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

Moon Miners' Manifesto

& The Moon Society Journal

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In FOCUS NASA "can't afford" to look for Killer Asteroids

The CNN headline was: "NASA lacks funds to find killer asteroids." It comes as no surprise As NASA Administrator Mike Griffin seeks to shed all NASA programs not directly related to his devalued goal to deploy a *visitable* outpost on the Moon in the time frame set by President Bush. While many space activists are dismayed, we think Griffin's ploy makes sense.

This does not downplay the importance of a focused and systematic program to give humanity the necessary information to design a risk-removal program. The point is that NASA, while space is its theater, is not necessarily the owner of the budget slice that should be tapped for this purpose. The Department of Defense DOD budget is perhaps a much better choice, as historically, DOD gets what it wants.

Yes, there is a risk in such a reassignment of responsibility. Many of us fear a wholesale militarization of space that would put everything beyond Earth's atmosphere off-limits to private enterprise. But this concern can be addressed in the writing of a DOD charter giving it ownership of the project.

Nor should this be seen as a challenge to the survival of the United States. It is the concern for the world at large. Other nations with the resources to do so, should step up to the plate and participate in an international effort to identify, "tag" and track all Earth threatening objects. The amount of money needed is rather modest in comparison to many space projects and programs.

Congressional Testimony, Wes Huntress, Jr. 03/24,1993

"The participants in the NEO Detection Workshop ... participants examined the likelihood of a major collision and the potential effects that could result. They concluded that while the probability of such an event appears quite small, the consequences can be so catastrophic that a focused, systematic approach to studying these objects appears prudent.

"The participants also concluded that the necessary technology is available for greatly increasing the rate of detecting NEOs. They recommended greatly increasing our capabilities for follow-on observations needed to identify the orbit, and to assess the probable size and composition, of newly detected NEOs."

What we need is an international meeting to which all nations with active observatories are invited, and at which a comprehensive identification and tracking program is laid out. We need to cover all areas of the sky, 24/7/365. That means at least two, better three or more observatories in both the northern and southern hemisphere. There is a lot of sky to cover: the more participants the less likely that we might miss a problem object.

Each willing country could choose how to finance its part of the program. In the United States, the National Science Foundation could direct the program with funds from DOD. *We must get out of the mentality that space is the privileged domain of NASA!* [⇒ p. 2, col. 2] !

The Large Millimeter Telescope in Mexico

At Volcan Sierra Negra, center, just SW of Mexico's tallest peak, Pico de Orizaba, right, what may become the World's most important astrophysical telescope nears completion, with 60% funding by Mexico. This could well be a prime site for a dedicated Near Earth Asteroid hunter telescope, 900 miles west of Chicxulub Crater, site of the dinosaur-killer impact. For full sky coverage we need Southern Hemisphere sites as well.

Moon Miners' Manifesto

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

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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.

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

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

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•• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." — www.MoonSociety.org - Contact information p. 9.

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

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

• **Submissions**

√ EMAIL to KokhMMM@aol.com (***preferred***)
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⇒ IN FOCUS Editorial continued from p. 1.

Now this may sound like a plan, but there is a catch: there is widespread skepticism outside the US that the danger is real enough to be worth concerted action now. Indeed, if by "real enough" is meant "Imminent enough" there can be no argument. The near term threat from the consequences of global warming such as extended droughts, a quickened pace of global desertification, rising ocean levels, the poleward migration fo agricultural areas; and severe demographic pressures is far more real. Indeed, the chances that the Yellowstone supervolcano might erupt and devastate the western US is perhaps a thousand times greater to occur within the next millennium as is another killer-asteroid strike. Even the chances of another ice age actually being triggered by global warming (diversion of the Gulf Stream into the Arctic Ocean triggering continuous snowfall over northern Canada, Europe, and Russia) is more real.

But we are not talking about an anti-asteroid missile program, or even an asteroid deflection program. We are talking about a modest program to thoroughly assess the danger and identify all Earth-approaching objects that may be a problem in the next few millennia. Of course, an previously undetected object could always come in from outside the inner solar system and, with greater velocity, do even more damage. There is no way to provide 100% insurance!

This is a matter that will be ill-served by hysteria and over exaggeration. A well-thought out program will identify problem objects decades, even centuries ahead of the problem encounter, giving us plenty of lead time in which to choose the *right* plan to put the object into a non-threatening orbit.

This problem object identification program must not stop with identification and tracking, however. We need to determine the internal structural integrity of each. so as to choose the right means of redirecting its orbit. Hitting a "bean bag" "rubble pile" astrochunk with a nuke may only rearrange the pile rather than deflect it. No one deflection program will fit all cases. Playing macho in space will prove no more helpful than playing macho on Earth. We must approach the problem with brains rather than with temperament.

We will need to send probes to a careful selection of these objects in order to better now the variety of challenges we face. Finding reliable ways to identify which class of asteroids/comets each object detected by Earthbound telescopes actually belongs is a priority.

There are a few small observatories now dedicated to this task. *We need more.* In our cover illustration caption, we suggested a site in Mexico worth considering, along with the reasons such an installation would be appropriate for Mexico.

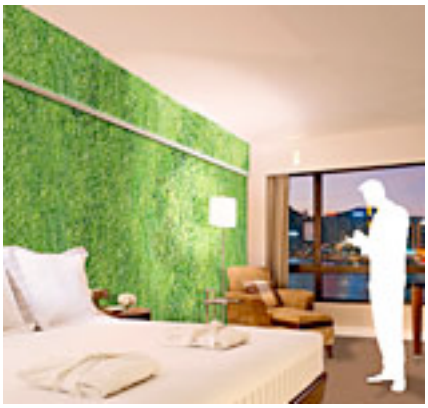
But such dedicated telescopes could be placed anywhere that the seeing is good most of the time. A network of such scopes on the Moon would be the ultimate.

MODULAR BIOSPHERICS

by Peter Kokh

I. Living Wall Systems, *Continued* from MMM #201 p.7

We recently found this excellent example to share.



[credit: Phillips & Co.] **A wall that breathes:** Envisioning some backlash against high-tech surroundings, designers conceived a back-to-nature hotel room with a lush "living wall" of grass-like vegetation. The wall, with a built-in watering and lighting system, would serve as an air filtering device, too.

http://www.usatoday.com/travel/hotels/2005-05-05-hotel-of-tomorrow_x.htm

III. Toilet-equipped Habitat & Activity Modules – Wolverton or alternate black water pretreatment systems

The organizing idea of "Modular Biospherics" is to distribute biosphere maintenance functions throughout a growing modular physical complex. This philosophy obliterates the "single point of failure" biosphere catastrophe scenarios to which any centralized system or complex of systems would be inherently vulnerable.

It is also a biosphere architecture that grows naturally as the physical complex of the outpost/settlement grows. The size of any "problems" that must be tackled in central, or neighborhood treatment facilities is greatly reduced. Modular Biospherics greatly reduces both the scope and the frequency of "growing pains" crises.

By distributing are and water treatment systems, biosphere maintenance becomes a democratic process: it is everyone's concern, and the immediate local consequences of neglected systems affect most those who are guilty of the neglect. We take Earth's immense biosphere for granted (up until recently, anyway.) On the Moon, the health of the minibiosphere of each settlement complex must be everyone's business or catastrophic failure will only be a matter of time, and will come sooner rather than later.

Living Wall Systems are designed to refresh air throughout the complex, with only local maintenance needed. Stale air sets off personal mental alarm systems rather effectively.

But we must also treat waste water, both gray (sink, shower) and black (toilet wastes: urine and feces) locally. Not only does this give us a further opportunity to "grow fresh air" within ever module that has a toilet system, but it helps pretreat blackwater *at the source of the problem,* greatly reducing the treatment burden to be handled in a centralized, or, better (in tune with our "as the settlement grows" philosophy), in neighborhood facilities. Wastewater treatment systems that "grow clean water" should be in every habitation and activity module: not just in residential quarters, but wherever people work, shop, go to school, play, or are entertained.

Many systems have been tried, some of them quite ingenious, mostly in rural settings that lack central water treatment systems. Some of these systems require an exhaust to the exterior atmosphere sink to handle the odor problem. As we can't exhaust stinky air outside on the Moon, at least not routinely, many "composting" toilet systems that work perfectly well on Earth will not pass muster on the Moon. The odor problem must be handled on the inside! That creates an extra burden, which to any one with the proper attitude, translates to an inviting "challenge," the kind of incentive that spurs ingenuity to greater achievement.

The Wolverton gray water system is one option that has worked for nearly 30 years in the home of retired NASA environmental engineer, Bill Wolverton in Houston.

KEY: 1 side- or wall-flush toilet; **2** blackwater tank with microbes to break down solids & destroy pathogens; **3** inert filter with irrigated soil; **4** plants rooted in wet soil mixture; **5** effluent water is 95% pretreated, ready to water plants in greenhouse and elsewhere. – *illustration by the author.*

There are undoubtedly other systems, but Dr. Wolverton's well-tested system sets the bar against which other systems must be measured.

The system above handles the load imposed by two people. We need to know to how many people-hours per day that translates. Are they home all day, everyday? Or half the day most days? Blackwater systems must be rated in people-hours capacity if we are to size them to the daily loads of other activity modules such as work spaces, offices, schools, shopping areas, etc.

If we can someday deploy a modular lunar analog research station facility, we will want to try a variety of such systems in order to verify how well they work, and how they compare on various performance parameters. This fits the goal of such an analog facility to demonstrate the technologies needed for actively growing lunar outposts and settlements. There may well be a commercial component of such experimentation, with various manufacturers contributing systems for the various modules in a high-stakes game of make or break.

The penalty of not aggressively developing a full suite of modular biospheric technologies is clear. The planned "visitable" (but no longer intended to be permanently manned) outpost must be constantly resupplied from Earth, or by a very wasteful program of local throw-away oxygen and water production. Engineers and architects of modules may prefer to "keep it clean, and sterile" but our job is to create a "biosphere flywheel" that largely maintains itself with a modest amount of monitoring. We need to keep dependence on resupply from Earth to a minimum, if we are going to progress to the point where those on the Moon can survive politically or economically driven cutoffs of support, be they temporary or indefinite. *This must be our goal!* **<MMM>**

On the Three Myths of the Planet MERCURY

By Bryce Johnson lesausl@sbcglobal.net

Myth 1) "Mercury is too Boring"

On first hearing, the suggestion of human settlements on the planet Mercury seems nothing short of ludicrous. Virtually every astronomy or space travel textbook we have read describes the planet as utterly hostile to human life. Generally described as a slightly larger Moon, Mercury is often ignored as being either too difficult to reach, too dangerous to live on, or just too plain *plain.* Let the unmanned probes go there. After all, Mars is more interesting. It depends on just what you are interested in.

