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

Moon Miners' Manifesto

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In FOCUS: TransHab Phoenix: The impending launch of "Genesis"

[*MMM's 18th Anniversary Issue*]

Will eight Space Shuttle flights be sufficient to "complete" the Bush-downsized International Space Station so that the Shuttle Fleet can be retired? Will alternative transportation for cargo and supplies on the one hand, and for human crews on the other, be in place by that time? These questions and their answers would be critical *if* ISS were to remain the "only game in town." But quite possibly by 2010, ISS will have ceased to be "the" space station, and have become "a" space station. That may be a hard pill for NASA, who escaped that bullet by insisting that MIR be brought down. The underfunded and woefully undermanned ISS may play a significant role for some years, but largely because of the NASA/government resistance to the idea of open-sourcing its further development to private enterprise, *ISS is clearly no longer on the road to the future.*

Ten years ago, the ISS was saved from impending death in Congress by one (1) vote. The unknown rest of the story was that if ISS had gone down, there was a private industry plan ready on the wings, to take over the project.

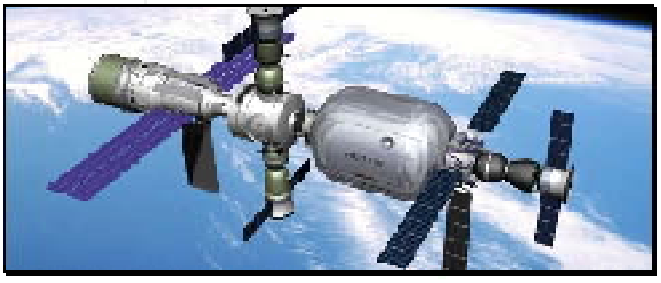
Now at last, private enterprise seems poised to enter the manned orbital installation game on its own, but again by building on the ashes of a prior NASA Program.

In a hanger in Houston, back in 1999, an inflatable module named TransHab was under construction. The idea was to use an inflatable structure that could ride into space in uninflated form in the size-limited shuttle payload bay, and which once inflated would offer significantly greater usable volume than a conventional hard-shell module. But Congress voted to kill the program for reasons that do not now matter. The Mars Society, which saw TransHab as a usable Mars outpost habitat structure was crushed. The Space Frontier Foundation, which wanted the project to be taken over by private industry was elated. In retrospect, SFF's judgment was right on the money.

Bigelow Aerospace of North Las Vegas, Nevada, won access to the TransHab plans and research and some of the expertise, and has now taken the development of such structures far beyond the level reached in Houston. Bigelow is looking at its own commercial space stations, at tourist hotels in orbit, at Earth-Moon tourist ferries, and even at outposts on the Moon and beyond in which its diversified line of inflatable structures would become a keystone element, providing almost 3 times the habitable space for significantly less money, less fuel, and in significantly less time. Best of all, the R&D is on schedule. [⇒ p. 2, col. 2]

The Nautilus Module Space Station Starter Kit

In this artist depiction, a full-size Bigelow Aerospace inflatable becomes a space station with the attachment of solar panels and docking adaptors. It is shown here with a Soyuz 3-person capsule docked on one end, and a future private enterprise personnel craft on the other. Addition of more 3,500 cu. ft. inflatable modules would soon make this starter station much larger than ISS.



Moon Miners' Manifesto

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

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

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

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

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

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

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

=> www.lunar-reclamation.org

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

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

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• **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.

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⇒ IN FOCUS Editorial continued from p. 1.

While the full-scale 13.7x6.7 meter 45x22 foot "Nautilus" module is still slated for a ride to orbit in 2008 with first occupancy in 2010, the first of two 1/3 scale testbed versions code-named "Genesis" is expected to be tested in orbit this coming year, 2005. The second is to go in 2006, followed by a 45% scale "Guardian" in 2007. An ambitious program, and one that should give all manned space supporters cause for excitement.

Bigelow Aerospace has already taken the inherited TransHab technology well beyond the level achieved in Houston, both as to the inflatable shell, and as to R&D of interior outfitting. Versions with the floors perpendicular to the long axis and with floors parallel to that axis are under study. This is important. The most severe handicap for planetary surface deployment of the old design (as well as of the current Mars Society Mars Hab design) is its height to width ratio. Tall structures pose a significantly greater challenge to shielding emplacement. Shielding is important on both Moon and Mars, not just for protection from cosmic rays, solar flares, and (on the Moon) micrometeorites, but also to provide thermal equilibrium. Structures undergoing thermal stress on a regular schedule are far more prone to develop leaks and become compromised. Making use of the on site rock-powder blanket ("regolith') to cover structures directly, or indirectly (covering hangers under which habitable structures can be parked) makes sense.

Bigelow's experimentation with a horizontal version with a lower profile promises a significantly more shielding-friendly "ranch style" version. On both the Moon and Mars, it seems stupid to build tall, small footprint structures as if the cost of real estate were an issue. Safety and ergonomics are far more important. Versions that are intended to be shielded will not need the foot thick walls for micrometeorite protection. Thinner, less bulky inflatable envelopes mean much more voluminous torus like modules can be crammed into the same payload space. The prospects for this kind of development seem bright. - **PK**

The Next Issue, **Moon Miners' Manifesto #182**, will be published in February.

There will be no **Moon Miners' Review** issue in January. 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 #3 - Year 3, Dec. 88 - Nov. 89
MMM Classics #4 - Year 4, Dec. 89 - Nov. 90

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

www.MoonMinersManifesto.com

First of two winning papers, in India's **Moon Mission Contest** cosponsored by The Planetary Society of Youth (TPSY), and the Moon Society. -- **Contest Specifics:**
http://www.geocities.com/amplanetary/moon_mission_contest.html

The contest was open to students in India and Bangladesh, as well as North America. The Moon Society helped refine the contest requirements.

