

Above: The Moon's northern nearside altimetry map courtesy of Japan's Kaguya Probe (Green and blue are lower, yellow and orange higher)

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NASA's Return will Exceed Past Achievements

In the glorious Apollo period, as thrilling as it was for most of us, there is so much that we did not do or try. In that context, NASA's moon base program, as scaled back as it is from the original "Moon, Mars, and Beyond" Vision, if not cancelled altogether by the next Administration, is sure to see men go, and do, where no man has gone before, or dared do 'til now. See pp. 3–4.

IN FOCUS I Earth Day 2008: Taking the Green Spirit to the Moon

We all know that at best, public interest is space is *shallow:* "a mile wide, and an inch deep." Among young people and among the growing percentage of those who are, or are becoming, "environmentally conscious," one of the most frequent reservations we hear is this simple challenge: "Why should we go to the Moon (or Mars) and trash them the way we are trashing the Earth?"

It is not to our credit that too often the response is to dismiss the question as well as the questioner. If we are going to build support, as we must, [=> p. 2, col. 2]



Moon Miners' Manifesto

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• 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/

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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

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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 chapters** 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.

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so long as we are stuck with a tax-supported program, we need to take this on this challenge with due respect. To fail to do so, only confirms the plaintiff's suspicions. Not exactly to our credit, too many space enthusiasts consider environmentalists the enemy, instead of natural allies whom we must do out best to court. *It is possible!*

If we love our own vision, we owe it to our own dreams to get past this silly pettiness. Nor should we pout and wait for "them" to make the first move towards reconciliation, cooperation, and collaboration. Unless we take the lead, we can forget about building *significant* public support. We already share one most significant goal in common: preservation of Mother Earth for future generations. We come at it from different perspectives, and from different cultures. This gap can be bridged!

What follows is a brief outline that our conversation with the Greens, and with ourselves (a guideline to considerations we must address in our own plans to advance the day when civilians will be living on the Moon, engaged in pursuits which will assist those on Earth to survive our current crises, crises probably typical of "adolescent" intelligent civilizations. Later in this issue, we will address these points in paragraph form, leaving fuller treatment to individual future articles.

Points to Make with the Environmentally Concerned

(A) *Mining concerns:*

Mining methods: most of the major and minor elements we will need are found in sufficient abundance in the rock powder blanket that covers the Moon's surface. The need to strip mine or mine deep underground is very minor.

Tailings: By conducting a cascade of mining sequences where removal of one needed element makes the tailings that much richer in other elements, we constrain our regolith mining operations and greatly reduce the total of energy input needed, and then using the final tailings residue for secondary construction uses.

(B) Recycling concerns:

Recycling spent energy; Everything we make embodies the energies needed to produce it. We can recycle that energy by recycling the materials, as items are replaced.

Industrial design: We can choose assembly methods so that diverse materials do not contaminate one another and can be easily separated for proper recycling.

Economics: to become economically viable, we need to make maximum use of everything we produce, and that can be done best by a comprehensive recycling system. This maximizes use, minimizes throughput (resources in/discarded waste out), minimizing our lunar "footprint." **Enterprise:** A very high percentage of entrepreneurial opportunities for pioneers will be in the area of reusing materials no longer serving their original design purpose.

(C) Concerns raised by our bad record on Earth: Postponed urgency: Our biosphere (atmosphere, hydrosphere, flora and fauna) is so vast until recently it has been doing a good job of handling of recovering from our environmental sins. We postpone solutions to the next generations (for which we will be condemned.) On the Moon, we must live in self-contained mini-biospheres, essentially living downwind and downstream of ourselves. What we do wrong will hurt us immediately. We learn to live in harmony with our mini-environments, or we will quickly get the "game over" message. The lessons we learn can be exported to Earth. – PK

"Anything worth doing is worth doing well"

Returning to the Moon

I: Bursting Apollo's "Envelope"

So many really basic things were left undone! by Peter Kokh - <u>Reprinted from MMM #88 - September 1995</u>

Apollo was without precedent. For scouts of Earth to break free from their womb planet and set foot on what had always been an unreachable celestial sphere was a clean break with all that had gone before. It electrified civilization for a moment. Yet for all these nine manned missions to the Moon accomplished, six of them landing, *so many really basic things were left undone* that roundly shattering that precedent will be easy. We mean no disrespect! But, yes, easy.

 \Rightarrow Twelve men set foot on the Moon. Yet none of them slept in a bed there. The LEMs had only hammock-slings. All twelve walked in one sixth gravity, but only with cumbersome pack-laden pressure suits - the pressurized LEM "cage" was scarcely big enough to pace back and forth in place. So no one experienced what it is like to walk in lunar gravity, not really.

 \Rightarrow All the missions were [lunar] morning ones. No one experienced a lunar sunset, a lunar night, a lunar dawn. We never even hung around into local afternoon.

 \Rightarrow We ate and slept in our station wagon, not even pitching a tent. In effect we just picnicked there. Since our vehicle was our shelter, we took it with us when we left, and there is no camp, no cottage, to which we might return. We never visited any site more than once. We left no "building" on the Moon, not bringing any with us, not erecting any.

 \Rightarrow We never stayed long enough to plant, or grow, much less to harvest. Even the science we did was just field work collection stuff. We brought along no lab. Nor did we play much. Sure we romped around in our suits, hit a golf ball, and playfully rigged our flags so they looked like they were flapping in some vacuous breeze. Playful, yes. Play, no.

 \Rightarrow We were there, that's all. Like Kilroy. And then we were gone, and are gone still. We took samples from which to learn what the Moon is made of, but which have since been guarded so jealously by an intermediating *priestly* class "lest we never return" that we have not been free to learn from these samples what we might **make out of** what the Moon is made of, as if to guarantee that we would never find the confidence to return on a live-off-the-land basis.

 \Rightarrow We left stuff too - more than footprints, stuff that could someday be prized pioneer relics in local lunar museums. But to date, almost four decades later, these leavings only remind us of our failure to build upon what we had done, to stand tall on the shoulders of our heroes. The "revolution in history" has been downgraded to an anomaly, a distraction.

2. A New Beginning

So much of both the technology and the expertise that carried the Apollo program on to its brilliant successes has been lost, dismantled, maybe even deliberately destroyed, that we can no longer just repeat these humble sorties. They cannot even be called beginnings since they have been robbed of the chance to lead to something more that follows. Not quite. We *have the knowledge*, the record, and some teasing results of matter-starved experiments that suggest what we might be able to do with lunar regolith - make oxygen, iron and steel, aluminum and titanium, cast basalt and ceramic objects, sinter blocks and concrete, glass and glass composites - in effect fuel, air, water, tankage, vehicle and habitat parts, furniture and furnishings. We could even do outof-fashion soil-based farming. Bring back with us but talented people, tools, and seeds, and we might just make a go of it.

With precarious and tentative political will, any return will have to be humble, laying down a few foundation stones at a time. Our first beachhead can only become permanent in time. But even if the first crew returns home for some while before the next is sent, it will have been easy to shatter *all* Apollo's achievements with the first mission.

(1) If we leave a habitat structure on the Moon, perhaps returning to an awaiting orbiting ferry (serving a function like Apollo command modules) ascending on a *cabinless* plat-form (not unlike the Apollo rover) protected just by space suits.

(2) If our habitat has room enough to walk around, and to sleep horizontally in cots or on air mattresses, and is big enough to boast both private and common room areas.

(3) If we "dig in" our shelter, placing it under a soil-shielded canopy or heaping soil directly upon it to make longer stays possible without high accumulative radiation exposure. Now we have a camp, a cabin, a cottage on the Moon, a permanent structure to come back to, and from which to expand in due course, as we learn to do so step by step, using primarily building materials made on location.

(4) *If we leave an electronic beacon* so that follow on missions can make instrumented landings at the same spot.

3. Then What?

(5) We stay not only all "day" but past sunset, outlast the long two week night, and start a new lunar day before going home. This will be quite a feat, not unlike the first "overwintering" on Antarctica. Even with a nuke source for energy, we'll have less power than during the dayspan when we can tap sunlight as well. We'll have to switch from energy-intensive tasks during dayspan to manpower-intensive energy-light tasks during nightspan, establishing a lunar rhythm that may forever after give life on the Moon much of its characteristic flavor. In the process, we'll have to have in place an advanced, possibly bioassisted, life support system regenerating our air and water supplies. We'll also have had to have demonstrated, probably in an unmanned dry run, thermal stability of the station through the nightspan. Shielding will help here too, minimizing exposure to the heat sink of space.

(6) If we stay six weeks or more, we can plant some salad stuffs and bring them to harvest. The first feat for lunar farming and agriculture to come.

