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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

196 JUNE 2006

Published monthly except January and July., by the **Lunar Reclamation Society** (NSS-Milwaukee) for its members, members of participating **National Space Society chapters**, members of **The Moon Society**, and individuals world-wide. EDITOR: Peter Kokh, c/o LRS, PO Box 2102, Milwaukee WI 53201. Ph: 414-342-0705. **Submissions:** "MMM", 1630 N. 32nd Str, Milwaukee, WI 53208; Email: kokhmmm@aol.com

In FOCUS: Russia to return to the Moon, with gusto!

June 5, 2006: Aviation Week & Space Technology reports that Russia is planning an ambitious return to the Moon. In the works are a lunar orbiter "mother ship" that will send some 13 probes to diverse surface regions, including two penetrators to be aimed at the Apollo 11 and Apollo 12 landing sites. The idea is to gather data on the subsurface that will add to the site characterization done decades ago by U.S. astronauts. The orbiter will also pepper the surface with ten other penetrators to form a seismic network that might shed light on nagging questions about the origin of the Moon.

One last penetrator will be targeted to the same south polar crater to be visited by a U.S. probe in 2008 to gather complementary evidence and data.

The new Russian Mother Ship and Penetrator Fleet is code named "Luna-Glob" and has a tentative launch date of 2012. This adds one more player to the grand "assault" on the Moon's mysteries, as Russia joins the U.S., China, India, Japan and Europe, all of whom have Lunar missions in some stage of planning.

Prior to Luna-Glob, however, Russia has unfinished business out by the two mini moons of Mars. Both of the Soviet Union's ambitious Phobos craft failed. But this won't be a Phobos rerun. Instead, the Russians are planning a sample return mission. At stake may be the viability of a future Mars frontier economy. With little one can think of that Mars would have to sell to Earth or Earth orbit, if Phobos turns out to have water locked up in its rocks, that would be marketable to the Lunar Frontier. We once thought that both Phobos and Deimos were captured carbonaceous chondrite asteroids. We are no longer so sure.

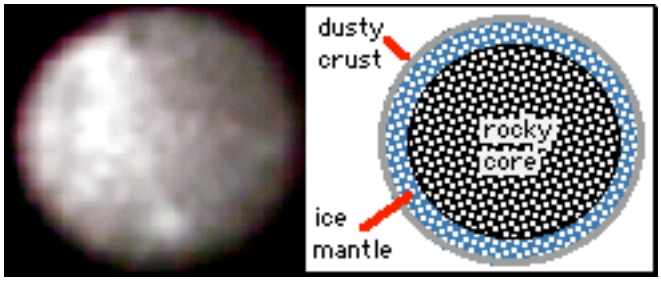
But the fact that these two moonlets are well up on the shoulder of Mars' gravity well, makes any products produced there important in balancing the Mars Export-Import Equation.

We are happy to learn of these two initiatives. Russia is barely half the population of the former Soviet Union, but it still has the cosmic wonder and wanderlust, and enormous talents to contribute to humanity's push to leave our cradle world, exploring, then settling elsewhere.

That "Russia is back" may be taken more seriously by Congress and the media than the really quite respectable Indian and Chinese efforts. If this respect helps prevent another round of program gutting cuts and stretchouts by an unappreciative Congress in the face of growing debt, that will be a big plus, and a boost for our hopes as well. *PK*

Ceres – biggest asteroid or "embryonic-planet?"

New observations of Ceres, the first, and by far the largest, asteroid ever to be discovered, suggest a rocky core surrounded by a substantial water-ice mantle and a thin dusty crust. These are resources that, if properly developed, could make Ceres not only the gateway to the asteroid belt, but perhaps the gateway to the entire outer solar system. See pp. 4-6 for more facts and possibilities.



Moon Miners' Manifesto

Moon Miners' MANIFESTO/ Moon Soc. Journal is published every month except in January and July.

• **Moon Miners' Manifesto CLASSICS :** Beginning with 'July 2004, we have begun an effort to re-edit, reformat, re-illustrate and republish the timeless articles of MMM's first ten years, with the intention of publishing two issues, each covering one year, in PDF format only, for free downloading, each January and July.

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

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

• **MMM retains its editorial independence.** MMM serves several groups each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test. Any presumption that participating organizations can be labeled by indirect mutual association is unwarranted.

• For the current 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 non-profit membership organization engaged in public outreach, freely associated with the National Space Society, insofar as LRS goals include those in NSS vision statement. LRS serves as NSS' Milwaukee chapter

=> www.lunar-reclamation.org

• **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 40 chapters, dedicated to the creation of a spacefaring civilization.

The National Space Society, 1620 I Street NW, Suite 615, Washington, DC 2006; Ph: (202) 429-1600 <= NEW HQ

FAX: (202) 463-8497; nss@nss.org => www.nss.org

• **MMM's desktop publication** has received computer hardware and software support from the **Space Frontier Foundation**, 16 First Ave., Nyack NY 10960; 800-78-SPACE - SFF seeks to open the space frontier to human settlement as rapidly as possible.

openfrontier@delphi.com => www.space-frontier.org

• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges necessary to establish a permanent, self-sustaining human presence on the Moon." — See contact information on page 9.

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

• **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.

√ **EMAIL** to KokhMMM@aol.com (***preferred***)

√ **Mac compatible CD / typed hard copy** to:

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MMM Classics Project Completed "The First 14 Years"

Just two years ago, in MMM #176, we announced that we were discontinuing the **Moon Miners' Review**. MMR, which appeared every January and July (originally August), was a twice yearly publication designed to be less demanding and thereby give the editor a biannual burnout-prevention break and time to recharge his batteries. We announced a plan to "re-edit, reillustrated, and republish instead the non-time-sensitive articles from the first 10 years, from MMM #1 in Dec., '86 through MMM #100 in Nov. '96. Each volume of the "**MMM Classics**" would cover one full year. Our intent was to publish two volumes each January and each July. The first four volumes were the hardest, as they were either typewritten or done on a vintage Commodore 64 - in both cases we had only hardcopy to go by. Once we got past these four years with help from others, the going got easier. We finished the first ten years six months ahead of schedule, this past January, and decided to continue.

As of June 7th, 2006 the first 14 years of MMM are now preserved in 14 pdf file collections, one per year, covering issues #s 1-140 from December 1986 through November 2000, in two locations:

www.lunar-reclamation.org/mmm_classics/
www.moonsociety.org/publications/mmm_classics

Both sites are freely accessible to anyone. You can download and print these files at will, and share them with anyone.

In May, 2001, we began creating pdf files of each issue, storing them on a Moon Society access-restricted site. MMM issues #145 to current (this being #196) are there. You need to be a current Moon Society Member and have a username and password to access them.

If you are keeping count, that leaves four issues in limbo, #s141-144. What to do with these? We have a problem. After a 2003 computer crash, while rebuilding my files on a new computer from back up CDs, I accidentally overwrote a newer folder containing those completed issues, with an older one which contained only placeholder folders. The result is that nowhere in creation do those four issues exist except in hardcopy form. So whether I add them to the Classics or to the Moon Society pdf issue archives, I have to reconstruct the original documents from which to create pdf files.

Next, I hope to create an online keyword linked index of all issues, and compile a glossary of "MMM Speak" -- old words given new meanings, and new words coined to convey totally new ideas.

The MMM Classics, The Index, and the Glossary are our way of celebrating MMM's 20th anniversary, coming up with the December issue, #201. **PK/Editor**

Scientific–Industrial Utilization of the "Lunar–Unique" Environment

by Peter Kokh

- □ **high vacuum** (vastly cleaner and higher than in LEO)
- □ **no global magnetic field** (unlike in LEO)
- □ **fractional gravity** (mechanical advantage over 0-g)
- □ **minimum atmospheric activity** (levitated dust at dawn)
- □ **seismically stable** (geologically dead)
- □ **sterile environment** (no air, water, soil pollution)
- □ **slow rotation** (once every 29.5 Earth days)
- □ **minimal seasonal thermal variation** (3° F/C?)
- □ **no humidity/water vapor** (exhaust dissipates to space)

The challenge is to *identify scientific, chemical, and industrial processes* that one or more of these unique environmental characteristics makes *practical or possible on the Moon that are impractical if not impossible here on Earth or in Low Earth Orbit* (i.e. at ISS or other future orbiting laboratories or factories).

Yes, you've heard a similar question posed before: what can we do in the micro-gravity of Earth orbit that we cannot do here on Earth's surface? We have yet to find potentially *profitable and practical* applications for processing and manufacturing at "zero-g" ("micro-g" may be more *picky*-accurate) in space stations and orbiting factories. But that should not discourage us from looking for similar advantages that the Moon's unique environment may offer. We owe it to ourselves to go through the exercise!

That LEO offers zero-g and the Moon only 1/6th gravity is not grounds for dismissal. "Fractional gravity" may preclude some chemical processes but it confers a very real mechanical advantage to materials handling and other mechanical opetatins.

And the Moon offers more advantages that LEO or other orbital locations do not:

The vacuum above the surface layer that is periodically "spoiled" by levitated electrostatic dust at dawn is much cleaner than the permanently dust and debris ridden low Earth orbit area, simply because that light one-sixth gravity continually purges that vacuum of foreign material including corrosive free oxygen.

LEO is very much affected by Earth's global magnetic field. The Moon, lacking such a field, has the advantage whenever background magnetism can affect a chemical or physical reaction negatively.

The Moon supplies an extensive seismically quiet (in comparison to Earth) platform for use of **global telescope arrays**. The only disturbances come from impacts, not tectonic plates in movement. Are there other advantages to this seismic quiet that may benefit research or industry?

That the payoff is yet to come from the so-called advantages of "doing it in Earth orbit" should not dissuade us from looking for possible processes and research that are uniquely favored by the special combination of scientific environmental assets given above to "doing it on the Moon."

If there are no areas of industrial and scientific activities better suited to the Moon than to either Earth or Mars, that would be surprising. The payoff to those advantages we find and are able to leverage *could make minor contributions to the economic viability of lunar settlement*. But until we find out otherwise, we cannot rule out the possibility that the payoff could be economically significant.