Any reasonable concept for human expansion beyond Earth must include hum drum activities like mining, energy production, manufacturing of common and exotic items, and the transport around of people and their stuff. This will be the case wherever we go. If we are wise, those of us who truly want to see *bona fide* human expansion into space – as opposed to mere exploratory visits – will weave the common, mundane issues into our planning. On that basis, we will do well to consider colonization of Mercury.

Mercury is one of the most energy-rich planets in the Solar System

Energy is the key to whatever we want to do in space. Historically, we have always sought out cheaper energy sources and have experienced economic booms when they are developed. So it will be in space. On Mercury, the energy situation is analogous to taking a shower under Niagara Falls: we'll most likely never use all of the available energy. In fact, if energy were the only criterion of concern, we would not even bother with Mars. With the possible exception of geothermal energy, Mars is wantingly poor in energy sources, having only 1/20th* the solar flux available on Mercury. [*solar flux varies with the inverse square of the relative distance from the Sun.]

Photovoltaic and thermodynamic power systems operating in Mars orbit would still have only 45%, on average, of the solar flux to work with as is available on The Moon. Systems operating on Mars surface would have even less owing to the atmospheric effects. While would-be Mars colonists can be assured of having *enough* energy to survive with, they will always be at the bottom of the well looking up, when it comes to Mercury.

line graphic of Mercury's proximity to the Sun re Venus, Earth, Mars, and inverse square

[**Ed.** Mercury and Mars may be on a par, however, when it comes to uranium and thorium sources for fusion power.]

Material resources on Mercury are known to include all the same base elements found on the Moon.

Silicon, oxygen, iron, aluminum, titanium, sulfur, potassium, calcium, and magnesium have all been identified as constituents of minerals that remain stable in Mercury's thermal environment. We do not yet know the exact details of abundances or distributions What we have learned has been gathered from interplanetary distances using spectrographic analysis. This implies the resources mentioned above must be in substantial supply if they can be detected from such a great distance.

Importantly, hydrogen is also a proven resource on Mercury. We know that hydrogen is available as a constituent in Mercury's atmosphere from both spacecraft observation and spectrographic analysis. Properly described as an exosphere, the abundance of hydrogen there is paltry by almost any standard. Still, it is a constant supply as it is derived from solar wind sources and is available over the plate's entire surface. Superconducting ion 'scoops' deployed over large areas and running constantly can collect substantial quantities of hydrogen. Liquifying the hydrogen is an energy intensive proposition, but Mercury *had* the energy.

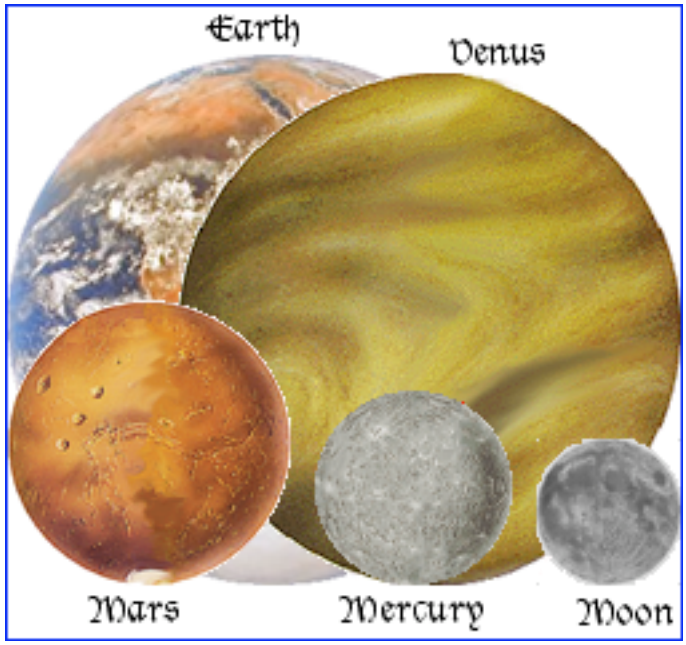
The importance of this hydrogen, diffuse as it is, cannot be overstated. First it means that people on Mercury are assured a self-sustaining source of water, *even if the data indicating water ice at the poles is wrong.* Second, it assures the ability to provide hydrogen fuel for flight into Mercury orbit, and, eventually, into interplanetary trajectories. This favorably alters the economics of flight to and from Mercury in a big way. [Ed. *Note that Mercury also possesses abundant oxygen reserves locked in the minerals of its crust, for use as a fuel oxidizer.*] Industrial processes involving hydrogen as a feedstock, or as a reagent, also become possibilities.

[**Ed.** Does the regolith on Mercury adsorb solar wind protons (hydrogen nuclei) as is the case on the Moon? The solar wind is stronger at Mercury than at the Moon. On the other hand, Mercury's global magnetic field may lower the number of solar wind particles getting through. The upshot is that we need a surface probe to find out.]

How does Mercury Stack Up?

	Merc	Venus	Earth	Moon	Mars
Mass 1024kg	0.33	4.87	5.97	0.07	0.642
Diameter km	4879	12104	12756	3475	6794
Density kg/m3	5427	5243	5515	330	3933
Gravity m/s2	3.7	8.9	9.8	1.6	3.7
Escape Vel km/s	4.3	10.4	11.2	2.4	5
Day hours long	4222	2802	24	708.7	24.7
Sun Dist10(6)km	57.9	108.2	149.6	0.384*	227.9
Insolation avg	6.68	1.91	1	1	0.43
Orb. Period days	88	224.7	365.2	27.3	687
Orbit Speed km/s	47.9	35	29.8	1	24.1
Orbit Inclined	7°	3.4°	0°	5.1°	1.9
Orbit Eccentric	0.205	0.007	0.017	0.055	0.094
Axis Tilt	0.01°	177.4°	23.5°	6.7°	25.2°
Mean Temp °C	167	464	15	20	-65
ATM Pressure bars	0	92	1	0	0.01
Number of Moons	0	0	1	0	2
Magnetic Field?	Yes	No	Yes	No	No

Note the figures for insolation: Mercury receives much more light from the Sun per square meter than does Earth/Moon or Mars. **Gravity:** while smaller than Mars, Mercury is much denser, and has a similar level of gravity. **Surface area** varies with the square of diameter. Mercury's surface is 2x that of The Moon but only half as large as that of Mars (or of Earth's total continental area.). Mercury's large orbital eccentricity means that it alternately it gets much more, and much less light and heat from the Sun than the average figure indicated.



Energy and raw materials are two of the four pillars upon which a planet's economy are supported. The other two are human creativity and time. The careful reader will note that 'location' -- which we hear about often -- is not on the list. In space travel, location is entirely a function of energy. Expend a certain amount f energy, and you will completely change your location. The implication here is that the cost of generating energy is what will largely determine the cost of transporting from one planet to another.

[Ed. We have another take on this issue. "Location" *can* matter, and far from being a handicap, its all in favor of Mercury's economic potential. It is Mercury's proximity to the Sun that endows it with an energy rich environment, as well as with a very short orbital period. That, in turn, is the reason Mercury has such short intervals between arrival and launch windows with all the other bodies in the solar system. Thus its location will one day make it the Grand Central station/transport hub of the Solar System. See MMM #78, Sept. '94, p. "Mercury: Gateway Grand Central" republished in MMM Classics #8 p 36, 38-9.

http://www.moonsociety.org/publications/mmm_classics/

Note also that all this solar energy can be used by lasers to decelerate inbound, and accelerate outbound spacecraft.]

Myth 2: "Mercury is too hard to reach"

Which brings up the first of the three great myths about Mercury that have kept it out of the limelight these many years: the myth that Mercury is just too hard to reach. To best understand the issue of flight to Mercury, it is helpful to compare it with a flight to Mars. Suppose, then, we consider two missions, one to each. Both have a crew of four. Both use identical engines, spacecraft and other equipment to the extent the different planets allow.

Both missions leave from Low Earth orbit. For the Mars-bound craft to reach Mars' orbit from Earth's orbit requires a delta-V (change in velocity) of 2.9 km/sec. Not bad. Its delta-V to enter orbit around Mars will be 2.6 km/sec, total 5.5 km/sec. Also not bad.

For the Mercury-bound mission, a delta-V of 7.5 km/sec is needed to reach that planet's orbit, and another 9.6 km/sec to go into orbit around Mercury: 17.1 km/sec total. This is more than three times what is needed for the Mars mission. However, the inference that a manned mission to Mercury will require three times as much propellant as a mission to Mars does not follow.

Using a Hohmann transfer (most economic trajectory) as a baseline for both flight, the one to Mars takes 245 days while we reach Mercury in just 105 days. That translates to a need for only 42% as much food and other consumables needed for the Mercury flight as for the one to Mars. Food would be about 0.75 kilograms per person per day. The 4 person Marsbound crew needs 736 kg, the Mercury crew just 315 kg.

If we assume a 'standard' LOX/LH2 propulsion system, it will take approximately 1.88 kg of additional propellant and spacecraft structure to deliver one kilogram of payload to Mars orbit. The same system would need three times as much propellant/structure mass to get a kilogram of payload to Mercury. However, in terms of actual mass in LEO needed to the respective missions,the Mercury-bound craft would be carrying considerably less payload for a given crew size. In the end, a Mercury-bound ship would require less propellant mass than the delta-V figures above would suggest. An exact figure requires an iterative process for both missions which is really beyond the scope of this study. Our point is that a crew of four could be delivered to Mercury using a craft (with fuel) 25% lighter than a similar one headed for Mars. (Note that propellant mass would be utilized as radiation shielding during solar flares in both cases.)

Off-loading one crew member from the Mercury mission results in a further reduction of mass required. For a 3 person Mercury craft, the weight in (low Earth) orbit is roughly the same as for a 4 person Mars craft. The point here is that mission duration has an equal part in determining mission cost and energy requirements.

] A manned flight to Mercury will still require more propellant [per kg of payload] than an equivalent mission to Mars The Mercury mission could use the same technology and same Earth-LEO vehicles - at cost levels only slightly more than those for Mars. *The assumption that we could* _not_ *do a Mercury mission at 'reasonable cost' is just plain wrong.*

There is more.