(7) We might try some brief nightspan sorties outside the station. That means headlights, that means lubricants that can take the cold - or magnetic bearings. That means heated space suits or an infrared radiating cage or a minimal cabin.

(8) We bring along pilot oxygen production equipment, demonstration iron fine and gas scavenging equipment, a solar furnace to experiment with cast basalt, ceramics firings, iron

sintering, and glass production. We have brought along some basic tools for fabricating sample test objects.

(9) There is a parallel Earthside "Moon station" in which problems on the Moon can be addressed in close simulation, and in which terrestrial brainstormers can proactively outline suggested new experimental exploits for the lunar crew.

4: Exploring Metaphors

For want of a better name!

Settlement is a long way down the road. But since we are determined to make that journey, we have to humbly begin with some lowly first steps. What lies between our previous "science picnic" visits and "settlement"? Here are some more relevant "meanings" my dictionary offers for some of the words we've been bandying about. Running through them might help clarify our thoughts about what comes first.

Base: (1) a bottom support on which a thing stands or rests; (6) *the point of attachment*; (7) a starting point or *point of departure*; (9) a *supply* installation that *supports* operations

Camp: a place where a group of persons is lodged in *temporary* shelters.

Fort: a fortified, protected place [here, living quarters and operations center, in a *physically* hostile environment, shielded against radiation, vacuum, and thermal extremes.]

Habitat: (3) a special contained environment for living within over an extended period in a life-hostile setting.

Hostel: an inexpensive, spartanly equipped lodging, offering minimal shelter for short-stay travelers.

Outpost: a station established *at a distance* from the main body [of humanity]; a post or settlement *in a foreign environment*.

Station: (6) a place *equipped for some particular kind of* work, service, research, or *activity*, usually semi-permanent

While all of these terms are applicable as far as they go, none of them are especially *instructive*. And most of them are static, not suggestive of leading anywhere, *thus requiring separate justification of any further steps*, and thus likely to become self-limiting. We suggest that we space advocates who really want to see human out-settlement wean ourselves of such terms as Moonbase, Lunar Outpost, etc. and *look for more pregnant terms that suggest a sequence of phases that lead to something much more*. If we find better terms we must popularize them and thus *alter the culture* in which space futures are discussed.

Words are not neutral

We must pay attention to their downside or selflimiting connotations. We are in a battle for the soul of humanity. We have to stop using the weapons the enemy gives us and forge our own.

Let us suggest some other terms whose applicability might seem a little forced at first thought, but which we think you'll agree are rather appropriate:

Beachhead: the area that is the *first* objective of a party *landing on an alien shore*, which once *secured and estab-lished*, can serve as a base of expansion of the occupation.

Incubator: an artificial environment that enables fragile beginnings to become hardy enough to thrive outside.

Interface: a common boundary [between two worlds i.e. the life coddling Earth, and the barren and sterile Moon]; (4) something that *enables* separate and sometimes *incompatible* elements *to communicate*.

"Interface Beachhead" & "Settlement Incubator"

If our gambit strategy is to establish a habitat station that serves as an effective interface with the Moon and its realities, then we suggest that the menu of Apollo-besting items given above lists steps in the right direction. We need to learn how to exist on the Moon, on *its* terms, through *its* cycles, boosting our resources *with those it offers*. A successful first Interface Beachhead will allow us to carry on a whole range of human activities in a way that comes to terms with lunar vacuum, lunar sixthweight, lunar day/night cycles, lunar temperature swings, and the absence of organic materials in the lunar soil. More challenging, we must interface with the Moon and learn to do so flexibly, through the handicap of a micro-biospheric barrier as "bubble" creatures.

We have to begin mastering how to thrive on stuffs and materials we can process from the lunar endowment. That means our interface station/camp/outpost/base/beachhead must have expanding dedicated space for processing and fabrication experiments, demonstrations, and production operations. That means we have to put together talent, materials, and opportunities for at least part time artists and craftsmen to learn how to express themselves in the lunar idiom. Call it survival, call it living off the land, call it acculturation, call it dealienization, call it adaptation, call it adoption, call it "*settling in*."

5. Our Presence must be more than Serial

We can't have wholesale rotation of crews. *Even if* everyone still goes home after a while, those with hard won onsite experience have to teach the newcomers before they can turn things over. There has to be an effective "cultural memory" giving enduring "soul" to our individual comings and goings. Given that, the outpost/base/camp/station/interface beachhead will take on a "permanent" life of its own, even though the day that "reupping" indefinitely, i.e. staying for the duration of one's natural life, may be a good ways down the trail.

"Permanent" can apply to the physical structure. That is easy - and "cheap" in a fully pejorative sense. At the other extreme of application, it can also apply individually to people who come to live out their remaining natural lives with no real thought of ever returning to the "old" planet - "forsakers".

In between these two states is the "permanence" of a growing acculturation between human and Gaian on the one hand, and lunar on the other. While we never want to lose sight of the longer term goal, we need to reject rusting on the laurels of achieving permanence in the first naked sense. All that would achieve is the establishment of an eventual ruin or ghost camp.

In this light, we need to consider which initiatives, NASA, International, Commercial, etc. that deserve our support. *We owe it to our own dreams to decide wisely*.

MMM>

"NASA is not about the 'Adventure of Human
Space Exploration," we are in the deadly serious
business of saving the species."
– John Young

[Early Lunar Industry]

By Peter Kokh

Cast Basalt

In a past article [MMM #135 - May 2000, p. 7] we have talked about "Cast Basalt" - basaltic moondust from the lunar maria or "seas" (of congealed lava sheets) that, given ample precedent here on Earth, can be made into

durable, functional, even beautiful tiles for floors, countertops, walls and more. Further, cast basalt is highly abrasion resistant. cast basalt floor tiles should resist being dulled or scratched by any moon dust that gets into living spaces.



This same quality has

led to a major industrial use

of cast basalt liners for material handling chutes and

pipes and associated fittings.

Both these uses will be most

helpful on the early frontier.



Hewn Basalt

Hewn basalt is chemically related, but structurally different product that may precede cast basalt as an early frontier industry. Here we are using not pulverized basaltic moondust, but solid basalt,



that can be cut into blocks (and tiles) for many



practical uses. Hewn basalt blocks of various sizes and shapes can be used to build columns, retaining walls, and shade walls. They could be cut on angles to build

arches. Such blocks would serve many practical external uses in unpressurized spaces.

Finding solid, minimally fractured basalt

The pulverized and impact gardened "regolith" blanket is on the order of 2-3 meters/yards thick in the basaltic maria. If we scrape off this top layer, we should reach fractured, increasingly pure basalt. The further down we go, the less numerous the fractures.

Another opportunity will come in road construction, where to smooth out hill, a cut and fill operation may be needed. The lower part of the "cut" could expose fractured, more or less pure basalt.



Basalt Blocks hewn from Lavatube floors

Where a settlement area includes a nearby intact lavatube, it is likely that, in the process of getting it ready for use, whether as a spacious pre-shielded industrial park or warehouse or agricultural space, or even as residential space, we will want to smooth out irregularities in the tube floor. The tube floor is likely to be relatively free of fractures. Thus the various sized blocks we cut out are likely to be of a superior guality.



It is basalt blocks from lavatube quarries that will be in most demand. Satin finish quarried tiles may be an architectural material of choice for some applications as it will have a different look from cast basalt tiles.

Hewn basalt blocks may be applied to exteriors of private, individually shielded homes, as retaining walls for moondust fill, to give the exterior mound a controlled shape as a sign of wealth and prestige.



KEY: (1) surface, minimally excavated to nest the rounded bottom of habitat hull; (2) Habitat Hull, in this case a squat vertical cylinder with round end caps; (3) vaulted, cove-lit ceiling; (4) "basement" area for utilities and systems and extra storage; (5) the "castle" rampart retaining wall made of cast basalt blocks with openings for narrow windows; (6) shaft for "window"; (7) regolith moon dust shielding and (8) berm; (9) slope of shielding without a retaining wall

Hewn Basalt Blocks as Sculpture Medium

Carving basalt blocks into sculptures of all sizes is an age old craft, practiced in Egypt and elsewhere. The columns of temples and other great buildings were often carved from basalt blocks.

But smaller sculptures and decorative items were also carved from basalt, a wonder, as we now have much superior tools such as titanium-tip chisels. Given the lack of other natural carving materials on the Moon, cast basalt statues and sculptures are sure to be a mainstay of lunar frontier homestead décor, as well as on a larger scale, of larger sculptures for public places, both within pressurized spaces and out on the surface in prominent locations. Art will be one major way in which we put a human stamp on the moonscapes surrounding our settled areas.

