colonize many thousands.

Survival

While infrequent, it is known that mass global extinctions caused by asteroid impacts have occurred several times in Earth's history, and will almost certainly occur again. Hence, in order to ensure the long-term survival of humans as well as many other Earthian species, there are only two reasonable options:

1. Establish human colonies at other locations in space, so that in the event of a major impact the human species will survive and may potentially re-inhabit Earth afterwards.
2. Learn how to modify the orbits of asteroids, or how to break them into smaller pieces, so that a potential extinction-causing impact can be prevented.

Both of these solutions require increase technical capability in space.

If an impactor is above a certain size or velocity, it will be impossible to divert or destroy it; furthermore, extra-terrestrial colonies will probably be dependent on resources from Earth for centuries. Hence, the optimal strategy for the long-range survival of humanity requires both of these solutions.

Increased Global Collaboration

At our current level of technology, exploration and development of space is still fairly expensive and complicated. Furthermore, considering that the effects of space research are often global in application rather than restricted to specific nations, there is overwhelming incentive for international collaboration in space activities. This has been one of the primary benefits of the International Space Station, which has brought together some of the greatest countries of Earth into a noble and productive exercise.

During the past century several arenas of activity have replaced military conflict, including sport, tourism, international trade, political union, and collaboration on technological development. The nations of Earth have started to realize that co-operation, instead of competition, leads to an improved outcome for everyone. By building on the success of the ISS and continuing with international collaboration on space development, the nations of Earth will be drawn into an even closer partnership. This can only lead to peace and an improved quality of life for everyone on Earth.

Technological Innovation

Countless examples already exist of technologies that were developed for space and have since been applied on Earth (computer technology, structural analysis, the hand-held video camera, communications, IT, sports training, energy storage, robotics, materials, etc., etc.). The question is, would these technologies have still been developed if people were not striving to solve difficult problems in space?

When given an inspiring and challenging problem, the human mind begins experimenting with solutions and gathering information, both consciously and subconsciously, with the result being eventual inspiration and breakthroughs. The challenging environment of space presents unusually hard problems, which thus tends to attract the most brilliant minds, resulting in especially innovative solutions that can have enormous application and value on Earth.

For example:

- Technologies developed for space settlements, such as atmosphere processing, in-situ resource utilization, recycling, etc., can similarly be applied to open up huge uninhabited regions of Earth, while also improving the efficiency and function of existing cities.
- Advanced robotics technology developed for exploration, mining and construction in space can be applied on Earth to an extremely wide variety of tasks, decreasing the cost of materials, products and services, and improving health and safety.
- Energy production methods developed for space applications, such as space solar power or nuclear fusion, can be applied on Earth to provide abundant electricity and thus improved quality of life to all people.
- Biotechnology developed for space agriculture or terraforming can be applied on Earth to drastically improve global food production and health.
- Carbon nanotube technology developed for space elevator applications can be applied to create all manner of ambitious structures and equipment on Earth, as well as space structures and vehicles.
- Planetary engineering strategies developed for terraforming Mars can be applied to Earth in order to improve the global environment, including cleaning the atmosphere and oceans, bringing life to the deserts, and stabilizing global climate.
- Vehicle technology, developed for space applications, will increase the speed and lower the cost of travel on Earth, vastly improving the efficiency of human transport, resource distribution, package delivery and emergency response.

The colonization of space offers hope for humanity. It is simply the only path to an abundant and peaceful future for an expanding human civilization. It will bring us everything we need to develop and grow; without it, our future will be one of increasing restriction, compromise, difficulty and conflict. If the number of people continues to increase while the amount of available resources remains the same, then, logically, this means a reduced share for all. The only other option is population control, which is not freedom; in fact, it would require increasing control by global authorities, and we would ultimately lose many of our technological capabilities along with our peace and freedom.

As an analogy, consider a tribe living on a small island. Their population steadily increases, but the amount of land they have available to grow food remains the same. They know that across the sea is a large, uninhabited continent with abundant resources, but they decide not to risk investing in trying to reach this place, and to focus all their energy on the immediate problems of survival. Eventually they begin to fight over the dwindling resources and further damage is inflicted on the island, and the tribe, until only a few remain to pick up the pieces.

Compare this with another tribe in a similar situation. They, too, are growing in number and approaching the population limit that the island can sustainably support; they also know about the abundant resources across the sea. Even though they are experiencing challenges, they realize that these problems will only get worse unless they find a way across the sea, so they begin researching boat technology while also tending to their immediate problems. This tribe is more optimistic – they know that their problems are temporary, and that soon a new era in their civilization will begin: one of peace, expansion and security.

At this juncture in human history, with the challenges that now lie before us, opening up space should be made an absolute global priority. It should not be something of marginal interest, or a heavy load to be pulled along by a dedicated few, or something we will do "when we get around to it" or "when things are better". The sooner we become a space-based civilization, the sooner tensions on Earth will be relieved and we can enter an golden era of peace, harmony, expansion, abundance, adventure, freedom, health and happiness. It should be commenced immediately, and should be undertaken with wholehearted passion and commitment by the entire global community.

The following strategy is suggested:

1. The establishment of an Earth Space Consortium (ESC) comprised of governments and government agencies, private corporations, academic institutions, space advocacy groups and philanthropists. This organization would be funded by both public and private money, with each member contributing an appropriate percentage of GDP or profits. The function of the ESC will be to organize a substantial fraction of Earth's resources (in particular, at least 10–30% of Earth's finest minds) into a unified and cohesive strategy for providing the people of Earth with access to the abundant resources and limitless expanse of space.
2. Government-sponsored financial benefits, including tax exemption or discounts, and/or investment, should be available for all companies involved in space exploration and development, environmental engineering, and the development of critical enabling technologies such as aerospace vehicles, solar power and robotics. This will hasten the development of solutions to immediate global problems, and more quickly secure a better future for all people.
3. A dedicated, coordinated and well-funded global program for reducing the cost of access to space. Everything depends on it; at this point, the primary obstacle preventing humanity from becoming a space-faring civilization with the resources of the Solar System at its fingertips is the exorbitant cost of reaching free space from Earth. The initial phase of a

unified Earth space program should be primarily focused (90%+ of expenditure) on advancement of space transport technology.

4. A global program to develop space solar power as a method of providing continuous, reliable and abundant clean energy to Earth, while simultaneously increasing our capabilities in space and developing technologies for on-orbit construction.
5. A global program to develop space tourism as a viable economic motivator for the private space sector, a source of inspiration and adventure to the people of Earth, and an essential precursor to space property development and colonization.
6. Development of a robust and profitable space mining industry. This will simultaneously provide three enormous benefits: an economic incentive for space development; a great abundance of metals, carbon, water and other materials necessary for construction of a space civilization; and the development of technologies and methods for defending Earth from asteroid impacts.
7. An international collaborative effort to establish permanent human settlements in Earth orbit and on Luna and Mars. These seeds will become new branches of human civilization, thus ensuring the long-term survival of humans and many other Earthian species. The exercise will also teach us about advanced recycling, nanotechnology, robotics, resource management, advanced biology and chemical engineering, planetary engineering, the successful formation of harmonious, close-knit communities, and many other things that can be applied with tremendous benefit on Earth.

The time is now. It will only become more difficult over the coming years. The past doesn't matter, and neither do our petty conflicts over resources; all that matters now is creating a positive future for ourselves and for our descendants. The sooner we make space development our utmost priority and open up space for the people of Earth, the sooner we will enter an amazing new chapter of human civilization. We need to pull together as a team, get organized and focused, and create an exciting new future of peace and freedom – in space.

<SM>

Shaun Moss was born in Melbourne, Victoria, Australia, but has lived most of his life in Brisbane, Queensland, Australia. Shaun has been a Moon Society member since shortly after the Society was formed. Earlier this year he joined the Moon Society Leadership Council and in August will become a member of the Board of Directors.

Shaun has been quite active in our new Town Meetings, and took the lead in formulating the Society's first "Town Meeting Project," the Apollo Moon Party, to commemorate and celebrate the 40th anniversary of the first manned Moon landing and Moonwalk. Widely traveled, Moss brings an international perspective to his work and to the organizations to which he belongs.

Shaun, like the editor, has also long been a avid member of the Mars Society, and tends to see things in perspective of how both frontiers can open together and to each other's benefit. See his editorial in MMM #223.

He hopes to unveil his new project shortly, the new interactive www.moon-mars.com website, which will serve enthusiasts of both frontiers. <MMM>

Things May be Simpler for Lunar Engineers

By Dave Dietzler pioneer137@yahoo.com

The lunar manufacturing engineer won't need to worry about jet engines, diesels, gasoline engines, steam turbines, petroleum refining, hydraulics, pneumatics or a whole host of other Earthly technologies. Tasks will be:

- Welding w/o the hassles of oxygen
- Rolling flat plates of metal; welding up "boxy" things
- Assembling parts made by 3D sintering
- Conventional casting and machining operations
- Making solar panels
- Batteries and/or fuel cell systems
- Electric motors of various sizes for everything from ventilation fans, O₂ compressors, water/sewage pumps, vehicle propulsion, heavy equipment power
- Mechanical arrangements using pulleys, augers, etc., to replace hydraulic and pneumatic devices
- Automating all the above with robotics

We can now see how to make all sorts of things on the Moon. The 2nd toughest challenge is making all the electric motors we will need. We need some sort of X-prize for anyone who can devise an electric motor manufacturing facility design for the Moon. The toughest challenge will be automating all this with robotics.