If both spacecraft are solar-powered, the Mercury vehicle will have a power system (presumably a photovoltaic array) weighing much less than thirty percent of its Mars counterpart. A solar array designed to generate 10 kw at Earth's distance from the Sun would be 25 sq m in area; at Mars distance from the Sun 55 sq m; but at Mercury's distance, just 4 sq. m. Power inverter systems would be the same mass in each case, but the net difference in system mass is significant. Each kg of array mass must be boosted from Earth with the requisite mass of propellant as outlined above. Mercury craft array mass is 1/20th the size and mass of that for the Mars craft. This is further to the advantage of the Mercury craft.

Going to Mercury is not necessarily cheaper than going to Mars. Our point is that the delta-V figures do not give an accurate, or even fairly approximate, picture of what a manned flight to Mercury would actually cost. Nor for that matter, do delta-V figures give any indication of whether a transportation system can be operated profitably between a given pair of planets.

Of course, all of the foregoing assumes use of

chemical propulsion systems. Now it happens that there is an alternative that can make Mercury settlement a very practical proposition - and even reduce the cost of settling Mars in the bargain.

Solar sails hold the prospect of being able to deliver incredibly large payloads to Mercury orbit without expending massive amounts of expensive propellant. Solar sails have numerous advantages over ay chemical system, including nuclear systems. They are relatively low maintenance, completely reusable, totally insensitive to plane-change requirements and the usual launch window constraints, extremely flexible in their payload capacity and pose no risk to crews from either explosions r radiation exposure. A single Ares launch vehicle can deploy a solar sail 25 square kilometers in area, large enough to deliver a 400 metric tonne payload to Mercury in just 600 days. Three such payloads could be launched every year if need be. There is no chemical technology that can begin to approach this capability for any planet.

In reality, there is no real likelihood of such massive payloads being sent anywhere. The Ares vehicle mentioned is designed to launch something like 150 metric tonnes to LEO. It would require at least three such launches thoroughly equal 400 tonnes. There is an argument that this is not particularly cost efficient.

With solar sails, the issue is more about how fast do we want to get our payload to Mercury. If solar sails have an Achilles' heal, it is that they can take a comparatively excessive amount of time to build up th velocities needed to reach Mercury. Ironically, and this is good news, getting a solar sail back from Mercury is a lot easier and faster, owing to its proximity to the Sun. As a transportation system comprised of several sails, more or less constantly in transit, the average payload could be reduced in size to enable faster transfers. Entire round trips lasting less than a year are easily achievable.

Myth 3: "Mercury is too dangerous to live on"

Radiation on Mercury is considerably more severe than on the Moon or Mars Depending on its orbital position, Mercury can receive anywhere from six to ten times the radiation flux encountered on the Moon. By implication, that means people would build up radiation-induced damage at a proportionally greater rate. This in turn means a crew on Mercury would need much more radiation shielding to reduce dosage levels to a particular point than on the Moon. It also means that the crew could not be exposed to natural radiation levels on Mercury for as long as a lunar crew. But just how long could they go unprotected before accumulating a career limit dose?

There is remarkably little direct information on ionizing radiation effects on Mercury. Most writers on the subject tend to focus on thermal radiation and do not consider that ionizing radiation, by itself, is a hazard because of the damage it causes on the cellular level. Mercury's extreme heat would destroy any unprotected living tissue very rapidly; in mere minutes. Ionizing radiation, on the other hand, destroys by overwhelming the body's ability to repair itself. This takes a bit longer.

Excluding intense solar flares, calculations indicate that a crew could work on Mercury's surface for at least five weeks with only their spacecraft or their space suits for protection. At that point, they would need to b under shielding -- as much as 15 meters of shielding, if it is comprised only of Mercury regolith. Five weeks is more than enough time for an experienced, well - equipped crew to build a small base under adequate shielding. Training such a crew on the Moon prior to Mercury would be logical and beneficial.

To clarify the five-week limit, that would be the length of time it would take the crew to receive a cumulative dosage that would cause a substantial increase in their likelihood of developing life-threatening cancers. It does not mean "five weeks and they are dead." There are some estimates that go as low as only two days (but do not specify the level of protection needed) and others that go up to ten weeks. Uncertainty remains and this is the subject of more study. What is clear is that a crew would have a window of time to establish adequate shielding.

For a crew of four people with just two days working simultaneously, this works out to a total of 192 man-hours or eight man-days - in which to get an initial base built. The more likely scenario is that only half that time would be productive. This still eaves four man-days of actual productive time to deploy the shielding: a worst case scenario that might not pas NASA safety rules.

[Ed. on the question of shielding, I asked the author about the possibility of lavatubes on Mercury. We have only photographed a little more than half of the planet's surface and do not see Moon-lie maria. His reply:

"There are 'sinuous rilles' on Mercury. Mostly they are in the Caloris basin region and they are not likely to have been formed by exactly the same process as lunar rilles. Uncollapsed lava tubes are not yet identified, so far as I know anyway. I have a CD of Mariner 10 images and am poring over them with gret interest and will let you know if i see anything NASA missed. Hey, it could happen. . ."]

As for thermal radiation, the logical approach is not to be out on the surface during times when the Sun is high enough to heat the ground to excessive levels. For current technologies, that still leaves about three weeks after sunrise and three weeks before sunset in which to explore by daylight. Of course, the entire 88-day nightspan is available for surface work, albeit under artificial lighting. Three weeks is more than enough time to conduct very extensive exploration sorties or surface construction work.

Mercury can be reached. We can cope with its environment, if not enjoyably. The rewards for making the effort are great. Abundant energy: a strategic transportation hub allowing access from Earth to Venus and Mars at intervals and with flight times better than direct routing; resources of metals, silicates, and volatiles that ensure self-sufficiency in vital needs such as construction materials, life support elements and even spacecraft propellants. ... The potential is impressive.

Given the advantages of solar sails for low cost transportation, combined with Mercury's many attributes (including the greater accessibility based on shorter synodic periods with other planets) it is even conceivable that Mercury could be developed much more rapidly and at far less total cost than Mars.

That's a subject for a future report ... **<BJ>**

Mercury Probe Updates

Mercury Messenger is due to fly by Venus on June 5, 2007. and go into orbit around Mercury on March 18, 2011 (in four years.) http://messenger.jhuapl.edu/

BepiColumbo (ESA/Japan) missio in planning. http://www.esa.int/esaSC/120391_index_0_m.html

More on Mercury as a Human Frontier

from Peter Kokh and Dave Dietzler

Much of what we know about Mercury was gained by Mariner 10 during three flybys in 1974 and 1975. A total of 2,300 photos were taken but only 45% of the surface was imaged at an average resolution of 1 km. and less than 1% of the surface at resolutions between 100m and 500m. The other half of Mercury is a mystery.

High resolution radar images of the un-photographed side show three bright features. One may be a large fresh impact crater. Another has a radar signature similar to a shield volcano as big as Mars' Olympus Mons. The third has no known radar counterpart elsewhere.

Mercury's surface is cratered like the Moon and has impact basins similar to those on the Moon. The largest lava plain is the Caloris Basin, 800 miles across. On the opposite side of Mercury there is a feature called the Hilly and Lineated Terrain which probably formed when seismic waves from the Caloris Basin impact converged. Radar studies done by JPL scientists using the Goldstone antenna and the VLA indicate the presence of water ice in northern polar craters and radar images from Arecibo confirmed the results and even discovered a bright patch in the southern polar region.

Because the obliquity of Mercury to its orbit is 0 degrees the planet does not experience seasons and temperatures in the polar regions should be less than minus 248 F. In permanently shaded craters it could be as cold as minus 290 F. Since the radars could penetrate the ground and the surface of Mercury based on infrared temperature measurements seems to be covered with a porous soil or rock power like the lunar regolith that is a good thermal insulator, the ice could be subsurface. **DD**

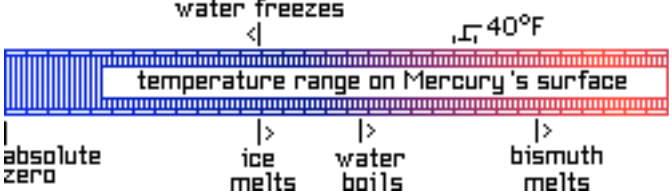
That Mercury's axis is not tilted at all, leads some to say that the planet has no seasons: yet the eccentricity of the orbit is such that there are both clearly distinct climactic regions, and a set of seasons in each.

When Mercury is at perihelion, the Caloris basin is always sunward, the antipodal chaotic area in darkness When Mercury is at aphelion, the Caloris antipodal chaotic area is sunward, Caloris in darkness. These areas experience very different climates even if at the same latitude.

At the equator, shade has to be overhead. Away from the equator, shade walls may work, and surface temperatures will be lower (less insolation per sq. meter.) Peri-arctic regions will have the most reasonable temperatures as well as close proximity to ice.

Mercury's day, noon to noon, is 176 Earthdays long. One need travel only 3.75 kph or 2.33 mph to keep up with the advancing sunrise or sunset, at the equator.

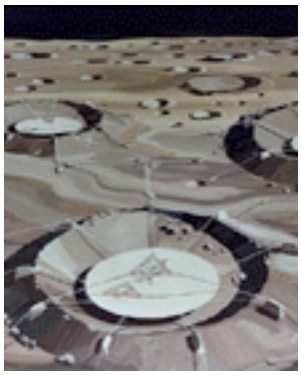
On Earth, a couple of meters down, the temperature may be temperate (40-60 depending on latitude.) I think Mercury's subsurface temperature will vary strongly with both latitude and longitude along with the local mean insolation per square meter. There not be much relief underground away from the periarctic areas. **PK**



MOON TRANSMISSION YIELDS

by David Semloh <semlohzinc@yahoo.com>

"How to make money from the Moon" asked the May 06 MMM #195. And in Dec 06 NASA published a poll [1] with the same question. Very little extension of the "Arecibo-type dishes [2] was offered in either article.



Possibly the best potential use of the crater dishes is for telemetry and transmission, and implications could be enormous.The previously mentioned Nasa poll at best suggested some lunar based remote terrestrial sensing for mapping and climate studies. But the AM transmission value alone could be in the billions (USD) for 0' lat/0' long crater dishes support of current terrestial and satellite efforts, if the bottleneck of precision columnation is available at low cost without nonspherical devices.

Agreed, some strong handicaps involving installation cost exist, the lunar method of time delay, distance, and with being out of contact for half the time with any one part of the Earth. And 6.5' tilt libration preventing a perfect columnation with a parabolic antennae. (Earth spin is not perceived to be a large problem for foci antennae arecibo type tracking, but this may be incorrect.)