Both for curiosity and to use for "show and tell" the writer bought this sample, a Scarab, online from a shop in Egypt. The photo does not do it justice!



Cast Basalt Blocks vs. Sintered Blocks

Perhaps the first manufactured building material lunar brainstormers came up with is simple blocks of moondust compacted by vibration in a mold, then sintered into a solid by microwaves. Such sinterblocks would look a lot like our concrete sinterblocks, and have a similar density and cohesiveness (or lack thereof.) It is certain that sinter blocks will be cheaper to produce and perform well enough for some purposes. In other applications, where hardness and density and visual quality are important, hewn basalt blocks may have the edge. At any rate, it is important both to support a greater variety of uses as well as to provide customers and consumers with choices, to develop all the near-term options.

One advantage of the sintered moondust block is that, as it is made in a mold, it can have a shape other than that of straight saw cuts. A sinter block can have indenttions and protrusions, not unlike a lego brick, so as to stack snugly and in line, one over the other and



Welcome to

Luna City

in staggered rows. Sinterblock will be easier to hand cut.

Make it Grand!

From crude and rustic to Romanesque or Gothic formality to almost spiritual simplicity and elegance, arches have been a favorite way of marking the entrance to a human settlement. Paris' Arche de Triomphe and St. Louis' Gateway Arch are examples of the variation.

A freestanding arch could mark the approach to the settlement main gate, or straddle the main road from

the spaceport to the town. And what more refined material than hewn basalt, marking our ability to use lunar materials to state proudly, "we *are* at home!"

A new Stone Age

Does it seem odd that our initial efforts to

use lunar materials will use a "stone age material? It is what we do with it that counts. Most of all, basalt is a material that is of the soul of the Moon. <**MMM**>

For a Vertical Moon/MarsHab



[Brightened Detail of Pat Rawlings' Painting s245] By Peter Kokh

It is arguably easier to land a vertically designed habitat than to bring along a crane to set down modules of the horizontal persuasion, even though it is quite a bit easier to shield the latter. The vertical design has a long history that includes TransHab and the "double tuna-can" Zubrin MarsHab. This configuration type appears in many NASA concept illustrations.

But in the *real* world, we do need to cover *any* habitat with moon dust or Mars dust shielding. Yet, it is desirable to avoid a large footprint hill. Natural regolith slopes are limited to 30° slopes, though tamped down as it is piled up, the regolith, being composed of angular particles, will support slopes of 45°, *still awkward*.

We can constrain the pile by erecting a circular wall around the habitat, using blocks made on location of sintered regolith, or made out of sandbags. Either will be labor intensive and delay the commencement of routine operations. Another way to get the job done with minimal fuss, is to bring along a saddlebag shape-following tent of sorts. This would be lightweight in comparison to the number of needed sandbags and filling equipment, or the equipment needed to produce sintered blocks.

Of course, we must choose a fabric that will wear well under cosmic radiation, raw ultraviolet sunlight, and micrometeorite rain. Rawlings' illustration suggests that this is something NASA has looked at.

On the other hand, if we are going to keep adding additional modules in an open-ended expansion plan, this shielding method would be money misspent; and on site production of shielding constraint systems will be something we should introduce as soon as it is practical, that is, when we have all the precursor equipment and technologies in place.

Yet, for temporary locations, say of construction camps, where crews will be on site for temporary periods of a few months or more, the shape following habitat moondust constraining fabric structure seems a good idea, especially if it can be emptied for movement, and then set up and filled at a new location, again and again.

Now this is a tall order for designers of such a system! Sounds like a great subject for an architectural system Design Competition, funded by NASA!

Comments welcome.

<MMM>

The Moon's Alpine Valley: Scenic Treasure vs. Vital Transportation Corridor

Bv Peter Kokh

It would be ideal if we could identify all the most scenically and geologically "special" features on the Moon and classify them into those that can be visited but not developed ("leave but footprints, take but photos") and those "common" and "mundane" enough to warrant consideration for development. Ideal! Unfortunately, sometimes very scenic areas, by their very nature also happen to be "in the at" of logical traffic routes, or, as in our case in this article, a logical transportation route precisely because of what makes it scenic and special.



Above: a close-up mosaic view of the Alpine Valley Below: The setting, between Mare Frigoris (north) and Mare Imbrium south)



Mare Frigoris (Sea of Cold) is an attractive area to begin industrial lunar settlement. It is by far the closest mare basalt plain to either polar region, and its long 120° East-West stretch would allow electric power transmission that would provide any settlement with a greater percentage of month-around effective solar power than that enjoyed by the South Pole Shakelton rim location.

The nearest craters large enough and far enough poleward to have ice deposits are only 200 miles to the north. There is nothing like this near the south pole.

To the point of the article, Mare Frigoris has access to the rest of the nearside "mare-plex" in three

locations: far to the west through Sinus Roris (Bay of Dew) into Oceanus Procellarum (Ocean of Storms) and points south; (2) far to the East via Lacus Mortis (Lake of Death) and Lacus Somniorum (Lake of Dreams) into Mare Serenitatis (Sea of Serenity) and points south: and (3) in the middle via Valles Alpis (Alpine Valley) into Mare Imbrium (Sea of Rains) and points south.

A southern gambit enjoying bandwagon status currently, will almost certainly prove to be a dead end. But if a commercial-civilian effort tries again here in the north, where all the assets are in place, the Alpine Valley is as sure to draw traffic as does the Panama Canal. The issue becomes one of how do we transform this awesome and unique lunar geological feature into a transportation corridor and still preserve its scenic beauty and scientific interest.

Railroads have a much smaller footprint than do highways, especially along stretches were no commercial development is allowed. Now that doesn't mean that there could not be a stop here and there for a tourist concession. At such locations there could be a hostel for hikers, or merely a pickup stop for a tourist off-road coach that woud take people up to the valley crest hotel.

There could be a hiking trail along the ridge tops to either side, a trail both for hikers and small off-road vehicles. Another option would be a ridge top cableway along which tourists would have a superior vantage point from which to enjoy the sights along this 101 mile (166 km) lava-flow filled trench through the lunar Alps.

This writer is strongly in favor of putting in place a system of Lunar National Scenic and Geological Parks, and protocols for respecting them plus rules for granting tourist and mining concessions (only if the material to be mined is not present anywhere else) before lunar development commences. Many people point out that we need a new Moon Treaty that sets out the rules under which lunar devlopment can begin, and private property rights be legitimized. We believe that this sort of setaside system that ensures that lunar development will respect the Moon's natural beauty should be part of that Treaty. Such provisions, will help, rather than hinder future lunar tourism by identifying and calling attention to the Moon's greatest and most unique scenic and/or geological treasures.

A system of Lunar National Scenic Parks, even prior to our return, would get across to the public here at home, that the Moon is part of a Greater Earth-Moon human ecosphere, and that we intend to pioneer it with respect. Of course, that means a civilian regime, not the multi-national corporations, must be at the helm.

In general, we need to combat the pervasive popular suspicion that we are going to trash the Moon just as we are increasingly trashing the Earth. We need to get across that this will be a new beginning, and why the only way we can be successful on the Moon, is by starting off on the right foot, learning to live in harmony with our new host world. Indeed, there are powerful economic incentives for doing so. Externalizing costs the way we do here, (because we have so many pockets of underpaid labor) just would not work there. But that's another article and we have already talked about many related lunar environmental issues previously.

Anyone want to get a lunar National Parks Group going? <u>kokhmmm@aol.com</u> <**MMM**>

Why Lunan Pioneers will turn their Gray World into a "Green" Sanctuary

By Peter Kokh

The common stock answer given by space enthusiasts to those who protest plans to go to the Moon by saying that "we will only trash the Moon *as we have been doing Earth* from time immemorial" is "the Moon has no biosphere, atmosphere, or hydrosphere to pollute." This reply is anything but convincing. "Trashing" includes garbage piles, physical scarring, and other ways we disrespect *our own* environment. Again, we do what we do, postponing lifetime costs, because it is cheaper, and above all, because our terrestrial environment is so vast that we believe we can continue to get away with it.

Primates cannot be housebroken. And up till now, all the evidence has been that humans cannot be planetbroken. We foul our own home world.

The message we need to get across to the environmentally concerned is this:

"On the Moon, we must live in mini-biospheres of our own creation and maintenance and will be essentially living downwind and downstream of our selves. There will be no "somebody else's backyard." We will have to learn how to live in harmony with and within our pockets of Nature, or, in gamers' language, it will be quickly "game over!"

