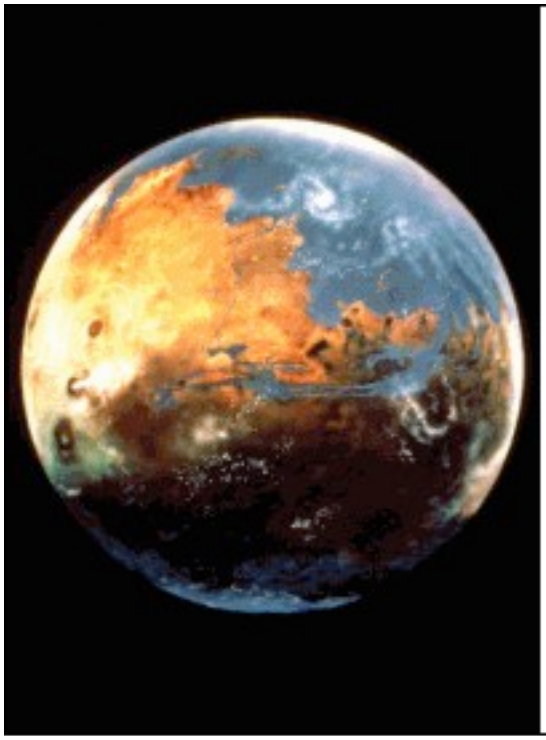
"Towards an Earth-Moon Economy Developing Off-Planet Resources"

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

213 MARCH 2008

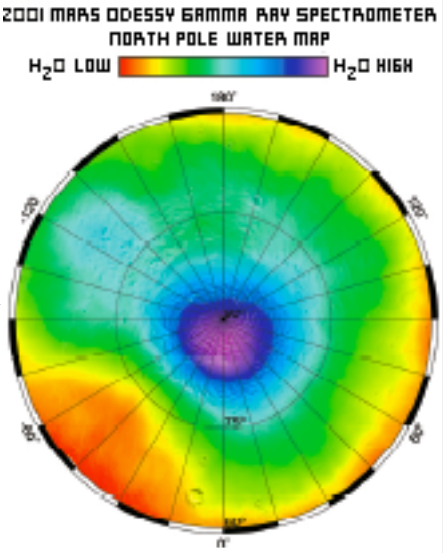


"Terra-formed Mars" by noted artist Michael Carroll, shows the northern (boreal) low-lying basin filled with water. The jury is still out whether Mars once had such an ocean covering 25% of its surface, or not.

Mars Phoenix lands on Mars, May 25, 2008

to look for subsurface ice near the North Polar Ice Cap

Previously, 2002 Mars Odyssey Orbiter gamma ray spectrometer scans looking for the signature of hydo-gen detected large amounts of subsur-face water-ice in the northern arctic plains. [red= lower and blue higher]



The ***Phoenix lander*** targets this area; a robotic arm digs through the protective top soil layer to the water-ice below and ulti-mately, brings both soil and water-ice to the lander platform for scientific analysis.

Feature Articles in This Issue

Our Annual Mars-Theme Issue

In FOCUS Rocket Science is not enough to get us to Mars *and back*

We can't launch a manned mission of over two weeks without an umbilical support line for oxygen & water.

First, let's get one thing clear. this writer is, and always has been, a strong supporter of manned explora-tion of Mars, and of eventual settlements there. Nor is this about the stupid "Moon or Mars" debate, when it is amply clear that we must do both. It's about what Mars advocates won't even tell themselves. [➪ p. 2, col. 2]

Railroads of Mars? Why not?

Fifteen years ago, an MMM reader brainstorming group tackled the idea of railroading on the Moon. Check out: http://www.lunar-reclamation.org/papers/rr_moon.htm Now we are revisiting the idea, not just for the Moon, but as a settlement-spreading infrastructure for Mars. In this issue we take a look at the design challenges that are unique for Mars, and introduce a new Google Group that readers can join to get in on the fun.

Moon Miners' Manifesto

Published monthly except January and July., by the **Lunar Reclamation Society** (NSS-Milwaukee) for its members, members of participating **National Space Society chapters**, members of **The Moon Society**, and individuals worldwide.

• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first eighteen years have been re-edited, reillustrated, and republished in 15 PDF format volumes, for free downloading from either of two locations:

www.Lunar-Reclamation.org/mmm_classics/
www.MoonSociety.org/publications/mmm_classics/

• **MMM's VISION:** "expanding the human economy through off-planet resources"; the early era of heavy reliance on Lunar materials; early use of Mars system and asteroidal resources; and establishment of permanent settlements supporting this economy.

• **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.

• **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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• **For additional space news** and near-term developments, read ***Ad Astra,*** the magazine of the **National Space Society**, in which we recommend and encourage membership

• **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 2006; 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.

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

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

• **Submissions by email** to KokhMMM@aol.com - Email message body text or MS Word, Appleworks, pdf attachments

√ Mac compatible CD / or typed hard copy must be mailed to:
Moon Miners' Manifesto, c/o Peter Kokh,
1630 N. 32nd Street, Milwaukee WI 53208-2040

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⇒ IN FOCUS Editorial continued from p. 1.

The evidence

Both the Shuttle and the Space Station leak badly, and it is not just from airlock cycling. The shuttle can stay up for up to two weeks, thanks to taking along enough "consumables." ISS can stay up indefinitely only because of Progress freighter consumable resupply. Most of us space enthusiasts have known for a long time that lunar outposts and expeditions to Mars are quite un-realistic unless these problems are tackled. One of the reasons we supported the effort to deploy a space station is our mistaken assumption that NASA would be forced to find a way to conserve and recycle air and water. The agency may have given the challenge a freshman-level college try but that is not enough. We thought that a station that conserved and recycled volatiles would prepare us for opening a viable station on the Moon. We were mistaken. We got only a "regenerative system" that uses up water.

In announcing the "Moon and Mars" initiative, the clear intention was that by going to the Moon, where **R**esupply, **R**escue, and **R**elief are possible, we could safely learn how to wean ourselves of this umbilical cord. But crying "not enough money" rather than being honest with Congress, the taxpayers, and space supporters, NASA decided to postpone indefinitely a "permanently manned" lunar outpost for a "permanent structure" (read future ghost ruin). That puts off indefinitely learning how to live "withot the cord" with technologies absolutely needed to go to Mars on missions that would last a minimum of two years. While NASA continues to make all the wrong choices, the Mars Society (to which I also belong) continues to be silent. Let's make it quite clear

We must learn how to "live without the cord" to get to a place where we can begin to "live off the land"

Meanwhile, crying budget woes, NASA has cut all biological life support systems research because, if we are only going to have a visitable lunar outpost, we can continue to maintain our addiction to the umbilical cord. "But what would you have NASA do?" Well, for starters, they could be honest with Congress, the President, and the American people. "We cannot pursue the mandate we have given because the budget does not allow us to make progress towards these critical goals." Still no money? Then the agency will be off the hook. Meanwhile, it is not just our new Moon Rocket that is "Apollo on steroids" but the outpost structure itself.

More: -- A **Mars** outpost left standing on the surface, naked and unshielded (at the mercy of Mars weather as well as to the cosmic elements) will need a lot of power to heat. The surface and atmosphere tempera-tures are in the same range as all-season temperatures in Antarctica. If we burrowed in or covered ourselves with marsdust, we would enjoy a more moderate thermal environment.

The Mars Society is now looking for a big new challenge project as it retires its Analog program. My suggestion? Demonstrate the technologies, not just to "live off the land" on Mars, but to "live without the cord" en route and back. And, oh, by the way, we need less cumbersome spacesuits also -- NASA cut spacesuit research as well. In short, the Mars Society should demonstrate how we can do biological life support systems "to and on" Mars. It makes sense to learn "how" to do this on the Moon. "Mars only" is undoable. - PK

Railroads on Mars

by Peter Kokh

Most of us are familiar with the critical role that railroads played in opening up the American West. The story was repeated, with some differences, in Canada and Australia. And with the railroads came the benefits of the Industrial Revolution. The railroads extended communications (telegraph) and by providing access to the territory they passed through, predeveloped the land.

How railroads can help

On the Moon and Mars, we aren't going to find building materials that we can "throw together" to provide shelter from the cosmic elements. We will need pressurized structures. *Pressurized modules made in a first quickly industrializing settlement can be shipped by the railroads to points along the route to provide the nucleus of new settlements.*

Pressurized modules have to be handled with care. Try to haul them overland on unimproved roads and the stresses of bouncing around are going to compromise seals and maybe open cracks. Rails on the other hand will provide a smooth low-friction ride to a prepared siding complex where they can be dropped off and docked with one another to provide an instant starter outpost. Such new "town starters" might even be called "sidingments" or "sidlings" instead of settlements. Every new train could bring another module or two including ready to plug in "container factories."

Now it is going to take some time before we are building pressurized modules on the Moon. Until then, inflatable modules will cost significantly less to produce and ship from Earth, and the railroads could carry these to desired locations as well. Clearly railroads could establish chains of interconnected settlements much faster than by any other option. That goes for the Martian frontier as well.

If the human frontier on Mars advances this way from one point of origin, we won't have the problem of distant settlements isolated from one another. But if we are going to open Mars by railroading, we need to do some homework first. Top priority is production of a high vertical resolution map of Mars so that we can plot logical rail corridors where along which grade changes are slow. We may soon have a good start on such a map from altimetry data from the present and planned fleet of orbiters. We need to look for the elevation change ***pinch points*** are located. On Earth, these are straights and passes through which traffic funnels. Those will be critical anchors along proposed routes.

Between such narrow points the doable routing options are greater, and attention can be paid to scenic areas that would draw tourist traffic, for example. Scenic and Geological treasures along the selected route would go to the top of the list for boundary determination, and for location of adjacent visitor concession areas to set the stage for tourist and excursion companies, serving Mars pioneers.

Next we need to really work to define a useful "**economic geography**" of Mars. That's a map that shows where "all" the critical resources are to be found, and in what degree of concentration. Where the elements from which building and manufacturing materials can be made are found to cluster, we have potential new industrial centers. Feasible routes that do not connect resource clusters would be options for development at a later date. These considerations are to the point on both worlds.

Routine aviation on Mars may be further in the future

Why take the train when we can fly on Mars? I do believe that we can, but I also think that aviation on Mars will be uncomfortably pushing the envelop and that because of that, it may be risky for some time.

On the one hand, we are confident that flight is possible at 125,000 feet on Earth, and perhaps that has already been demonstrated. But no one has ever demonstrated take off and landing at that altitude. The suggestion is to design Marsplanes like Harrier VTOL fighters.

