

# Moon Miners' Manifesto

& Moon Society Journal

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## In Focus A Post NASA-Bushwhacking Strategy to push Planetary Science

First President Bush announced on November 14th that he was nominating his top bean counter Sean O'Keefe to replace outgoing Dan Goldin as NASA Administrator. That sent a strong signal that the U.S. contribution to the International Space Station may be cut back even further, if not canceled outright.

X days later the second shoe fell. The OMB, the Procrustean Office of Management and Budget, was putting and end to the exploration of the Outer Solar System, beyond Mars. Galileo and Cassini would be our last missions to a realm that apparently has no redeeming relevance.

That effectively threw in the trash can two top priority probes that Congress had just approved with reasonable budgets: **Pluto Express** and **Europa Orbiter**. Exasperation and dismay quickly overcame the space science community.

There may be no righting things. The priorities of this administration are clear; minimizing tax burdens on the haves by cutting whatever they can get away with. You cannot hold an intelligent conversation with a bean counter. We need to back up and look for a radical new strategy, not for getting the *Government* to undertake space exploration, but

for *getting space exploration done* -- it's not necessarily the same thing.

Let's learn to play the President's game and best him at it. Think outside the box. Get Congress to comply by declaring that space exploration shall no longer be a direct undertaking of NASA or any other government agency. That clears the books and decks.

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**This is MMM's 15th Anniversary Issue!**

STEP II: Space activists, this time including the Space Frontier Foundation,

gather to carefully draft legislation that would establish attractive tax deductions for any individual or corporation funding a planetary science mission or resource prospecting mission to any Solar System destination other than the darling Mars.

Planetary Science would then "raid the Treasury" only indirectly, by reducing the total amount collected from the wealthy and from corporations. We would be out-Bushing the President and the winner would be Space Exploration. There would end up being much more of it, to more destinations, and on an accelerated timetable.

Our tax-saving Sponsors would find the best, most efficient ways to produce the most results. *IF we craft the language of the bill right!* [=> p. 2, col. 2]

### Learning to be "at Home" on the Moon

We began our "at Home" discussion last month, and continue it this issue and for a few more to come. Actually, this has been *the central theme* of MMM since issue #1, fifteen years ago. We chose the word "*Manifesto*" as an indication that MMM would be a *bold, brash, defense of an unlikely position: we can be at home on the Moon and elsewhere.* =>> pp. 3 ff.



# Moon Miners' Manifesto

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

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fi IN FOCUS Editorial continued from p. 1.

The key will be performance standards. If a mission fails, or to the degree it fails, the tax write-offs should be reduced. This creates an incentive to design, engineer, build, and control the mission so that it succeeds and succeeds brilliantly. There might have to be some sort of peer review of mission proposals to make sure that we're getting good knowledge bang for the buck.

It would be a big mistake, however, to try to sweeten the pot by giving property rights of any kind to the celestial object explored. Why? Because that would have the effect of taking distant objects off the list, no matter how interesting. Only missions to the Moon and nearer asteroids would then be attractive.

This is all a very radical approach, perhaps, but no more so than the Space Data Purchase Act, with regards to which this "**Space Exploration Incentives Act**" is a logical step beyond. The point is we do have to start looking for other ways of getting the job done. We need to quit deluding ourselves that we can somehow get the public at large to believe that the universe beyond Earth's atmosphere is relevant, not merely sometimes interesting. Nor is it reasonable to spend a lot of our time in an intense effort at educating those politicians in public office. Politicians come and go, appearing out of the public mainstream. If that mainstream is not convinced then all our political education efforts are as futile as the efforts of Sisyphus to roll the boulder to the top of the slope. It will always escape our grasp and roll back down hill before we get it to and over the top.

Don't misunderstand what I am saying. I *do* love public space outreach, and have spent hundreds of hours engaged in it, and many hours more in designing displays that teach and catch the attention. But I do so with no illusion that I am going to change the collective attitudes of the public at large, or start some groundswell of public opinion. The sole hope that drives me is that I will light a fire under a few talented individuals who will go on to advance the cause in some way.

The ranks of space activists suffers its losses of attrition. Individuals get tired of hitting their heads against a brick wall. There expectations were misguided. We all share the vision. What separates us is the mission. What's the difference? The mission statement lists the ways we intend to make the vision into a reality. The vision can be on target, while the mission statement is Quixotic.

For a long time the National Space Society was lead by a group of individuals convinced that "Space is Good Public Policy." It's a hard sell, indeed an impossible sell when all is said and done. Space may be right, but instead of trying to convince everyone we have to find other ways to get the job done, ways independent of public opinion which is forever rooted in near term self-interest. -- PK.

# Engaging the Surface with Moonsuits instead of Spacesuits

## “Mother Nature has a Dress Code!”

by Peter Kokh

In last month's issue (MMM #150 NOV '01) we began our discussion of learning how to be “at home” on the Moon with articles on domesticating regolith, getting comfortable with overnighing, and learning to live with the Moon's natural rhythms. But there is much more to this agenda, and we pick up the litany this month. First on the list: lunar space suits!

Space Suits have traditionally been designed *to protect* us from alien environments, not *to engage those environments* on a “let's make ourselves at home” basis. These would seem to be just empty and cheap words at first reaction, but let's play with the idea, follow it, and see if it leads *somewhere new*.

When NASA sent astronauts to the Moon, it was with suits designed to protect them from a poorly understood and understandably “alien” environment. They did have a good understanding of the thermal loads and heat-management problem, of the radiation flux at the Moon's surface, and some inkling of the uncooperative character of the pervasive moondust. In designing the suits, it was essential to err on the side of overprotection. After all, the scientific goals of these missions were definitely secondary to the overriding directive to “bring 'em back alive!”

When we return to the Moon, the controlling directive will be *to learn how to stay*. Breaking the systems engineering and psychological barriers of overnighing will be at the top of the list of milestones in this campaign. And that will mean that we must have suits that can do more than handle the moderate “mid-morning” solar heating loads. They must be up to handling the higher heat loads of “high noon” and of the lunar “afternoon” period (remember that from sun up to sun down takes a full 14 and three quarter standard Earth days). But in order to do outside routine and emergency housekeeping, maintenance, and other chores during the equally long sub-bitter cold nightspans, the suits must have a controllable heating capacity with high reliability. Proper insulation against heat loss by radiation to the black sky will be essential. So even without the extra features we will identify as desirable below, the suits for the return missions will have to be improved, at least in thermal management capacity, over those of the Apollo era.

So much for the obvious.

What we want to talk about in this article is the need for Moon Suits that go beyond such improved basics. We need to put to work the tremendous electronic telesensing abilities that have become doable in the three decades since the Apollo feats.

## Smart Suits

For safety' sake and to maximize the odds of safe return, or rescue if that should ever be necessary, we can build a number of sensors and computer processor chips into our new”smart” moonsuits. The wearer should have at his or her demand, all of the following kinds of vital information:

- power reserves and time available at current energy consumption rates
- oxygen reserves and time remaining at current consumption rates
- thermal management stress loads as a function of capacity
- radiation flux with screen becoming activated when flux exceeds normal range
- built-in GPS (global positioning system)
  - distance covered (GPS track)
  - over the horizon landmark locator (GPS calculator)
  - direct return route distance (GPS calculator)
- warning when the capacity of any system approaches the “point of no return” level

The readouts from these devices could be either constantly visible, or projected on the visor “heads up” area either when activated by a voice command or automatically when a caution or emergency condition develops. No one needs to be unnecessarily distracted by boring confirmations that everything is “functioning within normal parameters,” but information that requires attention, must have a way to get attention. An alternative to a heads up display for less critical information would be a sleeve readout device.

A transponder belongs in every moonsuit. It could broadcast its signals via satellite or via a relay at one of the Lagrange point station (L1, L2, L4, L5 -- according to one's location on the Moon's surface). To personnel at the outpost or vehicle from which the suited excursion originated, the wearer's position would be monitored (as a backup system in addition to the suit's own GPS monitor.) If there was sign of inactivity lasting long enough to cause concern, or a cut off in transmission, or a signal that a suit function had failed or been compromised (e.g. even slow depressurization from suit puncture), the wearer's location would be pinpointed.