This line of research is certainly worth pursuing, and some of this research may not need to wait until we find ourselves on the Moon with adequate laboratories and other facilities. If lunar settlement and industrialization is to be viable, every area of possible advantage must be explored and pushed to the limit. The issues are technical, however, and it is for specialists in each of the many areas of science and indus-try to identify operations that would benefit form the "Lunar-Unique" environment.

That should not discourage reader suggestions, however, and MMM very much welcomes reader input in this and all other areas. "Experts" often wear the horseblinders of their special area of expertise and that does not let them see all the inter disciplianry opportunities that may be there. Even if you are not able to develp an idea in depth, you may be able to hit on something that others can take to the next step.

Some likely applications:

Biology

- □ Quarantine Biology-Lab for Mars Sample Returns, Europa Sample Returns

Toxic Chemicals, Nuclear Wastes

- □ safe storage in remote craters or isilated lavatubes.

Astronomy

- □ Radio and Optical Telescope Arrays (interferometers)
- □ Northern and Southern hemisphere telescopes that can be focused on a given circum polar stellar object "24/7/365" (vs. a fraction of a day for only a part of the year)
- □ very large Arecibo-type radio dishes in craters, of which many thousands would be suitable

Energy

- □ Solar power arrays
- □ Power beaming from tower to tower rather than transmission by cable, above or below ground.

Architecture/Construction

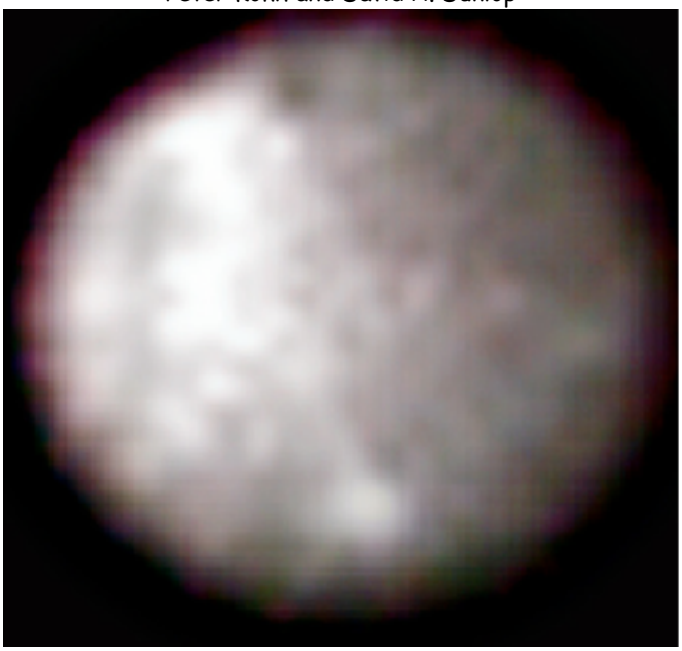
- □ Very tall towers are possible, kilometers high, for observation, relays, cable and cableway suspension, etc.
- □ Extensive use of Magnesium and ironfor surface construction it (both would quickly oxidize on Earth)
- □ Mag-Lev railways where speed is not limited by air-resistance or weather conditions

There may be many more areas of advantage and of application. Do send your suggestion to kokhmmm@aol.com or by mail to the MMM submission address below the front page masthead. ▲▲▲

CERES ♀

Ceres – *Largest* Asteroid or *Mini*–Planet?

Peter Kokh and David A. Dunlop



This contrast-enhanced false-color composite of Ceres is made from Hubble Space Telescope visible and ultraviolet images.
http://www.astronomy.com/asy/default.aspx?c=a&id=3478

Relevant Reading from Past Issues of MMM

MMM #24 April '89, "Ceres, Pallas, Vesta" pp. 4-6
republished in MMM Classics #3, pp. 23-24
www.lunar-reclamation.org/mmm_classics/mmmc3_Jan2005.pdf
MMM #70 Nov. '93, "Asteroid Workshop, Part I, A Permanent Main Belt Service Center on Ceres, pp. 3-8
republished in MMM Classics #7, pp 62-66.
www.lunar-reclamation.org/mmm_classics/mmmc7_Jan2006.pdf

DAWN: NASA's Mission to Vesta and Ceres

http://dawn.jpl.nasa.gov/mission/index.asp

- **Mission reinstated**, March 27, 2006
  http://www.nasa.gov/home/hqnews/2006/mar/HQ_06108_Dawn_reinstates.html
- **Dawn's Early Light** online newsletter (html or pdf)
  http://dawn.jpl.nasa.gov/DawnMedia/index.asp
- **First purely scientific NASA solar electric mission**
- **Dates:** Launch June or July 2007 on a Delta 7925H Vesta encounter 2011, orbiting Vesta for 7 months, Ceres encounter 2015, orbiting Ceres indefinitely
- **Craft 90% assembled** at Orbital Sciences

The occasion for this brainstorming article is the recent announcement that Ceres may have a water-rich mantle.
http://hubblesite.org/newscenter/newsdesk/archive/releases/2005/27/

We have always known that Ceres was by far the largest asteroid. Now we realize that in resources as well as size and location, it may be the best-endowed. As such, it is sure to play a major role in humanity's expansion beyond the orbit of Mars. Our aim is to sketch the possibilities.

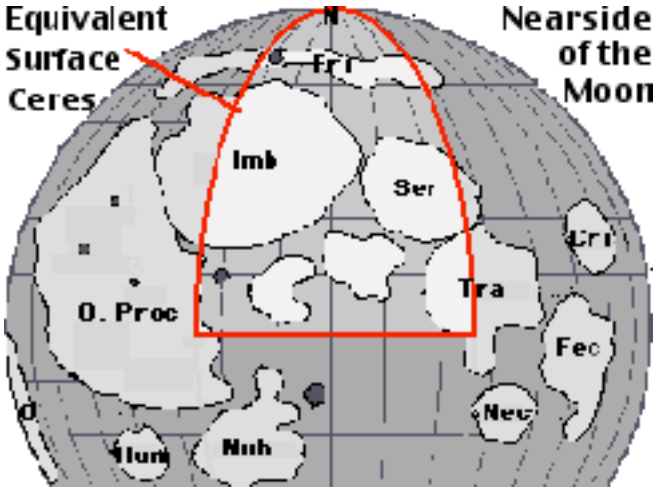
Sizing Up Ceres

DIAMETER: equator: ~975 km (~606 mi); polar: ~909 km (~565 mi); mean: ~950 km (~590 mi)

SURFACE AREA: 3,160,000 km2 (1,219,000 mi2)*
[*based on former diameter estimate of 1003 km]

COMPARABLE TO:

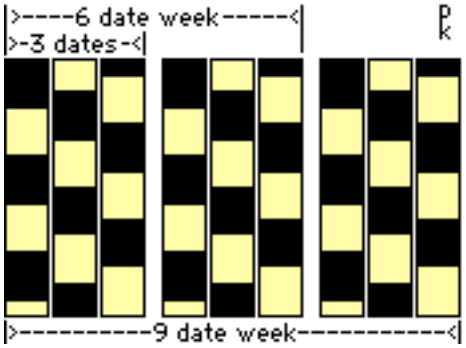
- □ All of India (1,229,737 sq. mi.)
- □ 40% of the Continental U.S.= either east or west of the plains states (i.e. excluding North Dakota thru Texas)
- □ Queensland plus Northern Territory in Australia
- □ A slice of the Moon from the Moon's N pole to its Equator, and from 27 °W to 27 °E:



CLASS and COMPOSITION: Carbonaceous chondrite. Stony (silicates and metal oxides) with admixed water ice and hydrates.

ROTATION PERIOD (one sol): 9.08 hrs.

POSSIBLE TIMEKEEPING SYSTEMS: a 2-date cycle of 5 periods would yield dates 22 hours 42 minutes long.
A 3-Date cycle of 8 periods = 24 hrs 12.8 min per Date



GRAVITY: 19% Moon's, 8.31% Mars', 3% Earth's. That *might or might not be just enough* to make gravity-dependent body functions work without providing an artificial gravity environment.

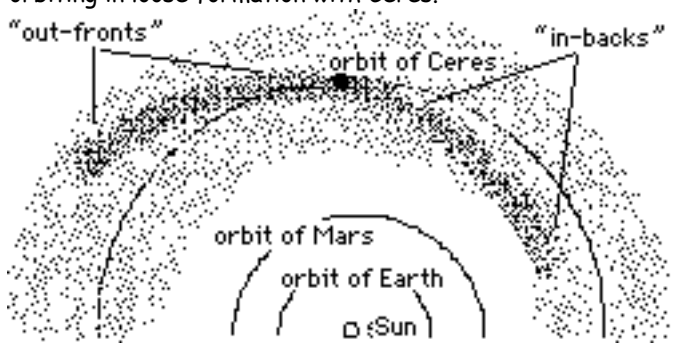
DISTANCE FROM SUN: 381-447 million km = 237-278 million mi. = 2.55-2.99 A.U. 1 A.U. or astronomical unit = the Earth's average distance from the Sun. At this distance, Sunlight at Ceres ranges between 15.4% and 11% of that reaching Earth, per square meter. To do the same job, as a solar collector 1 meter on a side on Earth, you would need a collector 3 meters on a side on Ceres. *That is still doable.*

A Supply and Staging Center for Belt Operations: Should it be Mars or Ceres?

The Catch-22 of orbital mechanics, something that is commonly ignored, is that the closer two bodies are in orbital period, the less frequent, on the average, are the launch windows between them in either direction. That Mars is closer to the Belt is a liability, not an asset. In fact, the Moon is the better choice with much more frequent windows to most of the asteroids.

Ceres and its "Flock"

While the Moon may be the jumping off point for asteroid belt operations early on, in time, facilities at Ceres could grow to become the center of operations within as much as a third of the Belt, especially for asteroids "orbiting in loose formation with Ceres."



Ceres' orbit within the Main Asteroid Belt and the swath, in relationship to Ceres' position, in which we'll find asteroids that will orbit in formation with Ceres for many decades.

