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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

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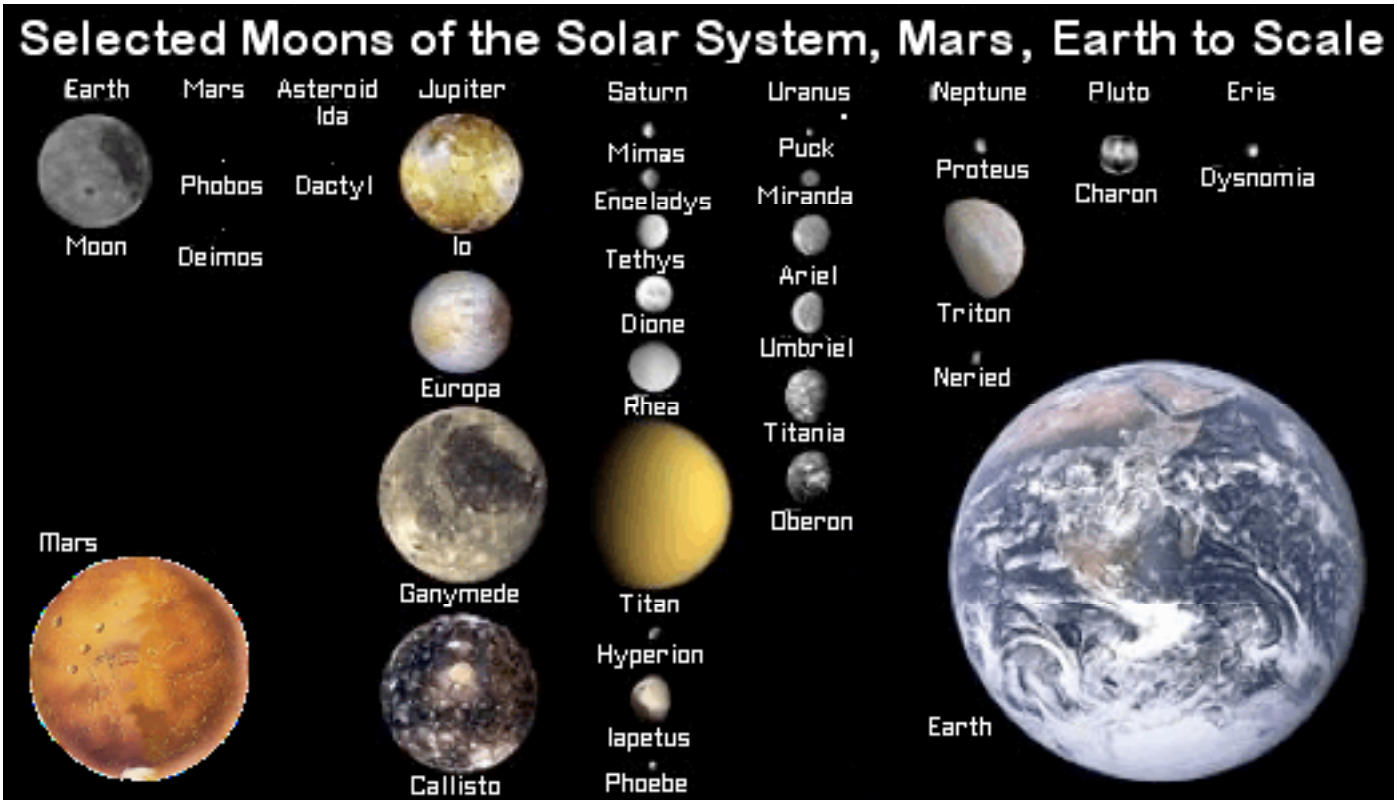


***Above**: There are 6 **m**oons comparable to *th*e **M**oon Io, Europa, Ganymede, Callisto, Titan, and Triton. Nine "half-size" me-toos are: Tethys, Dione, Rhea, Iapetus, Ariel, Umbriel, Titania, Oberon, and Charon*

Feature Articles in This Issue

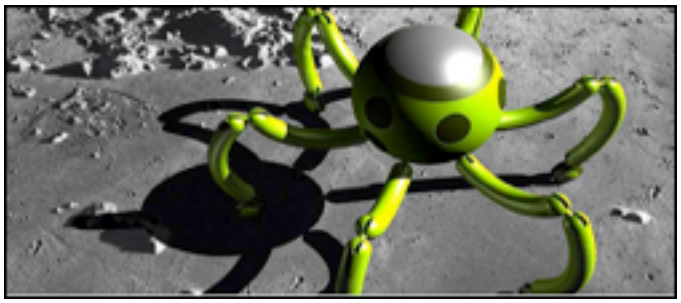
Salvaging Google Lunar X-Prize "Also-rans"

At right, a concept of Team Italia. There are only two prizes in this competition, which means some teams with ingenious designs, may be left hanging out to dry. Dave Dunlop, Moon Society Director of Project Development has a plan to find financing for some of these "also rans" to complete their work by contributing valuable Lunar Science. This proposal is gaining support. See page 4.

IN FOCUS Mars as 'the Destination' Makes Sense *even for us Loonies*

Opinion Piece by Peter Kokh

Many Moon base enthusiasts are disappointed, even to the point of being bitter, that, per the new NASA Administrator, "the destination is Mars" not the Moon. But if you are one of these, you need to take a wider look. In MMM # 191, December 2005, our In Focus Editorial read "Dear Santa: 'a Moonbase made for Mars.'" If you did not read this, here are the points. [=> p. 2, col. 2]



Moon Miners' Manifesto

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

• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first twenty years have been re-edited, reillustrated, and republished in 20 PDF format volumes, for free downloading from either of two locations:
www.Lunar-Reclamation.org/mmm_classics/
www.MoonSociety.org/publications/mmm_classics/

• **MMM Glossary: new terms, old terms with new meanings:**
http://www.moonsociety.org/publications/m3glossary.html

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

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

• **MMM retains its editorial independence.** MMM serves many 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. [Opinions expressed herein, including editorials, are those of individual writers and not presented as positions or policies of the **National Space Society**, **Lunar Reclamation Society**, or **The Moon Society**. **Copyrights** remain with the individual writers. Reproduction rights, with credit, are granted to NSS & Moon Society chapter newsletters.]

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

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

• **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization. National Space Society, 1155 15th Street NW, Suite 500, Washington, DC 20005; Ph: (202) 429-1600 - www.NSS.org

• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.

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

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

• **Submissions by email** to KokhMMM@aol.com - Email message body text or MS Word, Appleworks, pdf attachments
√ Mac compatible CD / or typed hard copy must be mailed to:
Moon Miners' Manifesto, c/o Peter Kokh,
1630 N. 32nd Street, Milwaukee WI 53208-2040

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⇒ In Focus Editorial continued from p. 1.

Here is what we Lunans would stand to get, *if, and only if,* "the destination is Mars."

- **A Biological Life Support System** that went beyond umbilical-cord-style "resupply, rescue, and repair", but had to work without relief for extended periods of time, two years or more. This most likely would involve a considerable greenhouse food-growing operation, something that had already been dropped by NASA from the Bush Moonbase-only program, given the inevitable budget pressures.
- **A design takes "shieldability" into account** because the long stay times on Mars demand such protection. On the Moon, in contrast, we can do without shielding if we rotate crews frequently enough.
- **A robust machine shop and repair facility**, because, on Mars, one might have to fabricate a critical part if the last spare had been used.
- **Development of an adequate power system** *not reliant on "eternal sunshine,"* something that would not be available on Mars. We might end up with a power system that would let us operate anywhere on the Moon, not just in the polar *cul de sacs* of not quite *"eternal sunshine*."
- **Inclusion of a superior medical facility** that with aid of the latest computer software programs from Earth would allow treatment of almost any medial emergency. In a Moonbase-only operation, we'd have emergency transport back to Earth as a crutch to fall back on.
- **Quicker development of Expansion Architectures** that rely as much as possible on locally produced building materials, modules, and parts. In a Moonbase-only operation, we'd continue to rely on shipment of made-on-Earth modules (hard hull, inflatable, or hybrid) and parts.
- **Living spaces that include the perks and amenities needed to ensure sustained crew morale** and productivity over yearlong plus stays. In a Moonbase-only operation, we'd make do with submarine style living standards, or less. Such perks are an essential step towards the introduction of optional "re-upping," signing up for continued stay duty – one small step on the road to the first "settler."

I am sure there are still more points to make!

The one thing that wannabe Lunans and wannabe Martians both don't seem to get, is that while Mars offers an atmosphere rich in oxygen, carbon, and nitrogen, plus a hydrosphere of unknown size, a more day-like rotation cycle, and other amenities, *it remains initially a much harder nut to crack,* because it lacks the one thing that the Moon offers: "location, location, location."

Ironically, however, that very "location benefit" *has served as a crutch* that has allowed NASA bean counters and politicians to restrict full development of any government (national or multinational) outpost to the bare minimum needed to allow us to boast that "we have a moon base."

Look, it's really simple. *Mars is a much more difficult goal, and by pursuing it, we are bound to get a much more robust technology development program from which all destinations can benefit, including the Moon.* We Lunans only seem to be the losers. But if we oppose "Mars is the Destination," we surely will be "the" losers. **PK**

Lunar Thermal Wadis

MMM Special Report by Peter Kokh

Lunar Thermal Wadis & Exploration Rovers
NASA Lunar Surface Systems Concepts
February 25-27, 2009
http://www.nasa.gov/pdf/314555main_AIAA-2009-1339-125_Thermal_Wadi.pdf

"**wadi**" is an Arabic term common in Syria and Northern Africa for a watercourse that is only intermittently flowing with water, and is otherwise dry, often with wet soil below a dried surface. An oasis. The Sudanese city of Wadi Haifa gets its name from such a feature.

Here the term is applied by analogy.