1. Artist renditions of stuff on the Moon are deceptions. Their stuff is all tubular, curved, domed and streamlined. That's too complicated to make. From mining shovel buckets to vehicle cabins to RR cars and habitat modules all we need are rolled and cut flat plates welded up into all sorts of "boxy" shapes.
2. NASA stuff is all very complex, microminiaturized, lightened, exotic and expensive so they can rocket it up there. Stuff we will make on the Moon could be much simpler, thus cheaper.
3. The lunar mining engineer's job is simplified because 99% of the mining will be strip mining. We might blast and tunnel a little bit into central crater peaks if there's anything of value from upthrust deep strata inside. Drilling for volcanic gas? Maybe. And there's no ground water to deal with. Less gravity = less cave-in danger.
4. The lunar architect and civil engineer's jobs are simplified because there is no wind and no ground water to contend with and less gravity. These are the guys who will use cast basalt (bricks, pipes, tiles), glass, glax, concrete, cement board, drywall and loose regolith for much of their work, as well as iron plates.
5. Lunar electrical engineer must learn to do everything with aluminum and calcium wire; and upported superconducting wire. Solar panels produce DC so we will use a lot of DC electrical stuff. As superconductors can transmit DC as easily as AC, we won't need transformers and substations. We will transmit 110V current for thousands of miles over the Moon with SC wires.
6. Furniture, housewares; all stone, metal and glass. No wood means no carpenters, but we might saw and nail together aerated autoclaved concrete stuff.
7. Chemical engineers won't do much organic chemistry outside of small laboratory workshops for small batches of plastic and silicones. The metallurgy guys will have to figure out how to make smelting furnaces and other stuff out of local materials for producing materials from Moon dust.

So can we industrialize the Moon? I think we can. Many things will be simpler. <DD>

MAGNESIUM

Workhorse Metal on the Moon?

By Dave Dietzler pioneer137@yahoo.com

Recently, I experienced a paradigm shift. Previously I thought, "Magnesium, nah, its soft and burns... ." But it won't burn in a vacuum and it won't even catch that easy in air unless it is powdered or fine parts are being machined.

Magnesium is the lightest of the engineering metals with a density of only 1.74 g/cm³. However, used as a structural metal in an alloyed form, most magnesium alloys have a density a bit higher.

has great strength to weight ratio and it is used for many products like auto body parts, wheels, engine parts, gear boxes, sports equipment, for which light weight is an advantage. Baseball catchers' masks, skis, race cars, and horseshoes are made with magnesium alloys. Consumer goods such as ladders, portable tools, electronic equipment, binoculars, cameras, furniture, and luggage also benefit from magnesium's low weight, and other applications make use of its ability to absorb vibration. Anyhow, Mg can be welded despite its low mp and lasers with their low heat input are very good for welding Mg although porosity can be a problem.

Sometimes Mg is better than Al or steel because of its hi strength to wt ratio. So now I am thinking that all that stuff we might make of Aluminum on the Moon like RR cars, rocket ships, ground vehicle frames and cabins, garage space frames, etc., could be made of Mg instead. Magnesium can be extracted with substances common on the Moon by silicothermic reduction, but Al requires H₂SO₄, carbon and chlorine, substances that are not too common on the Moon— unless something like Dr. Schubert's all -isotope separator which is sort of a giant mass spec or an e-beam and colusius columns can get Al. We will still need Aluminum for electrical wires, given that copper is present on the Moon only in trace amounts, but wiring doesn't add up to too much mass.

Magnesium is pretty interesting stuff. From "Metallurgy Fundamentals" by Daniel Brandt, 2005, we read on page 267:

"Magnesium is a very light metal used for small parts and many applications requiring low density and corrosion resistance. It has a high strength to weight ratio making it comparable in strength to aluminum and some alloy steels."

It has low density but is also less ductile than many metals. It is alloyed with small amounts of aluminum, zinc and zirconium to strengthen it.

On page 268 we read that magnesium is good for wheels but because of its low ductility it should never be struck with a tool because it can be chipped and ruined. We also read that it can't be strengthened by cold working but can be strengthened by alloying with aluminum, zinc and calcium. Well, calcium is abundant in the Moon's highland regions. Magnesium can be cast, extruded and hot rolled, then machined to final shape.

On page 269 we read about the fire hazards of machining magnesium and that water will make burning magnesium fires even worse. CO₂ fire extinguishers are no good either. Only special class D fire extinguishers can be used on magnesium fires. On the Moon we could

machine magnesium in the free vacuum or in inert gas filled chambers, so this won't be a big problem.

When we consider the strength of metals we must consider the strength to weight ratio. Mg is so light that we can make parts thicker thus stronger without being too heavy, especially in the low G of the Moon. Weight will not be as big a problem for architects and engineers on the Moon, but the mass of rotating or reciprocating parts must still be considered, as well as the mass of accelerating vehicles from mining robots to railroad cars.

I think that we will be able to substitute Mg for many things we would ordinarily make of Al like train cars, rocket frames and propellant tanks. We might alloy Mg with Ca, REEs and some Al. Magnesium can be welded despite its low mp and lasers with their low heat input are very good for welding Mg although porosity can be a problem.

The bias towards Al and Ti comes from the fact that we have so many aircraft engineers in the space community. The mechanical engineers want steel, but they will have to do with plain iron and concrete.

Conceivably, you could cut threads in a titanium bolt with lasers, but Ti is hard to extract and cast and upset and weld... so I predict that we will make nuts and bolts of steel. That won't demand too much carbon. David Heck told me that the aluminum frame of the Space Shuttle is bolted together because Al is hard to weld. Steel bolts of course. So perhaps we will be bolting Mg structures together on the Moon.

Here is a good page with photos of the many parts that can be made of magnesium:

<http://www.alibaba.com/showroom/Magnesium-Alloy-Parts.html>

Also, the tensile strength of wrought iron is 40,000 psi and compression strength is 40,000 psi. Pure iron will have about the same stats. We should be able to produce pure iron with magma electrolysis and an as yet undefined purification step to remove any silicon in it. Iron from fines harvesting contains 5% nickel and will be harder and stronger than pure iron.

The bias towards aluminum and titanium, the favorites of Earth based aerospace engineers must be overcome. We can't make everything out of steel, of which 95% of all metal made on Earth consists, on the Moon, but we will need it for special applications.

I suspect that all kinds of new uses for pure iron and magnesium will be found or invented on the Moon.

Lunar magnesium tech might be applied on or under the ice of Europa someday.

[See: "Magnesium – Workhorse Metal for Europa" by Peter Kokh, MMM #118, September 1998, page 8, republished in MMM Classics #12 pp. 61–62]

http://www.lunar-reclamation.org/papers/europa_outpost_paper.htm#mg_europa

PROPERTIES OF PURE MG (PARTIAL LIST)

- * Atomic number 12
- * Atomic weight 24.31
- * Color silvery gray
- * Density 1.74 g/cm
- * Melts at 650°C, 1202°F
- * Boils at 1103°C, 2017°F
- * Valence states Mg²⁺

Settlements in Space

Compared to those on Rocky World Surfaces

"Different Strokes for Different Folks"

By Peter Kokh kokhmmm@aol.com

The Vision

The O'Neill vision of very large free-orbiting space settlements,, exemplifying the best of suburban and exurban architecture is an appealing one. Comfort, convenience, access to everything one might need was the promise.

Notably absent are the rough edges and hard struggle of those who might choose to pioneer existing lunar and planetary surfaces that would be stark and barren by terrestrial standards.

Granted, both types of environments face the challenge of creating sustainable mini-biospheres with ever-fresh air and ever-sweet water.

Frequently mentioned is that those bound for space settlements would enjoy familiar "earth-normal" gravity, while those that choose to live on the Moon or Mars or, even worse, on the asteroids, would have to deal with the expected physiological deterioration that comes from prolonged stays in sub-normal gravity levels.

In the O'Neill scenario, space settlementarians were guaranteed the highest standards of living from income earned in production of Solar Power Satellites, whereas surface-rats would be hard put to eke out sustenance from sales of raw materials.

Unexamined: Building and Manufacturing Materials

Both economies will be able to pay for higher quality Earth-produced goods only from the sale of products made from a shorter list of building and manufacturing materials that can be produced, at first from lunar regolith soils alone, then eventually from asteroidal materials. To the extent that this is so, both frontiers will tend to look and feel very similar. Goods and products will be less sophisticated than those on Earth, unless those living in the artificial-gravity environments are much more successful traders than their cousins on rocky world surfaces.