Ceres' "Service Area"

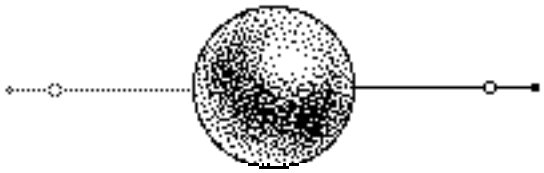
If the stats for the first hundred s asteroids to be discovered are typical,

44% have orbital periods within 10% of Ceres' so that one third of these or almost 15% of all asteroids would be within 60 degrees of Ceres at any given time and remain there for fifteen years or longer before drifting out of range. Some asteroids will 'fly in formation' with Ceres for centuries. Two target groups emerge:

- **'out-fronts'** ahead of Ceres but in slower larger orbits
- **'in-backs'** behind Ceres but in faster smaller orbits.

At any rate access to 15% of the Belt should do us well for quite a while. Between Ceres and loosely co-orbiting asteroids, craft could come and go at most any time with the only the trade off between speed and most economical use of fuel being the only real variable. As most of these trajectories will not be very eccentric, speed will be a minimal factor.

Ceres has a close in synchronous orbit just 782 km or 486 miles above the surface. Given Ceres low 3% Earth-normal gravity, an **Elevator-tethered Synchronous orbit Outpost Terminal** in the form of a **Torus** or **Cylinder** is much more feasible around Ceres that around Earth or Mars. (It is not possible for the Moon at all!)



Distance *to scale* of an orbital "**Sync Port**" above Ceres surface, showing elevator/tether and counterweight. Many of Ceres' port functions could be more efficiently conducted at Sync Port. The materials needed to build such an elevator are not only much less in total mass (than for Earth or Mars) but also much less demanding in performance parameters. Such an elevator could be built with today's technology.

Facilities on Ceres itself

In time, engineering development for belt needed equipment (prospector ships and tools, mining equipment, mass drivers, smelting equipment) could switch from the Moon to this regional center. Experience gained on this colder, wetter world could prove useful for ventures beyond the Belt. While mining, processing, and manufacturing facilities would be on Ceres' surface, the actual Port of Ceres spaceport could be better located in the close in synchronous orbit, with freight elevators carrying goods (and people) between "SynchPort" and the surface.

At the Asteroid Workshop in Huntsville during ISDC 1993, we spent some time better defining which functions the Ceres Settlement* would fill, and of these, which were appropriate for Ceres' low mini-gravity, which would be better placed in a surface artificial gravity environment, and which would best be filled in an elevator and pipeline cluster tethered synchronously orbiting space facility, the Sync Port", 486 miles above the main Surface Settlement.

ORBITAL SYNC PORT

- **Solar Energy facility** if practical, cabled to surface
- **Main Port of Call** for ships to and from other asteroid belt locations elsewhere in the solar system
- **Fuel Depot** for visiting ships
- **Light processing, manufacturing** incoming resources
- **Warehouse** for goods being transshipped
- **Traders' Market** for ships in port
- **Repair, maintenance, reoutfitting shops** for work that is routine, frequent, and requiring a low mass of equipment
- **Assay office** for incoming mining samples
- **Hotel** for more transient spacer use
- **Gym** for visiting personnel
- **Other recreation facilities** for transient spacers
- **Administrative offices** for handling routine matters for visiting spacers
- **Medical Outpatient Clinic** for visiting spacers
- **Other functions** for personnel, ships, goods in transit

SURFACE, FIXED (within/without main settlement area)

- **Mining and processing** of local Cerian resources

- □ **Manufacturing** based on local Cerian resources
- □ **Refinery** for fuels, volatiles from local resources
- □ **Custom manufacturing** using imported resources
- □ **Warehousing** for all of the above
- □ **R&D facilities** and labs for processing, manufacturing
- □ **Repair, maintenance, reoutfitting shops** for work needing heavier equipment that is less routine and/or frequent
- □ **Main agricultural areas**: food for local consumption and for export to other Belt markets
- □ **Nature parks**
- □ **Gym** using heavy equipment or for exercises that are not gravity-dependent
- □ **Space port** for orbit to surface shuttles loads too big or massive for the elevator
- □ **Main, permanent Trade Center**
- □ **Nuclear Fusion** (He-3) Plant
- □ **Main Hospital**

SURFACE, GRAVID - Artificial gravity via Maypole and/or Maglev facility

- □ **Residential area** (all locals to spend some time here)
- □ **Schools** (concern for children in developmental years)
- □ **Offices** (commercial, administrative)
- □ **Gym** for gravity-assisted exercise and sports requiring lightweight equipment
- □ Hospital recovery and rehabilitation areas
- □ Other activities and functions that require little space and little supporting equipment mass

What we "knew" and now "know" about Ceres

www.planetary.org/explore/topics/asteroids_and_comets/ceres.html

Ceres is estimated to contain one quarter of all the mass in the asteroid belt and it had been clear from its crudely calculated density and spectrum (carbonaceous chondrite) that it must contain a good percentage of the water-ice in the Belt. We thought that this resource might be just mixed in with the rock, but we now believe that Ceres may contain a mini subsurface ocean, similar to that on Europa, but on a much smaller scale.

Ceres suddenly emerges as a much more complex and interesting "little planet" all by itself, not only the largest of the asteroids, but in a whole league all by itself. Ceres becomes not just an asteroid, but the place to visit and do business in the Belt.

If we were to abandon our fixation with size is everything in deciding what is a planet and what is not, and look at the object's potential to have a roll in the spread of humanity, Ceres might be given the appellation "planet." Maybe we need a new word, not laden with size connotations, for objects that will play a major role as a human pioneer frontier of the future. Don't bother to look in a thesaurus. It is of little help. We'll just have to coin something. After all, Europa too needs to be reclassified! Whether a body orbits the Sun directly or indirectly seems irrelevant!

The Outlook for Ceres: Phase I:

a. In time, engineering development for belt needed equipment (prospector ships and tools, mining equipment, mass drivers, smelting equipment) could switch from the Moon to this Belt regional center.

b. The presence of considerable amounts of water ice and or ice/rock mixture along with this planetoid's carbonaceous crust means that **Ceres could be biospherically self-supporting** in food, fabrics, plastics, fuels.

c. Ceres could become the principal center in the Solar System for the **development of cryoplastics** including building materials that perform well at cryo-temperatures. (-100 to -200 °F ?) This industrial activity would enable opening frontiers further from the sun.

Phase II:

Given these advantages, Ceres seems destined to become a principal **staging point for exploratory expeditions, outposts, and settlements in the Jovian and Saturnian systems and beyond**. Some writers had previously expected that Callisto, the only one of Jupiter's big four Galilean satellites that is outside Jupiter's radiation belt, would emerge as the gateway to the entire outer system. But Callisto's sphere of influence might be confined to the Jovian system alone, with Ceres having more frequent launch windows to Saturn, Uranus, and Neptune.

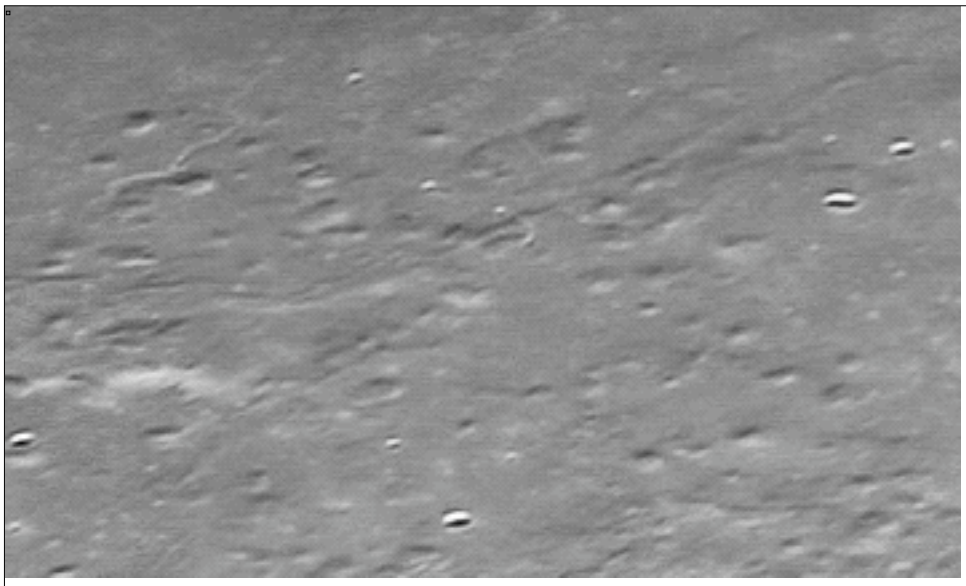
Ceres would grow in population and wealth with the spread of asteroid activities (phase 1) and then with the opening of the Jovian Moons (phase II). The limiting factor is the size to which its "SynchPort" could grow at the end of a tether. I'll leave it to science fiction writers to propose a vast "Synch Ring World" above Ceres, some 5,000 miles in circumference, or how artificial gravity would be maintained within it (perhaps this "ring" would be of individually rotating "sausage link cylinders" of the O'Neill variety, with lunar gravity (that of Io, Europa, Ganymede, Callisto, and Titan are similar) as the likely standard beyond Earth.

A short pool of suitable place names for Ceres.

Giuseppe **Piaszzi** discovered Ceres in **Palermo**, **Sicily** on the first day of **Century Nineteen** - 01-01-1801. Ceres was the Roman goddess of grain [hence our word "**cereal**"], and she chose the mortal **Triptolemus** to carry her knowledge (the plow, **agriculture**) to humanity. The **Ambarvalia** were rites of spring celebrated by Roman farmers in Ceres' honor. **Demeter** was the Greek equivalent of Roman Ceres.

My pick? The Century Nineteen Hotel in New Palermo. The Ambarvalia annual festivals. The Triptolemus subsurface ocean. But I won't be there to do the honors.