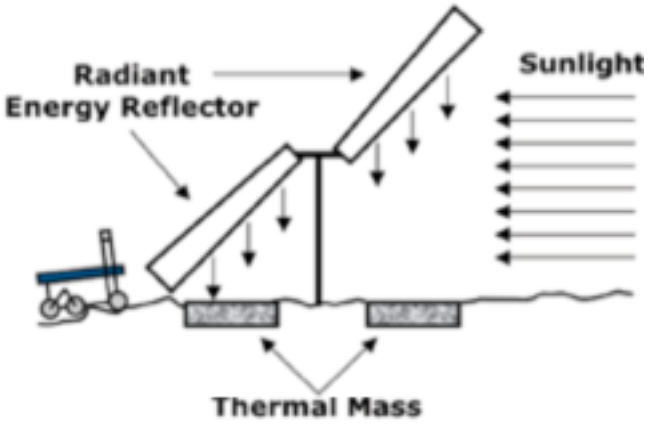
Source: Analysis of Solar-Heated Thermal Wadis to Support Extended-Duration Lunar Exploration
AIAA 2009-1339

Excerpt from the above:

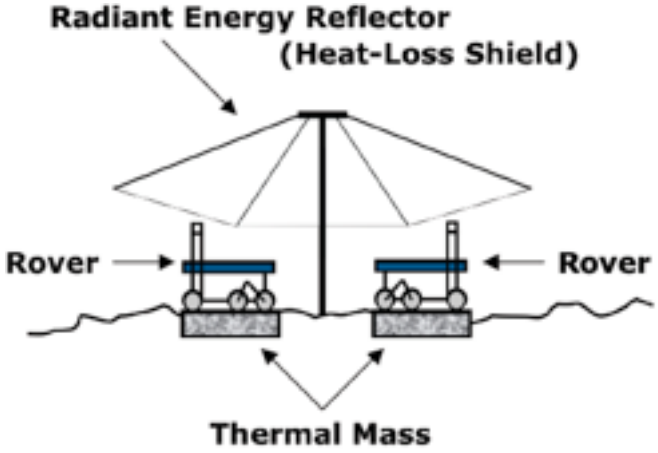
"Among the many challenges that renewed exploration of the Moon is the survival of lunar surface assets during periods of darkness when the lunar environment is very cold.

> "Thermal wadis are **engineered sources of stored solar energy using modified lunar regolith as a thermal storage mass** that can enable the operation of lightweight robotic rovers or other assets in cold, dark environments without incurring potential mass, cost, and risk penalties associated with various onboard sources of thermal energy."

"Thermal wadi-assisted lunar rovers can conduct a variety of long-duration missions including exploration site surveys; teleoperated, crew-directed, or autonomous scientific expeditions; and logistics support for crewed exploration. This paper describes a thermal analysis of thermal wadi performance based on the known solar illumination of the moon and estimates of producible thermal properties of modified lunar regolith. Analysis was performed for the lunar equatorial region and for a potential Outpost location near the lunar South Pole. The results are presented in some detail in the paper and indicate that thermal wadis can provide the desired thermal energy reserve, with significant margin, for the survival of rovers or other equipment during periods of darkness."



Above: a sun-tracking reflector directs sunlight onto a thermal mass during periods of solar illumination while rovers conduct lunar surface operations.



Above: rovers are thermally coupled to the thermal mass to stay warm during the nightspan, and further protected by a heat-loss shield to limit radiative losses to space.

Above: The setting sun illuminates a rover parked on its prepared pad of heat-retaining compacted soil under an umbrella that retards heat radiation to cold black space.

Excerpt: "The thermal property values of the thermal mass are critical to the effectiveness of the thermal wadi. In its native state, lunar regolith is a poor material for thermal energy storage. Due to its very low thermal diffusivity, ... per measurements made during the Apollo program, heat does not penetrate the lunar surface very deeply and is lost rapidly due to radiation during periods of darkness. It is this property that accounts, in part, for the large surface temperature swing during the Moon's 27-day diurnal cycle.

"However, the regolith contains the elemental materials needed for a reasonable thermal energy storage medium, and experiments on Earth have demonstrated that solar and/or microwave energy can enable the necessary conversion processes. Examples of regolith processing methods that can produce thermal masses with improved thermal properties include:

- Compacting and sintering
- Melting processed or unprocessed regolith, then solidifying the melt into a solid block
- Incorporating hardware and/or materials with high-thermal conductivity and/or high-thermal capacity.
- Reducing regolith, by thermochemical or electro-chemical means, to produce a metal-enriched product.

The paper goes into details on the relative merits of these options, the practicality of their use, and makes recommendations. Using the moondust's own assets to combat the harsh lunar environment, is a win-win option.

MMM

Salvaging the Google Lunar X-Prize "Also-Rans"

By David A. Dunlop,
Moon Society Director of Project Development

Google Lunar X-Prize –
www.googlelunarxprize.org/lunar/about-the-prize/introductory-video
www.googlelunarxprize.org/lunar/about-the-prize
www.googlelunarxprize.org/lunar/about-the-prize/rules-and-guidelines
www.googlelunarxprize.org/lunar/teams

Opportunities, Incentives, and Tools For New Lunar Science Missions

Google Lunar X-Prize Teams

- Twenty teams are now vying for Google Lunar X-Prizes. While only two teams at best will win the 1st and 2nd prizes, the other team programs may offer potential options for further development. If so, their investments to date should not be wasted.
- Their merits with regard to technological innovation or cost-efficient models should be not go untested simply because they were not the first or second to land on the Moon.
- GLXP teams that do not win 1st or 2nd prize will require incentives and support to continue advancing their projects to flight readiness status and actual flight to the Moon.
- These also-rans *may present opportunities to "re-purpose" their lunar landers to deliver needed or desired science payloads to lunar surface.*
- Evaluation of each team's design should be made in terms of
  - Risk reduction,
  - Technical feasibility
  - Cost efficiency
  - Suitability as platforms for lunar science missions that should be supported by the various national space agencies for those teams open to a follow-on incentives program to the original GLXP program.
- NASA and ILEWG (International Lunar Exploration Working Group) partners should support lunar program approaches and incentives that foster both international and commercial collaborations.

Incentive Science Contracts are an example of how this could work

- $50M incentives should be offered for delivery of ILN (**International Lunar Network**) science packages comprising laser retro-reflector cube, seismometer, lunar radiation monitors, and heat flow probes – http://nasascience.nasa.gov/missions/iln

Technology Incentives

A. NASA and DOE should offer RTG technologies as a missions-enabling technology incentive to lunar rover missions that deliver long duration sorties on the models of Pathfinder, Spirit, and Opportunity, and which address high priority science objectives. This should be jointly competed by ESMD (NASA Exploration Science Mission Directorate) and SMD (NASA Science Mission Directorate). http://en.wikipedia.org/wiki/Radioisotope_thermoelectric_generator

B. Incentives should be created for technology demonstrations that use non- nuclear techniques to survive the lunar night cold temperature cycle, such as "Lunar Wadis" – see preceding article.

C. Incentives should be offered and competed for principal investigators and teams which can demonstrate achievement of *science goals that are on lunar science road map* so that the process of lunar science missions development is more "granular" and financial "assets can be brought to the table" in consideration of lunar missions proposals by science investigators and teams whose instruments have been competitively qualified.

Open-Source Student Lunar Lander Engineering Missions

As a means of driving down the cost of lunar transportation and creating opportunities for the next generation of lunar engineers and scientists, the ILEWG nations should supports University-based engineering teams and networks working on a transparent open source basis.

Following the precedents of the ESMO (European Student Moon Orbiter) and ASMO (American Student Moon Orbiter), and **cubesat** projects ILEWG partner nations should all support at least one "open source" and "ITAR free" student lunar lander missions. This would create a pool of shared designs and platforms for engineering support of lunar landers and rovers and the expansion of the "lunar robotic village" by 2020.

These student lunar lander platforms should be cost justified by the requirement to deliver lunar a greater volume of lunar science packages to the surface, the need for technology demonstrations on the lunar surface, and the support of engineering workforce development goals.

An Open-Sources Science Proposals Database

An open data base for lunar science missions proposals should be created which identifies principal investigator, sponsoring organization, proposed science instruments, Their Technology Readiness Level, Lunar Science road Map Objectives, mass, power requirements, cost, so that the lunar community of interest is easy to identify and the lunar mission "market" potential for lunar science is transparent. This database should build on the Lunar Orphans Flight Test (LOFT) list of NASA Lunar Commercial Services Commercial Crew and Cargo Office and the ESA Lunar Science Proposals Solicitation lists. All ILEWG member agencies should be invited to support this database. **DAD**

Lunar Basalt

What, Where, and its Critical Role for Lunar Industrialization and Settlement

By David Dietzler
With contributions from Peter Kokh

1) Technical Terms and Chemical Description of "Basalt," "Gabbo," "Lava," "Magma"

Basalt is hardened surface "lava. Hardened subsurface lava is called gabbro. Molten surface rock is called lava and molten subsurface rock is called magma.

The lunar mare areas are covered with basalt pulverized into a fine powder by eons of meteoric bombardment. This material will be relatively easy to mine with power shovels.

This regolith consists of pyroxenes (iron, magnesium, and calcium silicates: SiO3), olivines (iron and magnesium silicates Si2O4), ilmenite FeTiO3, spinels and plagioclase CaAl2Si2O8.

Lunar basalts are classified as high, low and very-low titanium basalts depending on ilmenite and Ti bearing spinel content. **They differ from their terrestrial counterparts** principally in their high iron contents, which range from about 17 to 22 wt% FeO. They also exhibit a range of titanium concentrations from less than 1 wt% TiO2 to 13 wt% TiO2. A continuum of Ti concentrations exists with the highest Ti concentrations being least abundant. Lunar basalts differ from terrestrial basalts in that they show lots of shock metamorphism, are not as oxidized and lack hydration completely.

See: **http://en.wikipedia.org/wiki/Basalt**

Olivine contents range from 0% to 20%. Basalts from the mare edges or coasts probably contain more plagioclase, the mineral that makes up most of highland soils, than basalts closer to the center of the mare.

Types of Processed Basalt

- **Cast Basalt:** Basalt can be melted in solar furnaces, *cast into many forms*, and heated again and allowed to cool slowly (annealing) to recrystallize and strengthen the cast items. It can be cast in iron molds and possibly in simple sand molds dug into the surface of the Moon.

Iron could be obtained by harvesting meteoric Fe-Ni fines that compose up to 0.5% of the regolith with rovers equipped with magnetic extractors. Iron molds could be cast in high alumina cement molds. The high alumina cement could be obtained by roasting highland regolith in furnaces at 1800-2000 K to drive off silica and enrich CaO content. This could be hydrated in inflatable chambers with condensors to recover water vapor. It might also be cost effective to upport iron molds to the Moon since they would have a very long lifetime.

- **Sintered basalt** is not fully melted. It is placed in molds, pressed, and heated with microwaves or solar heat just long enough for the edges of the particles to fuse. This will require less energy than casting. Sintered Basalt can be used for low-performance external building blocks, pavers, and other uses.
- **Drawn basalt fibers** are made by melting basalt and extruding it through platinum bushings.
- **Hewn basalt** is quarried from bedrock, road cuts, or lava tube walls. It can be cut with diamond wire saws.

