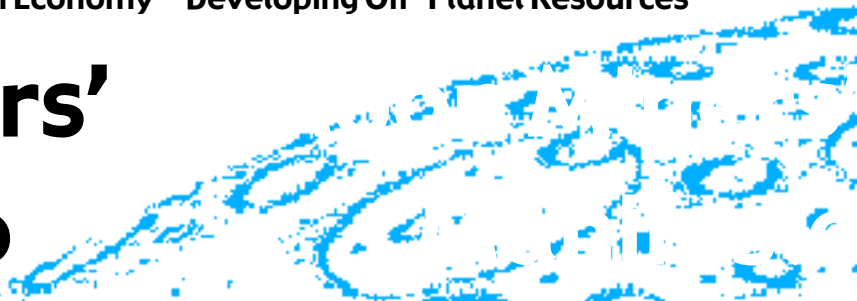


Moon Miners’ Manifesto



& The Moon Society Journal

www.MoonMinersManifesto.com

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JUNE 2005

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In FOCUS: **Cosmos 1 launch failure**

Solar Sails have been on the drawing boards, quite literally, for twenty years. In the 1980's it was the World Space Foundation under Robert Staehle who championed the effort, doing engineering studies, test deployment exercises and anything else WSF could find to do to promote the cause and the chances of a successful test mission.

In the late 1980s, when the International Space Year 1992 was set, an International Solar Sail race was announced as a feature event of the year-long celebration which coincided with the Columbus Quincentennial. Several proposals winnowed down to three. But in the end, the engineering challenges were too great for the 1992 deadline to be met, and instead of postponing that deadline, the effort was abandoned.

Sailing the Solar System with gossamer-thin sails catching the feeble yet constant power of sunlight, if large enough, could propel almost any craft at a slowly accelerating rate to destinations hard to reach otherwise. As you can “tack against the wind” with solar sails just as with wind-catching sails, you could propel a craft into the Sun, or send cargo to Mars timed to arrive whenever, not just at precise windows 25 some months apart. Solar sails could “pipeline” precious volatiles from the asteroids to the Moon.

hurts all of us, not just “MOM & POP”

The possibilities are endless. The Solar Sail is like the tortoise, the rocket like the hare, fast off the mark but quickly losing all its oomph, while the tortoise passes.

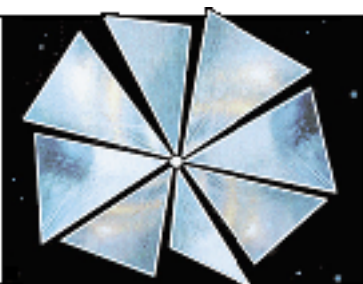
NASA has spent \$350 million on solar sail research. The Planetary Society, the largest of space advocacy groups with 75,000 members (according to the list of names on the CD carried along with Cosmos 1, TPS membership list as of 2003) raised a respectable \$4 million, much of it from the business of Carl Sagan's widow, Ann Druyan, to design, engineer, build and test Cosmos 1 for a trip to orbit on an ex-Soviet ICBM, now the Volnya. Its engines quit prematurely, dooming the precious cargo to a dunk in the Barents Sea. We all share the loss. While a certain percentage of MMM readers, are like myself, also Planetary Society members, we all stand to lose.

Solar Sails loom large in the future of the early frontiers on both the Moon and Mars. Laser and Magnetic Sails will one day take us even further, perhaps to the Stars. Meanwhile, we all have to get past this loss, pick up the pieces, and start again. May we personally ask that readers consider favorably appeals from the Planetary Society to fund a new, improved Solar Sail, hopefully for a ride on a more proven vehicle. [⇒ p. 2, col. 2]

The Personal Story behind Cosmos 1

Beginnings are always cloudy. It's not until much later that some small incident proves to have been the birth of something big. It was back in 1983 that Roald Sagdeev, a plasma physicist and head of the Space Research Institute (IKI) in Moscow visited the United States in hopes of forging better ties between American and Soviet scientists, and met Carl Sagan. The rest is history.

**There'll be
a next time!
The Stars Beckon
and one day
we will go!
Kudos to the
Planetary
Society!**



Moon Miners' Manifesto

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

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• **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 20006; 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*)

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1630 N. 32nd Street, Milwaukee WI 53208-2040

=> IN FOCUS Editorial continued from p. 1.

The Planetary Society sets the model in taking on ambitious projects, as opposed to being content with public, media, and congressional outreach (which it also does par excellence.) How does this organization do it? By keeping two sets of books so to speak: General Funds come from dues and other non specific sources; Dedicated Project Funds come from special appeals to support this or that exciting project. People know that their money is going to those projects, and not leaking out the back door to the General Kitty. The Society's record is unassailable. It delivers. And when there is a failure, it tries again.

The Mars Society has been taking on ambitious projects also, and now the Moon Society, though smaller, is trying to follow suite. Though second to TPS in numbers, the National Space Society (not its chapters or chapter activists) has always been gun-shy when it comes to projects. NSS has to scrape to fund operations from general funds, and taking money from that for projects seems like the wrong thing to do. But as we have complained to past NSS Exec Directors too often, "you don't use General Funds for projects. You do separate funding appeals and these appeals do not siphon money that would otherwise have gone to General Funds. They raise new money, money that otherwise would not have been give, because they tap a need of individuals to do something that is going to count."

We have new leadership in NSS now, and a fresh look is being taken at the idea of Projects. Let's hope the lesson of the Planetary Society's success record sinks in.

The loss of Cosmos I is just one more in a long list. Yet we go on and we do make progress. One step back, two steps forward, another step back, two more steps forward. Painfully, deliberately, we ratchet ourselves up the ladder.

Further, by trying yet again, we honor the efforts and memories of those who have striven so hard before us. Someone has said that failures are the stuff out of which success is made of. Quite so. Show me the person who has never failed, and I'll show you a person who has never tried.

Three cheers for the Planetary Society leadership, the giving members, and the hard working design and fabrications teams.

And for "MOM & POP?" I know you are wondering what that's all about. MOM is Mission Operations Moscow. POP is Program Operations Pasadena. Pasadena is the location of the Planetary Society Headquarters. POP specifically is run out of a 1920s bungalow.

We know that many a person intimately involved in this project has a heavy heart and may have shed a tear or two. Indeed this attempt was #2. How many more will it take before we succeed? It doesn't matter. If we have the right stuff, we'll try again and again until everything runs right. But it will not stop there. We'll go on to build bigger and faster sails with more cargo capacity, better maneuverability. **To the Stars**, indeed! PK

The Hercules Project at the University of Southern California



With permission by Madhu Thangavelu, Moon Soc. Advisor

Introduction:

- How do you make people realize that mankind's destiny is in space?
- Propose an idea that invigorates the space program, generates plenty of support through public involvement and private enterprise.
- A series of manned races that culminate in a race on the Lunar surface
- DARPA race, Xprize, American prize provide heritage, guidance, and proof that the race/space idea works.

During the Fall 2004 semester, the students of the graduate astronautics class ASTE 557 (formerly AME 557), Space Exploration Architectures Concept Synthesis Studio, outlined a vision that returns humans to the Moon for a sustained presence, fueled by commercial involvement and public support. The rationale for this vision is to tap the elements that elicit the most response from broad segments of humanity, such as competition, excitement, personal involvement and commerce.

This led to the vision of a series of races to culminate in a manned race on the lunar surface. The race series is called HERCULES, an acronym for Human Earth-Moon Rover Competition to Upgrade Lunar Exploration Systems.

The races on Earth, one in the Sahara and the other in the Arctic, allow the contestants to evolve their capabilities in a spiral manner. It also allows corporate participation and sponsorship as the race matures, and sustains public interest over a period of time.

Minimal infrastructure is needed on the Moon, to minimize delay and reduce cost. The hardware that is required will flow into future missions and capabilities. Small base camps are landed a priori at the lunar equator and the South Pole. Lunar medevacs enable emergency rescue of stranded rovers in a very short period of time. Resupply

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depots are landed at several locations along the route, and also act as breakdown and solar flare shelters. A robust communications and navigation system allows good situational awareness and live, commercial, consumer grade televising of much of the mission. The Earth-Moon transportation system is assumed to be a commercial version of the launchers and spacecrafts baselined in NASA's Vision for Space Exploration. The system is designed for safe, versatile and affordable transfer of crew and cargo to and from anywhere on the lunar surface.

And in the spirit of competition, two rover groups of students were formed to design entrants for the race. The two teams, SELENOPEDE and ARTEMIS, took quite different approaches for their designs. Each addressed several aspects of the challenges these rovers would have to face, including propulsion and locomotion, thermal dissipation, radiation shielding, and crew operations.

The team presentations were presented to a select panel that included former Moonwalker Dr. Buzz Aldrin, Ron Creel (Apollo rover design team), and several other distinguished members from NASA, industry, and creative professions. [End Introduction]

The Vision In order to reinvigorate the human space program, captivating ideas that enthral the public imagination are needed, those that restore space as that unique and awesome arena of interdisciplinary human endeavor, portraying new hope and a glorious future for all of humanity. The HERCULES race is such an idea. It involves a series of progressively harder races that culminates in a race on the lunar surface. The competition will excite people, enhance innovation. The public gets involved by either competing in the races directly, or by interacting with the crews. Use of cameras and media is heavily emphasized to better connect the public to "immerse them" in what's going on. It also provides a big source of money to tap into given advertising and its revenues. Corporations can become sponsors of these race teams, and new companies, ones that have never before been engaged in space activity, will bring new blood and work on the race. This momentum and infrastructure buildup will not end with the race but rather used as a new beginning for future missions including a viable Lunar economy with mining, transportation, and tourism at its core.