It still has to be demonstrated. And unless we are to be flying only at the Mars version of sea level, say within the northern ocean-sized basin or within Hellas, and if we are not going to just skim just over the surface, Mars aircraft are going to have to be stable at pressures a lot thinner than that at 125,000 feet on Earth.

Another thing I have never heard a Mars aviation fan (other than myself) concede is that the equivalent of 125,000 feet on Earth only describes the situation in spring and fall when much of the polar carbon dioxide snow over both polar caps is vaporized. As we go into either summer or winter, a significant part of the atmosphere, *as much as 30%,* will freeze out over one or the other poles. If Mars flight is possible only seasonally, it will not become the backbone of transportation on Mars. Another question is to what extent will dust storms that can last months, make flight dangerous.

Now maybe we can fly even when the atmosphere is at its thinnest. I hope so, but do we know? And more to the point, will we be able to hoist heavy cargo by air? I believe that railroads on Mars will become the backbone of global transport in the early decades

Mars-Specific Design Challenges

Seasonal thermal extremes on Mars (from just over the freezing point of water to temperature lows far below the lowest ever reached in Antarctica, means that ***tracks must be designed for thermal contraction and expansion.*** Now on the Moon, the challenge is greater. It gets just as cold on the Moon as in the Martian winter, and in-between far hotter than the highest temperatures ever experienced on Earth on a monthly schedule. On the Moon we may have to shade the rails somehow. unless we can find an alloy with ***a very low coefficient of thermal expansion.*** The same will hold true of whatever we come up with to keep the lateral rail-rail separation within close tolerances: a functional ***equivalent of our railroad "ties."***

On Mars we must use elevation contour maps to identify locked, no outlet basins, which could, in a terraformed future Mars become lakes or small seas. No sense pushing tracks through such depressions, no matter how conveniently smooth.

On both worlds, we have to ***design out the possibility of derailment*** that would involve upturned cars losing pressurization with a total loss of life. We will be dealing with lower gravities while momentum and mass remain the same. Very ***wide gauges*** (rail to rail

separation) and very ***low centers of gravity,*** even some amount of banking of curved track sections may be part of the answer. But perhaps the best approach would be to take a page from modern all ***steel roller coasters with wheels above and below the rails*** so that the cars cannot come off the track.

If we have to complicate rail design to meet these constraints, then track switching becomes more complicated as well. But there should be ways to do it other than the roundtable.

For passenger trains, there is another issue. On Earth our passenger cars are "vestibulated." They have flexible accordion like passageways above the couplings that allow protected access between cars. On Moon and Mars it is ***unlikely that flexible corridors could long be maintained*** without a pressure loss.

There would seem to be at least two ways around this problem. (1) restrict car to car (in Europe, wagon to wagon) passage to periods when the train is at the depot, or otherwise parked on straight level track sections. While so parked, the cars could snuggle up to one another, effectively docking as we do in space. For breathing purposes, Mars might as well provide a high vacuum, as does the Moon.

(2) There is another option. As the railroads will be pushed through new unoccupied lands with no in place transportation infrastructures in place, there will be ***as yet no overhead clearances to observe.*** Nor will the rights of way be expensive to acquire. Mars, and the Moon, are virgin territories and the railroads will have the chance to set both rail gauge and clearances.

There is no reason why a Mar/Moon passenger car/wagon could not be double the width, double the length, and double the height (two floors) ***able to carry as many passengers as a Jumbo jet.*** Not that traffic will mandate such jumbo one-car trains at first, but the point is we should design the system so that in the future, when and if traffic warrants, we could build such capacious cars. The word "train means an coupled row of cars, one following the other, pulled/pushed by an engine car.

On the new frontiers of Moon and Mars, we have the option of starting with a clean slate blackboard, and we should take the opportunity to design for a more densely populated frontier with many major settlements. *Now most people are not thinking that far ahead, but if we don't, then we risk making a slew of unnecessary, stupid, contraceptive dead-end decisions.*

The Railroad as Land Developer

Another thing worth paying attention to well in advance of the time when we starting to expand out of an initial outpost, is the role the railroad land grant system in place when railroads opened the American rest. What were the good points? What points were not so good.

The Martian (and Lunar) railroads could be a major force in developing the strips of land that they passed through. This is too significant an opportunity to ignore. We will need to get it right.

Many more issues

How will railroads be powered? Nuclear power is an option that was taken quite seriously back a few decades ago by the Norfolk and Southern running between Cincinnati, Ohio, and Norfolk, Virginia. I am not sure how far along that brainstorming effort got before being abandoned. If we can make a nuke sized to run a submarine, then why not a railroad? But they are heavy units requiring water for cooling.

The tops could be paneled with photovoltaic cells. The railroad could be paralleled with communication and electric power cables. On Mars, there is another option. A small nuke on board could ***process methane fuel from the atmosphere*** as the train travels! This is an option not available on the Moon. This system would be self-contained, ideal for day-night, ***all-season operation through territories without any other infrastructure.***

Choosing between options

Some options will be realizable and practical before others. Yet if the most desirable option will save many headaches down the road, it's worth predeveloping. The bottom line is what percentage of the various options involves the least mass to be shipped from Earth - Earth sourcing is by far the most expensive option of all.

So we need to design a railroad system that has a lot of features with no guarantee that they will all be ready on time:

- Lowest total component mass to be upported out of Earth's deep gravity well
- Highest percentage of component mass that can be manufactured on location (English for technospeak "in situ") in time to start building the system
- Most rugged in terms of wear and tear, but also with respect to constant exposure to the Moon's naked (Mars almost naked) cosmic environment.
- Overall architecture that best supports spread of settlements as well as route-side development
- The system is the most rugged and least prone to degradation and early repair or replacement.
- The system design that best supports quick deployment of new settlements (sidingments)

So if this article intrigued you, whether or not you have always been a train buff or a model railroader or you have simply enjoyed train travel, *and if you enjoy a engineering challenge,* why not join our brand new design brainstorming group: *teasing illustrations on next page*

Google Groups

Railroading on Moon and Mars

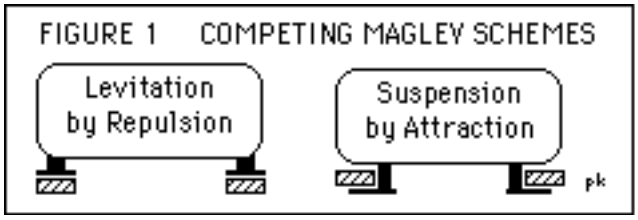
http://groups.google.com/group/railroading-on-the-moon-and-mars/

Calling all railroad buffs, model railroad fans, systems architects, 3-D modelers, systems integration experts, and anyone else who would like to get in on the ground floor of creating these different but yet similar ready-to-go transportation architectures for Moon and Mars.

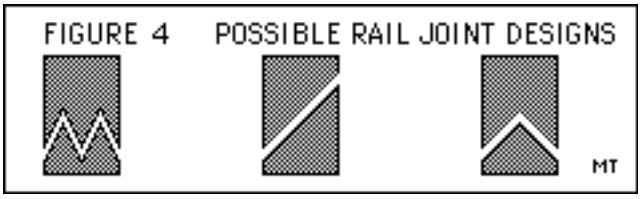
We need your help. Let's collaborate across disciplines to give railroading a special future on the space frontier.
We will be uploading more files to this site, so visit often.

A joint initiative of the Moon Society and MarsDrive and is cosponsored by The Lunar Reclamation Society and Wisconsin Mars Society. More cosponsors welcome. Help spread the word. Such an effort will open eyes of people who never thought of Moon and Mars as human frontiers!

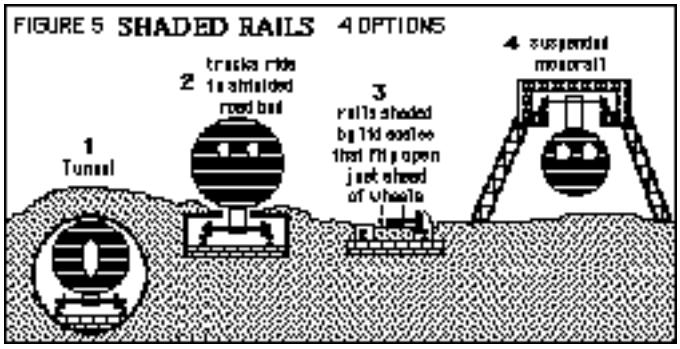
Railroad System Illustrations from '93 Paper



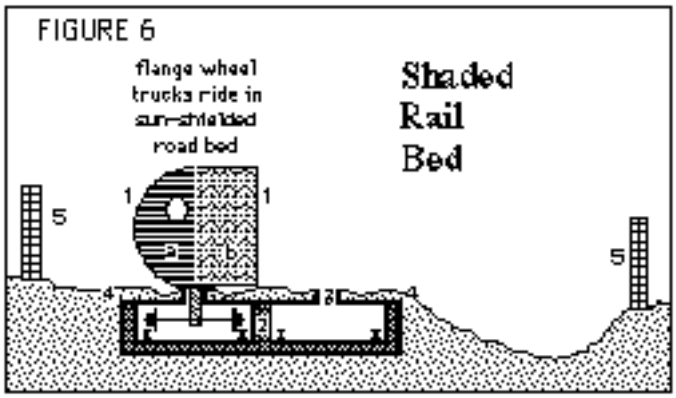
The Society has a member developing and all new Maglev system with many promising terrestrial applications



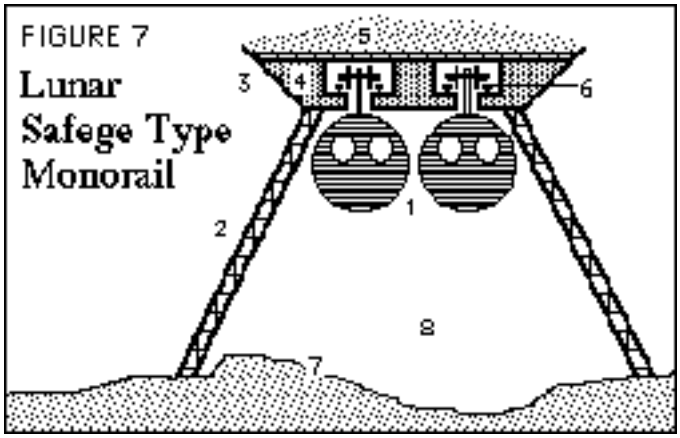
to allow for thermal expansion and contraction

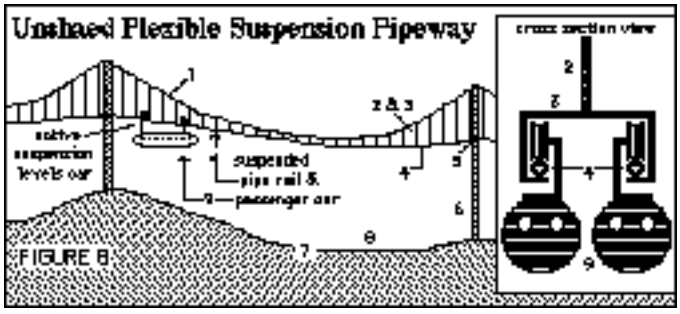


Every method of rail-shading (on the Moon) brings its own advantages and disadvantages.