Other names, of course, will be conferred by explorers and settlers in honor of places and persons whom they wish to remember, persons in places in their favorite works of fiction, etc. as has always been common and traditional among settlers and pioneers. ΔΔΔ



LPOD: Lunar Photo of the Day
January 21, 2006 (portion of photo)

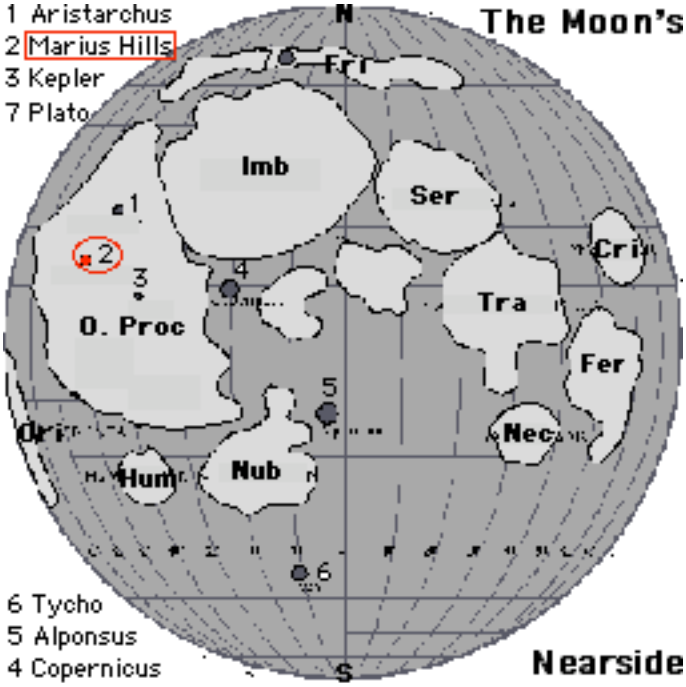
This is the largest volcanic complex on the Moon (neglecting all the maria, of course) and no one understands why it exists. It appears that the entire area may be slightly higher than the surroundings, like a miniature ... of the Aristarchus Plateau. **The Marius Hills** includes hundred of slightly steep hills and flat domes and three sinuous rilles. Spectral studies show that the steep hills have volcanic ash on them, indicating that explosive eruptions built them. The domes were formed by non-explosive flows of lava. And the sinuous rilles probably formed from greater rates of flow of lavas. -- Charles Wood [1]

The Marius Hills

Could the Originally Intended Landing Site for Apollo 17 have Changed History? It may change the Future!

by Peter Kokh and David Dietzler

Marius Hills (14°N, 56°W),



What has intrigued us (P. Kokh & D. Dietzler) is the suspicion that the Marius Hills might someday be the Ruhr of the Moon, (its major industrial complex) and make an outstanding site for a major settlement. The Hills offer:

- ☑ variations in basalt
- ☑ perhaps a good number of intact lavatubes
- ☑ possible or likely pockets of unreleased volcanic volatiles that could change the prognosis for industrial development of the Moon.

This area appears to have experienced a number of lava/magma flows, each successive flow somewhat different chemically than the one before - "layered igneous intrusions" in geological parlance. On Earth, the most significant case is The Bushveld area in South Africa, source of much of that country's mineral wealth. The reserves of chromium, platinum, palladium, osmium, iridium, rhodium and ruthenium are the world's largest along with vast quantities of iron, tin, titanium and vanadium. [2] South Africa is second only to the United States in the production of mineral resources.

The elements listed above are essential to a modern industrial complex. If the Lunar Frontier were to rely only on the elements most abundant on the Moon, oxygen, silicon, iron, aluminum, titanium, magnesium, and calcium, the result would be something like late nineteenth century industry, more than an advanced New Stone Age" but not much more.

Lunar industry must find, or import at great expense, copper, gold, silver, platinum, zinc, lead, and other metals not well represented in the regolith at large. The Clementine and Lunar Prospector data have yielded helpful maps, but their resolution leaves much to be desired. New orbiters with more sensitive instruments able to detect specific signatures at very high resolution are essential. Prospecting from orbit is extremely cheap in comparison to fielding and supporting a veritable army of human prospectors on the ground! The later will be needed in time, but they are best used in areas targeted for further "ground truth" investigation by orbiting chemical sleuths.

Clementine, Lunar Prospector, and Truth in Science

Clementine and Lunar Prospector have clearly shown that the Nearside Mareplex is much richer in iron, titanium, thorium and other useful elements than highland sites. The poles, in contrast, have little of industrial significance beyond the yet to be "ground truth" qualified and quantified hydrogen enriched permashade areas, and more round-the-

month low angle sunlight in mountainous terrain that may be risky to traverse (ever-changing very long ink black shadows as well as anything but level) with irregular plateaus of "eternal sunrise" (To use the term "eternal sunshine" is very misleading.) At the poles we may find water ice of yet unknown purity and mixture with regolith, and of yet unknown friendliness to mining techniques, and nothing to do with it except waste it as one-time-use rocket fuel.

But these same Clementine & Lunar Prospector maps do not tell us where the real prizes are to be found, if anywhere. But looking at topographical and geological characteristics, the Marius Hills area certainly looks intriguing, perhaps even promising.

Questions and more questions

David writes: study of the impact craters in the region revealed none that had penetrated through to the underlying highland bedrock. So if there are underground chambers, "vesicles," of volcanic gas, they *might* be intact.

So much for the "Moon is all homogenized, contains no surprises, the crust is all fractured, gas would have all leaked out" theory that I have come to believe is entirely false. I say this region could be like a volcanic gas field, truly a gold mine for lunans. One can see that there are no giant craters there or fissures in the surface."

Peter: I checked the reports on TLP, transient lunar phenomena which might include leaking gas. This does not seem to be a "TLP area," unlike the nearby Aristarchus Plateau, which is the source of many TLP reports. But the major difference is that in the Aristarchus Plateau, we have a major relatively recent impact crater, Aristarchus itself, which has clearly penetrated into the highland crust underlying the basalt flows which formed the plateau.

David: clearly any gas in fractured basalt has already long escaped. I am growing confident that there may be intact pockets of volcanic volatiles in unfractured layers.

Ground penetrating radar and landing teams with explosives and sonic sensors like the stuff they use for oil exploration are what we need. What we have to do is create a vision for others to be inspired by.

Volcanic Gases? The Envelope, Please!

On Earth, more than molten rock, thick fire-red lava escapes from the throats of active volcanoes! See:

http://volcanoes.usgs.gov/Hazards/What/VolGas/volgas.html

"At high pressures deep beneath the earth's surface, volcanic gases are dissolved in molten rock. But as magma rises toward the surface where the pressure is lower, gases held in the melt begin to form tiny bubbles. The increasing volume taken up by gas bubbles makes the magma less dense than the surrounding rock, which may allow the magma to continue its upward journey. Closer to the surface, the bubbles increase in number and size so that the gas volume may exceed the melt volume in the magma, creating a magma foam. The rapidly expanding gas bubbles of the foam can lead to explosive eruptions in which the melt is fragmented into pieces of volcanic rock, known as tephra. If the molten rock is not fragmented by explosive activity, a lava flow will be generated."

"The most abundant gas typically released into the atmosphere from volcanic systems is water vapor (H20), followed by carbon dioxide (C02) and sulfur dioxide (S02). Volcanoes also release smaller amounts of others gases, including hydrogen sulfide (H2S), hydrogen (H2), carbon monoxide (CO), hydrogen chloride (HCL), hydrogen fluoride (HF), and helium (He)."

Now given that the Moon was apparently formed from material from which any native volatiles had been driven off by heat, we will be most unlikely to find water or water vapor or hydrogen, either alone or in combination.

The Moon is also apparently "underoxidized." Even though the regolith and the crust from which it is derived by impact gardening is 45% or so oxygen by weight, in the form of metal oxides and silicates, there is not enough oxygen to have rendered the vast majority of the Moon's crustal iron into the ferric form, Fe2O3 predominant on Earth. The iron we find is predominantly ferrous, FeO, or even pure, not oxidized at all. That leads us to suspect that the fully oxidized forms of carbon and sulfur are also unlikely. Instead of carbon dioxide, we will be lucky to find carbon monoxide. Instead of sulfur dioxide, we will be lucky to find sulfur monoxide. Helium is also unlikely.

As there is enough sulfur, and enough oxygen in the regolith, the presence of SO gas is of no interest. The prize, perhaps the sole prize, as we see it, is pockets of carbon monoxide, CO, which would be most invaluable, both as a handy industrial reagent in itself, and as a source of carbon which is vital to life in all forms, as well as essential in making steel. We may never find enough carbon on the Moon to use profligately in plastics and other synthetics.

Gas pockets may be too small and insignificant in volume to show up as "negative mascons", even at highest resolution. Radar designed to ferret out lavatubes might find such pockets. They would have characteristic shapes noticeably different from the long tubular lavatubes.

The discovery of substantial carbon monoxide reservoirs on the Moon would rival the discovery of polar permashade ice reserves in brightening the prospects for fuller industrial diversification, and the chances of attaining economic self-sufficiency. We had previously considered the possibility of finding such "lacunae" (to suggest a Latin topographic term) but The Marius Hills are the first site to suggest that "here is a good place to look."

We have a lot of prospecting homework to do on the Moon before we can be confident that any reestablished human presence on the Moon has a real chance of an open-ended future. Most lunar probes are designed by scientists with other things on their minds than resources. Scratching the itches of scientific curiosity is good. But it is not what we need. This should guide what missions we support. ΛΛΛ

The Moon Society

J O U R N A L

http://www.moonsociety.org

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/

The Artemis Project™ – Project LETO™ – Rent–MDRS

Moon Society DUES include **Moon Miners'Manifesto**

- **Electronic** (pdf) **MMM $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, shows the Moon in its natural beauty, empty and deceptively barren, waiting for human settlers to shelter and to mother as an adopted new human home world. We have work to do!

Growing The Moon Society's GSP: Our Gross Societal Product

From Moon Society President, Peter Kokh

It is to be expected that our members join the Society and make their annual decision whether or not to renew, in great part according to their assessment of whether or not we are producing. Is the Society making evident progress towards the realization of the goal of advancing the settlement of the Moon? That's a journey of a thousand steps, to be sure. But are we making progress? Is what we are doing or accomplishing on target? Are we further along than last year? ***Are we obviously busy?***

It goes without saying that we could enumerate many things worth doing, that we are not tackling. But to judge us by that may be unfair. We are a membership society - all members, all volunteers, no paid staff. If there is something that we are not doing that we could or should be pursuing, it is not because those who roll their sleeves up are not working hard. It is because we do not have as many people with discretionary free time to help out. We know and appreciate that most members are contributing all they can just by paying dues. Your dues *do* support our efforts and we are very grateful for this.