Nonetheless, lunar platforms are massive and enormously stable for footprints [3], unlike man-made satellites (the latter are unstable and have short lifetime due to stationkeeping [4] requirements), which allows long period savings and possible transmission focus that is otherwise impossible. Which suggests a niche market not currently being used, especially with fine tuning resolution. [5] [6] [7] [8]

Pluses and minuses weighed, the idea has great potential. It only suggested that closer examination is in order. Currently involved in receiving more information from some previous Nasa workshops on the subject, I now request input from MMM readers, particularly expert opinion in AM transmission and collection. I admit not being familiar with a great many technical details, but simply see promise in an area others appear to have overlooked. Any positive comments or offered detractors would be appreciated to help settle this proposal.

Relevant and related issues online:

[1] www.nasa.gov/pdf/163560main_LunarExplorationObjectives.pdf
[2] www.space-frontier.org/Projects/Moon/lunargallery.html
[*note Pat Rawlings art above is from this page*]
[3] http://en.wikipedia.org/wiki/Footprint_(satellite)
[4] http://en.wikipedia.org/wiki/Station_keeping
[5] http://en.wikipedia.org/wiki/Satellite_radio
[6] http://en.wikipedia.org/wiki/Direct_broadcast_satellite
[7] http://adsabs.harvard.edu/abs/1977ATTM...67..300B
[8] web search Forbes "Broadcast Bullies" **<DS>**

Lunar Zen Gardens Inside & Outside

The Blending of Interior and Exterior Spaces

by Peter Kokh

In last month's Mars-theme issue, we discussed how Martian pioneers could blend indoor and outdoor spaces. These pioneers will be working with a different color palette, and eventually, with something more than sand and rock: plants, once Mars-hardy plants begin to take root out in the open under a steadily thickening and warming atmosphere.

On the Moon, we have just regolith (sand analog) and rock to work with. Fortunately, these two elements have been media enough for artists in many cultures from the Stone Age through the present. Stonehenge comes to mind, but that, and many similar pre-Celtic creations are evidently something more than artful arrangements.

When it comes to sand, be it desert sand or beach sand, people (and children) have been drawing patterns and pictures in them with a stick from time immemorial. http://hebert.kitp.ucsb.edu/sand/tradition.html

But the most refined art form combining sand and rock is arguably the classic, serene Zen Garden, in which an odd number of different shaped stones or rocks are placed in a "sea" of sand, complete with raked "ripples." This is an art form that begs to be translated with lunar elements found everywhere: moondust and boulders.

We can do this out on the surface, but also indoors: below is a design perfect for a lunar home foyer.

Zen Gardens in Lunar Homes

If there is a Zen garden just inside the airlock, there could be another just outside, especially if it is visible, along with persons coming and going, through a periscopic picture window. The garden outside, though constructed of thoroughly natural elements, puts a friendly, welcoming human touch on what otherwise may seem an alien and hostile landscape.

Inside, the Zen Garden will look the same only with very careful preparation. The moondust must first be purged of the troublesome fine powder component, the last thing we want to bring inside our living spaces. Then, using a magnet, one must purge as much of the iron fine component as possible. Why? Because the moondust has never been exposed to humidity before, and will begin to take on a rusty color instead of its characteristic gray tones. The effect would look somewhat Martian. An option would be to use controlled gradual purging of the regolith so that nearest the outside (nearest the airlock) gray tones would predominate, gradually shifting towards rusty shades at the end furthest from the airlock. This could symbolize an assimilation of the lunar environment.

Of course, there is no reason to limit placement of small indoor Zen gardens to the airlock antechamber. They might be even more appreciated in the foyer of a lunar homestead at the entrance to the home from a pressurized settlement street or passageway. Far more visitors will enter lunar homes from other pressurized areas than directly from the out-vac, the airless surface. As such it will be a statement that this is the home of Lunans, people at home on the Moon, welcoming others who have also made that passage.

Small **tabletop** Zen Gardens can be put in dens, bedrooms, anywhere people will enjoy having them.

A strange but fittng companion for a small Zen Garden might be a **Bonsai tree** planter, representing the forests left behind on Earth.

Zen Gardens out on the Lunar Surface

There is no reason to restrict Zen Gardens to the airlock entrance areas. On the other hand, as they take some labor in a space suit to create and arrange properly even if all the elements are handy to the location, we are unlikely to see the median strips in lunar versions of our divided highways in the form of a continuous Zen Garden!

We might see them as periodic trail markers, at road junctions, scenic waysides and rest stops. Wherever we create them, they will remind all who pass and enjoy them that we are Lunans, people who have come to live with the Moon in harmony. *Zen Gardens, whether indoors or out on the surface, will be a respectful way of saying that we will make the Moon a human world, even as it reshapes us as Lunans into its own people.* **<MMM>**

The Moon Society

JOURNAL

http://www.MoonSociety.org

http://www.MoonSociety.org/blog/

Please make NEWS submissions to 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 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 Moon base 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®**

PROJECTS: www.MoonSociety.org/projects/

Moonbase Simulations - Lunarpedia wiki

Moon Society DUES with ***Moon Miners' Manifesto***

- **Electronic MMM** (pdf) **$35** Students/Seniors: **$20**
- **Hardcopy MMM**: U.S/Canada **$35** Elsewhere: **$60**

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

Mail Box Destinations:

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

□ **Projects, chapters, volunteers, information, etc.**
Moon Society Program Services
PO Box 080395, Milwaukee, WI 53208, USA

OUR 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!

Moon Society Adopts Statement of Agressive Support for VSE

from Moon Society President, Peter Kokh

The George W. Bush Administration has proposed a Vision for Space Exploration (VSE) for the United States in which NASA will lead an effort to return human crews to the Moon, "to stay."

This vision, however, is already in process of slowly being eroded and redefined downwards both in its timetable and in its overall scope. This negative trend may be with us for a while. It serves no purpose to try to analyze its causes, though they are several, and complex.

Our task is rather to find a way to compensate, so that the goals of the Vision are met all the same.

In this light, the Moon Society's support of the Vision for Space Exploration (VSE) involves:

"complementing NASA initiatives and goals by looking for alternative options to advance research goals NASA is no longer able to undertake."

[The above language was unanimously approved by the Moon Society's Leadership Council at the March 7, 2007 online meeting.]

The list of such sidelined items continues to grow.

Canceled VSE line items through March 2007:

- NASA cancels work on advanced (biological) life support research (BioPlex, NSCORT)
- NASA will not build a pressurized rover for the Moonbase
- NASA is looking at an "intermittently occupied" moonbase only with just short 2 week visits now and then
- NASA can not afford to analyze data from Lunar Reconnaissance Orbiter (the agency is reconsidering)
- *What moonbase support program will be next?*

All these cancellations and cutbacks are opportunities for The Moon Society to help find other, much less expensive ways of getting done the jobs in question.

If you support the VSE, we urge you to support the Moon Society's efforts to ensure that this Vision becomes real. Please join or renew your membership today. Please look for opportunities to volunteer that may match your skills, interests, and discretionary freetime.

In our determination to rise to the occasion, the Society will aggressively seek to grow our network of affiliations and alliances. Other organizations, universities, and private enterprise have major roles to play. So may other Departments of the Government, notably the Department of Energy.

At stake is not just preserving the Vision, but our chance to go beyond a first permanent moonbase to true resource-using industrial settlements on the Moon, which in turn promise to play a major role in mitigating Earth's two major intertwined and hitherto intractable problems:

dirty energy production and
continuing environmental degradation

With this expanded Vision before us, we believe that the Moon Society's goals are relevant to the concerns of most people. **<TMS>**

Nominations for Society Officers and for the Board of Directors are now open, for the 2007 Elections

from President Peter Kokh president@moonsociety.org

Our annual election ritual begins again. This year, the following positions are open: ***respond by May 1st***

Moon Society Officers:

- **Vice President:** for a two year term, ending 2009: currently held by Randall Severy
- **Treasurer:** for a two year term, expiring 2009: currently held by Dana Carson
- **Secretary:** for the second year of a term ending 2008: vacated by *retiring* Secretary, Ben Smith

Moon Society Directors:

- **three director slots:** for two year terms, ending 2009: currently held by R. Scott Gammenthaller, Randall Severy, and James Gholston

All of the above incumbents are eligible to run again, but, as President of the Society, entrusted with the smooth running of the Society and its steady progress towards our goals, I am requesting that those who have been unable to attend Leadership Council and Board meetings on a regular basis, make way for newcomers. It has become increasingly difficult to do business requiring a quorum because of attendance problems. We know that all candidates intend to participate regularly, and that unforeseen conditions in employment and family matters can interfere with realizing this sincere intention. We thank you for what service you have been able to provide, and should circumstances change and free up meeting time, we would be glad to work with you again!

Leadership Council and Board Meetings

The Council, of which all Officers and Board members are subsets, meets regularly twice a month, on the first and third Wednesday evenings, 9-11 pm ET, 8-10 pm CT, 7-9 pm MT, 6-8 PT, on the ASI-MOO online chat environment. If you currently are not regularly free on those evenings, you should not put your name in nomination. We can use your assistance in other non-time-sensitive ways! Of course, only those with a computer and internet connection would qualify. A fast (DSL/Cable) connection is not necessary.

Anyone interested in the affairs of the Society may ask to join the Leadership Council. Simply address an email to president@moonsociety.org with "Leadership Council" in the subject line. The Council as such takes up matters of interest to the Society. If it becomes apparent that the nature of a matter is such that a decision must be made by the Board, the Board members present convene during the meeting to consider motions and vote. All Council members are welcome to offer opinions and help reach a consensus, but only Board members can vote.

Our Society is 100% volunteer run. Our only staff person, Director of Project Development, David Dunlop is himself a volunteer. We need more volunteers. The more members who participate and take ownership, the more the society can achieve. Whether as Council Member, Officer, Director or Volunteer, please consider serving

MMM Publisher Considering Changes that could get MMM hardcopy issues to your mailbox in a more timely fashion

From the Lunar Reclamation Society

Moon Miners' Manifesto has been published by the National Space Society's Milwaukee chapter since its first issue came out in December, 1986. Publishing MMM has been a core chapter project ever since. It is now a much more streamlined operation than it used to be. When the master copy was finished, the editor took it personally to the Printer, then brought the stacks for each page home and sat down to collate, fold, and staple each issue, before putting on the labels prepared by someone else, and then taking the prepared mailing down to the local Bulk Mail Unit.

Things got a bit easier when we switched from 8.5" x 11" single sheets (i.e. to piles to collate) to 11"x17" format (i.e. 5 piles to collate); Charlotte Dupree and her mother Carol Nelson got us in the door after hours at the Direct Marketing firm they worked at and we could use the automatic folding and stapling equipment. We still had to collate and stick on labels, however.