2) Uses of Basalt: source:

http://en.wikisource.org/wiki/Advanced_Automation_for_Space_Missions/Chapter_4.2.2

Table 4.16 Lunar Factory Applications of Processed Basalt

Cast Basalt – Industrial uses

- Machine base supports (lathes, milling machines)
- Furnace lining for resources extraction operations
- Large tool beds
- Crusher jaws
- Sidings
- Expendable ablative hull material (possibly composited with spun basalt)
- Track rails reinforced with iron prestressed in tension
- Railroad ties using prestressed internal rods made from iron
- Pylons reinforced with iron mesh and bars
- Heavy duty containers (planters) for "agricultural" use
- Radar dish or mirror frames
- Thermal rods or heat pipes housings
- Supports and backing for solar collectors
- Cold forming of Metal fabrication with heat shrink outer shell rolling surfaces

[Current industrial uses omitted above]

- Abrasion-resistant Pipes and conduits
- Abrasion-resistant Conveyor material (pneumatic, hydraulic, sliding)
- Abrasion-resistant Linings for ball, tube or pug mills, flue ducts, ventilators, cyclers, drains, mixers, tanks, electrolyzers, and mineral dressing equipment
- Abrasion-resistant floor tiles and bricks

Cast Basalt – commercial, agricultural, & residential uses (omitted on source list above)

- large diameter (3" plus) pipe for water mains and for toilet and sewer drainage systems
- floor tiles
- countertops, tabletops, backsplashes
- planters and tubs of all sizes, flower pots
- possibly contoured seating surfaces (contoured seats lessen the need for resilient padding, cushions)
- lamp bases
- many other commercial and domestic uses

Sintered Basalt (from URL reference above)

- Nozzles
- Tubing
- Wire-drawing dies
- Ball bearings
- Wheels
- Low torque fasteners
- Studs
- Furniture and utensils
- Low load axles
- Scientific equipment, frames and yokes
- Light tools
- Light duty containers and flasks for laboratory use
- Pump housings
- Filters/partial plugs

{Logical lunar uses omitted from above list]

- Blocks for shielding retainer walls
- Slabs for airlock approaches, external paths and walks
- lightweight light-duty crates and boxes
- Acoustic insulation
- Thermal insulation
- Insulator for prevention of cold welding of metals
- Filler in sintered "soil" cement
- Packing material
- Electrical insulation
- "Case goods" furniture as we might use wood composites such as OSB, MDF, etc.

Basalt Fiber – Uses (in place of glass fibers)

- Cloth and bedding, pads and matts
- Resilient shock absorbing pads
- Acoustic insulation
- Thermal insulation
- Insulator for prevention of cold welding of metals
- Filler in sintered "soil" cement
- Fine springs
- Packing material
- Strainers or filters for industrial or agricultural use
- Electrical insulation
- Ropes for cables (with coatings)

[In Gujarat at M .S. Univ., Kalabhavan, Baroda, basalt fibers are used as a reinforcing material for fabrics, having better physicomechanical properties than fiberglass, but significantly cheaper than carbon fiber.] www.fibre2fashion.com/industry-article/3/256/new-reinforced-material1.asp

- basalt brake pads? (no asbestos on the Moon)
  http://www.technobasalt.com/news/?id=14
  http://www.basalt-tech.ru/en/prospects

Hewn Basalt (MMM's list)

- Heavy duty Building blocks
- Road paving slabs
- Heavy duty floor slabs
- Architectural pillars, headers, arches
- [a] Carving blocks for sculpture statues, other artifacts
  - lamp bases, mancala/oware boards, etc.
  - fountains, bowls, table pedestals, vases, etc.
  - statues, plaques, beads, bracelets, endless list

3) Properties of basalt From--
http://www.islandone.org/MMSG/aasm/AASM5C.html

Table 5.9.- Properties Of Cast Basalt

Physical properties Average numerical value, MKS units
Density of magma @ 1473 K 2600-2700 kg/m3
Density of solid 2900-2960 kg/m3
Hygroscopicity 0.1%
Tensile strength 3.5X107 N/m2
Compressive strength 5.4X108 N/m2
Bending strength 4.5X107 N/m2
Modulus of elasticity (Young's modulus) 1.1X1011 N/m2
Moh's hardness 8.5
Grinding hardness 2.2X105 m2/m3
Specific heat 840 J/kg K
Melting point 1400-1600 K
Heat of fusion 4.2X105 J/kg (+/-30%)
Thermal conductivity 0.8 W/m K
Linear thermal expansion coefficient
... 273-373 K 7.7X10-6 m/m K
... 273-473 K 8.6X10-6 m/m K
Thermal shock resistance 150 K
Surface resistivity 1.0X1010 ohm-m
Internal resistivity 1.0X109 ohm-m
Basalt magma viscosity 102-105 N-sec/m2
Magma surface tension 0.27-0.35 N/m
Velocity of sound, in melt @ 1500 K 2300 m/sec (compression wave)
Velocity of sound, solid @ 1000 K 5700 m/sec (compression wave)
Resistivity of melt @ 1500 K 1.0X10-4 ohm-m (author's note--this is of importance to magma electrolysis which requires an electrically conductive melt)
Thermal conductivity,
... melt @ 1500 K 0.4-1.3 W/m K
... solid @ STP 1.7-2.5 W/m K
Magnetic susceptibility 0.1-4.0X10-8 V/kg
Crystal growth rate 0.02-6X10-9 m/sec
Shear strength ~108 N/m2

4) Gallery of Basalt Products

Cast Basalt Pipes

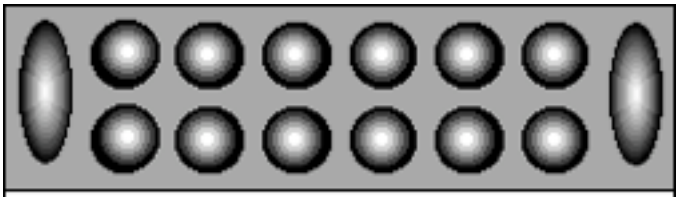
With unequalled abrasion-resistance, such pipes *and chutes* will be **pre-requisite** for all moon dust handling industries, even for oxygen production.

Cast Basalt tiles (from Czech Republic)

Cast basalt planter

Hewn and carved basalt:

blocks, carved scarab



A Mancala or Oware game board

A bathtub

Note: The above are individually crafted items. Production items include pipes and tiles of various kinds.

Basalt: What Does All This Mean?

By Peter Kokh and Dave Dietzler

The cute things such as what you can carve out of solid basalt, aside, the essential message is in the abrasion resistance of basalt vs. the very abrasive nature of moon dust out of which we are going to have to make as much as possible. The name of the game is to produce locally on the Moon as much as possible of local frontier needs, and to develop export markets for those things, to defray imports on the one hand, and to earn credits to import what they cannot produce on the other hand.

Our Thesis: A lunar basalt industry is **pre-requisite** to any other lunar materials industry. Unless we prefer to bring from Earth, all items needed to handle abrasive material such as moon dust,

Lunar industrial settlement must have access to basalt

We believe that we must start in the maria, preferably along a mare/highland coast with access to both major suites of lunar material. The Lunar North Pole is some 600 miles from the nearest such coast – the north shore of Mare Frigoris. The Lunar South Pole is more than twice as far removed from the nearest such coast, the south shore of Mare Humorum.

Despite the advantage of more hours of sunlight, and eventually recoverable water ice, starting at either pole could be an industrial dead end.

Yes, access to water is essential, but most of us interested in lunar settlement, *before the possibility of finding water ice at the pole became a common hope,* were determined to launch lunar settlement anyway. We would harvest solar wind protons from the moondust and combine them in fuel cells with oxygen coaxed from the same soil, to make water and extra power.

Having to do this, despite the now-confirmed reserves of water ice at the poles, may be a good thing, as it will prevent the rape of water-ice for the production of rocket fuel, and thereby preserve it for future lunar settlement needs including agriculture and biosphere. Yes Liquid Hydrogen and Liquid Oxygen are the most powerful fuels now in use. But 1) we don't need that much Isp to rocket off the Moon, or to hop from here to there on the Moon, and 2) we should be more concerned with developing more powerful fuels anyway, including nuclear fuels.

The polar water ice is at cryogenic temperatures, and extremely hard. Harvesting it in darkness at the bottom of steep crater walls will not be easy, and unless done entirely robotically, could be a very risky occupation. That it will be easy to harvest is myth #2. Myth #1 is that the sunlight at the poles is eternal. Honest estimates are that sunlight at any one spot is available only 76% of the tie at the South Pole, and possibly 86% of the time at the North Pole. That means for 52% of the nightspan at the South Pole and 72% at the North Pole. We must still bite the bullet and learn to store dayspan power for nightspan use for 100% of the nightspan, a factor of 2 times as long at worst. Then we can go anywhere, including places where a more complete suite of mineral assets are available, including possible gas deposits elsewhere.

The critical role of basalt is so fundamental to success that we must rethink our destinations. **DD/PK**

WORLD WATCH
AFD News Service

Fate of LCROSS Instrument Package a Mystery

03.31.2010 – NASA Ames Research Center, Moffet Field, Mountain View, CA. The Centaur rocket stage successfully impacted the Moon within the permanently shaded portion of Cabeus Crater near the Luna South Pole on October 9, 2009. And the impact splash-out debris cloud was successfully photographed and analyzed by the LCROSS probe proper, following close behind. There was no way, however, to record the impact of the latter. Now some are daring to speculate that it may not have impacted the surface at all. **Below left:** the Centaur rocket, **Below right:** LCROSS Instrument Package Proper.

Behind the wild speculation: It seems that a millionaire space enthusiast, looking through his own personal 36" reflector in the desert mountains west of Las Vegas, *did see something! Or did he?* We leave his name out of it, as a simple beginner's mistake had him looking at the wrong part of the Moon. Most amateurs know that through a telescope, the Moon's image is inverted, and south is at the top. Our unlikely hero, oblivious or forgetful of this, was looking at the bottom of the image, that is, at the Moon's *North* Pole. And he did see something! A few moments after the LCROSS instrument package telemetry signal was lost on schedule, he saw a small suddenly sunlit object "speeding downwards" (actually to the zenith above the north lunar pole) and he followed it for a few seconds before it disappeared.

While most people dismiss this as a sheer coincidence, astronomer Brad Jonathan believes that this strange sighting may not be a coincidence at all, that there is a connection between LCROSS disappearance over the Moon's South Pole, and the quick ascent of a small object skyward above the Moon's North Pole. "The permanent shadows at both ends in this case indicates that they may be connected by a "worm hole." The LCROSS impactor had been traveling at 6,000 miles per hour; and the Moon is over 2,000 miles in diameter, so unless its speed was somehow accelerated in its passage down the Moon's axis through the core and then out the north polar "exit" you might expect emmergence in about 20 minutes. But the object receding from the North Pole did so only a few minutes later, indicating that the alleged "worm hole" "tubeway" between the permanently shadowed craters of the Moon's two poles must have accelerated the object's speed considerably."

No one at NASA has been willing to comment on this "wild" "science fantasy" story.