This entry is not a proposal for any one Moon Mission, but rather an essay laying out the underlying philosophy behind Lunar Exploration. The writer is a 20 year old gifted student from the Madras area of southeast India who has ambitions for a career in space research and activity.

Earth's Moon – 'Our Second Home'

by Rohan Sahani < astronasatics@yahoo.org >
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KEYWORDS: Science-Outposts, Resource-Developing Settlements, Catastrophe Study.

ABSTRACT:

This paper is dedicated to putting an end to the whole debate of whether or not we must go back to the Moon. The need of the hour is-"Crewed missions" to the Moon and Mars instead of "our present crude missions" to Earth orbit.

The Moon holds Earth's ancient secrets. We must return to the Moon "to demonstrate our capability" and pursue the science of Asteroid-impact history. Failing to do so, we humans may also disappear from the face of this Earth just like how the Dinosaurs did (After all, we must learn from the mistakes of others because we cannot live long enough to make them all).

We should explore the Moon and Mars with the big theme of discovering whether life ever started there, and thus whether life starts easily on water rich planets throughout the universe.

I not only see human-settlements on Moon but I also see it as ***'Our Second Home'***.

THEME:

Science ***of*** the Moon,
Science ***on*** the Moon,
Science ***from*** the Moon.

Shape of permanent human presence on the Moon:

Thinking positive:

A home must have everything that is required for present and future sustenance. So, we need to not only look at developing Science-outposts or Resource-developing settlements on the Moon but also look at making the Moon as a *base* for all other solar system exploration and thereby create a solid *foundation* for future human-settlements.

A better study of past catastrophes on the Moon like asteroid-impacts will make human presence in the universe last for eternity. I see the shape of development **growing** from the first stage of having Science outposts like Astronomical-observatories and Mars-outposts to the second stage of Resource-developing settlements like tapping power, minerals and water. Then from Resource-devloping settlements it will grow into the third stage of being the first resort for Space-Tourism.

The fourth stage will consist of efforts to alter the environmental conditions on the Moon to make better living conditions for tourists. Then, after centuries of human effort we will enter the final stage of settlement which will be colonization of the Moon by making its conditions similar to that of the Earth. This can initially be done by building a protective dome around a specific area of the Moon to protect the Earthlings from radiations and extreme temperatures. We can then start inducing environmental changes by introducing various life-forms like plants and microorganisms in those domes. These domes can then be used to change living conditions in adjacent areas of the Moon. Once this is achieved we will begin to have permanent human colonies on the Moon.

There will then be everything from homes and hotels to parks and sports on the Moon. This will surely happen in the future provided we do not make an important mistake when we are in the first stage in settlement of setting up Science-outposts. While setting up Science outposts we must make sure that greater emphasis is laid upon 'Study of catastrophes'. After all, evolution of intelligent life is primarily subject to the question of surviving the cosmic shooting gallery that characterizes each planetary system.

Thinking negative:

While Science-outposts could help understanding the Moon and its environment and also the outer Space from the Moon through an airless sky, it is impracticable to create human colonies as there is no atmosphere for life sustenance. It is simply impossible to create a oxygen rich atmosphere as it will be soon lost to space by one-sixth gravity. Permanent human presence can only be done within limited space and within a protective dome, where bio-acceptable conditions such as sustainable temperature with oxygen supply is continuously maintained. All the activities and infrastructure depend upon these important life sustaining environment.

Unless a protective atmosphere is created to stay on , whether over the roof or within a protective chamber of enormously large size to accommodate, say hundreds or thousands people, it is impossible to colonize as ultraviolet, X-ray and gamma radiations would destroy life.

Scientific observatories with remote operation from Earth and also laboratories can be established but Sports-activities are far-fetched imagination as these activities are not feasible at one-sixth gravity where long-

term biological changes in the human body must also be taken into account.

Ice or water presence at the lunar poles is still not definite. Tapping it for human consumption from the poles to mid-latitudes is uncertain. While we have not yet converted water as fuel for space travel on Earth itself, it is impracticable on the Moon.

Positive or negative?

Which is right? In deciding which view out of these two will prevail we can look at a single fact that will lead us from darkness to light. The fact is that-'Before the nineteenth century, nobody ever imagined that Man would set foot on the Moon'. Leave alone going to the Moon with rockets; those people never dreamt of Motorcars or Airplanes. Here we are two centuries later, in the 21st century, having visited the Moon and Mars several times.

Trips to the Moon:

I think that thinking beyond our planet is an essential trait. The thought itself elevates the person. The person is transformed into a creative state. I feel that this creativity synergized with inspiration is the foundation of discovery and inventions. Of course, no one knows what might be invented in an effort to set up lunar colonies, reach Mars or mine for metals on an asteroid.

People would love to take a trip to the Moon. When they have a chance to convert this *thought* to *reality* (I mean to literally be beyond the planet) then they will grab it with both hands and never look back again. It is not only the sense of raw adventure that would make me and many of us take a trip to the Moon but also a feeling of exploration that exists amidst us which cannot be expressed in words or any form. It goes beyond words and can give answers to the very meaning of our existence. After all, charisma in others allows us to temporarily forget death's steady approach. So we should not be deterred by all the dangers of going to the Moon and beyond, because exploring the universe is something larger than life and death.

Stepping Stone to Mars and Beyond:

There are those who say a human mission to Mars is what the Space-world on Earth really needs to reinvigorate itself. Many would like to go directly, and soon. I see a progression of exploration, only if we make the Moon as a base for future explorations. Its gravitational field is about one-sixth that of Earth's, meaning it would take less energy and money to launch spacecraft from there. The Moon may also have water, frozen in dark polar craters. If so, it could be converted to fuel, turning the Moon into a base for all other solar system exploration.