What we need to do is to grow our members. If we need more actively involved members, we need many more members in the first place. There are three ways to help:

1. If you have talent, and some discretionary free time to help out, write us at president@moonsociety.org or by letter to the Milwaukee PO Box at left, telling us about your talents and interests in detail. We'll try to send you some helpful suggestions.
2. Whether you fall into that category or not, please help us recruit more members, with special attention to those with special talents, *and free time (e.g. retired seniors).*
3. Consider a gift membership to your local library and/or high school or college alma mater. *Help spread the word!*

Our "Gross Societal Product" is not just what the few members of the Leadership Council produces, it is what we all collectively produce. To increase our productivity,we have to both give our members more ways to get involved by using their own talents, and we need to greatly increase our membership. Meanwhile, we are aggressively looking to do more and more all the time. If you missed our recent email Progress Report (you may not have a current email address posted with the society, or your spam blocker software [especially those with att.net addresses] has us blacklisted) you can read it online, at our near the top of the Society news announcements on our front page.

Finally, if you have been a member in good standing for two years by the upcoming August 1st (member #s 1336 and lower) consider running for office. Send in your self-nomination to elections@moonsociety.org. Any member is welcome to join the Leadership Council. **<PK/TMS>**

2008 NSS Space Settlement Calendar Contest
What's in it for the Moon Society?

Preview of Contest Announcement (work in progress)
from Peter Kokh, member, Calendar Committee

"The National Space Society (NSS) is looking for visions of a spacefaring future. A future of space settlement, be it on the Moon, on Mars, on asteroids, or orbiting independently in space. The NSS is holding a contest for such artwork. The best artwork will be selected for inclusion in the 2008 NSS Space Settlement Calendar.

"First, second and third place prizes will be awarded in four categories:

1. Orbital settlements
2. Settlements in and on asteroids
3. ***Settlements on the Moon***
4. Settlements on Mars

"In addition, a grand prize will be awarded for the best artwork overall. This work will be honored with an award at NSS's annual convention, the [2007] ISDC.

"Work should depict permanent space settlements. Preference will be given to works featuring views of the settlement that clearly establish the settlement's setting. Space settlement refers to people living perma-nently in space, not temporary visits such as tourism or for work.

"Artwork must be submitted in digital format suitable for use in the calendar, 14x11 inches at 300 pixels per inch. Artist must give NSS non-exclusive rights to use the artwork for the calendar, the NSS website, and other venues. Artwork is due by 1 September 2006." ###

On Tuesday, May 16th, I took part in a conference call Committee Meeting for the publication of a glossy 11" x 14" Calendar on Space Settlements. The Committee had met on April 4th, and then again May 3rd at ISDC 2006. I was curious to see what it was all about, and was invited to join.

I gave a report on this project to the Moon Society Leadership Council Meeting on ASI-MOO the next evening. While this calendar would not be a precise fit for our needs, it may include one or more pieces of lunar settlement art. If we like the winning, and/or runner-up lunar settlement art submissions, and could secure rights to use it, that would be of substantial benefit to the Moon Society.

Setting a budget for art acquisition is on the Moon Society Leadership Council and Board agenda. We may wish to offer a special additional prize to any selected lunar settlement art and may offer prizes to runner-up, non-selected, lunar settlement art. Whether we advertise this prize up front, or only after the contest is over, is to be decided. It's NSS" contest; it is only right that we defer to their judgment on timing. **<PK/TMS>**

LUNAR TRADERS

http://www.lunartraders.com/index.php

FOR SALE

Letter from Lunar Traders™ Proprietor Tim Cadell
to Moon Society President Peter Kokh

April 12, 2006 -

[snip] "I've received orders recently and processed them. There is more of a delay normally than there should be; my work is keeping me very busy and we're buying our first house!

"If you know anyone who is interested in taking over the business, please let me know. I have some inventory (lots of t-shirts, books, videos, some toys) that I could send to them and help them set up their own credit card processing. I'd be willing to let it all go *for the cost of packing and shipping it all.*"

Tim Cadell
tcadell@gmail.com

If you sconsider yourself an entrepreneur wannabe, why not examine the Lunar Traders' site and catalog. Tim set this up in the early Artemis Society days, and has always offered quite a variety of products.

You will have to ask Tim about how much inventory he has, how much of what - an itemized list. Then negotiate a price. Once you are in charge, you can replenish inventory for existing items, or buy on demand, and add to the catalog as you wish.

To help you celebrate your new business, The Lunar Reclamation Society may contribute *gratis* (plus the cost of shipping) several 10-ream boxes of MMM back copies, mostly from the earlier 17 years. The past three years we have been running very lean, printing only what we need to deliver. Should such a gift or nominal transaction take place, you would be able to market these back copies at whatever price the market will bear, *probably not much* now that almost all the articles are available online.

I do not know about what kind of business relationship Tim had with the Artemis Society, you will have to ask him that, but retaining and reaffirming that relationship (now with the Moon Society) may be part of the purchase conditions. Nothing, however, would restrain you from marketing your inventory outside the Moon Society/Artemis Society membership.

Lunar Traders™ is worth saving. ***This could be a chapter project***, or the work of an individual. **<PK/TMS>**

Moon Society Election Schedule Changes

Unfortunately it can take several weeks from the completion of an issue of Moon Miners' Manifesto until members who get MMM by mailed hardcopy get to read it. As I write this, on June 8th, the May issue has just recently arrived in the mail box. We had hoped to post the election ballot in *this* issue, but doing so would mean that members who had just learning of the opportunity to nominate themselves or someone else for a position would have no time to do that. Accordingly, We will allow more time for nominations to come it and finalize the ballot at the July 5th Leadership Council Meeting.

Then, as there is no MMM during July (editor's semiannual burnout prevention break) the ballots will be mailed to members separately by first class mail. We hope that that leaves enough time for ballots to be returned so that the election results can be tallied at the August 2nd Leadership Council meeting. If not, the deadline for returning ballots will be extended.

Openings are available on the Board of Directors and for the offices of President and Secretary. One of the Board members whose term is up (Gregory R. Bennett) and the current President (Peter Kokh) will be running for re-election, but that is no reason not to nominate yourself or someone else for Director, President, or Secretary.

No one should run if the principal reason for doing so is to have more to add to one's resume. We very much need working persons to hold these positions, people who will accept, and even volunteer for action items, and make a real effort to attend the twice a month meetings. (1st and 3rd Wednesday evenings, 9-11 pm Eastern, 8-10 pm Central, 709 pm Mountain, 6-8 pm Pacific) Meetings are held on the ASI-MOO an advanced "chat room" environment for which you will need a Moon Society username and password, plus approved access.

Meanwhile, any member is welcome to choose to join the Leadership Council in order to give nonvoting input into the various discussions. The Leadership Council is the normal "training ground" for future leaders, but it is not necessary to have belonged to the Council to run for office.

The Moon Society is a **totally volunteer organization.** No pay (zip, nada) for any office or position.

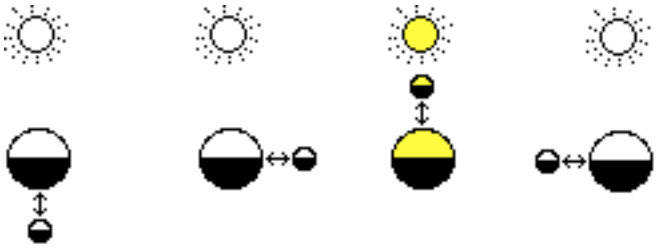
Trick Lunar Trivia Question:

When is the Moon closer to the Sun? During Dayspan or during Nightspan?

A. The Moon in genral is closer to the Sun at New Moon than at Full Moon. That means during Dayspan on the Farside and Nightspan on the Nearside.

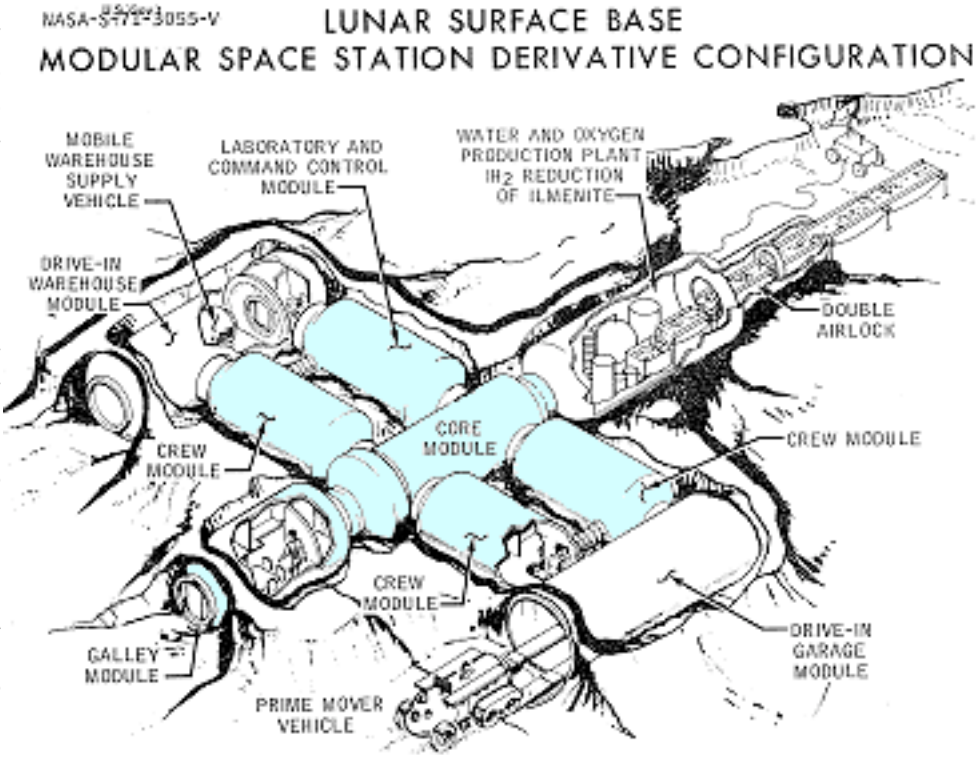
While Earth's orbit takes both Earth and Moon closer to and further from the Sun during the year, season for season, the Moon is closest to the Sun when it is between Earth and the Sun, at "New Moon," and overhead on Earth at noon, rather than at midnight.

Thus "high noon" on central Farside will be somewhat hotter, season for season, than "high noon" on central Nearside.