The Architecture

The architectural concept is simple: a progressive race that will concurrently build up public interest, technical sophistication and achieve a lunar presence through a series of publicly sponsored events. We begin by setting the challenge to the world for a chance to compete in the worlds biggest arena, the Moon. There will be a series of three competitions each with increasingly more difficult design and operations requirements.

We start simple:

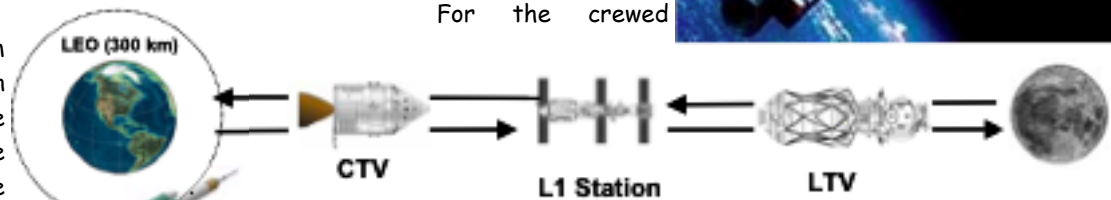
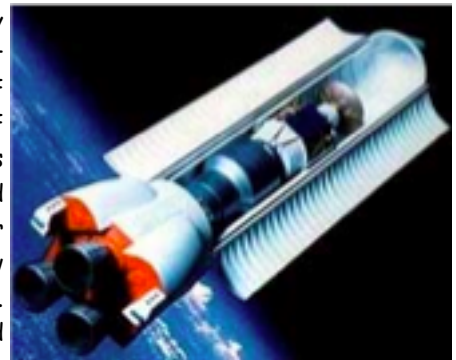
a race across 3800 km of the Sahara desert in which any team in the world can compete. The design requirements are basic and require that teams focus on dust mitigation, vacuum operated power systems, speed, and overall ruggedness. The competition will be a battle between many Davids and many Goliaths with the top 10 teams advancing to the second round set in Antarctica. With teams narrowed down to 10, the stakes are higher and so are the design requirements. The rovers entered in this race must contain their own life support systems, offer pressurized crew cabins, withstand thermal extremes, and have the capability to support EVAs. Similar to round one, this race will take place over 4000km of harsh terrain and will test the abilities of not only each team's rovers but the robustness of the HERCULES race logistics and support infrastructure. Additionally, each team is responsible for finding corporate sponsors to fund the development of their rovers as well as the entry fee for each competition. The top 5 teams in the Antarctica race will move on to the final and most prestigious round : a race the moon. Five teams from around the world travel 384,000 km to compete in a 4000 km race from the lunar equator to the lunar pole. The team that completes the race in the quickest time wins, and winner takes all.

Logistically, there is an enormous amount of background work behind each of these races which is being handled completely through the HERCULES Company. HERCULES Inc., is conductor of this symphony and we have put together a comprehensive outline of Race Rules. With the funds raised through the entry fee and separate HERCULES funding raising efforts and sponsorships, we are orchestrating the development of all the separate functions of this race. From transportation to communication to lodging, HERCULES is the world's ticket back to the moon. In the following abstracts, you will see abstracts for the basic strategy, design and operations of our subsystems.

Earth Moon Transportation System

The team goal is to provide transportation for humans and cargo to any-where on the lunar surface safely and cheaply. The choice was made to transport the cargo

and crew separately for safety and cost reasons. An array of possible types of transfer concepts is presented, followed by a selection for each of the crew and cargo systems. For the crewed



mission, rendezvous at L1 is selected. For the cargo mission, a low energy and low thrust transfer is chosen.

The transfer architecture and mission sequences are discussed, followed by a description of the components involved in the mission. The advantages and disadvantages of the selections are then discussed. It is concluded that the transfer selections combine to form a very robust transportation infrastructure.

Habitat & Waypoints in Support of First Lunar Race:

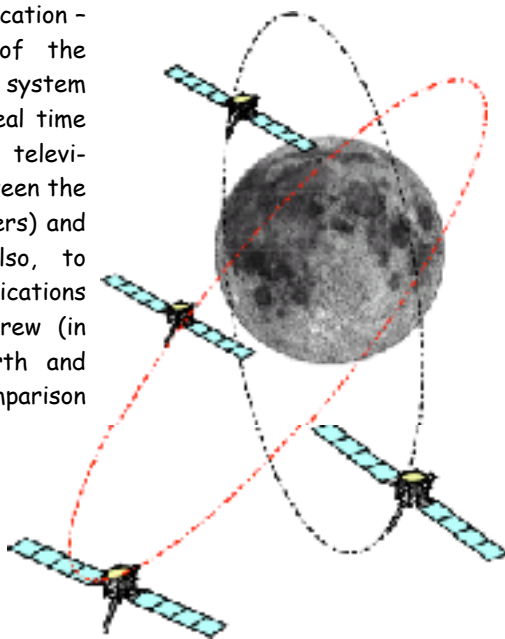
To support the exciting first lunar race, two outposts will be required at the finish and start points as well as waypoints equally distanced along the way. This architecture will yield all the necessary functions, supplies and safety related preferences that would be required for such a hazardous traverse across the lunar surface and consists of two bases, one at the equator (the starting point) and one at the Southern Pole (the finishing point). In conjunction with these outposts, fifteen waypoints will be strung along the general race path to provide various supplies as well as for safety and communication purposes. CTV L1 Station LTV LEO (300 km) CTV L1 Station LTV LEO (300 km)

The bases will be designed around the general living and working quarters, the habitat. These habitats will be landed autonomously and deployed in a similar manner. The structural shell will unfold and an internal bladder will be inflated to provide a pressurized vessel. A separately shipped robotic rover will then pile lunar regolith upon the habitat to provide radiation and micrometeoroid shielding. All the supplies and materials that will reside within the habitat will be shipped separately and brought into the habitat once constructed. Connecting tubes and airlocks are also designed in a modular format and will be landed on site and installed separately to complete the overall habitat design. The primary source of energy will be of nuclear derivation and be complemented by solar array backups. Separate rovers for people and cargo transport will also need to be shipped to site and implemented.

The waypoints will be number in the region of fifteen and be distanced approximately equally along the route. They will provide all the resources that the rover teams will require during their extended lunar traverse. A docking ring will allow the rover teams transfer all the gaseous and liquid resources directly to their rovers without enduring an EVA. Panels will open from the sides of the waypoint for access to solid resources, tools, etc. There will be four boxes on each panel, one for each team, and for panels yielding 16 teams per waypoint total. The teams will be able to predetermine what they want in their individual boxes and at which one of the waypoints. They may be taken from the waypoints by the rover teams using a remote manipulator system or EVA; it is up to their discretion. The waypoints will also provide a 30 meter light tower with three optical beacons separately placed equally along the length that will rise into the lunar sky and will be a visual cue and provide a distance gauge for the rover teams as they come over the curve of the moon's surface. First aid and an independent communication system will also be present for emergency use.

Communication and Navigation

Communication - The purpose of the communications system is to provide real time high definition television feeds between the lunar race (rovers) and the Earth. Also, to provide communications between the crew (in transport), Earth and Moon. A comparison between RF (satellite based), Laser Com (satellite based) and Tower communications systems was performed. The results showed that a combination between RF and Laser Com was the optimum solution that satisfied the com needs. Thus, the system will have RF communications between the rover and lunar orbiting satellites, laser com between the lunar and earth orbiting satellites, respectively, and RF communications between the earth satellites and tv stations.



Navigation - The purpose of the navigation subsystem is to meet the navigation requirements needed for the lunar race at minimum costs. To accomplish this, a comparison between a satellite-based system to a beacon and buoy based navigation system was performed. Results of the comparison showed that the simpler beacon and buoy

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based system met the requirements of navigation. Also, this was achieved without having to incur added satellite (need 4 satellites in line of sight at all times) system costs. The system will be made up of beacons at bases, beacons on rovers, beacons at waypoints, RF buoys dropped by rovers and image terrain navigation for rovers.

Extravehicular Activity Suits

Extravehicular activity will be crucial to a manned presence on the moon and eventually Mars. The HERCULES Lunar Rover Race will serve to accelerate EVA suit design and spur innovation. The development of rover concepts will drive, and in some cases, be driven by suit design. Supporting the race requirements will force suit evolution for focused needs and lead to diversified suit choices.

The EVA suits requirements to support the current race architecture are:

- Suits must have camera capability to provide face shots and exterior shots
- Suits shall have direct voice com independent of rover
- Suits must provide EVA time of up to 10 hours
- EVA suits will be provided by HERCULES staff

EVA capability and the events involving EVA (scouting, crew transfers, etc.) are crucial to the race appeal.