Last year, things got a bit easier when a Printing outlet in Sarasota Florida found us, and offered us a better price than we could find 20 years ago. All we had to do was email him the pdf file and the box of collated, folded, stapled and trimmed copies showed up at our door a couple of days later. At that time we lowered our group rates to all MMM clients, including the Moon Society and 7 NSS chapters, and to our own members.

The stickler in getting the hard copy edition out the door has been preparing the merged database with data coming in from eight different groups. At times the database for the labels has not been ready until two or more weeks after the print copies came back from the printer.

Hopefully, in no more than two months, we will have new procedures in place which will have the database ready to be emailed with the new MMM pdf file to Florida, and the Printer will print the labels right on the copies, and even mail them to you direct from Florida. And the total cost for this? Actually the labeling and mailing service from Florida will cost us less than the UPS shipping of the box of copies back to Milwaukee!

The few overseas copies that do not go by bulk mail, will still be mailed from Milwaukee, we believe.

We have much regretted the delays in getting MMM into the mail that we have experienced over the years. But, if everything works out as we have reason to expect it will, You should be getting your hard copy in 2-3 weeks after the pdf file is finished. (Bulk Mail is slow after all, and to mail first class would be prohibitive.)

LRS is grateful to all its members and friends who have helped get MMM into the mail over the years. all 203 issues to date! But some of us are weary, and reducing the load on the volunteer team is a good thing, especially if it is combined with much improved service. Thanks to Dan Galuska, Mark Kaehny, and Joe Mackowski, Bob Bialecki, Debbie Grede, Charlotte Dupree, Carol Nelson and anyone else who I have missed, from *ye ol' editor*

We Welcome our Newest Affiliate The Mexican Space Society Sociedad Espacial Mexicana (SEM)

By Peter Kokh, Board of Advisors, SEM

I had been aware of **Jesus Raygoza B.**, head of the **NSS Chapter in Guadalajara**, for well over a decade. Last summer, Moon Society Director of Project Development, David A. Dunlop, caught up with Jesus, temporarily living in Colorado to the south of Pueblo, and began exchanging emails, cc'ing to me. We got Jesus enrolled in the Moon Society and started brainstorming areas of mutual interest, specifically lunar analog stations. Jesus is the principal proponent of the **MexLunarHab** (MLH) defined as a research and educational outreach project.

Then in late November, I got a call. Jesus was at the downtown Milwaukee Greyhound Depot and needed directions to take the city bus to my house. I met him at the bus stop. He stayed with me and my three dogs about two weeks before Dave picked him up to take him to his home in Green Bay.

Over the next two months, with me kibitzing now and then, Dave and Jesus developed a master strategy to take advantage of a unique opportunity: Mexico's House of Representatives had just passed a bill that would create a modest, Johnny-come-lately Mexican Space Agency. President Calderan seemed interested. Now was the time for citizen input!

Meanwhile, Jesus accepted my invitation to join the Moon Society Board of Advisors. A month ago, headed in that direction, Dave dropped Jesus off in Colorado. But now he had a mission, and quickly moved back to Mexico, this time not to his native Guadalajara, but to the Capital.

There he has been busy with other associates of SEM which he is now transforming into a truly national space activist organization, no longer confined to Jalisco State. Jesus and associates are putting the finishing touches on a fresh translation of the English version he and Dave had put together. It is an ambitious phase by phase proposal, fully aware that Mexico is late to the game and must leverage a modest collection of assets.

While Mexico is late to Space per se, it is now at the forefront of modern astronomy with some world leading instruments. It also "owns" three Geosynchronous Earth Orbit spots, yet to be developed or leveraged.

SEM's proposal includes a campus of tourist-worthy space facilities near Cancun, Mexico's' #1 tourist destination. Included would be an Analog Lunar Hab / Space Camp complex with a visitor center. U.S. tourists would help make such a complex a financial success.

Northern Yucatan is the site of the Chuxculub Crater formed 65 million years ago by the dinosaur-killer asteroid impact. We have suggested to SEM, that a new observatory, dedicated to the search for and tracking of Near Earth Objects would be appropriate, and a natural response to what happened here so long ago. This observatory could join the growing complex on Sierra Negra, which includes the Large Millimeter Telescope (see p. 2).

SEM is experiencing a major transformation with growing pains, without the organization its ambitious mission needs, or a website. We watch with interest. **MSJ**

A 1st Observatory on the Moon in 2009? International Lunar Observatory Association

News Volume 2, Issue 2–March 2007–Hawai'i Island

International Lunar Observatory Association Seeks Investments, Contributions, Global Endorsements in Prelude to November Founders Meeting

The International Lunar Observatory Association (ILOA), now operating with a growing number of Acting Directors, financial resources and global endorsements, is currently soliciting minimum US$1 million contributions and investments (or identification of same) from institutes, individuals and enterprises interested in and dedicated to realizing the ILO – a pioneering multifunction astrophysical observatory to be placed on the lunar surface as early as 2009.

These hopeful investments and contributions, accepted in the form of cash and/or in-kind goods and services, will be directly applied to the $50 M required to realize the first mission. Investors and contributors will be guaranteed ILOA accreditation, lifetime membership, and Directorship consideration. In addition, they will receive a customized package of benefits that include ILO ownership, operational involvement and their name on the Moon.

The ILOA Founders Meeting, to be held from 4–8 November on Hawai'i Island, will serve to advance the organizational, financial and technical challenges of the ILO and its follow-on missions. Fellow Endorsers, Contributors, Members and Directors are invited to discuss and strategize ILO matters at the Founders Meeting in Hawai'i and/or at a planned Preliminary Founders Meeting at the International Astronautical Congress in Hyderabad, India from 24–28 September. A working agenda for both events is expected by the end of April, and US$775 Early Registration for the Hawai'i Founders Meeting will be available through 15 May.

With the desire to outreach and support Hawaii-based astronomy, as well as to pioneer an ILO analog site, the ILOA also is currently seeking to establish a bureau on the summit of Mauna Kea on Hawai'i Island. Operating in a remote and extreme environment similar to that of the Moon, this bureau office aspires to take its preparatory steps towards lunar operations while supporting and engaging with the astronomy observatories currently established on the summit.

The ILOA continues its outreach for global endorsements, requesting any interested institutions, individuals and enterprises to publicly declare their support for the ILOA. This universal opportunity for each and every individual is highly valued and offers anyone the distinction, opportunity and reward of a unique and innovative space mission.

Over the next several months, the ILOA will be processing its 501(c)(3) non-profit status. Also being released within the next few weeks will be the much-anticipated ILOA website, www.iloa.org. Aloha.

For more information on the ILOA, including contributing, investing and endorsing, please respond to this email or contact us, in care of Space Age Publishing Company at news@spaceagepub.com **<MSJ>**

An Interesting & Important Project that Chapters can do to increase our kowledge about the Moon.

From: "Veronica Ann Zabala" <Veronica.Zabala@asu.edu>

Help NASA Spot Moon Meteorite Impacts

By Tony Phillips, Science.NASA.gov - 4 January 2007

Another meteor shower, another bunch of lunar impacts...

On December 14, 2006, we observed at least five Geminid meteors hitting the Moon," reports Bill Cooke of NASA's Meteoroid Environment Office in Huntsville, AL.

Each impact caused an explosion ranging in power from 50 to 125 pounds (22 to 56 kilograms) of TNT and a flash of light as bright as a 7th-to-9th magnitude star.

The explosions occurred while Earth *and Moon* were passing through a cloud of debris following near-Earth asteroid 3200 Phaethon. This happens every year in mid-December and gives rise to the annual Geminid meteor shower: Streaks of light fly across the sky as rocky chips of Phaethon hit Earth's atmosphere. It's a beautiful display.

The same chips hit the Moon, of course, but on the Moon there is no atmosphere to intercept them. Instead, they hit the ground. "We saw about one explosion per hour," says Cooke. ...

Cooke plans to release **data reduction software developed specifically for amateur and professional astronomers** wishing to do this type of work. (To be announced on Science@NASA in the near future.)

http://science.nasa.gov/

The software runs on an ordinary PC equipped with a digital video card. "If you have caught a lunar meteor on tape, this program can find it. It eliminates the need to stare at hours of black and white video, looking for split-second flashes."

Telescopes as small as 14" aperture could be used, according to the NASA article. Such instruments may be owned by members of your local astronomy club. This is an exciting project that can lead to greater collaboration between local space chapters and local amateur astronomy groups.

For more information:

http://space.com/scienceastronomy/070104_moon_meteors.html

Editor's Comment

MMM will be keeping a heads up for any future announcement about the availability of PC software designed to automate or semi-automate this project.

Just as has the ingenious SETI@home project allowed commoners to make valuable contributions, this lunar meteorite flash observation project does the same thing.

There may be another such opportunity down the road involving "mining" and analysis of the great volume of date expected from **Lunar Reconnaissance Orbiter**, data NASA has no budget to analyze. **<MSJ>**

Introducing our new email newsletter

Moon Society *Frontlines*

Want to sign up? *Simply go to:*

http://list-manage.com/subscribe.phtml?id=0006e65d5b

Chapters & Outposts

Bay Area Moon Society

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

Meeting **4th** Thurs. montlhly at Henry Cates' in San Jose

Contact: Henry Cates <hcate2@pacbell.net>

Moon Society St. Louis

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

Meeting the **2nd** Wed. monthly at Buder Branch Library 4401 S. Hampton, in the basement conference room

Contact: Keith Wetzel <kawetzel@swbell.net>

Report on Moon Madness Night, January 5, 2007

www.moonsociety.org/chapters/stlouis/MoonMadness07.htm

The online report has details and pictures ot this annual student outreach event organized by Christine Nobbe.

Bob and Rufus man the Moon Society table. The Gravity Bricks got the most attention. Dave Heck gave a presentation titled "What to do with Space Station Poo"

Moon Society Phoenix Outpost Blog

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

Contact: Craig Porter <portercd@msn.com>

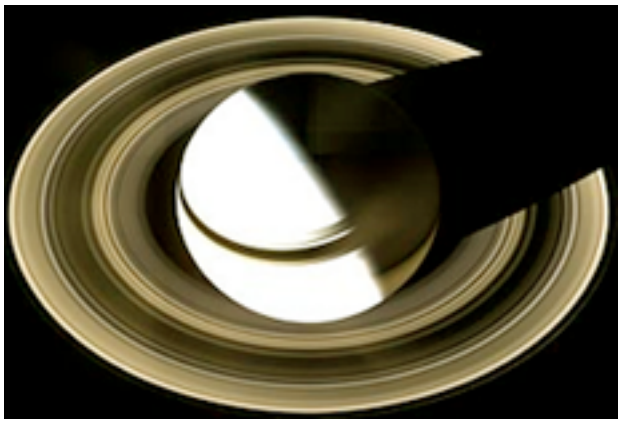
This is a very active blog worth a regular visit!