If the colonial policy of taking from "the colonies" only unimproved products is followed, while exporting to Earth value-added products, and if pioneers on rocky world surfaces are somehow prevented from exporting value-added "transformed" and "improved" products, and allowed to export only raw materials, such a difference in standard of living will indeed be the result. But this great difference in standard of living can only come from this type of 20th century economic imperialism, happily, fast losing its grip on underdeveloped former colonies.

Unexamined: "1-G" as a requirement for health

We are all familiar with the overwhelming experience from many thousands of man-hours spent in "0-G" (or "Micro-G" to nit-pick) that muscle-tone and physiology in general degrades over time. The non-sequitur conclusion, however, that this will necessarily be the case for those spending equally long stays on the Moon or Mars is in need of a second look.

1. Will physiological deterioration proceed as *fast* for those on the Moon or Mars experiencing 1/6th and 3/8th gravity?

2. Or will the deterioration proceed at a slower rate on the Moon, and at a still slower rate for those on Mars?
3. Will this deterioration halt at an acceptable plateau level for those on Mars, and at a lower but still manageable level on the Moon?

To make the absolute unexamined and intellectually lazy prediction that lunar and Martian pioneers will face the same unsustainable fate as those in Earth orbit, demonstrates an unexamined bias that those who hold it *want to hold over the head of those who would be so dense as not to see the very great advantages of in-space settlements.*

In fact, no one having spent more than a few days on the Moon, we have no confirmation of this dogmatic assertion. In actuality, our experience on the Moon has been rather minimal. No one has slept *lying down* on the Moon. No one has walked, much less run, on the Moon *without a space suit.*

Without real evidence one way or another, it would seem to be the honest thing to suspend judgment until we have data from persons spending long times in 1/6th or 3/8th gravity in reasonable living conditions.

Indeed, if either or both 1/6th and 3/8th gravity proves sufficient to maintain an acceptable level of physiological health, then those who would build in-space settlements will stand to gain as well. How?

In comparison to anything else we have ever built, from the largest cruise ship or oil tanker to the largest dam, structures such as a 1km wide Torus (Island 2) or "Sunflower Cylinder" (Island 3) are dauntingly large, for one reason. Coriolis forces, which can induce dizziness, would seem to advise against spin rates greater than 1 rpm, and that translates into a wider radius/diameter to produce 1.0 Earth-normal gravity. The surface area expands by the square, and the structural mass by the cube. If either or both 1/6th g or 3/8th g proves livable, then the construction threshold for such in-space settlements comes down dramatically. And that would make them much more realistic, and near-term, less 22nd Century of beyond.

In essence, while branding everyone who would prefer a rocky world surface as a living environment as a "planetary chauvinist" those who do so exhibit a less than fully examined "1-G chauvinism."

Why pick one settlement type over another?

Instead of looking down on one another, those who can better envision themselves in an in-space settlement than in an on-surface settlement – *and vice versa* – should listen to one another's points. Some may wish to switch "sides." Others may become even more convinced that one of the options is for them. But the end result would be mutual understanding and respect.

From an in-space settler point of view:

An in-space settlement is of fixed size and easier to plan as a whole, with urban, residential, and agricultural planning carefully worked out for best land use and most pleasant living standards. Planning makes the difference. A high standard of living is promised. On the other hand, surface-rats have to deal with the unpleasant traits of their chosen rocky surface world: dust everywhere, unpleasant climates, unbreathable atmosphere if any at all. The prospects of forever living in a struggling frontier town with life therein having a lot of rough edges and too much hard work.

From a rocky surface settler point of view:

An in-space settlement may have beautiful parks and pastoral streams, but they are all artificial. The rocks and "mountain"-lets are zoo-type artificial constructs, not something that resulted from natural processes. There is a difference in biological beauty and geological awe on Earth. That duality won't exist on an in-space settlement, wherein all the beauty will be man-made.

Rocky surface dwellers may be able to look up at the stars and wonder. On in-space settlements, the heavens will zip by at 360° per minute, not a pace for enjoyment. One has to climb to the axial core, and then despin.

It will be a harder road, but all the more satisfying for having trodden it, to reach the point of being truly "at home" on a rocky-surface world than in a planned in-space community. One requires pioneering which builds character and soul; the other does not.

But each of us is at different points in our life and each of us needs something different to feel fulfilled and happy. It makes no sense to put one another down. If those who would settle in-space planned communities need to bash those with other needs, that is not good.

Settlement vs. World

In a previous article, we tried to define "world" as experienced (not in the astronomical sense) as a continuity of horizons, not all of which can be seen from any one location. In this sense, neither the Island One Bernalsphere, nor the Island Three O'Neill Sunflower Cylinder, are "world-like." On entering, one gets an overwhelming picture-postcard view. But along with Peggy Lee, they must then wonder, "Is that all there is?"

Those entering a Torus world let can only see a third of it, an improvement. But here on Earth, no one, not even from the tallest mountain peak, can see but one tiny corner, one tiny pocket of our world.

On rocky-surface worlds, any one settlement may be "all there is" temporarily, but there will in time be many more, each unique, each a place to get away from it all for a vacation break.

He, she, or they who came up with the trio of space settlement designs based on the trio of "only known Cassini curves" conveniently overlook *something nature was smart enough to discover*: the **double helix** which is produced when the dumbbell does not just rotate in one plane to produce the torus, but it also moves along the axis of its rotation. Inside an unfixed extendable double helix settlement, one begins to experience sense of world in which one glimpse only reveals a small part of itself. We have suggested a triple helix design to allow everyone to work on three shifts, staggered eight hours apart, so that each person can work his or her "dayshift" while maintaining facilities and equipment that for highest economic efficiency are run around the clock: "24/7." Such a design direction will, we admit, not allow an easy solution for sunshine access, and perhaps a design competition to work out solutions that are elegantly simple for the poorly thought out classic in-space settlement designs.

Those who choose rocky-surface locations will face the greater challenge in learning to be "at home." But, harder work can be rewarded with greater satisfaction. One sees seniors financially able to choose, make different choices: all senior planned communities devoid of children, devoid of problems, and others equally able

to choose, decide to continue living in multi-generational and multi-cultural settings. To each his/her/their own.

Moving off-Earth

Let us respect one another. It should not be necessary to bash another group to reassure oneself that one's own group's choices are correct. Yet we do that all the time in rendering political, social, religious, cultural, and other judgments.

There are enough of us to fill all the varied kinds of off-Earth settlements that we can imagine. Let's not look down on one another or insist everyone be like us and think like us.

To many, in-space settlements alone make the prospect of moving off-Earth palatable. To others, in-space settlements are as unnatural and "zoo-like" as possible. As a species, we would be much less interesting if we all felt the same way.

How much land?

Add up the surfaces of Mars, the Moon, the large moons of Jupiter, Saturn etc. – their surface totals are insignificant to the combined interior surfaces of millions of in-space settlements. If we need to find ever more living space because we continue to fail to breed without checks, then, of course, the overwhelming percentage of human generations yet un-born will live in in-space settlements. But from the viewpoint of those unwilling to be so tamed, learning the hard way to come to terms with rocky worlds far less friendly than Earth, will be the more rewarding lot. And have we not already learned that here on Earth? Our home world was once just part, not all, of Africa. Every pioneer has chosen to leave a place where life was comfortable, for the challenge of settling a new environment in which at first life would be much harder because of all the adjustments to be made. Pioneers leave because they know that the struggle will be rewarding in life-meaning, if not in ease of life-style.

If humans bifurcate, which group will pioneer what?

It is hard to imagine children raised in and in-space worldlet setting out to pioneer a new rocky-world setting. Some children raised in rocky-surface settlements may be won over to the "cushy" side, but others, forged of stronger stuff, will pioneer new and more challenging rocky-world settings. Will there become two branches of humanity? Perhaps, and most likely, each will look down on the other, and that's too bad. Traditional surface-dwellers are pre-destined to be the minority, and in their own eyes, the more fortunate.

But, as a lover of mountains, mountain lakes, and waterfalls, of endlessly variable settings, of star-studded heavens that turn on a 24-hr clock, as one who treasures the experiences of "roughing it," who would rather die from violence in the "hood" than spend one second in a gated community, I say "vive la difference!" <PK>

Reading from Past issues of Moon Miners' Manifesto

#11 DEC '87 - Colonist Quiz; Space Oases: 1st Locations; "Internal Bearings"; Space Oases & Lunar Culture; "Space Oases, The Moon and Different Drums."
#12 FEB '88 - "Space Oases: Static Design Traps;" "Space Oases; A "Biodynamic Masterplan"
#13 MAR '88 "Space Oases: Back at Square One – Baby Steps with Artificial Gravity"
Summed up in "Reinventing Space Oases"
http://www.lunar-reclamation.org/papers/reinv_so.htm
and in MMM Classics #2 pp, 1-15



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



Objectives of the Moon Society

include, but are not limited to:

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

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

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

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

The Moon Society Presence at ISDC 2009

By Peter Kokh, President

The 29th International Space Development Conference, like every one before it, was a memorable one. This series of conferences began in 1981 under the aegis of the former L5 Society, an organization that strived to realize the goals and ideals of Gerard K. O'Neill and his vision of Space Settlements and Solar Power Satellites, using resources from the Moon.