Looking at a model for a one-floor "ranch-style" Lunar Analog Research Station architecture.

We. think the following NASA illustration has some great features. A first stage "core" section is shaded blue.



New Journal of Lunar Geological Studies
SELENOLOGY TODAY

from Raffaello Lena, Editor-in-chief

Dears Friends, I am Raffaello Lena, and I also work with the ALS (American Lunar Society, a Moon Society Affiliate). My group is the Geological Lunar Researches Group (GLR), and i am working intensively with ALS about several projects.

I would like to share with you **SELENOLOGY TODAY**, an our new specific Journal Here the info of the Journal.

http://digilander.libero.it/glrgroup/

Selenology Today is a new online journal devoted to the study of the Moon. It is a free, international journal welcoming contributions from professional and serious amateur scientists. Selenology is the Greek word for the Moon and Today refers to modern studies that derive understanding from detailed imaging and measurements of surface characteristics. **SELENOLOGY TODAY** ***can be downloaded from the website above.***

During the space race of the 1960s there was tremendous interest in the Moon. In the decades since there were only three probes to the Moon, but a new race to the Moon is heating up. The European Space Agency is currently orbiting a spacecraft around the Moon, and China, India and the USA will send others there in 2007 and 2008. In parallel with these large national efforts, computers and other modern technologies have allowed skilled amateur astronomers to contribute lunar images, measurements and analyses that rival those of professional scientists. **SELENOLOGY TODAY** publishes articles based on such modern approaches.

SELENOLOGY TODAY is published by the Geological Lunar Researches Group (GLR), an informal international organization of about 50 lunar observers in nearly a dozen countries. GLR was started in Italy by Raffaello Lena and Piergiovanni Salimbeni in 1997 and has published more than 100 studies, mostly of lunar domes. Recognizing the need for a new outlet for the publication of serious studies of the Moon, members of GRL initiated the new journal.

Editor-in-chief: Raffaello Lena, Italy. <lena@glrgroup.org>

Editorial Office: <Selenology_today@christian-woehler.de>

Board: M.T. Bregante, C. Kapral, F. Lottero, J. Phillips, P. Salimbeni C., Wöhler, C. Wood*

GLR Website: http://www.glrgroup.org/home.htm

[*Charles Wood is the creator of Lunar Photo of the Day - http://www.lpod.org - and author of many great books about the Moon.]

</MMM>

Chapters & Outposts

Bay Area Moon Society

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

From: Bill Clawson <billclawson@yahoo.com>

Meeting the 4th Thursday each month
at a member's home.

Moon Society St. Louis

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

From: Keith Wetzel <kawetzel@swbell.net>

Regularly scheduled monthly meetings of MSStL are at 7:30 PM on the Second Wednesday of the month at the Buder Branch Public Library, 4401 S. Hampton, in the basement conference room

Acquiring Exhibits & Other Resources Without Setting Chapter Dues
The Wisconsin Mars Society Experience

by Peter Kokh

While it should be clear from MMM's annual Mars issue each March, that the MMM Editor is keenly interested in Mars "too," it may come to a surprise to many to know that I am a founding and active member of Wisconsin Mars Society, a Mars Society chapter. When we first got together in 1999, we discussed chapter dues, and decided against it. So how is it then that we came to have quite a repertoire of exhibits?

The answer is simple: I proposed that ***all exhibits be individually owned items, that would be made available to the chapter for our various outreach opportunities.***

This has worked well. Anyone who is interested in seeing a particular exhibit added to our collective inventory, pulls out their own wallet and uses their own hands to fund and create the exhibit. In some cases it is easy: someone just buys something like the false color MOLA Mars globe that shows deep basin in blue, as if they were (or sometime could be) filled with water. In other cases, the individual or a pair of individuals design and build something together. You cans see some of our stuff at:

http://chapters.marssociety.org/usa/wi/exhibits.php3

This is a formula that Moon Society chapters could adopt *if they decide that they do not want to adopt special chapter dues.* That does not prevent "passing the hat" on occasion for collectively supported exhibit projects.

GREAT BROWSING !

NASA offers a $250,000 prize for a better glove:
http://www.courant.com/technology/hc-space0425.artapr25,0,666931.story?track=rss

Scientific Visualization Studio
http://svs.gsfc.nasa.gov/search/Scientist/JamesGarvin.html

Insightful Notes on Presentations at ISDC 2006
http://www.hobbyspace.com/AAdmin/archive/RLV/2006/ISDC-2006.html#May.5.06

Rutan Takes Aim at NASA's CEV Plans, Likens it to 'Archeology'
http://www.space.com/adastra/adastra_isdc_rutan_060504.html

Pete Worden on Lunar Property Rights, more ...
http://www.spaceagepub.com/ArticleArchive/20060511_1.html

Vision for Space Exploration: New Opportunities - A Speech by NASA ARC Director Simon P. Worden
www.spaceref.com/news/viewnews.html?id=1119

M.O.O.N.* CON: (*Middle of Outer Nowhere")
http://www.mooncon.bravehost.com/

Send Something into Space for $99
http://www.newscientistspace.com/article.ns?id=dn9023&feedId=space_rss20

New Journal about Lunar Studies - "Selenology Today" - free download
http://digilander.libero.it/glrgroup/

Newt Gingrich on the Vision for Space Exploration and the importance of space commercialization
http://www.thespacereview.com/article/623/1

NASA million $+ Lunar Lander Analog Challenge
http://www.thespacereview.com/article/621/1

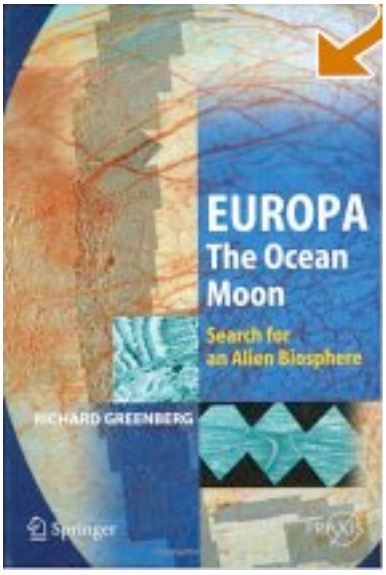
Development of the Spitzer Space Telescope
http://www.thespacereview.com/article/620/1

Transient Lunar Phenomena Telescope
http://www.geocities.com/CapeCanaveral/launchpad/1837/equipment.html

New High-Res Video Ride through Valles Marineris
http://photojournal.jpl.nasa.gov/archive/PIA02891-95.mov

Venus Express Reaches Final Orbit May 7th
http://planetary.org/news/2006/0509_Venus_Express_Reaches_Final_Orbit.html

Mars Express Snaps Mons Pavonis Lavatube signs
http://www.marsdaily.com/reports/Mars_Express_Spots_Lava_Tubes_On_Pavonis_Mons.html



EUROPA:
THE OCEAN MOON
Search for an Allien Biosphere
by Richard Greenberg

Springer, 2005
ISBN: 3540224505
Hardcover 380 pages

Key Phrases:
dilational bands, tidal elongation, tectonic terrain, diurnal working, oceanic exposure, tidal shape, tide raiser, cycloidal cracks, typical chaotic terrain, uplift features, tectonic record, depth diameter relationship, cycloidal ridges, tidal working, double dark lines, dilation bands, tidal heat, free eccentricity, chaos patches, diurnal stress, tidal tectonics, chaos formation, convergence bands, tidal potential, strike slip displacement

You can examine the table of contents on Amazon.com at:
http://www.amazon.com/gp/product/3540224505/102-2140818-7585705

Also by this Author on this topic:

TIDES AND THE BIOSPHERE OF EUROPA: A liquid-water ocean beneath a thin crust of ice may offer several habitats for the evolution of life on one of Jupiter's ... moons. : An article from: American Scientist [HTML]

This is an online paper that can be downloaded from Amazon.com for $5.95 - unknown legnth.

NOTE: The MMM Editor has not read this book or any other work by this author. MMM is printing the above for reader information only, as a book of possible interest. **</MMM>**

M.O.O.N. as an Acronym

Recently, I came across M.O.O.N. standing for the "Middle Of Outer Nowhere," a Wisconsin Sci-Fi Con. For curiosity sake, I checked Google for other MOON acronyms:

- **M**eeting **O**ur **O**perating **N**eeds
- **M**innesota **O**rganization **O**f **N**umismatists
- **M**PLS (Multi-Protocol Label Switching) **O**ver **O**TN (Optical Transport Network) **N**etwork
- **M**ulticenter **O**rthopedic **O**utcomes **N**etwork

At least the Sci-Fi Con version is interesting! The rest are *boooooring!* If you can come up with an acronym rendering of Moon, *that involves the Moon,* we'd like to see it. Email your fun suggestion to kokhmmm@aol.com with "MOON Acronym" in the subject line.

ISDC 2006 Report

International Space Development Conference

Los Angeles, California – May , 2006

by Mark Hopkins

I have been to all 25 ISDCs. This was *spectacular* -- better than any of the previous ones.

The mix of those interested in personal space flight and those interested in space settlement worked very well. There is a large and growing overlap between these groups.

The combination of the motives "I want to go, because it is cool" and the " people must go and settle, because it is critically important to the future of humanity" creates an amazingly powerful force. It combines what people want to do for themselves with a larger and noble goal. This ISDC included in a major way, not only NSS and the Planetary Society, but the Space Tourism Society, Sunsat Energy Council (yes, space solar power is making a come back) and the Space Studies Institute among others. There was a large amount of technical meat about very cool ideas.

We sold out the hotel, we sold out the tours, we sold out the meals, we sold out everything. Attendance exceeded 1300, breaking the previous record.

Profits, even after giving the Planetary Society its share, will also be record breaking.

The arts were there in force to a far greater extent than in any previous ISDC. These people deal in emotions. They were bubbling with enthusiasm and excitement.

The best of all was the energy in the air, the optimism, the feeling that we are unstoppable. The conference was at the cutting edge of humanity and the attendees could feel this fact in their bones.

Much thanks is due our conference organizers, particularly George Whitesaides and Pat Montour, but it was more than that. When you strive hard towards a noble goal, such as Space Settlements, wondrous things can happen and in this case did.

Don't miss the next ISDC !