Additionally, if someone sensed s/he was in trouble, the whereabouts of any nearby persons also out on the surface could be ascertained, and a route to their location plotted or a signal sent.

One of the tradeoffs of such safety features is that if the Big Brother aspect. There are times when one may want to be alone -- just him/herself, the moonscapes, and his/her thoughts. One should be able to turnoff a transponder, but with a double switch to prevent accidental disconnects.

These kinds of "Guardian Angel" features are well within current technology limits. They would make us *more safely* "at home" on the Moon. There is more we can do, so stay tuned.

### Smart Visors

Not only can we thus greatly improve moon-suit safety features as described above, we also have it within our power to greatly enhance the wearer's perception of his/her environment. In comparison to the "Native Scout" expert clue recognition abilities that moonsuit wearers will "put on" when they don their suits, the Apollo moonwalkers had all the clueless sensory capacity of city slicker dudes. No offense intended, of course! They were all genuine heroes of the first rank who did all they could and more with the tools we gave them.

Our point is that it is not enough just to be able to look through a helmet visor with the naked eye. Moonscape's are notoriously monochromatic and the immense information that they bear comes across to the naked eye as a monotonous blur of seemingly trivial details. Smart Visors and other electronic sensory enhancers could change all that, and allow the wearer to see an immense variety of significant information of scientific, prospecting, or other value that normally fades into the monochrome overload.

Smart Visors and other sensory enhancers will allow future moonwalkers to "engage" the Moon as never before, by letting them see and sense information clues that "naked eyesight" just can't detect, notice, or pick out. Here are just some of the possibilities that are within our means.

- infrared scanning of the ink black shadows and knee-mount shadow penetrating spotlights
- phosphorescence sensors
- picking other humans out of the background
- exaggeration of slight and subtle color difference
- telescopic zoom-in capacity
- sensors that sniff any outgassing in the area
- range finder (distance to near horizon features can be greatly misjudged by the naked eye according to Apollo EVA experience)
- level horizon guide (in low gravity, one's ability to detect slight slopes is impaired)
- filters that enhance visibility through any dust electrostatically suspended over the surface
- alert-alarm and activation of laser spotlights when sensors in combination with expert recognition systems detect the special spectral and reflectivity signatures of minerals etc. on a field science or prospecting watch list
- alert alarms for any motion in the visual field
- alert alarms for any motion in the shadows
- other expert recognition programs

- major computing power to analyze inputs (the computer design should address the clumsy gloved fingers vs. keypad issue using voice recognition software and other means, be able to calculate mineral and element abundances of samples, and, using GPS and range-finding data draw simple but functional "map" guides)

We've probably missed a lot of other possibilities and if readers have some suggestions to add to this list they are encouraged to contact MMM by mail or by email <KokhMMM@aol.com> But the list above will give some indication of the enormous potential there is to use today's electronic wizardry to let future moonwalkers be vastly more attune with and aware of their environment. "Engaging the Moon on its own terms" is what we are after -- the ability to be able to see critical information normally lost in the visual monotony as if one were an experienced native-born scout.

### Wearability and Mobility Issues

Comfort and Convenience were justifiably secondary concerns from the designers and fabricators of the Apollo moonsuits. One can put up with most anything on a temporary basis, so long as the discomfort or inconvenience is not great enough to compromise the work at hand. But now we are going back to the Moon, intending to stay, intending to make ourselves at home. Field scientists (geologists, mineralogists, etc.) and prospectors and others will be out on the surface for longer periods, and repeatedly. In such circumstances, discomfort and inconvenience risks compromising the work at hand.

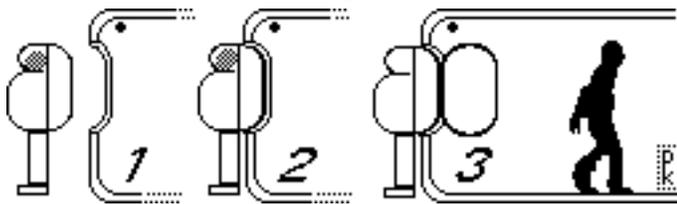
What do we need here? Surely suits that are easy to put on and easy to take off without assistance. And suits that do not require pre-breathing special air mixtures. We need to make it so wearing proper apparel to go outside on the Moon is no more of a big deal than wearing proper apparel for rain, cold, wind, or snow is for us on Earth. In short we need suits that protect us without a lot of bother and drama.

We shouldn't attempt to find an ideal design that offers such features in isolation from the even more important issue of dust control. The use of conventional airlocks will inexorably lead to the immigration of annoying and troublemaking amounts of fine powdery moondust into pressurized habitats, labs, workspaces, and other facilities. Previously we have proposed a solution prefigured in illustrations by the great lunar outpost illustrator, Pat Rawlings - the clamshell-back or turtle-back spacesuit. We described its operation in the MMM #89 article cited at the bottom of this article.:

"Pat Rawlings who did the illustrations Ben Bova's 1989 book "Welcome to Moonbase" [Ballantine Books, New York, ISBN 0-345-32859-0] has elsewhere illustrated a much superior dust-control approach. The cover of "Lunar Bases and Space Activities of the 21st Century" [ W.W. Mendell,

Editor; Lunar and Planetary Institute, Houston 1985, ISBN 0-942862-02-3] shows personnel wearing what I have come to call the "Turtleback" suit, in which an oval hardshell backpack covers the torso and back of helmet. This backpack is hinged on one side, and entry to the suit is made through the opening.

"In pre-release conceptual illustrations Rawlings did for the David Lee Zlatoff/Disney/ABC '91 movie "Plymouth" (still the only science fiction film ever made about settlement and the idea of using lunar resources), there are sketches of turtleback *conformal* airlocks (my word) into which this specially designed backpack makes a sealed connection, then swings open, allowing the incoming astronaut to (pulling his hands and arms out of the suit sleeves) reach back and up through the opening to grab a bar above the inner door of the lock and pull himself out of the suit and into the habitat. The suit and most of its dust remains outside, perhaps to be stored automatically on an adjacent rack. Whether Rawlings himself ever thought through his artistic concept this far, or further, is unknown to this writer. But we want to give him full credit."



Next we need suits which are as light as they can be made, and agile! There are probably things we can do with both the boots and the loves to make the wearer more sure-footed in all types of lunar terrain, and more dexterous in handling samples, climbing, making repairs or performing service operations. If our moonsuits constrict our mobility and agility, making us "all feet and all thumbs," wearing them will exhaust us all too quickly, decreasing both the amount and the quality of work accomplished.

The amount of quality work that gets done per person hour is the name of the game. In time, it will also be a question of enabling people to go out on the surface to engage in field hobbies and out-vac individual or team sports. If we meet the needs of the scientists and prospectors, we will enable those with an "outdoors" recreational needs as well.

Out-vac exercise and sports activity of any kind will depend on the invention and debugging of a light-weight, supple pressure suit that can handle the heat and perspiration loads generated. If total out-vac exposure times are kept to an acceptable accumulative minimum, radiation protection can be minimized. Given the considerable benefit and boost to overall settler morale, the development of such a suit is sure to be on the collective front burner. Such suits will have to have many "smart" features we have described above.

For both work and recreation, overall morale enhancement is the real prize. Upon this morale

hangs the long term viability of lunar settlement.

Now unlike providing sensory enhancement, providing EZ-wear suits that allow maximum mobility, agility, and dexterity is a goal much more easily described than realized. Our intent is not to give clues as *how* we can meet these goals, but to define *what* these goals should be. NASA has long been aware of the shortcomings of its spacesuits and for a time was funding two different teams to come up with replacement designs. Then the work stopped. There may have been some Agency dissatisfaction with the results being achieved in the two projects underway. Each was promising advantages, but by means that were mutually incompatible so that all the proposed advantages could apparently not be realized in either design. But we think that the real reason for shelving these two projects was Neander-thal budget-cutting, by those who could not see the big picture, or cared.