Astronomers would love to set up observatories on the Moon for looking at Mars and beyond. Optical telescopes could be placed almost anywhere on the lunar surface and, since there's almost no atmosphere to scatter light; they'd get clear, Hubble-like views of the cosmos. Astronomers could build scopes that are far larger than Hubble, too.

The Moon would be an ideal place to assemble equipment such as housing that would then be transported farther afield. It is close enough to Earth that communications with the planet would be easy. Astronauts could develop new technologies and perform simulated exercises on its surface.

Of course no one knows what might be invented in an effort to set up lunar colonies. But a lot of us think it's worth finding out. The Moon is the proving ground and that's where we need to be going.

Positive Psychological Effects of having a Lunar frontier:

Beyond the basic needs for food, shelter and clothing, we humans are a restless lot. Exploration seems to be in our bones. The quest for knowledge is not an exclusive motivator in the desire to venture across land, sea, air or cosmic frontiers. From the psychological point of view, we humans have a built in sense of adventure in each of us. Therefore, most of us can some way or the other be called as Space-Enthusiasts.

A permanent Moon settlement will not only make the Earthlings feel better and more secure about themselves but will also make them feel sure of their survival in case of any threat of a huge Asteroid or Comet colliding with the Earth.

When people face their day to day life tensions they sometimes say –"I want to get away from this planet". With the Lunar Frontier opened for people they can literally do that. The existence of a Lunar-Frontier will make Earthlings mentally united in their quest for space-exploration because they would be confident that they could also find a new home for themselves just as a first few Earthling pioneers had found a new home for themselves on the Moon.

Thus, to sum it up in one sentence, we can say that- "In the psychological sense, the Earthlings would have spun a web of security in their minds".

Course of the Moon–Treaty:

As the only Earthly creatures which can impact the Moon, we will have a special responsibility to recognize our propensity for throwing the balance of nature off kilter and actively guard against it. At this juncture, I do not see the need for changing the Moon-treaty. This is because the primary reason for our landing on the Moon will only be for setting Science- outposts and Resource-developing settlements.

When we are in a process of setting them up, the focus must only be on tapping those possible treasures of the Moon like asteroid debris, minerals and frozen water on its poles and not protecting them. Unless and until we succeed in tapping these resources the question of protecting them goes straight out of the window. This is because of one simple fact- 'we cannot protect what we have not yet acquired'.

Emphasis on protection will form an obstacle in the development-process on the Moon. In the beginning the treaty must only be aimed at finding and tapping the resources. Therefore, the Moon treaty must only be changed with respect to 'due protection' when settlements begin to come up on the Moon and we have finished finding scientific, geological and scenic treasures. To alter the treaty before tapping the resources will only hamper the speed of settlement.

Choice of Missions:

The type of missions I am choosing are primarily based on finding and tapping the resources on the Moon which can be useful for future explorations that have the Moon as its base and secondarily based for studying the Moon as an attic of the Earth.

Attic of the Earth:

I see the Moon as a place where rocks long ago blasted from our planet are sitting around waiting to be studied. The Apollo era answered many questions about the Moon. But much was left undone. This history has not decayed much because there is almost no atmosphere and little geological activity on the Moon. Earth, on the other hand, regularly recycles clues to its past, pulling material inward, and spitting it back out as unrecognizable lava.

Samples of the Earth 3. 9 to 4. 0 billion years ago, if found on the Moon, could tell us a lot about the state of the early atmosphere, what the crust and surface were like, and possibly even when life began to evolve. The Moon's nearly pristine state means billions of years of asteroid impacts are preserved, as obvious scars on the surface. When these two missions have been successfully completed we can start to look forward to human- settlement missions as the ' icing on the cake'.

Advantages and Challenges of the missions:

The advantages of my mission are numerous. The gravitational field of the Moon being one-sixth that of Earth's makes it more meaningful to launch spacecraft from there. A blend of robots and humans will transform the Moon into a 21st Century hub for science and a jumping off point for deep space missions. It is close enough to Earth that communications with the planet would be easy. Also its poles contain frozen water.

A key to relearning how to live and work beyond low Earth orbit is establishing an L1 Gateway, a point of gravitational balance between Earth and the Moon. From L1, space science advancements are possible, as well as moving humankind back to the Moon and onward.

Studying many of these craters up close -- from an Antarctica-like outpost -- would allow scientist to figure out if mass extinctions on Earth, including the death of dinosaurs that allowed the rise of mammals, were the result of single, large asteroid impacts, flurries of smaller assaults, or neither. An answer would impact many scientific fields. A lunar base could be designed that would benefit not just a few of us pedantic planetary scientists who want to study lunar rocks, but a wide range of sciences -- biology, paleontology, planetary science, historical geology, and even exobiology.

We can look outward to the farthest corners of the Cosmos by setting observatories on the Moon which will give excellent views of the Cosmos because of the absence of atmosphere on the Moon.

Once the resources have been tapped we can also generate power. Space is full of free solar power. There are no clouds on the Moon. Those two facts make setting up a lunar power station sensible in the minds of many futurists. The power could be beamed to Earth or to satellites for distribution around the world, 24/7.

The Moon has minerals, and many proponents of human space exploration figure lunar mining is good enough reason to go back. Gaining experience and mastering the necessary technology might then allow venturous and potentially more lucrative claims to be laid on success of future explorations.

The only disadvantages I can see in my mission are the cost and energy wastes in the initial stages. When we think of these challenges we must remember we have 'Nothing to lose'. We are not going to carry money to our death-beds. It is time for us to move on.

Addressing the Challenges: The two challenges to be addressed in my mission are cost and energy.

Addressing Cost:

I think space tourism and even certain mining and manufacturing will succeed in space if only entrepreneurs are turned loose (and perhaps assisted with federal money or incentives). Just as the International Space Station packed explorers from previously antagonistic nations into tight quarters, an effort to return to the Moon could bring nations together in an era of increasing international tension.

