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

Moon Miners' Manifesto

& Moon Society Journal

#163 – March 2003

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

In FOCUS: The Shuttle Crisis and Manned Mars Mission Game Plans

March takes its name from from the Roman god of War, Mars. March is for Mars, and the March issue of MMM has been a Mars theme issue for many years now. And the current space "situation" in the wake of the tragic loss of the shuttle Columbia and her crew, and the grounding of the rest of the shuttle fleet, decisions are very much up in the air about how to proceed from here in support of manned space operations and the International Space Station. These uncertainties, and how they will eventually be resolved, bear directly on the hopes and dreams of most of us for future manned exploration of Mars.

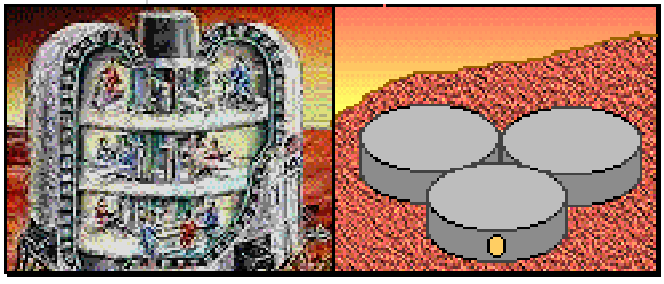
Pre-Mars Direct Manned Mars mission scenarios rely on assembly of expedition spacecraft in Earth orbit. Ideally, this would be done at a station in equatorial or near-equatorial orbit. The high inclination orbit of the ISS would pose high fuel penalties on departing craft bound for solar system destinations in the plane of the ecliptic (our orbit around the Sun.) Robert Zubrin's "Mars Direct" architecture evolved, however, more in response to the apparent budgetary "black hole" that the space station seemed sure to become, than to a question of suitable assembly orbits. The high orbit chosen for the ISS is ideal for the Russians, and their Baikonur, Kazakhstan launch site, and also for down-looking Earth observation programs, essential in the selling of the ISS to the public and Congress. But ISS does not loom as a prerequisite for Mars missions -- except in its capacity to simulate multiyear long manned missions.

Indeed, until we can elevate the station's life-support autonomy to the point that Progress "resupply" missions bringing oxygen, water and other consumables for "make-up losses" are unnecessary over a term of two to three years, we would be insane (murderous?) to send crews on 2-3 year missions to Mars and back. Mars enthusiasts who would launch now, if we could, are not realistic. We do not have the life-support expertise for missions that long,. So, from this point of view,continued support of the ISS is absolutely necessary. Stronger support, and perhaps U.S. subsidies for the Soyuz & Progress assembly lines in Russia is urgent, as is getting the remaining three Orbiters back up in service as soon as prudent caution allows.

But it becomes clearer than ever that we must put replacement of the current Space Transportation System with cheaper to fly, easier to turn around, safer people-rated launch vehicles -- another topic. [➪ p. 2, col. 2]

M.A.R.S. Simulations: Next Logical Steps

With "M.A.R.S. OZ" - the 4th Mars Society analog simulation outpost in South Australia - the Mars Society operations simulations program will branch out to include alternative outpost architectures. This month, we look at other architectures worth testing for their operational advantages and disadvantages in an extended M.A.R.S. HAB program. See page 8.



Moon Miners' Manifesto

Moon Miners' MANIFESTO/ Moon Soc. Journal is published every month except in January and July, by the Lunar Reclamation Society. In January and July, all members and subscribers recieve **Moon Miners' REVIEW** instead.

• **MMM** is being reedited for the World Wide Web by members of the Artemis Society International. => www.asi.org/mmm

• **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/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 over 25,000 members and 80 chapters, dedicated to the creation of a spacefaring civilization. The National Space Society, 600 Pennsylvania Ave. SE, Suite 201, Washington, DC 20003; Ph: 202-543-1900; FAX: 202-546-4189; 202-543-1995 NSS Space Hotline; nss@nss.org => www.nss.org

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

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fi IN FOCUS Editorial continued from p. 1.

Back to the choice of manned Mars mission architectures: Missions that call for spacecraft assembly in orbit would seem to require building of a second "Orbiting Space Depot" station in near equatorial orbit. As such a station is not currently on anyone's drawing boards, and would add enormously to the cost of such a Mars mission, there seems little point in pursuing such a tack. That leaves us with something like "Mars Direct."

Enter the loss of Columbia, and the sudden long-overdue realization that the present shuttle system cannot be relied on to serve us indefinitely into future decades through endless overhauls and updating retrofits. "Mars Direct" as envisioned by Robert Zubrin uses a shuttle-derived launch vehicle, the Ares. Ares uses the shuttle External Tank and Solid Rocket Boosters, but replaces the side-mounted Orbiter with a top mounted faring. In this faring would ride the in-situ fuel production plant and the Earth-return crew vehicle -- on the first flight -- and the Mars Habitat and crew -- on the second flight two years later. [See Zubrin's Remarks, page 15, this issue.]

The question is this. Is it rational to continue to plan "shuttle-derived" vehicles in the light of all that has happened? Columbia's fate seems linked to vulnerabilities of the tile thermal protection system and not to the ET and/or the solid boosters. It seems defensible to continue to design top-mounted shuttle derivatives. Is the high cost of shuttle missions disproportionately due to the cost of having to overhaul the Orbiter between missions? Is the ET "strong back" and SRB system separately taken relatively economical enough to make looking at shuttle-derivatives a reasonable R&D choice? Or do we need to start from scratch with another heavy-lift launch vehicle?

It is clearly time to reexamine all these issues. If the Ares still passes muster on post-Columbia reexamination, that will provide a boost to Manned Mars mission plans and dreams, and to serious consideration of same by the Administration and NASA. But the reexamination does need to be made, and with it, aggressive brainstorming of other options. What can be done with existing heavy lift vehicles like Titan 4 and Ariane 5 and others, including those on the drawing boards with line item budget support?

"Mars Direct" is now over a decade old. It continues to be a brilliant plan. But it is time to take a second look at things. Technology has made major advances in the past decade along several fronts. Our experience with manned space operations is now much deeper. Let's encourage fresh examination. If "Mars Direct" still comes out on top, the result will be renewed and intensified enthusiasm for putting Mars the human frontier on the public Calendar. And the distraction from the present political/international insanities would be most welcome.

Mars beacons! Let's do our homework! **‹PK›**

From the MMM Archives
Mars Articles Online

In this list we use a "shorthand notation" to refer to issue, month, and year of Moon Miners' Manifesto: EXAMPLE: [113MAR98] = MMM # 113, March, 1998. All articles cited are by Peter Kokh unless otherwise noted. Most issues and articles have yet to be put online. Some issues (1986-1990) do not yet exist in electronic form.

NOTE: URLs below follow http://www,asi..org/ [>>]

[6JUN87]

- **Mars, PHOBOS, Deimos**

>> adb/06/09/03/02/006/marsdestiny.html

[93MAR96]

- **Mars will require a hardier breed of pioneer**

>> adb/06/09/03/02/093/editorial-teaser.html

- **MMM's 'Platform for Mars'**

>> adb/06/09/03/02/093/mmm-mars-platform.html

- **REDHOUSING: breeding 'Mars-hardy' plants in compressed Mars Air**

>> adb/06/09/03/02/093/redhousing.html

- **The Shifting Climate of Mars**

>> adb/06/09/03/02/093/shifting-climate.html

- **Searching Mars for Lavatubes**

>> adb/06/09/03/02/093/mars-lavatubes.html

- **Surveying Mars for Permafrost**

>> adb/06/09/03/02/093/permafrost.html

[103MAR97]

- **The Moon's Role in the Opening of Mars**

>> adb/06/09/03/02/103/editorial-teaser.html

- **"Outlining a Comprehensive Mars Fossil Discovery and Mapping Program**

>> adb/06/09/03/02/103/mars-fossils.html

- **Feasible Goals of Assistance in the 'Opening' of Mars for an early profit-seeking Lunar Industrial Settlement**

>> adb/06/09/03/02/103/feasible-goals.html

- **Tempering Enthusiasm for the Red Planet as 'The Next Human Frontier' with Personal Honesty**

>> adb/06/09/03/02/103/truth-about-mars.html

- **"How to Re-start a Space Race to the Moon & Mars"** by Alan Wasser

>> adb/06/09/03/02/103/space-race.html

[110NOV97]

- **Lunar Quarantine Facility for Mars Sample Returns**

>> adb/06/09/03/02/110/quarantine-marsmission.html

The intent is to eventually put all back issue articles online

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There is Daylight on Mars!

by Peter Kokh

That may seem to be a strange declaration. But in fact, Mars is likely to be the only world in our Solar System where people will walk and live in "daylight." For, despite the Sun shinning constantly on the Moon for nearly 15 days at a stretch (the "dayspan"), there is no true "daylight" on our neighbor world to be experienced and enjoyed. The Moon's "skies" are black, not bright blue (or any color). There is direct sunlight but no *ambient* daylight, light scattered from all directions, such as we experience here on Earth. Indeed, the Moon has "heavens" but not a "sky."

Mars, on the other hand, has a real sky. Yes, it is not blue. Yes, it is only half as bright as our sky. But a sunny day on Mars is significantly brighter than a cloudy day on Earth. This is one aspect of the Mars Frontier that will make it more attractive than the Moon to many.

We wrote about "The Black Sky Blues" (on the Moon) in MMM # 138, SEP 2000. For future Lunans, relief will come in ample "middoor" spaces with brightly cove-lit vault ceilings, possibly sky blue in color, and possibly similar ceilings in private residence structures, hallways, etc.

Indeed, since most Lunans will live the bulk of their everyday lives within enclosed settlements, not out on the surface, one might be tempted to say, "what's the big deal? The sky is black! So?" Actually, Lunans will have the better nightspan star gazing experiences. Not so during dayspan. As confirmed by the Apollo astronauts, during the day (all of them were on the Moon only during *midmorning* lighting conditions) the intense glare of the Sun makes the stars invisible in the black sky.