MMM PHOTO GALLERY

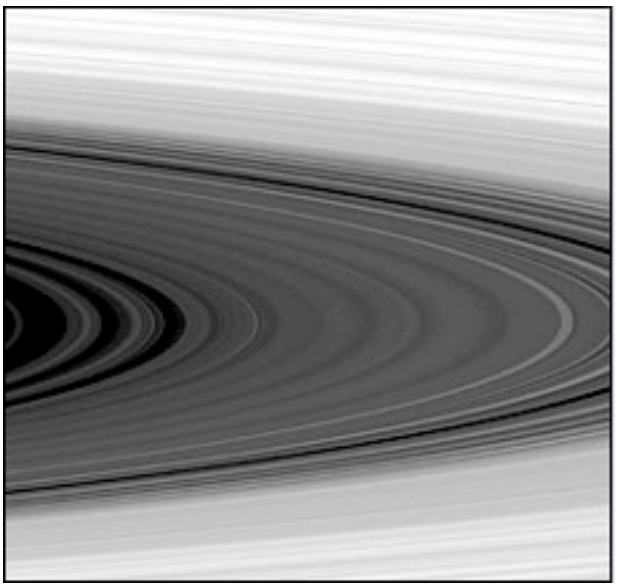
Great Snaps from Cassini @ Saturn

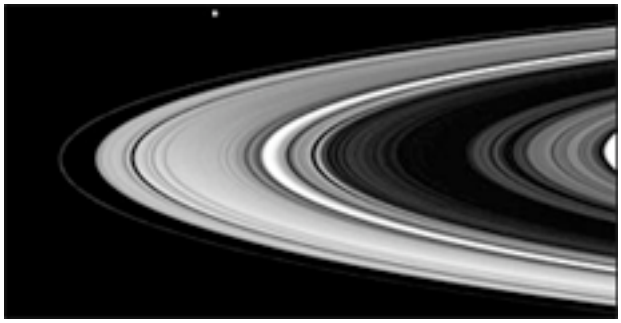
Cassini@Titan

from60°above

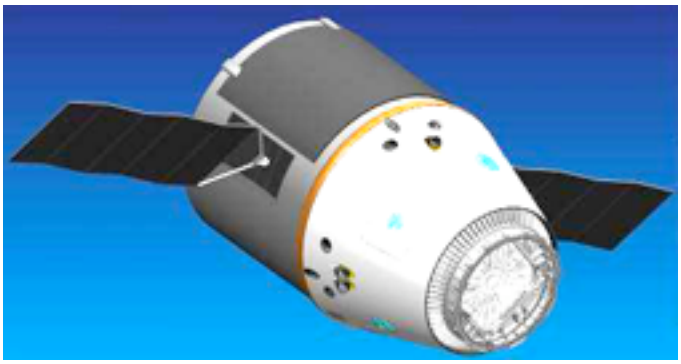


in near infrared light w Enceladu

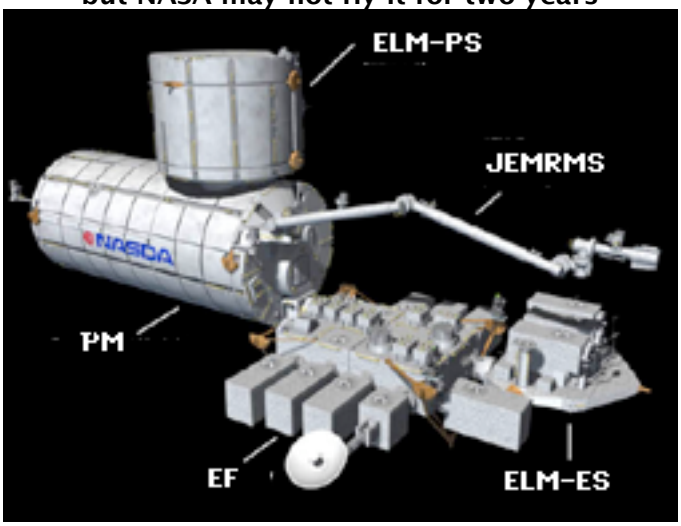




Details of Space-X' Dragon Crew/Cargo Capsule



Japan's Gem ISS Module shipped to Cape but NASA may not fly it for two years



KEY: ELM-PS = Exposed Logistics Module-Pressurized Section
JEMRMS = JEM Remote Manipulator System
PM = Pressurized Module; EF = Exposed Facility
ELM-ES = Exposed Logistics Module-Exposed Section

WORLD WATCH
AFD News Service

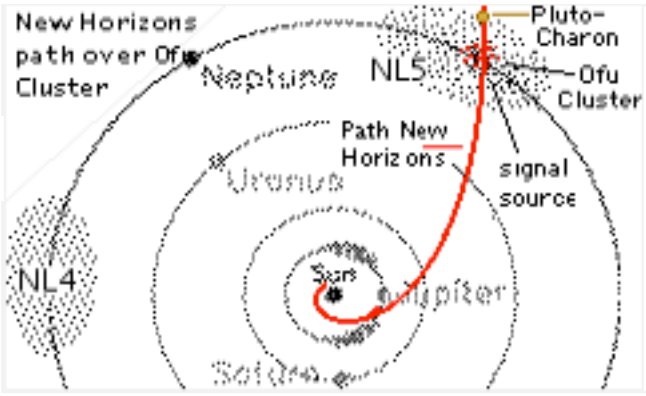
First L4 Neptune Trojans, now L5 Trojans, with a difference!

CERRO PARANAL, CHILE: On October 7, 2005 an object designated **2005 TN53**, some 230 km (140 mi) in diameter was discovered with the Magellan 6.5 meter telescope in Chile. It shares Neptune's orbit but at a relatively high inclination, oscillating above and below the orbital plane of Neptune at the L4 leading Trojan position, with the same period. This was the first Neptune Trojan to be discovered. Subsequently three more such objects were found, also in Neptune's L4 Trojan area.

The expectation is that the Neptune Trojans may be even more numerous than either the main belt asteroids or the Jupiter Trojans, but at that distance from the Sun they are hard to observe without the largest telescopes, using sensitive digital cameras. These Trojans may form thick clouds of objects with varied individual orbits. Those observed to date are all a similar pale red hue. They likely share a similar origin and history. They predcde Neptune in their 166 year orbit period.

Now, using the new VISTA instrument (Visible and Infrared Survey Telescope for Astronomy) a veritable cluster of Trojans has been found in Neptune's L5 Trojans, trailing the gas giant in its orbit around the Sun. But these objects seem different. Christened "The Ofu Cluster" after its discoverer, Adamski Ofu, the over two dozen objects found exhibit no variability in magnitude or in light reflectance such as would normally suggest rotation of an irregular shaped object. Albedo, photometrics and polarization suggest all we see is sunlight reflected off the center of a spherical surface. They seem to be clones of one another. Unlike the L4 Trojans which appear to have been in place for billions of years, the dispersal pattern and slow mutual drift rates suggest that this formation may be only 65 million years old, give or take 5 million. That the individual members of this cluster are of the same age is no more than a reasonable conjecture, without direct evidence.

Just two weeks after the announcement of this discovery, the nearby new Atacama Large Millimeter/submillimeter Array (ALMA) was trained on the cluster and immediately picked up a narrow band, weak signal which so far is constant and without any detectable fluctuation or variance. "It's like what a homing beacon would be," said an observatory spokesman, "but, of course, there has to be some natural explanation."



By sheer coincidence, the Pluto and Kuiper Belt-bound ***New Horizons*** craft which just recently got a boost in speed and a change in direction as it passed Jupiter, will fly over the Neptune L5 Trojan area in the 1914-16 time frame. Alas, the probe is not equipped with an instrument that can detect the signal, and its path will take it high enough over Neptune's orbital plane, that the craft's optical instruments will not be of much use. "For now, we are all dumbfounded," ###

Russia's Romance with Venus is Rekinlded

MOSCOW, RUSSIA: Russia's romance with the planet Venus, which soon withered once the Venera spacecraft revealed the hellish nature of Venus' very hot high pressure atmosphere, seems to be experiencing something of a revival. Energiya S.P. Korolev Rocket and Space Corporation, powered by money from Volga Ceramics Corp., is in the early phase of an R&D program designed to produce temperature-hardened ceramic components for future **Venus** landers and orbiters. Energiya expects to have a durable hardened instrument package and rover ready to launch within the next five years. The design goal is a 90-day lifetime. Previous landers have lasted an hour or less before being fried in the intense heat. Volga Ceramics expects to find several profitable terrestrial applications for the ceramic lines it develops for Energiya. For this program, all components will be tested for prolonged service and reliability at a temperature of 550 °C = 1022 °F.

The instruments to be hardened include multi-spectral cameras, including one on a telescoping pole to provide panoramas from a height of 10 m., 31 ft. above the surface. A first weather station lander, if successful, may be followed by similarly equipped rovers deployed to investigate various areas of special interest. *Below:* Venera 13 image, reworked

Meanwhile, the Russian Space Agency Roscosmos is working on a Venus Aerostat Geochemical Mapper (VAGM) designed to float just under the cloud tops. Its mission will map the topographic chemical heterogeneity of Venus. The shifting location of the floater will be mapped by a trio of relay sats in orbit which will log how the floater drifts in latitude, at speed relatives to the surface, and in altitude, both relative to the surface below and to the cloud deck above, tracking also external pressure and altitude changes. Light sensitive instruments will not work between "Lightset" and "Lightrise" but other instruments will be working all the time. Information gathered from this mission will be used in designing superior floaters. in planning future Venus aerial science missions,

VAGM and the trio of relay sats will make the trip to Venus together, separating about a week before arrival, to follow their separate trajectories.

Our present image of Venus surface is based entirely on radar data, and shown in false colors indicating elevation. VAGM should produce a whole new look at our sister planet.