Russia, China and India, with their own lunar ambitions, are a good example of the countries the United States might want to work more closely with. To afford the cost, a joint mission will be required in the future by setting up a forum. I can see many European countries also joining the forum that maybe called as say, "World Space Forum". I think the international public would cheer a program designed as a flagship for how space technology can be a role model for letting scientists and technicians of various countries work together in programs that would benefit all of us.

Addressing energy: There is no agreement among scientists over the role private enterprise ought to play in human spaceflight. Yet already, commercial companies help build the machines that carry astronauts into space. The technology race throughout the world has already sparked

off tremendous development in dealing with energy related problems like fuel and manpower for future space missions. With the advent of nuclear, solar, ion, antimatter propulsion techniques and excellent robotic-technology we have already begun dealing with most energy related problems.

Tabulation of Mission Statements:

DATA TO BE COLLECTED HOW? WHY?

(1) Rocks and Minerals. Lunar-Mining using manpower and robots. Finding material from the very early Earth will tell us a lot about the state of the early atmosphere, what the crust and surface were like, and possibly even when life began to evolve. It would impact Sciences like biology, paleontology, planetary science, historical geology, and even exobiology.

(2) Images of deep space. Setting up astronomical observatories on the Moon. Optical telescopes can be placed almost anywhere on the lunar surface and, since there's almost no atmosphere to scatter light, they'd get clear, Hubble-like views of the cosmos. Astronomers could build scopes that are far larger than Hubble, too.

(3) Asteroid–debris. Set up of special Research outposts on the Moon for studying these Crater-causing bodies. Asteroids, which are rich in metals, contain everything needed to support their own colonies, from water to iron, nickel and cobalt. Studying them would help us deal with the threat of an asteroid hitting the Earth sometime later.

(4) Frozen water on its poles. Lunar mining and Water tapping-outposts. Water can be converted to fuel, turning the Moon into a base for all other solar system exploration. Later, during the settlement-stage it can be used to alter the environmental conditions in the Moon to suit humans.

(5) Impact–Craters data. Advanced rovers and machines can reach every nook and corner of the Moon's surface. This would allow scientist to figure out if mass extinctions on Earth, including the death of dinosaurs that allowed the rise of mammals, were the result of single, large asteroid impacts, flurries of smaller assaults, or neither.

(6) Gravitational–balance data. Establishing an L1 Gateway, a point of gravitational balance between Earth and the Moon This is a key to relearning how to live and work beyond low Earth orbit. Many Space- science advancements are possible, as well as moving humankind back to the Moon and onward.

(7) Power–Sources data. Tapping Solar-energy and other useful deposits found on the Moon by setting up Power-generation stations. Power is required by the Science-outposts and Resource-development settlements. Space is full of free solar power and there are no clouds on the Moon. These two facts make setting up a lunar power station sensible in the minds of many visionaries.

Sporting activities and Olympic Lunar Events:

Once we have established a permanent settlement on the Moon by altering its environmental conditions then we will look towards Sports as a recreation or in some cases a career for many human-settlers there. Similar to the sporting inventions of Earthlings we can also expect the Lunans to have their share of sporting inventions like "Thin-Air Running races". I mean to say the gravity of the Moon is one-sixth that of Earth and with an assist of a 'fly-wing' analogous to the 'spikes' the sprinters on Earth use, the Lunans can fly in a running race. I think that event will be the spotlight of the athletic events in the Moon-Olympics.

Another interesting event to watch out for in the Moon-Olympics will be the Long Jump. It will be great to see Man jump those *giant* leaps with the help of the minimal gravitational pull in the Moon. At that very moment during those jumps, we should not forget what Armstrong had told about his small step. It indeed was a-"*giant leap for mankind*".

Most Sports played on the Earth will also be played on the Moon. Perhaps future space probes will be plastered in commercial logos, just as Formula-1 racers are now. I can see 'robo-wars' on the Moon being a lucrative spectator sport. The Moon will have its own political divisions competing against each other in their homeland Olympics. There will be a Special-Olympics between Earthlings and Lunans held in an alternating basis on the Earth and the Moon.

Conclusion:

I feel this proposal is certainly feasible from a technical standpoint and, indeed, has a high probability of success even though it might seem too far-fetched. Whenever possible, existing technology and components have been specified to increase reliability and cost effectiveness.

Also, there is no significant restriction on what year and what month these missions can be launched. And, finally, the purpose of this mission is believed to be of significant interest to the general public.

I conclude by saying that-"If the Moon is the centerpiece of the space initiative then we would have pieced together a plan that will be a Masterpiece in the little pieces of time that constitute Human-history and will forever be called a Masterplan". <RS>

We should not be deterred by all the dangers of going to the Moon and beyond, because exploring the universe is something larger than life and death.

- Rohan Sahani

The need of the hour is-

"**Crewed missions**" **to the Moon and Mars**

instead of our present

"**Crude missions**" **to Earth orbit**.

- Rohan Sahani

Human–Robot Synergies

by Peter Kokh

When there are so many things we can do together, that neither humans nor robots can do by themselves. the "Humans versus Robots" debate is worse than useless. It's a waste of precious time and a mischievous diversion.

Not letting the "other side" control the discussion

Most of us get more than a little riled up when a planetary scientist, interested only in science data, gets on a soapbox to condemn the manned space program. Yes, they are shortsighted: in the long run, if not in the short term, we will learn much more about the solar system if humans are involved at the forefront of exploration, and, even more so if explorers are followed by settler pioneers. Compare what we now know about the geology, flora, fauna, and other aspects of the Americas with what we would know if Europe had had robot probes back then, and had only sent those.