Rescue Capabilities

The danger inherent in the rover contest calls for advanced rescue capabilities. Prioritization of quick response to any emergency led to the selection and preliminary design of a ballistic medevac vehicle called MoonHIND. Key features include rescue EVA systems that are fast, flexible, and robust, dust mitigation during landings near vehicles in peril, and suggested integration with ongoing ISRU activities to compensate for high propellant consumption.

ROVER COMPETITION:

With the HERCULES Group working together to put together an overall race architecture, we decided the best way to test it was to design two teams to compete. In the next few sections you will see how our teams approached the design of their lunar rovers.

The Selenopede ®



The mobility offered by long range pressurized rovers is an essential step toward opening the lunar frontier

to further exploration and exploitation. Bridging the vast distance between the equatorial region and the lunar South Pole in a lunar race will be a trail blazing event, analogous to the Golden Spike experienced with the U.S. transcontinental railroad. The establishment of long range mobility on the rugged lunar terrain will promote the development of advanced rover technologies. The design and operational strategy of the winning rover will set the standard for lunar mobility for years to come.

The Selenopede ® rover was designed to take advantage of key technologies, innovative concepts, and race-winning strategies. It will consist of a 3-segmented articulated frame powered by a Dynamic Isotope Power Supply (DIPS) to allow mobility over treacherous terrain during both lunar day and night. A constant high-output power supply is essential for high-speed mobility, life support and environmental thermal control (especially during lunar night). The Selenopede weighs approximately 5 metric tons and is 13 meters long by 3.5 meters wide. It will carry a crew of three at a nominal speed of 15-20 km/h, depending on terrain. EVAs will only be needed in case of emergencies and the crew will be protected from solar events through innovative shielding strategies.

The first two segments are pressurized and connected by a flexible passageway. The power supply is housed in the third segment. This segment shields the crew from harmful nuclear radiation and provides radiators for thermal control. As with any competitive race, a carefully designed strategy and ingenuity will be the deciding factor in the end.

ARTEMIS This rover is an awe inspiring vehicle designed to win the HERCULES race on the moon. Equipped with technology for the next generation, this vehicle will take the competition by surprise. Powered by the sun and fuel cells, ARTEMIS cruises at a top speed of 25 mph, which is faster than any existing vehicle known to humans on the moon. This vehicle also enables a comfortable crew of 3 to traverse the harsh lunar landscape for weeks at a time, day and night.

ARTEMIS has three innovative techniques designed to cut down on dust and radiation. The first is a new wheel design that throws dust away from the vehicle as it navigates the dusty moon. The next innovation uses the lunar regolith as a radiation protection shield. Before the initial expedition, the mechanical arm can be used to scoop regolith into the Kevlar bags that surround the crew living space. The final innovation uses the cameras that surround the vehicle for sight. There are no windows on the ARTEMIS, but multiple cameras are projected onto many LCD screens that enable the crew to navigate with ease.

Even though ARTEMIS comes loaded with all the best capabilities, it still is not a huge vehicle. The interior is 14 x 6 x 6 feet with a pressurized living space of 6.5 x 6 x 6 feet. It comes equipped with 4 feet diameter wheels and 2.5 feet of ground clearance to plow over small craters and

obstacles. ARTEMIS only weighs c. 1 ton as well, which is less than the Hummer vehicle, a close but inferior relative.

Ladies and gentlemen, boys and girls, welcome to
The Hercules Program for Return to the Moon.

HERCULES Mission Control to Artemis and Selenopede :
start your engines !

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Space Technology Division (213) 821-5817

Instructor Biography Madhu Thangavelu is a co-author of the book "The Moon: Resources, Future Development and Colonization", John Wiley & Sons 1999, 2nd edition in prep.

- Conducts the AE557 graduate Space Exploration Architectures Concept Synthesis Studio in the AME Dept. at the USC He also teaches the Arch599 Extreme Environment Habitation Design Seminar in the School of Architecture where he is also a graduate thesis adviser.

- Educational background is in Architecture (Masters in Building Science, USC School of Architecture) and in Engineering (Bachelors in Science and Engineering, India). Versions of his masters thesis (conceived during ISU '88 at MIT) entitled "MALEO: Modular Assembly in Low Earth Orbit. An Alternate Strategy for Lunar Base Establishment" were published in several journals worldwide

- At USC, he was mentored by and worked as a research assistant under Dr. Eberhardt Rechtin, Prof. of Electrical, Systems and Aerospace Engineering, considered the chief architect of NASA's Deep Space Network and President Emeritus of Aerospace Corp.

- Since 1992, he is a creative consultant to the aerospace industry in this newly evolving field of space architectures complex concept synthesis. Mr. Thangavelu's concepts have been reviewed and appreciated by NASA, the National Research Council, the National Space Council (Bush Sr. Administration), and his work has been presented before the National Academy of Sciences.

- A visiting lecturer at the International Space Univ. (ISU) and co-chaired the Space Systems Analysis and Design Department at their California 2002 summer session. He continues to present and publish original concepts in Space System Architectures; chairs related conference sessions .

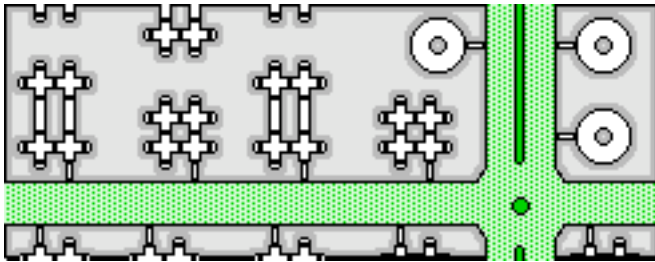
Former Vice Chairman for Education, Los Angeles Section of the AIAA. Director of Space Exploration Projects at the California Inst. of Earth Art and Architecture. Most recently, Mr. Thangavelu's concept creation work was greatly appreciated for proposing ideas that pointed to the "leading-edge sensor concept" for return to flight of the space shuttle fleet. Mr. Thangavelu, his spouse, space system architect Catherine Girardey and children Chloe Saras(10), Chelsea Manon(7) and O'Paul Roy(16m) live in Palos Verdes Estates, California. </MMM>

Favorite Hobbies, Pastimes, & Activities: Pioneers won't have to give up "Everything"

by Peter Kokh

The Moon is quite a different environment than our familiar home planet. You can't go out under the open skies without a space suit. The sky isn't bright blue or even cloudy. There is no "weather" as we know it. The sun does not set every 24 hours, nor rise at that pace. There is no native vegetation nor wildlife. No outdoor sports, no nature walks. No planes flying overhead. No oil, no coal, no gas. No rivers or lakes or beaches. No forests, no grassy plains, no snow-packed ski slopes. "Boring!" as the young would say.

That said, we will establish local biospheres, and, if they are to survive & thrive, ones with substantial "middoor" spaces filled with diverse vegetation and even with a carefully selected wildlife ecosystem. So whereas "the" outdoors on the Moon, the famous "magnificent desolation" is quite inimical to life and unprotected pursuits of any kind, pioneers will enjoy a created "outdoors" within the biosphere airlocks, an environment that falls neatly between the indoor spaces of individual residences, shops, factories, schools, offices, etc. and the "out-vac" airless spaces of the Moon's surface, exposed to the vagaries of cosmic weather. The middoors will offer much, but hardly all, of the pleasures we might at first thought be leaving behind forever.



The "Middoors" as key Biosphere Component - In a modular settlement, allowed to grow as need be (not a fixed size megastructure based on someone's guesstimate of future needs), modular habitats and other structures are connected to pressurized residential/commercial "streets." These "commons" will contain the bulk of the settlement's biomass and biosphere. See "Being able to go Outside" pp. 5-6, MMM # 152 FEB '02

We have to stop thinking about living in tin cans hosting a few house plants and instead thinking of lunar habitats as ecosystems of vegetation hosting people. If we build in "full" modular fashion, expanding the biosphere along with the pressurized maze, erring in favoring plants over people rather than the other way around, we will create vibrant ecospace, not a sterile engineering ones. And such spaces will support many of the hobbies, pastimes, and activities we feared we would be leaving behind forever.

Of course, we must forget about sailing boundless seas stretching from horizon to horizon, of flying from anywhere to anywhere, of climbing tall snow-capped mountains, of hacking trails through tropical rain forests, of doing a lot of things, to tell the truth. Yet, in smaller, restricted confines, some of our favored hobbies, pastimes

and activities will find exuberant expression on the Moon.

The inevitable depression and sadness that comes from the initial experience of loss, only to be eventually replaced with the newfound joy of meeting an old long lost friend, has occurred countless times through human history as peoples have migrated from location to location, changing niches and climes as they adopted unfamiliar settings. Much of what they thought they must leave behind forever, they would eventually find a way to transpose, to translate, to reexpress in the new territory. Carpenters and builders might have left their favorite woods behind, but found new trees with woods almost as good, or even better, with new exciting grain. Potters, gardeners, weavers, all sorts of artists and craftsmen and tradesmen and hunters and fisherman will have had similar experiences. It takes time, of course, and having the right positive attitude surely helps. And so will it be when we migrate from "The Green Hills of Earth" to the sterile gray hills of the Moon.

Arts & crafts media (paints, ceramics, metals, fibers)



"Moon Garden #1" was reverse painted on an 8"x10" piece of glass, by MMM Editor Peter Kokh in September 1994.. The "paints" were not solvent based and incorporated no organic additives. Instead an inorganic adhesive (the only one known), sodium silicate, was used to suspend either raw regolith powder or colored metal oxide powders. The palette is still limited and the art form undeveloped.