This kind of R&D needs to be directed by a commercial enterprise that has a stake in the results and in the quality and quantity of work done on the Moon. For now, brainstorming and paper studies of radical new moonsuit designs that meet these objectives are about all we can hope to see -- until some intently for-profit consortium has a eureka-dream that "there's (a) gold(mine) in those (gray) hills!"

### Active Helper Systems

One could also imagine a number of "helper systems" that would enhance the surfacer excursion experience even further. Power tool plug-ins Set II. In addition to tools useful in investigating rocks and minerals (drills, saws, core samplers, etc.) and various glove and boot accessories, we could "plug in" more exotic, even "handier" tools. How about an automatic laser device that would leave "Reeses Pieces" "hot spots" that would remain detectable for a few hours to assist the wearer in retracing steps especially in jumbled and confusing terrain?

Or how about a retrievable tethered mini "scamperer" probe that could reach spots (up/down cliffs and escarpments, inside crevices and clefts, etc. and other hard or inconvenient to reach areas) and either analyze what it detected and send back the data or pick up and return promising samples? The second season team at the Mars Society simulation outpost on Devon island discovered the surprising usefulness of such critters. They experimented with 100 m and 200 m tethers (leashes, anyone?)

We'd be delighted to hear from readers about more such active helper systems. Think of them as productivity maximizers and safety insurers.

### The Fremen Stillsuits of Dune/Arakis

Okay, so that's a bad title in as much as those who do not allow the pleasures and escapes of science fiction into their lives will have no clue of what it means. To Sci-Fi fans, no explanation is needed. So let's try again.

## Accommodating Human "Needs"

Our suits of the Apollo moonwalkers had provision for urination -- a definite improvement over the one Alan Shepherd wore less than a decade earlier. But these suits were made to enable stays of a few hours at most. We'll want to do some trial and error experimentation with alternatives that will cover our butts, so to speak, for longer periods under both normal and distressed conditions (er when it's Immodium time). Accommodating for regular bowel function (other than by the "low residue diets" fed to the Apollo crews) within the tight confines of a space suit will pose quite a challenge, but one we must meet sooner or later, so why not sooner?

Truly long-duration suits would have the capacity to recycle urine into drinking water, and for the uninitiated, that was the gist of the first subtitle for this section. Now that will make many queasy but it is no more than a very accelerated version of what happens in nature. So if this makes you ill at ease, get with the program!

Suits will have controls to adjust the gas composition of the air, and scrubbers to remove or recycle exhaled carbon dioxide. To create a "micro" biosphere system to handle all this indefinitely without frequent fresh inputs would seem an impossible challenge. Fortunately, some people relish "impossible" challenges. We predict breakthroughs in this area -- in time, and not by an "agency."

The ultimate backup system would be a "non-invasive" vital signs telemetry system. That is a nearer term goal, one we should find easier to meet.

## Wrap Up - "Moonskin"

Actually, we are all born with a space suit of sorts -- our skin, which is one of the most important yet least appreciated of the body's essential systems. The skin works to keep our body fluids in and contaminants out. But this natural integument evolved to meet the challenges of our terrestrial environment. Now as we move out into spaces and places beyond our native atmosphere, we do not have the time to let "evolution" do its work in spinning us an improved form-fitting protection layer.

But the way the skin works without encumbering us to assist our mobility, agility and dexterity is the model we must hold before us in designing our "moonskins" the suits that will let us be at home on the Moon as if we were natives.

With the right outerwear, we could operate freely on the Moon's surface and be attentive of all the clues the moonscapes hold. Well designed moon-suits well let us "belong" in our adopted homeworld.

## Relevant articles from MMM issues past:

#89 OCT '95, p.5 "Dust Controll"

§ "Enginnering Countermeasures - Suit-Locks"

#96 JUN '96 p. 6 "Spacesuit Aversion"

<MMM>

## Could we be "at Home" on the Moon without Pets & Wildlife?

by Peter Kokh

In today's busy, high-paced over structured society, many homes are without pets. More and more people have grown up without them, and have an acquired indifference to animals, if not fear. Perhaps because of increasing exposure to environmental pollutants, a growing percentage of the population is now allergic to many things, pet fur included.

Put in historical perspective, this situation is a sad aberration. Humans have lived with animals from prehistoric times. Cats have been domesticated for six thousand years. Dogs have been a standard part of human households for over a hundred thousand years. *In that light*, it is clear that *as a species*, we have become "human" in the presence of dogs.

The value of pets to the development of individual personality is well-documented. The benefits for children and the elderly are even greater. Yet many previews of life on the space frontier, perhaps the forecasts of pet-deprived and animal-insensitive individuals, would make no place for pets. But for those of us who have had the good fortune to have our humanity more fully realized by pets, it is clear that *as a fully human society* we will never be "at home" on the Moon or anywhere else with "just plants".

Pets may not produce tangible benefits. But what they contribute to morale and to humanity, however intangible, is too immense to be written out of the picture -- even if a fraction of our population has grown aberrantly insensitive and immune.

Recently, I was interviewed by a local newspaper reporter who asked if I would go to the Moon "to live" if I was offered the chance. I replied, "in a heart beat, provided I could take along at least one of my three dogs." Not all of you will feel the same. But if only the pet-insensitive are picked to go, the settlement that will result will only be a caricature of a truly human town, by all standards throughout time and in every corner of the globe.

And there will be a place for urban wildlife as well: hummingbirds, songbirds, bees, butterflies, fish and much more. Animal lovers still rule. <MMM>

## ↩ NEXT MONTH ↩

Readers will get ***Moon Miners' Review*** #30 - our semi-annual editor-relief issue.

***Moon Miners' Manifesto*** will return on schedule in February, with issue #152 in which we'll continue our current series on "*Leaning to be At Home on the Moon.*"

Our annual "Mars issue" in March, #153, will carry that theme to the Red Planet.



[For those of you of “other traditions,” read on. You may get some ideas on how to celebrate those as well.]

# How to Celebrate The HOLIDAYS on the Moon

by Peter Kokh

Okay, so we made the final cut and we'll be shipping out to the Moon next fall. Right now, as excited as we are, Christmas is vying for our immediate attention. There's the tree to get. We wonder if for one last time we should leave the old artificial tree in the box in the attic and go get a fresh cut one. Then, this being our last Christmas on Earth, we want to buy some special gifts for those who have been dear to us and whom we may never get to see again.

Then it hits us. How are we pioneers going to celebrate the Holidays on the Moon? Oh, of course, there's no problem with the religious observances, or with caroling. And that's reassuring because these traditions are something we will always be able to cherish. But what about the material trappings of the Holidays? We enjoy them too! They've been part of our life ever since Grandma and Grandpa woke us up in the middle of the night with sleigh bells to let us know that Santa had been here. Face it, we treasure both aspects of Christmas.

## We've become so thoroughly spoiled

If you are like us, you may have gotten used to artificial Christmas trees -- much cheaper over the long run, and you can leave them up as long as you enjoy them. And then there is tinsel, glass ornaments (We've always hated the plastic ones), foil garlands, and electric lights. (Oh how we miss the brighter, much more vividly colored large lights of the past! One consolation of being “older” is having those memories!)

And the boxes and gift wrap and ribbons -- most of it used once to be thrown away. Sure, there are some who save every scrap for next year. But they are the exception that proves the rule.

And the immense quantity and variety of things to buy and to give! Sometimes it is all a bit overwhelming. So much to choose from! For many of us, of course, the amount we can afford to spend acts as a brake and narrows the choices. But still!

## But on the Moon ...

None of all that next year. On the Moon there won't be any Wal-Mart or Toys-R-Us or Circuit City. Nor will the governing Council let anyone order anything out of a catalog, or even online. Actually, they don't have to police such restrictions. Our wallet will do that for us. Even lightweight items will be quite

*expensive* to ship up from Earth.