The knowledge that robots return from their planetary missions is indeed priceless - compared with no knowledge at all. But if we indulge in the "versus" argument we are letting our myopic friends control the debate.

Human Tool Partnerships are Primeval

We became humans while using tools. The tool is the extension of the hand. It can do things that fingers and fingernails cannot. But the tool without the human to use it is an admirable piece of art and no more. This partnership has taken on new meaning with the appearance of each new and improved tool. Nor is the idea of tools going where hands dare not something new. Consider the tongs that holds red hot iron over the anvil, or molten glass in the furnace. They take us places where we could not go without them. The canoe, the boat, the car, the plane - and the camel and horse before them, serve as aids. How often has not each of us felt them to be an extension of ourselves.

Humans vs. Robots in Space

Thus the idea of human-robot partnerships is hardly revolutionary, though to hear some speak, you might get that idea. Perhaps it arises because in space applications, robots are not things we wear, physically wield, or ride, but have become proxy scouts, going far beyond borders that we are not ourselves prepared to pass. But the pendulum must inevitably swing back. Thesis begets antithesis and ultimately synthesis. The synthesis of the human and robot space explorer is where we are headed.

Early robotic probes simply reported back to us. But gradually, we have found ways to give them instructions, even new instructions, changing their programming. We've had far more luck along this line with orbiting probes and probes coasting through space where time was not of the essence. But the radio link hardly re-establishes a hand and glove, hand and tool relationship. We've been *able* to do that clumsily for some time, with surface probes on the Moon where the time delay of under three seconds is something we can learn to master. I said "able" because we haven't had a surface probe on the Moon to teleoperate. On Mars we do, and Sojourner, Spirit, and Opportunity have amazed us with the data they have returned. But the amount of "work" each of these rover-probes is able to do in a day is much less than one percent as much as would be possible if the teleoperator was stationed on Phobos or Deimos a few thousand miles away, instead of on Earth, between 35 million and over 200 million miles away, suffering with time lags of 6-40 minutes instead of a fraction of a second.

Indeed, there is a strong argument for sending robots to prepare a site for human arrival, doing things well beyond return flight fuel production. They could grade sites, excavate hollows, pile up shielding berms, even make a supply of building blocks or sand bags. They could drill into the soil to tap the permafrost, possibly even tap liquid water aquifers deep below the permafrost layer. They could explore nearby lavatubes, mapping them, determining points of accessibility. They could construct a landing pad, and a road network. One could go on and on. But only if all this activity were teleoperated from a convenient perch on Phobos and/or Deimos.

Symbiosis Regained.

While such prospects are interesting, we are totally missing the boat if we only see robots as remote agents to be teleoperated. Once both humans and robots are on the scene together, we will quickly reestablish the prehistoric role of the hand and tool, the rider and horse, the driver in his/her dream car - the paradigm of the extension of one's own being and capacities.

Humans and Robots will work together, each doing what they do best. In the Canadian High Arctic, on Devon Island, both at the Haughton Mars (NASA) outpost and at the Mars Society's Flashline Mars Arctic Research Station, crews on simulated EVA excursions have learned how helpful companion robots can be. Little tethered scramblers can go ahead, climb down and back out of crevices and gullies, scamper up cliffs and escarpments to take a look, even crawl under rovers to check for damage to the undercarriage from passing over boulders. Similar experiments have been underway with one NASA crew each season at the Mars Desert Research Station in Utah.

The Robot as an Idiot Savant Scout.

The robot scout can be equipped with visual apparatus far more sensitive than the human eye, with a chemical sense of smell far more acute than that of a bloodhound, with texture discriminating senses far more attuned than the human finger, the elephant's proboscis, the octopus' tentacle. Imagine how helpful that would be to the prospector looking for valuable trace elements in unusual concentrations, to geologists and exobiologists looking for clues. Like any Idiot Savant, the robot will have no

appreciation for what it has found, following its detec-tion programming. But it will isolate and identify rocks and samples the accompanying human will want to inspect further, making the prospector or scientist far more productive on each sortie, wasting far less time looking at non-significant samples. To put it colorfully, the explorer with a robot companion will have to kiss a lot fewer toads to find the handsome prince. A prize sample found and presented to its master, the robot companion might be even more helpful by holding the sample so that the human master can work on it with both hands free.

Companion robots of this kind can work at the end of a physical tether, or at the end of an electronic one, so long as line-of-sight with its handler is maintained, either directly, or by it placing mini-relays at strategic points. Signals from the robot companion could be translated into audible intelligible form. Visual data could be flashed on a heads-up area on the visor of the human handler. Other data could appear on some sort of conveniently placed screen in various readout forms.

Robot companions will also go where there human handlers cannot, into hot nuclear piles, for example, into impassable rubble strewn lavatube entrances, spending hours, even days, in the hot lunar sunshine. But just as there will be close companion robots, and remote robots, so also will there be even closer associations.

Back to the horse, the canoe, the car

We don't think of any of the above as robots, but actually they are the antecedents of a class of robots where the human-robot synergy will be especially intimate and intensive: robots we wear, robots we ride.

Most pioneers will seldom be out on the lunar or Martian surface - both are extreme environments. Prospec-tors, rock-hound hobbyists, spelunker lavatube explorers, and crater peak climbers are among those who will frequent the out-vac, enjoy being washed by the cosmic elements. But their activities will be both more enjoyable and more productive if they wear or ride their robots. Far from being science fiction, we've been at this point without realizing it for some time. Nor are we talking about the recent cyber-netic revolution that has put computer chips in everything from toasters, to washing machines, to automobile trans-missions, and sewing machines. Think of the operator of a construction crane, or of an open pit mine steam shovel, or of an icebreaker, or of yourself on a garden or farm tractor, or the wheel of your car. These machines all extend our capacities, doing things we could not do with hand tools, even with hand-held power tools - and we wear them.