It was at ISDC #6 in Pittsburgh, held early, in late March 1987, that L5 merged with the former National Space Institute founded by Wernher von Braun. The new united organization inherited the L5 Society's system of chapters, its activist approach to space politics and public outreach and the International Space Development Conf.

The annual ISDC travels around the country, being hosted by various chapters, every now and then being in Washington DC and hosted by NSS headquarters. The former Artemis Society had a good showing at 1997 Orlando, and an even greater presence at ISDC 1998 in Milwaukee as member Peter Kokh was ISDC chair.

In July 2000, after the ISDC in Tucson that year, ASI members met in Las Vegas to organize the more broadly-focused Moon Society, transferring membership services to the new organization. In the following years, it was difficult to gather a good showing at the annual ISDC. However in Washington DC at ISDC 2005, we forged a mutual affiliation with the National Space Society, on very favorable terms. Since then, we have made ISDC our conference as well. That ISDC travels around the country, allows more of our members a chance to attend a conference not too far from home.

We have supplied the Moon Track Chair since Dallas 2007 (Peter Kokh that year, Dave Dunlop in 08 and 09) and had a good handful of officers and members present at each.

This year Peter Kokh, Charles Radley, Randal Severy, Peter Schubert, Dave Dunlop, and Fred Hills were on hand. We participated in four tracks, with exhibits

Next year, ISDC returns to Chicago, where in 1989 ISDC set attendance records which by some reckoning, still stand (it depends on whether you count those who got in free or not.) Chicago intends to have a large exhibit hall, and the Milwaukee-based Lunar reclamation Society and The Moon Society hope to have the largest set of exhibits yet fielded together. Airfares to Midway or O'Hare are always very cheap. While we will be out by O'Hare, we are hoping to have at least one Lake Michigan lakefront event, perhaps at Adler Planetarium in front of Chicago's awesome lakefront skyline.

Start planning to attend now. Registration and room rates will be considerably lower than they were this year in Orlando. The event will be back on Memorial Day Weekend, our calendar spot of preference.

Apollo Moon Party Progress Report

This event, an idea born out of our first Town Meeting on February 11th earlier this year, was something we had hoped would start a world-wide groundswell, and lead to greater worldwide recognition of the promise of using the Moon's considerable resources to help tackle some of Earth's most intransigent problems, such as the production of as much clean energy as we can use.

Promoting this event has turned out to be more difficult than any of us had imagined. The reasons are clear: we are few in number. The world is huge. Most of us have day jobs that come first!

It has taken awhile to produce the software that will allow individual groups anywhere to register their event, but now that we have it, we can use that software for promotion of future events as well. Nothing lost!

Our Houston, Milwaukee, and Green Bay chapters and San Diego and Philadelphia NSS chapters are actively planning local events on either Saturday, July 18th, Sunday, July 19th, or both. St. Louis has found a local event to support. Phoenix plans an informal party..

Abroad, we have heard of parties in Mexico City and Guadalajara, London, Melbourne and Canberra, Australia, and at the Moon-Mine Analog Project in central Sweden, in most cases, details yet to be determined.

The original idea of linking all the local parties in one big round-the-world 24-time zone internet-based party appears to be the tougher nut to crack. Not enough time to line up enough of a globe-encircling chain, and again the problem of day-job priorities.

Whatever we do, even if it is in far fewer locations than we had hoped, will still help. This "learning experience" will be something we can build upon. Any failure can be easily transformed into success if we can but learn enough of a lesson to successfully pull off something similar next time.

We had hoped to have Apollo Moon Party souvenir logo memorabilia ready at CafePress.com but ran into a snag. And mass production of a 2001-type monolith in black plastic appeared to be well beyond our price range in quantities worth the risk.

Meanwhile, in the UK, on Sunday May 26th, people celebrated the 400th anniversary of the first recorded observations of the Moon through a telescope – which were actually carried out by an English astronomer named Thomas Harriott, and not by Galileo! There was a huge number of enthusiasts gathering at Syon House, which is where Harriott made his observations, though there were no plans for the evening, other than a lecture about Harriott at a cost of £20. At the time there still appeared to be a potential for an Apollo 11 event, though it would take a bit of sorting out. – Jerry Stone, reporting

We sincerely hope that our new monthly Town Meetings will survive the disappointment that will inevitably follow from the too-partial success of this first Town Meeting Project.

The Town Meetings have brought a lot of fresh new talent to the fore, greatly enlarging the vision of what our small society might accomplish. We have a reputation to protect: "the Little Society that Could" form our solar power beaming demo unit produced last year. We have done it, we can do it again, and we have earned the right to dream bigger!

<PK>

Test your Lunar *Navigation* Skills

"Lost on the Moon!"

By Frederick Hills

Just the facts

- Jeff and Neha are orbiting the Moon in their transport and fire the engine to descend.
- They realize too late that the parameters are wrong! They look out the windows to see where they are headed.
- Jeff, looking out the right side, notices that they are crossing the Sea of Serenity. Further off he can see the Apennines Mountain range. "we are moving southwest parallel to the Apennines Mountain range."
- Neha is on the other side and looking out the left window. She sees what appear to be seas. She can't decide which one but is quite sure they have now passed the Sea of Serenity. Ten minutes later she spots something that looks familiar. "I see the Fra Mauro region now," she announces.
- Looking ahead Jeff notices the wall of a sizable crater. Behind it is the wall of a much larger crater. "We need to find a good spot to set down here," Jeff declares. "The low rolling hills this side of crater look reasonable."
- Jeff activates the engine again and slows their forward speed.
- "The area somewhat to the left looks smoothest," Neha said.
- Jeff seemed to agree and set the craft down in the area she liked. "Now we just have to figure out where we are and contact base."
- Neha thought for a moment and said: "We have one clue. That big crater looked like it must be 100 miles across."

Reader challenge:

Follow the story and figure out where they landed. Can you name the large crater?

Hints:

- You will need a lunar globe or something like the Rand McNally "The Atlas of the Universe".
- For a detailed view of the area try Google Moon and the charts it provides.
- The small crater carries an 'A' designation which is often done for satellite craters.
- Check your detective work with the answer is on p. 11.

=====The Price of Progress=====

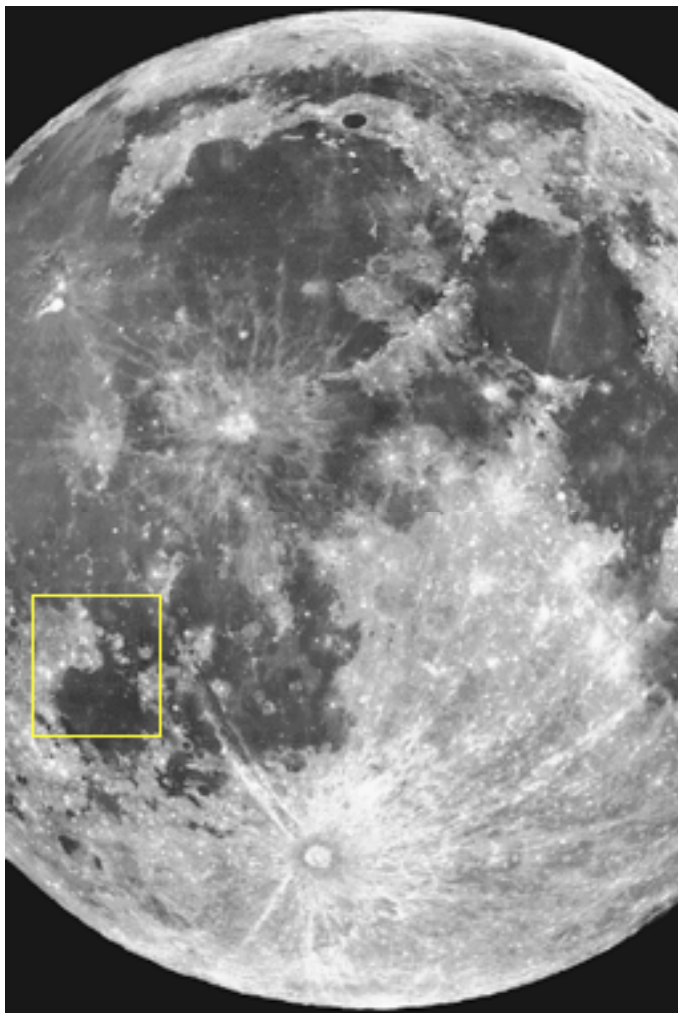
From Dave Dietzler pioneer137@yahoo.com

Large sums of money scare people. The Apollo program of the 1960s cost from \$25-45B, \$100-200B in today's money. US 2008 estimated GDP \$14.33 Trillion. So the cost of the great project was 1% to 2% of one year's GDP, spread out over ten years, so only 0.1% to 0.2% of the GDP every year was dedicated to this investment in the future. Now we are talking about \$100 billion for Return to the Moon. Seems like a lot of money, but it will lead to the development of new launchers, manned spacecraft, and tech for survival on the Moon. If only we can inspire the planners to go further than an intermittently manned base and get into ISRU and bootstrapping with long term goals for everything from science to asteroid deflection to Mars colonization to tourism to exploration of the solar system and beyond.