But when Lunans travel between settlements and other remote locations, they will never experience daylight. The lunar terrain may be brightly sunlit, but the sky will be black, and almost all the available light will come from one direction, from the sun. There will be some reflected off of sunlit surfaces, but that will be proportionally little. Yet Lunans will be a hearty bunch, and learn to adapt.

On Mars, the pioneers will also have to adapt -- but not to a black sky, to a salmon colored one much easier on the eye. They will enjoy full daylight when traveling or working out on the surface. This difference between the Moon and Mars may seem trivial, but should result in some distinctive cultural differences between the two frontiers.

As content as future Martians may be with their color-shifted daylight, future Lunans will be the better able to adapt to similar black sky situations on most other moons and asteroids in the solar system. For besides Mars, only Titan offers a bright sky, one also reddish, but much, much dimmer (only about a fiftieth the light levels!)

Alas, I'd still miss the blue skies of Earth, and the Arizonesque Marsscapes will seem wrong without them. For a while, anyway!

<MMM>

Keeping the Mars Frontier in the Pink

Solar Sail Cargo "Pipelines"

can greatly reduce the cost and risks of "opening up" Mars as a frontier

by Peter Kokh

The long-awaited Cosmos-1 solar sail mission may provide a big boost for dreams of opening Mars to human settlement. The reasoning is simple. By being able to tack in the solar winds, solar sail cargo vessels can slowly make their way to any destination in the inner solar system without waiting for ideal launch windows, in the case of Earth <—> Mars flights, some 25+ months apart.

The cargo or payload capacity of a solar sail depends on the size (area) of its sail. Cosmos I is a modest 30 meters (99 ft.) in diameter, but much larger sails could conceivably be built, all of gossamer light materials, using such devices as inflatable tubes and/or rotation to keep the sail taut in its unfurled state. It can "tack" inward and outward against the solar wind much as sail ships on the oceans can tack towards and away from the wind.

Sails made on Earth need to be coated with polymers to be sturdy enough to launch. Selecting polymers that degrade and evaporate in sunlight would help reduce the weight and increase the efficiency. Someday, more efficient sails may be manufactured in space.

About the Cosmos I Solar Sail Mission

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

The spacecraft is being built by the Babakin Space Center in Russia, under contract to The Planetary Society. It will have a 30-meter (100 ft.) diameter sail, configured in 8 triangular blades and deployed by inflatable tubes from a central spacecraft at the hub. The 100-kilogram spacecraft will be launched by Volna, a submarine-launched converted ICBM, into a 800-kilometer (c. 500 mi.) circular, near-polar orbit of Earth. Microwaves beamed from the 70-m Goldstone radio dish in the Mojave desert will then push it through space.

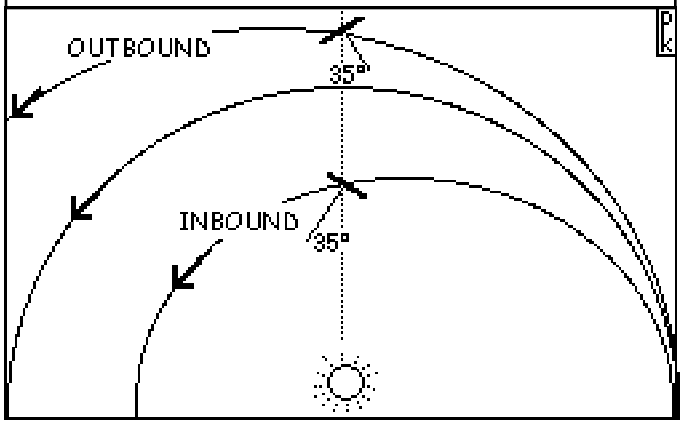
The submarine launch planned for **mid 2003**. will be from the Barents Sea north of Murmansk. The spacecraft will be operated from the Babakin Space Center near Moscow. Telemetry data will be received in Russia and in the United States.

Inflatable tubes keep the sail rigid. The solar sail will use the pressure of sunlight to increase its orbital energy and raise its orbital altitude. The sail is controlled by pitching the blades, thus turning the direction of the solar force. []

The purpose of the Cosmos I mission is to conduct the first solar sail flight and demonstrate the technique for traveling between planets.

Tacking outbound, tacking inbound

Aligning the sail so that sunlight falls on it straight on (perpendicular) is not efficient in orbital mechanics. If we tilt the sail so that the angle between the sun and the perpendicular to the sail is about 35 degrees, we maximize the component of thrust parallel to the direction of travel. This allows the craft to be pushed along the direction of travel, climbing up the gravity well, yet slowing down. By aligning the angle the other way to oppose orbital velocity, sunlight pushes against the direction of travel, dropping the sail down the gravity well and causing it to speed up Solar sail can travel sunward as easily as away from the sun.



While the original idea was to use the energy of sunlight, quite strong everywhere in the inner solar system, scientists are now considering additional "beamed energy" sources such as microwave beams and lasers. These energy boosters would work to increase cargo capacity and/or shorten trip times. Beamed Energy Propulsion (BEP) is gathering a lot of attention these days, witness the First International Symposium on Beamed-Energy Propulsion held 5-7 November at the Univ. of Alabama in Huntsville. Using sunlight or beamed energy instead of tons and tons of rocket fuel and fuel tanks and the engines themselves, makes this form of transporting cargo relatively cheap.

Solar Sail Cargo Shipments as Infrastructure

Solar or beamed energy cargo sailing vessels, given their ability to take a variety of complex trajectories to their destination, can create a virtual "pipeline" if they are dispatched in sufficient numbers to form a "steady stream" of cargo is always arriving at the destination -- say Mars. While this transportation system would not address any emergency needs of the Martian pioneers, it would be ideal to provide a steady stream of fresh supplies needed on a regular, routine basis for maintenance of the base and staff, and for planned expansion of habitat space, the agricultural areas, power systems, etc. Examples include foodstuffs not yet grown on location, components needed for outpost expansion, agricultural soil amendments and nutrients, fuels which cannot yet be produced locally, clothing items, tools, seeds, replacement parts, etc.

The Great Solar Sale Race of 1992

[Excerpted from]
http://caliban.physics.utoronto.ca/neufeld/sailing.txt]

The outlook in 1990

The first President George Bush charged a committee with planning events to commemorate the five hundredth anniversary of Christopher Columbus' departure from Europe for the Americas. Among the ideas chosen to be implemented... was the Columbus 500 Space Sail Cup. Spacecraftwere to launch on conventional chemical rockets around Columbus day of 1992 and have to go to Mars using only light pressure. Among the serious competitors were the Canadian Solar Sail Project, an initiative of the Canadian Space Society, the Aeritalia Team from Italy, Cambridge Consultants from Britain, and the World Space Foundation from the United States... also teams from Japan, Israel, and the Soviet Union ... Among the criteria for winning, was shortest transit to Mars orbit and the closest approach to the planet. To be recognized as a winner the sail must have received no government funding, but could have received money from the Columbus Commission. One team from each of the Americas, Europe, and Asia, was to receive whatever money became available. The World Space Foundation sail was the official Americas sail, and was receive some of the money ...

In retrosopect: The race did not take place. Commercial funding was not available for private launches, and the U.S. government decided not to pay for launch costs for three of the entrants of the race.

How long it will take a Cargo Solar Sailer to get to Mars?

Cargo sailers may take much longer to reach their destination than would chemical rockets. The time will depend on the sail and payload mass relative to the area of the sail, and to the relative positions of Earth and Mars at launch time. But for "routine cargo shipments, all that will matter is that there be a fairly continuous supply at the destination. Time spent "in the pipeline" is immaterial.

How a Cargo Sail Pipeline will Help Open Mars

The advantage to Martian pioneers will not only be in the much greater frequency of shipment arrivals, but also in a significantly lower bill for "shipping & handling."

> Solar sailing is attractive as a means of travbel between the planets, when time spent in space is not important. The propellant is sunshine, there is no fuel, and the thrust is continuous. In contrast to chemical rockets, solar sail freighters do not have to be 95% fuel by mass.

As the pioneers will be hard put to produce exportable products that will be marketable on Earth, it will be vital for their bottom line to minimize the cost of imports for which they must find some way to make payment. Solar Sail Cargo shipments will thus greatly reduce the bill for maintaining, sustaining, and growing the human outpost(s) on Mars.

Cargo sailers are not one-use-throwaway craft. With proper trajectories, payloads can be dropped off, and picked up, as the sailer flies by Mars. This is vital, because goods exported to Earth will help settlers pay the reduced bill for imports. Using solar sail freighters to ship items back to Earth will minimize shipping costs, making Martian exports more attractive on Earth. Thus solar sail pipelines between the Earth-Moon and Mars-Deimos-Phobos systems will help on both ends of the Import-Export Equation.

The attractive economics are not the only advantage, however. A solar sail cargo "pipeline" will also provide some insurance against missed launch window opportunities for chemical rocket payloads, whatever the cause of their being missed (technical, weather, political mischief.,)

How payloads will be delivered to the surface of Mars is important too, but another question. Aerobraking cargo shuttles, self-landing payloads using parachutes and inflatable pods, are among options to be considered.

What cargos will go by the solar sail pipeline?

The pioneers will be doing all they can with the tools and equipment provided to rely on building materials they can produce locally on Mars, and on other local resources. But as they expand their settlement they will need many components and items that they cannot yet manufacture or supply locally. Along with imports of more and more capital equipment to allow local manufacture of more items on the strategic must-make-locally list, they will need ever more vehicles, appliances, electrical wiring components, plumbing items, water and air recycling systems, vehicles, power generators - the list is quite long.

The alternative: the "yolk sac" strategy

There Mars pioneers will need a continued influx of many common commodities such as fuel, food stuffs not yet produced in outpost farms in sufficient quantity or variety, pharmaceuticals, clothing, etc. But without a solar sail cargo "pipeline" to deliver such items on a "just-in-time" basis, the outpost will need a substantial nest egg (a "yolk sac") of supplies in quantities large enough to provide prudent margins should consumption or accident use up or waste needed items faster than expected. If a dire need develops before the next rocket shipment from Earth (on 25+ month intervals) they would simply be out of luck. Mars is simply too distant for an umbilical cord type of nourishment. [see MMM # 113 MAR '98, p. 6, "Yolk Sac Logistics"]

Yet a solar sail freighter pipeline will provide no relief at all for unexpected emergencies. To maintain & repair critical systems (power, life support, medical, etc. a "Yolk Sac" cache must be "on hand," not "in the pipeline.