The buppet or body puppet or robosuit

Someday, lunar prospectors and scientists may go out into "the field" inside one person pressure capsules. They might have a variety of deployable transit modes from wheels, to tank-like tracks, to long jointed legs that can scamper up boulder strewn crater rims, or even bound over rille valleys. They will have appendages you operate safely from inside, appendages with interchangeable tools and finger like sensory probes. Inside your wearable robot, you will be warm when its bitter cold outside, cool when its scorching, protected from the glare ... and listening to the surround sound recording of your choice, the refrigerator close at hand. The buppet or bodybot and you will be more than a team. As you get familiar with it, and it gets familiar with your touch, you will bond, becoming one. And as a team you will get farm more done than either could do alone or in mere sequence.

Productivity and Conservation of Human Labor

No experiment is a failure if we learn from it. But to the extent that Biosphere II seems on first superficial glance to have been a failure, one contributor was the prior decision to have the human biospherian volunteers raise all their own food, by primitive hand gardening means. On the space frontier, given the cost of transporting humans to and far away shores and supporting them with whatever they cannot (yet) provide on location, it will be especially important to use manpower wisely. Growing food, to the extent that automation, semi-intelligent robots (idiot savants) and teleoperated equipment can do the same job better with far less human manhours is surely one place were human-robot synergies must be applied to the utmost. We have already seen how companion robots can greatly multiply the productivity of prospectors and scientists in the field. Human-robot teams will do the mining and mineral extraction, the manufacturing, the construction of new habitat space, new factories, new schools, new agricultural units. HR teams will build new roads, explore and develop lavatube shelter spaces. They will deploy astronomical installations, giant solar power arrays, maintain nuclear power facilities, maintain the biosphere recycling systems. In short, the idea of humans or robots working alone in many areas of activity will become unthinkable.

The point of all this is that the future frontier of human-robot synergies are not a brave new world, a world that would be unrecognizable to our grandparents, or even to our preindustrial age ancestors. Development of human robot synergies and teamwork and strategies and modes of interaction and integration - all this is but the logical extension of the quintessential human relationship with tools. Indeed, there is growing evidence that this relation-ship may have been pioneered by protohumans, as we see more and more evidence of discriminatory tool use in Chimpanzees and other not-so distant relatives.

Working hand in glove with robots is indeed the way we will continue to explore "being all that we can be," because we cannot be as much as we can be without them. We must work to change the discussion from "humans ***vs.*** robots" to a more productive "humans ***and*** robots." **<MMM>**

The Moon Society

J O U R N A L

http://www.moonsociety.org

Please make NEWS submissions to KokhMMM@aol.com

The Moon Society was formed in July, 2000 as a broad-based membership organization with local chapters, to spearhead a drive for further exploration and utilization of the Moon in cooperation with other like-focused organizations and groups.

Artemis Society International was formed in August 1994 as a forum for supporters and participants in the **Artemis Project™** quest to establish a commercial Moon base as a first step to a permanent, self-supporting lunar community. **ASI** does not engage in any form of commercial business directly, but seeks to build a Project support business team. Registered trademarks of the **Artemis Project™** belong to **The Lunar Resources Company®**

PROJECTS: www.moonsociety.org/projects/

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

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

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

Join/Renew Online – www.moonsociety.org/register/

Mail Box Destinations:

- **Checks, money orders, membership questions**
  Moon Society Membership Services:
  PO Box 940825, Plano, TX 75094-0825, USA **:**
- **Projects, chapters, volunteers, information, etc.**
  Moon Society Program Services
  PO Box 080395, Milwaukee, WI 53208, USA

OUR LOGO above, shows the Moon in its natural beauty, empty and deceptively barren, waiting for human settlers to shelter and to mother as an adopted new human home world. We have work to do!

Moon Society Chapter Rules Relaxed to Promote Chapter Formation and Growth

www.moonsociety.org/chapters/chapterRules.html

By Peter Kokh

Two Changes in the Rules

At the Moon Society online Leaders Council and Board Meeting, Wednesday, November 17, two amendments were passed to the Society's Chapter Rules:

1. The number of Moon Society members required for an outpost to be granted full chapter status is hereby reduced from five to three.
2. It is no longer required that all members of the chapter be members of the Society. However officers must be members of the society, and only chapter members who are Moon Society members may be eligible for chapter office and/or vote in chapter officers elections.

What these two changes mean:

1. It will now be much easier to reach the magic number required to form a chapter. The old limit proved to be a discouragement, which was not its original intention. Yet having three persons does not automatically mean chapter status unless accompanied by a list of initial officers and society members involved, and any updated contact information that may be appropriate.
2. The chapter may define other classes of members as they find appropriate, and set dues for them, to paid to the chapter for its sole use. Such members, not being also members of the Moon Society, will not have access to the members only areas of the Moon Society web site, nor will be entitled to receive the Society newsletter, Moon Miners' Manifesto. Nothing, however, prevents such members from subscribing to that newsletter individually, or getting it as a member benefit through another organization. Chapter officers may choose to circulate copies of MMM among their members, as an encouragement to upgrade their member status.

We had asked the board for this provision with Third World chapters in mind, as many space enthusiasts in such countries will find Society dues out-of-reach. This request was occasioned by the current develop-ment of a new chapter in India. But the board decided to relax the rules for all chapters, domestic and international. The new rule allowing chapters to have members who do not pay dues to the Moon Society, will make it much easier to form and maintain campus-based chapters as well.