We could learn those same lessons here on Earth, but we won't, because the need does not seem pressing. But lessons learned and technologies developed on the Moon because pioneers will have no choice, can all be exported to Earth. In short, one very vital reason to go to the Moon, a reason seldom considered, is that we need to do so to learn how to save Mother Earth, not from energy shortages (that too) but "from ourselves."

Yes, the Greens (I am one, and I am sure that some of you are also) are trying, and *have* come up with many ways for us to do better. Yet much of such insight is lost on those who do not see the urgency, or do not want to be inconvenienced, or do not want to see their incomes go down even temporarily. Environmental action on Earth helps postpone the day of final reckoning. But it cannot stop pillage of our planet simply because runaway population growth more than neutralizes these efforts.

Itemizing concerns and measures to meet them

Many people do not want to see the surface of the Moon, as visible from Earth, scarred. We need to stress reasons why a growing human presence on the Moon need not do so. Most mining will be within the already pulverized rock powder blanket 2–10 meters thick that covers the Moon. We extract what we need and leave the remnant in place. We will obliterate small craterlet dimples, but steer around bigger ones still too small to be seen from Earth even with most telescopes.

As to roads and railroads, they will themselves be too small to be seen by the naked eye. As to settlements, the need to cover them with regolith shielding, both to protect from the inclemencies of cosmic weather and to sustain a thermally moderate environment, will, so to speak, *camouflage them with moondust*. As to lunar city lights, light aimed upward will be wasted energy. Lunar cities, except for lit spaceports, will be nothing so dramatic as the brilliant urban cluster lights of Earth. Gradual oxidation of iron fines in the regolith will slowly redden the moondust, but perhaps in a way too subtle to be noticed by the naked eye (as opposed to scientific instruments.)

As we pointed out in the editorial above (page 2b) lunar settlers will be behind the economic "eightball" for some time. Using energy and materials as efficiently as possible will be a must if they are ever to reach economic viability and sustainability. This need will force recycling of used energy and used materials at a level far beyond the token and and somewhat trivial measures we are slowly trying to adopt here at home.

We also need to identify what we waste so readily here on Earth: paper, wood, plastics: their constituents, carbon, oxygen, hydrogen, and lesser amounts of other volatiles are superabundant here on Earth: in a word, "dirt cheap." Those same elements, excepting oxygen, are many orders of magnitude less abundant on the Moon and thus as precious on the Moon as are gold, silver, and platinum here on Earth. The very things we discard without a thought or care here below, will be religiously recycled back into our life-sustaining minibiospheres. It will not be an exaggeration to say that this turnabout will be a matter of "life *or* death."

Modern industry has learned a very neat but also nasty trick: using super-adhesives to assemble unlike materials that effectively cross-contaminate each other in a way that makes recycling impossible or many times more expensive than it needs to be. At the same time, the growing mobility of our population has created a niche for "knock-down" furniture that can easily be taken apart and reassembled at a new location. This method of assembly minimizes cross contamination and maximizes the possibility of proper recycling. *It should be the law.* The point is that options exist that will help Lunan pioneers avoid the pitfalls into which we have leapt.

Even on the Moon, with sunshine abundant enough to cover energy needs, nightspan as well as dayspan, it will make no sense to waste energy. For one thing, wasted energy exacerbates the need to radiate excess heat produced. Wasted energy also increases the mass of energy production equipment needed. Learning to reuse spent energy, by recycling everything possible, over and over again to reduce overall throughput, can but help the pioneers reach and maintain economic viability.

A lesson that many a detractor of environmental approaches has failed to learn or admit, is that doing things the right way generates more income opportunities than it removes from the approved list. All communities that have been "going green" have experienced economic growth, as counter-intuitive as that may seem.

Many space enthusiasts envision communities beyond Earth as inanimate constructs, clean and metallic, "uncontaminated" by vegetation or critters, even of the microbial kind. A few house plants will be "tolerated." I suppose we can eat Soylent Green or nutrition capsules produced by nanotechnology. Fortunately, these are the fringe in our pro-space constituency. Lunans will be surrounded by more vegetation than most urban terrestrials. We have to stop thinking, *and speaking*, of humans going to the Moon and Mars. We need to start thinking, and speaking, of Earth Life, stewarded by humans, bringing Mother Earth to Father Sky for the ultimate consummation. In that light, we will not be invaders, but suitors that can alone realize the previously thwarted ability of alien and sterile worlds to become lifesustaining worlds. In that light, we hardly trash them. We go to make other worlds "whole!" - PK

The Moon Society



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

Objectives of the Moon Society

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

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

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

www.moonsociety.org



Moon Society Elections Ballot 2008

By Chuck Lesher, Elections Secretary

Dear Moon Society member,

We are now conducting the annual election of officers and directors of the Moon Society. This election is being conducted by both email and paper mail ballots. You may vote either way. Your ballot must be received (email) or postmarked by August 1, 2005.

Three directors will be elected this year to keep the total at five. Officers whose terms expire this year are President and Secretary. All posts are two-year terms.

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

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

If voting by email, please include your membership number, if you know it, and email your completed ballot to this email address:

mailto:elections@moonsociety.org

If you vote by mail, send the paper Ballot to:

Moon Society, PO Box 940825 Plano, TX 75094-0825

Postmarked by August 1, 2008. Do not forget to *sign* the ballot and, if you can, enclose your *membership number*.

OFFICERS VOTE

President (Vote for one)
[] Peter Kokh #239
[] write in candidate _____

BOARD OF DIRECTORS VOTE (in order of seniority)

- [] David A. Dunlop # 1348
- Benoit Nault # 1365
- [] Fred L. Hills # 1379
-] write in candidate

Voter's Signature____

Membership # (if known) _____

President's Comment:

All of the above candidates have been very productive during the past year. While we have no contests this time, we are fortunate to have an outstanding slate, and I urge all members to vote *as an indication of confidence and support.*

Members who would to like to have non-voting input on Management Council deliberations, are welcome to email me with a request for Council access:

mailto:kokhmmm@aol.com

The Moon Society Journal - Free Enterprise on the Moon

Candidate Statements:

For President, 2 yr term: Peter Kokh #239

A member of the Artemis Society and the Moon Society since 1995, I started Moon Miners' Manifesto in 1986 and continue to produce it monthly. I was elected to the Moon Society Board in 2002, and to the office of President in 2004, and reelected to this post in 2006.

<u>Chapters</u>: I have continued to serve as Chapters Coordinator from 2002 through the present, endeavoring to create resources local members can use in public outreach. I have been a chapter person for 21 years. It is now easier for chapters to organize and work effectively.

<u>Collaboration</u>: A life member of the National Space Society from 1973, and an active leader from 1986, I negotiated an affiliation agreement with NSS at ISDC 2005. NSS subsequently cosponsored our Moonbase simulation exercise at the Mars Desert Research Station in Utah, in early 2006. We continue to work with NSS in the area of promoting Space Based Solar Power

Our affiliation with the American Lunar Society remains active. We are also engaged in projects with the Mars Drive Consortium and with LunarWire.com. We are working with the Space Nursing Society on ways to promote the mental & physical health of lunar pioneers.

<u>Projects</u>: We continue to look for doable projects that will (a) help advance the goals of the Society, (b) publicize our existence and thus attract new members, and (c) provide more ways for members to involved. We are near completing an ambitious "hands on" project to build a Solar Power Beaming Demo unit for ISDC 2008.

Since our Moonbase Simulation Project at MDRS two years ago, we continue to develop plans for our own analog research program and have recently had offers of assistance. There is so much to be done in this area.

<u>Recruitment</u>: we need to keep growing our numbers. Our members are essential as "keepers of the vision." But we need to attract many more of them. We also seek persons with a wide range of, to be able to undertake projects that leverage and combine these talents, and produce valuable results. We seek not just a return to the Moon to set up a first human beachhead, but establishment of a viable community of pioneers from all walks of life: chemical engineers, systems managers, agriculture & biosphere specialists, product development experts, marketing experts – the list goes on and on. Rocket scientists and other "gray" engineers may get us back to the Moon. But we need the "green sciences" engineers and others to keep us there.

Enterprise: We layman can also do more. We can work in teams to identify technologies needed on the Moon then brainstorm each of them for any promising terrestrial applications. Our goal? to predevelop turnkey business plans entrepreneurs can follow for profits now. Any success would put new technologies "on the shelf."

As one who lived through the glories and frustrations of our first "flags & footprints" manned Moon missions, the last thing I personally want to help happen, is a rerun of that dead end. We cannot be sure what the new Administration will bring. But we are determined to be "the little engine that could.

I am fortunate to be retired, and able to spend most of my time trying to grow the Society and make progress towards our goals. I appreciate your support.