The Moon Society Journal - Free Enterprise on the Moon

Answer to the Navigation Puzzle on p. 10

The Crater Gassendi roughly on the NNE flank of Mare Humorum, "The Sea of Moisture", 40°W, 18°S



Approximate area of top photo is yellow-outline above.

What Steps Should Come Next in Promoting Space-Based Solar Power

By USAF Lt. Col. Peter Garretson*

1) [This one comes from Darren Pierce] With the Space Canada video as a starting point, **construct a Public Service Announcement**, and Run it in various friendly venues, Discovery, History, Sci-Fi Channel

2) **Take out a full-page add in major newspapers** (WSJ, LA Times, USA Today), asking for Exploration and development of SSP to be included in Obama's energy & space plans

3) **Get SSP part of Obama's renewable energy partnership with India**

4) **SSP Student Design Competition** like the Space Colony Competition by Anita Gale & Al Globus ... perhaps expanded into a virtual creative space

5) **Educate and convert to advocates 2 Congressmen** using SSAFE total resources (public service and industry)

6) Make up a chart that shows **potential locations of job creation nation-wide** should we reach a productive capacity of 2 Powersats/year

7) **SSAFE support** – make use of Media surrounding the Power Beaming Challenge at the Space Elevator Games

8) **Get on PBS Special "PlanetForward"**

<http://www.planetforward.org/>

9) **Host ITER-like SSP International Experiment Definition conference...or at least begin laying the groundwork for one**

10) **Host a special Space Investment Summit focused on SSP**, and bring in Energy and Utilities, including: TVA, Rural Electrification, National Energy Regulatory Commission, EPRI, NREL, ARPA-E, Apollow Alliance, MIT/CALTECH energy centers

11) **Hold a Space to Environment SSP summit** with representatives from the major environmental agencies

12) **Set up a Millionaire/Billionaire SSP Trust Fund** for an Academic Center devoted to SSP and to fund Prizes and Travel. Initial goal: One endowed professorship and 4 graduate students. SSAFE approach Space friendly individuals like:

* **Peter Garretson** was the one who got us to do our SPB-Demo project in the first place) and one of the real dynamos behind all the current activity.

What is the Moon Society Role in this effort?

The Moon Society has still not completed its follow up project of designing an "online kit" that others can use to replicate the display unit we built last year – but we are making real progress.

Our society is only one of 13 SSAFE organizations that are promoting Space Solar Power, and we need to pick "homework assignments" for which we can be confident that we can produce useful results.

The Management Council (Officers & Directors together) will be looking at our options in the coming months.

That said, #11, above fits right in with our already announced initiatives and we are in the forefront of that effort. We might also look at #1 (our Moon Colony Video production experience) and #3 (through our MMM-India Quarterly) and work with the National Space Society on # 4.

<MSI>

The Moon Society Chapters & Outposts Frontier Report

Moon Society St. Louis Chapter

<http://www.moonsociety.org/chapters/stlouis/>

Contact: Keith Wetzel <kawetzel@swbell.net>

Next meetings – May 20th, June 17th, July 15th

Meetings 3rd Wed monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room.

Note: We have switched to the 3rd Wednesday so that members can be free to participate in the Moon Society Town Meetings held on the 2nd Wednesday evenings.

We are not planning our own Apollo Moon Party but will support a talk by Gregg Maryniak (X-Prize org.) at Herbies (formerly Balabans) in Central West End (near the NW corner of Euclid and McPherson) on July 16 at 7 pm. This is a free event.

Moon Society Phoenix Chapter

<http://www.msphx.org>

<http://www.moonsocphx.blogspot.com/>

Contact: Craig Porter <portercd@msn.com>

Moon Society Phoenix' next meetings are on
3rd Saturdays: **June 20th, July 18th, August 15th**

In cooperation with the world wide Apollo Moon Party movement, the Moon Society of Phoenix is having an Apollo 11 celebration on Saturday, **July 18th** at Chuck Leshner's home, 1982 N Iowa Street in Chandler. BYOB. Everyone is welcome. This will be in lieu of our regular monthly meeting which would fall on the same date.

Chuck will supply the munchies and sodas. Even though the Moon will not rise until after 3AM, several telescopes will be set up to star gaze and a full compliment of Apollo videos will be available. Lots of good Moon conversation!

Moon Society Houston Chapter

<http://www.moonsociety.org/chapters/houston/>

Contact: Eric Bowen eric@streamlinerschedules.com

May 18 meeting Report: we committed ourselves to participation in not one but two major activities in support of the Society's Apollo Moon Party project! Our members are going to sponsor and man a booth at "Fly Me To the Moon", a community celebration of the first lunar landing to be held at Alumni Park at the University of Houston, Clear Lake, from 6–9 pm Sat., July 18, 2009. Event website: <http://www.uhcl.edu/flymetothemoon>

FREE Admission, including an old fashioned family-style picnic suppe! This is a great chance for all our Houston-area members to stop by and participate. We intend to put together some Moon Society activities for both adults and kids. Your suggestions are welcome; send them to eric@streamlinerschedules.com and we'll see that they get sent to where they can do the most good.

Our regular chapter meetings are generally held the 3rd Monday evening of odd-number months. So our next regularly scheduled chapter meeting will be the evening of July 20, 2009—the 40th anniversary of the landing itself! We will meet at 6:30 p.m. at Coffee Oasis for a purely social meeting; no business to be discussed. We'll have snacks and refreshments, and through special arrangement with HBO films we will be show two hours' worth of the documentary, **From The Earth To The Moon**. Once again, we hope that all of our current (and even not-so-current) members will take the time to show up and relax with us. Spouses and friends welcome too! There will be no charge for the event itself, although

donations to help cover the cost of refreshments are welcome. Coffee Oasis, again, is located at 4650 NASA Road 1 in Seabrook; we hope to see you there!

In support of these two projects, there will be a planning meeting held in the meeting room at Coffee Oasis on June 15, 2009 at 7:00 p.m. All members are encouraged to attend, especially those who have volunteered to help us out at Fly Me To the Moon. For more information email or telephone – Eric Bowen

College of the Menominee Nation–Green Bay* Campus Chapter (Formerly, Green Bay, WI Outpost)

Contacts: Dan D. Hawk hawkd_0212@menominee.edu

David A. Dunlop dunlop712@yahoo.com

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

Activities: Dave and Dan took in ISDC 09 in Orlando with some chapter exhibits to show.

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

www.moonsociety.org/chapters/chapter_outpost_map.html

Bay Area Moon Society, CA Outpost – South Frisco Bay

<http://www.moonsociety.org/chapters/bams/>

Contact: Henry Cates hcate2@pacbell.net

Meeting May 28th at Henry's; Pizza & Space Speculation

Moon Society Longview, TX Outpost

Contact: James A. Rogers jarogers2001@aim.com

Moon Society DC Metro, DC–MD–VA Outpost

Contact: Fred Hills Fredhills7@aol.com

Milwaukee, WI Outpost (MSMO)

www.moonsociety.org/chapters/milwaukee/msmo_output.htm

Contact: Peter Kokh kokhmmm@aol.com

Challenged by NSS' Larry Ahearn of Chicago to create and prepare more exhibits for next year's ISDC in Chicago, we are dusting off exhibit plans meant for ISDC 1998 as part of the "Lunar Homestead Show" but not finished in time.

Moon Society Tucson Outpost

Contact: Avery R. Davis tuslan@earthlink.net

Moon Society Nashville Outpost

Contact: Chuck Schlemm cschlemm@comcast.net

**For news of our NSS Partner Chapters in
Portland, Milwaukee, Minneapolis/St. Paul, San Diego
see pp. 17 ff.**

Moon Society DUES with *Moon Miners' Manifesto*

Electronic MMM (pdf) \$35 Students/Seniors: \$20

Hardcopy MMM: U.S./Canada \$35 Elsewhere: \$60

Join/Renew Online - www.MoonSociety.org/register/

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions

Moon Society Membership Services:

PO Box 940825, Plano, TX 75094-0825, USA

Projects, Chapters, Volunteers, Information, etc.