That fact has consequences that those who insist that a prior lunar outpost would not help open up Mars in a timely fashion must consider. It would be the height of

presumption to send undebugged, unproved, critical systems to Mars without proper field trials. Some of these systems can indeed be tested in low Earth orbit. But those that rely on gravity to function properly, can be tested with more reliable results, and greater confidence, on the Moon where rescue, resupply, and repairs are only a few days flight away. We don't ask the government to open the Moon first, or at all, but if a commercial Moonbase is in place before decisions about critical equipment to be included in a first Mars outpost, that would take some of the pressure off the need for a burdensomely large cache of replacement parts.

Point of Departure in the Earth–Moon System

For routinely needed parts and goods that can be made on the Moon, sails departing from near the Moon will provide quicker service to Mars than sails departing form low Earth orbit. The climb out of Earth's deep gravity well on sunshine alone, will take months. The Moon rests on the shoulder of that gravity well. Sails leaving from the Earth-Moon L1 Gateway will make the trip that much faster. Thus any early lunar industries making items for use in the lunar outposts and settlements that can also be of use on Mars will help sustain efforts to open the rusty frontier.

If Cosmos I succeeds, what's next?

The Cosmos I mission hopes to test several things: in-space deployment of the sail itself; tacking in sunlight; rates of acceleration etc. We know from bitter experience with NASA tether missions, how disappointing such test flights can be. Failure can come from an unrelated system with the result that nothing at all is learned. NASA's reaction has been to not try again. Cosmos I is the baby of a determined party, however. The Planetary Society understands the crucial value of solar sails to the opening of Mars, a goal to which TPS is committed. Congress, unfortunately, has not allowed NASA to be so committed.

If the flight goes less well than hoped, it'll be back to the drawing boards, with a retest a couple of years down the road. If all goes well, we'll want to do several things:

- testing improved, more efficient sail materials
- testing improved deployment systems
- trial flights to Mars over several windows
- recovery of the sail after Mars flyby
- payload delivery to Mars surface, on target and intact
- test navigation precision
- scaling up the sail to carry helpful payloads

The years ahead promise to be exciting ones for solar sailing. It's been a very long wait, **<MMM>**

Read More -- SOLAR SAIL LINKS

www.kp.dlr.de/solarsail/
www.spacetransportation.com/ast/abstracts/3C_Frisb.html
www.spacetransportation.com/ast/abstracts/3E_Horod.html
http://caliban.physics.utoronto.ca/neufeld/sailing.txt
http://web.mit.edu/newsoffice/tt/1990/sep19/23638.html
http://members.aol.com/dsfportree/AT13.htm

The Ideal Mars Suit

If we ever would be something more than "Strangers in a Strange Land," we'll need lightweight, Mars-hardy, and intelligent "outerwear" to let us enjoy "the big red outdoors" as if we truly belonged there.

by Peter Kokh

Attitude is Everything

On Earth, those of us who live in winter country, know how to dress to keep warm no matter how cold, how blustery, no matter what the wind chill. It's all a matter of layering. For most of us rugged winter-hardy folk, it's a matter of just keeping warm enough to go about our business of getting from here to there without getting a chill.

That said, many of us would have to admit that while winter is "not a problem," we still do not feel quite "at home" outdoors in that kind of weather. But there *are* those who have transcended to that point of comfort, thanks to lightweight winter "sportswear" flexible enough to allow full free movement of arms and legs. It is the winter sports people, and their outfitters, who have found a way for people to feel quite at home outdoors in weather that our less hardy sunbelt countrymen would find nothing short of Antarctic.

NASA did an excellent job of designing the Apollo Moonwalker suits, again relying on layering to provide micrometeorite, radiation and thermal protection, along with pressurization and life support. The suits were big and bulky, but they allowed us to get around, clumsily, and get the assigned tasks done. The Apollo suits provided a personal micro-environment that allowed us to explore an alien environment that would have been instantly fatal without the protections they afforded.

Compare those suits to the first early diving suits, or (why not?) to the aquarium "suits" that fish must "wear" to survive in our air-filled living rooms. "Strangers in a Strange Land" - SISL. SISL suits are good enough for exploration perhaps, but not for pioneers that want to be able to go here and there in their adopted homeland "as if they belonged," in a way that protects but yet allows full freedom of movement without fatigue. Lunar "Out-Vac Sportswear" will appear when there is a market. Pioneers who volunteer to settle the Moon, but who are unwilling to check their love of outdoor sports at the door of the launch pad on Earth will create that market. In time light, flexible, yet still fully protective suits will be available that will let future lunans fill truly at home engaging in a wide variety of out-vac sport activities.

The SISL mentality will likewise produce suits for Mars Explorers that will be adequate for all the tasks that mission control assigns. But, again, in time the market for something better, much better will appear.

Anticipations of Martian Surface Sportswear

One place people are already working to design a "better Mars suit" is in Australia. We first reported on Mars Society Australia's "Marsskin" Project in MMM #150 NOV. 2001, p 15. Mars Society Australia Projects. See:

www.marssociety.org.au/marsskin.shtml

The Apollo suits, and all space suits used to date by both astronauts and cosmonauts are of the gas-pressurization type. They work, and have been amply tested in the field. But they have stiff joints which fight the wearer's efforts to bend them. And they are bulky. Moreover, by containing an atmospheric shield that envelopes the whole body of the wearer, they greatly increase the chances that a puncture of any part of the suit will be fatal.

In 1967, Webb and Annis published the concept and early experiments of a Mechanical Counter Pressure Suit (MCP), and in 1971 described the first demonstration of the many advantages to the MCP approach which exerts pressure on the body using formfitting elastic garments.

MCP garments offer dramatic improvements to gas pressurized suits i*n reach, dexterity and tactility due to the replacement of stiff joints and bearings with light, flexible elastics, lower suit costs and vastly reduced weight and volume.* And, they are *safer:* a tear or hole would remain a local defect rather than cause a catastrophic puncture. . MIT flexibility tests in the mid 1980's found MCP gloves to be notably superior to gas-pressurized ones. Since then there have been major advances in textile technology for fibers, yarns, and automated knitting machines.

Mars Society Australia's Project MarsSkin aims to design, produce and test analog mechanical counter pressure (MCP) space suits to be used in Mars analog research projects undertaken in Australia and internationally. They will behave in a near identical fashion to the real MCP suits which may one day be worn on Mars.

Meanwhile, NASA-supported research into MCP suits has become another victim of the budgeteer's ax.

The U.S. Army's new "warwear" - (as shown on ABC's "Good Morning America," 2/26/03) includes a handsfree drinking tube (reminiscent of Fremen Stillsuits for all you Dune fans) and a handsfree radio that uses your skull bones as an amplifier, and a walkie-talkie GPS combo.

Military needs are akin to the needs of the sports-minded, in that performance is paramount. The wearer must not be encumbered in any way. To the contrary it is important to give the wearer every possible tool to be able to comprehend, analyze, and negotiate his/her "alien" environment to advantage. A proper Mars Suit (or Moon Suit) just as a battle suit, needs to be a smart one.

What "smart suit" features will help us on Mars? One can conceive of a "dust storm visor shield" that would automatically slide over the helmet visor when a certain threshold of airborne dust was reached, paired with a shield-activated visor heads-up screen on the visor that would use radar (and infrared and/or whatever can penetrate the dust?) to create a useful live picture of one's surroundings good enough to navigate by. Such a dust shield and enhanced view screen will be a miniaturization of what will be needed on Mars vehicle "windshields."

Infrared heat sensing vision will be important in search and rescue, in finding cave entrances (shelter) and even in prospecting (highlighting minerals that either retain heat longer or lose it faster than the background, minerals that heat up faster/slower than the background.)

In dusty or overcast sky situations where the direction of the sun is not apparent, and where the terrain seem monotonously the same in all directions, it will be easy to lose one's bearings. As Mars lacks a magnetic field, a compass will be useless. A satellite network GPS system will help determine position. But not necessarily direction, until one moves enough in some direction to make a noticeable change in position. Or can the GPS be configured to reveal direction as well?

We wrote about "Engaging the Surface with Moon Suits instead of Spacesuits" in MMM # 151 DEC 2001. In that article, we discussed a number of useful smart suit features such as monitors that would keep the wearer informed of straight-line distance from base or vehicle and minutes of life-support remaining before safe return to base or vehicle became marginal.

But while the first explorers will definitely benefit from any improvements offered by the improved space suits of the time, for the pioneers themselves, those intending to spend the rest of their lives on Mars, the difference between a suit that will make them feel "at home" out in the open and one that will merely keep them safe, is critical -- critical to the overall morale and mood of the settlement population. Feeling safe, but still "a fish out of water" will do little to reinforce their decision to stay and make a new life in a new niche for mankind.

NASA and other government agencies involved in the effort to explore Mars are likely to prioritize "some" space suit improvements. But the budget ax will fall on other worthy improvements. Nonetheless, the explorers will make do and "succeed" in their explorations.

Yet we in NSS, the Mars Society, the Planetary Society, and even the Moon Society seek to go beyond exploration, beyond another series of science picnics and temporary encampments. Our vision is not that of the explorer or scout. It is that of the settler, the colonist, the foresaker of an Old World, of one committed to a fresh start in a virgin land, willing to learn the ways of that land, determined to "become a native" to the extent that such a seeming contradiction in terms is possible.