But now the question is whether this presumed wormhole along the Moon's axis is primordial, or had been "built." We do not know enough about it to even begin guessing. How wide is the hole? Is it of uniform width throughout? Is it straight or have some curvature? What happened to the material it displaced? Or did it not displace any lunar material? One thing seems certain; planetologists are unanimous in insisting this could not be a natural formation, the result of any known planet-building geological process. "I, for one, am not volunteering to go to the Moon, climb down into Cabeus, and jump into this 'hole' just to see what happens!" – Arne Saknussem X.

So what is it? Some sort of sentient-made stargate? It would seem that we need to do an experiment: drop something into the North Pole maw and see if it is similarly accelerated out of the South Pole maw. Current betting is that the acceleration effect works in one direction and we will find deceleration in the other, and that it is aimed at a target well outside the solar system. The Moon's north pole is pointed in the direction of Zeta Draconic, currently. But this changes over time.

At present, having never had a real live wormhole to study, we have no way of estimating its age. Where the "stargaters," as they are now dubbed, came from, and over what time period their visits extended, is a guessing game. Their home system could very well be around some inconspicuous star that has yet to be named. So right now, and probably for a long time, we are left with only questions, mysteries, and wild speculations.

Indeed, without a series of experiments flying into both polar maws at varying speeds, it is not possible to determine how much of an acceleration or deceleration is provided and thus how much interstellar journey times might be shortened. The exit speed is clearly sub-light

Trying to narrow down the stargate target destination by studying the precession of the Moon's North Celestial Pole is also pointless. There may be thousands of reasonable targets wherever it was first pointed.

Back on the Moon, the search is on for what we might find in the way of transportation support systems in the occasionally sunlit portion of Cabeus, but so far nothing there has caught the eye as out of the ordinary for floors of craters of this size. Nor have any surface features elsewhere on the Moon, puzzling enough to suggest a sapient origin, come to the attention of anyone other than writers for supermarket tabloids. **AFD News**

04.01.2010 – Las Vegas, NV – **Global Conciliation Services** (GCS) has signed a deal with a manufacturer of inflatable space habitats for a $150 M structure in space to be devoted to mediation and conciliation between parties to apparently irreconcilable disputes. A group of billionaire benefactors is footing the bill.

The idea is novel. Those in need of "extreme dispute intervention" will have the use of the orbital facility, *free for one week*. There is a catch! The ship to return them home will not depart until the parties have reached a binding agreement. And to exert even more pressure, there will be a hefty price per extra day at the facility beyond the first week. *"Lock 'em up and throw away the key until they agree!"*

At a 150 miles up and at a speed of 17,000 mph, you just can't open an airlock and drop back home safely if you give up on finding a satisfactory solution! Nor will "agreeing to disagree" solve the stalemate.

That's the whole point of the GCS business plan, according to a spokesman for. On the other hand, there will be a team of mediation experts available to either or both parties by closed circuit television. **AFD News**

MMM's 23rd Happy April Fools' Day News

The Moon Society www.moonsociety.org

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

Objectives of the Moon Society

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

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

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

Monthly Moon Society Progress Reports: visit our Homepage http://www.moonsociety.org and scroll down the center of the page to the prominent yellow **Frontlines** link. This report has been issued monthly since April 2008.

We Encourage our Members to Consider Joining us at ISDC 2010 in Chicago May 27th -31st – Memorial Day Weekend

By Peter Kokh, President

For information on this year's International Space Development Conference, see page 16, this issue.
And/or visit the ISDC site at: www.isdc2010.org

The ISDC is not just the conference of the National Space Society. It has traditionally been a "**Big Tent Conference**" supported by many space organizations, as *"the"* premium opportunity to network. Leaders and members of NSS, The Moon Society, Mars Society, The Space Frontier Foundation, Space Studies Institute, AIAA, and many other organizations, including major and lesser aerospace corporations and NASA are on hand, not just to keep up with what each other is doing, but to establish and/or strengthen new or existing efforts of collaboration and joint projects.

The programming covers just about every field related to space that you can imagine, and there is always several things going on at once.

Here you can get a chance to talk to the major movers and shakers and presenters on hand, find other like-minded individuals, and above all, return home with a major "shot in the arm" of encouragement and commitment to make a personal contribution.

It was at ISDC 2005 in Washington, DC, where the Moon Society and the National Space Society mutually affiliated on terms we proposed (down to the last letter.) You can read the details at:

www.moonsociety.org/reports/affiliation_report.html

Yours truly has not been able to make every ISDC but we have been to quite a few: 1987, 1999, 1989. 1990, 1991, 1993, 1994, 1995, 1997, 1998 (chair). 1999, 2000, 2004, 2005, 2007, 2008, 2009, and I expect to be at this year's event.

At ISDC 2007 Dallas, a Society team led by Chip Proser and David Dunlop produced about thirty video interviews with some of the most significant people in the space movement. These are available by clicking on the "Moon Colony Videos" link top center on our home page. We also introduced our University of Luna Project Awards at this ISDC (Alan Binder PI for Lunar Prospector, T.D. Lin researcher on lunar concrete, Phil Sadler and CEAC for the South Pole Station's Food Growth Chamber.)

At ISDC 2008 in Washington, DC we gave an award to Dr. Lawrence Taylor (U. TN) for his work that showed how we can control the behavior of moondust by magnetim. This year we will be giving another ULP award.

Last year in Orlando, NSS bestowed a considerable honor on the editor of Moon Miners' Manifesto for "twenty-three years of inspirations" – the "Gerard O'Neill

Space Settlements Award," which had gone to Harrisson Jack Schmitt (Apollo 17) and John Mahrburger III (Pres. Bush's science advisor) the two previous years, and will be presented to Freeman Dyson this year. Last year, in connection with that award, NSS produced one thousand CDs containing the first twenty years of Moon Miners' Manifesto (The MMM Classics files) to be distributed to all attendees – at NSS' expense!

We introduced our Solar Power Beaming tabletop Demonstration Unit at ISDC 2008, again last year, and it will be in Chicago this year. Our NSS partner chapter in Milwaukee, The Lunar Reclamation Society, which had hosted ISDC 1998, and had created a number of exhibits for that event, will be bringing them to Chicago this year.

Several members of the Moon Society St. Louis "think tank" including major MMM contributor Dave Dietzler will be on hand. We hope to see and meet many other members and to make ourselves available.

You should know that for two decades the 1989 ISDC, also held in Chicago, was the largest ever, with the most programming and attendance. Key people from that event are behind this one two. *So if you were waiting for a very special ISDC, this is the one not to miss!* Of course, they are all memorable.

Many things happen in the magic of networking at these events. 1987 lit a spark that at ISDC 1988 led directly to the formation of the Lunar Prospector Team that, affer some disappointments, was finally financed by NASA and flew a successful mission in 1998-1999.

The 1998 event in Milwaukee saw the announcement of the Founding Convention of the Mars Society, with yours truly, as chair, giving Robert Zubrin a plenary session at which to make the announcement.

So the ISDC is much more than a place to take in outstanding presentations by key speakers. It is a place to meet people who are doing things, or hoping to do things, to get involved yourself, or simply to get a major shot in the arm for your vision of the future.

Some may wonder why the Society does not have its own conference. The answer is simple. The number of people who would come, the players with whom we could network, the creative mischief in which we could get into, would all be limited. There is much more opportunity for both Moon Society Leaders and Moon Society Members at this shared big-tent conference. Our opportunities to meet others, to do outreach, to enter into collaborations, to showcase our own efforts, are all much larger at ISDC than they would be at a stand-alone conference.

Of course, we dream of growing large enough to make a dedicated conference worthwhile. But in the current economic downturn, all grass roots space societies are losing members. We are proud to say that over the past year or so, we've been holding steady. That is not as good as growing, but at least our numbers are not declining as in most other organizations.

If you are coming, or thinking of coming, please drop a personal message to president@moonsociety.com so that I can be on the lookout for you. I would like to have some special time with all of you.

Room sharing is one way to make the event more affordable. We have one member who wants to share the room he has reserved, and there may be more of you who wish to do so. So drop me a line! I hope to see many of you in Chicago. And for those of you who have never been there, ***Chicago is a World-Class City!*** **PK**

And the Winner is

(of this year's University of Luna Project Award)

Dallas Bienhoff

For his work in developing the rational and design for orbital refueling stations

We first met Dallas in Dallas! He was at ISDC 2007 in the city after which he was named (?) to make a presentation on this concept, and to show how with orbital refueling, the same rocket could deliver 2-3 times as much payload tonnage how, to the Moon, or how, conversely, we could delver the same payload with a much smaller *(and cheaper)* launch vehicle.

We grabbed him, of course, for our videotaping team (Chip Proser and son plus Dave Dunlop) and you can watch the results (in four segments. Just go to our homepage www.moonsociety.org and click on the top center "Moon Colony Videos" imager lnk, then select "GAsteroid" – or directlty go to:

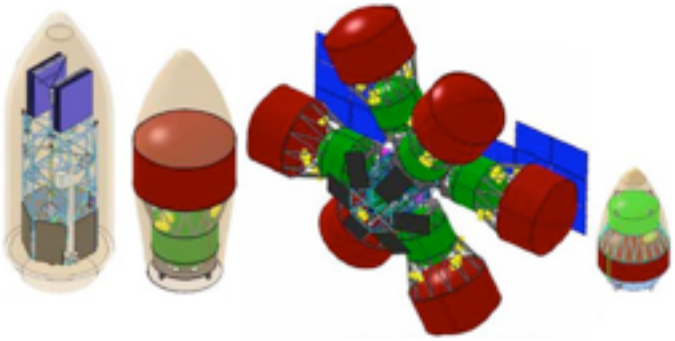
http://gaiaselene.com/GAsteroid/GAsteroid.html

While we have always thought that this was a great idea, NASA, which has based all its manned Moon program concepts (both Apollo and Contellation) on a "lov flight rate" for which the expense of building and deplyin an orbital refueling station would be not be justified. The trouble with this "low flight rate" model is that it necessarily becomes a self-fulfilling prophecy. We give credit to the advisors of the Obama Adminsitration for seeing this clear case of a Catch-22. The new NASA direction would include money to design, build and deploy such an orbital gas station, allowing smaller launchers to deliver more to the Moon, more often.

To those bitterly disappointed in the new direction, we point out that the Bush 2020 target date, given underfunding, was always been "science-fictional." But now with more money being spent on fundamental tech,nologies to bust NASA's "low-flight rate" paradigm, out of the water, we might actually have people on the Moon, NASA personnel or not, before 2020.

With Dallas' team at Boeing now set for funding, we want to honor Dallas for his work to date, by givng him this award. It is a plaque, a very special and attractive one we think, and not a monetary one.