For Director, 2 yr term: Benoit Nault #1365

I have been fascinated by the Moon ever since I first looked at it with my small telescope as a 7-year old. A short few years later, men orbited the Moon and then walked on it. I remember skipping school to watch the moonwalks. A new frontier was opening and I wanted to be part of the adventure.

Many of us share that same experience. The adventure has turned out to be a long, mostly fruitless, walk in the wilderness. But the goals of creating a spacefaring civilization and of settling the Moon make as much sense today as they did all those decades ago. In fact, they probably make even more sense today than 40 years ago. Science tells us that the Moon probably holds key answers to the creation of the solar system and of Earth itself. Advances in technology make lunar resources available to us to help mankind move out into the solar system and quite possibly make life on Earth better in many ways. It is time to go back to the Moon to stay and the Moon Society intends to be part of the adventure.

I have been a "space activist" for more than 25 years. More recently (since 1991), I have been involved in National Space Society chapter activities. I have had the privilege of holding various positions in the Tucson L5 Space Society including four consecutive terms as chapter president (my last term ended in November 2007). I was also webmaster (and web developer) for the ISDC2000 website which included the very first online registration and payment form for an ISDC.

Professionally, I am a consultant in e-business and e-commerce technologies for medium sized companies. In that capacity, I manage fairly large projects with substantial budgets and work with teams that can range up to 20 people.

As the United States gears up to renew its exploration of the Moon, the Moon Society is uniquely poised to be benefit from a renewed interest in the Moon. But we must position ourselves to capture these benefits.

I do not think I have the answers to all challenges facing us. And the challenges are substantial. All space activist groups face a declining and graying membership. I believe that attracting and retaining new and younger members is our number one challenge. Societal change is accelerated by technologies that are changing the world around us at a rate unseen in many generations, perhaps in human history. New ways of thinking and of doing things are appearing quicker than they can be inventoried. The Moon Society must find way to keep up and communicate in modern, relevant, ways.

In real world terms, the Moon Society must continue to work on a strategic plan to favor growth and a higher public profile. We should also put in place tools and instruments to help individual members and chapters with their projects and outreach efforts. I wish I had easy answers but I do not. But I would like to contribute to the debate. Your support is much appreciated.

For Director, 2 yr term: Fred L. Hills #1379

My interest in space goes back to an article Werner Von Braun published in Collier's Magazine describing space ships to reach Earth orbit and to go on to the moon. I was so impressed I built a model of the former.

Later I built a spaceport model and placed it in the county fair. I was disappointed at not winning a Blue

The Moon Society Journal - Free Enterprise on the Moon

Ribbon. Dad said the judges just didn't understand the model. So a year later I built one that they would understand... and got the Blue ribbon. There is a lesson here; our society needs to press ahead while keeping in touch with our readers.

My career has not included as much space activity as I would like, but it has included contracts for building the XM Satellite Radio service and Orbital Science's Orbview III Satellite.

For Director, 1 yr term: David Dunlop #1348

I met Peter Kokh at the August 25, 1989 Neptune-Triton encounter (the Voyager 2 flyby) event at a planetarium in Neenah, Wisconsin. Peter had brought along some exhibits from his Milwaukee Lunar Reclamation Society NSS chapter, and I was hooked. Living two hours north of Milwaukee, in Green Bay, I became an at large member of the chapter. We worked together to start the Wisconsin Space Business Roundtable, and he helped me launch the LUnar National Agricultural experiment Corporation – LUNAX – to get college level agriculture and ag-business students interested in doing ground level experiments. The purpose of these experiments was to help pin down what minimum lighting pattern during a simulated two week long lunar nightspan, would allow plants to survive and go on to harvest.

In the mid-1990s, I developed the Rockets for Schools program that has involved students in rocket launch and other space activites annually in Sheboygan, Wisconsin. I then developed a similar program for Muskegon, MI on the opposite shore of Lake Michigan.

For the past two years, I have been assisting Kokh, who had since been elected Society President, as Director of Project Development, an unpaid staff position. My work in that regard has been primarily to help develop the "University of Luna Project." Currently, on the Society's behalf, I am putting together the ISDC 2008 Moon Track. These efforts have taken me around the country, meeting Moon-focused movers and shakers. I will continue as DOPD if elected to the Board to finish the second year of a currently empty seat.

End, Candidate Statements

NSS-Moon Society Joint Bid for Space & Environment Conference Goes back to the Drawing Board

From Peter Kokh

Our bid to the Environmental Protection Agency for major funding for a unique Space-Environmental Conference, presented to EPA on January 8, 2008, was not accepted. The concept itself was acceptable. But EPA could only fund 2 of the 17 proposals sent in. **Options:**

a) Rebidding with a stronger presentation, specifically one cosponsored by more Environmental organizations.

b) Putting on such a conference by ourselves (NSS, Moon Society, and environmental and bridge groups already aboard – without prior funding.

Many an ISDC has been successfully conducted without major funding of any kind. (We personally favor this option) But we will also look for alternative funding.

For more information on this bid, see MMM #214, "Mother Earth & Father Sky, page 11, column B.

Lunar Analog Facility Proposed for abandoned iron mine in Sweden

By Niklas Jarvstrat <u>niklas.jarvstrat@hv.se</u>

Moon Society Advisor, and member #670

April 14, 2008 "I am purchasing an abandoned iron mine. My firm belief is that a moon base is best-situated underground in mine tunnels or lava tubes. A couple of ideas that could be pursued in a mine environment are:

• Habitation and agriculture design - layout and design

to make a pttunnel "feel" like outdoors and open space. • Artificial light agriculture – or even better, agriculture using fiber-transmitted sunlight.

- Collecting and distributing sunlight for agriculture
- Low equipment production facilities (Extracting iron
- from the low-grade ore that might still be available in this mine and using the iron for producing metal parts.)

Right: minehead entrance

The mine is located in a very pretty part of middle Sweden. The coordinates of the site are N 59*30'44'' and

E 14*58'41". There are no maps of the mine itself on the web, but there are three shafts, as much as 275 meters deep. The mine is currently water-filled to 100 m below surface, but



there is very little water flow and there are quite a network of tunnels at the 60 meter and 80 meter levels.

The first technical problem after securing a safe entry and some reasonably dry tunnels will be to bring light down inside. Electric light is easiest, but if we could collect sunlight and beam down through fibers, that would be a much better simulation for the moon.

My expertise is in material mechanics; so for agriculture I will be collaborating with horticulturists. We would try to grow garden salad at first, but permaculture of a mix of edible plants would be much better for both diet and productivity.

We will be buying the mine at a very small cost. We will own the tunnels including mining rights; so no lease. Mining ended in 1924, and reattempted in 1954, but the ore was considered to be of too low quality for economical extraction. It is abandoned completely now, though the hoist was used as late as late 1990s. Above ground, there are firm restrictions, and the site has to look 1880-ish... The buildings are in good shape. I believe that there are no restrictions below ground level.

Tunnels are, from the mine map 2–3 meters by 2–3 meters, most places. There are several bigger rooms where the ore was located. A total volume of roughly 30,000 cu m (140,000 metric tons) of ore was mined. There should be enough space. My guess is that it will be damp. Average yearly temperature is about 6° C/43° F. But a moon colony would need to be insulated against vacuum, and that should make it a kind of analog with water. Maybe keep the environment at elevated pressure and monitor the pressure level to minimize leakage...

A lot can be simulated without relevant mineralogy and any kind of walls. Available iron ore can be used for demonstration purposes, effectively extracting tools from the walls of the colony as it grows.

Niklas (www.moon-isru.com)

The Moon Society Chapters & Outposts Frontier Report



Moon Society St. Louis Chapter

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

Meetings **2nd Thursday** monthly, Buder Branch Library 4401 S. Hampton, in the basement conference room **Next meetings day May 8**th, **June 12**th

Moon Society Phoenix Chapter

http://www.moonsocphx.blogspot.com/ Contact: Craig Porter <portercd@msn.com> Meeting the 3rd Saturday of the month

Moon Society Phoenix' next meetings are on Saturdays May 17th, June 21st

at Chompie's at 1160 E. University at 3: PM.

April 19th Meeting Report:

Chuck Lesher is working on a model of the Space Station for our outreach display. Our next outreach event is coming up fast, the Sci-fi convention LepreCon 37, at Casa Grande May 9 - 11th. Chuck Lesher would like to repeat the talk he gave at Yuri's night.

Chuck Lesher was appointed Moon Society Elections Secretary at the Moon Society's Management Council Meeting on Wednesday, May 7th. It is expected that Chuck will be appointed Secretary of the Moon Society at a special Board Meeting, as soon as that meeting can be arranged. Meanwhile, Ben Nault is on the ballot for Moon Society Board of Directors!