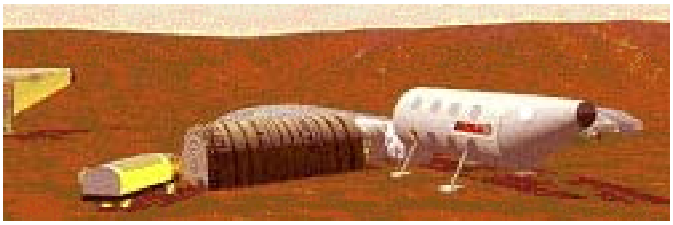
It is our efforts, spearheaded by MS Australia, and eventually championed by commercial outfitters of frontier sportsmen, that will make it possible. **<MMM>**

Need for More, Diverse M.A.R.S. Habs

by Peter Kokh

The Mars Analog Research Station designs in use on Canada's Devon Island in the Arctic and in the south central Utah desert are based on Robert Zubrin's "twin tuna can" Mars Habitat designs featured in his "Mars Direct" mission proposals. Both are two story structures supported on legs used for landing the habitats on site. The new EuroHab version is the first one to tweak the original design somewhat. Making it "a tad taller" gives just enough room to squeeze in three floors (with reduced ceiling height) and therefore 50% more floor space. One of the positive things to come out of operations in Iceland, where this hab will be deployed soon, is an analysis of the affect this increased roominess will have on operations, both directly by making room for more apparatus, and indirectly, by its affect, if any, on crew morale.

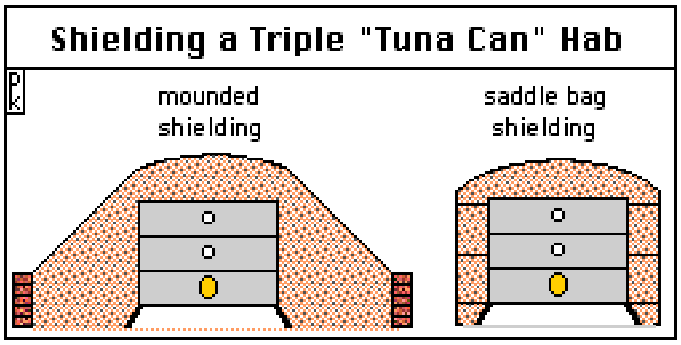
The 4th M.A.R.S. Hab will part company with its predecessors in using a pre-Mars-Direct design, the so-called Biconic shape for a habitat "flying in" for a landing rather than lowered to the surface vertically by parachute.



http://www.marssociety.org.au/technical/tech_images/MarsOz_cover.jpg

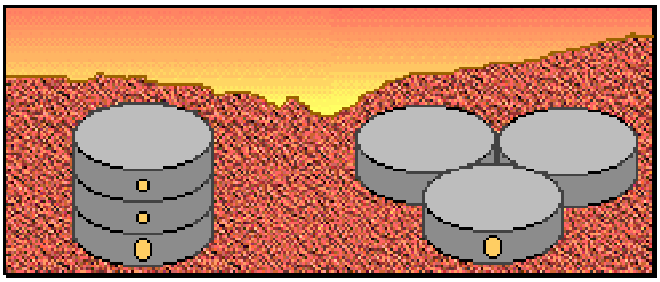
While the pros and cons of landing the two basic designs cannot be tested in Australia, the relative effectiveness of the two designs in supporting operations can. The biconic design has the advantage of a lower profile, which will make it easier to shield with loose Mars regolith soil. In fact, it would be feasible to test various methods of robotic or teleoperated shielding emplacement in Australia. We do not know if that is one of their intentions, We do know that the need for shielding is a concern dismissed by Zubrin, both for the duration Mars explorers will be on the surface (30 days to more than a year, depending on mission profile) and in transit in spaces. An unfortunate attitude.

Shielding ease and methods are things we can pretest and pre-debug without spending a lot of money, and therefore should be one of the goals of the M.A.R.S. Hab program. There are ways the higher profile twin or triple tuna can design habitat (even with legs) can be shielded. A large mound with sloping sides can be bulldozed or otherwise moved in place. This mound would involve moving a considerable amount of soil. Starting with a perimeter ring of blocks sintered from packed soil, or of bags filled with soil, several rows high would help constrain the diameter of the mound necessary.



As shown in the illustration above, using fabric "saddle bag" held in place by straps to the habitat hull, and folded in pleats against the hull for the transit from Earth would reduce the total volume of soil needed as well as the footprint area of the shielded habitat. Both methods could be tested, and tweaked, on location in Utah.

It would seem, however, that the tuna can stack has disadvantages. Not only does the high profile complicate shielding emplacement, but it sacrifices volume to a ladder well. In Utah or another location, an "unstacked" version, in which all three separable floors are hoisted off the landing feet and onto a prepared flat soil bed, might have advantages. Access between units would be direct through doorways 120° apart. And with the lower profile, shielding might be much easier, as well as adding expansion modules sometime in the future.



Perhaps all these experiments will reaffirm the choice of the stacked hab concept. There'll still be a need for additional testing. Zubrin's design is ideal for launch on top the external tank of a shuttle derived launch vehicle. Thus its 27 foot diameter. But by choosing an inflatable version, to fit uninflated inside the 15 ft. wide shuttle payload bay or in a same size faring on top of an expendable vehicle such as Titan 4, Delta 4, Ariane 5, Proton, etc. would help insulate Mars Mission plans from the uncertain future of shuttle-based systems. NASA's aborted TransHab project with similar 27 ft. diameter and 3 floors, could be resurrected. Meanwhile, a faux-inflatable stacked M.A.R.S. Hab with a TransHab like interior architecture would serve to test the ergonomics and effect on operations performance of such a design.

These suggestions do not exhaust the options, but if pursued, would provide invaluable experience and confidence in the appropriateness of the design chosen for the first Manned Mars Mission. Meanwhile, we support and follow the M.A.R.S. Hap project with enthusiasm. **<MMM>**

http://www.moonsociety.org

Please make NEWS submissions to
David Wetnight at newsmonger@asi.org
Other submissions: 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 explor-ation 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®**

Join/Renew Online at

www.moonsociety.org/register/

- $35 USA/Canada + MMM hardcopy
- $60 elsewhere + MMM hardcopy
- $35 anywhere + MMM electronic PDF file

Questions? email: membership@asi.org

The Artemis Project™ http://www.asi.org/

- Artemis Reference Mission
- Artemis Data Book

Project LETO™

http://www.projectleto.org/

Please send all mail related to Memberships to:
The Moon Society Membership Services
PO Box 940825, Plano, TX 75094-0825, USA

How to fix MMM Subscription Errors:
www.asi.org/adb/06/09/04/1999/09/news-19990915.html

Report of the Chairman of the Board

From Randall Severy <severy@asi.org>

February 19, 2003 [Addressed to members and former members of the Moon Society] you might be interested in the following updates from the Moon Society. We can use your help if you'd like to renew.

On October 1st, 2002 the Moon Society elected a new expanded Board of Directors. Added were Peter Kokh, Michael Mealling, and Arthur Smith as new board members, joining Greg Bennett and Randall Severy as re-elected members and Dana Carson and Ian Randal Strock as existing board members serving the second year of their two-year terms. Scotty Gammenthaler (Treasurer), David Wetnight (Vice President), and Amy McGovern (Secretary) also serve as ex-officio members of the board.

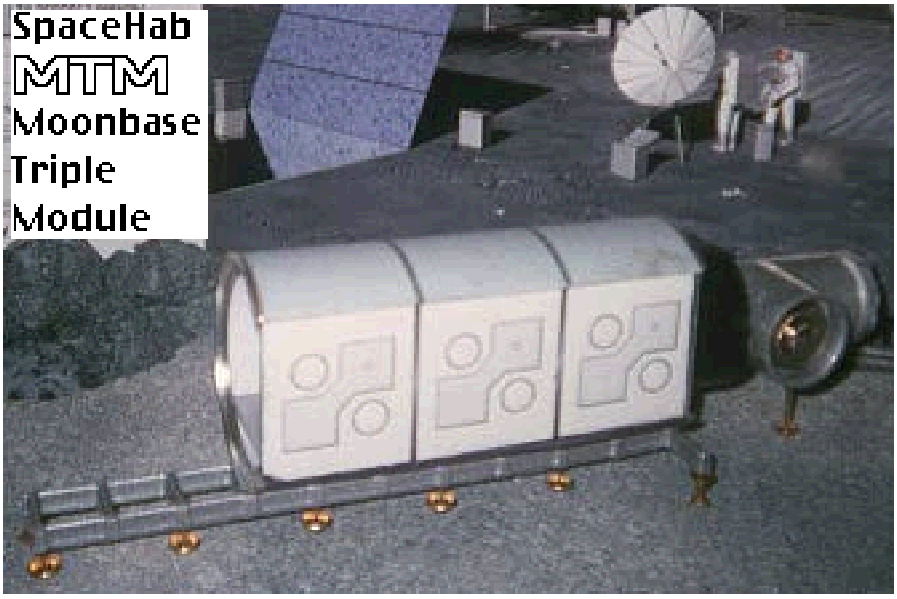
The additional board members give the Moon Society some much needed additional resources to tackle several key projects. Those key projects include:

• **Membership Services** - New board member Arthur Smith agreed to help Treasurer Scotty Gammenthaler in improving the membership services of the organization. His first task was wading through and responding to a lengthy backlog of e-mails with membership questions.

• **Chapters Coordinator** - Building on his long experience with NSS Chapters, Peter Kokh volunteered to coordinate the chapter activities of the Moon Society. Although all of the ASI chapters were moved to the Moon Society, many of them had become inactive in recent years. Peter is leading a new effort to organize new chapters and resuscitate existing chapters, including the recognition of "mini-chapters" called "Outposts".

• **Web Team** - Updates to the Moon Society web site have fallen behind recently, due to changes in personnel managing the web site. John Schrock volunteered to lead a new effort to update and improve the web site, and was put in charge of the Moon Society Web Team. John and his team have been working hard over the past few months on an improved design of the web site, which will be unveiled in the near future.