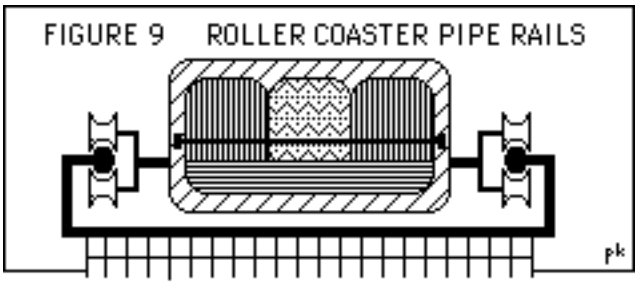


There are many solution to shading rails depending on latitude, time of solar day, direction of travel.

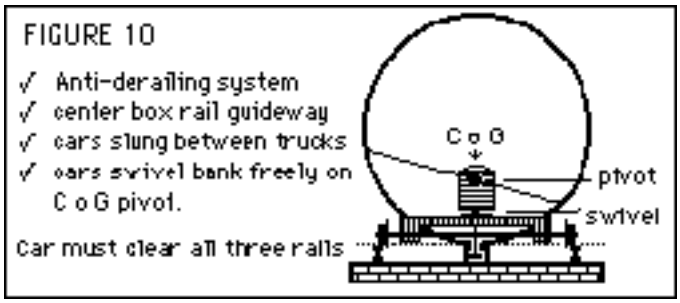




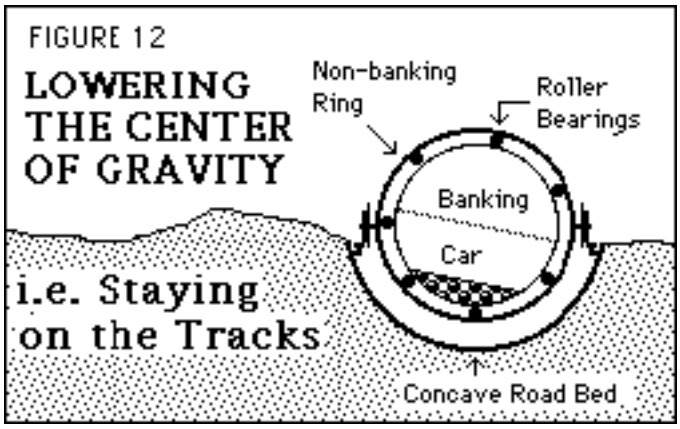
Monorail systems ^ are ideal in rough and scenic terrain



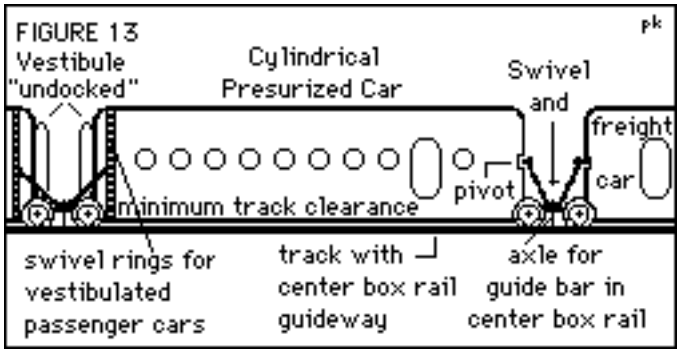
Derailment must be engineered out of possibility as ruptured cars/modules would mean instant death.



Center box rail, ability to "lean" minimize derailments



Above: ultimate in derailment proofing, cog below rails, cars swivel into proper lean in turns.



MMM Platform for Mars v.2.0

Dare to Dare!

Revisit our original version in MMM #93 March 1996
reprinted in MMM Classic #10, p. 25
www.moonsociety.org/publications/mmm_classics/

by Peter Kokh

PART I - Basics

• Getting Humans to Mars

No rocket, no matter how powerful or fast, can deliver humans safely to Mars without **a life support System weaned of frequent "umbilical cord" resupply of oxygen and water.** Preferable and to be prioritized are biological/agricultural/biospheric life support systems on which outpost expansion and future settlements can be based. Had we now all other equipment ready to go, humans could not go along. This need underscores the importance of testing such systems on the Moon where any test failure would not be catastrophic.

• Atmosphere Mining for Methane, Oxygen, Water

Yes this technology has been repeatedly demonstated. But there has been little follow-through. We need to perfect methane or propane fueled generators. We do have methane and propane fueled vehicles. We should tweak these technologies for use on Mars. We also need to develop/demonstrate atmosphere-derived production of organic chemistry feedstocks for the production of plastics and many other useful products. Such industry would have an export market on the lunar frontier.

• Inflationary Growth of Human Presence

Having crews return to Earth to be replaced by fresh crews is not an efficient plan for maximum growth. We must identify the architecture and *systems needed in a fist Habitat* landed on Mars *capable of indefinite occupation.* We need to identify the set of perks necessary to encourage crew to remain on Mars indefinitely, so that with each new crew ad Hab, both the physical complex and the population grows. While this idea will meet with enormous ridicule and opposition, *any other plan is doomed to failure, so become* good social citizens in order to survive. Of course, that must be sooner *rather than later.* This "Option toe Stay" is the superior tactic for the Moon as well. This is so important that the Sydney Gambit should not be ruled out. Sydney, Australia was founded by British Convicts who were forced to voluntary!

PART II - Filling in the Holes in an Economic Geography of Mars

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

"is the study of the location, distribution and spatial organization of economic activities across the Earth." To this writer, that is not an adequate definition. Economic geography includes a set of maps which show where resources of economic significance are to be found. It also should identify geographic, geological, topographic features and other physical features of potential economic significance, including features that affect transportation routes (navigable waters, straights and passes, etc. In application to Earth, it also identifies population density, relative use of transportation routes, industrial concentrations and more. For Mars, as uninhabited we are concerned with potential features that will affect how a human frontier will expand globally, as well as what choice of sites will optimize future expansion.

• Mars Permafrost Explorer — The opportunity to pre-test such a probe in Earth orbit to improve our knowledge of terrestrial tundra resources, makes this an easy sell. While current orbiters can locate water ice very near the surface they cannot identify ice or liquid aquifers at the depth at which they are more likely to be found.

Once we have mapped these resources, ground truth probes which can drill down to identified reservoirs, and characterize the water resource as to salinity and other features are in order. Siting a first outpost without such a comprehensive study would be plain stupid.

• Mars Lavatube Explorer — We have already identifies lavatube entrances on the flanks of Olympus Mons. Lavatubes of a scale larger than terrestrial ones but smaller than Lunar tubes are likely to pervade the great shield volcanoes on Mars as well as the entire Tharsis Uplift. The opportunity to pre-test such a probe in Earth orbit to improve our knowledge of lava flow terrain, makes this a logical priority. We could refly such instruments around the Moon where tubes lie deeper below the surface. The results could be far less important for geology than for future Mars settlement scenario options. Ancient near-surface Martian limestone caves could also be identified. Meanwhile robotic mobile probes should be targeted to already identified tube openings.

• A High Vertical Resolution Topographic Map of Mars

With accurate elevations, a contour map of the entire planet would identify logical transportation corridors and transportation obstacles. Such a map would help create a rational plan for spreading human presence on Mars in the most efficient manner, as well as help us choose between competing resoucre-extraction sites.

Of relevance to the question of terraforming Mars (currently, our only experience is in de-teraforming Earth) would identify potential watershed basins and their downward linkage, as well as basins that have no outlets. No sense in putting a settlement in a location that might someday be under water!

• A global network of weather stations

A better knowledge of area weather patterns through all seasons over several years would help crews and pioneers prepare for weather related eventualities.

• A global seismic activity monitor station network

There is no wisdom in continuing to assume that Mars is geological dead. We should also look for any "hot spots" that could be a source of geothermal energy. It serves no purpose to assume the answer is know when we could check.

• Potential resources on Phobos & Deimos

Russia's probes Phobos 1 and Phobos II both failed to reach their target. Fortunately, Russia's current **Phobos Grunt** (Phobos Soil) mission may give us some answers. Resources developed on one or both of these moonlets could not only help open the planet itself but provide valuable exports to the Lunar frontier, *earning credits to be applied to purchase of badly needed equipment and supplies from Earth.* This knowledge will be a cornerstone of any realistic "Economic Case for Mars." Relying solely on handouts from Earth is a sure invitation to wholesale cessation of support.

We thought at one time that these moonlets were captured carbonaceous chondrite asteroids. Now we are

not sure. If so, this would be a supply of hydrogen, carbon, and nitrogen high up the shoulder of Mars gravity well, that could routinely be shipped to the Moon. We need to know. Any attempt to bypass these worldlets in developing Mars, grounded solely on impatience, will bite the dump-Phobos in the butt sooner or later. We need to know what resources are there so as to plan intelligently.

- **Outline of Mars Economic Geography topics:**
  - □ subsurface water / ice
  - □ iron, other metals
  - □ thorium & uranium
  - □ gold, silver, platinum, copper, zinc
  - □ cementacious/silica materials/salts
  - □ regolith/sand depth over fractured bedrock/basalt
  - □ sedimentary areas, sediment depths
  - □ topographic clues to transportation corridors
    - □ gaps, passes for roads and railroads
    - □ aqueduct/canal/pipeline routes
    - □ future rivers / lakes
  - □ atmospheric pressure seasonal variations
    - □ Mons summits, Tharsis plateau
    - □ Boreal Basin bottom, Hellas, etc.
  - □ outgassing
  - □ geothermal areas
  - □ likely lavatube areas
  - □ tourist sites - historic & scenic sites
  - □ geological wonders

Part III - Needed Equipment

The excuse that we don't need something right away, surely to be the mantra of those only interested in exploration of Mars (satisfying their own set of scientific curiosity itches) and not interested in Mars as a future human frontier, if not entirely hostile to that prospect, is no excuse for those of us who do care, to leave it to NASA whose interest is minimal and peripheral to develop equipment needed on a Mars Frontier.