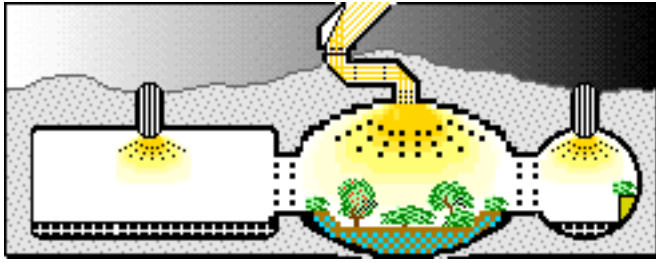
The media familiar to our artists may not be the same, but in time, we will develop paints and clays, alloys, and waste biomass fibers out of which lunar pioneers with a creative artistic bent will do wonders, filling homes and public places with beautiful objects, made on the Moon, of moon-stuffs. To some extent, we can pioneer those media, or at least analogs of them, here and now while we are waiting. Any activity along those lines would give frontier artists and craftsmen a helpful head start. See:

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

Gardening, flower craft, canning

While at first, there may be very few crops, all staples, and only a few species of biosphere support plants, this will change, and quickly, if attainment of biospheric self-sustainability is a goal. And home gardeners will be a

major part of this, and cottage canning industries as well. Garden stuffs will support arts & crafts, especially among children, as they do today, here on Earth, everywhere.



The Heart of a Lunar Home: An "Earthpatch"

On Earth, if there is a feature that is considered the "heart of the home" it is the "hearth." Real fireplaces are a highly unlikely feature for Lunar homesteads. But pioneer homes will have a "heart" nonetheless, the interior Garden, a veritable "Patch of Old Earth." The "Earthpatch" will be important for much more than strong morale! See pp. 3-7, MMM # 148 p. 8 — SEP 2001



Goodies from Homestead Gardens - What do fruit jellies and preserves, deserts with special ingredients, herbal teas, specialty wines, organic dye stuffs, specialty house plants, craft papers, gift items, and family morale have in common? They are all possible products of pioneer homestead garden cottage industry enterprises.

We have written much and often about the role of homestead gardening in the frontier settlements:

- MMM #2 FEB '87 "Moon Garden" republished in MMM Classics #1 at http://www.lunar-reclamation.org/mmm_classics/
- MMM #109 OCT. '97, pp 3-11. Luna City Streets
- MMM #149 OCT. '01, p 5. Homestead Gardens & Early Cottage Industry
- MMM # 65 MAY '03, p 3. Settlement Garden Tours, a Favorite Pastime

Sculpting & carving & carpentry

No marble, no soapstone, no sandstone, no ivory, no whalebone, no wood. No copper, brass, or pewter. What's the frontier sculptor, carver, and carpenter to do to express what's inside himself by exposing it in a material? We will have to explore new media, probably less easy to work with. The stable of lunar-formable alloys is not yet clear. metallurgists will definitely need to be on the lookout for alloys that are "workable." There is every reason to start the search now. We know what alloy ingredients are economically available on the Moon. Let's experiment!

Are any types of moon rock carvable? Probably not, but we can cast basalt. As to wood carving, the wood from many fruit trees, especially apple, cherry, and pear, is hard enough to make beautiful adornment items. Wood will be an accent item, not a main "stuff." For example, we will see metal cabinets with wood handles, the opposite of what we are used to. The carver can work with AAC, autoclaved

aerated cement. We ordered samples, and you can nail it, drill it, saw it, and carve it. The sculpting and carving stuffs will differ, the inspiration and creativity will not.

Fishing, boating, nature walks, flying

The corridors and streets of the settlement must support the bulk of the biosphere mass. There is every reason to believe streams, ponds and waterfalls will be integral parts of the water recycling system. Ponds and streams will be stocked with game fish as well as ornamental varieties. Canoes and paddle boats will be common. There will be nature paths, pointing out the various plants and other features. Chains of such walkways could be a proud and much used feature.

Eventually, if the nitrogen which will be by far the most expensive component of air can be found in ample enough supply to support open spaces with high ceilings, human powered flight should be possible in the light gravity. This will not be a satisfying substitute for seasoned pilots. But the young, growing up on the Moon, will hardly complain.

For rockhounds

Those into rock collecting, cutting, and polishing may miss their familiar favorite rock types. There are no sedimentary rocks on the Moon, no marble or granite, and probably no geodes. But there are types of rock on the Moon not found on Earth and rocksmiths will soon figure out how to reveal their "hidden essence and beauty," and make objects of art and decoration, even jewelry with them.

Japanese style sand and rock gardening should be an early favorite using larger surface rocks well placed in a regolith "pond" well-ripple-raked.

Ceramics and pottery will have to begin by making clay from scratch. Then mixing in various types of natural regolith and lots of experimenting. With cast basalt pieces, these media will be the source of much that is special and unique to tourist shops stocked with made on Luna items.

Sports - Terrestrial sports for the most part would make poor imports. With one sixth the weight and traction but full standard momentum, any familiar game could be but a caricature of the original, when imported to the Moon.

The pioneers will develop their own games, sports events, rules, playing fields etc. Some of them might make for good telecasting to fascinated watchers on Earth. (ABC's "Wide Worlds of Sports") The same goes for popular artistic dancing (e.g. lunar ballet, lunar ice skating) In short, those of us who enjoy athletics and energetic exercises, as such, or in the form of sport or dance, will still enjoy them on the Moon, though the forms may be different.

In short, no matter what kind of hobby, sport, or pastime activity you are into, there will be something for you on the Moon. It may not what you are used to, but it will tap the same energies, the same free spirit, the same creativity. Lunan pioneers, with the right spirit, will find many outlets for their energies. <MMM>

The Moon Society



JOURNAL

<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!

Moon Society Election Ballot 2005

from Elections Chair, Gary Gray <ggrey2@juno.com>

Dear Moon Society member,

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

Three directors will be elected this year to maintain the total of seven. Officers whose terms expire this year are Vice President and Treasurer. All posts are two year terms.

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

This is a preferential ballot. Indicate your preference with numbers, [1] being your first choice, [2] your second and [3] for third choice using the form below. Do not skip or duplicate any numbers. If you prefer, you can stop voting before you have reached the total number of candidates for any one office. If you do so, and during the counting that point in your ballot is reached, your ballot will be counted as "no reference" for that position.

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

If you vote by email, please include your membership number, if you know it, and email your completed ballot to the Moon to the elections email address:

elections@moonsociety.org

If you vote by postal mail, send the paper Ballot to **Moon Society, PO Box 940825 Plano, TX 75094-0825**, postmarked by August 1, 2005.

OFFICERS VOTE

Vice President (Vote for one)

Randall Severy. # 125

write in candidate

Treasurer (Vote for one)

Dana Carson #10

write in candidate

BOARD OF DIRECTORS VOTE (in alphabetical order)

Vote for only 3 candidates: Place 1 - 3 beside each name (in order of preference)

Dana Carson #10

Scotty Gammenthaler # 393

John Schrock #1178

Randall Severy. # 125

Dave Wetnight #627

write in candidate

Voter's Signature _____

Membership # (if known) _____

Candidate's Statements (listed in alphabetical order)

Dana Carson # 10 (incumbent Board member running for re-election to the Board and for the Office of Treasurer)

I'm a computer consultant dealing in web based systems. Previously I worked for Westinghouse Aerospace building tools for the embedded systems developers. I've been a space enthusiast since Apollo and have been on the board of the Moon Society since its founding.

John R. Schrock # 1178 (incumbent running for re-election)

I am running for a Moon Society Director positions. I have worked, in previous years, to create a new front page on our web site and helping with our Help Director answering Society e-mail. As a builder, contractor, and salesman in the lumber business, I have strengths in getting material and people in the right place and at the right time. I believe very much in the Space Settlement Initiative.

Randall Severy # 125 (incumbent director, and chairman of the Board, running for reelection to the Board as well as for the office of Vice-President)

In several leadership roles in Artemis Society International since late 1995, I have worked hard to help build the society into an effective world-wide organization. When the Moon Society was founded, I joined the board of the new organization to continue that effort. I also founded CyberTeams, one of the early program participants in the Artemis Project. To help other program participants get started and develop, I formed the Artemis Project Business Team. If re-elected to the Board, and elected to the office of Vice-President, I will continue to devote my time to growing the organization and supporting projects launched by the Moon Society.

Scotty Gammenthaler # 393 (retiring Treasurer, running for the Board of Directors)

As Treasurer of the Moon Society for the past five years, I have been responsible for collecting and depositing funds, paying bills, and preparation of financial statements. I also led the effort to obtain 501(c) (3) non-profit recognition from the IRS, and I developed most of the on-line membership registration system.

I think my previous experience as an officer and director of the Moon Society will be valuable to the Board of Directors in understanding our history and deciding future actions. I remain committed to the goals of the Moon Society as expressed in our organizing documents and in public statements of our position on various issues.

David Wetnight # 627 (retiring vice-president, running for the Board of Directors)

"I would like to continue to work for the Moon Society as a member of the Board, and to devote my available time and energy to the needs of the Society."