• **Help Desk** - Using a new product from CyberTeams, processing of e-mail sent to Moon Society support addresses has now been moved into an automated system that will help prevent the large backlogs of support e-mail that have accumulated in the past. Staffed by members of the Moon Society Leadership Council, the help desk system keeps track of all incoming e-mail messages and responses, and sends out reminders on a nightly basis. Over the past few months the help desk staff have worked their way through the entire e-mail backlog and are now able to provide swift response to most e- mail questions. You can use any of the following e-mail addresses to reach the appropriate Moon Society department: ➪ page 11, col. 2.



LEFT: Artemis Moonbase Model made by Peter Kokh http://nsschapters.orgb//hub/exhibits/artemismoonbase_model.htm

To these ends, we must not only outfit the MTM with all the appropriate equipment, but also choose an ergonomic (work-friendly) arrangement. Paper studies can produce layouts that look promising, but experience is the only true test.

Proposed "Action Items"
A Design Competition & a Simulation Exercise

Define a DESIGN COMPETITION aimed at getting layout suggestions from many indivi-duals and teams. This competition could be open to Moon Society members and nonmembers alike.

- Issues to be decided:
  - how to advertise/promote the design competition (Astronomy, Sky & Telescope, MMM, web links, etc.)
  - awards and prizes to offer (plaque in actual walk-thru model? lifetime memberships? runner ups?)
  - assembling a suitable panel of qualified judges (expertise in ergonomic arrangements, etc.)
- Meanwhile, and independently, a "crew" of four to six *self-funded* volunteers would arrange to "overnight" in the Jules' Undersea Lodge off Key Largo, Florida [http://www.jul.com/] to experience for themselves close quarters and the environmental isolation imposed by the sea (as an analog of space/vacuum) and judge how much elbow room is needed for various kinds of activity. This would cost each volunteer $350 plus travel. After exiting the facility in the morning, the "crew" would regroup to mutually debrief one another and compose a preliminary report on their findings.
- Using the findings of the Undersea Crew as a guide, a panel picks the best Design Competition entries, or comes up with an layout version of their own.
- LAYOUT BLUEPRINTS of the walk-thru tour version (probably 80% to 90% scale for trailerability) and a full scale deployment version would be prepared. We would want someone with architectural drafting experience.

Task THREE – Contractor RFPs

What is the best construction material? the best construction method? We will need to send out Requests for Proposals to interested contractors, then weigh the various proposals for considerations of fidelity to the plan, cost of materials, cost of construction and assembly, and ease of disassembly, mobility., and other considerations.

Announcing an MSJ Project
Moonbase Triple Module

by Peter Kokh

The Moon Society, as is the companion Artemis Society International, is a volunteer organization with no paid staff. We are in not yet in a position to contract out R&D projects. To make teams have been started by leadership direction, some by member volunteer initiative.

This is a proposal for a Project to design and test interior outfitting for the triple SpaceHab module proposed for the Artemis Moonbase™.

Task ONE – Defining Moonbase Interior "Consist" -- We *do not have* a layout plan for the Moonbase interior, not even a well-developed list of equipment needed.

Proposed "Action Items"

- determine list of equipment and apparatus used on the Apollo Landing Modules -- sizes, weights, and shapes
- determine kinds of operations not pursued in the Apollo era missions that we want to support on the Artemis Moonbase™. Develop a list of additional equipment to be inside the MTM to support such activities.
- research dimensions, weights, shapes of all needed items that are currently "on the shelf" (along with costs)
- identify any desired items *not* "on the shelf"

Task TWO – Determining the most "ergonomic" layout options for the Artemis Moonbase™ Interior

Our Team Goal is to produce (a) a walk-through mockup of the Artemis Moonbase that can go on tour around the country; and (b) a full scale version to support Simulated Operations Exercises in lunar terrain analog locations, much as in the various M.A.R.S. Habitats.

We need to send out two sets of RFPs - (1) for the sub-scale trailerable walk-thru. The interior outfitting need only be of a dummy mockup variety. A trailer, either existing or specially made would be part of this contract.

And (2) for the full-scale deployable version to be used for in the field operations simulations exercises. Ease of knock down, transportation to a new field site, and ease of reassembly should be part of this contract, Interior partitions would be included, but the contract(s) for the needed operating equipment would be separate.

The choices of materials and construction methods might well turn out to be different for the two versions,

Task FOUR – Fundraising

Until we have a handle on contract costs, we will not know how much money to raise. Since one goal of the traveling trailerable walk-thru mockup would be to help raise money for the deployable operations simulation version, the first funding goal will be to raise the money to build the walk-thru mockup, its trailer, and for transportation and other exhibit costs. Exhibit staffing would be volunteers, an opportunity to recruit new society members.

Sale of logo space on the walk-thru model exterior and interior will be a major source of funds. Gifts in kind of a trailer and construction materials and components would also help a lot. Not to forget individual donors!

Follow Through Tasks – walk–thru exhibit mockup

If we are succeed at all of the above tasks and action items, there'll be additional tasks to address, and the need for volunteers to address them.

- BOOKING AGENT for appearances of the mockup at various conferences, fairs, theme parks, etc.
- VOLUNTEER COORDINATORS at each exhibit location
- EXHIBIT COORDINATOR in charge of complementary exhibit materials and literature
- PUBLICITY COORDINATOR for each exhibit event

Follow Through Tasks – Field Simulations Habitat

If the Mars Society chooses to take a cavalier attitude towards radiation hazards, that's its business, and their lost opportunity. Besides simulating operations activities, primary goals of an MTM analog station must include:

- SHIELDING DEPLOYMENT & TELEDEPLOYMENT - First, we can have another design competition for the most practical teleoperable means of deploying regolith over the MTM as shielding. Minimizing the weight and bulk of the necessary equipment and of the power plant to operate it would be design goals. The most promising proposals could then be field-tested at the simulation site and further R&D design goals decisions made based on performance results and problems.
- OVERNIGHTING SIMULATIONS: Getting through the 14+ days of the lunar nightspan is a challenge that most moonbase advocates and enthusiasts dread -- to the point that some prefer a south polar site where this challenge could be avoided, ostrich style. At the Artemis Moonbase Analog site, we couldn simulate lighting conditions and practice getting through the nightspan in powerdown mode, reserving labor-intensive but power-light tasks nightspan as much as practical, to get a handle on required power generation capacity.
- The Analog site would also be ideal for field testing mobile modular power plants to serve mobile industrial activities: settlement and road construction, resource exploration, in situ manufacturing of solar arrays, etc.

Not to forget

The Artemis Moonbase EVA-Docking Port has a number of design ambiguities and potential problems and could benefit from a design competition. This is a critical part of the Moonbase Phase One Assembly. The same can be said of the two couch open-vacuum ascent vehicle.

Getting Started –– *Action Items –– LET'S GO!*

- SET UP PROJECT TEAMS on Team Director. with their own meeting space on the ASI-MOO, a project web page and e-mail address -- before you get this issue.
- LINE UP OTHER PARTNERS (the Lunar Reclamation Society, Oregon L5 Society, etc.

Chairman of the Board Report Cont. from page 9

- info@moonsociety.org - General Information Requests
- listmaster@moonsociety.org - Mailing List Support
- membership@moonsociety.org - Membership Information
- newsmaster@moonsociety.org - News Server Support
- pr@moonsociety.org - Publicity/PR/Interview Requests
- webmaster@moonsociety.org - Web Site Support

To provide a forum for the day-to-day operations of the Moon Society, we re-formed the Moon Society Leadership Council. The council meets twice a month in the ASI MOO online meeting server to review project status and set the direction for future projects. The Leadership Council consists of all of the board members and officers as well as John Schrock, the Web Team Leader, and Mike Delaney, the Moon Society Listmaster.

As part of reorganizing the chapters and projects of the Moon Society, Mike Delaney has been working overtime during the past few months overhauling the team infrastructure of both the Moon Society and Artemis Society International. This overhaul included the mailing lists and private web sites used by project teams and chapters. All of the active chapter web sites have been

moved from www.asi.org to www.moonsociety.org and teams that have been inactive for a while and no longer have a team leader have been removed from the active teams list.

To provide an easier way to join and leave teams and chapters, we have developed a new, interactive "Teams" web page that lists all of the available teams in the Moon Society and Artemis Society International and will show you which teams you are a member of. That web page is available at: http://www.moonsociety.org/teams/

In addition to the new teams page, we have built a new "portal" web page called "My Moon Society" that gives you easy access to all of your membership information, team membership, and even help desk questions. You can view and change your membership information, see which teams you belong to, and view and submit help desk questions directly from that web page. You can log in to the My Moon Society web page by going to the following location: http://www.moonsociety.org/mymoon/

In closing, a volunteer membership organization like the Moon Society is only as active and successful as the collective effort of its membership. With a variety of initiatives and new projects underway, the Moon Society is growing and expanding in a number of exciting ways. But we are dependent on the help and participation of all of our members. Join one or more of the project teams and get involved! Join or found a local chapter and meet and work on local projects with other Moon Society members. Stop by our real-time chat room and virtual lunar city in the ASI MOO at http://moo.asi.org. There are many ways in which every member can participate, so now is the time to GET INVOLVED!

To the Moon!

Moon Soc. Chapters Outpost Report

Moon Society Utah Outpost Kickoff

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

Formed in November 2002., we welcome anyone in Utah who has interest in the Moon, lunar development, private space exploration, or space entrepreneurism to join us. We are particularly looking for people with backgrounds in business, finance, marketing, and engineering.

The Utah Outpost meets on the 2nd Tuesday each month at 6 pm in the Crabtree building lounge, Brigham Young U. Provo campus. Current Projects: We are working on getting a team together to develop several potential "spin-ups". Interested in entrepreneurism? Have a business, marketing, or finance background? We need your help.

We also want to try sponsoring, or cosponsoring a "Spin-Up Plan Competition", in conjunction with either the BYU Business Plan Competition, or the U ofU Utah Entrepreneurial Challenge. Jon Goff <jongoff@myrealbox.com>

Welcome Central New Jersey Outpost!