So how are we to decorate? What choices have we for gift-giving? How are we to get in the mood without all the customary props? Are we going to be forced by the realities of the gravity well barrier to concentrate solely on the religious observances? Did we sign up for the Moon to become monks with marital privileges? Or will we find other ways to surround ourselves with some fitting trappings?

## Answering my own Question

It is a wise man who said “if you don't know the answer, it is because you haven't asked the right question.” “Will we be able to find other ways ...” Well there it is. Of course! It just takes the right attitude.

## Once upon a time ...

We have always been able to celebrate the Christmas holidays with material items that put us in the mood of excitement and anticipation -- anticipation not just of receiving, but of seeing the delight in the eyes of those we give to (at least respectfully feigned) when they open the gifts we've gotten (or made) for them. Yes the Christmas carols and songs and music excite us as well. Yes, we're uplifted by the spiritual message of the observances. These are things that cost little money except when we insist on embellishing them.

But we've always been able to decorate, and to give, long before everything we have come to take for granted in the past century. Money may help, but it has never been a necessity. We will be pioneers. It is only fitting that we learn from pioneers of earlier times. If we pay attention to the *function* of decoration and to the function of gift-giving, letting go of familiar *forms*, we may find some clues, some ways to make next Christmas as good as any, if not better! *Attitude is everything!*

## What do we have to work with?

Well, we have iron (steel by next year), glass, ceramics, cast basalt and ... You get the idea. No plastics or other synthetics. No quality alloys. No this, no that. But let's not sing along in that litany.

Those with artistic talents are encouraged to turn out accessories and other items that could serve as gifts in their spare time. Given that the factories are all busy producing items with export potential or necessary items for domestic lunar consumption, after hours arts and crafts are experiencing something of a special renaissance in the settlements. Guess we'll all be trying to cultivate our hidden artistic talents, such as they are!

According to the orientation classes that all settler recruits must take, we'll all be encouraged to participate in greater or lesser ways in the agricultural food-production and biosphere maintenance units. And soon, word has it, they'll start churning out built-on-Luna habitat modules to start giving us



## The Moon Society



## JOURNAL

<http://www.moonsociety.org>

Please make NEWS submissions to  
David Wetnight at [news monger@asi.org](mailto:news monger@asi.org)  
Other submissions: [KokhMMM@aol.com](mailto:KokhMMM@aol.com)

**The Moon Society** was formed in July, 2000 as a broad-based membership organization with local chapters, to spearhead a drive for the further exploration and utilization of the Moon in cooperation with other like-focused organizations and groups.

**Artemis Society International** was formed in August 1994 as a forum for supporters and participants in the **Artemis Project™** quest to establish a commercial Moonbase as a first step to a permanent, self-supporting lunar community. **ASI** does not engage in any form of commercial business directly, but seeks to build a Project support business team. Registered trademarks of the Artemis Project™ belong to The Lunar Resources Company®

### Join/Renew Online at

[www.moonsociety.org/register/](http://www.moonsociety.org/register/)

### Questions? email:

[membership@asi.org](mailto:membership@asi.org)

### The Artemis Project™

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

### Project LETO™

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

Please send all mail related to Memberships to:

**The Moon Society Membership Services**  
**PO Box 940825, Plano, TX 75094-0825, USA**

How to fix MMM Subscription Errors:

[www.asi.org/adb/06/09/04/1999/09/news-19990915.html](http://www.asi.org/adb/06/09/04/1999/09/news-19990915.html)

## Recent Artemis / Moon Society Publicity

### Ian Randal Strock gets Reuters Coverage

<http://www.cnn.com/2001/TECH/space/11/23/minerals.moon.reut/index.html>

Ian Randall Strock, one of three incorporators of the Lunar Resources Company, and the Editor of **Artemis** magazine, was one of three sources of a Reuters copyrighted article appearing on CNN.com **"Miners eye moon for the mother lode"**

Also cited was Denise Norris, CEO of Applied Space Resources [see MMM #140 NOV '00, p. 11 "Mare Nectaris Next Lunar Sample Area"] and Richard Taylor, a council member of the famed British Interplanetary Society.

Ian's points were that it will be business, not a politically unmotivated government, that returns to the Moon; that the Moon Treaty should not be an obstacle -- it was never signed by the U.S.; and that it is capital, not technology that is holding us up.

### BBC Radio Interviews Greg Bennett, Peter Kokh, and Ian Randall Strock

A Miss Jamillah Knowles of the "BBC Radio 5Live, London" called MMM Editor Peter Kokh just before noon on Thanksgiving Day [11/22/'01] to interview him for the BBC on "Moon Mining" and on the Artemis Society's commercial Moonbase project. She seemed very interested to hear about the promise of Helium-3 and the future of virtually unlimited clean power for Earth as a prime benefit of moon mining. They talked several minutes. Then she asked him for Ian Randal Strock's contact information, which he promptly emailed to her.

Previously, according to a response from Greg Bennett, she had called him also.

### Richard Perry pens SpaceDaily Article

<http://www.spacer.com/news/oped-01f.html>

#### **Moon, Mars, and Making Money**

British Artemis Society and Moon Society member Richard Perry <[rperry@dial.pipex.com](mailto:rperry@dial.pipex.com)> who regular makes the trip over for society conferences, and who is on board the TransOrbital team [its mini Trailblazer I orbital mission in the works for early 2002] had been auditing a series of reader-contributed essays on the "Children of Apollo" and just had to set things straight.

Richard talks about "Moon vs. Mars" and why it is a non-issue -- not because one is the right way and the other nuts, but because only government can explore Mars and only private enterprise can develop the Moon. We have Richard's express permission to reprint his article. Look for it next month. 

## Configuring a Lunar Orbit-Surface Ferry

In a recent discussion on Artemis-Discuss James McEnanly asked whether, on a Lunar shuttle designed “to ferry passengers and freight between the Lunar surface and LLO” [Low lunar orbit] it made more sense “to locate the cargo modules on top of the craft, like a flatbed truck, or beneath, like a bomber.”

In response Wallace A. McClure contributed the first four “very compelling arguments” below “for putting the cargo on top” and Gregory R. Bennett seconded the motion with reasons 5-10.

[McClure ]

1. Dust. You don't want the dust blown up by the engines to blast onto the modules -- which would be more likely if they were hanging below, near the engines. (You'd want a shadow shield at least)
2. Failsafe cargo latching. If the cargo module attachments fail during powered flight, they'll most likely be lost if they are mounted below. Put them on top, and the propulsive thrust will keep them in place. Yes, you'll still want latches, but it will be easier and safer.
3. Loading. A low-bed approach should be easily done in low-gee, with unlimited vertical clearance Whereas loading them under something with a low top will be more difficult and harder to do. You'll need to carefully position the objects in 3 dimensions to properly latch them in place, whereas 2 dimensions to load them on the top.
4. Thermal issues. Don't put them near an engine. Thermal > radiation will be a bitch to deal with from the engine exhaust > or from the engine bell.

[Bennett ]

5. Shorter landing gear. Save weight.
6. Safety in a crash. The engines become a crumple zone. A hard landing can crush the engine bells and landing gear without damage to the cargo.
7. Controllability. Keep your center of gravity above your engines.
8. Engine-out recovery. You can cluster engines beneath the cargo aimed mostly through the center of gravity. If you sling the cargo below, you have to spread the engines so that a single engine failure results in disaster.
9. Easier assembly in space. The cargo module can be transferred to another ship without having to reach a robot arm into a maze. You have more margin for error in the robotics; and you need that. A run-away arm joint is a real possibility.
10. Abort capability. If your escape stage is above your main propulsion system you can abort from a really bad landing. If your cargo is below the main structure, you die.



### Priority 2nd Mission Moon Cargo

First, what I think should be in that Artemis cargo container [MMM #146 pp. 10-12: “What’s in the 20,000 lb. Cargo Container of the 2nd Artemis Moon Mission?”]

- tanks of hydrogen (to combine with lunar oxygen to make water)
- equipment to process glass composites for base expansion construction
- inflatable node with four berthing points for future growth by adding more modules
- secondary life-support system (redundancy)
- compact machine shop and tools
- Snicker bars (for morale!)