Because of the conversion of the meeting room at Bookman's into a coffee shop, we are looking to find a place that will be easily accessed and give us a little quiet and some scheduling flexibility.

Moon Society Houston Chapter

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

Next Meeting Place & time

Monday May 19, 7 pm, Freeman Branch Library, Clear Lake (16616 Diana Ln, Houston 77062, 281-488-1906)

For news of our NSS Partner Chapters in

Portland, Milwaukee, Minneapolis/St. Paul, see p. 17

Moon Society DUES with Moon Miners' Manifesto

Electronic MMM (pdf) \$35 Students/Seniors: \$20 Hardcopy MMM: U.S/Canada \$35 Elsewhere: \$60 Join/Renew Online - www.MoonSociety.org/register/

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions

Moon Society <u>Membership Services</u>: PO Box 940825, Plano, TX 75094-0825, USA

Projects, Chapters, Volunteers, Information, etc.

Moon Society <u>Program Services</u> PO Box 080395, Milwaukee, WI 53208, USA **Bay Area Moon Society Outpost**

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

BAMS' March Meeting postponed to Thursday, April 3rd with next meetings slotted for May 26th

Moon Society Tucson Outpost

Contact: Ben Nault

bnault@comcast.net>

We welcome new member, Ingrid Saber

Ben Nault is now officially a nominee for the Moon Society Board of Directors. As there is no opposition, congratulations are in order! Ben has been attending Moon Society Management Council meetings regularly so that he can get off to a running start. While he hasn't been able to vote officially as yet, his input has been well received and appreciated.

With Chuck Lesher of the Phoenix chapter likely to be appointed Moon Society Secretary (he is already the Moon Society Elections Secretary for the 2008 vote), the Arizona Space Mafia will have a significant role in leading the Moon Society into the future.

Moon Society Chapter Photo Gallery



Moon Society Phoenix, fortunate enough to have a Challenger Center in the area, and already having made acquaintances with the center staff, were welcomed to set up an exhibit for the Yuri's Night worldwide celebration on April 12th of the 47th anniversary of Yuri Gagarin's first human orbit. The event is universally recognized as the dawn of human spaceflight.

Shown above left to right: Famed space artist Robert McCall and wife, Chapter President Craig Porter, and dynamo chapter member Rev. Dr. Bonnie Ann Burgard-Ross. Several other chapter members participated in the event. This chapter keeps itself busy!

Why not start a Moon Society Outpost in Your area?

All it takes is one person - you!

write: chapters-coordinator@moonsociety.org

< End Moon Society Journal Section >

GREAT BROWSING

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

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

Google Group: Colony Worlds http://groups.google.com/group/ColonyWorlds?hl=en

Mining and Manufacturing on the Moon http://aerospacescholars.jsc.nasa.gov/HAS/cirr/em/6/6.cfm

Basalt tiles made here, can be made on the Moon http://www.chinamarble.com/E-basalt-stone.htm

Threats to Human Existence and What we need to do about them – John Young http://www.johnwyoung.org/main/jyessay.htm

Lunar Farside Magnetotail Problems http://www.nasa.gov/topics/moonmars/features/ magnetotail 080416.html

Universal Studio: Neil Armstrong Moon movie www.comingsoon.net/news/movienews.php?id=43603

Russia planning to send Monkeys to Mars http://www.universetoday.com/2008/04/14/russiato-send-monkeys-to-mars/

So you want to be a *commercial* rocket pilot http://www.thespacereview.com/article/1099/1

Speed up Shuttle successor, or extend Shuttle? http://www.thespacereview.com/article/1098/1

Diversity of tourist rocket technological paths http://www.thespacereview.com/article/1095/1

Mars Sample return vs. Outer planets mission? http://www.thespacereview.com/article/1094/1

Scramjet-powered single-stage aerospaceplanes? http://www.thespacereview.com/article/1092/1

Jump-starting point to point suborbital flight http://www.thespacereview.com/article/1103/1

New Space Exploration Political Action Committee http://www.thespacereview.com/article/1102/1

Nuclear rockets: technology and policy issues http://www.thespacereview.com/article/1107/1

Renewable Launch Vehicles: The Sequel http://www.thespacereview.com/article/1114/1

Launch Service Providers: too many or too few? http://www.thespacereview.com/article/1090/1

Pushing the Moon sans Economic Benefits won't fly http://www.thespacereview.com/article/1088/1

Celestis offers Moon as cremains resting place http://ca.news.yahoo.com/s/reuters/080327/us/usre port space moon dc

Crafty tricks for fining Moon water: NASA's plans http://science.nasa.gov/headlines/y2008/27mar_mo onwater.htm?list994099

Spaceport America's plans for the future http://www.krqe.com/global/story.asp?s=8173339

Mountaineering and Climbing on Mars www.spaceref.com/news/viewnews.html?id=1278

ATV: the most powerful space tug yet built www.esa.int/esaHS/SEM462VZJND_index_0.html

Send Your Name to the Moon http://lro.jhuapl.edu/NameToMoon/

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

Cities at Night Word Tour - *Astounding!* http://eol.jsc.nasa.gov/cities/CitiesAtNightWorldTour 720X480edit7.mpg

NASA-Caterpillar™ Partnership: teleoperable excavation equipment for a Moonbase www.cat.com/cda/layout?m=8703&x=7&f=177263#/ nasa/

Stephen Hawking: Why we should go to Space www.nss.org/resources/library/spacepolicy/hawking. htm

The Earth receives only one-half of one billionth of the Sun's radiant energy.

Measure a man (or organization) by the opposition it takes to discourage him (or it.)

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 no membership services are not involved, the cheapest way we can do this is by submitting these subscriptions directly to the publisher at a costminus 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 53201

MMM PHOTO GALLERY



The Jamesburg Earth Station 20 mi SE of Monterrey, California, now privately owned and looking for users, including those wanting to bounce signals off the Moon. [dish jargon cue: "QSO" = "communicate with"] <u>http://www.jamesburgdish.org/</u>



View of near-Earth space from above the poles, GEOsynchronous orbit grows increasingly crowded. The inner white ring is LEO. The size of Earth (within the white ring) is proportionate. The Moon will be a cheaper source of construction materials for anything in GEO or LEO than from the Earth's surface. The Space Report 2008.



The Moon is inside the magnetotail for 6 days every month; farside telescopes may need to be hooded> www.nasa.gov/topics/moonmars/features/ magnetotail_080416.html



Rival to SpaceShipTwo, XCOR's Lynx "ready in 2010"



Europe's ATV "Jules Verne" is biggest Space Tug yet Below full Kaguya Moon Altimetry Map: Farside right



Blue lowest elevations - Red highest elevations

June 30th - 100th Anniversary of the Tunguska Event

Let's do something with this Opportunity!

By Peter Kokh

At about 7:14 am local time, in Krasnoyarsk Territory, Siberia, Russian Empire, June 30, 1908, a great explosion occurred above the ground. The light was seen hundreds of miles away in the hills of what was then a sleepy small town of Bratsk. The site was not visited until 1917 when it was found that all the trees had been snapped off at ground level and laid with their tops facing away from the center like so many toothpicks.



In 2000, 20 years (almost to the day) after the eruption of Mt. St. Helens in Washington State in 1980, I saw a very similar and most awesome sight. Up between the dead tree trunks the most beautiful flowers and little sapling pines were reasserting themselves!



On July 31st, 1981, this writer was in Bratsk, Irkutsk Region, Siberia, USSR (Brezhnev years) to see a total eclipse of the Sun. Our Intourist guides had promised that, in the event that we were clouded out, our group (40 Americans) would be taken 600 miles NNW to the Tunguska site. It was indeed a cloudy day. Fortunately *or unfortunately* depending on how you looked at it, the clouds parted 5 minutes before the start of the eclipse. (*Drats!*) But the eclipse *was* spectacular. I also got to see the Bratsk dam, largest in the world when built in 1961. But I was frustrated in not being allowed to visit Irkutsk, 300 miles south, or famed Lake Baikal 200 miles to the east (my visa was specific on where I could go.) Map of totality for this eclipse (Bratsk is at 101.5°E):

www.zam.fme.vutbr.cz/~druck/eclipse/Ecl1981ss/0-info.htm

The Tunguska Event was the largest impact event in modern history, possibly since historic times. The impactor, likely an icy comet nucleus, could not hold itself together as it plowed through the atmosphere above Siberia, and apparently exploded at some height above the ground. Nonetheless, it remains an awesome tribute to the power of stray celestial objects, whether comet remnants or asteroid chunks.