Contact: Edward R. Antrobus III <antrobu2@tcnj.edu>

Moon Madness Strikes St. Louis!

from David Heck, Pres.Moon Society St.Louis

On Wednesday, January 16, parents and students of the Center for Creative Learning, an elementary school in the Rockwood School District, came together to celebrate MOON MADNESS NIGHT. Organized by teachers of the second grade at the CCL, the students exhibited art work (including clay Moonscapes, life-size spacesuit drawings and letters to a local newspaper columnist who dared to say we should not return to the Moon), attended demonstrations and listened to some of St. Louis' local space and Moon experts.

The school was JAM-PACKED with enthusiastic kids. It was a HAPPNIN' PLACE!! Organizer Chris Nobbe (a member of Moon Society – St. Louis) and other teachers scheduled local experts, including several members of the Moon Society-St. Louis. The lecturers discussed a wide variety of topics, several of which were aimed right at the kids' interest (like "Sports and Games on the Moon", and the "Vomit Comet"). Chris Nobbe and her coworkers put together the following list of presentations.

[* = MSSL Member]

- Sports & Games on the Moon - Burt Sharpe*, Former NASA Houston & JPL Engineer
- Mercury Spacecraft - Ray Tucker, Retired Mercury Assembly worker
- Return to the Moon & Future Colonization - Dr. Paul Czysz, Professor, St. Louis University Retired McDonnell Douglas Scientist
- Vomit Comet - Bryan Hydek, Graduate Student, Washington University
- Space Age Travel - **Christie Dudley***, Genuine Experience Tours
- Galileo: Mission to Jupiter - Dr. Jerry Cline, Retired McDonnell Douglas Scientist
- Lunar Samples Research - Dr. Larry Hoskins, Professor, Washington University., Former NASA researcher

With the help of Karen Geisler, an Alumni of NASA's Educator's Workshop, they displayed samples of Lunar rocks returned form the Apollo program using a video-microscope so the kids could get an up-close view of real Moon rocks. To complete the event, members of the St. Louis Astronomical Society had set up three telescopes. Students were able to see Saturn's rings, Jupiter's moons and the main attraction …. The MOON !

Kudos and congratulations to Chris Nobbe and the teachers at the Center for Creative Learning for their MOST EXCELLENT event!!

[and Kudos to MSSL for their participation!]

Meandering *through the Universe*

Column on the Cooperative Movement on the Space Frontier

The Tragedy of Columbia: an occasion to reaximine what a "Socialized Space" Program can and cannot do for us

With the horrible tragedy of Columbia's destruction and the loss of the valiant crew, many space advocates sense real and significant opportunities to advance our goals. I, also, believe that in all situations there is the potential for opportunities to exist — even in the midst of tragedy. Or, as Maria in the Sound of Music puts it, "When God closes a door, somewhere He opens a window."

But this time I'm afraid that we are being hit with a manifold horde of closed doors. And, considering that there seems to be little will to look for open windows, I am not very hopeful. In the current situation, it is almost treasonous to not stand firmly behind the current administration's soviet [oops! scratch that] ... I mean, socialist space program. No, they didn't create it, themselves. It was created long ago by another firmly anti-socialist administration as an answer and an inferred threat to another nation's socialist space program, in order to prove that socialism was a dumb idea.

Well, it really, really worked! Though, I personally don't understand how it could be so successful at its primary goal of showing the evils of socialism, and yet, not only prevail, but continue to maintain such great rhetorical support from those who hate socialism.

I suppose I will be putting myself at risk of being thrown into a concentration camp without access to legal counsel for the rest of my life for saying so, but now that we've proven the immense folly of socialism, why don't we implement a non-socialist regimen for doing space?

I know that there have not been any "liberals" who have done any better. But why should they be expected to? The "conservatives" have made it abundantly clear to us that "liberals" lust after the evils of socialism. I can't see how anyone would expect an administration or congress like that to do anything to free us from socialism and its inherent evils. But the "conservatives" keep telling us how they, in St. George fashion, range far and wide, facing down dragons galore with bravery, vigor, and spirit to rid the land of all vestiges of that demon socialism which destroys all that is good wherever it is found. One might expect that there would be *some* truth in that. But, instead, reality suggests that it is all hot air and doesn't reflect their real agenda at all.

Well, if you want, you can stand up and proudly salute the current "patriotic" effort to find any last errant eggs, put them in the one approved basket, and weld the lid shut over them. But I won't. I am convinced that it is an unreasonable, undemocratic, and unproductive course to take. And, I'm willing to stand up and be counted.

Blame NASA's Switchhandlers, not NASA

Now, you should understand that I don't dislike NASA or the people who work for NASA. The national space program has its problems and even contributes to its own problems, sometimes. But NASA is NOT responsible for the commandments that come down to it from on high, sent by presidents and congresses. If NASA is on the wrong track, one must look to the switchmasters for the reason. One could try to blame the citizenry who are eligible to vote. But they mostly do not have the time, energy, nor the means to fully research political issues and candidates. At some point they must decide to trust a politician's words. Time and again they have been abused by those whom they have trusted.

Cooperation as an alternative

Ultimately, I don't see any way out of the dead end we have long been rushing into. And, now, with the Columbia disaster, we are told that it is our patriotic duty to rush even faster and that it is almost treasonous to consider alternatives. Still, with all due respect to our president, I will continue to consider alternatives. I hope there will be others who will also be courageous enough — or stupid enough — to also consider alternatives to our monopolistic, socialistic space program. And I further hope that someday soon, we who choose to stand apart from the crowd will learn to stand, strive, and succeed together. For it is only *united* that we will stand. Divided, we *will* fall. Some would even have the gall to call standing united "socialism." I would call it "cooperation."

In the face of pressure from our own personal, individual, factional objectives, fears, and pride, as well as pressure from those who stand against us out of their objectives, fears, and pride ... against those pressures, it would not be easy to stand at all ... not even *together*. But the "together" part is, perhaps the hardest part of all. How can we find agreement on what it is we should be standing up for? It is *not* enough that we all be "standing." But to stand together, united, we have to find or create a significant common ground that we all can and will want to choose to come together on. Just the thought frightens most libertarian minded space enthusiasts away. Frightening or not, it is necessary if we are to really play a meaningful part in making our goals a reality. It's either that, or admit that we are just tickling our fantasies, playing meaningless games.

Space is important; but all people do eventually die. So, we can struggle to open this new frontier, or we can float along until old age, disease, or accident takes matters out of our hands. I, personally, want to be a part of this important task.

<RRR>

Richard's homepage:

http://richardpatricia.homestead.com

Mail For MMM

Columbia, and the future of Manned Space

There is a frontier out there. It is unconquered, untrammelled, and unexplored. It awaits our footprints, yours and mine. It awaits discovery. And we all await taking that step, those many steps, to uncovering the secrets of the universe. We will find some of these secrets right in our own backyard. Some we will discover within ourselves and our fellow human beings. But some await the kind of leap our astronauts and space agencies are now attempting, a longer step and farther reach than we have heretofore known.

Ask the astronauts who are scheduled for the next dozen missions if any one of them will give up his or her seat. You know full well you don't have to ask because the answer is a certainty. None would retreat an inch or surrender what for them has become their means to taking that step into the unknown.

In the area of space exploration there will always be controversy over the use of taxpayers' money. Our society has a long way to go to get its act together in the appropriate allocation of resources, in many respects. Perhaps our quest to finish the International Space Station at a significant cost is premature or ill advised. Perhaps our visionary's dreams of a settled Moon and a colonized Mars are unproductive and a detriment to other more pressing programs and societal needs. Perhaps not.

We do not have the luxury of hindsight or the perspective of the ages to measure the significance of our current first steps into the greater realm of existence, steps into our Solar System. Nor can we estimate the effects of the losses of the Columbia crew nor the losses of the seven young skiers on the world in which we live and the contributions that now never will be. But let the historians of our grandchildren's grandchildren note with pride that the losses we suffered did not deter us from our larger mission; to explore, to settle, to discover, and to challenge the blackness of space.

We will press on. We will keep the vision alive, and keep the program alive, and keep going into space. And if one of those individuals in the Shuttle crew manifest would indeed exchange places with an eager civilian, my chances of filling that seat would be close to zero, for ten thousand times ten thousand hopefuls are awaiting the opportunity.

Paul Swift, AIAA Sr. Member, < pswift@shaw.ca >
President, Calgary Space Frontier Society
Pres. Recreational Aircraft Assoc.of Calgary

218 - 200 Lincoln Way SW,
Calgary, Alberta, Canada T3E 7G7
(403) 686-7430

Murder & Justice and Distance from Earth

In MMR #32 [January 2003] on Mr. Richardson's article on "Murder and Justice on the Space Frontier", I was wondering how distance from Earth might effect a settlement's justice system, a settlement in LEO verses a settlement on Mars would have different means of handling Justice, Mars would have to settle it locally, a LEO settlement could either import legal help from Earth or deport to a terrestrial court, if fact most of Cis Lunar Space, L4,L5 & the Moon is either 3days travel from Earth or 3 light seconds, you could do some kind of teleconferences the judges & legal help if necessary, this might not be the optional solutions, but for settlements of small size/ limited personnel power, it might be the only option

Keith Wetzel <kawetzel@swbell.net>
Moon Society St. Louis Chapter

[Editor's response: I have written about this problem before. Mars will need substantial autonomy on almost every front right from the gitgo.

It's also clear, that on the frontier, manpower will be in short supply, and locking someone up will be quite counterproductive. So whether assignment to needed but undesirable duties is the answer (road construction in the boondocks, dangerous lavatube exploration, other chores) or some other kind of rehabilitation, it would seem to me that at last, hallelujah, on the space frontier society will be forced to realize that imprisonment punishes society as much as the individual. PK]

Zubrin on Columbia and the Ares

[Excerpts from Letter to Members, Feb. 11th, 2003]

"Prior to the disaster, NASA had begun to launch a number of promising initiatives. These included a program to develop space nuclear power, which is vital for providing electricity to a human Mars base, and an Orbital Space Plane program, which can free NASA from dependence on the Suttle for Earth-to-orbit crew transfer and therefore allow the Shuttle launch stack to be reworked, sans orbiter, as a heavy lift launch vehicle.