- **Mars Aviation** - NASA has indeed looked into small drone aircraft for use in exploration. We believe that flight on Mars is possible. But takeoff and landing from an equivalent altitude of 125,000 feet on Earth has as yet not been demonstrated. If we are to rely on passenger & cargo aircraft to facilitate travel and trade on Mars, we should be thinking of how we can develop the needed technological advances here on Earth.

- **Mars Railroads** - Railroads were essential to the opening of the American West, of Canada, Australia, and Siberia. It could be so on Mars. See RR articles this issue.

- **Solar Sail "Pipeline" Cargo Deliver Systems** - The descendents of Cosmos 2 provide the best option to byappassing the 25+ launch window intervals between Earth/Moon and Mars. In pipelines, how long it takes something to go from source to market is irrelevant as long as something is always entering the pipeline and something is always coming out the faucet at the end. This is a system vital to tapping asteroid resources as well. How can we help? Suppoting the Planetary society Cosmos 2 Solar Sail project with donations is certainly one way, for those of us technically challeged!

Part IV Mars Analog Activities

It was a deep honor, a great privilege, and a matter of pride to have served on two crews (# 34, #45) at the Mars Desert Research Station in Utah. I have great respect for the program and detractors have taken many cheap and unfounded shots out of ignorance and lack of first had knowledge. But my enthusiasm did not blind-fold me to the limitations, *and failures,* of this project.

The Mars Society was founded on the belief that Mars is the best location for a second basket in which to put human and Earth life eggs as a hedge against the possibility that human civilization could collapse on Earth, whether from a possible untimely asteroid impact, from human strife, or from total collapse through overpopulation and runaway exhaustion of resources.

All the same, these two stations, in Utah and on Canada's far north Devon Island, are totally designed to demonstrate Mars exploration tactics only. The vertical Hab standing above the Mars surface, fully exposed to temperatures that can range at the equator from just above freezing to lower than anything we have experienced in Antarctica. Such an architecture invites catastrophic collapse of any Mars exploration mission of anywhere from six months to up to two years. What is easiest to ship and land is not necessarily the easiest to maintain on Mars. Nor is the solitary Hab structure designed for expansion. What should be the demonstation goal of the project are technologies that make expansion towards a more comprehensive permanently manned outpost leading to real first settlement.

What is needed is not the phase out of this analog program, but a whole new start based on a whole new philosophy. Perhaps some of the design ad research objectives under consideration for a proposed Lunar Analog Research Station will produce know-how and experience useful on Mars.

Part V- Building an Economic Case for Mars

"Mars First/Only proponents are fond of pointing out that Mars has a more complete set of resources on which to base a sustainable frontier. That is partially true.

Partially, because it will be a very long time before the Martian Frontier could sustain itself should all resupply and supply of things that the pioneers could not yet provide for themselves somehow cease whether from economic collapse on Earth or international weariness of supporting the young Martian frontier. To create "An Economic case for Mars" means identifying realistic potential export products to earn credits to pay for imports. Outside of potential but as yet uncertain exports of volatiles from Phobos and Deimos to the lunar frontier. we have not seen a single realistic export suggestion. Gems not found on Earth? Unlikely, and purely speculative. Medicinal plants that grow only in Mars Soil? Again pure speculation. Income from Earth tourists? Who but the rich terminally ill are going to take two or three years out of their lives for the round trip experience?

Partially, because three other resources, none of which Mars offers, are really hard to do without. We all know what they are: ***"Location, location, location."*** The Moon has it, Mars does not. Like Japan which lacking steel,coal, and rubber, developed the entire Pacific rim for markets of raw materials and markets for exports created from these raw materials. The Moon, a handier source of materials for building out the human presence in LEO and GEO, and of capital goods for Phobos, Deimos, and even Mars, is poised to become the Japan of Space. Japan has proved that by far the most important resource is not physical at all. It is ***resourcefulness***.

In a future in which both Lunar and Martian frontiers are expanding apace, there will be a trade economy between Earth, LEO, GEO, the Moon, and Mars in which a greater Mars, Mars PhD, will have a place as a supplier of goods to the Lunar Frontier that will earn them credits for purchasing equipment from Earth. Prevent the Lunar frontier out of blindness, and perish.

It is in the Moon Society's best interests, *and in the interests of all who want to see a health lunar frontier develop,* ***to help develop a strong Economic Case for Mars*** *– even if Mars entusiasts don't care to do it themselves, or scorn our help. The Moon and Mars will either thrive as trade partners or both whither on the vine.*

Accessing the Asteroids

Isn't Mars closer to the asteroid belt? This is a point that has been made by science fiction writers from long before the Space Age began. It is both true and a curse. Why? Because of a catch 22 of celestial mechanics: The closer two orbits are to one another in period, the less frequent the launch windows between them. And the corollary: the further apart to orbits are in period, the more frequent the launch windows between them. This may look like a cruel trick, but we could not have solar systems without it. Mars greater proximity to the Belt, but this is actually a disadvantage that will make the Moon the preferred transportation "hub" of the asteroid belt.

Observatories on Mars or on Phobos or Deimos) can help identify and keep track of asteroids and astrochunks that could threaten Earth. So that is one investment we ought to make.

So how do we build the Economic Case for Mars? It would be deceitful to say we have a plan. But we have outlined the starting point: **Promote completion of the Economic Geography of Mars:** A chemical and physical resource map will help us plan where first settlements should be located, and facilitate global expansion.

Shouldn't a first outpost be sited near the places of most scientific interest? Yes if you are self-destructively impatient. In the end we will explore Mars much more thoroughly if we have a permanent human frontier on Mars, than we will if we rely on hit and miss landers and rovers. Impatience always bites one in the butt.

We first gave a presentation on the need to build an Economic Case for Mars at ISDC 1994 in Toronto at the request of Chair Paul Swift. There was no response from the mostly pro-Mars audience. Nor do I expect more input from Mars fans to this new report. That's why we Moon-enthusiasts must take the lead. It is in our own best interests to do so. We do not now have the needed information. We have pointed out that a Mars alone (damn Phobos and Deimos) approach is doomed. We are trying to jump start brainstorming on potential Mars transportation infrastructures: aviation and railroads. We have tried to point out that the Mars Analog Research program is not optimized to produce the best results.

For now, the most helpful thing we can do to ensure that the Mars Frontier gets off to a good start is to keep on working on the Economic Case for the Moon. The lunar frontier will be a cheaper source, once capital costs are amortized, of goods for Mars, as well as the best source of field-tested hardened pioneers, for whom, Mars will be "a walk in the park." **<MMM>**

ESA presents Mars in 3-D Courtesy of Mars Express

www.esa.int/esaSC/SEM8Q2PR4CF_index_0.html

"Constructing a Digital Terrain Model requires a spacecraft to look at the same surface feature twice, each time from a different angle. Most attempts to do this in the past have required the spacecraft to target the same feature from two different orbital passes. The High Resolution Stereo Camera (HRSC) on Mars Express is the only experiment that can do it in one pass.

To achieve its complementary views, HRSC has nine individual scan lines that point fore, aft and straight down. It therefore sees a feature coming, sees it directly underneath and watches it recede into the distance, providing all the different angles needed.

"NASA's Mars Global Surveyor carried a laser altimeter instrument (MOLA) that provided spot heights across the surface of Mars, but these were often separated by many kilometres. HRSC provides altitude data for every data point the camera sees. It is the first time that high-resolution images have been accompanied by high-resolution topography."

"The high-resolution images used have a resolution of 10 m/pixel (33ft/pixel). The DTM elevation data derived from these images is provided in pixels of up to 50 m, with a height accuracy of 10 m."

This program should be released soon according to the information on the URL above. **</MMM>**

Help us put MMM in a Library near You!

Whether you are a member of an NSS Chapter or of a Moon Society Chapter or Outpost, or a Moon Society member at large, you all get Moon Miners' Manifesto as a membership benefit. A library subscription to a library in your community will help spread the word, whether about local or national or international Moon-focused programs and projects.

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

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

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

How to participate in this program

Send by postal mail only

- □ Your check of money order for $10.00/per year
- □ With the complete name and address of the Library,
- □ made out to

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

The Moon Society www.moonsociety.org

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

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

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

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

Mastead Design

by Charles F. Radey, Moon Society Vice-president

Moon Society Update: February 15, 2008

Full Report: http://www.moonsociety.org/reports/society_update_02-15-2008.html

Report Highlights

At the Board's February 6th meeting, a helpful revisions in the bylaws was passed that introduces a new body, the "Management Council" consisting of all officers and all Board members. The MC will have the ability to make day to day decisions, without waiting for the long prior notice to the Board. While some few issues are reserved to the Board, now meeting *quarterly,* decision making is now streamlined, as appropriate for an organi-zation trying to take advantage of every opportunity to advance toward society goals. In contrast, the **MC** meets *twice a month.* The Leadership Council remains, being simply the Management Council plus other nonvoting individuals who join in to give input in forging consensus.

Chapter System Growth

We welcome Houston and Phoenix, two former outposts who have graduated to full Chapter status; *and* two new outposts: Tucson and Longview/Kilgore (Texas)

New Web pages

- www.moonsociety.org/legislative/
- www.moonsociety.org/publications/papers/
- www.moonsociety.org/visitors/
- www.moonsociety.org/downloads/

New Web portals

- http://profile.**myspace.com**/index.cfm?fuseaction=user.viewprofile&friendid=198887204
- www.**facebook**.com/group.php?gid=6457556893
- **Change.org** http://apps.facebook.com/causes/view_cause/27816

New Partnership with the **MarsDrive**, jointly sponsoring groups.google.com/group/railroading-on-the-moon-and-mars/

Our new "hands-on, metal-bending" Project: Desk top Solar Power Beaming demonstration – We are hoping to have this unit ready for the Internat'l Space Development Conference at the end of May – for more, see *next page*

A Draft Strategy plan for Society growth

In short, we are not standing still waiting for the world to come our way. Yet we are limited in what we can do by the number of available volunteers. Leveraging the talents and energies of other organizations is one trick up our sleeve. We hope to have more areas of progress to report on to our members and visitors in the near future.