Moon Society Program Services

PO Box 080395, Milwaukee, WI 53208, USA

< End Moon Society Journal Section >

GREAT BROWSTING

Astrobotic's "Red Rover" to race for Apollo 11 site
<http://www.space.com/business/technology/090428-tw-glxp-astrobotic.html>

Odyssey Moon aims to place 1st Flower on Moon
http://www.space.com/common/media/video/player.php?videoRef=SP_090402_moon_flowers

New Missions Target Mars Moon Phobos
<http://www.space.com/scienceastronomy/090430-mars-phobos-missions.html>

Solar Interstellar Sailing
www.theatlantic.com/doc/200905/solar-sailing

Leveraging space tech for terrestrial applications
<http://www.thespacereview.com/article/1362/1>

Future of the Lunar Lander Challenge
<http://www.thespacereview.com/article/1361/1>

International dialogue on solar energy from space: International Symposium on Solar Power Satellites
<http://www.spacecanada.org>

Messenger Probe reveals a dynamic Mercury
www.aerotechnews.com/local/Space/MESSENGER-spacecraft-reveals-a-very-dynamic-planet-Mercury

Mercury "more interesting than Mars"
 40% of surface due to volcanic activity
 Surface washed by solar flares
<http://news.softpedia.com/news/Mercury-is-more-interesting-than-Mars-110629.shtml>

Innovative SETI@home project turns ten, 05/17/09
<http://www.physorg.com/news160402800.html>

Elements in Comets may have jumpstarted Life
<http://www.jpost.com/servlet/Satellite?cid=1239710841634&pagename=JPost%2FJPArticle%2FShowFull>

Canada launches 1st NEO detection satellite:
<http://www.neosat.ca/>

Shuttle crew films Hubble repair with IMAX camera for Hubble 3D, in IMAX theatres Spring 2010.
<http://www.IMAX.com/>

First Weightless Wedding planned for June 20, 09
<http://www.space.com/missionlaunches/090602-weightless-wedding.html>

Boeing X-37B (Air Force) space plane to fly, 01/2010
www.space.com/news/090602-x-37b-space-plane.html

New Technique Could Reveal Exoplanets w. Water
<http://www.space.com/scienceastronomy/090601-mm-exoplanet-water.html>

Space Station population grows to full size: 6
<http://www.space.com/missionlaunches/090529-iss-full-crew-arrival.html>

China To Launch First Mars Probe In 2nd Half 2009
http://www.spacedaily.com/reports/China_To_Launch_First_Mars_Probe_In_Second_Half_Of_2009_999.html

One way ticket to Mars safer than round trip
http://www.marsdaily.com/reports/A_One_way_Ticket_To_Mars_999.html

One Giant Bounce for Mankind: Moonbounce 2009
www.wired.com/wiredscience/2009/06/moonbounce

Operating ISS as a National Laboratory
<http://www.thespacereview.com/article/1385/1>
A Spherical Design for a Solar Power Satellite?
<http://www.thespacereview.com/article/1383/1>

GREAT SPACE VIDEOS

MOON COLONY VIDEOS - The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) can be found at.

<http://www.moonsociety.org/video/>

<http://www.mooncolony.tv/>

<http://www.stickymedia.com/>

ASSORTED SPACE VIDEOS

Odyssey Moon Team to place 1st Flower on Moon

http://www.space.com/common/media/video/player.php?videoRef=SP_090402_moon_flowers

Moon 2.0: Join the Revolution

http://www.space.com/common/media/video/player.php?videoRef=240907_Moon2_Google&mode=

ISS Assembly Step-by-step

http://i.usatoday.net/tech/graphics/iss_timeline/flash.htm

Animation of James Webb Telescope Unfolding

www.spaceref.com/news/viewpr.rss.html?pid=28208

Balloon Launcher to shoot for the Moon

http://www.space.com/common/media/video/player.php?videoRef=SP_090527_ARCA-GLXP

Obama taps Bolden to run NASA (Senator Bill Nelson)

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

"1/6th G"

It's not just a good idea, it's the law."

— Luna City local ordinance

Help us put MMM in a Library near You!

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

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

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

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

As membership services are not involved, the cheapest way we can do this is by submitting these subscriptions directly to the publisher at a cost-minus rate of \$10 a year, available for libraries only.

How to participate in this program

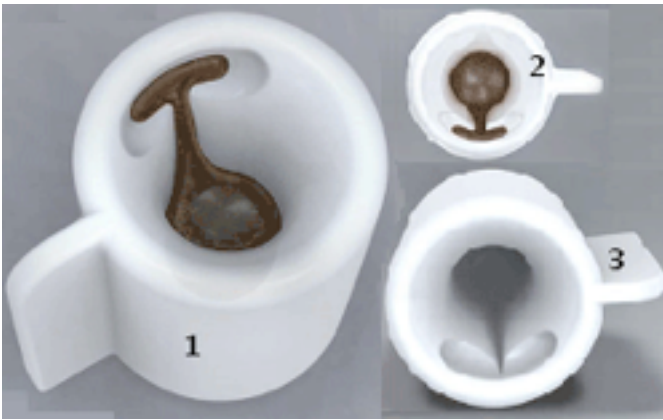
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- Made out to

"Lunar Reclamation Society"

Attn: Library Subscriptions

PO Box 2102, Milwaukee, WI 53102

MMM PHOTO GALLERY



Astronaut Donald Petit, Space Shuttle mission STS-126, has designed a **coffee cup that won't spill in zero-g.**

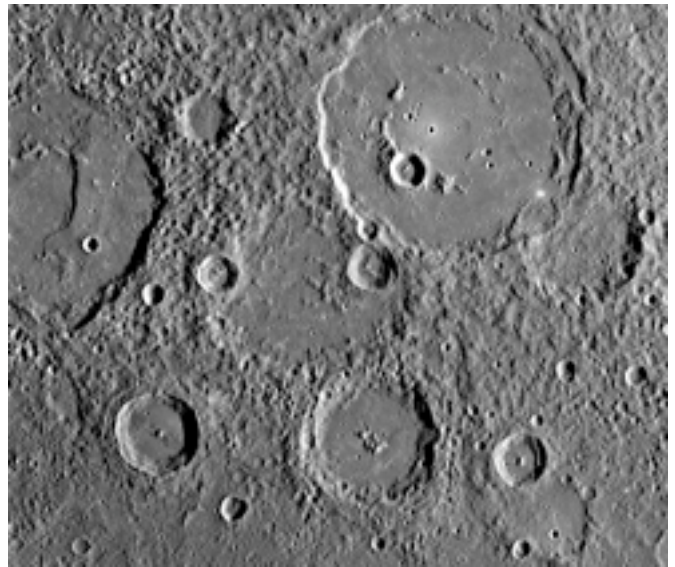
1 This mug can hold a cup of coffee and keep it "drinkable." **2** Coffee is held in the narrow section at the bottom of the cup by surface tension. The deep groove acts as a wick, drawing coffee up as it is drunk. **3.** The lip depression retains coffee at the top of the groove. "Donald, you have made Captain Janeway (Star Trek Voyager) and millions more, very, very happy!"



Depiction of Astrobotics' "Red Rover" on the Moon. Astrobotics is one of the teams racing to land a private robot on the moon and win the Google Lunar X Prize.



Highest resolution photo yet taken of Mars-facing side of Phobos, Mars' larger satellite, target of Russia's *Phobos-Grunt* mission. Photo by ESA's Mars Express Orbiter



The Messenger Probe reveals surface areas of Mercury that at first glance look very much like Moonscapes.



X-37B unpiloted "space plane" to launch Jan 2010



International Space Station Finally reaches Full Crew Complement of Six: Expedition 20 now has the most international mix to date, representing The US, Russia, Canada, Japan, and Belgium, the 11-member European Space Agency

To those who helped make it possible!

I wish to acknowledge the generosity of the following LRS & NSS members and friends who made it possible for me to attend this year's International Space Development Conference in Orlando, Florida, to accept the **Gerard K. O'Neill award for Space Settlement Advocacy**, given to me for over twenty years of illustrating, in **Moon Miners' Manifesto**, how we can open the lunar and Martian and other space frontiers, and make ourselves at home in each case.

In alphabetical order:

From my home Milwaukee NSS chapter, The Lunar Reclamation Society;
Bob Bialecki, Dave Dunlop, Charlotte and Gene Dupree, James Schroeter

From my friends in the Chicago & Minnesota chapters who had helped launch the Milwaukee chapter in 1986:

Larry Ahearn, Ben Huset, Jeffrey Liss, Jim Plaxco, Dave Stuart (now with Seattle L5)

From these other National Space Society friends:
Gary Barnhard, Robbie Gaines, Mark Hopkins, Tom Kozorou, Ronnie Lajoie, Claire and Cliff McMurray, Ken Murphy, Joe Redfield, and John Strickland.

With deep appreciation,

Peter Kokh

Note: the immense 15" w, 22" h card, with original artwork by Jim Plaxco, was also signed by Buzz Aldrin!



From **Paul Graham** paul@openluna.org 248-274-0177

The Open Luna Foundation seeks to return mankind to the lunar surface through private enterprise and to do it in such a way that it is accessible to everyone. Initial goals focus on a stepped program of robotic missions coupled with extensive public relations and outreach. Our research will be open source and one of our specific aims is to reach out to the community and educational systems to spread interest, enthusiasm, and involvement. Following these purely robotic missions, a short series of manned missions will construct a small, approximately six to ten person settlement based on a location scouted by the robotic missions. This settlement will be open for anyone's use (private individuals to government agencies), provided they respect our ethical conduct and heritage policies.

Open Luna Foundation takes a unique approach in that:

1.All aspects of the mission plan and hardware will be open source. This information will be publicly available and community support and involvement will be actively pursued and welcomed. Special efforts will be made to involve students, educational facilities, and amateur space enthusiasts. These missions will strongly emphasize community participation and collaboration.