"In addition, NASA had set up a headquarters organization called NExT (NASA Exploration Team) to start to consider plans for human exploration beyond low Earth orbit. ... as one of its first technical recommendations, the NExT group advised that NASA begin artificial gravity research. If adopted, this initiative would be an enormous step forward towards enabling effective human Mars exploration."

India's Weather Satellites Named After Dr Kalpana Chawla

Indian Space Research Organisation, Bangalore, India

February 5, 2003: The Prime Minister of India, Mr Atal Bihari Vajpayee, annouced during the condolence meeting held for Dr Kalpana Chawla [killed in the Shuttle Columbia disaster] at Parliament Annexe, New Delhi, that India's meteorological series of satellites, METSAT, will be named as KALPANA.

The first of the series, METSAT-1, launched by India's PSLV [Polar Satellite Launch Vehicle] September 12, 2002, will be now known as KALPANA-1.

Experimental Rocket Propulsion Society

[Excerpts from] http://www.erps.org/

ERPS is a volunteer, non-profit liquid fuel rocket engine design and test group based in the San Jose, CA area. ERPS experiments with and is developing new rocket engines using high density propellents that are storable at room temperature and that will allow ERPS to demonstrate simplicity of operation and cost advantages for single-stage-to-orbit launch vehicles. General meetings are on the 1st and 3rd Thursdays of each month, in the back room of the IHOP on Great America Parkway in Santa Clara.

Founded in February of 1993, the group early on decided to concentrate on developing and testing high density storable propellant combinations because they allowed the maximum amount of work to be done with the minimum amount of risk to life and limb.

Several engine and vehicle projects are in the works. The old "build a little, test a little" philosphy used so well by people like Kelly Johnson of Lockheed Skunkworks is the underlying foundation of this program.

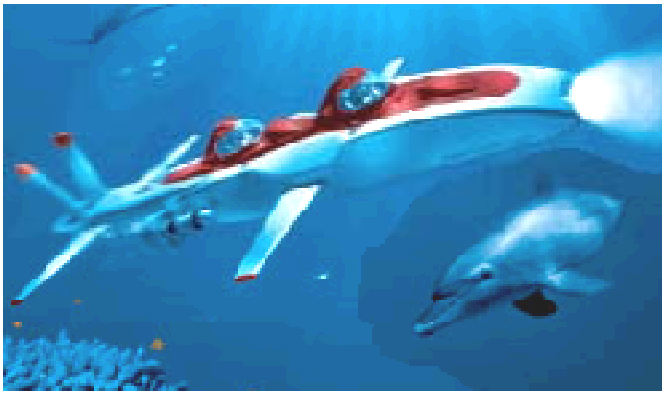
Can't Get Off Planet?

"Sub-Sea Aviation" as the Next Best Thing

SUB SEA AVIATION SCHOOL in the Bahamas

[Excerpts from] http://www.**deepflight**.com

www.incredible-adventures.com/deep_flight1.html



Deep Flight Adventures -- Be among the first to experience a totally new dimension of flight underwater. Hawkes Ocean Technologies and Incredible Adventures offer a 2-day adventure, culminating in a deep dive/flight in heretofore unexplored waters. Strap into the Aviator's five point restraining harness, the same used by Indy car racers, and experience an adventure like no other.

Barrel roll with whales at 1000 feet and experience the pure adventure of the unknown,s an adventure to rival space flight, pushing out and beyond the familiar world.

The Deep Flight Aviator - unique hydrobatic submersible craft. The Deep Flight Aviator is a new class of hydrobatic submersible craft, built to fully explore underwater flight. Think of conventional submersibles as slow, bulky, stiff underwater balloons, and the Deep Flight Aviator as a lightweight, high-powered, composite airframe with wings, thruster and flight controls. It is similar in configuration to the USAF A10 and is piloted by two crew. The Deep Flight Aviator looks like an airplane and flies like an airplane. The sub is fully hydrobatic; it can even barrel roll with dolphins! The Aviator will break all kinds of new records that have never even been thought of: fastest ascent/descent; longest/fastest search range (for a submersible); first (one atmosphere) inverted flight; and more!

The Deep Flight Aviator combines the freedom of scuba and the depth capability and underwater viewing of a submersible with the low intrusiveness of a stealth submarine. A traditional submersible must slowly sink down to its desired depth. The battery-propelled Deep Flight Aviator is "flown" quickly and quietly to its destination.

Behind the Deep Flight Aviator is Graham Hawkes, inventor of a significant percent of all manned underwater vehicles ever built for research or industrial use.

While you can buy your own Deep Flight Aviator for about $1 M, it's much cheaper to sign up for classes and/or go on a Deap Sea Aviator Expedition!.

GREAT BROWSING !

Mars Revealed by Laser Altimeter

Great Mars eye-candy pics & videos by Kees Veenenbos

Made with the digital elevation models of the Mars Orbiter Laser Altimeter (MOLA).

These are visualizations of Mars in ancient, contemporary and future settings. Made with DEM15.6 and Terragen 8.11 and 8.44.

www.space4case.com/index/index1_nn4.html

http://home-1.worldonline.nl/~veenen/terragen/mars/mars_nn4.html

Griffith Observatory Star Awards

http://www.griffithObs.org/StarAward.html

"The Griffith Observatory Star Awards were established to recognize excellence in web sites that promote public awareness of astronomy. These are the best astronomy sites on the World Wide Web, and they present useful, thorough, and accurate information in a well-organized and attractive way, making the sky more accessible. The exclusive Star Award is presented once each week to a deserving site."

ED: On the website above there is a link to every site winning the award since January 1997, over 250 sites and counting. Many of these are astronomy sites, but some are sites dedicated to various solar system bodies and topics of general interest to space enthusiasts.

Pay this site a visit and bookmark it for those moments when your free-ranging browsing episodes run low on inspiration. You won't be disappointed. **<MMM>**

The Spacefaring Web

www.space-frontier.org/Projects/Spacefaring/
John Carter McKnight

McKnight regularly posts provocative essays on many timely topics. Agree or disagree with his insights, but they are always worth reading. Click on the Archive link for past posts, be prepared to think new thoughts.

Some recent topics: Weapons in Space, Space tourism, NASA, Loss of the Frontier, the pointless Moon-Mars debate, Space & Bureaucracy, Space as a cultural blind spot, space colony independence, national identity on the frontier, what to build when we "go to stay," Can we get there from here? Experimental outposts north of Phoenix, social experimentation on the frontier, the political economy of space settlement.

The Lunar Reclamation Society, Inc.

PO Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

LRS NEWS

• **Aviation Career Day Fair** at Mitchell International Airport will be on the 2nd Thursday evening and Friday morning of April, **April 10th & 11th**. Last year LRS & Wisconsin Mars Society co-hosted an exhibit about the possibility of flight on Mars. Peter reports that some new exhibits bought and produced since last year will make the exhibit more effective. The event is attended by hosts of supervised students learning about career opportunities in aviation.

• Another Outreach Op is **April 12th** "**Yuri's Night**" celebrating Yuri Gagarin's & Columbia's first flight in '61 and '81 respectively. Observance is spreading quickly, being well received by the younger generation we need to reach.

• The **Rockets For Schools** event in Sheboygan will be on the weekend of Saturday, **May 17th**. We were invited to have an exhibit this year and will probably do so. The event draws thousands of kids and adults.

• The **Moon Society Milwaukee Outpost** [MSMO] now has three of the five members needed for full chapter status. MSMO promotes the Artemis Commercial Moonbase Project by producing models, displays, and other public outreach materials, uploading replication instructions and pdf files to the Space Chapter Hub website for duplication by other Society Chapters & Outposts. MSMO currently meets conjointly with the Lunar Reclamation Society.

LRS MARCH Events

Saturday, MAR 8th 1–4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G110** (lower level, NE part of Mall) near the ground-level entrance below Cinema complex. FREE to public as usual.

• AGENDA: Report on MMM Contract concluded with the Moon Society; Moon Society plan to increase numbers (of thieir members and therefore subscribers to MMM.) The Columbia investigation; NASA's Options for Shuttle replacement; Outreach Opportunities: (April) Odyssey Con - Madison, Aviation Career Day - Mitchell Field, (May) Rockets for Schools - Sheboygan; Possibility of joint projects with the Moon Society.

LRS April Events

Saturday, APR 12th 1–4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites Room G110 (lower level, NE part of Mall) near the ground-level entrance below Cinema complex. FREE to public as usual.

• AGENDA: Summer Field Trip? Report on Odyssey Con in Madison on weekend prior, and Aviation Careern Day at Mitchell Field on previous Thrs/Fri. Additional items TBD.

• Check our Meetings page online at:

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

SE Wisconsin Astronomy Clubs

Milwaukee Astronomical Society
http://www.milwaukeeastro.org/

Wehr Astronomical Society
http://www.wehrastro.org/

Northern Cross Science Foundation
http://www.gxsc.com/ncsf/

Racine Astronomical Society
http://users.wi.net/~rasastro/

Collaborating Milwaukee Area Space Groups

Moon Society Milwaukee Outpost [MSMO]
c/o Peter Kokh
414-342-0705 - kokhmmm@aol.com
www.moonsociety.org/chapters/milwaukee/
MSMO currently meets jointly with LRS

Wisconsin Mars Society [WMS]
c/o Matthew Giovanelli
7133 West Wells Street, Milwaukee, WI 53213
414-774-8952 - marsmatt@wi.rr.com
http://chapters.marssociety.org/usa/wi/
WMS usually meets at address above on 3rd Sat. 1pm
contact Matt by phone or email address above

U.S. CHAPTERS

NSS Chapter Events
MMM 8 Chapters Strong

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

MINNESOTA

Minnestoa Space Frontier Society

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

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

[www.mnsfs.org/]

MEETNGS: 3rd Saturday of the month from **1–4 pm**
at the: **St. Anthony Park Library**'s Meeting Room
2245 Como Ave. St. Paul, MN

• Twin Cities Regional Science Fair

http://www.FreeMars.org/mnfan/tcrsf/2003/

The following received a Certificate of Achievement and a prize packet from MN SFS for their projects: Justin Cusick (Hot Air Balloon) - Kyle Rosenberg (Which Paper Airplane Has the Longest Flight Time?) - Kelly Roach (Does the Ratio of Vinegar & Baking Soda Effect the Distance of the Rocket?) - Emily Dillard (Which Weather Forecast is More Accurate?) - Jonathan Killiam (How Do Airplanes Get Lift?) - Garrison Hunter (How Far Will a Pressurized Rocket Go?) - Adam Allen (Help Terraform Mars by Extracting the Oxygen in the Soil) - Zach Arney (Stealth Technology) - Rebeckah Power (How Does an Airplane Fly?) - Lee Swanson (Which Surface Creates Less Drag?) - Jake Fremont (Aerodynamics) - Mike Lemke (Aerodynamics) - Alex Hewett (Airplanes & Propellers) - Erik Jorgensen (Which Airfoil Design Creates the Most Lift?) - David Ricke (Which Airfoil Design Creates the Most Lift?) - Nino Caliandro (Wings of Flight) - John Pickard (Wings of Flight)

Thanks to NASA Glenn Research Center, MN Space Frontier, MAS, and Radio City who contributed to the prize packets. Thanks to Craig Borchard who helped pick the winners.