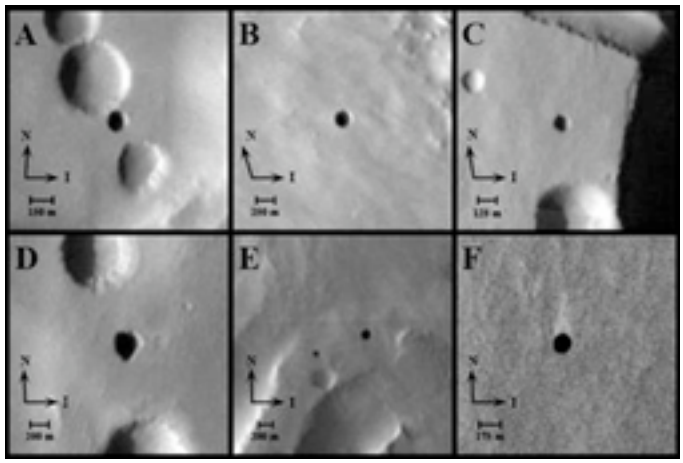
MMM's 20th Happy April Fool's Day News

7 Likely Cave Skylights Found on Mars

on the flanks of the Arsia Mons Volcano

MMM Special Report

http://cosmiclog.msnbc.msn.com/archive/2007/03/19/94112.aspx



Seven proposed cave skylights. Clockwise from upper left [and centered in each frame] are ***Dena, Chloe, Wendy, Annie, Abbey & Nikki,*** *and* ***Jeanne****.* Arrows show direction of solar illumination (I) and north (N).

March 19th, 2007: Researchers say pictures from a Mars orbiter show holes from 330 to 825 ft (100 to 252 m), across andd at least 240 ft (73 m) deep that may be the entrances to subterranean caverns. If the claims prove out, such caves would be prime targets in the search for Martian life and prime real estate for future pioneers.

"The possibilities are raised in a research paper [http://www.lpi.usra.edu/meetings/lpsc2007/pdf/1371.pdf] presented last week at the Lunar and Planetary Science Conference" – *online source cited above*

Lavatubes on Mars have been long suspected

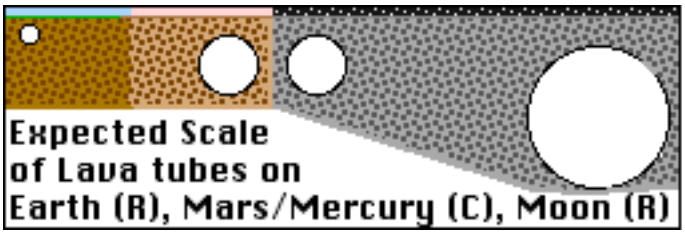
On Earth, we find lava tubes to be very common features of lava sheets and of shield volcanoes (article: http://en.wikipedia.org/wiki/Shield_volcano).

We have both types of features on Mars. In fact, the Tharsis shield, on which three of Mars' great shield volcanoes sit) is the most extensive and thick lava flow sheet known in the solar system. And Mars' great shield volcanoes ***Olympus, Ascraeus, Pavonis,*** and ***Arsia*** dwarf any similar features on Earth, where our largest example is the the Big Island of Hawaii, with its twin shield volcano peaks ***Mauna Kea*** and ***Mauna Loa.***

The Evidence from the Moon

The Apollo 15 mission to Hadley Rille was an eye-opener. We had no idea of how such winding "sinuous" rilles had formed. It soon became clear that this feature was the collapsed ruins of a lavatube of gargantuan scale. The implications are that the scale of lavatubes, both in length and cross section is in reverse relationship to the strength of the planet's gravity.

The Moon's gravity is 1/6th that of Earth's. Mars' gravity is 3/8ths that of Earth (as is Mercury's)



The implications were that there must be lava tubes of intermediate scale on Mars, honeycombing the flanks of the great shield volcanos and of the Tharsis Uplift in general. In MMM #73, March, 1994, Bryce Walden estimated, on the basis of a study of the Medicine Lake volcano in northern California, that Mons Pavonis, 700-1,000 times larger in mass, could contain 333 square miles, 874 sq km, enough space for a typical sprawling American city of one million people. [You can follow his reasoning on pp 10-12 of MMM Classic #8, download from www.lunar-reclamation.org/mmm_classics/]

Pavonis Mons, astride Mars' equator, is the one most strategically located, its west flank the best launch-track site in the solar system, its caldera rim the logical anchor of a space elevator. But all Mars' great shield volcanoes are potential ***megalopolis sites*** by some time in the next century.

Indeed, we have now found collapsed lavatubes galore on the flanks of Pavonis, and by implication, a many uncollapsed ones in the lava flow layers below. See the following story:

http://space.newscientist.com/article/dn9220-lava-tubes-snapped-snaking-across-mars.html

Lava tubes snapped snaking across Mars May '06

A clear additional advantage of choosing Mars' shield volcanoes as the principal frontier population sites is that should we succeed in restoring Mars' water-rich past, these areas will be high and dry. **</MMM>**

GREAT BROWSING !

Science is but one reason to return to the Moon
http://www.thespacereview.com/article/818/1

Nixon's Great Mistake: Scuttling the Saturn V
www.nytimes.com/2007/02/20/opinion/20porco.html?_r=1&ex=1329714000&en=6c99&oref=slogin

International Lunar Observatory Asociation
http://www.iloa.org/
http://www.iloa.org/iloa_news_v.1_i.1.html
http://www.iloa.org/iloa_news_v.2_i.1.html
http://www.iloa.org/moon_appendix.html

No Safe Place from Solar Storms in Solar System
http://science.nasa.gov/headlines/y2007/22feb_nosafeplace.htm?list161084

One Person's Vision of Our Future on the Moon
http://www.trinity.wa.edu.au/intranet/subjects/Astronomy/My Webs/Yr 8 Astro/RALLYING FOR A RETURN TO THE MOON.htm (leave in spaces or replace with "%20")

Time Capsule Photos en route to Pluto
http://planetary.org/explore/topics/time_capsule/selections.htm

"Fear Above, Terror Below" Mars Fiction
http://www.crazy4mars.com/story4.html

SMART-1 and future Lunar Probes
http://www.esa.int/esaCP/SEMEZ2N0LYE_index_0.htm

Lunar Railroads and Transportaion
http://www.lunartransport.blogspot.com
www.lunar-reclamation.org/papers/rr_moon.htm
write kokhmmm@aol.com to join our brainstorm team

Craft may surf the solar system on magnetic fields
http://space.newscientist.com/article/dn11375

Mars Rovers Get a Brain Boost
www.astronomy.com/asy/default.aspx?c=a&id=4975

Titan Lake 20% Larger than our Lake Superior
www.astronomy.com/asy/default.aspx?c=a&id=5275
[photo comparison] www.astronomy.com/asy/objects/images/superior_comparison_500.jpg

Congressional Testimony on Asteroid Hazzards
http://impact.arc.nasa.gov/gov_earthasteroids_4wh.cfm

Military Micro-satellites to Hunt Down Asteroids?
www.space.com/scienceastronomy/solarsystem/neo_defense_000207.html

***Early* NASA expectations for Shuttle Applications**
http://history.nasa.gov/SP-432/ch9.htm#66

Space Tourism and Greenhouse Gas Emissions
http://www.thespacereview.com/article/813/1

Can Comeercial Space Enterprises Make Money?
http://www.thespacereview.com/article/812/1

"Capricon One" Revisited
http://www.thespacereview.com/article/811/1

The Flipside of the Fermi Paradox, Man's Future
http://www.thespacereview.com/article/810/1

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

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Newsletter Mailing - Carol Nelson 414-466-2081
(*Board Members & Ken Paul <kenpaul@cape-mac.org>)

LRS News

• **Bob Bialecki and Peter Kokh** are making progress on a new publishing and mailing routine that should result in MMM getting into the mail 2-3 weeks earlier than has been the case - see page 10, column A, above.

• **Astronomy Day:** It was a great idea, piggybacking on an event planned by the Northern Cross Science Foundation for an event in Harrington Beach State Park. If we want to do something like this next year, we have to start now looking at the obstacles and addressing them. For one, we do not have any event-appropriate materials and displays ready. A display on Astronomy from the Moon would be great but take some time to prepare.

LRS Upcoming Meetings & Events:

Meeting Location, Time, Agenda

Mayfair Mall, Garden Suites Room G110,
2nd Saturday of the month (ex. ~~July~~, ~~Aug~~) **1-4 pm**
AGENDA: www. lunar-reclamation.org/page4.htm

April 14th Meeting

Agenda: √ See notes about new MMM Mailing routine and about preparation for Astronomy Day, above. √ a brief, stunningly **beautiful PowerPoint presentation** showcasing Earth from Space and featuring night time city lights around the world, put together by the Moon Society St. Louis Chapter √ A preview of ISDC 2006 in Dallas

May 12th Meeting

Agenda: Peter will be out of town for a family wedding. General discussion of Space news

June 9th Meeting

Agenda: √ Report on ISDC 2007. √ Possible plans for summer events, and a look ahead at the Fall Calendar

MMM 7 NSS Chapters Strong

NSS Chapter Events

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

Oregon L5 Society

P.O. Box 86, Oregon City, OR 97045
voice mail / (503) 655-6189 -- FAX (503)-251-9901
[http://www.OregonL5.org/]

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

Meetings 3rd Sat. each month at 2 p.m.
Bourne Plaza, 1441 SE 122nd, Portland, downstairs
Next Meetings: April 21, May 19, June 16

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

INFORMATION: Larry Ahearn: 773/373-0349

Minnesota Space Frontier Society

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

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

[www.mnsfs.org/]
MN SFS News & Pictures

MarsCon 2007 Pics
http://freemars.org/mnfan/MarsCon/2007/
http://freemars.org/mnfan/MarsCon/2007/2007-March3-101.jpg

Twin Cities Regional Science Fair - MNSFS Certificates: Billy Bird, Up Up & Away; Kristina Netterlund, Floating on Air; Hannah Perry, Aiming for the Stars; Shane Gallagher & Luke Wirth, Paper Airplanes; Tou Moua, How Paper Airplanes Fly; John Woolfrey, Aerodynamics; Brennan Stitt, Does Parachute Diameter Affect the Rate of a Rocket's Descent; A.J. Carlson, Rockets in Flight; Caitlin Lewers, Weight vs Gliding Distance

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042-1034

c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@charter.net>
>>> **DUES:** "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020

[http://www.tcei.com/sss/]

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

April 19th The Stoelting House, **Kiel**
May 17th: UW-Sheboygan, Room 6101, **Sheboygan**
June 21st The Stoelting House, **Kiel**

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105

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

[http://pasa01.tripod.com/]
[http://www.phillypasa.blogspot.com/]

PASA regular business luncheon/formal meeting from **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 or Mitch 215-625-0670 to verify all meetings.