2.A strong media presence will be a priority. The entertainment and educational potential of the mission will be exploited to allow the mission to reach the maximum number of people possible. This furthers the educational potential of the mission, provides publicity for sponsors (which will encourage support for future missions), and demonstrates to people that this is possible in the present and inspires the next generation to continue and exceed these mission goals.

3.Mission hardware will be light and geared toward continuity from one mission to future missions. This will save costs and simplify the mission and hardware development. Superfluous hardware will be removed from missions and each component will be made in the lightest fashion possible. This may create initial complications, but it will balance out over the span of the program. Risk levels will be assessed and considered to balance risk with the cost of safety to the ability of the mission to continue forward. Much like an Alpine expedition, moderate risks will be acceptable in favor of exploration.

4.Access to all scientific data generated will be made freely available and acceptance of outside research proposals will be encouraged.

Editor: Paul Graham was crew commander on my first tour of duty at the Mars Desert Research Station in Utah in early 2005 (crew 34). As head of the MDRS and FMARS engineering teams, he has a comprehensive grasp of analog station design, utilities, and engineering issues. While he works for the Mars Society in this capacity, he evidently has a great interest in opening up the Moon, and I have the greatest respect for his capacities. **PK**

The Gerard K. O'Neill Award



The object represented is a Bernal Sphere Space Settlement, also referred to as "Island 1."

<http://www.nss.org/settlement/space/bernalosphere.htm>
www.nss.org/settlement/space/bernalospheredetail.htm

About Gerard K. O'Neill

http://en.wikipedia.org/wiki/Gerard_K._O'Neill

The High Frontier: Human Colonies in Space:

Apogee Books Space Series 12 (Paperback)

Available from Amazon.com \$14.93

by [Gerard K. O'Neill](#) (Author)



Krafft Ehricke's "Lunar Slide Lander"

From: Axel Walthelm axel@walthelm.net

[Famed rocket scientist, Krafft A. Ehricke, in his paper "Lunar Industrialization and Development – Birth of Polyglobal Civilization," included in Lunar Bases and Space Activities of the 21st Century, W. W. Mendell, Editor, Lunar & Planetary Institute, Houston, © 1985, pp. 828-55, wrote (pp. 848-850) about his concept of a Lunar Slide Lander.]

Recently I found some time to get back to moon/space topics. Someone noted Krafft Ehricke's "Lunar Slide Lander" concept in a forum.

I'm not a rocket scientist, but as you may know I do have a bit of engineering and physics knowledge. So I wonder: are there any calculations around showing what about this concept is provable possible and what kind of risks haven't been covered and need experimental validation?

You know, I wonder why this concept isn't known by a wider audience? Ehricke had a reputation for being an excellent engineer. Did he become a little funny in his older days, and everyone was too polite to mention it? Or is it just that Lunar Slide Landing is so far into the future that no one is talking about it in current plans? I hope it is the latter.

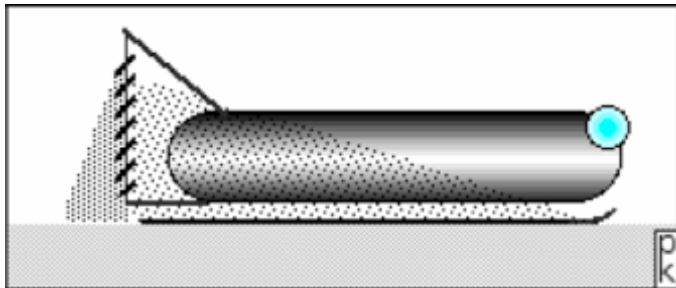
Ehricke wrote that he did some in depth study of the idea. But so far, I couldn't find anything beyond a coarse concept outline on the web. It would be great if you could point me to something more substantial.

Also I can't remember your suggested modifications to the concept. Can you remind me? Best

Axel Walthelm, Am Ruhstein 33, D-91054 Buckenhof, Germany

Editor: Go to our new MMM Glossary

www.lunar-reclamation.org/papers/m3glossary.html and look up the entry "Harenobraking" – The concept we introduced was that of a louvered dust-cloud braking system as pictured below.



From Axel: Thanks!

1.5 km/s, mach 4.5 (if one can say that in vacuum). That sounds challenging,

even with rocks removed from the landing strip.

Rule of thumb is: if it hits at 2 km/s, impact is as powerful as if it was made of dynamite (and explodes on contact). It's getting better at and below 1.5 km/s, but still, without any calculations or experimental evidence I would guess your louvered dust-spray control device will get sand-blasted away very quickly. (It might help at very low speeds, so.)

There must be some tricks Ehricke applied to avoid explosive erosion of the sled / contact surface. Somewhere I read he intended to half-hover the vehicle with rockets to control amount of friction heat to the ground. Furthermore, there are questions like: will the landing strip have to be smoothed after every landing? Is there really a lunar region flat enough? How flat does it have to be? How to keep the vehicle oriented on track?

Editor: First, remember that that contact speed of 1.5 km/s is not head on but horizontal. My guess is that the strip would have to be maintained between landings. The Maria are generally flat, except for occasional small craters, rilles, and lava flow fronts

In the Maria, but probably nowhere else, there should be available East-West stretches long enough. The "slideways" may need to be rather wide to keep incoming vehicles from wandering "into the rough," to borrow a golfing term. I think that you probably are going to have to shed some of your horizontal velocity by retro rockets first. So slide landing may save some fuel, and be a partial help

The tests had best be unmanned!

Axel: Peter, I looked at your louver device, and I think that at high speed, the dust cloud might make short work of that.

Editor: Good point on the louvers. At first they will need to be parallel to the surface, presenting a minimum cross-section. As the vehicle slows, they can be lowered to present more and more dust-braking power. It is just an idea, one that needs to be tested on paper, and then, if anything survives, in a wind (...er, wind-blown dust) tunnel

Challenge to Readers:

If you have followed the to and fro above, you will see that this suggestion of Krafft Ehricke is just a seminal one. To make it real will involve a lot of R&D and experimentation, failure, more experimentation and so on. Take a look at our illustration and at Ehricke's original article, and if you feel challenged to help make improvements that will transform this visionary idea into a working system that would cut the cost of landing payloads on the Moon, you will have done a lot to advance the day viable human settlements on the Moon will start to become a reality. <MMM>



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

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LRS News

- **Dave Dunlop drove down to Orlando for the ISDC:** Taking all our displays with him in his van. Dave was chair of this year's Moon Track, and gave one presentation on a plan for global lunar robotic exploration.
- **Peter Kokh flew down on a free RT ticket:** Together, they erected all the displays including the Moon Society's solar power beaming demonstration unit. Peter gave a talk in the art track on his 1994 painting experiments with metal oxide powders mixed in sodium silicate – only known inorganic adhesive – as pioneers might do. He also gave a talk on the importance of lunar pioneers being at ease with going out onto the lunar surface, and another on how environmentalists and space enthusiasts could work together.
- **ISDC 2008:** In Washington DC this year, May 29–June 1, the weekend *after* the usual Memorial Day Weekend schedule. Peter Kokh and Dave Dunlop will be attending.
- **March 8th LRS meeting:** Bob Bialecki brought another great video for us to watch: “**Base Camp Moon**” – great!

LRS Upcoming Events – June & July

Saturday: June 14th, 1–4 pm

LRS Meeting, Mayfair Mall, Garden Suites Room G110
AGENDA: www.lunar-reclamation.org/page4.htm

Report (hopefully some photos) on ISDC 2009
Peter hopes to bring his O'Neill Award to show
Preview of ISDC 2010 in Chicago

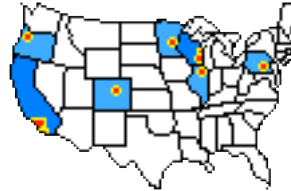
- This will be our last meeting until September 12th

Our Apollo Moon Party

Saturday – Sunday: July 18th–19th

Soref Planetarium (in the IMAX DOME)

We are preliminary approval to have exhibits and outreach materials on hand. Once we know the schedule we'll be looking for volunteers to man our exhibits and talk to people.