Sudbury: It's Back to Square One, Alas!

Planetary & Terrestrial Mining Sciences Symposium

June 6-9, 2005 - Report on Findings by Peter Kokh

For more than sixteen years, I have been talking about the need to find "Sudburys on the Moon." The Moon has the four "engineering metals" in abundance: iron (>steel), aluminum, magnesium, and titanium. That hardly means that we are home free in building an industrial resources-based economy and settlement civilization on the Moon. To make these metals truly useful, we need to alloy them with other ingredients. And that's the catch. Most of the alloy ingredients in common use are anything but economically abundant on the Moon. Where could we look for good ores?

Our hope was that we might just find some craters on the Moon endowed with nickel and copper and other "Platinum Group Metals" in abundance, as is the case at Sudbury, Ontario, north of Lake Huron. The working assumption was that the "Sudbury stuff" came from the impacting asteroid two billion years ago. That seemed to be the most plausible explanation. Now if we could just find out if any remote sensing instruments had been able to pick out not just the Sudbury crater (it stands out like a sore thumb) but its unique mineralogical endowment, we could fly those same instruments in orbit around the Moon, hoping to find a lucky strike. And so I went to the PTMSS this year.

Alas, it turns out that the current consensus is that the large impactor shattered the crust, melting the mantle just below into magma, and all the mantle PGMs, being heavier, settled to the bottom as the magma oozed up through the impact-caused fractures. Two billion years later, the crater rims have eroded to the point that some of these magma veins are exposed. But the bulk of the prize ore is still deep below. Mines are now down about a mile.

This unexpected finding raises more questions than it answers. Why do we not find similar PGM-rich basalt in other magma extrusions around the world? Why just here?? The answer may help us predict where, if anywhere, to look on the Moon. Until now, moon mining seemed like a surface activity. Pick up the already conveniently crushed regolith and extract what we need: a reasonably straightforward process. But if there are PGMs on the Moon we may have to go deep to tap them.

Never fear. PTMSS is hosted by the considerable geology/mining sciences talent pool behind the operations at Sudbury. They already do much by automation and teleoperation. And they are eager to put their can-do know-how to the test on the Moon. We have lots of work ahead of us to brainstorm a reasonable prospecting strategy. Settlement economic viability is at issue. And the PTMSS conference? I think we need to put it right at the top of the list of Lunar Conference must-attend events. **<MSJ>**

The Moon Society: Growing by Affiliation

From Moon Society President, Peter Kokh

Round II: The American Lunar Society

<http://www.americanlunarsociety.org>

The ink had hardly dried on the statement of affiliation signed by representatives of the Moon Society and of the National Space Society, at ISDC 2005 in Arlington, VA on May 22nd, when we received a simple request from Eric Douglass, newly elected President of the American Lunar Society (and a Moon Society Advisor), asking that we explore avenues of affiliation, as "partners with much in common." At the moment, initial trading of ideas and suggestions are ongoing, and the final shape of this affiliation/partnership/collaboration is not yet clear. But we can tell you some of the things on the table. Some of the items will need approval of the Moon Society Board of Directors, and of the ALS Board of Directors as well.

- The Society and ALS already cosponsor ALS' **Lunar Study & Observing Certificate Program**
- **Access to PDF files of each other's publications.** (ALS' "Selenology" is a 40 page quarterly)
- **Co-authoring a position paper on Astronomy from the Moon** (another logical Partner in this effort is the Stanford-on-the-Moon lunar observatory group, an arm of Space Age Publishing run by Steve Durst, another Moon Society Advisor.)
- **Cohosting a workshop to take another look at the concept of an Amateur Space Telescope.** It is nearly 20 years since the first effort failed in the aftermath of the Challenger accident. The time is ripe, not to dust off the old plans, but to reinvent everything in the light of two decades of new technology development since. The idea this time, would be to put a pair of scopes at the Earth-Moon L4 & L5 Lagrange points, from which observation around the flanks of the Moon's nearside, stretching 60 degrees into farside on both East and West, the scopes available to stellar and planetary observer's when the facing side was in darkness. Even if we hit a showstopper or two, the very effort would arouse much excitement and build interest in the Moon.
- Joint proposals to make some badly needed additions to the nomenclature of features on the Moon.
- Opening each organization's projects to participation by the members of the other.
- Offering ALS its own meeting room on the ASI-MOO.
- The big thing is we'll be sharing resources and talent and projects and whatever else wherever our interests and focus overlaps or coincides.

Round III: The Planetary Society of Youth (TPSY)

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

We first heard about this 500 member youth group in India, not quite two years ago. They wanted to conduct a Moon Mission Contest, and wrote the Moon Society Chapters Coordinator asking for help. They sent us the proposed guidelines for the contest asking for our input, and we helped rewrite them to ensure better results. And while we were not in on the judging, we offered to cosponsor and publicize the event, open to International participation, and to donate Moon Society memberships as prizes.

Now they have approached us once again:

"to have an Affiliation between Moon Society and TPSY to publish both TPSY and Moon Society Journals at TPSY Website. Moon Society Members would also get an additional benefits, being able to read Indian Space related Journals from the TPSY website."

The above inquiry came in on the eve of the June 15th Leadership Council Meeting on ASI-MOO. As we had much to discuss in order to prepare the 2005 elections ballot, we did not have time to discuss closer relations with either ALS or TPSY. So we do not know yet where these will lead. We just wanted to let you know that some other groups out there find us an attractive partner.

Finding Solutions

We are a firm believer that affiliations should be structured to fit reality, defined pragmatically, allowing each partner to define its own collaborative role, rather than trying to fit the affiliation into some preexisting and probably inappropriate pigeonhole. This was the successful philosophy behind the Moon Society's approach to the National Space Society.

That said, the Moon Society By-laws, as currently written, mention a category of membership, Institutional, which has not yet been exercised, or even defined. While a partnership between equals is preferred on all sides, when it comes to the question of access to newsletter pdf files, now Username & Password protected, having new organizations "also" become "institutional members" might be a solution that we can live with, and which would give each new partner group, its own username and password, in common for all their members. Now there are potential pitfalls in that idea, and so we cannot predict what will come out of further discussion once the members of the Leadership Council and the Board of Directors have looked at it.

The point is that this is fast becoming a decade of collaboration, sharing talents, resources, facilities, and more, so that we can each be more productive. It is in the Moon Society's interest to keep pursuing these feelers. Not all of them will be equally productive. But we must try.

**Ask not what your Society can do for you.
Ask what you can do for your Society!**

Reality Check

We get many suggestions, some via postal mail, but most by email, as to what the Moon Society could be doing, and what it should be doing. All of these suggestions are well-intended and this sort of feedback is welcome.

Unfortunately, the Moon Society does not have a paid staff that can do basic footwork in following up on these suggestions, much less actually realize them. Every time we undertake a new initiative that means an already busy volunteer must agree to take on one more task on his or her free time, or, that we must find a new volunteer to join the Leadership team.

In an ideal world, the person making the suggestion would volunteer to take the lead. Of course we understand that not every such person, sincerely trying to be helpful, is in a position to do anything more than make the suggestion. But anything you can do to provide some investigative or preparatory footwork would help advance your proposal closer to "the front burner."

Perhaps the most helpful and effective thing would be to help recruit persons of talent and a roll-up-the-sleeves can-do attitude to the Society. Our current pool of volunteers is already stretched.

The Moon Society is in need of:

- An Assistant Treasurer
- Grant Proposal Writers
- Outreach coordinator, and assistants
- Fundraising coordinator
- Publicity coordinator
- Conference presence coordinator
- Liaison Coordinators with other groups
- Translators
- Artwork Solicitor
- Local and Campus Contacts

There are many ways in which individuals can apply their talents in a way that will help the Society advance towards its near term and far term goals

If you would like to find out if there is a way your special talents, abilities, and expertise could be put to work, simply write us:

By email

- volunteer@moonsociety.org
- president@moonsociety.org

By postal mail

Moon Society Program Services
PO Box 080395,
Milwaukee, WI 53208, USA



Chapters & Outposts

Bay Area Moon Society

<http://www.moonsociety.org/chapters/bams/>
From: Bill Clawson <billclawson@yahoo.com>

May 26 meeting of BAMS: The Bay Area Moon Society met Thursday, May 26th at a new location, Henry Cate's house, at 6708 Landerwood Lane, San Jose. That's in South San Jose, near Camden and Almaden Expressway (about 3 miles from where 87 'T's into 85.) Pizza was the fare.

June 30th meeting: We're going to be having the BAMS meeting for this month at the Masten Space Systems shop. We will hopefully have some things to show off, and Henry Cate has some stuff he's been looking at that he wanted to bring up for discussion. The meeting will probably be from 7-9pm. We're located at 473 Sapena Court, Suite 23, Santa Clara Clara 9505

Next meetings scheduled for July 28 and August 25th, locations to be announced.

Moon Society St. Louis

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

June 8 meeting of MSSIL: We met on the second Wednesday of the month 7:30 PM as usual at the Buder Branch Public Library 4401 S. Hampton, in the basement conference room
Next meeting Wednesday, July 13th same place.