### A future in the making?

That said, now think ahead to say 2010. The *still* unfinished ISS [International Space Station] circles the globe little more than something for Japanese tourists to gawk at on board one of the *Kankoh-Maru* SSTOs as it flies by to the *Kawasaki-Honda* hotel (the only one in orbit) or to the *Mir 2*.

On board ISS, the heroic NASA astronauts struggle to keep things going. A hastily built reboost engine now occupies the space where the Russian *Zarya* and *Zvezda* used to be, long since undocked in protest of “Son of Star Wars.” These modules, now renamed *Mir 2* and devoted to true commercial space, the sturdy Russian craft has long outstripped ISS when it comes to making a fast buck.

Meanwhile, the Chinese space station expands with another module ...

But what of NASA? Still using the aging shuttle fleet, of course!

But back at the Cape in the Vertical Assembly Building, one of the solid rocket booster inspectors has not got her mind on her work. Her boyfriend has been seeing someone else. Thinking about this, she fails to note an O-ring problem and so the countdown to 1986 Part II begins.

Halfway to the Moon, an FGB module attached to a refurbished SpaceHab module hurtles Moonward. Plastered all over it are the logos of sponsors along with the Artemis Moonbase badge.

Will this future come about? Hard to say, but the loony dream of Star Wars could put a few spanners in the works. We shall see.

*E. Philpott*

South Wirral, England, UK

[A Moon Society Liaison Committee Report]

## Other Players in the Moon Game

### The Space Frontier Foundation

- [www.space-frontier.org](http://www.space-frontier.org)
- By Peter Kokh, Foundation “Fellow Traveler”
- The Space Frontier Foundation (which prefers the shorthand “the Foundation” rather than “SFF”) was formed by a group of Senior Associates of the Space Studies Institute (SSI -- see our report in MMM #145 May ‘01 pp. 10-12 Moon Society Journal Section) in 1988. It’s founding purpose, and its governing mission still, is to change public and government perceptions about space, overturning set paradigms.
- “Space is a place, not a program!” The Foundation has been at the forefront of the call for CATS “Cheap Access to Space” and the critical importance of commercializing space at every level: space shuttle operations, the space station (the “Alpha Town” and “Space Station Port Authority” proposals), and even robotic space probe missions (the “Data Services Purchase Act”). The Foundation has developed and found the sponsors to introduce several pieces of paradigm-changing space legislation.
- While the Moon is not always the focus of this activity, it is clearly a major focus. The Foundation’s call has been to “let the government do the Lewis & Clark type expeditions do Mars. Leave the opening and development of the Moon to private enterprise.”
- “Join the Revolution,” says Rick Tumlinson, longtime Foundation president. His idea is not just to talk about the Moon, but to identify ways of getting things done, step by step until the dream becomes the reality we all want to see.
- The Foundation holds its own Space Frontier Conferences usually in September or October, and in Los Angeles. In these conferences, getting back to the Moon is just one of the themes.
- **Moon-related Activities**
- The Foundation was and remains a principal Sponsor of the Lunar Development Conferences, the first of which was held in Houston in July 1999, the last two in Las Vegas. Finding commercial pathways back to the Moon and reporting on the latest developments in that direction is their primary function.
- It also has a special Moon Project Home Page on its website:
- <http://www.space-frontier.org/Projects/Moon/>
- For the 1999 Lunar Development Conference, the Foundation authored “The Lunar Declaration”:
- [http://www.space-frontier.org/POLICIES/Lunar\\_Declaration.html](http://www.space-frontier.org/POLICIES/Lunar_Declaration.html)

### *The Lunar Declaration*

“Recognizing it is the dawn of a new millennium, and the human spirit cries out for new beginnings;

“Recognizing the need for new challenges to the human spirit, new domains for the exploration of human freedoms and the rapidly growing pressures on our biosphere and natural systems;

“Recognizing humanity has developed the ability to routinely access & utilize the space near Earth & maintain human habitation in the space environment;

“We, the undersigned people of Earth, do hereby declare that it is the duty and responsibility of our species to expand our civilization and the biosphere of our home world outwards into space.

“We further declare that it is our duty to assure that this movement is safe, supportable, sustainable, and unstoppable.

“First explored by human beings several decades ago and given its proximity to our home world, its location on the edge of the near and far frontiers of human exploration, its bountiful resources, its ability to serve as a platform for further exploration and as a nearby location for our first human habitats on another planet, we believe the Moon represents the next and most vital step for humanity as we expand beyond Earth orbit.

“Be it as a training base for future human explorers of Mars and other worlds, a supplier of precious materials for the development of clean energy on Earth and construction in the space between planets, a home to observatories that will probe the cosmos, a location for commercial enterprises including hotels, or simply as land to be settled and owned by individuals who are willing to stake their lives and fortunes to open its bounties; the Moon represents a new opportunity for an unprecedented partnership between the public and private sectors that will result in savings to taxpayers and profits to those willing to take the financial risks.

“We believe there is an appropriate role for all in this endeavor, with private industry providing services and supporting operations and the government providing a regulatory environment and acting as a good customer as it fulfills its legitimate needs to develop the technologies and systems necessary to explore the far frontier.

“Therefore, we call on the people of Earth and its governments, industries and institutions, each acting in their appropriate roles, to join together in a renewed and united effort to seek these synergies, mold a new unified approach to opening the frontier, and create the financial, legal and policy incentives that will catalyze this effort.

“To summarize: We, the undersigned people of Earth, do hereby declare it is time to Return to the Moon. This time to stay.”

## The Frontier Enabling Test

Perhaps the most strategically invaluable product that the Foundation has introduced that is relevant to the cause of opening the Lunar Frontier (and all other space frontiers!) is the "Frontier Enabling Test." This test was developed to enable the Foundation to determine whether or not it should support or oppose an issue. But it is also a test that all of us need to apply to make sure that we are not wasting our efforts spinning wheels that won't take our buggy where we want it to take us.

The Frontier Enabling Test defines a frontier enabling technology as one that:

- accelerates the creation of low cost access to the space frontier for private citizens and companies
- enables or accelerates our use of local space resources and/or
- accelerates the rate at which wealth can be generated in space

This and other Foundation policies and position papers can be found at:

<http://www.space-frontier.org/POLICIES/>

The Foundation's web page belongs on everyone's list of bookmarked locations, and deserves to be monitored regularly. One of the dangers in the space activist business is letting "personalities" and how easily we handle them (or "suffer" them) get in the way of decisions about supporting efforts, cosponsoring events, and entering into joint ventures.

## MMM Editor's personal comments

Opening the space frontier is very much an uphill battle against the overwhelming weight of the prevailing inertia. It is only to be expected that the personalities of many of those who succeed in making headway in this upstream effort will be strong ones, sometimes uncomfortably assertive.

Here is the point where each of us is called upon to decide which is most important to us: the overall goal we profess to be so important, or our personal comfort zone.

Over the years, the Space Frontier Foundation sensing a kindred spirit in the pages of *Moon Miners' Manifesto* has provided both hardware and software support for the Lunar Reclamation Society's desktop publishing setup and taken MMM under its wing. At the same time, we have never felt under editorial pressure and have expressed friendly differences of opinion when we had them.

Yet, on the road to the Moon, we are proud to call ourselves "Fellow Travelers" of the Foundation and Rick Tumlinson's industrious legion. 

"If we can put a man on the Moon, how come we can't put a man on the Moon?" - Bill Engfer (SFF)

## The American Lunar Society's Lunar Study and Observing Certificate

<http://otterdad.dynip.com/als/page101.html>

This certificate program emphasizes not just observing, but an understanding of the geology so that the person understands what is being observed. This project was designed for those who want to move beyond the simple observing stages.

In completing the Certificate, you observe not just 'craters and maria', but also sinuous rilles and volcanoes, flooded craters and secondary craters, arcuate rilles and mare ridges.

Further, you will come to understand just how these features formed, and what they tell us about the history of the Moon. In short, this project will produce competent observers, who are qualified to teach others about the wonders of the moon. May you enjoy the learning and the hunt.