In the meantime, check out the links above. You just might find a place where you may want to jump in. We have a very high percentage of active members and that bodes well for our future. – *Peter Kokh*

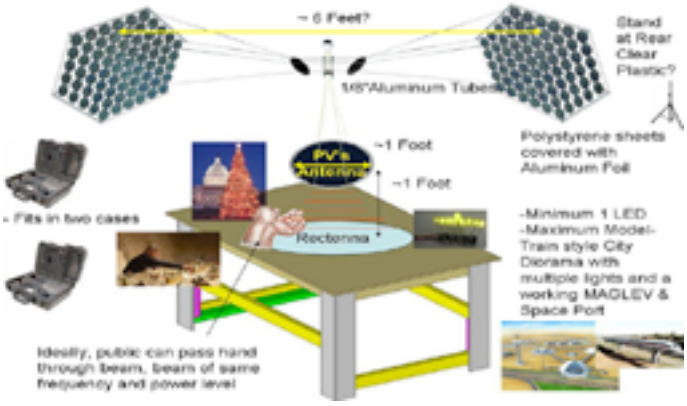
"Power Beaming Desktop Demo" Project
A New Project of the Moon Society

from Society President, Peter Kokh

On October 10, NSSO, the National Space Security Office went public with its study that showed that the United States can only achieve true energy independence by building a system of Solar Power Satellites in Geosynchronous Earth Orbit [GEO]. The Moon Society and the National Space Society and eleven other organizations rallied in advance in support of this initiative.

In our IN FOCUS editorial in last month's MMM, we pointed out that since such a huge infrastructure can only be constructed affordably by using lunar building materials for as much of the SPS mass as possible, that adoption of this initiative was a *surer way* to realize Moon Society and NSS objectives of space settlement than the VSE, the current program of NASA to erect a permanent, but not permanently occupied, lunar outpost in a location far from ideal for launching a rational plan of lunar development and industrialization – a plan which may well be scuttled by the next administration taking office in 2009.

Since this announcement, Air Force Major Peter Garretson, Society VP Charles F. Radley, and others have put together a plan to create a "tabletop" "end-to-end" demo of just how SPS would work.



for a larger, crisper, more legible image go to:
www.moonsociety.org/projects/spb-demo/

The idea is to make it sufficiently compact and light to fit into two airliner-checkable containers, so that the display could make the rounds from conference to conference, being showcased at museums and elsewhere in between. Also involved is Society Director Dr. Peter Schubert. This project gained immediate support from myself and Director of Project Development Dave Dunlop, and now Leadership Council. We've been busy identifying needed parts and sources. The challenge is to build a working Rectenna (rectifier + antenna) but we have found no showstoppers. Once the first demo is produced, we'd like to work on more affordable versions that Moon Society and NSS chapters could use for public outreach. We do not have the funds to do all this, however.

Your donations are essential! Go to our home page www.moonsociety.org, scroll down the left hand column, and click the **make a donation** button. Thanks

THE book worm REVIEW

THE LUNAR EXPLORATION SCRAPBOOK

A Pictorial History of Lunar Vehicles

by Robert Godwin

Publisher: Apogee Books - www.apogeebooks.com

(Apogee Books Space Series)
ISBN: 978-1-894959-69-8 - Paperback

Reviewed by Peter Kokh

In one word, *Wow!* This book is an irreplaceable treasure trove, collecting designs for Lunar landers and rovers from long before the start of the Apollo Project

All the designs for Apollo equipment by NASA & competing contractors that didn't make the final cut – *amazing!*

This book clearly illustrates how the final designs had developed, and zeros in on the considerations that carried the day.

Not only does this book give an in depth detailed look at how NASA decided on the winning designs, it also gives the reader an appreciation of the ingenuity and inventiveness of the various competing contractors.

But now that NASA, and the space agencies of Russia, China, India, Japan, and other nations, *and private enterprise* are planning to return to the Moon, these illustrations and blueprints deserve to be revisited. Paths not taken by NASA, could inspire different design approaches that might be less expensive, and work just as well or even better for some missions with a differing sets of objectives.

You will find more information on the publisher's website (and an Amazon.com link):

www.apogeebooks.com

This is a temptation you owe it to yourself *not to resist!*

A MOON PROJECT CHALLENGE

from Moon Society President, Peter Kokh

Let's say for speculation sake, that we have identified a donor who will give us a tidy some of money for

"a bold new project showing imagination, ingenuity, and resourcefulness, and witch promises to make a contribution to the Return to the Moon effort. We are to have a competition to flush out some project ideas that meet the donor's expectations."

Got any ideas?

- □ a space education project focusing on the Moon's place in our future?
- □ a hitchhiker instrument or device to ride on one of the Lunar X-Prize contender lunar rovers?
- □ a hitchhiker not to the lunar surface but into orbit around the Moon – perhaps a cubesat (4" on a side, max. 2.2 lbs, off-shelf electronics)?
- □ a low budget demonstration of artificial gravity at the lunar 1/6th G level
- □ It could be ... ???

We can think of more neat ideas, *but let's hear about your ideas!* Your proposal could fit one of the suggestions above, or be something quite different.

Who can make a suggestion

- □ Members of the Moon Society
- □ Members of Moon Society affiliates (NSS, ALS, CSW) and collaborators (MarsDrive, etc.)
- □ Other MMM subscribers
- □ Friends and website Visitors
- □ Chapters of the Moon Society or the National Space Society
- □ Other Groups, including ad hoc groups assembled just for this challenge opportunity
- □ *Note:* officers and directors of The Moon Society may compete, provided that they submit their idea under a pen name, and via an email address or postal address not in our database

Deadlines – July 20, 2008, the 39th anniversary of the Apollo 11 moon landing

Submission Details & Incentives – TBD – This informat-tion will be posted on the website below

Similar efforts that were successful

- □ Lunar Prospector (designed before NASA adopted it as its 2nd Discovery class mission)
- □ The ongoing CubeSat program which includes some successes and some failures

Similar efforts that were not successful

- □ 1980s Amateur Space Telescope effort
- □ 1991 Experimental Space Craft Society's "Just-do-it"

"Nothing ventured nothing gained"
"Show me the man who has never failed, and I'll show you a man who never tried."

Please visit this page for more complete details

www.moonsociety.org/projects/challenge_project.html

New Moon-focus Organization Dreams Big

from Peter Kokh

It is now almost seven years since we effectively abandoned the Artemis Project™ without realizing that by forming a successor organization with no real power or authority to advance this "Flagship Project," we were kissing it goodbye. Many former ASI members have privately expressed frustration, even a sense of betrayal about this turn of events. Along comes a fresh start by another group determined "to get to the Moon," or at least to create "stepping stones" along the way.

"Help Create an Orbital Propellant Station"

says http://www.lunarwire.com/

Indeed, given a ragtag team of too few members and little in the way of financial or other resources, it is hard to see how this new start could fare any better than those of us who gave our all to The Artemis Project™. But we ought to follow closely what they are doing.

Answering an invitation by Society Vice-President Charles F. Radley, **Chad Willson** of LunaWire.com has joined the new **Moon Society Yahoo Group** (see the button in the left hand menu column of our front page.) He is willing to work with us:

"We have gotten off to a good start and there is much work to be done. Let us know how we can support you. ... This is a very exciting time."

Perhaps with new inspiration, we can yet succeed. The Artemis Project™ was built on an expectation that we could pay for it with "*infotainment*" revenues, an expecta-tion that proved unrealistic. A mission must be paid for largely in advance, or with Venture Capital from sources convinced of the business plan's merits. There was nothing major wrong with the Reference Mission™ itself.

We occasionally get letters that say "let's do it ourselves!" Well we tried, and it proved far more difficult than we realized. But perhaps someone else will find a magic key to succeed where we have not. Part of the problem may have been that the Artemis Project™ was a tightly held proprietary one, and ASI members in general, were not given shares or a way to buy in, or earn shares. We were pioneering new territory, not just in the mission design, but in the way we sought to bring it to realization. If another group, learning form our experience can find a better route, more power to them. Let's put skepticism aside and see what happens!

We have launched **Lunarpedia.org** as a substitute for the Artemis Data Book™ and **www.AngusBay.org** (a name not trademarked by TLRC) where we can post art work, illustrations, graphics, articles, discussion threads and even create simulations of lunar settlements. **<PK>**

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/

Mail Box Destinations:

□ **Checks, money orders, membership questions**
Moon Society Membership Services:
P.O. Box 940825
Plano, TX 75094-0825, USA

□ **Projects, chapters, volunteers, information, etc.**
Moon Society Program Services
PO Box 80395, Milwaukee, WI 53208-8395, USA

Phoenix chapter leader tends booth at the Sally Ride Festival at Arizona State University in Tempe, March 1st.

Moon Society Internet Groups

Yahoo Group Check the bottom of left hand menu column of our homepage www.moonsocity.org for links

Google Group: Railroading on Moon & Mars
http://groups.google.com/group/railroading-on-the-moon-and-mars/

The Moon Society Blog belongs to *You!*

The archive at www.moonsociety.org/blog would seem to indicate that this Blog is for the use of the Moon Society president only. But that was not the intention.

All Moon Society officers, directors, and current members are welcome to post on this site. We will remove posts on "off topic" subjects not related to Moon Society goals such as political, social, relgious issues, and will edti out inflamatory remarks that serve no constructive purpose. But other tha that, any member should feel free to post suggestions, commentaries, etc.

If you have something constructive that you would like to share please do register on the blof for a user name and password. As soon as this login is confirmed, you are welcome to post.

Send questions about topics to kokhmmm@aol.com
Questions about how to post etc. to tomg@mnsfs.org

Chapters & Outposts

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>

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

Moon Society Phoenix Chapter

http://www.moonsocphx.blogspot.com/
Contact: Craig Porter <portercd@msn.com>

Meeting the 3rd Saturday of the month
Saturdays **March 15th, April 19th**
at Chompie's at 1160 E. University, Tempe, at 3: PM.

News: At the February 16th Meeting, we elected officers to replace the provisional list.

We have received our Chapter Certificate from the Moon Society! and continue to support the Tucson area outpost, helping with recruiting and area outreach events.

We had a tent/booth at the Sally Ride Fetival at ASU on March 1st, with great attendance.

Moon Society Houston Chapter

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

Next Meeting Monday evening, March 24
Park Place Library, 8145 Park Place, Houston, TX 77017

News: Our Moon Society Chapter Certificate has arrived!

Bay Area Moon Society Outpost

http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates <hcate2@pacbell.net>

Meetings: every 4th Thurs.7pm at Henry Cate's, San Jose

Thurs. Feb. 28th, pizza and gossip. Jonathan Goff talked about an atmospheric Scooper to gather LOX at orbital altitudes of 325 km. We will have a copy of the original AIAA paper at the meeting. It claims that a 1 meter scoop at 325 km altitude could gather 1 ton per year of atmosphere. It seems to me that an orbiting satellite would fall out of orbit if it were exchanging momentum with that much mass. More data or wisdom on this subject, will be appreciated. (My sanity check is that the ISS reboost schedule appears to indicate that the entire satellite is only bumping one or two tons per year.?)