The purpose of these changes is simple: we need to make it easier for chapter contacts and outposts to recruit other persons and form chapters. Chapters are stable local clusters of individuals ideal for hands-on real projects that will futher the goals of the society. It is our intent to empower our chapters and their members. **‹TMS›**

We have added a 2nd Mail Box

[See page 9. bottom of column A]

By Peter Kokh

Unlike NSS, the Moon Society does not have a physical headquarters, only a virtual one. Thanks to the Internet, Moon Society officers and volunteers can all operate and network effectively out of their own regular or on-the-road locations. Yet our actual geographical spread creates a challenge for the timely redirection of incoming stamped mail. We have now added a second PO Box to expedite the direction of mail for quick response for letters and packages that should go to the desk of the President or of the Chapters Coordinator, including the following:

- MDRS Moon Mission Crew applications
- Chapters, Outposts, and Local Contacts
- Student Information Requests
- Collaboration Proposals
- Volunteer Positions (except imembership services)
- Sparkplug Roles

Choosing the Right PO Box.

In selecting the proper PO Box for your mail, please apply this simple rule of thumb

- **P.O. Box 940825, Plano, TX 75094-0825** - all non-online membership applications and renewals; any mail concerning membership questions or services; mail concerning legal questions pertaining to the Society; and mail which is intended for the Society Treasurer
- **P.O. Box 080395, Milwaukee, WI 53208** - all other mail.

In the future, if we find a way to further expedite the timely handling of postal mail by adding additional PO Box destinations, we will do so.

The Moon Society is Going to ISDC 2005

By Peter Kokh

The Moon Society has entered into a sponsorship agreement with NSS and ISDC 2005 to cosponsor this annual event and contribute to Moon-related programming. One of the several advantages for us is that Moon Society members can now register for the 2005 International Space Development Conference at the same current applicable rate listed for members of the National Space Society.

As we have a good concentration of members within a day's drive of **Washington DC** where the conference will be held **May 20-22, 2005**, we hope to have a get together.

Anyone interested in speaking or helping to find speakers for our sponsored portion of the program should contact me at kokhmmm@aol.com, or call (414) 342-0705 (CT hours). ISDC URL: http://nsschapters.org/isdc/2005/

Register before January 1, 2005 for best rates!

Progress Report – "Rent-MDRS": Renting the Mars Desert Research Station for Lunar Outpost Simulation Exercises

By Peter Kokh. Interim Project Manager

Initial Project Feasibility Findings

In the past two months we have made encouraging progress towards realization of this exciting project. Our review of the archives of crew activities at both the Mars Arctic and Mars Desert Research Stations brought to light a long list of not-yet-tried outpost simulation exercises, both many that are Moon-appropriate only, but also quite a few that would apply to a Mars outpost situation as well.

We then ranked these ideas by order of difficulty from easiest to more ambitious, in order of the amount of equipment to be obtained or fabricated from least to most, and in order of expected expense from least to most costly. The result was a considerable number of valid and worthy simulation suggestions for an initial Moon Mission Crew at MDRS, with a plenitude of gradually more ambitious projects for crew exercises to come.

You can read our Initial Project Feasibility Findings at www,moonsociety.org/projects/mdrs_moon_proposal.html

What's Next?

Encouraged by these findings, we have applied to the Mars Society MDRS Mission Program Manager for a "crew rotation" spot on the calendar of the current field season which begins in December and is expected to close in mid-May, 2005. As of this writing, a slot has not yet been confirmed. It is possible that our first MDRS Moon Mission will not occur until the following 2005-6 field season.

Nonetheless, we have sent out a first early call for those interested in volunteering. You got this email if we have your current email address on file, an d if your mailbox was not full. Those who did not receive it can read it at: http://www.moonsociety.org/reports/

rent-mdrs/mdrs_mooncrew_call_1.html

A Visit to Utah and MDRS

It became clear that to do a reality check on the feasibility of some of the identified lunar outpost simulation exercises, that we needed first hand familiarity with the location and facilities. That in mind, we applied for a crew spot on one of the regular MDRS Mars crews. We have been selected for crew #34, February 5-20, 2005. This is an engineering crew, rather than a simulations crew, and that is especially appropriate We have been putting together a list of "homework" items to work through on this first visit.

What about the money?

In the meantime, we are beginning to look for sponsors for our first mission expenses, c. $8,000.

Empowering Individuals in 'Sparkplug' Roles

Chapter and Local Contact activity is not for everyone. Nor are the "team player" opportunities offered on our website. We need to empower those more comfortable working alone and those who, through location, schedules or other reasons, find team activity coordination burdensome. To this end, we have identified the following four "Sparkplug" activity roles ideal for the individual..

- **Ambassadors**
- **Interpreters**
- **Pathfinders**
- **Pioneers**

Ambassadors - a term used by JPL (Jet Propulsion Laboratory) to give status to those who communicate the excitement of planetary exploration to the public. Substitute the excitement of Lunar Exploration & Settlement, and you get the idea. Lone individuals can set up information tables at public events, using visual aids prepared by the Society, and/or give presentations and talks at any event opportunities they can find or hustle up. (See Ken Murphy's letter in last month's MMM #180, pp. 13-14.)

Interpreters - self-motivating members who take it upon themselves to interpret the vision, mission, and goals of the Society in ways that the average lay person and the public in general can better understand. This is a role for artists, graphic designers, illustrators, even cartoonists. But it also includes those who write articles, books, and documentaries, that inform the reader, while making our ideas concrete.

Pathfinders - By this title, we dignify those who engage in Research & Development that may accelerate the day when pioneers are living on the Moon, and using its resources. This covers a lot of ground: transportation, processing, manufacturing, power systems, architecture and more. "Pathfinders" scout ways to make the dream real, through a regular day job, or after-hours, in ground-breaking experimentation.

Pioneers - This title dignifies entertpising members who brainstorm technologies not yet "on-the-shelf" for possibly profitable terrestrial applications, then develop business plans for enterprises designed to earn a profit here and now from just those terrestrial applications. The ulterior motive is to put a close analog of a needed technology on-the-shelf, ready for further adaptation to frontier condi-tions. This "spin-up" is just the reverse of "spin-off." Willing consumers foot the bill, not grudging taxpayers.