Next Meetings: April 21, May 19, June 16

March 11 Meeting Notes: Our meeting took place on Sunday March eleventh to that members who work Saturdays would be able to attend. Instead, we where fortunate in having an appearance by Ray Katz a space advocate that learned of our meeting from our website. More , in his guest report, later.

Event Report: at the end of February and in early March, through an invitation from the George Washington Science Fair, our group was again privileged to give awards in memory of several of our past members. We give an award at the Elementary and Mid and Senior High level, with the Elementary being The James H. Chestek and, for the seventh to twelfth grades, The Oscar H. Harris Award.

The awards are for work that our judges believe are space science and technology related. Three of our members, Michelle Baker, Mike Fisher, and Alex Howerton, where our award judges. The James H. Chestek Award was given to Dennis Brusilovskiy for his research titled "Where is the Point?" in which he looked at the effect of of medium on laser beam travel.

Our Mid and Senior level Oscar H. Harris Award winner was Bansi Bhatt for her work on "Magnetic Fields: Does it Affect Plant Growth?". She found that the field does alter growth. This is useful to us and builds on her earlier work. She was a winner in this same work several tears ago and is doing this study as a multiyear project. The prizes given where: an R/C "Flying Saucer" , a combination Laser pointer and night light, and a kite, for Dennis. For Bansi I gave: an MP3 player, a miniature digital camera (which could do still or short video clips) and the Laser. In addition both received a plant seed starter kit which was given with the explanation that "wherever we go we will take a little part of Earth with us". I thought this was in harmony with our goals. We where thanked by Thomas Anderson, a founder of the Fair, for our participation.

Guest Ray Katz had great additions to our meeting and brought his activities in space education and outreach to us. He currently has material on exhibit at The Frontiers of Flight Museum in Dallas Texas. One of the neat things he got to do was visit "the back room" of the museum and see archival artifacts like a M.O.L. space suit. This early 60s outfit was blue. He is hoping to move into the space exhibit and education field after having built a successful Internet business, with a partner, that has produced the money he can use for these ventures.

We discussed the possibility of him and several organizations and individuals being brought together by us. We have Alex Howerton and his parent company, Environmental Tectonics Corp. as some of the possible excellent contacts in business, with Derrick Pitts and The Franklin Institute in the education field. Ray also will be checking with several New York possibilities, thanks to Dorothy Kurtz, including the Hall of Science and another Worlds Fair site. Oh, did I mention his project with" The History Detectives" TV show?Thanks for coming Ray.

Michelle Baker reported that we are solvent and that its time to pay annual membership dues. She also pointed out that the president, me, should renew for NSS as well as PASA We talked of the mailbox again but, since no one who talked about dropping it was willing to take over the responsibility or offer a practical solution, we will maintain the box for the foreseeable future.

Dorothy Kurtz brought material on the Ahnghito Meteor , retrieved by Admiral Peary during his expedition to Greenland, being displayed in The Hall of Meteors section of The Rose Planetarium, a part of The American Museum of Natural History in New York. Really impressive chunk of iron rich material. I found it described in an old reference where its apparent age was listed as less than a million years due to a low level of helium three found in the "skin" of the object. Neat.

Larry reported on the increased number of hits we have been getting on our site and some news on cool stuff we can do if we add some Google Gadgets to our browsers. We can now view NASA tv on our computers! You have to have at least Internet Explorer V7 + to view it but we can finally get it. Larry brought screen shots to encourage us. He also brought the sunspot activity records and predictions again causing a talk on weather effects, and the perils to our technologies to go forward. A "Super Storm" on the Sun could cripple some of our new wireless infrastructure as well as the power grid. Some ideas where expressed on the need for "Early Warning" of this as a practical reason for extending our solar probes into a network of monitors to let us activate safeguards against the effects.

Mitch gave us several reports including one about a possible venue that we found comical by its incongruity. An astronomer at a major university in our area thought a talk on space exploration at the university. [sic] This was very funny, considering that the talk was to be the up close and personal exploration of a celestial body and the speculation on what we could learn on the development of planets and life on them. A major reason for funding astronomy and space exploration is to find out if we could benefit from what we find in practice as well as for intellectual satisfaction. I think the students should be given the chance to hear us at another venue and think that Mitch should continue.

Mitch also brought in the March/ April issue of The Futurist Magazine with an article on "Swarm- Bots" where a group of antlike robots would be used for a variety of exploratory activities. By Marco Dorigo. This is about ongoing work at NASA to create a low vulnerability, high mobility exploring system. We discussed some of the exploration devices we had seen, both for space and Earth. Mitch also brought up another important topic: The 50th Anniversary of Space Exploration. We should start working on this now so that we will be good presenters and advocates on this October celebration. Mitch will work on getting local art institutes and schools involved in this. Go Mitch!

Janice brought up asteroid impact again, describing her work on the potential impact effects of Apophis if it hits us. On reviewing the Popular Mechanics article that was one of her references, I noticed that it did not have information from her current report: the asteroid will close approach Venus on one of its passes. This will be in 2016 on the inward leg. She also reported that she was looking into the calculation of the orbit and potential damage. Hopefully, she has plenty of time for this. An added note: in the article mentioned above; the orbital data being used for the studies is being gathered via the Arecibo Radar Telescope. There's a problem with this however: a committee has recommended shutting down the system! Replacement(s) for this, and other major instruments, is being recommended, but this looks like one we better keep going. Go Janice!

Earl brought a few space and science oriented materials: from Nuts and Volt we have short pieces on cleaning of nano tubes. The National Institute of Standards & Technology has found a way to remove contaminants from amongst the tubes. Among other uses, the nano tubes can be used to improve the sensitivity of optical detectors as well as the usual geosynchronous tower that we sometimes read about. They used a laser ablation technique for this. Much other geek stuff and the ongoing Near Space column. This installment is on charting your balloon flight based of using Google Earth. this is a cool application of publicly available software.

You download the basic software to your Pentium 3 (or Mac 3), 500 mhz minimum, and a fast phone connection. You then write your instructions in KML. The article includes a "how to" on using the software and examples of flights.

Mr. Verhage has also set up a website showing past missions and KML files for many of them. From the March edition of the magazine. In Analog magazine for May is a fact article on not being able to talk to aliens," I Couldn't Read You, E.T." by Henry Honken on the real difficulties of understanding what other Earth societies are saying. He gives a number examples of different tough languages we have, and the further problems of beings with different vocalizing equipment. Anyone who has seen the work done to decipher human communications in physical form, Linear B and Quiots come to mind, will get an inkling of what we really might face. But we have to get ourselves "out there" in the meantime.

And finally, from The AMSAT Journal, the continuing project called "SuitSat" which involves the novel use of worn out space suits for educational purposes and entertainment. A few people do the hard part of getting this kind of project to operate (a few is a few dozen in this case) and tens of thousands enjoy using their results. Suitsat II will use a solar cell array to charge secondary cell batteries and will incorporate, the currently hot, "Software Defined Radio". This is a system where you can change the functions rapidly from stored or transmitted instructions. Students at The College of New Jersey are working on this.

Another article: "Why Can,t I Hear AO51?" is in a technical vein describing the sort of system that "makes the margins" for successful acquisition and recovery of this satellites' (and others) signals. I think that this would be the first amateur flight of this technology. More cool stuff on tracking and using weather satellites and the use of a package called Nova. It is reported to be better in resolution, and has more features, than others. And more as usual. Authors : H. Paul Shuch, Phd (N6TX), The Orbital Classroom, Mark Spencer, Satellite Signal Strength, and Mark Spencer (WA8SME) again, for Bringing Space Into Your Classroom. As it happens Paul is the AMSAT Director of Education, and Mark is the ARRL Education and Technology Program Coordinator.

Websites/Blogs: Our blog is: phillypasa.blogspot.com, museumofspacetravel.com,. analogsf.com, amsat.org, nastarcenter.com, nutsvolts.com, nss.org, marssociety.org See more at http//pasa01.tripod.com/ . Submitted by Earl Bennett

SOLAR SYSTEM AMBASSADORS
www.jpl.nasa.gov/ambassador/

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CALIFORNIA

OASIS: Organization for the Advancement of Space Industrialization and Settlement
Greater Los Angeles Chapter of NSS

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

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

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

Regular Meeting 3 pm 3rd Sat. each month
Microcosm, 401 Coral Circle, El Segundo.
• June18 th - July 16th - August 20th

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

Upcoming Events

- **Sat. April 12th - L.A. Party, 7:30 pm** - Griffith Observatory, 2800 East Observatory Road, LA. info: alicia@yurisnight.net - www.yurisnight.net/2007/
- **Fri. Apr.l 13th, 7:30 pm** -Santa Monica Amateur Astronomy Meeting - http://connect.to/smaac "The Genesis Mission-Sampling the Stuff of Our Sun"
- **Sat April 14th, 2:00 pm** - "Space - Star Stuff" Film introduced by Edwin Soedarmadji of Caltech's Electrical Engineering Dept. Discussion afterwards, $5 Beckman Suditorium, Caltech, Pasadena map at www.admissions.caltech.edu/visiting/campusmap.htm
- **Sat. April 21st, 3:00 pm** - OASIS Board Meeting at the home of Craig and Karin Ward, 1914 Condon Avenue, Redondo Beach.

Looking Ahead

- **May 19-20, JPL Open House** -- The Jet Propulsion Laboratory will host its next Open House on Saturday and Sunday, May 19th and 20th, 2007 from 9am to 5pm both days. For more information, visit http://www.jpl.nasa.gov/pso/oh.cfm.
- **May 24-28, International Space Development Converence** -- The 2007 ISDC, Dallas, Texas at the InterContinental Hotel. http://isdc.nss.org/2007/

Recuring Events

- **Fridays** -- Mike Hodel's Hour 25 webcast. The world of science fact and fiction with interviews, news, radio dramas, artists, writers, stories, reviews, and much more. Information: http://www.hour25online.com/.

Note to readers: As OASIS does not publicize its events on its website more than a few weeks in advance, we regret that we cannot give you advance "heads up" on upcoming events in the month or two ahead. Do consult the website for the latest information. - The Editor

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○ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

○ $12 low "one rate"

MINNESOTA SPACE FRONTIER SOCIETY

○ $25 Regular Dues

OREGON L5 SOCIETY

○ $25 for all members

O.A.S.I.S. L5 (Los Angeles)

○ $28 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE

○ Annual dues for all with MMM $25, due in March or $6 times each quarter before the next March

SHEBOYGAN SPACE SOCIETY (WI)

○ $15 regular, ○ $10 student,

○ $1/extra family member

"SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020

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