To earn the ALS Study and Observing Certificate one must complete the following steps:

1. Read article "Geologic Processes On The Moon" - <http://otterdad.dynip.com/als/page3.html>.
2. Complete an 'open book' test over the article "Geologic Processes On The Moon" (not a difficult test. It was designed only to ensure the article was read. Passing score with 80% correct answers.)
3. Observe a list of objects: (<http://otterdad.dynip.com/als/page103.html>) and keep a log of what was seen. Only 90% of these objects need be observed to complete this requirement.
4. Mail both the test and a copy of your log, along with a check for \$8 (processing fee) to:

Eric Douglass  
10326 Tarleton Dr.  
Mechanicsville, VA 23116

Your certificate will be mailed to you within 4 weeks of arrival in my hands.

There is also an ALS Navigator's Certificate program aimed at Middle School Students.

<http://otterdad.dynip.com/als/page71.html>

A number of other grade specific projects are listed at:

<http://otterdad.dynip.com/als/page94.html>

These include:

- The Lunar Ray Project
- The Lunar Height Project
- The Lunar Dome Project
- The Transient Lunar Phenomena Project 



## TransOrbital, Inc. Begins Sale of Cargo for Transport to the Moon

From: Paul Blase <PBlase@aol.com> -- Nov. 29, '01  
*We're Going to the Moon - Join Us!*

TransOrbital, Inc. is proud to announce the opening of our on-line Lunar Time Capsule catalog site. The Lunar Time Capsule will be launched on our "2001 TrailBlazer" lunar imaging mission and deposited on the lunar surface at the end of the mission.

Customers can include messages and pictures in the time capsule; these will be micro-etched onto a special metal disk and placed into a hardened capsule inside the space probe, which is designed to survive the impact when the spacecraft is de-orbited at the end of the mission. A limited amount of space for carriage of personal memorabilia is also available.

Please see our website at

**<http://www.transorbital.net>**

The Online Catalog is at

**<http://www.transorbital.net/catalog/>**

Learn more about the TrailBlazer I Mission at

**[www.transorbital.net/missionshome.html](http://www.transorbital.net/missionshome.html)**

**<http://www.asi.org/adb/06/09/04/2000/03/news-20000319.html>**

[cf. MMM # 125 MAY 1999 p.10. "Spotlight on Artemis sponsor TransOrbital, Inc." -&- MMM #134 APR 2000, p. 11 "TransOrbital Update"]

## Solution to Zero-G Bone Loss?

Bruce Moomaw <moomaw@cwnet.com> 10/2/2001

I first saw this "Nature" article two months ago and was about to mention it here [europa-digest], speculating on its possible relevance to the problem of zero-G bone loss:

[www.nature.com/nsu/010809/010809-10.html](http://www.nature.com/nsu/010809/010809-10.html)

...but NASA has just beat me to it:

<ftp://ftp.hq.nasa.gov/pub/pao/pressrel/2001/01-187.txt>

It's been known for a long time that bones (like muscles, ligaments and tendons) respond to the stress placed on them by exercise by increasing their bone-cell growth rate and thus their strength. But the trouble with using that as a therapy for osteoporosis, of course, is that stress breaks the increasingly brittle bones as fast as it strengthens them -- and it seems to be impossible to get enough exercise on space stations to prevent the serious loss due to zero-G.

However, researchers at the State Univ. of NY have now found that just 10-20 minutes per day on a platform vibrating quite gently at 90 Hertz fools bone cells in sheep into thinking that they're undergoing major mechanical stress -- and so they proliferate like mad, despite the fact that the mechanical stress they're undergoing is actually only 1/1000 of that they would get from the regular exercise needed to thus stimulate them! 20 minutes per day on such a platform for 1 year increased the bone density in sheep femurs by fully 34% -- and NASA now confirms that tests on sheep "prevented from regular, weight-bearing activity" (as they would be in zero-G) had their resultant bone loss completely countered by only 10 minutes per day.

Medically -- if this also works in humans (and preliminary tests are encouraging) -- it's absolutely sensational: the final solution to the plague of osteoporosis, without any of the risky hormonal and metabolic changes in the rest of the body produced by estrogen and other drugs. *And, as a little side benefit*, it could also put an end to the medical problems produced by both prolonged zero-G and the low-gravity environments of the Moon and Mars, since treadmill exercise in such environments DOES seem to counteract all the other harmful medical effects of low gravity. <BM>

EDITOR's comment: This is certainly something to be tested on long-duration visits to ISS, long enough for bone mass deterioration to otherwise show up. Yet it will be tricky. The associated vibrations could make sensitive micro-gravity research impossible. So there has to be devised a workable way to isolate an astronaut undergoing 20 minute a day treatments, i.e. a way to keep him/her in mid air without drifting into a wall/bulkhead. A simple engineering problem! PK

## Six more LRS White Papers Now Online

Include material from past issues  
of *Moon Miners' Manifesto*  
and *Moon Miners' Review*

[http://www.lunar-reclamation.org/  
page12wp.htm](http://www.lunar-reclamation.org/page12wp.htm)

### The six papers just added are:

- "Spinning-up" Glass-Glass Composites Technology © 1987
- Prinztown: a Rille-Bottom Settlement for Three Thousand Pioneers © 1989
- Railroads on the Moon © 1993
- Reinventing Space Oases © 1995
- Living "Off the Ice" on Europa © 1997, 1998, 2001
- "Improving" the Moon and The Developer's Role © 2000

### The following papers were put on line previously:

- MUS/cle Strategy for Lunar Industrial Diversification © 1988
- The Lunar Hostel: An Alternate Concept for First Beachead and Secondary Outposts © 1991
- The "Frontier Builder": an Earth-Moon Hotel Cruise Ship: Definition & Design Exercise © 1992
- SSI Research Goals Proposal © 1993
- The Prehistory of Lunar Prospector © 1995
- The Use of Lunar Lavatubes © 1995
- What do Lavatubes Look Like? © 1999
- TransHab and the Prehistory of its Architecture. © 1999
- Steps to Civilian Lunar Home Rule Authority © 1999

### The White Papers Project is part of LRS 15th Anniversary Celebration

Additional Papers will be added  
to the above list in the near future.

<http://www.lunar-reclamation.org/>

Explore our Site!

## Mars Odyssey Mission Update

<http://mars.jpl.nasa.gov/odyssey/>

Mars Odyssey Home Page

As of November 13th, the Mars Odyssey craft had begun the main aerobraking phase of the mission.

Skimming through the upper reaches of Mars atmosphere during each orbit at periapsis, the point of closest approach to the surface (110 kilometers or 68 miles), the orbital period has been reduced by more than three hours in the first two weeks to about 15 hours. Closest approach is over the north pole.

"Aerobraking is a spaceflight technique wherein an orbiting spacecraft brushes against the top of a planetary atmosphere. The friction of the atmosphere against the surface of the spacecraft slows down and lowers the craft's orbital altitude. The solar panels are used to provide the maximum drag in a symmetrical position that allows some control as the spacecraft passes through the atmosphere.

"Instead of using onboard jets and propellant to adjust a spacecraft's orbit, aerobraking uses the atmosphere as both a brake and a steering wheel. The technique ... shares more elements with sailing than with driving: successful aerobraking depends upon precise navigation, knowledge of weather and a solid understanding of the forces the craft can withstand."

[http://mars.jpl.nasa.gov/odyssey/  
mission/aerobraking.html](http://mars.jpl.nasa.gov/odyssey/mission/aerobraking.html)

The aerobraking phase should be completed by late January 2002. Then Odyssey will have settled into a circular orbit, and the science mapping mission should begin sometime in early February.

### The Science Mission

Mars Odyssey is the first craft sent to Mars with a Gamma Ray Spectrometer, the same kind of instrument that Lunar Prospector used to search for water ice in the permanently shaded crater areas of the Moon's north and south polar areas. The GRS does not directly detect the presence of water, but sniffs hydrogen, inferring water (hydrogen dioxide).