ISDC 2007 will be held in Dallas, TX

InterContinental Hotel – May 24–28, 2007

http://isdc.nss.org/2007/

"From Old Frontiers to New"

Hosted by: The National Space Society of North Texas

Contacts: Kenneth Murphy <Ken@isdc.nss.org>

and Carol Johnson <CarolJ@isdc.nss.org>

Pre-registration May 9 - December 31, 2006

Members Rate: regular $100, Senior $85, Student $30

Add $25 to these rates for non-membrs, but only $20 if you choose to join NSS as you register. More at website.

Huygen's landing on TITAN – the Music Video

[flash player/plugin required]

http://www.esa.int/esaSC/SEMIJROFGLE_index_0.html

View from Huygens on 14 January 2005 - 'intro & music' version. This movie was built thanks to the data collected by ESA's Huygens Descent Imager/Spectral Radiometer (DISR) on 14 January 2005, during the 147-minutes plunge through Titan's thick orange-brown atmosphere to a soft sandy riverbed.

In 4 minutes 40 seconds, the movie shows what the probe 'saw' within the few hours of the descent and the eventual landing. At first the Huygens camera just saw haze over the distant surface. The haze started to clear only at about 60 kilometres altitude, making it possible to resolve surface features as large as 100 metres. Only after landing could the probe's camera resolve little grains of sand millions and millions times smaller than Titan. The movie provides a glimpse on such a huge change of scale.

Video: Erich Karkoschka, DISR team, U. of Arizona.
Script: Chuck See, DISR team, U. of Arizona.
Narration voice: KUAT radio broadcaster David Harrington.
Music: Beethoven's Piano Concerto No. 4 by Debbie Hu (Yelm, Wa, USA).
Credits: ESA/NASA/JPL/U. of Arizona.

NASA (JSC, SAIC)
Lunar Outpost Design Challenge

Tuesday, May 02, 2006

Roger H. Weiss, JSC, SAIC: <roger.h.weiss@nasa.gov>

Mark your calendars: Coming this fall, students will be challenged to design systems that will support living and working on the Moon. The challenge will be to design a combination of facilities that

- □ support arriving precisely (on target)
- □ living adaptively and
- □ working efficiently

that will make exploration possible on the Moon and can protect both the explorers and the Moon from contamination.

As usual with Quest Challenges, students will work on these authentic problems under the watchful eye of NASA experts.

Join us as we begin with registration in September and finish with a webcast in early December.

A website, with a growing list of reading material that will help you get started, is available at

http://quest.nasa.gov/lunar/outpostchallenge/

If you have any questions, please write to:

Quest-Challenge@mail.arc.nasa.gov

KIDS TO SPACE: A Space Traveler's Guide

by **Lonnie Schorer**

ISBN: 1894959426

$29.95 US
$33.95 Canada
£19.95 UK

GC Publishing (**Apogee Books**)

Publisher's Blurb

Based on an imaginary trip to space with America's school children, **KIDS TO SPACE: A Space Traveler's Guide** is a comprehensive collection of children's questions about traveling to and living in space. From black holes to possible destinations, from group dynamics to weightlessness, from medical concerns to space communities, internationally recognized experts in each field provide answers to 100 different categories of student questions, making the book a fascinating space guide, not just for kids but for all who have ever wondered about the universe and dreamed of what it would be like to be a space traveler. [snip]

In responding to "Would *you* go to space?" students provided insight into why they would or would not personally go to space. Statistical results will be included in the book.

Educators throughout the US who participated in the **KIDS TO SPACE** project were excited to get the kids thinking about tomorrow. Students, ages 5-18, were excited to be asked to participate in planning for humankind's future in space. The experts, including astronauts, educators, astronomers, doctors, engineers, scientists and architects were excited to be challenged, and sometimes stumped, by the questions. Sometimes they had to readjust their ideas of what they thought they knew in order to answer some of the students' questions.

Hundreds of student illustrations, brilliant depictions of what it would be like to live in or travel to space, will be included on an accompanying CD/ROM.

From science fiction to accessible reality, **KIDS TO SPACE: A Space Traveler's Guide** serves as a timely message to children that the space future is in their hands, and we welcome their help in planning for it now.

National Space Society
Regional Space Development Conference

October 6th & 7th, 2006

Marriott Hotel, **Ogden, Utah**

Sponsored by L3-Communications & ATK Launch Systems

TOPICS WILL INCLUDE:

*** Breakthrough Propulsion Physics** — Including the possibility for star travel at acceptable energies and in acceptable time frames. Work of Greg Meholic and H. David Froning. Zero-point-energy, electrogravitics and future space travel, with Thomas Valone. Faster-than-light breakthroughs, with Bill Gardiner. A special panel discussion as well.

*** The Colonization of Mars** — With Robert Zubrin

*** Space Tourism, Facilities, and Financing** — With Royce Jones

*** Space Activism to Fulfill our Dreams** — With Mark Hopkins

*** Solar System Exploration** — With Robert Bigelow, NASA Solar System Ambassador of the Salt Lake City Clark Planetarium

*** How to Build a Political Consensus for Space and Alienate all Your Friends** — With Ben Bova

*** The Spirit of Exploration** — With Don Piccard. Star Trek character named after his father

*** The Heritage of Project Apollo and Our Future in Space** — With Tim Miller. Tim is a member of the Front Range L5 NSS Chapter in Denver, CO.

*** Development of the CLV for Astronauts Return to the Moon** — With Charlie Precourt.

*** Heavy Lift Launch Vehicles** — With Eric Boethin. He is also a member of the Front Range L5 NSS Chapter in Denver CO.

Arrangements should be made with USS Ogden Express to transport participants from the Salt Lake City International Airport to the Ogden Marriott. Cost is $25. ($10 per passenger for additional passengers, on a trip) Ogden is only 30 miles from Salt Lake City. Must phone the USS Ogden Express to make advanced reservations for transportation to and from the Salt Lake City International Airport. Phone 866-745-5438.

The Ogden Marriott Hotel is located at 247 24th Street off Exit 342 from I-15 North Bound. Their phone number is 888-825-3263. Participants will be charged $69 per night (plus 10.6% Utah State Tax) for the Marriott. But reservations, at that rate, must be made at least one month in advance. The code name for the $69 per night rate is: Utah Space Association.

[Editor: For those of you who have never been to the Salt Lake Valley, you are in for a surprise. The metro area is 1.5 million people, up tight against the unforgettably beautiful Wasatch which has Denver's Front Range beat all to heck, hands down! Utah is a beautiful state.]

MAIL TO MMM

From Richard A. Brown <rab@freemars.org>

Peter, in the current Moon Miners' (May, #195) you're asking for topics appropriate for a regional Moon conference. A few random ideas which have been popping into my head from time to time, maybe appropriate for a workshop, maybe appropriate for an essay in MMM, maybe appropriate for the bit bucket:

1) Kaleidoscope: A recurring theme in your lunar building plans is a periscope to let outside views in while excluding hard radiation. The simplest version, with just 2 45-degree mirrors, will give a view like looking through a 2-3 meter long culvert... nothing to the sides. Adding kaleidoscope mirrors to a Kokh periscope will give a view that's less like looking through a long tube -- but more weird. *Too* weird?

2) Earth light: From anywhere on the near side of the moon a Kokh periscope can be oriented to bring a view of Earth into a habitat. Since the moon only bobbles a few degrees as it orbits, Earth will remain in view through that 2-3 meter long culvert. Will (nearside) lunar colonists forget about Earth? When it's the only blue thing outside? When it's darn-near the only *changing* thing outside? I don't think so.

3) Shadow garden/sundial: Earth changes constantly, the Sun moves through the sky. Piles of regoligh could create changing patterns of shadows as an outdoor art project. Interesting for the first month, boring and repetitive thereafter.

4) Night light: Earthlight is something like 25 (?) times brighter than moonlight (~ 16 times the visual area, much more reflective too boot). For a habitat centered on the near side of the moon, Earth's phases run from 1st quarter to last quarter thru the 2-week night. 1/4 Earth is still 12x a full moon ... you don't need artificial light for general lighting, just enough windows/periscopes. (You'll still want task lighting in work areas, though.)

5) Grow light: Light levels at 12-25 times moonlight aren't enough to keep plants from going into shock during a 2-week overnight, right? Can you put crops into hibernation 2 weeks out of 4 by lowering the room temperature to near-freezing? Or can you concentrate enough Earthlight to keep them growing all night with non-tracking parabolic mirrors?

Some plants like a 24-hour day/night cycle. Rather than waste hard gained sunlight (2 weeks) and Earthlight (2 weeks) with shutters, put your trays of greenhouse crops on a big slow conveyor belt to cycle between bright and unlit areas of your greenhouse. Watering stations and the like can be placed somewhere along the conveyor belt and every plant will get to it once every 24 hours. Plus, when it's harvest time, you just set up in one spot and the crops come to you :-)

6) Quick crops: Is there anything yummier than duckweed that can be grown in a 2 week growing season? Will a monthly oxygen/CO2 roller coaster ride have a horrible effect on Lunans?

7) Mushrooms: The perfect nighttime crop. I like 'em more than duckweed, at least.

Editor's response: Thanks much, Richard! Comments below.

1) The periscopic window is not my idea, though I will take credit for applying it to the Moon. The periscopic picture window was a feature of an underground house I visited in 1985. Idid not get the idea I was looking through a tube. It was done very well. But for this home there was only an 8 foot soil overburden. On the Moon we will want almost twice that, and that will be a design challenge. I can see kids interested in kaleidoscope thing, but losing interest fast. Maybe if the upper mirror could be turned slightly from side to side to pan the horizon? That deserves a mockup testbed to see if it would work. By the way, if you are going to give, what I call the Z-vue (from the zigzag light path) a name, it should be that of the architect of this home, called Terra Lux (Earth Light), George **Keller** (Ger. "Cellar".). The Terra Lux tour and the insights it gave me into underground living are *the real wellspring of Moon Miners' Manifesto.*

2) I expect the sight of Earth will be endlessly fascinating for those born there, but for native Lunans, born on the Moon, it might be just one more thing to take for granted.

3) This is a fascinating idea! I smell an article and you'll be sharing the byline!