We apologize for not being on top of this anniversary in time to use the opportunity for public outreach education about the threat from beyond of killer asteroids." They *are* a threat to continued human survival, of course, but on the other hand, we owe our rise to ascendancy to the asteroid which wiped out the dinosaurs and many other species, leaving the previously diminutive and intimidated early mammals to expand into vacated niches eventually leading to human ascendancy.

But this process can stop now, thank you! We all enjoy being at the top of the food chain and having inherited the role of steward and guardian of the planet. We need to do our part to concern fellow humans with the threat from above as well as from threats abroad.

Asteroid Impact Awareness Day?

Recently, together with the its asteroid "Apophis Tagging Design Competition", the Planetary Society launched its "Impact Earth" project to increase public awareness of the potential danger. While mathematically, the chances of a major impact within the same timeframe as the start of the next ice age, is low. And yet no one in Canada or Scandinavia, both sure to be wiped clean off the face of the Earth by a major glacial advance, is losing any sleep over that more certain threat. The Yellowstone supervolcano is likely to blow in the same time frame. But averages do not matter. Something could happen at any time.

And in fact little Apophis, while not a dinosaur killer, is due to pass close to Earth in 2028 and possibly hit us in 2032. It could still do major unwelcome damage in which there could be significant loss of life, even if it hit in the ocean.

It is this writers opinion that an alarmest tack would only backfire, just like jumping the gun and crying "wolf!" Rather our various chapters should educate the public about potential risk (but also about the real service to us humans that past major impacts have done by snapping evolution out of ruts and opening up new niches into which the best of the survivors could expand. A terrestrial planet in a system without errant asteroids would be unlikely ever to host intelligent species!

Points and Priorities:

In educating the public, we need to be upfront with all the facts. Most relevant to reality, is the fact that we do not now know how to do anything about the situation should it arise. Perhaps a half dozen movies so far on killer asteroids all offer the same solution: nuke 'em!"

That may work for a solid body. But there is evidence that many of these objects may be loose piles of gravel and other unconsolidated material. Nuking them would not be unlike punching a beanbag chair. The object would simply rearrange itself and continue on its path undiverted.

We need to lobby the next Congress and the incoming Administration to allot funds to complete the census of near objects and to track and tag, (if need be) all objects identified as possible future impactors. We also need to find ways to detect from a distance how each object is composed and structured.

That is, we have a lot of fact finding to do before we start resorting to testosterone-based brainstorming of ways to divert those which may find themselves on a collision course with our planet some day. We can start this year, and then make this an annual outreach event.

What's in it for the Moon-focused community?

The short answer is quite a bit! While the Moon's relatively shallow gravity well makes it less of a target, one only has to take a brief look at the Moon to tell that it has been hit often and hard. Earth looks relatively unscarred, but that is an illusion. The Earth's deeper gravity well should, and has, attracted ten times as many impactors of any given size, geological period for geological period. The era of greatest bombardment seems to have been well over by three billion years before present. That indicates that the lion's share of co-orbital debris had already been swept up by the Earth-Moon system.

But since then, Earth's very active tectonic geology has reshaped all land surfaces. Erosion by wind, rain, ice and eruptions have erased most of the evidence. It is amazing that the crater from the Sudbury impact two billion years ago is still evident, although its shape has been deformed by continental plate tectonic movement.

But back to the topic: future settlements on the Moon would share our risk from impacts (no tsunamis, of course!) On the other hand, dedicated asteroid searching (and following) telescopes on the Moon could fill in some blind spots, guaranteeing a more thorough and successful search.

Important Fringe Benefits of a thorough Asteroid Tagging and Classification Effort

It is quite possible that thorough Earth-crossing asteroid searches accompanied by careful geological classification, may identify asteroids that can be reached by relatively low delta V (change of velocity) fuel costs, *and* which seem to be blessed with volatile and metal elements that are in short supply in the Moon's surface. An easily and regularly reached carbonaceous chondrite could supply the Moon with the hydrogen, nitrogen, carbon and other volatile elements the settlements will need to survive, at a significant fuel savings over the alternative – bringing them all the way up the deep gravity well from Earth.

Identification of an Earth crossing asteroid rich in "PGMs" (Platinum Group Metals) could be even more opportune. Now that said, we must dispute the myth that asteroid resources are cheaply accessed. It may take little fuel cost to get to an asteroid and return. However a cruel Catch-22 provision of celestial mechanics states that on average, the closer two orbits are In period, the less frequent the launch windows between them. Distant main belt asteroids can be reached with greater regularity than can nearby Earth-crossers. And if we must send humans, that means greater amounts of life support provisions, all but erasing any advantage. Asteroid fans, if they know this, do their best not to mention it.

Yet a lunar frontier stands to gain a lot from a thorough search for, and classification of, Earth-orbit crossing asteroids, big and small. It is in the interests of the Moon-focused community to support such an effort. The flip side is that failure to do so would not only be shortsighted and petty, it may bite us someday where we are most tender. - Once lunar settlements are in place, lunar industries could support manned and unmanned asteroid missions alike. That support would help pay for materials imported from these same asteroids.

Potential Allies

The Asteroid-focused community is substantial. It includes many members of the National Space Society, surely some members of the Moon Society, as well as of The Planetary Society, the Space Frontier Foundation, and lesser known organizations like the B612 Foundation, supported by Astronaut Rusty Scweikert. The Foundation's declared near-term goal is "to significantly alter the orbit of an asteroid, in a controlled manner, by 2015." -- http://www.b612foundation.org/

It would be substantially to our credit if we, in the Moon-focused community, started an annual observance of asteroid impact danger on the June 30th anniversary of the Tunguska event, then invited these others to join us in this effort.

<PK>

[Thanks to Birger Johansson, Umeå, Sweden]

New ability to resolve nearby Earthlike Planets Proposed telescope focuses light without mirror or lens

A team of scientists from the Observatoire Midi Pyrénées in Toulouse, France have been working with an unusual technique for focusing light. It takes advantage of diffraction – the bending of waves when they encounter an obstacle in their path – to focus light as it passes through a foil sheet with precise holes in it.

The scientists suggest that an orbital 30-meter imager could resolve planets the size of Earth within 30 light-years. In addition, the foil is much lighter than traditional materials, and thus easier to transport.

"A Fresnel imager with a sheet of a given size has vision just as sharp as a traditional telescope with a mirror of the same size, though it collects just 10% or so of the light. It can also observe in the ultraviolet and infrared, in addition to visible light.



An 8-centimetre prototype carved in stainless steel foil has demonstrated the Fresnel imager concept in laboratory tests (Image: L Koechlin et al/OMP)



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LRS News

• Peter Kokh interviewed on the Space Show: Thurs., April 24th, 11:30 am -1 pm CDT. Peter talked about the prospects for the Lunar Outpost initiative surviving in the next administration, and on the Moon Society's focus on Solar Power Satellites constructed with lunar materials. On Moon vs. Mars, he emphasized that we need both. About a dozen listeners sent in questions

http://www.thespaceshow.com/detail.asp?q=935

• **ISDC 2008:** In Washington DC this year, May 29–June 1, the weekend *after* the usual Memorial Day Weekend schedule. Peter Kokh and Dave Dunlop will be attending.

Our chapter is cosponsoring the Moon Society's **Solar Power Beaming Demonstration unit** which will be on display at ISDC. Light shining on the solar panels will be converted into microwaves and beamed to an antenna which will then light up an LED display to show how Solar Power Satellites will work. The Moon Society had to observe very strict guidelines to get a permit to display this working model. The cost was about \$1,500, a bit more than we had hoped, but a lot less than we feared.

• March 8th LRS meeting: Bob Bialecki brought another great video for us to watch: "The Orion Capsule"

LRS Upcoming Events - May & June Saturdays: May 10th, June 14th, 1-4 pm

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA: www.lunar-reclamation.org/page4.htm

• May 10th: Ken Paul will bring the DVD on the recent

"In The Shadow of the Moon" (2007) where astronauts recount their inner experiences on the Moon.

http://www.imdb.com/title/tt0925248/

And Peter will show a presentation on **Nighttime City Lights around the world** as seen from space.

No events or meetings in July and August September 13th meeting next after June 14th

MMM 8 NSS Chapters Strong



NSS Chapter Events

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

OREGON



Oregon L5 Society

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

voice mail / (503) 655-6189 -- FAX (503)-251-9901 [http://www.OregonL5.org/]

Allen G. Taylor <allen.taylor@ieee.org> Bryce Walden <moonbase@comcast.net> (LBRT – Oregon Moonbase) moonbase@comcast.net

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

Bourne Plaza, 1441 SE 122nd, Portland, downstairs May 17 - June 15 - July 20

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

INFORMATION: Larry Ahearn: 773/373-0349

CSFS L5 25th Anniversary Event Saturday, June 14, 2008 during Duckon 17 - <u>http://www.duckon.org/</u> Holiday Inn Select, Naperville, Illinois Directions: <u>www.naperselect.com/set_location.html</u> Hotel: <u>http://www.naperselect.com/set_concierge.html</u>



Hope to see some of you at ISDC May 28- June 1st. Look for me by the Moon Society's new Solar Power Beaming Display or ask someone to point me out. Tell me your interests, what you you want

to see and read about in Moon Miners' Manifesto. Tell me how MMM can be more helpful to your chapter.