The THEMIS instrument (Thermal Emission Imaging System) will map the distribution of minerals and is tuned to be especially sensitive to those minerals which can only form in the presence of water. If Mars Odyssey finds them in abundance, that will prove beyond doubt that Mars once had a much wetter past. These prize minerals include carbonates, silicates, hydroxides, sulfates, hydrothermal silica, and phosphates.

Finally, the MARIE (Mars Radiation Environment) Experiment will better characterize the radiation environment on Mars so that future explorers can be properly shielded (without overdoing it!). This promises to be an exciting mission! </MMM>

# ♂ Mars Society Updates ♂

## 3 Sites make Aussie Mars Sim Short List

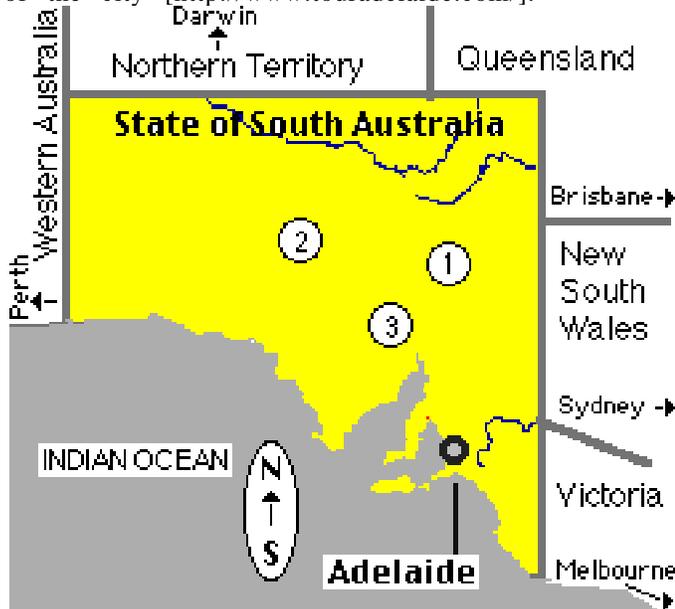
<http://www.marssociety.org/bulletins/Bulletin50.3.asp>

The Project Jarntimarra expedition, a group of Australian and international scientists and engineers returned to Adelaide, South Australia after two weeks in the "Red Centre". The team identified three sites for the proposed **MARS OZ** Research Simulation Station to complement the work being done at the Mars Arctic and Mars Desert Research Stations in the Canadian arctic and Utah respectively. The three sites, all in the State of South Australia, have Mars-like characteristics, where valuable research can be carried out, such as testing rover vehicles for surface exploration and interaction between crews and mission controllers. The prime [see (1) on map below] site has good access by road year-round, is close to infrastructure such as an airstrip and the Arkaroola resort, and has visual characteristics which are analogous to Mars, such as the red soil and dust.

The expedition raised the public profile of Mars Society Australia and on its aim of facilitating future human exploration and colonization of Mars.

Mars Society Australia will consult with traditional [aborigine] and existing owners/leaseholders before making definite proposals to undertake activities at any of these locations. A number of options for type and size of facility are under consideration. AU \$250,000 (US \$130,000) may be needed to set up the facility for its first field season.

Below is a map of South Australia, a state 43% larger than Texas. Its capital Adelaide has over a million people. The three sites identified by the Jarntimarra expedition lie some 200-400 miles north of the city [<http://www.touradelaide.com/>].



KEY: (1) Arkaroola area in Northern Flinders Ranges; (2) Arkarina near Coober Pedy; (3) Woomera region

## Mars Desert Research Station in UTAH

<http://desert.marssociety.org/index.asp>

The new, lighter weight Mars Desert Research Station (half the weight of the Mars Arctic Research Station though of the same dimensions) was built to be portable. It can be assembled, disassembled and moved to a new location, and reassembled anew. It has already been through this process, having made its debut last summer at the Kennedy Space Center where it was toured by many thousands of visitors.

[marssociety.org/bulletins/06.13.01.MDRS.KSC.asp](http://marssociety.org/bulletins/06.13.01.MDRS.KSC.asp)

It has since been reassembled in Utah, on a stretch of rugged red terrain some midway between the Canyonlands National Park to the East and the Capitol Reef National Park to the West. This location is easily reached from Denver (Mission Control) via I-70 to Green River, UT, then SSW on state 24. It is also within a day's drive of Salt Lake City, Phoenix, Las Vegas, and Albuquerque.

<http://www.sltrib.com/11212001/utah/150821.htm>

The new station is scheduled for shakedown trials in December and to be operational by mid-January. The plan is for MDRS to be a year-round facility, with summers dedicated to public outreach. Students and other visitors will be allowed in the habitat module, or "Hab," only during the summer.

The site is a remote location that is still accessible by roads. The station sits on School and Institutional Trust Lands Administration property some five miles north of **Hanksville**, population 362. The Mars Society has a right-of-entry permit to the SITLA site. The one-year agreement can be renewed.

The area is almost totally devoid of vegetation. For the Mars Society, the big pluses are that the MDRS can be operational year-around whereas the Arctic Station has a two month long field season at best. Further the logistics are much better. It can be reached from Denver almost at will, and cheaply, in stark contrast to the site on Canada's Devon Island. Finally, the Utah site will allow the public at large to visit, something very difficult and expensive to arrange in the arctic.

The Arctic Station is equipped only with All Terrain Vehicles which have proved to be very handy. But for longer field trips, the Utah station will also have a "Mars Rover", similar to a four-wheel-drive recreational vehicle. University of Michigan students are building the living area to go on a donated U.S. Army Medium Tactical Vehicle truck chassis. It will be able to house three researchers.

The Desert Station could stay in Utah for several years. At any time it suits the purposes of the Society to simulate Mars operations in other areas of the U.S. southwest that offer differing terrain with other analogies to terrain on Mars, it can be easily relocated. Besides the Planned Australian station, a 4th is being planned for Iceland. </MMM>



### **Mining the Moon for Strategic Metals**

10/1/01 *The Moon has been bombarded by meteorites for ages. As I understand it, troilite (FeS) is found all over the Moon and is thought to have come from meteors. Don't most stony-iron meteorites also contain some nickel? And some cobalt? Yet I hear that the Moon is lacking in nickel. Could there not be a large impact somewhere that is rich in nickel, and perhaps platinum as asteroids are richer in platinum than is Earth. There is a nickel mine in Canada where a large meteorite once hit. These metals have many uses. I don't agree with the buzz that the Moon is so "deficient." In the process of helium 3 mining, we will be able to bake substantial amounts of H,N,C,S & Na from the huge quantities of regolith processed.*

Dave Dietzler <Dietz37@msn.com>

EDITOR's Response: The Moon is "deficient" in many things, "compared to the Earth." But you are right, we can harvest solar wind-derived volatiles. I think that if we design all earth-moving equipment (or regolith moving equipment) for excavating, emplacing regolith shielding, building roads, gathering material for processing operations so that all the handled material is first preheated to c. 600 °C to drive off the volatiles, and these are captured and stored in tanks, we will end up with all the hydrogen and carbon and helium and neon and argon, and most of the nitrogen we need. We need to do this if we are to succeed. .

If future probes show that the polar ice fields are real, then given their cometary origin, they may include a considerable amount of immixed carbon oxide and nitrogen oxide ices as well. I think that the best way to move this bonanza to the mare-highland coastal areas better endowed to serve as industrial centers may be to refine this mixed ice and ship CH<sub>4</sub> methane and NH<sub>3</sub> ammonia in tanks or by pipeline to be burned with local destination oxygen in fuel cells, to produce water, carbon dioxide, nitrogen and power.

You're right that there *could be* a Sudbury like asteroid impact area atypically rich in nickel and copper. Alas, the instruments we've used from orbit to date are not up to the job of identifying such areas. That should indeed be a priority.