4) Actually, thanks to clouds, ice, and snow, the Full Earth as seen from the Moon is 80 times as bright as the Full Moon seen from Earth. Earthlight might make electric nightlights unnecessary, unless pioneers find it too bright and shutter the Earth window when they sleep.

5) Actually, the Russians/Soviets tried just such an experiment, putting the plants in a refrigerator in darkness for two weeks then taking them out. The plants went on to a normal, but delayed harvest. If we want to minimize the delay in harvest time, we might want to find the ideal lighting regime during the nighttime. That was the purpose of LUNAX, the Lunar National Agricultural Experiment Corp. which tried to interest science and ag-science teachers in experiments students could do. We found many interested teachers, but they were almost always only interested in enthusing students, not in returning data. So the effort failed and was discontinued.

6) The beauty of mushrooms is that they take advantage of the catabolic part of the biomass cycle. They make plant growing that much more efficient. Now that we are enjoying more varieties like Shitake and Portabella, and a whole new cuisine is developing, they might become a staple on the Moon to rival the potato in menu diversity. ***PK***

Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

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(*Board Members & Ken Paul < kenpaul@cape-mac.org >)

LRS News

• **Peter completes MMM Classics Project:** See page 2.

• **September 15th will be the 20th anniversary** of the day (a Saturday) that members of the Chicago and Twin Cities L5 Society chapters corralled about 15 Milwaukee and Wisconsin L5 members in a room at the Triangulum II Sci-Fi convention at the Red Carpet Inn (now Sheraton 5 Points) to successfully encourage us to start a local chapter.

• **December will be the 20th anniversary of getting our charter as the Milwaukee Lunar Reclamation Society L5** and also the 20th anniversary of Moon Miners Manifesto #1. We will have our annual holiday party on December 9th and celebrate our 20th anniversary at the same time. ***Do save this date on your calendars!***

No Scheduled Chapter Activities

During July & August as usual – Summer Break

LRS Upcoming Events – September, October

Saturday, September 9th, 1–4 pm

Saturday, October 14th, 1–4 pm

Saturday, November 11th, 1–4 pm

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

Reports on Summer events, Updates on space and space mission news, conferences etc. A look at the calendar ahead. Planning our Holiday/20th Anniversary "Big Bang!"

U.S. CHAPTERS

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Chapter Events
MMM
7 Chapters Strong

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

OREGON

Oregon L5 Society

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

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

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

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

Meetings 3rd Sat. each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**
June 17 – July 15 – Aug.19

[MMM Editor Peter Kokh hopes to attend the August 19th meeting. Details TBD]

MINNESOTA

Minnesota Space Frontier Society

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

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

[www.mnsfs.org/]

MN SFS News & Pictures

Ben "highly recommends" Al Gore's new environmental documentary, "**The Inconvenient Truth**."

In that spirit, the following quote:

We will go to Mars
to take our civilization there.
We will go to the Moon
to save our civilization here!

- Dennis Wingo, in ***MoonRush***

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 at **7-9pm**

JUN 16th The Stoelting House, **Kiel**
JULY 21st: UW-Sheboygan, Room 6101, **Sheboygan**
AUG 17th 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/]

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: June 17, July 15, August 19

April 15 Meeting Notes: Good attendance and contributions from most participants, both negative and positive:

Dorothy is dropping her subscription to National Geographic, her primary reportage source, due to its lack of space related material. She will, instead, report on found articles she thinks are space related. This is the negative report. Larry, our group business card producer and web-master, brought a number of cards for distribution at the Super Science Festival (see later) and other events. Thanks, Larry! He also asked for more web and blog material. Dotty and Larry also gave me an archive, on disk, of Dotty's publication "Dotty's Dimensions" in PDF format. Thank you folks!

Michelle brought our treasurers update: we are still solvent, and its time to renew! Send checks to our business mail box.

Hank discussed the routing to the Balticon event Memorial Day weekend. The location is at The Hunt Valley Inn just off of I-83 (the York Road) near Exit 20 See Balticon's website for more. Hank will also be going to WesterCon in San Diego on the Fourth of July weekend. And the World Science Fiction Convention this fall! Philcon?

Oh yes, he's helping with that event at the Sheraton Franklin Plaza, formerly The Franklin Wyndham Plaza, in November. www.philcon.org . He will also become our Planetary Society Coordinator in May. Thanks Hank!

Mitch, our Public Outreach Coordinator, has received a response from Drexel Univ. and its Research and Special Program Coordinator, Katie Gibson, to arrange for a lecture on The Mars Homestead Project. Our main contact for this project is Gary Fisher who would be the presenter if this is arranged. We also talked about the Mars Society conference (marssociety.org) this August. Mitch also brought Ad Astra for continued review.

Janice brought two environmentally related items: one was "Instant Pizza", a set of seeds to grow the component parts of a veggie pizza, and an article on sea floor Clathrates which could severely disrupt our climate. The first item concerns long term storage and germination of plant seeds. To live off Earth some of us will need to be experts in these things and other biotechnology areas. The other subject could force us to live somewhere else: Clathrates are compounds where one molecule, in this case methane, is trapped inside another, frozen water in this case. If sufficient deep ocean warming occurs the methane gets released and our greenhouse effect drastically increases. This is from a N.A.S.A. report on the web from the Goddard Institute for Space Studies, April 22, 06. Thank you, I think!, Janice.

Earl brought several items, two articles and plans for Super Science. Suitsat was reported on again; this time in the April 13 E.D.N. in the "Prying Eyes" column. The experiment was a Ceres, drawing interest of children and Hams around the world. The suit fell into the atmosphere, after several weeks in orbit, late in February. And the next mission will be?

The future space flight article was: Solar System Commuter Trains: MagBeam Plasma Propulsion from the June Analog Science Fiction and Fact by James Grayson and Kathy Ferguson. It was a somewhat difficult system to explain since it involves something called Helicon Plasma Propulsion. Many of you have heard of the Ion Drive but I will recap: a material, usually a noble gas, that has an electron removed and is then pulled through a set of electrodes to very high velocities. The electrons are added back to the stream of fast ions to neutralize it. The electrical parts in the ion stream are damaged over time, however, and this can be a serious problem for this low acceleration

system (cm/sec/sec) The MagBeam, developed by Prof. Robert Winglee, works on moving a plasma, which is a mix of ions, electrons and neutral particles, with magnetic fields. The accelerations thought possible are impressive: meters/sec/sec. The damage to the control element is much reduced because the plasma is buffered by the magnetic fields. The system needs to be tried in space to really get good data on how it could function. Consider an example given in the text: a trip to Mars could take only 50 days. This would alter our concept of doing the job of going. The interesting thing I see in this design is the echo of the Mass Driver in that the MagBeam system: the vehicle in this system is also basically a" bucket" that leaves its engine at home See the magazine and the references!

Last and not least: we demonstrated at the New Jersey State Museums Super Science Festival on April 29 and 30 in Trenton. We had a good crowd both days, with the Michelle Baker and I being the presenters and Mitch Gordon and his friend Hal helping Sunday. I was able to show the "Cold Finger" demo to explain how very cold and faint things in space are detected and explain the atmosphere of Mars and how its made primarily of Carbon Dioxide. Dry ice was bought to do this. Both days included: demonstrating various applied science principles, discussing the cost of launching materials and ideas for reducing them, designing rovers for the task rather than as riding vehicles as most have been pictured, and the education of young children on space through talks and demonstration; this was primarily handled by Michelle on Saturday. On Sunday we where aided with our talks to the public on the increased possibility of tourism and talks on the L-5 concept and its roots by Mitch, who also filled in on various talks and demonstrations. He really enjoyed showing the beloved "Space Bricks" of Peter Kokh's manufacture. An addition may happen to our set: I asked Ken, a Planetary Society presenter (and Ambassador to the Solar System) about a new planet: we might send rovers to Titan. We are talking of adding a Titan Brick to the collection and will mass it for that moons gravity effect on the mass. Thanks to an idea developed from talks with Michelle I put together a non conventional rover that kids loved. After explaining the costs of sending a large (1000 Kg.) rover the adult began liking it a lot to! I will describe that lecture in a separate paper.

Earl Bennett, President, PASA

ILLINOIS

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

INFORMATION: Larry Ahearn: 773/373-0349

CALI FORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS
P.O. Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine:(310) 364-2290
Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com
[http://www.oasis-nss.org/]
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.
• June17 th – July 15th – August 19th
Information: OASIS Hotline, 310/364-2290; website.

Upcoming Events

• **Sat. June 17th, 3:00pm –** Monthly Meeting at home of Craig and Karin Ward, 1914 Condon Avenue, Redondo Beach. Planning for the World Science Fiction Con. (L.A.Con IV) August 23-27,Anaheim Convention Center. OASIS will be helping with the science program and participating as an organization. For more information about Worldcon, visit http://www.laconiv.org/.-OASIS Hotline, 310/364-2290;

• **Thurs. June 22nd, 7:00 p.m.** --JPL, "Moon, Mars and Beyond - Apollo on Steroids" by Michael J. Sander, Manager, JPL Exploration Systems and Technology Office. *Admission free. Seating limited.* NASA has spent two years defining, refining, and starting down the implementation trail for the systems that will take us back to the Moon, this time for a much longer time with more exploration tools and a purpose to use the Moon to prepare to move out much further. A number of major components are needed, modeled along the Apollo mission lines. The major advances in robotics and computers since the Apollo era open the doors to an exciting combination of robotic and human partnerships in this great new adventure. While reminiscent of Apollo, the approach has a number of known challenges to be met, and like all explorations will have some challenges yet to be uncovered. This journey will open many doors to new technologies, open many minds to new possibilities and lead down paths yet to be imagined. - 7 pm, von Kármán Auditorium, Jet Propulsion Lab., 4800 Oak Grove Drive, Pasadena, (818) 354-0112 http://www.jpl.nasa.gov/events/lectures/jun06.cfm.

• **Sat. July 15th, 1 pm** -- ***OASIS* Annual Pot Luck Picnic**, Pollywog Park, 1601 Manhattan Beach Blvd, Manhattan Beach. Look for the Big NSS Sign. Info: 310/364-2290

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Send proper dues to address in chapter news section

=>for those outside participating chapter areas <=

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❍ $25 for all members

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❍ $25 regular dues with MMM

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

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❍ $15 regular, ❍ $10 student,
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"SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020

Moon Miners' MANIFESTO

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