We featured Dallas' design on the front cover of our February issue, MMM #232.



http://nextbigfuture.com/2008/01/boeing-propellant-depot-useful-space.html

Dallas also serves as a Moon Society Advisor

Nominees for Moon Society Offices and Board Positions *still needed*

Even if all incumbents whose positions are up for election this year choose to run for re-election, we will still be short one candidate for **Secretary**, and one for the unfinished term (one year remaining) of retiring **director** Shaun Moss. Often enough, we are fortunate to have one candidate per position. Now if we had more than that, there would be one or more real contests, and that would make this annual exercise much more interesting to our members! All positions are for two-year terms, except for filling remaining one year periods of a vacated position.

Eligibility: Anyone who has been a member of the Society for a full year as of August 1, 2010 is eligible to run for a board seat or officer position. This covers all members with a membership number of 1568 or lower are eligible for election. If you are unsure of your eligibility, and have a Moon Society username and password, you can check your membership # at:

http://www.moonsociety.org/mymoon/

Our meetings are held in a private and dedicated chat room (in the **ASI-MOO** environment. If you have never been "on the MOO" go to our homepage, scroll down the left hand menu to the ASI-MOO image link. Scoll down the page until you see:

Java MOO client: Framed Popup

For newcomers, we suggest the Popup option. You wlll get a Java screen showing a steaming cup of coffee, a symbol of waiting. When the screen comes on, below the line at the bottom enter **connect** (then your particular) **username** (then) **password (**without quotation marks or commas, just spaces) and click *enter.* This will get you into "The Commons." If you want to see what our meetings are like, let us know so we can arrange access. To get to the meeting room from the commons, type **north** (enter, then) **moon-leaders** (enter) and you will be in our special meeting room (if access is pre-aranged.)

Recommendations: (1) Anyone who is unable to attend our meetings on a regular basis should not run for office. The Management Committee (officers and directors meeting together) meets the 1st and 3rd Wednesday evenings of each month, 9-11 pm Eastern, 8-10 pm Central, 7-9 pm Mountain, 6-8 pm Pacific. Times will be earlier in Hawaii and Alaska, Times in the Eastern Hemisphere will be on the following Thursday: wee morning hours in Europe, morning in India, and early afternoon in Australia.

Recommendations: (2) Anyone who has not previously served in a Moon Society leadership capacity and who wishes to run, is encouraged to join us in our meetings ***now*,** so that you will be up to speed by election day. To gain access to the Management Committee meetings, please send an email to president@moonsociety.org so that access (restricted) can be granted.

Nothing ventured, nothing gained. If you believe you have talents and or knowledge and understanding or vision that you would like to put at the disposal of the Society, we will welcome you. Our discussions are free-ranging. While we do vote on motions, in general our decisions almost always reflect consensus. Even if as a visitor, you cannot yet vote, your input is valued, and helps us reach a consensus. president@moonsociety.org

A "Moon Books" Drive for India

By Pradeep Mohandas, Secretary Moon Society India
moonsocietyindia@gmail.com
Jayashree Sridhar, President Moon Society India
jayashreesridh@gmail.com
and Peter Kokh, President, The Moon Society
president@moonsociety.org

Moon Society India's first project is to build a **Lunar Resource Library** of books that could be loaned out to members and/or chapters in India. A good list of the some of the books in print that would be most welcome, is maintained by NSS/Moon Society member Ken Murphy at:

www.outofthecradle.net/categories/lunar-library/

We are asking Moon Society members in the U.S. and elsewhere outside India, to gather those books on this list that they are willing to donate. If you are a member of a chapter, gather all the books available from your fellow chapter members and send them to the Moon Society's Milwaukee P.O. Box 80395, Milwaukee, WI 53208.

Or if you will be attending the International Space Development Conference in Chicago, May 27-31st, bring them with you to leave with Moon Society personnel (look of anyone tending the Moon Society exhibits in the ISDC Exhibit Hall.

If you are neither connected to a chapter and/or won't be attending ISDC 2010, just send them to the above PO Box.

> The Post Office new program
> ***if it fits, it ships®*** *...* ***for a low flat rate***
> https://www.prioritymail.com/simulator.asp

may be the cheapest route to ship a number of books, as the rate is determined by the size of the (provided Post Office) boxes, not by the weight.

But *do check the book rate* as that may be even cheaper.

Posters in good condition are also welcome.

Collected books and posters will then be shipped to India by the least expensive method available. In India, the library will be kept either in Mumbai (Bombay) or in Chennai (Madras) to be determined.

The Moon Society (International) and Moon Society India, thank you in advance for your generosity. This is an open-ended effort, with no end-of-effort deadline. But, of course, we are anxious to get this project launched with a bang! So look now through your library. Those books you refer to regularly and prefer to keep for your own use, please do so. Those you can spare will be most welcome, however.

As we begin to acquie multiple copies, additional lunar libraries will be set up in other major Indian cities such as Delhi, Banglore, Hyderabad, Pune, Kolkata, etc. There are NSS chapters in the last two cities.

"One book can make an immense difference" – get involve and make a difference!

The Moon Society Chapters & Outposts Frontier Report

Chapters & Outposts

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>
Next meetings Apr 22nd, May 20th, June 17th
Meetings **3rd Wed** monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

The April meeting was shifted a week because we had not made our meeting request to the library on time.

From MMM Files:

L>R: Bob Perry, Chris Nobbe, Gregg Maryniak, Bert Sharpe on the occasion of Gregg's talk, *"Can the Moon save the Earth?"* at the St. Louis Science Center, Science Cafe presentation, January 18th 2007

Moon Society Phoenix Chapter

http://www.msphx.org
http://www.moonsocphx.blogspot.com/
Contacts: Craig Porter portercd@msn.com
Chuck Lesher: chuckmiester999@yahoo.com

Meeting the **3rd Saturday of the month**
Moon Society Phoenix' next meetings are on Saturdays **April 17th, May 16th, June 19th**

Moon Society Houston Chapter

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

Next monthly meeting May 17th

Discussion Forum:

The Houston Chapter invites all Moon Society members and interested guests to participate in our discussion forum, available at your convenience 24 hours a day! Moon society members may give their membership number at registration for access to the private "Members Only" discussion section, while all local chapters and outposts will be provided with their own designated sub-forum upon request. The forum is available at:

http://www.moonsocietyforum.com/

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Chapters & Outposts Map (North America)

www.moonsociety.org/chapters/chapter_outpost_map.html

Chapters & Outposts Events Page

www.moonsociety.org/chapters/chapter_events.html

Space Chapter HUB

http://nsschapters.org/hub/

For Chapters of the Moon Society, Mars Society, National Space Society – *we all face the same obstacles and have the same set of tools*

Meetings and Agendas	Downloadable Transparencies
Events Calendar	Chapter Scrapbooks
Projects Unlimited	Growing Your Chapter
Display Blueprints	Chapter Websites
Models & Exhibits	Image Libraries
Downloadable Flyers	Chapter Merchandise
Download Slide Sets	*and much more!*

===== Moon Society Outposts =====

www.moonsociety.org/chapters/chapter_outpost_map.html

Moon Society Nashville Outpost – Central Tennessee
Contact: Chuck Schlemm cschlemm@comcast.net

Bay Area Moon Society, CA Outpost – South Frisco Bay
http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net
Informal meeting at Henry Cate's home in San Jose
The 4th Thursday every month

Moon Society Longview, TX Outpost
Contact: James A. Rogers jarogers2001@aim.com

Moon Society DC Metro, DC-MD-VA Outpost
Contact: Fred Hills Fredhills7@aol.com

Milwaukee, WI Outpost (MSMO)
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com
The monthly Lunar Reclamation Society meeting on the 2nd Saturday afternoon every month, serves MSMO also

NSS Partner Chapter News – pp. 17-19

Oregon L5 (Portland), **Lunar Reclamation Society** (Milwaukee), **Minnesota Space Frontier Society** (Minneapolis-St. Paul), **San Diego Space Society**, **Houston Space Society**

Moon Society Chapters Coordinator

chapters-coordinator@moonsociety.org

Moon Society DUES with ***Moon Miners' Manifesto***
Electronic MMM (pdf) **$35** Students/Seniors: **$20**
Hardcopy MMM: U.S/Canada **$35** Elsewhere: **$60**
Join/Renew Online - www.MoonSociety.org/register/

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions
Moon Society Membership Services:
PO Box 940825, Plano, TX 75094-0825, USA

Projects, Chapters, Volunteers, and Information
Moon Society Program Services,
PO Box 080395, Milwaukee, WI 53208

< End Moon Society Journal Section >

GREAT BROWSING

Probes vs. Humans :: Maps vs. Burried Treasure
http://www.thespacereview.com/article/1559/1

'Facing Mars' exhibit tests your readiness for space
http://seattletimes.nwsource.com/html/thearts/2010919769_mars29.html

Reactions to big switch to Commercial Space
http://www.thespacereview.com/article/1566/1

Could China win the Moon Race?
http://www.thespacereview.com/article/1565/1

Could new emphasis on New Space backfire?
http://www.thespacereview.com/article/1564/1

Critical technologies for cost-effective exploration
http://www.thespacereview.com/article/1572/1

Earth and Moon, As Seen From Mars
www.universetoday.com/2008/03/05/earth-and-moon-as-seen-from-mars/

Constellation ves. Commercials: a 3rd Option
http://www.thespacereview.com/article/1571/1

NASA's new "Space Weather Tool"
www.companiesandmarkets.com/news/environmental/nasa-unveils-new-space-weather-science-tool-DC59700.asp

Control a lunar rover on NASA I-phone app
http://www.companiesandmarkets.com/news/environmental/nasa-unveils-new-space-weather-science-tool-DC59700.asp

Microbes can split H^2O into H^2, O^2 for fuel cells
http://www.ias.ac.in/currsci/25feb2010/499.pdf

Veil lifts slightly on Blue Origin's 3-man Capsule
http://www.space.com/businesstechnology/blue-origin-rocket-secrets-100226.html

"At least" 600 M tons of ice on Moon's North Pole!
http://www.space.com/scienceastronomy/water-moon-north-pole-100301.html
http://www.nasa.gov/mission_pages/Mini-RF/multimedia/feature_ice_like_deposits.html

ITAR reform – a way to satisfy all concerns
http://www.thespacereview.com/article/1587/1

Griffin's Big Mistake in selling Constellation
http://www.thespacereview.com/article/1585/1

Anousheh Ansari's dream of space
http://www.thespacereview.com/article/1583/1

Potential landing sites on Phobos photographed
http://news.yahoo.com/s/space/newphotosshowpotentiallandingsitesonmarsmoon

Japan to launch Akatsuki Venus probe
http://www.nature.com/news/2010/100315/full/news.2010.126.html