An interesting piece of data is that atmosphere at that altitude is 85% Oxygen, so the ratio of useful stuff is high. If you could gather LOX at altitude, it would help open the rest of the solar system. The merits a look!

Moon Society Tucson Outpost

Contact: Ben Nault <bnault@comcast.net>
We've picked up a second member. One more to go!

Why not start a Moon Society Outpost in Your area?
All it takes is one person - you!

< End Moon Society Journal Section >

GREAT BROWSING !

ESA presents Mars in 3-D
www.esa.int/esaSC/SEM8Q2PR4CF_index_0.html

New insights into mass & origin of Saturn's Rings
www.astronomy.com/asy/default.aspx?c=a&id=6104

McCain supports Moon/Mars space policy
www.al.com/news/huntsvilletimes/index.ssf?/base/news/120160177666960.xml&coll=1

Giuliani: "US should be 1st to land men on Mars"
www.miamiherald.com/news/breaking_news/story/397285.html

Will corporations have naming rights for new discoveries in space?
http://media.www.mcgilltribune.com/media/storage/paper234/news/2008/01/29/Opinion/Off-The.Board.Like.An.Intergalacic.Virgin-3172745.shtml

Are the Martian Winds Still Resurfacing the Planet?
www.universetoday.com/2008/01/28/are-the-martian-winds-still-resurfacing-the-planet/

Reassesment of 1908 Tunguska impactor suggests threat to Earth from small objects greater
http://news.yahoo.com/s/ap/20080129/ap_on_sc/asteroid_recalculated

ESA research on Space Solar Power Satellites
www.nss.org/settlement/ssp/library/esa.html

Mercury surprises from MESSENGER flyby
www.astronomy.com/asy/default.aspx?c=a&id=6536

NSS' 2009 Space Settlement Calendar Art Contest Winners (great choices)
http://www.nss.org/settlement/calendar/gallery.htm

Volunteer Image Analysis to help Planetary Science
http://clickworkers.arc.nasa.gov/top

Journey to Satun From Your Computer
www.jpl.nasa.gov/news/news.cfm?release=2008-018

NASA Rolls Out Lunar Hot Rod
/abcnews.go.com/Technology/story?id=4221055&page=1

India expects to have crews in space in 7-8 years
http://timesofindia.indiatimes.com/World/ISRO_Chief_confident_of_sending_Indian_crew_to_moon_in_8_years/articleshow/2746728.cms

SpaceDev's throttleable hybrid lunar lander engine
www.moontoday.net/news/viewpr.html?pid=24365

SpaceDev to develop lunar observatory payload
www.moontoday.net/news/viewpr.html?pid=24393

"Mars for Less"
http://en.wikipedia.org/wiki/Mars_for_Less

Mars Movie Guide
http://marsmovieguide.com/

OregonL5's lavatube simulations in Second Life
http://www.oregonl5.org/sl_colab/sl.html

Martian Mileage Guide
http://nssdc.gsfc.nasa.gov/planetary/mars_mileage_guide.htm

Proposed lunar S. Pole site is rougher than thought
www.nasa.gov/mission_pages/exploration/mmb/022708.html
www.nytimes.com/2008/02/28/science/28MOONW.html?_r=1&oref=slogin

NASA's new off-road concept lunar rover
www.moondaily.com/reports/NASA_Newest_Concept_Vehicles_Take_Off_Roading_Out_of_This_World_999.html

Cassini to get extra cozy with Enceladus
http://ciclops.org

Mars Simulation v. 2.83 released
http://mars-sim.sf.net

Kaguya Image Gallery -High Definition
http://wms.selene.jaxa.jp/index_e.html

India and the US - Partners or Rivals in Space?
http://www.thespacereview.com/article/1056/1

Chicken or Egg - New markets or new vehicles
http://www.thespacereview.com/article/1050/1

Should China be invited to join ISS team?
http://www.thespacereview.com/article/1042/1

Review: The Lunar Exploration Scrapbook
http://www.thespacereview.com/article/1038/1

Not all (Mars) water is fit to drink
www.marsdaily.com/reports/Mars_Rovers_Sharpen_Questions_About_Livable_Conditions_999.html

MIT To Develop New Farside Radio Telescope Array
www.moondaily.com/reports/MIT_To_Lead_Development_Of_New_Radio_Telescope_Array_On_Lunar_Farside_999.html

So you want to build a base on the Moon
www.universetoday.com/2008/02/20/building-a-base-on-the-moon-part-3-structural-design/

"Tagging" asteroids that threaten Earth
www.here-now.org/shows/2008/02/20080220_13.asp

The big things about space, in particular nearby space like the Moon and the rest of the solar system, are:

- that is where "places" are, *on which to stop, rest, settle down, and in general make a life;*
- also that is where *an awful lot of the stuff we need* (i.e. raw materials and such) exists.

– John Barber

GREAT SPACE VIDEOS !

MOON COLONY VIDEOS - The Moon Society

30 plus thought-provoking videos produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) can be found at.
http://www.moonsociety.org/video/
or at:
http://www.mooncolony.tv/
http://www.stickymedia.com/

ASSORTED SPACE VIDEOS

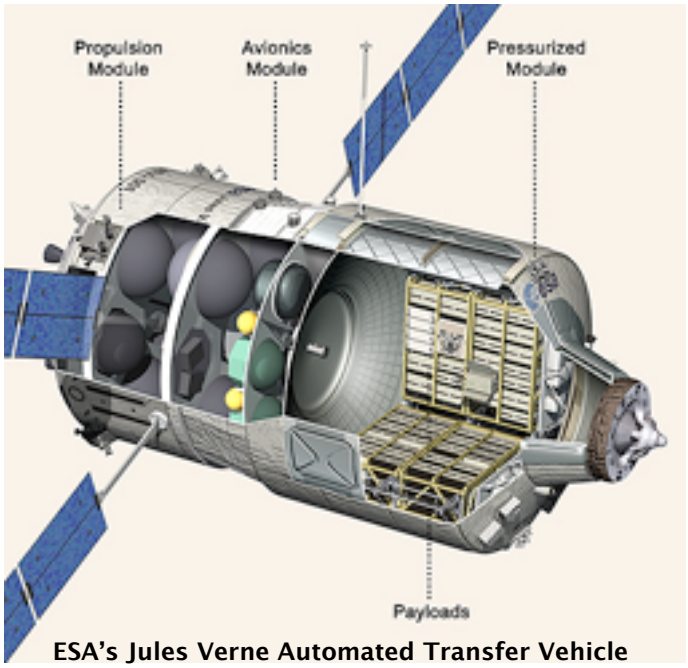
1 hr 47 m NASA Video on Space Based Solar Power
www.nss.org/settlement/ssp/sspnasavideo.htm

Animation of sunlight over Moon's south pole in one lunar dayspan/nightspan cycle
www.nasa.gov/mov/214260main_Lunar_Illumination_Movie_4_Web.mov

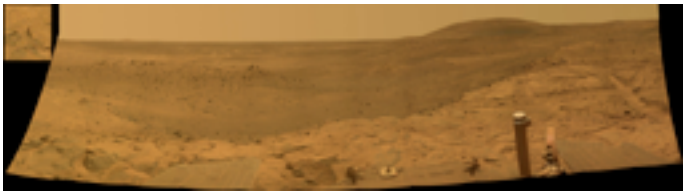
MMM PHOTO GALLERY

Shot taken by Spirit? by Opporunity? – *No!*
Ben Huset**: Mars Desert Research Station, Utah, Dec. 07**

Unsung SpaceShipTwo Designers
http://cosmiclog.msnbc.msn.com/archive/2008/01/28/616215.aspx

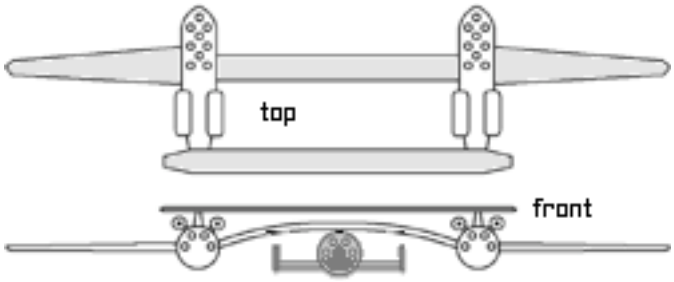


ESA's Jules Verne Automated Transfer Vehicle
www.spaceflight.esa.int/users/technical/transport/transfer/vehicles/atv/atv_spe.htm
www.esa.int/esaCP/SEM4ZV22VBF_index_0.html

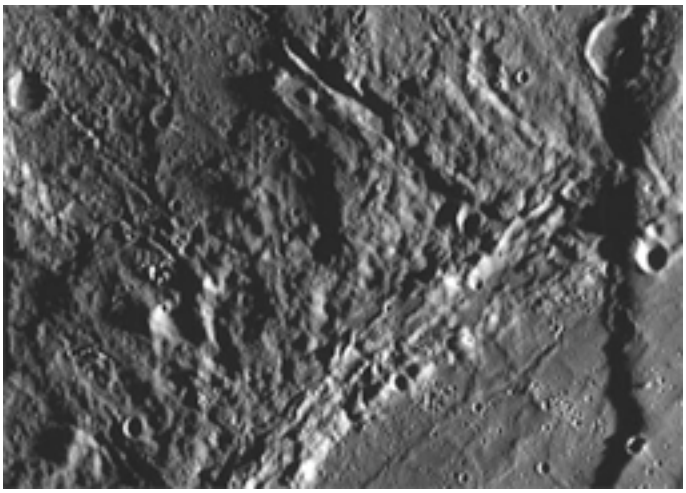


West Valley Panorama – Spirit Mars Rover
http://www.independent.ie/travel/travel-destinations/space-the-vss-enterprise-1276828.html

Virgin Galactic's VSS Enterpprise will carry a crew of two and six paying passengers – income total $1.2 Million



WhiteKnightTwo to roll out in May
www.flightglobal.com/articles/2008/01/29/221169/virgin-galactics-white-knight-ii-to-roll-out-in-may.html

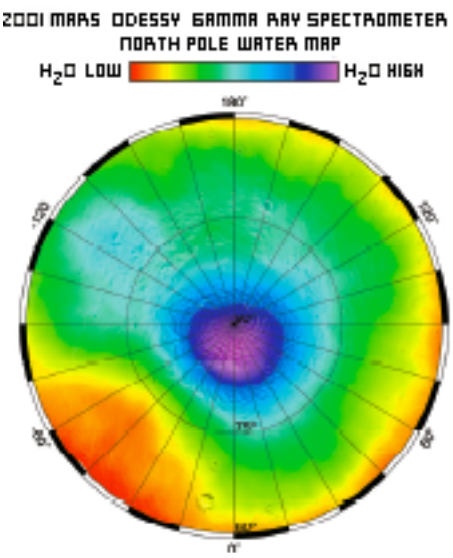


Mercury area 125 miles wide previously unseen with scarp at right hundreds of miles long.
www.astronomy.com/asy/default.aspx?c=a&id=6536

How big is the Phoenix lander?

http://phoenix.lpl.arizona.edu/faq.php

The Phoenix lander is about 18 ft (5.5 m) long with the solar panels deployed. The science deck by itself is about 5 ft (1.5 m) in diameter. From the ground to the top of the MET mast, the lander measures about 7 ft (2.2 m) tall.