ILLINOIS

Chicago Space Frfontier L5 Society
c/o Bill Higgins <higgins@fnal.gov> 630-393-6817
MS 355, Fermilab Box 500, Batavia, IL 60510
[http://www.astrodigital.org/csfs/]

CALIFORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement

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

Events Hotline/Answering Machine: (310) 364-2290
Odyssey Ed: Craig Ward - cew@acm.org
E-mail: oasis-leaders@netcom.com

Our Website has Moved. NOTE NEW ADDRESS

[http://www.oasis-nss.org/]

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

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

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

MAR 15th -- OASIS Monthly Business Meeting, location: Microcosm, 401 Coral Circle, El Segundo.

APR 19th -- OASIS Monthly Business Meeting, Microcosm, 401 Coral Circle, El Segundo.

Recurring Events

- **The Griffith Observatory** is undergoing renovations and upgrades to reopen in 2003. - www.griffithobs.org/
- **Fridays, 7 pm** "Night Sky Show." -- **8 pm** Guest lectures. Santa Monica College John Drescher Planetarium, 2nd Floor Technology Bldg, 1900 Pico Blvd. $4 per show or $7 both. 310/452-9223 www.smc.edu/events/weeklyeven.
- **Fridays** - "Mike Hodel's Hour 25" webcast. The world of science fact/fiction: interviews, news, radio dramas, artists, writers, stories, reviews. www.hour25online.com/

OREGON

Oregon L5 Society, Inc.

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@attbi.com>
(LBRT - Oregon Moonbase) moonbase@attbi.com

☞ Meetings **3rd Sat.** each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**

NEXT MEETINGS: **MAR 15th, APR 19th**

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105
c/o Earl Bennett, EarlBennett@erols.com
215/633-0878 (H), 610/640-2345(W)

[http://pasa01.triipod.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.

NEXT MEETINGS: MAR 15th, APR 19th
Call Earl or Mitch 215-625-0670 to verify all meetings

• **Meeting Notes:** We had a limited attendance this time due to other commitments and the severe weather that was approaching (30" of snow after years of milder weather). The end result was that only four of us attended.

Columbia: We had a brief discussion of the ongoing news and the start of the investigations into the disaster. Serveral of us where interviewed by Kim Globus of radio station KYW (.com then look for radio category) both for on the air use (including a mention of G. Harry Stines article in *Analog* in the early 80s) about possibilities of damage or loss of a shuttle and a website mention of what I said about "no bailout" regimes on liftoff and reentry portions of flight in atmosphere. Mitch Gordon and Michelle Baker where also interviewed.

N.S.S has sent out a request for interview information as well as a request for letters of support of manned space exploration to counter any crying out about its risks and costs using the tragedy against exploration. As this is written anti-war protests may be diverting the cry to this area since the limited number of people who may dislike the spending on the future provided by space exploration also, are fighting an enemy more important to them. A letter writing campaign after this appears may be a good idea since other important groups who are distracted now will be more accessible: the government and the papers (assuming a war happens and ends or is still coming "later". Reports: Michelle Baker mentioned the ongoing J.P.L Ambassador Program and the upcoming Mars missions launching in May & June and the upcoming Space Studies Institute event May 8 to 10 in Princeton New Jersey.

Michelle also briefly mentioned an event she will be going to in April: The *National Conference of Aviation and Space Educators* which will be held in Dayton Ohio, the 2nd

through the 5th. This date and location is significant as the Wright brothers are from Dayton and this is the *Centennial of Powered Flight.* We also will have an event in our area at The Franklin Institute called The Wright Festival commemorating the anniversary to be held March 28-30th. Also: *Seticon 3* will be happening April 25-27th.

Spring is coming, lots of activity! Mitch Gordon came with newspapers on the *Columbia* destruction and mentioned a request by someone for copies of newspapers with there stories. Michelle pointed out the availability of most of this directly from the papers free for downloading which the requester could do. Mitch may suggest this to his correspondent. Mitch also mentioned the upcoming book signing at the center city *Barnes & Noble* for the book *Viable Utopian Ideas* with editor *Arthur Shostak* at 7 PM. on April 30th. The chapter "Out ward Course: Dystopias and Utopias in Outer Space" by two highly space oriented authors (*Marylin Dudley-Rowley* and *Thomas Gangale*) which is available from them in extended form from: md_r@hotmail.com . Other World Future Society and space related material was a possible joint panel on *"Wither Space Flight?"* in the early summer. Mitches extended report included "The Expressive Robot" article from the March/April *Futurist* Magazine. The *Aibo* from Sony was featured in the "Robots and Technology" piece.

As our N.S.S. coordinator, Mitch also discussed the reduction in frequency of *Ad Astra* issues per year to four from six but on the plus side the incorporation of a *Book Watch Column* into the publication as he suggested. Excellent Mitch! Earl Bennett gave an extensive Technical Report: from *Nuts & Volts* magazine for Feb. 2003 (p. 32): "Americas Other Space Program Launches a Rocket and Balloon to Open a New SpacePort" which detailed the opening of *The West Texas Spaceport* near Ft. Stockton.

This is the first *commercial* spaceport in Texas and it has a customer: *JP Aerospace* from California which will use it for its commercial operations base. They are responsible for *The Pongsat Program* that a wide range of students at all grade levels can us to get experiments to high altitudes (20,00 feet for one system) or much higher. This latter is with a novel *Balloon Borne Launch Pad* which the company has developed, launching from 100,000 feet!. The company can be reached at www.jpaerospace.com .

From *R & D magazine,* Jan. '03 (p. A7): "Automation in Aerospace-Taking the Human Out of the Loop" that describes some of the work done on autonomous control of several systems; the initial design shown was for stand off materials delivery near forward fire zones and to refugees, but another application described is the use of advanced techniques to control free flying platforms for the *Terrestrial Planet Finder Mission. This* work is being done by *J.P.L* for N.A.S.A. The instrument will operate at .1 AU (~9.3 million miles/50 light seconds) away. Written by contributing editor *C.G. Masi.* Magazine site: www.rdmag.com.

From *NASA Tech Briefs* (Feb. '3, pp 48+): "Integrated Electrode Arrays for Neuro-Prosthetic Implants" which describes in a short article the application of some semiconductor assembly techniques to electrode array and drive electronics integration. the authors are using platforms designed for *ball grid array packages* to mount the microscopically thin (some in the 100s of microns in diameter range) to this substrate and, because it is a platform for mounting an integrated circuit on the back face, putting a control/ driver interface on the back. The work was done by Eric Brandon and Mohammed Mojarradi of Caltech. Report submitted by Earl Bennett, Pres. P.A.S.A.

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042-1034
c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@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 Tuesday** of the month at **7-9pm**

Mar.18: Foerster Academy of Dance, **Sheboygan**
APR.15: Stoelting House, **Kiel**

Solar System Ambassadors

PASA
Michelle Baker - Princeton, NJ/Philadelphia, PA
chaos@cybernet.net

CSFS
Bill Higgins - Chicago,IL
higgins@fnal.gov

SSS
Harald Schenk - Sheboygan, WI
hschenk@excel.net

Plan now to attend

ISDC 2003 San Jose, California

May 23-26th, 2003
Memorial Day Weekend
Hyatt San Jose

www.nsschapters.org/isdc/2003/

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❍ **$38 NATIONAL SPACE SOC.** dues includes *Ad Astra*
❍ **$20** NSS dues if under 22 / over 64. *State age* ___
600 Pennsylvania Ave SE #201, Washington DC 20003

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- **For members residing in the U.S & Canada:**
  Printed **MMM** delivered by postal mail: **$35**
  Electronic (pdf) **MMM** available on website: **$35**
- **For members residing in other locations:**
  Printed **MMM** delivered by postal mail: **$60**
  Electronic (pdf) **MMM** available on website: **$35**

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

=>for those outside participating chapter areas <=
❍ $18 Individual Subscriptions to MMM/MMR: Outside North America ❍ $50 Surface Mail -- Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CUYAHOGA VALLEY SPACE SOC. (Cleveland, OH)
❍ $15

CHICAGO SPACE FRONTIER L5
❍ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
❍ $18 reg. ❍ $24 family ❍ $15 student/senior

MINNESOTA SPACE FRONTIER SOCIETY
❍ $20 Regular Dues

OREGON L5 SOCIETY
❍ $25 for all members

O.A.S.I.S. L5 (Los Angeles)
❍ $25 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE - Dues Increase
❍ Annual dues for all with MMM $20, due in March or $5 times each quarter before the next March

SHEBOYGAN SPACE SOCIETY (WI)
❍ $15 regular, ❍ $10 student, ❍ $1/extra family memb
"SSS" c/o B. P. Knier, 22608 County Line Rd, Elkhart Lake WI 53020

Moon Miners' MANIFESTO

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PO Box 2102, Milwaukee WI 53201-2102.

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