Exploring the Universe's 1st "trillionth of a second"
http://www.eurekalert.org/pub_releases/2010-03/jhu-jaa031510.php

Remarkable story of fan-built Shuttle "Trainer"
http://www.nasa.gov/centers/kennedy/news/shuttlemockup.html

Lunakhod 2 found on Moon 37 yrs, 34 km later
http://story.malaysiasun.com/index.php/ct/9/cid/89d96798a39564bd/id/613016/cs/1/

NASA may sample & 'interrogate' primeval asteroid
http://www.spacedaily.com/reports/Interrogating_The_Asteroid_999.html

GREAT SPACE VIDEOS

MOON COLONY VIDEOS – The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics)

Saving the Earth by Colonizing the Moon
http://gaiaselene.com/Saving%20Earth/SavingEarth.html

The Moon Society
- **The Moon Society**
- **Moon Rush – Dennis Wingo 5 parts**
- **NASA – Pete Worden 3 parts**
- **Paul Spudis – 2 parts**
- **Rick Tumlinson – 6 parts**
- **Moon Colonies**
- **Thomas Pickens – 3 parts**

http://gaiaselene.com/Moon%20Society/MoonSociety.html

The Lunar Greenhouse
http://gaiaselene.com/Moon%20Society/MoonSociety.html

Refuelling Depot in Orbit
http://gaiaselene.com/GASteroid/GASteroid.html

Space Solar Power
http://gaiaselene.com/Solar/Solar.html

Visionaries:
- **Arthur C. Clarke on the Space Elevator**
- **Buzz Aldrin on the Space Race**
- **Buzz Aldrin on Asteroid Danger**
- **Elon Musk on Commercial Rockets**

http://gaiaselene.com/Visionaries/Visionaries.html

Peak Oil – Matt Simmons – 5 parts
http://gaiaselene.com/Peak%20Oil/PeakOil.html

NASA Regolith Challenge
http://gaiaselene.com/RegolithChallenge/RegolithChallenge.html

ASSORTED SPACE VIDEOS

WISE – Wide-field Infrared Survey Explorer T-scope
http://www.space.com/common/media/video/player.php?videoRef=TWiS_WISE

IMAX Hubble 3D – Exclusive Look Inside the Film
http://www.space.com/common/media/video/player.php?videoRef=Hubble3D_02

Spirit's Last Moves before the Martian Winter
http://www.space.com/common/media/video/player.php?videoRef=SP_100212_spirits_last_move

Last Moments of LCROSS – NASA Probes Hit Moon
http://www.space.com/common/media/video/player.php?videoRef=SP_091009_LCROSS-impact

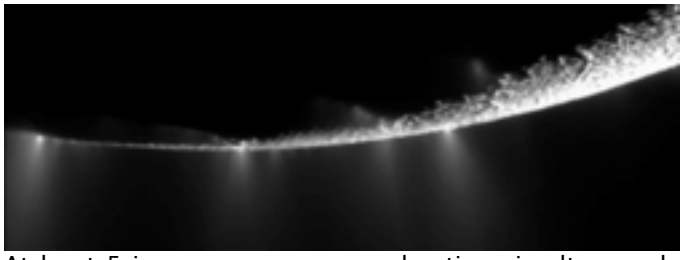
"All men dream, but not equally. Those who dream by night in the dusty recesses of their minds wake in the day to find that their dreams were just vanity: but the dreamers of the day are dangerous men, for they may act out their dreams with open eyes ...making what they dream possible." – T.E. Lawrence

"Yesterday is history, tomorrow is a mystery, and today is a gift; that's why they call it 'the present.'"
---Eleanor Roosevelt

Amateurs built the Ark; Professionals built the Titanic!

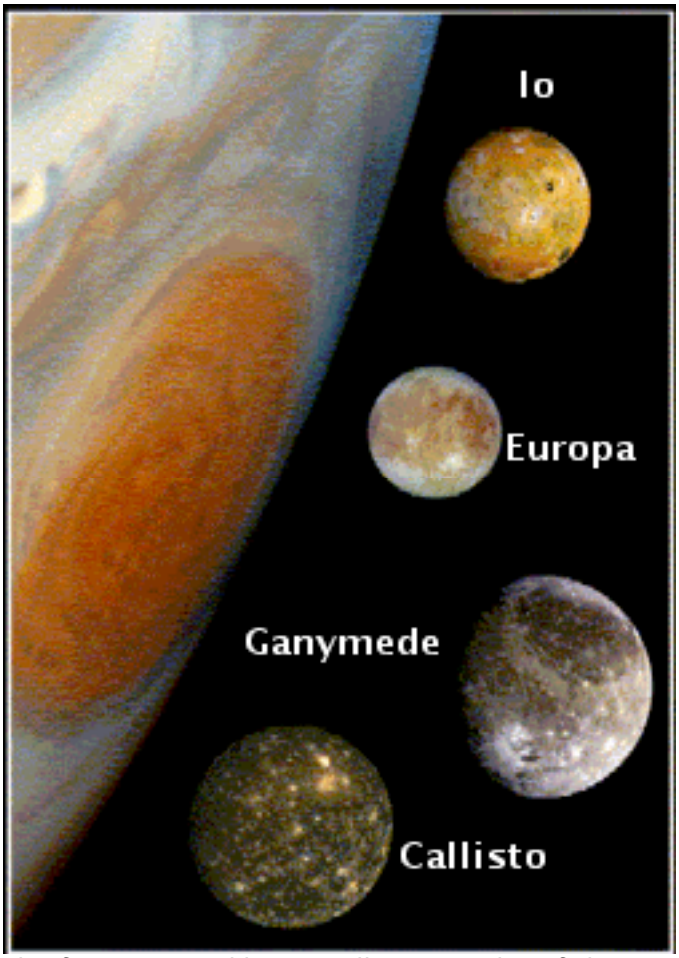
"The best way to predict the future is
to be busy inventing and creating it."

MMM PHOTO GALLERY



At least 5 ice geysers are seen shooting simultaneously from Enceladys' south polar area in this Cassini photo, dramatic proof that this small moon of Saturn is continuously active, and probably has a sub-ice-crust ocean, much as does Jupiter's much larger moon Europa.

http://www.solarviews.com/eng/enceladus.htm
http://en.wikipedia.org/wiki/Enceladus_(moon)

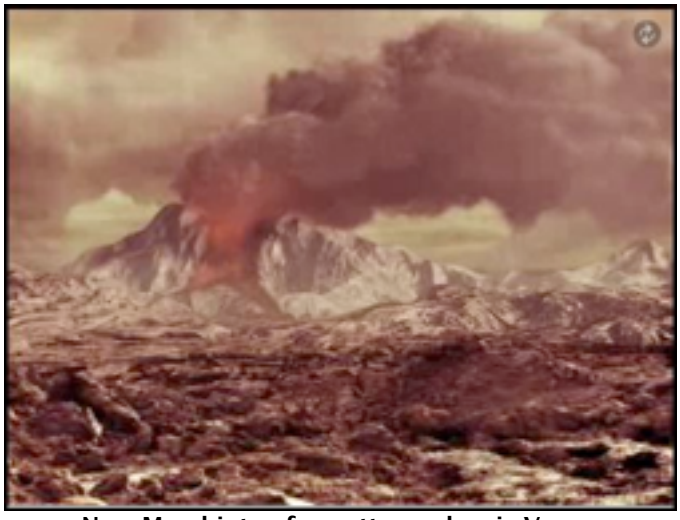


The four great Galilean Satellites in order of distance from Jupiter, Io, slightly bigger than the Moon; Europa, slightly smaller than the Moon; Ganymede and Callisto compare with Mercury and Titan in size.

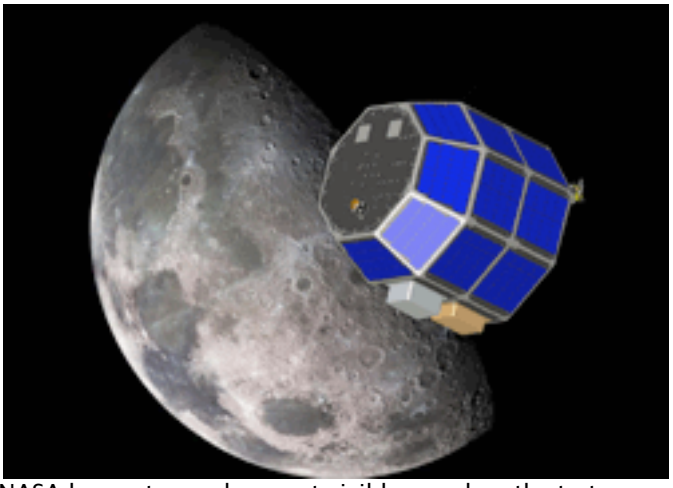
Satellite	mass	diam	period	dist
Moon	1.00	2,160	29.53	238
Io	1.12	2,255	1.77	261
Europa	0.65	1,940	3.55	416
Ganymede	1.98	3,265	7.15	663
Callisto	1.41	2,920	16.69	1,170

Jupiter's big four compared to the Moon: In mass (Moon=1), diameter (miles), orbital period in days, and mean orbital distance from planet in thousands of miles. Gravities are all similar to the Moon's, dense Io's highest.

The **Huyghens probe**, aerobrake shield below and protective helmet above, is the only probe to land on a body in the outer Solar System – *five years ago,* on January 14, 2005. But most of what we have learned about Titan is from 20-some flybys by the Cassini probe. A conference comparing notes in Barcelona Jan 14-16



New Map hints of a wetter, volcanic Venus
http://www.universetoday.com/2009/07/14/new-map-hints-at-venus-wet-volcanic-past/

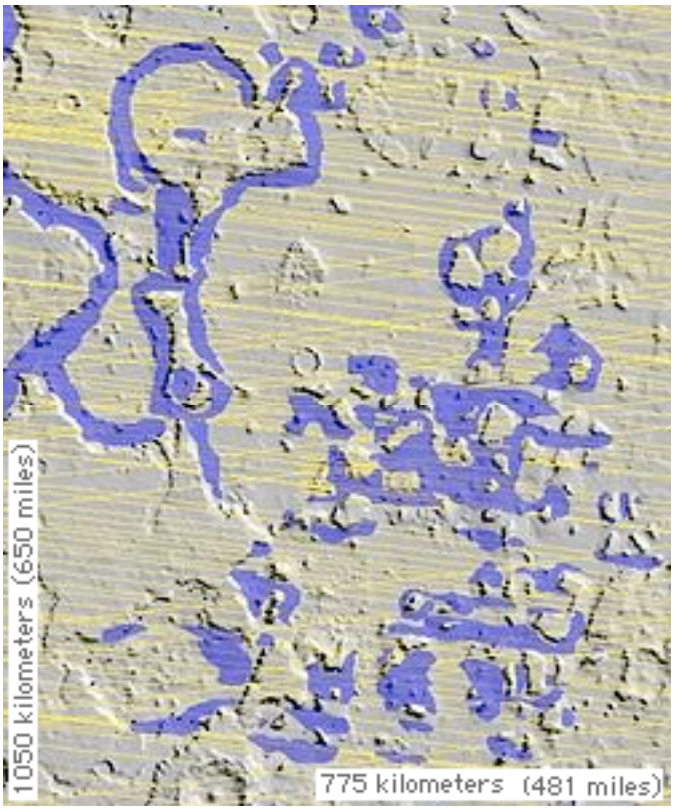


NASA hopes to use lasers at visible wavelengths to transmit data the lunar orbiter, **LADEE** (above), to be launched as early as 2012, allowing transmission of data at rates at least 10 times higher than radio, with far less power.