If this gets to you only after ISDC, then simply write me at <u>kokhmmm@aol.com</u>, or call me anytime from 7 am to 10 pm central at 414-342-0705.

Consider donating a subscription to the library of your choice for just \$10 - details on page 13, col. 2.

MINNESOTA



MN SFS News & Pictures

Info on past/future Events

www.freemars.org/mnfan/MNSFS/2008-12-Review/ Ben's Minicon Pix

http://freemars.org/mnfan/MiniCon/2008/index1.html Minicon science room Pix

http://freemars.org/mnfan/MiniCon/2008/ index-sci-rm.html



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 May 15th UW-Sheboygan, Sheboygan Cancelled June 19th: The Stoelting House, Kiel
 July 17th UW-Sheboygan, Sheboygan, @room 6101



• 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: May 17/18*- June 21 - July 20 * In May we will meet at The New Jersey State Museum, Trenton, on the seventeenth and eighteenth. This is both an informal meeting and outreach to the public. The June 21st meeting will be at the regular location.

April Meeting Notes: A short, interesting meeting, with Michelle leading off with our Treasurers report: We have money in the bank, but should review our Moon Miners recipient list to send the proper amount in for current members. Dues should be sent to Mitch Gordon's address as this is where we receive the organization's mail:

(928 Clinton Street, Philadelphia, Pa., 19107).

Hank Smith talked of his plans to check various paths to reach the November site of the **Philcon** Convention in Cherry Hill, New Jersey. He will inform us of the Guest(s) of honor and other details as he gets them.

Mitch at the Franklin Institute for our table set up and tear down, respectively, on May 10, Astronomy Day. Mitch says we can set up from 10 to 11, and tear down after 4 pm. We'll bring: The CubeSat Q & A game, The Lunar Lava Tube Display, The Space Bricks, and other materials. Mitch. also brought the new issue of Ad Astra for our perusal. There were write-ups on building Solar Power Satellites (from the Moon), "The Fifty Year Countdown Calendar" on space events and "Saving Arecibo" on what NSS. will be doing to help keep this great instrument going. I will editorialize on this area at another time. I will point out, however, that this is also a Radar Telescope, with a million watt transmitter on site, and that sounds like a great "beamed power" experiment waiting to happen. The antenna was used to hit the Moon with several watts per square meter in the 70s.

Display Materials for the Exhibit: I had considered also building a Rover that could be driven around (with a video camera attached) but did not put time into it. First priority is the new display on Lava Tube Habitats of which MIchelle and I have been the primary builders. I may put together a mock up of a Far Side Radio Telescope: a very simple concept model. In addition, we will have literature from a number of groups and some give away material for the Q & A game as well as what Mitch and others contribute. Many of our members contribute their knowledge of various space topics and have the ability to relate them to members of the public of all ages. This "material" is one that makes the physical exhibits and literature understandable and memorable to members of the public who will visit us.

Post meeting notes: There is a number of things I could comment on that might be of interest to Moon Miners readers but I will limit myself: In the January issue of Scientific American there is an article on solar energy: "A Grand Plan for a Solar Future", or something close. This piece, written by three people (including a solar cell company partner and a university professor) that have an "Earthbound" view of getting this energy, have written an interesting concept piece that might be good for space advocates to read. One of the authors' area of expertise is life cycle costs and there may be reasons the resulting report does not include silicon cells but goes to a multi

element compound instead. Or it may be a question of self interest in the use of the cell manufacturer's technology. The result is that the presently available high quality silicon components, that are " off the shelf" items are not talked of much, even though there basic research and development costs are paid off for the most part. I think the "grand" part of the plan could be achieved since it is a gathering of previously considered ideas except one: converting the electricity generated by covering a large area in the western US desert (thousands of square miles) and using an international tie in (for when the sun sets), converting water to hydrogen and oxygen gases and transporting at least the hydrogen, via pipes, around to fuel the "Hydrogen Economy", and a number of other things. What is missing, obviously, is the use of the "24/ almost 7" location of space as the location of the power generators. The simple fact, that we all know, of using a large space based array to feed a relatively small rectenna could be done with very little effect on the local environment, or even needing to manufacture most parts on Earth was apparently not brought into the analysis. It would be good if an establishment writer of note brought our version of this "Grand Plan" to SciAm readers.

On a more fun note: I had the opportunity to attend a lecture at The Trenton Computer Festival on The Apollo Flight Computer" by Frank O'Brian of Infoage (a.org). Beyond the great interest of the audience in this historic piece of hardware, which Frank brings to the lectures, is Franks abiding interest in getting people into space. We had several conversations culminating in one that lasted over an hour on what he needed for some projects Infoage is working on, the current space related activities that I brought in to show him (he may subscribe to Moon MIners after seeing it), and his views on some of the things not often mentioned, as such, in space promoting circles. He is the guy who got me to look more at infrastructure as a topic for discussion as an explicit point after seeing it for years in Moon Miners. This is a subject into which he has put much time and thought. In addition to this area we also talked of the "green technology revolution" and the influence of the X prize paradigm on this and space hardware development. He would like volunteer help with projects info age is working on and is looking forward to presenting at Philcon's' science track this fall

And last: the college has a real booster in Dr Allen Katz of the School of Engineering (and fellow SETI League member) who was constantly auditing the various events and lectures on a busy weekend for the College. He was also a lecturer: "The Future of Computers".

Report 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 Monthly Meetings, every 2nd Monday, 7 PM Next: May 12th, June 9th

Englewood Public Library, Englewood, CO 80110 1000 Englewood Parkway, First Floor Civic Center



of Space Industrialization and Settlement Greater Los Angeles Chapter of NSS P.O. Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine:(310) 364-2290

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[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 May 17 - June 15 - July 20

Microcosm, 401 Coral Circle, El Segundo. Next Meetings May 17 - June 21 - July 19

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

FRI May 16, 8 pm – Mars Phoenix Lander Party, Room 223 Drescher Hall, Santa Monica College Planetarium

SAT May 17, 3:00 pm. - OASIS Board Meeting, home of Craig & Karin Ward, 1914 Condon Avenue, Redondo Beach, CA 90278-3404

MON May 19, 7:00 pm LECTURE: "Spitzer's View of Statr Formation" Dr. Luisa Rebull, a research scientist from Caltech who works at the Spitzer Science Center. Visit Dr. Rebull's site: <u>http://web.ipac.caltech.edu/staff/rebull/</u>

Sun May 25, 2:00pm – 9:00pm – NEW VISIONS OF MARS – Planetfest 2008 (join Bill Nye, Ray Bradbury, Louis Friedman and mission scientists as Phoenix lands on Mars. A one-day live data event with special guests from the space community. Pasadena Hilton, 168 South Los Robles Avenue, Pasadena,CA 91101/1-877-PLANET http://www.planetary.org/explore/topics/planetfest08/

FRI May 30, 8:00 PM – LECTURE: "Mars Phoenix Lander – Before and After" – Adult, per show = \$5; "double feature" (both 7:00 planetarium sky show & 8:00 lecture) = \$9; Children (12 years or under) & Seniors (60 years or older) = \$4 per show; "double feature" = \$7 – Santa Monica College, John Drescher Planetarium, 1900 Pico Blvd, Santa Monica, CA – Ph: 310.434.4223 (http://events.smc.edu/planetarium.html)

FRI May 6, 3 pm-closing: Space Lecture – Space News and Update program by Griffith Observatory Curator and staff_Leonard Nimoy Event Horizon Theater -

SAT June 21, 1 PM – OASIS General Meeting: details TBA

SAT June 21, 7:30 PM– Lecture/General Meeting: "To Be Announced" by Jim Traweek, Observatory Director – San Diego Astronomical. Cossentine Hall, La Sierra U., 4500 Riverwalk Pkwy, Riverside, CA 92515

SAT July 21st, 1 PM – OASIS General Meeting: details TBA **SAT July 21st, 7:30 PM**– Lecture/General Meeting: "To Be Announced" Peterson, San Diego State U. Cossentine Hall, La Sierra U., 4500 Riverwalk Pkwy, Riverside, CA 92515

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