Discoveries made by Mars Odyssey Orbiter in 2002 show considerable amounts of sub-surface water ice in the northern arctic plains.

Phoenix lander targets this area; a robotic arm digs through the protective top soil layer to the water-ice below and ultimately brings both soil and water-ice to the lander platform for scientific analysis.

French Pres. calls for intern'l Mars mission

New Scientist / Reuters (2/12) reports, "French President Nicolas Sarkozy called on Monday for a global program to explore Mars, bringing together European states and more established space powers like the US and Russia." During a recent visit to an Ariane launch site in French Guiana, "Sarkozy said he would ask the European Space Agency and the European Union to cooperate on a framework for dialogue with the U.S. and other space powers on a joint initiative."

Sarkozy said that Europe has "skills in robotic exploration, transport and technology, while the U.S. had the financial means and 'technical and scientific competence.'" He added, "I am convinced that an exploration program can only be global, without exclusivity or appropriation by one nation or another. Each will be able to take part with their capabilities, their strengths and their choices." New Scientist notes that, according to NASA, "a manned Mar mission is unlikely before the early 2030s."

The Mars Project Challenge

www.marssociety.org/portal/MPC

Part of the Society's stated purpose is: "Starting small, with hitchhiker payloads on government funded missions, we intend to use the credibility that such activity will engender to mobilize larger resources that will enable stand-alone private robotic missions and human exploration." We are now ready to progress towards that purpose. **We are looking for a bold & inspiring project in the $10M range.** This challenge is giving our members the opportunity to suggest what our next project should be. The project can be technical or otherwise, it can be from the Earth's surface all the way to Mars itself. We will be especially interested in ideas that, as our Mars analog stations do so well, allow direct participation of the membership. The challenge will close 25 May 2008.

End of an Era for MDRS

from several unoffical sources

After 2007's four-month long mission, FMARS, the Flashline Mars Arctic Research Station that opened the Mars Society's analog research program on Devon Island back in 2000, it has been decided that the facility wil only be used in odd numbered years. The next mission will be a two month long one in the summer of 2009.

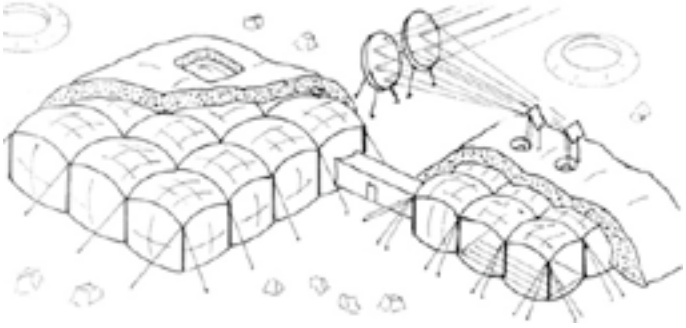
By the end of this, the seventh field seasons, MDRS, the Mars Desert Research Station in south central Utah, *will have hosted some 6 dozen Mars Society, Mars Society Canada, NASA, and Moon Society/NSS sponsored crews*. A wealth of practical knowledge and useful research has been earned through these missions, but the time has come to put the venerable exploration outpost out to pasture. MDTS is going be institutionalized and a post doc will operate it as an education center. The facility will be run by the Mars Society, NASA and a university, probably New Mexico Tech.

"Building a Base on the Moon"

based on research by Haym Benaroya and Leonhard Bernold ("**Engineering of lunar bases**")
(Quoted from the weblink sited below)

"Many types of structure have been proposed for lunar colonies. However, the main focus for mission planners center on *cost and efficiency*. Structures fabricated on Earth, while viable, would have to be very lightweight to allow for easy launch out of the Earth's deep gravitational well. It is generally envisaged that the first bases to be established on the lunar surface will be built on Earth, but once a base of operations is set up, with a contingent of human (and perhaps robot) workers/settlers, local materials should be mined and habitats fabricated in-situ (i.e. built on the Moon). Some of the structures currently being considered are detailed below.

Inflatable designs: "Inflatable habitats have always been a favorite, optimizing living space while using lightweight materials. As the Moon has no atmosphere, any habitat would must be highly pressurized to simulate the terrestrial atmosphere (to approximately 1 atmosphere or 101,325 Pa) and atmospheric gas quantities. Due to the high forces acting outwards (by the maintained gas pressure), structural integrity of an inflatable can be assured. Assuming the membrane of the inflatable is strong enough, risk of depressurization should be low."



Above: Many inflatable "pillows"create a cuboid shape by using high-tensile beams to battle against the bellowing membrane material. Regolith protects against impacts.

http://www.universetoday.com/2008/02/09/building-a-base-on-the-moon-part-2-habitat-concepts/

Feb. 17, 2008 re: **Lunar Living - Fred Hills**

I thoroughly enjoyed your article on Lunar living. Clearly this topic needs a lot more exploration and research. Here are some of my thoughts on the matter.

Re. Community: I think a small group (~30) can function successfully as a community if certain conditions are met.

- each person can be alone some of the time (e.g. I am, at this time, alone in my home office while the rest of the family is sleeping.)
- sleeping space is subdivided (i.e. not more than 4 people to a space).
- normal work groups are small and groups may vary over time.
- physical space is divided into compartments so that groups function with minimal awareness of other groups. (i.e. work spaces, sleeping spaces, eating space, exercise room, etc. are isolated to some extent)
- entertainment: TV, movies, and music should be available. (that is easy) Group activities should also be encouraged: e.g. dancing, concerts, movies, and plays (as in colonial times). This requires significant space.
- There should be ample time for this during the lunar night even as 'night work' continues.

Re: Work

- Inside work: 'office work', laboratory work, maintenance, managing/controlling outside work.
- Outside work: Construction and mining done with remotely operated machines (controlled from the base or even by operators on Earth.
- Transport: Robots can move supplies, outvac equipment, etc. around, and pressurized vehicles (mini-buses?) can move people around.
- Facilities: may cover a fairly large area.
- Experiments - strategically placed
- Mines - wherever conditions are best and reasonably close.
- Roads - graders can create smooth paths for vehicles between facilities and work areas.

Re: Outside activity

- Remotely controlled equipment provides a vicarious experience and should be sufficient for most tasks.
- Outvac work: I think workers in space suits will be about as rare as scuba divers on earth. The expense, inconvenience and time needed is burdensome. (I have been snorkeling in the Caribbean and scuba diving in Hawaii. Both fun when one happens be in a suitable location.) Scuba diving is expensive and can be dangerous. Space suits will be very expensive and require a lot of maintenance. Outvac workers will have to be extensively trained I think.

Fred Hills <Fredhills7@aol.com>

PS the new [US Antarctic] south pole station is an excellent model for a lunar habitat. Could we get a floor plan and the number of people that it accommodates over the (8 month?) winter? (An overview map of the entire area and photos (mostly outside) are on the web.)

Comment: I know just the people to ask. Phil Sadler spent 13 grueling Antarctic winters at Ammundsen-Scott Station where he installed the Food Growth Chamber. ***PK***

02/03/08: **The word "world" - Larry J. Friesen**

After reading through Moon Miners' Manifesto # 211, I have a very strong semantic disagreement.

This concerns how we each want to define and use the word "world". It is clear from your article, "**As the World Expands**" that you have given a great deal of thought about how you want to use the term, and you seem to have become rather attached to that meaning.

However, many years before I read your article, I had also devoted a great deal of thought to how I wanted to define and use the word "world". I concluded that the most sensible way of defining it in a way that I was seeing it used (especially in publications related to astronomy or space flight) was to define it in an astronomic sense.

My definition for "world" is: "a celestial body massive enough that its overall shape is due to its own self-gravitation - that is, it forms itself into a ball, with possible modifications from equatorial bulges due to its rotation or tidal bulges caused by nearby gravitating objects - but too small to sustain thermonuclear reactions within itself. Objects too small to be worlds are 'rocks' or 'rubble piles' depending on how much internal coherent strength they have."

Editor's comment: In my post Pluto-demotion blog post entitled, "Of 8 planets, and 28 worlds and counting" (8/28/06) it is quite clear that I use the word "world" as a common noun, in the same way you do *except that I reserve it for bodies a human can stand on and explore,* thus excluding gas giants and other surfaceless bodies.

But Let's back up a couple of paragraphs where you say" *It is clear from your article, "As the World Expands" that you have given a great deal of thought about how you want to use the term, and you seem to have become rather attached to that meaning."*

Larry, you are off track right here, from this last sentence. The meaning I gave to it in that article is clear from the article. I was not talking about the meaning of the word "world." My use of "a" world and of "worlds" is is much like yours, with the exception noted above. I am not talking about world in the astronomical sense but about "The World" as the common man, educated or not, thinks of it, as what we live "in" -- not "on." "The world" vs. "worlds" or "a world" is a clear case ofcomparing apples and oranges.

I have been interested in astronomy since the day I could read my parents' coffee table book on Nature back in the early 1940's. But I never lost touch with the way people use the word, "World." Yes, the term was then synonymous with our planet Earth, and had been since Europe first realized that "Earth" is a globe. Prior to that "The World" was synonymous with "Terra Cognita," now translated as The Known World, literally "Known Lands."

All we have to do is distinguish "The" (with emphasis pronounced "thee" with a long e) from "a." The difference is in the context. Should we choose a new term? I don't think so, but a new one may someday catch on. In a spirit of reconciliation, I offer "**Humandom**" *or better,* the "**Anthropause**" - everything within human reach, a "sphere" which clearly *expanded* beyond our "home world" when hundreds of millions of people watched Armstrong and Aldrin step out onto The Moon. Ever since "*The World News Tonight"* has meant something more. *Larry, I do enjoy our conversations!*

Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

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< James_Schroeter@excite.com > 414-333-3679
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LRS News

• **Our February 9th Meeting**: We canceled the meeting the night before because of major snowfall.