**Calling Chapters & Outposts
Outreach Opportunity of the Year
IMAX "Magnificent Desolation" Opening**

<http://www.imax.com/magnificentdesolation/>
<http://www.imax.com/sacramento/films/magdes.htm>

Opening this September, MAGNIFICENT DESOLATION: WALKING ON THE MOON 3D, will take audiences to the surface of the Moon to walk alongside the extraordinary Apollo astronauts who have stepped upon its surface. With never before seen photographs, CGI renditions of the lunar landscape and previously unreleased NASA footage, audiences will be immersed in the life-changing experiences of these astronauts by showcasing what they saw, heard, felt, thought and did while on the lunar surface.

Contact your closest IMAX Theater to see if they will be showing this spectacular. If so, start brainstorming how to piggyback on the event. Some theaters may allow you to set up an information table or stand, or leave brochures and flyers. Another idea is to publicize an open group viewing event to be followed by a lecture or other events at which you can get to interact with others.

GREAT BROWSING !

The post-X Prize Rush

<http://www.thespacereview.com/article/371/1>

Of Moonbuggies and the Vision

<http://www.thespacereview.com/article/370/1>

Spaceport New Mexico and the X Prize Cup

<http://www.thespacereview.com/article/366/1>

Apollo: what didn't get built

<http://www.thespacereview.com/article/364/1>

The Space Settlement Institute

<http://www.space-settlement-institute.org/>

Difficulty of Reducing the Costs of Space Access.

<http://www.thespacereview.com/article/387/1>

Will there be Piracy on the Moon?

<http://www.thespacereview.com/article/386/1>

Asteroid 2004 MN4 won't collide with Earth in 2029

<http://www.thespacereview.com/article/384/1>

Understanding solar activity and space weather is critical to the success of the exploration program.

<http://www.thespacereview.com/article/383/1>

A reconsideration of the Space Treaty to prevent it from hindering the utilization of space

<http://www.thespacereview.com/article/381/1>

A Lunar railroad, mounted with solar cells as a power solution

<http://www.thespacereview.com/article/380/1>

Gallery: t/Space CXV mockup

<http://www.thespacereview.com/gallery/11>

Cosmos I Solar Sail to launch June 21st

http://www.planetary.org/solarsail/latest_updte.html

Follow the Cosmos I mission at:

<http://planetary.org/solarsailblog>

Learn the Basics of Solar Sailing and the Cosmos 1 mission from Bill Nye the Science Guy

<http://planetary.org/solarsail/animation.html>

A paper model of the Cosmos 1 Solar Sail Craft

<http://spacecraftkits.com/cosmos1/index.html>

Send Your Name to Pluto on the New Horizons Spacecraft due to arrive 2015

http://pluto.jhuapl.edu/ecard/sendName_ecard_content.html

New Horizons Mission Home Page

<http://pluto.jhuapl.edu/>

Interim Ground Rules Proposed For Civilian Spaceflight Industry

http://space.com/news/050525_faa_permit.html

LEAG Conference Oct 25-28, 2005 Lunar Resources Roundtable VII

<http://www.lpi.usra.edu/>

[meetings/leag2005/leag2005.1st.html](http://www.lpi.usra.edu/meetings/leag2005/leag2005.1st.html)

the South Shore Harbour Resort & Conference Center

2500 South Shore Blvd, League City, Texas 77573

(phone: 281-334-1000 or 800-442-5005)

Sponsors:

- Lunar and Planetary Institute;
- National Aeronautics and Space Administration;
- Space Resources Roundtable, Inc.;
- NASA Lunar Exploration Analysis Group (LEAG)

This conference is brings together scientists, engineers, and business people to help mold the lunar exploration program into a coherent, integrated, exciting, and productive program. It will be an opportunity for experts from diverse fields to share ideas, form collaborations.

Central Topics

- Science (geochemistry, geophysics, remote sensing)
- Science on the Moon (astronomy, biology, materials science, Earth observations, etc.)
- ISRU technology, approaches, and economics
- Private sector involvement (models for ways of involvement benefitting both science and the private sector)
- Lunar industrial development and permanent settlement
- Human health and safety (including dust hazard and protection against radiation)
- Human exploration systems for the Moon (construction and installation of habitats, vehicles)
- Roles of humans and robots in exploration
- Moon-Mars linkages (science, exploration tools, ISRU)

A substantial amount of time will be devoted to discussions in breakout groups, each considering a single topic, with focus given by the discussion leader and a prepared list of key discussion topics and questions. Each group will report to the plenary about their major conclusions, to form the basis for a written version of the findings of the discussions. Discussion leaders and note-takers will be asked to stay an extra half-day to synthesize the reports for each topic. The reports, along with the abstracts and list of organizers & participants, will be included in a volume to be published by the LPI.

The Space Resources Roundtable, Inc., not-for-profit private organization devoted to development of space resources for the benefit of people on Earth.

The Lunar & Planetary Institute (LPI) fosters lunar and planetary science & the exploration of the solar system.

The Lunar Exploration Analysis Group (LEAG) is a community-based interdisciplinary forum that analyzes scientific, engineering, technology, and operational issues associated with lunar exploration it reports its findings and analyses to the Science Mission Directorate and the Exploration Systems Mission Directorate.

Mars Society Convention VIII

August 11-14, 2005

at the University of Colorado, Boulder

The conference facilities will be on the UC campus
in the club house above Coors Stadium

Program: The schedule for the 8th International Mars Society Conference is still under development

Conference Highlights will include:

- **Advanced Spacesuits Symposium**
- **Plans for the Phoenix Mars Landing Mission** to be Unveiled at Mars Society Conference
- **X Prize Architect Peter Diamandis to Speak**
- **Reports on Flashline Mars Arctic Research Station**
- **Reports on Mars Desert Research Station**
- **The Moon, Mars & Beyond Initiative**
- **Much, much more**

Hotel and Hotel Registration:

The Boulder Inn, 770 28th Street, Boulder, CO 80303.
Phone: 800-233-8469 or 303-449-3800 locally
Contact Ari at the hotel via email at ari@boulderinn.com.

Register on-line, go to <http://www.boulderinn.com>.

Directly across from the University and within walking distance of the venue at Folsom Field.

Special conference rates are \$84 single and \$89 double. Rooms with two beds are limited, so register early.

Free continental breakfast each day, 6:30-10:00 am. Free in-room high speed internet access, and 24-hour business center. Large outdoor pool, sauna, hot tub, Restaurant. Large capacity meeting room for members to hold chapter, task force, etc. meetings off site at their convenience.

To get the conference room rates, use the code "Mars" when registering on-line or mention the code and The Mars Society if you register by telephone.

Check in: 3:00 PM Check out: 11:00 AM

Getting to The Boulder Inn Shuttles from DIA

Denver/Boulder Yellow Cab & SuperShuttle: 303.444.0808
Boulder Express Airport Shuttle: 303.457.4646 \$18 one way and \$32 Round Trip to/from hotel.

RTD -- Regional Transportation District is the Denver area's public transit system. skyRide route AB runs between DIA and Boulder. Tickets can be purchased at DIA. More information at www.rtd-denver.com - click on "skyRide," then click on schedule AB. The ride takes between 70 and 90 minutes, with schedules an hour or less apart. \$10 (\$% Senior/student) each way.

Driving Directions from DIA (Denver Internat'l Airport) - Exit DIA on Pena Boulevard. Continue until you reach I-70 west. Take I-70 west to the I-270 north exit toward Fort Collins. Take I-270 north to the U.S. Hwy 36 west exit, toward Boulder. Continue on Hwy 36 to Boulder. Take Baseline exit. Straight through the light to hotel

Conference Registration after June 1, 2005:

Adult **\$270** (non member) **\$210** (member discount*)
Stdnt/Senr **\$105** (non member) **\$ 70** (member discount*)

**The member discount is available to all those who have a membership expiration after August 12, 2005.*

Register Online at:

<https://www.marssociety.org/secure/register3a.asp>



MARSIS: Mars Advanced Radar

for Subsurface [water] and Ionosphere Soundings

http://www.esa.int/esaCP/SEM1T1DU8E_index_0.html

16 June 2005: The second 20-metre antenna boom of the MARSIS instrument on board Mars Express was successfully - and smoothly - deployed, confirmed today by the ground team at ESA's European Space Operations Centre.

With the two MARSIS 20-metre radar booms fully deployed, Mars Express is already in principle capable of 'looking' beneath the Martian surface, and also studying its ionosphere (the upper atmosphere). The third 7-metre 'monopole' boom, to be deployed perpendicularly to the first two booms, will be used to correct some surface roughness effects on the radio waves emitted by MARSIS and reflected by the surface.

The third boom deployment, not considered critical because of its orientation and shorter length, will take place on 17 June 2005. Further tests on the spacecraft and the MARSIS instrument will follow for a few more days. [as of June 22nd, there was no report of this deployment.-Ed.]

The radar's long booms, will allow Mars Express to continue its search for water on Mars. By night, it will be used to make soundings for water below the surface. By day, it will probe the structure of the ionosphere.

Methane on Mars could be Geological

www.nature.com/news/2005/050531/full/050531-10.html

According to a June 2nd nature.com article by Mark Peplow, there may be a geological explanation for the methane detected by a some instruments in Mars' atmosphere.