Photo of Blue Origin's (Jeff Bezos) *New Shepherd* rocket snapped from a plane, reminds one of the Delta Clipper!

Mars Reconnaissance Orbiter Unveils Subsurface Frozen Rivers and Glaciers

MMM Special Report – Source: http://photojournal.jpl.nasa.gov/catalog/?IDNumber=pia12861 [area shown is half the size of Alaska]



Thick masses of buried ice are quite common beneath protective coverings of rubble in the middle-latitude region of northern Mars according to Shallow Subsurface Data [Italy's SHAROD] gathered two years ago. While Mars geologists are excited about such findings, this knowledge is of major significance for would-be human settlements on Mars, as they indicate that on many places, water-ice can be tapped by drilling down.

What is needed is a global map of such sub-surface, and one in three dimensions, not just two, indicating at least roughly, how far below the surface such reservoirs lay. The depth will determine the practicality of tapping the ice for various water needs: agricultural, domestic, industrial, etc.

This is clearly a start. We hope that in the useful lifetime of MRO, the craft can come close to accumulating the data for a global map. Whether this data has a dimension that included information on depth below the surface, we do not know.

The real significance is that if such deposits can be tapped with less equipment than needed to create aqueducts from the edges of Mars polar caps, the amount of Mars Surface suitable for settlement, at least from the vantage point of water needs, could become considerable.

Such a water map, plus detailed maps showing abundances of various industrially important elements, plus demonstration that we can produce more than methane from Mars air, i.e. that we can build a rudimentary atompsheric-chemicals industry including useful fuels and plastics, will make settlement realistic. **MMM**

Bigelow Aerospace Progresses To point of Hiring 1st Astronaut

From Bigelow Aerospace via CareerBuilder.com

http://www.careerbuilder.com/JobSeeker/Jobs/JobDetails.aspx?IPATH=JELGF3RI&je=myrec&APath=1.39.21.0.0&jrjob=true&sc_cmp2=10_JobMat_JobDet&Job_DID=J8G1NC5XTZWKB1BYLVG&ff=39

Bigelow Aerospace seeks professional astronauts to fill permanent positions. Qualified applicants need to have completed a training program from their government or recognized space agency and have at least some flight experience on a recognized space mission.

Specialized training and/or experience (ie: Medical, Payload Specialist, EVA, Pilot, etc.) is not a pre-requisite, but is definitely a plus.

Possible opportunities will come in two areas:

1) Ground

: – Working with Marketing Team to secure government and cooperate clients.

: – Working with Design and Fabrication Teams to help optimize layout of systems for on-orbit serviceability and ergonomics.

: – Working with Mission Control Team on final checkout of flight vehicles, both pre and post launch.

: – Help Develop Astronaut training programs for Bigelow Aerospace Professional Astronaut Corps as well as Client Astronaut Corps.

: – Work instructing in the Bigelow Astronaut Training Program

2) Flight

: – Perform as Professional Astronaut aboard Bigelow Aerospace Station Complex

: – Manage all onboard aspects of employee and customer astronaut personal safety

: – Maintain the Station Complex as required (mainly IVA, but some EVA as well)

: – Help clients with payloads or experiments (primarily with regards to integration into station's systems and communications)

Comment: This is a welcome sign that Bigelow progress to date, including its two nautilus modules now in orbit, have given the company confidence that its dream of deploying manned inflatable space stations, and even inflatable moon bases is on its way to becoming real. For all of us followers of New Space Commercial companies, this is a good sign.

BIgelow had previously stated that it could deliver a BA 330 module, with more volume than all the current space station hard-hull modules together, for a $100 million, not including outfitting.

Outfitting these modules is another question. Bigelow surely has some worked out templates, one for a vertical deployment (floors perpendicular to axis, and at least one for horizontal deployment, floors parallel to the axis. Anything not built-in as a "fold-down" or "pull-out" feature will have to be designed to slide in through the airlock.

For new spacefaring countries who might want their own space station, and for anyone, of any national space agency or commercial program that wants a spacious and relatively inexpensive moon base module, Bigelow inflatables may be the best thing out there. **MMM**

2010 Intern'l Space Development Conf

Everything you wanted to know about what's going on in space, in one place at one time

That's what you will find at the National Space Society's 29th International Space Development Conference in Chicago over Memorial Day weekend, May 27-31, 2010.

"40 years after Apollo - Getting Back to the Future That We Originally Envisioned"

Multi-track programming throughout the conference: Topics will range from "**Astrogeology**" to "**Water on the Moon**," with intervening sessions on **breakthrough technologies, entrepreneurial space start-ups, futurism, governmental programs, the International Space Station (including construction lessons and future uses), living in space, lunar construction and settlement, making money in space, Mars as a destination, sex in space, technical possible showstoppers, and propulsion options**

All this will be jam-packed into four and a half days, and at a price substantially lower than any comparable space event. Even better, the room rate at the site hotel is only $115 per night.

MAJOR FOCI; The US Space program is at a crossroads and this year's ISDC will feature:

- **New Directions**. New NASA Administrator Charles Boldin has scheduled an appearance, along with representatives of both "Big Aerospace" and the "New Space Entrepreneurs," to discuss their roles in re-energizing the space efforts. However, we can also expect significant discussion in the programming and in the corridors as to whether the new NASA direction is a "path to nowhere" and whether our space program needs to "go somewhere

BEYOND THE BIG DEBATE: Two special topics:

- **Space-Based Solar Power** (SSP or, sometimes, SBSP). Three days of symposia led by John Mankins, covering the state of the art, the hurdles, and the infrastructures, of SSP. The symposia will also highlight the uncomfortable fact that only SSP will be able to fulfill our increasingly voracious energy needs.
- **Building & Using a Lunar Outpost.** Lest we forget that our overall mission is to create a spacefaring civilization, and sooner rather than later, and with the state of the art "doable" is sooner than many people realize.

AUXILIARY EVENTS: ISDC will also host

- The **Space Investment Summit**
- The **Council of Chapters** of the Students for the Exploration and Development of Space (**SEDS**)
- The first **Commencement ceremony of the new Kepler Space University**
- A **"Living in Space" symposium** organized by the AIAA Space Colonization Technical Technical Committee
- Sunday and Monday special **programs for teachers**.
- Thursday A **reception for NSS Space Ambassadors**.
- Friday optional all-day **tour of Argonne National Laboratory and Fermilab**.
- Friday night program to **certify teachers to handle Moon Rocks.**
- Saturday night will see our Governors Dinner, followed by a special open program, "**How the Space Movement began**," commemorating the 45th anniversaries of the L-5 Society and the National Space Institute (which merged in 1987 to form NSS).
- During the ISDC and culminating at that dinner, NSS will conduct **a fundraising auction** of **space-related memorabilia** and other items.
- Sunday traditional **NSS Awards Banquet** highlighting the space community's labors during the prior year and its plans for promoting an exciting spacepolicy in the next.
- Monday morning, NSS leaders will host the **annual NSS Town Meeting**, to update and answer questions from members about the Society. This being 2010, there will be a discussion of "The Science of 2010 (the movie) Compared to the Science of 2010 (the reality)." We may even show the movie.
- **Watch the ISDC website**, www.isdc2010.org, for **updates** on the program schedule.
- **Chicago is an exciting city to visit**, with great space centers at the Museum of Science and Industry and Adler Planetarium.

ISDC BASICS

Thursday, May 27 through noon Monday, May 31 Chicago, Illinois. Hotel: The new **InterContinental Chicago O'Hare** Hotel. A short ride on free shuttles from O'Hare Airport. **Rooms only $115/night**. **Register** online at www.icohare.com, or **phone toll-free** (877) 834 3613. Use **Group Code "NSD."**
ISDC Registration: $150 thru April 30 ($40 for students), $180 thru May 24 ($40 students), $240 thereafter and at-door ($60 students).
Register at www.isdc2010.org.
Our Chair Tom Veal, Vice Chairs Larry Ahearn and Jeffrey Liss, and the entire 2010 Committee look forward to welcoming you. Come early or stay late.

SPECIAL NETWORKING OPPORTUNITIES

- 15-minute breaks between sessions.
- Various speakers will be at assigned locations to "meet and greet" attendees and answer questions about their work from 5 to 6 p.m. every day.
- Large Exhibit Hall perfect for networking, conversing.

CONFIRMED SPEAKERS AND GUESTS INCLUDE:

Buzz Aldrin (astronaut & NSS Governor)
Eric Anderson (President, Space Adventures)
Charles Boldin (NASA Administrator)
Peter Diamandis (ISU and X-Prize founder)
Hugh Downs (legendary correspondent & NSS Governor)
Freeman Dyson (Prof. Emeritus, Inst. for Advanced Study & NSS Governor)
Paul Eckert (International/Commercial Strategist, Boeing)
Richard Garriott (civilian astronaut & NSS Governor)
Lori Garver (NASA Deputy Administrator)
Chirinjeev Kathuria (Chairman, PlanetSpace)
LCROSS Team representatives
Lon Levin (President, SkySevenVentures & NSS Governor)
James Logan (NASA Medical)
John Mankins (Co-founder. COO, Managed Energy Technologies)
Tim Pickens (President, Orion Propulsion)
Michael Simpson (President, Int'l Space University)
Harrison Schmitt (astronaut & NSS Governor)
George Whitesides (NASA, Senior Advisor)
Robert Zubrin (President, Mars Society)

The **Moon Society** is cosponsoring the ISDC and will have **key leaders** on hand, along with **great exhibits**.

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!