• **Peter at MarsCon:** Peter had a ride to the Twin Cities for the February 29th – March 2nd weekend to take in MarsCon at the invitation of the Minnesota chapter's Ben Huset. He gave a talk about solar power satellite systems and, with Larry Ahearn (Chicago) on Space Settlement. Our exhibit in the MarsCon Science Room was a hit.

• **ISDC 2008:** ISDC will again be in Washington DC (as in 2005) this time the weekend *after* Memorial Day. Peter and Dave Dunlop are pre-registered and Dave is running the Moon Track. Anyone else who wants to go should contact Peter.

• **Undersea Lab under construction in the Aquarium area of Discovery World at Pier Wisconsin on the Lake Michigan waterfront:** Peter revisited the exhibit on Friday, March 7th and took pictures. Much had been done since his last visit, but the project is now on hold while other museum projects with a higher priority are being completed. Peter told the person in charge that when the exhibit was ready for a grand opening, LRS would be happy to contribute an exhibit about the relevance of undersea facilities to moonbase research. We will post the photos online with a link on our gallery page, www.lunar-reclamation.org/page12.htm (*We would have designed it quite diffenetly, but an opportunity is an opportunity.)*

LRS Upcoming Events – April, May

Saturday, April 12th, 1-4 pm

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

Updates on space and space mission news, conferences etc. A look at the calendar ahead.

Saturday, May 10th, 1-4 pm

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

MMM 8 NSS Chapters Strong

NSS Chapter Events

Space Chapters HUB Website:
[http://nsschapters.org/hub/]

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
March 15 – April 19 – May 17

Check out our Lavatube simulatins in Second Life
http://www.oregonl5.org/sl_colab/sl.html

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

INFORMATION: Larry Ahearn: 773/373-0349

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/]
MN SFS News & Pictures

Twin Cities Regional Science Fair Pix:
http://freemars.org/mnfan/TCRSF/2008/

MarsCon Feb 29-March 2. We staffed the Science Room and gave a talk about MDRS – **Ben's MarsCon Pix**
www.freemars.org/mnfan/MarsCon/2008/

Upcoming: March 20: participation with Bailey Sci night:

March 21 Minicon: we will be staffing the Science Room

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/sss/]

We meet the 3rd Thursday of the month 7-9pm

MARCH 20th: UW-Sheboygan, Room 6101, **Sheboygan**
APRIL 17th Stoelting House, Kiel - ***cancelled***
MAY 15th: UW-Sheboygan - ***cancelled***

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: March 15 - April 13 (2nd Sunday)

We may have an event instead at the **Franklin Institute** in connection with the Star Wars Exhibit. This is being worked on by **Mitch Gordon**. Go Mitch! In May we will be at The New Jersey State Museums Super Science Weekend on **May 17th and 18th**.

January Meeting Notes: we had a good meeting that included Gary Fisher of The Mars Society, The Mars Homestead Project, NSS, and Judge for the Carver Science Fair! O.K., enough crowing, we actually were talking, this time, about exploration where Gary is for doing asteroids in place of the Moon. We also discussed a historical connection: in the early 1970s the Soviet Union launched several lunar rovers called Lunakhods that drove around the Moon sending back data and pictures. They where driven from Earth!. Years later the developer of these space devices was called on again: when the meltdown at Chernobyl happened he built a recon robot in only a week and a half to check out the reactors environment. Gary also discussed the Mars Society steering committee meeting in Austin and his new post as the Mars Society Treasurer. And more! Gary gave us Ad Astras for our event give aways, and contributed to our fund for the Carver Fair awards. Later in the meeting Gary mentioned the Robot Challenge which will be held at The Mars Desert Research Station in June. He said that last years was shown on Canadian television. It would be nice if PBS. could do this.

Larry, our webmaster, brought several things, including information of interest to spacers: he found a report on the Hubble Space Telescope spotting a galaxy that was thirteen billion years old, somewhat older than the universe is supposed to be. He also found a system for growing plants called "Vertigro" for plant growth, with a video on the companies site, and an algae system from the same source. Google the name to find out more. No change in the website this month.

Dorothy brought in a large amount of information from various locations including: The Maryland Science Centers ongoing programs on space science that include "Meet the Moon", "Live from the Sun" and others. There is a lot in this Baltimore location! Also, she had material from the future reopening of the Smithsonian Air and Space Museum in April. Before that, though, there are a number of interesting lectures in a series called Ask the Experts'. The March 13 lecture will be on the Vanguard 1 at the Steven F. Udvar-Hazy Center (in Virginia) I should point out that the lectures are usually less than an hour and should be a nice catch if you happen to be there but not the main event. However: the Exploring Space Series and the opening event show, Unmanned Military Vehicles (UAV) Exhibit, on April 24, could be. These are at the Mall location. As you might guess, Dorothy was involved in the travel business.

Hank Smith brought news of the next Philcon location. It is possible that this November the event will be held in Cherry Hill, New Jersey. There was much talk about this as the hotel location, The Crown Plaza, which may not be convenient to public transport. If this works out, the convention will be held from the twenty-first to the twenty-third. In the meantime, Hank will be going to Datclave in Gettysburg, February 29, and Balticon in May.

Mitch talked on a possible presentation venue again: the White Dog Cafe. This would be a panel discussion with Michelle, Gary, Earl, and Mitch as the panelist. This would be at 3420 Sansom Street in the University City section of Philadelphia, before Philcon. Mitch will also asked for permission from Derrick Pitts of the Franklin Institute for us to be part of the Star Wars activities in April. We might reprise the Cubesat Q&A game that Michelle developed for this. We,ll see. Mitch also asked a general interest question of Gary on the need for, and creation of, artificial gravity during tourist trips. Gary explained that for short trips of a few days, as had happened during Apollo Moon flights, the damage of zero g would be mild but on longer flights something to simulate the stresses of gravity (my words) would be needed. This could be done, for tourists especially, by

spinning the craft in classic movie fashion, the only real question being just how big would the vehicle or the set of vehicles have to be. As both Gary and I explained, this would require a rather large object or set of tethered objects. As luck would have it I had brought in, for talking points, The 1986 Reagan Space exploration report that had Cycling Spacecraft as part of future regular traffic vessels. This included spinning sections to give simulated gravity for travel to Mars in particular and any other place that was outside our local vicinity. Mitch accepted that the present vessels from Virgin Galactic and possible competitors where not planning to do this yet. Sometimes we forget what we talked of in the days of the O'Neill colonies and the Von Braun stations. Even the ship in 2001, with the rotating living area, isn't far enough across. Back to the Future!

Earl gave an abbreviated technical report with some material from E..D.N. on Robot Developement Platforms. This was from a December and February issues and was about professional engineering components and software. You buy the bases and outfit them, and program them, to perform the task(s) you desire. See E.D.N.s website. For another take on the subject see Servo Magazine, by the publishers of Nuts and Volts. The March issue of that publication includes L. Paul Verhages' report on "The Spaceward Games" and the various sub divisions of the technologies that will be needed for The Space Elevator.

Paul gives a rather thorough report including the work on new materials (The Materials Challenge) for the tether to be climbed, the Climbing Challenge, with several teams getting close, the Power Beaming Challenge, again with no winner at the contest, and a new event: The Light Racer Challenge. This last is a vehicle riding down a track driven by beamed energy alone. See the magazine for details on these October events and one other thing: The Electromagnetic Coil Launcher Project. The author, Karl P. Williams shows how to build a single stage projectile accelerator that can push (pull) an object to 129 ft/sec (39.32m/sec). He calls it a rail gun based on the Cockroft-Walton voltage multiplier design. It has some nice historical info. but should not be tried without careful consideration to the risks of building such a device. There are lethal voltages involved and the article includes a disclaimer of responsibility. I present it as an interesting technical device with good engineering information. On a fun note: WE gave the elementary level George Washington Carver Science Fair our James H. Chestek Award to. Sujatha Changolkar for her project "Contamination Commotion" which was the study of pollution in seven streams she examined. She is a sixth grader at Masterman School. Her advisor was Kathleen Tait . Our member, Mike Fisher is owed our thanks for judging. Mike was busy as he also judged for the Fair itself and Mensa. And we must also thank Pete Stevens, the award presenter from Mensa, who took pictures for us.

And a correction: the pioneer fusion researcher who Tom Ligon worked with was Dr. Robert Bussard. I missed correcting this previously. This was from the "Worlds Simplest Fusion Reactor Revisited" report.

Submitted by Earl Bennett.

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

Next Meetings:

● Tuesday Mar 18th, Tuesday Apr 1st

Denver University's Olin Hall, Room 105
http://www.du.edu/maps/olin.html
at **2190 East Iliff Avenue**, Denver, CO

CALIFORNIA

OASIS

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS

P.O. Box 1231, Redondo Beach, CA 90278

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

[http://www.oasis-nss.org/wordpress/]
oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month
Microcosm, 401 Coral Circle, El Segundo.
● March 15 - April 19 - May 17

Information: OASIS Hotline, 310/364-2290; website.

Upcoming Events

- **Sat. March 15th, 3 pm** OASIS Monthly Meeting at 1738 La Paz Road, Altadena, CA 91001-3317
- **Sat. March 15, 2-11:30 pm** - Star Party: Vasquez Rocks Natural Area Park, 10700 Escondido Canyon Rd, Agua Dulce. **2-5 PM** the Sun. **7 PM:** the stars
- **Thurs, March 20, 7 PM** - Lecture: Geysers on Enceladus" Dr. Amanda Hendrix, JPL. FREE — www.jpl.nasa.gov/events/lectures/Mar08.cfm) The von Kármán Auditorium at JPL, 4800 Oak Grove Drive, Pasadena, CA
- **Fri. March 21, 7 PM** Lecture: "Yellowstone-like Geysers on Enceladus" by Dr. Amanda Hendrix, JPL Research Scientist - FREE; no tickets or reservations required, Vosloh Forum, Pasadena City College,, 1570 East Colorado Blvd., Pasadena
- **Fri., March 21, 7:30 PM** Lecture: "Astronomy in Ireland" by Roy Schmidt, PVAA, Galileo Hall, Harvey Mudd College, 12th & Dartmouth, Claremont. (map at www.pvaa.us/maps/meet.html)

NAME _____

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CITY/ST/ZIP _____

PHONE#S _____

○ **$45 National Space Society dues** include *Ad Astra*
○ **$20** NSS dues **if under 22 / over 64.** *State age* ___
600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include *Moon Miners'Manifesto*

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Moon Miners' MANIFESTO

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