The trouble is that "pure" scientists, not practical minded prospectors, call the shots. *Lunar Prospector* is the only prospecting probe, designed to look for resources as such. NASA did not think of it, design it, or build it. It won a Discovery Mission Opportunity slot because it was relatively inexpensive and ready to go, thanks to a lot of hard work by people outside of NASA working on a shoestring.

Follow up probes to visit polar areas or other areas Lunar Prospector has shown to be intriguing are not likely soon given NASA's "been there done

that" attitude, and the perception of the Moon as just a barren rubble pile. Mars is sexier.

I believe it is possible to build a fairly self-reliant industrial settlement on the Moon. But even if things go well (enough H, C, N for water, air and food production) there will always be a scarcity judged from the viewpoint of what we are used to on Earth.

People are concerned about hydrogen (water), but actually, in comparison to the amount that we'd need to live comfortably, it is neither hydrogen nor carbon that is the pinch point, but nitrogen. We'll have to reduce air pressure, with nitrogen taking all the hit, and probably have only room height ceilings in general. The idea of filling domes (structurally absurd in the first place) with that much nitrogen rich air is not going to fly anytime soon.

There are industrially important metals that are deficient on the Moon so far as we know, present only in parts per billion, with no likelihood of concentrated ore veins as that would require billions of years of tectonic processing in the presence of water.

These include gold, silver, zinc, platinum, and copper (there *is* enough cobalt and nickel even though it is nowhere concentrated in ores). Today, platinum is used in about a quarter of all modern industrial processing and manufacturing operations. Silver is also important. But copper!!! We will have to rely on aluminum electrical wiring. This was tried with bad results in the sixties, but we know well enough what caused the problems and it can easily be remedied. Using aluminum will be inconvenient (it is very energy intensive to produce it even from good ores) but we will be able to make do.

Some industries will be much easier to jump start than others. Powdered metal technology applied to unoxidized iron powder in the regolith) and cast basalt being easiest and requiring the least investment in capital equipment. Lunar concrete and glass-glass composites may come next. Aluminum, steel, titanium, etc., will all require much larger scale operations. Many fail to realize is that the major alloys used in making serviceable aluminum are copper and zinc: we'll have to do without either. Not much critical metallurgical research is being done.

Mining folks look at the Moon and see no concentrated ores and say we are crazy. But if we can learn to process metals and other elements from poor ores, then suddenly every so-called resource poor nation on Earth will have access to technology that will allow it to rely on its own so called poor ores.

Buzz coined the expression magnificent desolation and never got beyond that first impression. We arrived on the Moon as aliens. If we return to stay, fully accept the Moon as our new home, determined to think like natives would if there were any, then well see and find the ways to use the hidden resources.

*Peter Kokh*

Moon Miners' Manifesto





**Minnesota Space Frontier Society**

**c/o Dave Buth, 3331 Cedar Ave. S. #2  
Minneapolis, MN 55407**

612-721-4772 (Dave Buth) 612-375-1539 (Jeff Root)  
Email: mnsfs@freemars.org

<http://www.FreeMars.org/l5/index.html>

- **NEXT MEETING: Saturday, Dec. 29 th, 1 pm** at **Radio City Inc.**, 2663 County Road I, **Mounds View**, MN 55122, **back meeting room** . -- (763) 786-4475.
- **DIRECTIONS:** north of I-694 just off of County 10, between Long Lake and Silver Lake Road, not Hwy 10 which is close by. Hwy 10 runs along I-35W. You have to be on **County 10**. If you need more directions or want to add to the Agenda call: (612) 333-1872.
- **AGENDA:** We will be discussing reworking the website, donations to and educational work at the Minneapolis Technical Training Academy, student Emma Schmidgall's trip to a NASA Conference, a U of M program and many other topics. See you there!
- **Nov 18th Meeting: Election Results & Minutes**
  - Executive Director: David Lee Buth
  - Assistant Director: Rich Brown
  - Secretary: George Anderson
  - Treasurer: Kevin Bruce Wilson
  - State Councilor (3 yr.): Ben Huset
  - State Councilor (2 yr.): Jim Cran
  - State Councilor (1 yr.): Scott Shjefte
- After the Showing of "A Trip to the Moon" & "Dancing on the Moon" everyone who was hungry chowed on chili and all the other greats food folks brought. We all ate while we watched "Cinema Secrets" on "The Woman in the Moon" (1929), "Destination Moon" (1950) and, "2001" (1968) as well as additional film clips until 7:00 PM where the election itself ran quite smoothly. Thank you to Melissa Novner who counted up the ballots for us!
- Don Butner spoke on the plight of the MTTA (Minneapolis Technical Training Academy) being hounded by MPS for being too successful! We will continue the discussion at the December meeting in.



**Guyahoga Valley Space Society**

**3433 North Ave. Parma, OH 44134-1252**

c/o George F. Cooper III, Phone 216-749-0017  
E-Mail: geocooper3@aol.com [new]

☞ Monthly Meetings, the 4th Thursday **7-9:15 pm**,  
**rm 106, Wilker Hall, Baldwin Wallace College, Berea**  
NEXT DATES: **DEC 27th, JAN 24th**



**Oregon L5 Society, Inc.**

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

voice mail / FAX (503) 655-6189

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

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

Bryce Walden <BWalden@aol.com>

(LBRT - Oregon Moonbase) moonbase@home.com

☞ Meetings **3rd Saturday** each month at **2:00 p.m.**

**Bourne Plaza, 1441 SE 122nd, Portland, downstairs**

NEXT MEETING DATES: **DEC 15th, JAN 19th**

**Results of Oct 20th annual ORL5 elections:**

Officers:

- President: Allen Taylor
- Secretary: Cheryl Lynn York
- Treasurer: Bryce Walden
- Archivist: Rea T. B. Young

Standing Committees:

- Lunar Base Research Team  
(LBRT; Oregon Moonbase): Robert D. McGown
- Mars Instrument and Science Team (MIST):  
R. D. 'Gus' Frederick
- Legislative Action Working Group (LAW Group):  
Thomas L. Billings
- Media: R. D. 'Gus' Frederick
- Program: Robert D. McGown

As per our Bylaws, these people constitute the Steering Committee and serve as the Board of Directors for Oregon L5 Society, Inc., Chapter of National Space Society. Congratulations to all!



**OASIS: Organization for the Advancement of Space Industrialization and Settlement**

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Odyssey Ed: Craig Ward - cew@acm.org

E-mail: oasis-leaders@netcom.com

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 \$20 NSS dues if under 22 or over 64. *Must state age* \_\_\_\_  
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 (Make payable to local chapter *for 1st year free local dues*)  
 (Offer not honored by Oregon L5 Society)

\$35 **MOON Society** dues with MMM  
 \$25 **Moon Society** dues for those already getting MMM  
 Moon Soc. Membership, PO Box 940825, Plano, TX 75094

 **INDEX to # 151 DEC. 2001** 

- p 1. IN FOCUS: A Post NASA-Bushwhacking Strategy to push Planetary Science, Editorial, P. Kokh
- p 3. Engaging the Surface with MOON SUITS instead of Spacesuits, P. Kokh
- p 7. How to Celebrate the HOLIDAYS on the Moon, P. Kokh
- p 9. MOON SOCIETY JOURNAL™; Recent Artemis / Moon Society Publicity.
- p 10. Configuring a Lunar Orbit-Surface Ferry; MAIL
- p 11. Other Players in the Moon Game: Space Frontier Foundation
- p 12. ALS Lunar Study & Observation Certificate Program
- p 13. TransOrbital 's Cargo to the Moon Sales Announcement; Solution to Zero-G Bone Mass Loss?
- p 14. LRS White Papers Online; Mars Odyssey Mission Update
- p 15. Mars Society News: Australian Sim Sites; MDRS in Utah:
- p 16 MAIL Moon Mining. -- p 17. LRS News -- p. 18 NSS Chapters

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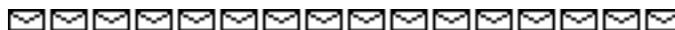
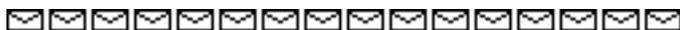
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