News & Events of NSS' Nine “MMM” Chapters

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

WISCONSIN



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

c/o Will Foerster 920–894–2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@charter.net>

>>> **DUES:** “SSS” c/o B. P. Knier

22608 County Line Rd, Elkhart Lake WI 53020

<http://www.tcei.com/sssf/>

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

- **Next Meetings: Jun 19th – Aug 21st – Oct 16th**

OREGON



Oregon L5 Society

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

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

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

Allen G. Taylor <allen.taylor@ieee.org>

Bryce Walden <moonbase@comcast.net>

(LBRT – Oregon Moonbase) moonbase@comcast.net

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

Bourne Plaza, 1441 SE 122nd, Portland, downstairs

- **Next Meetings: June 20th – July 18th – August 15th**

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

INFORMATION: Larry Ahearn: 773/373–0349

MINNESOTA



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

Tom Greenwalt (w) 763-784-6244 (h) 763-442-6015
David Buth (w) (612) 333-1872, (h) (763) 536-1237
Email: tomg@mnsfs.org
[www.mnsfs.org/]

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

- May 12th, 2009 STS-125 Display
www.nasa.gov/mission_pages/shuttle/shuttlemissions/hst_sm4/index.html
- July 14th MN SFS Meeting
- July 20th, 2009 – Apollo 11 40th Anniv. EVENT
- Jul 30th – Aug 2nd – 12th Mars Soc Conf 2009

COLORADO

Denver Space Society (formerly Front Range L5 Society) 1 Cherry Hills Farm Drive Englewood, CO 80113

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

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

Monthly Meetings, every 1st Monday, 7 PM

Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway

First Floor of the Englewood Civic Center – Map:

www.mapquest.com/maps/1000+Englewood+Parkway+Englewood+CO/

Meetings: Tues. July 6th – Aug. 3rd – Sept. 7th

PENNSYLVANIA



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

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

[<http://pasa01.tripod.com/>]

[<http://phillypasa.blogspot.com>]

- PASA regular business luncheon/formal meeting 1–3 pm, the 3rd Saturday of every month at the Liberty One food court on the second level, 16th and S. Market. Go toward the windows on the 17th street side and go left. Look for table sign. Parking at Liberty One on 17th St. Call Earl/Mitch 215-625-0670 to verify all meetings. Next Meetings: June 20th – July 18th – Aug. 18th

Our July meeting may be at The Franklin on **Sunday, July 19**. This is tentative as we may be part of the Apollo Moon Landing Celebration at The Franklin! Mitch and I are working on it. More later.

Michelle Baker came back from Texas for the meeting! Just kidding, but she did come to visit and told us how much she enjoyed being in Houston and being able to visit the Johnson Space Center. She plans to go to lectures there when they are held. NSS-Houston, you have a potential member!

Dorothy brought in a huge amount of material on museum exhibits in various locations. Philadelphia has several ranging from the Star Trek Exhibit, and a much more serious, and historic, event honoring Galileo and the four hundredth anniversary of his discovery of the moons of Jupiter. There will be lectures and very special displays of Galileo's instruments writings and other artifacts. These will be on display into September also.

Additional activities have also been scheduled at the Art Museum. Check the Franklin website for more (fi.edu). Meanwhile, in Maryland, the Maryland Science Center has a number of exhibits and will have a Fall display on the other great Italian scientist we respect: Leonardo Da Vinci. This will be from October One to January thirty First, 2010.

Last, and certainly not least, the Smithsonian will have many events this summer, with **the annual John H. Glenn Lecture being held July 19. The speakers will be the Apollo 11 crew and Chris Kraft**, former director of the Johnson Space Center. By the time you read this, the tickets will have been given out, but it, in itself, is a historic event. As usual, there are many more activities surrounding this convergence of historic events. Dotty gives a well-documented. Thanks Dorothy!

Larry, our webmaster, asked for questions and comments about our site and has included meeting times in the postings. He also announced a new capability: We are twits now! O.k., somebody had to make a joke about it and, since our resident punster Hank Smith isn't writing this, I volunteered. You can tweet us at pasa09 to view our content and comment. This actually ties in with a part of Dotty's report in that she mentioned that the first tweet was posted from space on STS-125 by astronaut Mike Massimino (as@astro_Mike). Are we having fun yet? We'll check on the banner for our site at the next meeting. Thank you Larry.

Hank requested the position of Head of Science Programming at the May PSFS meeting, but assignment of this position had not been confirmed. I jumped the gun on this. We will find out at our next meeting. Hank reported that a Principal Speaker/Guest of Honor had not been selected for the 2009 Philcon yet either. He will be going to Balticon in Maryland for Memorial Day weekend and will report on that and his outreach there. Go Hank!

Mitch Gordon reported on a number of things including an article in The Metro newspaper. "The Final Frontier: Not so Far Off" is about commercial space flight and the chances of it being available in twenty years. The piece is an interview with Will Whitehorn by Reuters News Service. He thinks we'll have commercial flights out to the Moon by then. This was on the front page of the May 8–10 issue.

Mitch talked on the interest the public had at Super Science Weekend in April and how they enjoyed the presentation he did using the loose-leaf book he created. It starts with our current Space Station and shuttle, and

progresses to tourist hotels, mining the Moon, and going on to terraform Mars. This long-term vision was especially interesting to the teen and young adult audience (the children enjoyed the Lunar Lava Tube display, with the space monkey, at the same time).

Mitch is working on a number of venues for the group: He is working on the Franklin events in July and may have speaking platforms for several of our people at the Institute. I am helping with this and have been in contact with Dennis Pearson and Frank O'Brien as possible presenters. Dennis is a member; Frank speaks on Apollo flight hardware). Mitch is trying for talk on the future of space exploration as well as the past with presentations on returning to the Moon and colonizing Mars, with our Mars Society coordinator Gary Fisher as speaker. We have no Moon Society members, at present, but will use material from Moon Miners, among other sources, for presentations. In the fall, Mitch is working on outreach at the University City section of Philadelphia, World Space Day (in October) and, with Hank Smith, Philcon in November. Book us, Mitch!

Earl received a large infusion of material of interest as well as from readings: a gift from Michelle of *Sky and Telescope* and the loan of a gift to her, *Scientific American*, contained a number of interesting items: from *Sky and Telescope* for July is "who Really Invented the Telescope?" by Albert Van Helden (who also appears on the P.B.S. special Galileo and the fight for the Heavens and is a professor of History at Rice University) which explains that Galileo *tremendously improved* the device but was not the inventor. There are a number of people referenced from this period, Hans Lipperhey, who patented the telescope in 1608, and Thomas Harriot, who also examined the Moon in 1609 as Galileo was doing, among others. The magazine publisher also implores readers to go to Philadelphia for the Galileo Exhibit in his editorial. "We" have two of his telescopes and much more as noted previously. There is also an article on "Uncovering Mars's Secret Past" by Jim Bell, who is both the Lead Scientist on the Spirit and Opportunity missions and President of the Planetary Society!

Back to telescopes for a moment: the June issue of S&T has a piece on our newest instrument: "Plank Readies to Dissect the Big Bang" by Physicist Thorsten Dambeck. This instrument is built to pick up signals in an area of the spectrum that is hard to do on Earth: the millimeter and submillimeter wave bands between microwaves and infrared light. From our planet an amateur astronomy researcher was allowed to use one of the large ground based instruments for the hunt for SETI signals in the 170 GHz region. He is Peter Vekinis and he used the 12-meter Kitt Peak instrument for data gathering. This from the winter 2008 issue of *CQ VHF*, reported under "Dr. SETI's Starship" by Dr. Paul Shuch..

From the March issue of *Scientific American* is more material we can use for promoting Space solar power. The report: "The Power of Renewables" by Matthew L. Wald of The New York Times. It is very revealing in the efficiencies of storage systems and conversion Efficiencies of the processes: sources are first mentioned, as well as estimated costs with Solar Thermal being first listed. It is reported as very costly and having a number of drawbacks including disturbance of pristine desert environments. We space advocates might create a workaround for this using space based reflectors and alternate sites. Costs were quoted at 19.9-28.1 cents/

kwhr for trough systems. Demonstrated system. Solar-photovoltaic is listed with current cost being in the 46.9 to 70.5 cents per kwh.

Notes for drawbacks: "If you have to ask, you can't afford it" which is true at present. It also works best in that pristine desert environment noted above. Other systems are analyzed, but these are not what surprised me in the exposition. The storage systems are major drawbacks with fuel cells, at less than 50% energy recovery reported. Compressed air is even reported and has a number advantages, but has not been really deployed except in Alabama (since 1991).

One is reminded of the space based mirror idea in reading of "Building Harlequins Moon", which was dedicated to Robert Forward, by Larry Niven and Brenda Cooper. A "Solleta" sunlight driven A Solar Sail is used in the story and, for our use, a geosynchronous mirror is basically a small Solar Sail. "We" can put light where we need it, or want it, using this to support 24/7 solar driven power production on Earth.

And finally: NASA will crash two orbiters on the Moon in late August A number of craft will be looking at the impact from near the Moon, but you may see it with a 10" or bigger telescope (say at The Franklin for example). <http://lcrs.arc.nasa.gov/mission.htm> - Earl Bennett.

CALIFORNIA

SDSPACE.org

San Diego Space Society

<http://sandiegospace.org/>

info@sandiegospace.org

Quarterly Newsletter: **The Bussard Scoop**
Meeting the 2nd Sunday monthly
June 14th - July 12th - August 9th

- **Next Meeting: June 14th** 2:30 to 4:30 pm. Talk on Advanced Space Propulsion Concept. by Greg Meholic
- **Sat. July 18th:** Celebrate the 40th anniv. of Apollo 11 at the Reuben H. Fleet Science Center with author Francis French "how the Apollo 11 Crew was chosen."

CALIFORNIA

OASIS

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

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

Odyssey Newsletter Online

<http://www.oasis-nss.org/articles.html>

- **Next Meetings: June 20th - July 18th - August 15th**
- **Sat. July 18th** OASIS Board Meeting; annual Potluck Picnic - Time? Place? Check website.

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.
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