Methane is not stable in atmospheres at this distance from the sun, and decomposes into water vapor and carbon dioxide at a rate that demands continuous resupply. Microbes hidden in the rocks and below the surface offer a biological explanation. The methane findings have excited exobiologists hoping to find evidence that life on Mars not only began in the distant past, but persists to this day, safely out of reach of the Sun's sterilizing ultraviolet rays

Now a natural explanation is proposed: instead of 20 tons of microbes, the observed amount of methane could be replenished by the annual chemical decay of 80,000 tons of olivine through a process called serpentinization. The trick was to pin down the quantities needed (given above) as a reality check on the reasonableness of this process. The findings were published online in *Geophysical Research Letters*3. To account for the presence of that much methane throughout Mars 4.5 billion year history, would require a layer of olivine about 20 inches thick spread across the planet at a depth of a few kilometers (the process requires pressure.) Who will win the debate? We'll probably have to wait until we get to Mars *in person*.

Notes from Analog Mars



Progress Report on the Mars Desert Research Station

by Peter Kokh, member MDRS Crew #34, Feb 6-20, '05

The casual observer might think that the list of useful things that could be simulated at a crude desert mockup of a Marsbase, simulated well enough that we could learn something useful from them, would have been long exhausted by now, the end of MDRS' 4th Field Season.

In something like the parable of the Loaves and Fishes, the more we learn, the more we realize we need to find out. The really good research ideas keep coming. And not all of this research is thought up and scheduled by the Mars' Society MDRS Program Management, or by the Remote Science Team, on hand online to tackle requests and questions from crew members in the field. Indeed, a lot of great ideas keep coming in from those people in academia who volunteer for crew assignments to test thesis ideas.

Nor is it just students, and professors of biology and geology who come up with experiments relevant to how we will explore Mars. People in electronics, chemistry, robotics, human factors, agriculture, energy and other fields can sense by themselves the relevance of what they are doing. It will take a lot of disciplines applied beyond the edge to make Mars exploration truly successful. And to our good fortune, it is these people working now in many respective fields that catch the spirit and see the potential applications of their own work to field work on Mars.

MDRS -- I had two weeks to study it in person this past February -- is a crude mockup of what we will really need to support exploration crews on Mars surface. While that crudeness might make some lines of experimentation fruitless or difficult [see MMM #183 March 2005, pp 3-7, "A Broad-Based Effort to Expand the Scope of the Analog Research Station Program"] the physical plant and the awesome setting are enough of a "let's pretend" support to deeply motivate all who come there. This imperfect structure and its not quite accurate setting get into your blood in short order. The percentage of crew members, especially those coming with their own research projects (rather than as support personnel) who re-volunteer is high.

Research highlights of the Nov. '04 - May '05 Field Season

The following list makes no claim to be complete. And these things are over and above the already impressive list of productive experiments conducted in the first three seasons, and at Flashline Mars Arctic Research Station on Devon Island in Canada's Arctic.

The Season began with **Crew #30**, a Mars Society Canada effort billed as "Expedition Alpha." The MSC team hit the ground running with an ambitious research program in Field Operations. [http://chapters.marssociety.org/canada/expedition-mars.org/ExpeditionAlpha/reports/]

Traverse planning and the equipment and proce-

dures to do it well, was high on the list. The "obvious" line of sight path from point A to point B is not always the one that requires the least exertion, or even the least time. On Mars, our people will have to be trained and equipped to find the least energy and safest route, in order to be as productive as possible while remaining as physically fit as possible. In their effort various pieces of equipment as well as a number of software programs were tested.

Another goal was to study the effort and exertion needed to don and remove the EVA spacesuits. The space suits are quite ingenious but have many issues that need to be addressed to make them ergonomic partners in exploration rather than hindrances. Handling equipment with a helmet on and thick gloves is difficult. New EVA dataloggers were tested. Exploration is only as successful as the data that is successfully harvested.

Crew #31 continued the work with the Traverse Generation Assistant. The factors would differ for different EVA's: robots, humans on foot, humans in a pressurized rover, or humans in a non-pressurized rover. Fuel consumption, fatigue, and time are some factors that would need to be considered. They also attempted to assess the environmental loads on the MDRS systems, and to investigate any opportunities to develop tools, programs, or devices that could increase the efficiency and effectiveness of the crews

Crew #33 tackled the immense engineering job of grounding the Hab in soil with poor conductivity. Gregorio Drayer, a 26 year old graduate Power Engineer from Simon Bolivar University in Caracas, Venezuela, had come up with a successful solution, and raised all the money himself to buy and/or fabricate all the parts and equipment needed, for this his second trip to MDRS. Installation would take three weeks, spilling over into Crew #34, with Greg staying on. Crew #33 set the stage for the crew to follow.

Crew #34, the refit crew, had no other assignments than to renovate all the Hab utilities. That meant replacing all of the electrical wiring, bringing it up to code (with all the carpentry work associated), the heating systems, the plumbing systems, and the power generation systems - plus relocating all the utilities (water tank, diesel fuel storage and generator, electrical power needs, and gas lines) from just behind the Hab to a sequestered location behind a nearby buffering hillock. This improved safety, operations, and greatly cut down on ambient noise levels. [Note: the mission patch of this crew shows the complex rewiring diagram for the Hab 2nd floor superimposed on a photo of Mars: www.marssociety.org/MDRS/fs04/crew34/]

To be honest, the research goals of the next few crews were compromised by the need to "clean up" the mess that the refit crew could not help making, and did not have time to clean up themselves. Indeed, some of the refit tasks were completed on the follow-on crew. This problem highlighted for me some obvious faults in the Hab design that

need addressing -- some by expansion to allow separation of laboratory and science areas from the maintenance areas; others by partial rebuilding -- if we are going to tackle some simulation options not possible now.

Crew #35 evaluated the effects of confinement on crew performance and conducted an exploratory human factors study to see if an intelligent crew assistant program could fit into the work patterns at the MDRS.

Crew #36 conducted the unique Red Flyer program using a radio controlled model airplane to test the concept of the of teleoperated aerial reconnaissance vehicles in an analog environment, imaging surfaces under low flight speed as an aid to planning successful EVA geology excursions.

In addition to quite a bit of geology work, this crew tested a Scouting Exploration Methodology Study (SEMS--a systematic field photo documentation and science data collection process.)

Crew #37 was a team from **Georgia Tech** that tested radio systems and techniques, including a balloon repeater, as well as navigation techniques, including overhead imagery analysis and contingency navigation procedures. This nicely dovetailed with the research of the **Crew #36 Red Flyer** team.

Crew #38 NASA team led by Bill Clancy. Clancy's team comes to the MDRS Martian desert every summer to test the latest improvements in the wireless EVA data management system ("Mobile Agents") that they have been developing. Astronauts recorded voice notes, took photos, labeled samples, and directed a robot to take panoramas--with all of this data transmitted automatically, time and place-stamped, and stored in ScienceOrganizer, and emails sent to the Remote Science Team providing reports of the EVA status and pointers to the data. The project name, Mobile Agents, refers to software running on moving computers--those carried by the astronauts and the rovers. This is all networked with the Hab computers. Computers, astronauts, mobile computer software programs, and mobile robots all make one team, each complementing and enhancing the work of the others for the greatest yield. (And some still think it is a "humans or robots" question!) Clancy's work clearly demonstrates that both humans and robots work best together, each contributing its own unique strengths.

This year the team added a second Extravehicular activity Robotic Assistant (ERA), with a capability to automatically deploy a wireless network repeater station (robotically deployed relay, RDR). Plus the robots will have a rudimentary capability to explain to the astronauts what they are doing (e.g., "Who are you following?" "Where are you?") and the state of the network connection ("Do you still have comms?"). In addition, the astronauts will be able to ask their "personal agents" (software programs running on the computers they carry) basic navigation questions (e.g., "Where is the next activity?" "Where is astronaut one?"). The astronauts have about 50 categories of commands for

affecting the GPS, biosensors, EVA plan, and science data (images, voice annotations, and samples) -all during the EVA. They can even print labels for sample bags from a printer on the ERA's equipment cart. In conventional terms, we're providing a voice-operated "work flow" system. The created data is routed, copied, and stored appropriately; plus the Mobile Agent system is keeping track of time and the astronauts' location and health, and providing warnings verbally to the astronauts, as well as on the loudspeaker in the hab, and via email to the Remote Science Team.

That NASA finds MDRS an ideal environment for this experimentation speaks volumes.

Crew #39 and **Crew #40**, all male "Leonardo" and all female "Mona Lisa" respectively, attempted to assess the differences in crew dynamics and human factors that may come from such a selection. This is an effort to extend ongoing research into crew composition variables such as personality and leadership styles, group size, cultural and gender mixes, role and power structures are frequently cited as areas that have affected group performance and impacted group functioning. When **Crew #40** locked the Hab door and left "Analog Mars," the 4th regular Field Season was over.

You will have noticed that I used the word 'regular' -- that was for a reason. The Field Season is a period of continuous occupation and operation, one crew turning over the facility to the next. But during the hot Utah summer, a number of heat-hardy groups bring the Hab back to life for intermittent intervals.

The recent **FLAME Crew** consisted of one nuclear family, a mother who had served on previous crews and her three children, to test crew dynamics and in particular, how well children may perform in a pioneer environment. The results were interesting and follow suite with past pioneer experiences. FLAME stands for "Family Living Analysis on Mars Exploration."