2009 LRS OFFICERS | BOARD* | Contact Information

PRES. / MMM Editor – *Peter Kokh **NSS**
kokhmmm@aol.com 414-342-0705
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SECRETARY – *James Schroeter **NSS**
James_Schroeter@excite.com 414-333-3679
TREAS./ Database – *Robert Bialecki
bobriverwest@yahoo.com 414-372-9613

LRS News

● **Our March meeting**: Dennis Groves brought a BlueRay of last summer's hit movie "***Moon***." Robot intrigue a la Hal from Space Odyssey 2001! Bring in the "clones!." James Schroeter brought in his working Living Walls exhibit (a work in progress), which we will be binging to Chicago for ISDC Memorial Day Weekend.

● **Rockets for Schools: May 7th/8th in Sheboygan.** They havw invited us to participate and bring our exhibits, The event once again falls on our meeting date, and this alone makes it unlikely for us to attend.

● **ISDC 2010:** In Chicago this year, May 27-31. Peter Kokh and Dave Dunlop will be attending as will Charlotte Duprees, James Schroeter and Bob Bialecki. A big turnout! ISDC was in Chicago in 1989, 21 years ago (already!?)

● **Our website is still off the ether!** This is all very frustrating as we are not the registrar of record and must wait on others to straighten out the mess.

LRS Upcoming Events
Saturdays: 1-4 pm
April 10th – May 8th – June 12th

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

● Space News Update, ● Exhibits for ISDC in Chicago,
● Discussion of possible summer picnic and/or field trip
● Field Trip Suggestions: New Discovery World Museum and Aquarium on the Lakefront, _____?, ___?

News & Events of NSS "MMM" Chapters

Space Chapter 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
Apr 17th, May 15th, June 19th

MINNESOTA

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

David Buth (w) (612) 333-1872, (h) (763) 536-1237

Email: info@mnsfs.org

Email: info@mnsfs.org
www.mnsfs.org/

Proud hosts of the MDRS Web Cams
http://freemars.org/mdrscam/
The counter has now passed 1,000,000!

Ben's MarsCon Pix
http://freemars.org/mnfan/MarsCon/2010/

Pics of JUST science stuff @ Marscon 2010
http://freemars.org/mnfan/MarsCon/2010/sci-rm.html

MN SFS Upcoming events schedule
http://freemars.org/mnfan/MNSFS/2010-12-Review/

ILLINOIS

Chicago Space Frontier L5
610 West 47th Place, Chicago, IL 60609

Larry Ahearn: 773/373-0349 LDAhearn@aol.com

Host of ISDC 2010 – May 27-31, 2010
http://isdc.nss.org/2010/

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WISCONSIN

Sheboygan Space Society
728 Center St., Kiel WI 54042-1034

c/o Will Foerster 920-894-2376 (h) astrowill@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 Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI
● Apr 15th – Jun 17th – Aug 19th – Oct 21st

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113
http://www.angelfire.com/space/frl5/

Eric Boethin 303-781-0800 eric@boethin.com

Monthly Meetings, every 2nd Monday, 7 PM
Next: March 9th, April 13th, May 11th

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

PENNSYLVANIA

Philadelphia Area Space Alliance
928 Clinton Street, Philadelphia, PA 19107

c/o Earl Bennett, Earlisat@verizon.net
215/633-0878 (H), 610/640-2345(W)

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

● PASA regular business luncheon/formal meeting 1-3 pm, the **3rd Saturday of every month** at the **Liberty One food court** on the second level, **16th and S. Market.** Go toward the windows on the 17th st. side and go *left*. Look for our table display. Parking: Liberty One on 17th St. Call Earl/Mitch 215-625-0670 to verify all meetings.

Next Meetings: Apr 10th, May 6th, June 5th

In addition, we will be at **Super Science Weekend** at The **New Jersey State Museum** on April 24. It will be a Saturday only event this year at the Museum's **Trenton** location: see the website: www.njstatemuseum.org.

Recent events: we gave awards at The **George Washington Carver Science Fair** on February 25th and March the 12th, the former being the James H. Chestek Award, and the latter the Oscar H. Harris Award. Both are for space related science and technology. This covers a very wide span and this year our judge, Mike Fisher, chose a project involving water treatment for the elementary level award, and heat flow in a closed structure for the senior levels. The winners where surprised and delighted to receive our "presents". Both where given "Everything that Flies", a kit that lets you build kites, Frisbees, and so on. Both also got a 4G memory stick and some horticultural material. The senior winner also received Dava Sobel's "The Planets" and, of course, $50 in cash. We thank the Carver Committee for allowing us to judge and give our special awards, and Nancy Peter of the committee in charge of special awards and Thomas Anderson Jr., who founded the Fair. And again, our judge, Mike Fisher. In my opinion Mike should be invited to be part of the Committee due to his support of science education. And one more thanks: to Pete Stevens for his excellent pictures!

Meeting notes: Larry, our webmaster, found that we had a virus on our website and worked overnight to fix the problem on the day of the meeting. He had to reconstruct our picture gallery, and closed our blog site temporarily. One of our attendees, Janice, had recently put a paper on the site about the Apophis asteroid and the possibly of deflecting it from hitting us. Back to Larry: he will be putting our meeting notes on the site with a three month lifetime, and he should have the Fair pictures up when I send them.

Dorothy brought several magazines on New York that included The Intrepid Sea, Air, and Space Museum directions, costs, and the new "Mission to Mars" description. She also reported on a special exhibit at The Rubin

Museum of Art: Visions of the Cosmos: From the Milky Way to the Evolving Cosmos", through May 10th. And much more. She also supplied her business card for the proper address to which her ***Moon Miners'*** should go.

Mitch asked us to change the rules of admission to the group and put up for consideration changing from using ***Moon Miners'*** as our publication of record. We voted to amend our bylaws to allow for attendees to be given the ability to help at events and vote on our actions. The requirement is that they must attend at least three meetings a year. Serving at the Carver Science Fair was vetoed. We also voted to keep ***Moon Miners'*** for our publication primarily due to the articles it carries. Mitch will bring his display books to the Super Science event and will use the Moon and Mars globes for his talks.

Earl reported on several topics that included the Science Fair noted above, Wired Magazines' March issue "Atoms Are the New Bits" (pages 58 to 67 plus) on the availability of small scale manufacturing to most people. Most of the vendors cited are offshore, primarily in China. A few of the entrepreneurs want better control of there intellectual property and use other vendors, while still others work with U.S. suppliers.

This was especially true of the "crowd sourced" car design discussed in the publication. I'm not sure if this would work for the main components of a space system (i.e. the spacecraft) but it is already "old hat" for some of the other items. We have analog habitats, rover designs, and teams working on space suit elements, habitat elements, and a host of robot designs.

And speaking of robots: The X-Prize Foundation has a number of interesting links to a number of robot development teams. This is a global competition with twenty teams (at this writing) with videos and requests on there websites. I visited a German site that was looking for communication help for when there groups rover is on the Moon. They are "the Part Time Scientists". Go to Lunarxprize.org for more. The April issue of Sky and Telescope has "Hanging in the Balance" by Greg Laughlin on what may happen in the Solar System due to chaotic motions of some of the planets and moons. Mercury is a possible runaway, but not anytime soon. Then there are Jupiters' moons. And lastly, the March issue of Nuts and Volts has a Near Space article on a Sun Sensor assembly for balloon born instrumentation. It uses four cadmium sulphide cells and a micro controller for interfacing to the rest of the instrument package.

And: Wallace and Janice came to our meeting, with Wallace being inducted as an associate. Janice noted that she is trying to contact someone at NASA who does asteroid path analysis to check her Apophis deflection idea. Submitted by Earl Bennett

CALIFORNIA

San Diego Space Society
http://sandiegospace.org/
info@sandiegospace.org

Meeting the 2nd Sunday monthly – 2:30 to 4:30 pm
Next Meeting: April 11th, May 9th, June 13th
Serra Mesa Branch Library 9005 Aero Dr, San Diego
Quarterly Newsletter: ***The Bussard Scoop***

CALIFORNIA

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

Events Hotline/Answering Machine:(310) 364-2290
Odyssey Ed: Kat Tanaka – odyssey_editor@yahoo.com
http://www.oasis-nss.org/wordpress/
oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

Regular Meeting 3 pm 3rd Sat. each month

Next Meetings: Apr 17th, May 15th, June 19th

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

MON April 12th Yuri's Night
LA Party 2010: Yuri Area 33, 11822 Teale St.
April 10, 2010 – 22:00 to 06:00
Per http://yurisnight.net/yn2aiaia010/ (Party List)

THU April 15th 5-9 pm **AIAA, Dinner Meeting, Lecture:** Jerry Elverum, Principal Developer of the Lunar Module Descent Engine that brought Apollo astronauts home.

THU-FRI April 15th/16th 7pm JPL Lecture "Mapping the Infrared sky with WISE Wide-field Infrared Survey Explorer
15th von Karmen Audit'm 4800 Oak Grove Dr, Pasadena
16th Vosloh Forum, Pasadena City Coll., 1570 E Colorado

FRI April 16th 8-10 pm LA Sidewalk Astronomers Star Party San Fernando Road and Palm Ave., Burbank

SAT April 17th, 3 pm OASIS Board Meeting
Home of Phil Turek, OASIS' President

TUE April 20th 7:30 pm Panel Discussion "In Search of Living Worlds" by 30M Telescope/Discover Magazine **Free** No Reservations needed, Beckman Auditorium, Caltech, Pasadena. http://events.caltech.edu

SAT May 15th, 1 pm OASIS Board Meeting
Long Beach Public Library, 101 Pacific Hwy

Tentative: following Board Meeting
Free OASIS Lecture series: **Shuttle Retrospective Lecture** by Ron Urquidi, Rocketdyne engineer.
Long Beach Public Library, 101 Pacific Hwy, Long Beach

FRI May 21st Astronomy Night
Come do some sidewalk astronomy with us!
Cerritos Public Library, 18025 Bloomfield Ave., Cerritos

THU-MON, May 27th – 31st
ISDC 2010, Chicago, IL
InterContinental Chicago O'Hare Airport Hotel
http://isdc.nss.org/2010/

FRI June 18th (tentative)
Tour of Space-X, 1 Rocket Road, Hawthorne, CA 90250, (310) 363-6000 ***OASIS members only*

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.
PO Box 2102, Milwaukee WI 53201-2102

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- **$45 National Space Society dues** include ***Ad Astra***
- **$20** NSS dues **if under 22 / over 64.** *State age* ___

600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include *Moon Miners' Manifesto*
Electronic MMM (pdf) **$35** Students/Seniors: **$20**
Hardcopy MMM: U.S. & Canada **$35** - Elsewhere: **$60**
P.O. Box 940825, Plano, TX 75094-0825, USA

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Member Dues -- MMM Subscriptions:
Send proper dues to address in chapter news section

=> *For those outside participating chapter areas* <=

- **$12 USA** MMM Subscriptions; • US **$22** Canada;
- US **$50** Surface Mail Outside North America

Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CHICAGO SPACE FRONTIER L5
- $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

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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