Crew #35 commander **Hugh S. Gregory** returned this summer to do extensive, exhaustive, and detailed photography of the Hab, inside and out, and of all the EVA trails and surrounding geological and topographical features as part of **Project MAST, the Mars Analog Simulation Trainer VR program**. This is an ambitious project to create a virtual reality program for training new crew members, but also for use by the Media, and by enthused Mars Society members and others. Similar VR programs will help successive crews to a real Mars Base get off to a running start with the minimum of delay getting familiar and acclimatized.

Crew #33 & 34 Commander **Paul Graham**, head of the refit and engineering operations, continues to visit MDRS to make sure everything operates as it should and to make ever more improvements. It would be hard to pick anyone more dedicated than Gregory and Graham. But actually, all crew members get infected by the MDRS bug! •



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

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LRS News

• Planetary & Terrestrial Mining Sciences Symposium:

On Monday, June 6th, Peter took in the special first day package of this young conference in its second year. His report on his trip to Sudbury, Ontario is on page 10.

• Mars Convention VIII: Peter is registered and "hopes" to be able to attend this event in Boulder, CO Aug 11-14th.

LRS Summer Events - None Scheduled

Summer Field Trip: We discussed a short trip up to Myra, just east of West Bend to the home of Charlotte and Gene Dupree for a pot-luck dinner, and, weather permitting, evening stargazing in the back yard. If the weather is bad, we can always watch a science fiction film. However, the June meeting drew only two people and no decision was made on a date. We'll be handling this by email and phone.

NEXT MEETING - Saturday, SEPT. 10th, 1-4 pm.

Mayfair Mall, Garden Suites Room G110


AGENDA: <http://www.lunar-reclamation.org/page4.htm>

Reports on Summer events. Updates on space and space mission news, conferences, etc. Tthe calendar ahead.

A Fall Field Trip to Chicago?

As of mid-June, it now looks doubtful that the Humphrey IMAX Dome Theater in Milwaukee will run (or is prepared to run) the Tom Hanks IMAX film debuting this September: **Magnificent Desolation: Walking on the Moon 3D.** Maybe a Fall Field trip is in order. We'll be working on an Itinerary proposal and also looking at some possible dates. Perhaps the Chicago NSS people can join us, or we them.

U.S. CHAPTERS



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Space Chapter Hub Website:
 [<http://nsschapters.org/hub/>]

OREGON



Oregon L5 Society

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

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(LBRT - Oregon Moonbase) moonbase@comcast.net

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

Bourne Plaza, 1441 SE 122nd , Portland, downstairs

June 18th - July 16th - August 20th

MINNESOTA



Minnesota Space Frontier Society

**c/o Dave Buth - 433 South 7th St. #1808
 Minneapolis, MN 55414**

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

Email: tomg@mnsfs.org

[www.mnsfs.org/]

MN SFS News & Pictures

• MAS June 2nd Meeting: Due to a logistics "snafu." the scheduled speaker, Prof. Robert Pepin, U of MN Physics Dept., was not able to make it and Ben Huset rose to the occasion and talked about the history of the Chinese Space Program. This was fitting, as Prof. Pepin was to tell us about his physics experiment which had flown on a Chinese mission.

• MNSFS General Meeting was held Tuesday, June 14th 7 pm at Center Village Party Room (15th Floor) 433 So. 7th St. in Minneapolis. Our program was "Exoplanets and Exobiology"

• June Meeting Pix

<http://www.freemars.org/mnfan/mnsfs/2005-Jun/>

• Ben's Pix from ISDC 2005

<http://freemars.org/mnfan/ISDC/2005-DC/>

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@excel.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**

MAY 19th: UW-Sheboygan, Room 6101, **Sheboygan**

JUN 16th: The Stoelting House, **Kiel**

JULY 21st: UW-Sheboygan, Room 6101, **Sheboygan**

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: July 16, August 20

• **May Activities Report:** This is a supplement to our regular meeting report for June as we did not have a meeting in May. We did have great events in May. The other events will be reported as members who attended them come to the next meeting on Saturday the 18 of June.

Thanks to an invitation from Anthony Miskowski to be part of the New Jersey State Museums' Silver Anniversary to do Space Science oriented public educational outreach our group had the opportunity to give demonstrations to science oriented people of all ages.

On Saturday, the twenty first, I gave several presentations to the limited crowd we had due to intermittent rain. When I first "set up" I found that one of my

exhibits on Solar Sails could not be set up as I wanted. But I managed to rig up a flat version of that display element. It Turned out to be a great location for it.

The exhibitor next to us was from the Planetary Society! Ken Kremer (Ph.D.), the presenter for that group, was happy to have us next to him and I enjoyed using there exhibit to make points about "real places we could go" with pictures from the current Huygens probe and discussion of Europa's' liquid interior. What was the connection with our exhibits?: Another part of our display that I had developed was on the exploration vehicles we might need and a property we normal had not thought of in connection with explorers: *buoyancy*. This exhibit consisted of several Easter candy spheres filled to give some of them the same buoyancy and one with more. The rest of this demonstration consisted of two containers of liquids with different densities. Something that would float in one liquid, sank in the other! This was to make the point that we design for the medium the lander could land in and that we had to design conservatively in the case where we did not know what we might find. This is why one of the " spacecraft" was less dense than the others: it would float, and keep its transmit antenna out of the liquid, even if we had imperfect knowledge of the planets surface. Kids liked to do the experiment themselves and I ended up with a towel to be used to wipe off the vegetable oil used for the "hydro-carbon fluid".

On Sunday: the Marines landed! While setting up I was allowed to expand the size of our exhibit area and began doing demonstrations again. By eleven a.m. members of PASA, NSS. and friends came to support our activities. Mitch Gordon and his friend Hal began helping with audience questions and then Michelle Baker came to visit and deliver some news from the ISDC and to offer to be our treasurer. Great!

Suddenly I recognized someone else coming to the table: Dennis Pearson had come and brought a major portion of the display he developed to educate people on the Lunar Specimen that he had exhibited in the Allentown area last year(bringing a cast model of that this time) and his particular display element about the use of Helium Three in helping a fusion reaction along. He also brought a computer and DVDs from the ISDC.!

At one point Michelle and I went to a combination Sky Tour and Laser Light Show, leaving the exhibit in the capable hands of Dennis, Mitch and Hal. We also helped Ken at the Planetary Society exhibit later while he did a formal presentation inside on the Mars Rovers and future exploration of that planet. They had great Three D pictures and free literature that complimented our displays. This included some images of the surface of Titan, including some in "natural lighting" that I worked into the talks on conservative design with the public. One picture of a hazy atmosphere is worth lots of hand waving and verbiage!

Liquids on Titan and in Europa was a success with the public.

This is not to say that classic displays and demonstrations were abandoned: due to our location outside of the building this year we were able to point out how high the Rovers bounced on landing, "over that building's height" etc., and the relative size of a lunar mass driver with similar visual references. The public was mighty impressed with the reasoning behind the work on miniaturization and the cost of launches. Having children give their weight, then converting it to Kilos, and telling them how much putting them into orbit was both sobering and enlightening to them. Why we came up with tricks like Aero Brakes and Air Bags for landing became clearer when explained in this manner.

We packed up very happy to have been invited and will be ready for next year's event. Thank you Tony and the Museum of New Jersey!

SOLAR SYSTEM AMBASSADORS

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Attn: MNSFS, Oregon L5, OASIS: If a member of your chapter is a JPL Solar System Ambassador and you would like him or her to be listed above, please email MMM c/o kokhmmm@aol.com

No MMM Next Month

The Next Issue, **Moon Miners' Manifesto #187**, will be published as scheduled in August, on our regular 10 issues a year schedule.

There will be no **Moon Miners' Review** issue in July. MMR has been discontinued.

Instead, readers with online access will be able to download the next two volumes of **Moon Miners' Manifesto Classics**, as pdf files.

MMM Classics #5 - Year 5, Dec. 1990 - Nov. 1991

MMM Classics #6 - Year 6, Dec. 1991 - Nov. 1992

Classic Articles, Re-edited, Re-illustrated, and Republished — Watch for the link at

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 **Regular Meeting 3 pm 3rd Sat. each month**

Microcosm, 401 Coral Circle, El Segundo.

• **June 18th - July 16th - August 20th**

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



Upcoming Events

- **Sat. June 18th, 12 noon - . -- (Note the early start!)**
OASIS Monthly Business Meeting at the home of Craig and Karin Ward, 1914 Condon Avenue, Redondo Beach.
- **Sat June 18th, 3:30 pm - OASIS presents *To the Edge of Space: Judging the X-Prize Competition*, a presentation by Dr. Richard Van Allen at Microcosm, Inc. 401 Coral Circle, El Segundo. A**
- **Sat. June 18th, 7:30 pm - Riverside Astronomical Society General Meeting. Cossentine Hall, La Sierra University, 4500 Riverwalk Pkwy, Riverside. Free admission. <http://www.rivastro.org/index.html>.**
- **Fri. June 24th, 8pm - "Robot Technology in Extraterrestrial Environments," by Robert Staehle, JPL Space Experiment Systems. Science Lecture Hall 140, Santa Monica College, 1900 Pico Blvd. 310/434-4003 or <http://www.smc.edu/planetarium/>.**

Recurring Events

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

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

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