We are considering a series of steps to identify, and create a list of such needed technologies. Spin-up businesses are a good fit for the Artemis Business Team.

And you? - To inquire further about any of the above roles, send an email message describing your interests, abilities, and related experience to: sparkplugs@moonsociety.org with any of the four Sparkplug roles as the subject line.

Introducing the first members of the Society's new Board of Advisors

We are building a new Board of Advisors to help us shape ambitious projects, review proposed position papers, organize breakthrough workshops, and choose collaboration partners. A second round of invitations is in the works. A brief look at the first fifteen members.

- **Tom Billings**, Portland, OR and
- **Bryce Walden**, Oregon City, OR and
- **Cheryl Lynn York**, Oregon City, OR. All three of the Oregon L5 Society, and part of the team that ran the Oregon Moonbase simulation exercises in lavatubes outside Bend, Oregon in the late 1980s and early 1990s. Tom's additional research interests include teleoperations and the design of a Lunar Lavatube Locator probe.
- **Paul Blase**, .Alexandria, VA, of TransOrbital Inc.
- **David Dietzler**, St. Louis, MO, major contributor to MMM, knowledgeable about processing, geochemistry.
- **David A. Dunlop**, Oak Park, IL, expert on lunar agriculture, project organizer, and an all-around brainstormer.
- **Steve Durst**, Palo Alto, CA, CEO of SpaceAge Publishing and Editor of Lunar Enterprise Daily; chaired the 2003 International Lunar Conference held in Hawaii
- **Marianne Dyson**, Houston, TX, author of the award winning children's book, *Our Home on the Moon.*
- **Niklas Jarvstrat,** Trollhatten, Sweden, head of the Moon-ISRU (in situ resource utilization) project.
- **Chip Proser**, Los Angeles, CA , well-known writer, director, cinematographer, and film producer. Co-producer: *Innerspace* (1987), Story writer: *Innerspace* (1987) Writer: *Iceman* (1984). Chip's latest project is the documentary "*Gaia-Selene: Saving the Earth by Colonizing the Moon.*" (See MMM #180, Nov. 04 p. 10.
- **David Schrunk,** Poway, CA Editor and co-author of *The Moon: Resources, Future Development, and Colonization.*
- **Burton Sharpe**, St. Louis, MO and
- **Madhu Thangavelu,** Rancho Palos Verdes, CA both co-authored *The Moon: Resources, Future Development, and Colonization*. Sharpe was heavily involved with the Apollo program in the 1960s and 1970s.
- **Ian Randall Strock**, Brooklyn, NY, of co-founder of The Lunar Resources Company and the Artemis Project, the Editor and Publisher of *Artemis Magazine* featuring a mix of science fiction stories and science fact articles, with a strong focus on the Moon.
- **Terry Kok**, Bedford, IN, a hands on experimenter with closed life support systems and mini-biospherics.

Moon Society Participation in India Moon Mission Contest Leads to Surprising Rewards

Report by Peter Kokh

In December 2003, a year ago, we reported that the Moon Society would cosponsor a Moon Mission Contest for students being put together by the Planetary Society of Youth (TPSY) in India. We helped design the contest entry guidelines, committing to a prize of a free one year membership for the first place winner. See:

http://www.moonsociety.org/news/moon-announce-2004-0223.html

On October 21, 2004 we were notified by TPSY that two first place winning entries were selected. We expect to publish their entries. One of the winners, Theo Allan Fernandes, is from Mumbai, as Bombay is now called; the other, Rohan Sahani, is from Chennai, as Madras is now called. Both winners have been so motivated by the process and their selection as winners that this contest has made a major difference in their career prospects.

Both are working together to create the new Moon Society India chapter with Fernandes as the contact person and webmaster and Sahani as acting president.

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

Sahani has since became the first student to have a paper selected for the International Lunar Conference in Udaipur, India in November, and is now applying for admission to Stanford and other highly ranked research institutions in the US, and has also applied for a crew assignment to the Moon Society's first Lunar Outpost Simulation exercises at the Mars Society's Mars Desert Research Station in Utah, with a research project ready to conduct on location. Dates for this exercise have not yet been set. Both are spreading the name of the Moon Society throughout India's space community.

So what was originally just an act of helpful collaboration now has had some very exciting results. Little seeds can become great trees. We have to plant more seeds!.

We received the following letter from Rohan Sahani detailing high points of the past few weeks since he was awarded one of the two First Prize awards for his entry in the Moon Society co-sponsored Moon Mission Contest of the Planetary Society of Youth

Dear Mr. Kokh,

I met your friend Mr. Steve Durst [SpaceAge Publishing: *Lunar Enterprise Daily*] in the [International Lunar] conference [in Udaipur] and he was very happy to know about the Moon Society Outpost in India. I also took a picture along with him next to my poster paper. Mr.Steve then introduced me to the great Russian Scientist Ivashkin and we had a talk about the Moon Society plans for the future and also about the possibility of starting a Moon Society outpost in Russia.

I was able to meet the President of India after he had just inaugrated the conference. That was a memorable moment. One of the national newspapers also interviewed me on account of being the only student throughout the world to present a paper at this conference.

I am seeing this day only because of The Moon Society. If I had not won the Moon Mission Contest I wouldn't have been here.

With gratitude,

Rohan Sahani

Chapters & Outposts

Chapter Rules Relaxed – see page 9

Moon Society List of Chapters, Outposts, and Local Contacts Updated.

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

U.S. Chapters, Outposts and Local Contacts

There are a few deletions: Contacts moving out of the area; Contacts with email addresses that are no longer valid; Contacts who are no longer members of the Society.

On the bright side, we now have a presence in the Chicago, Illinois area, and Jonathan Goff, formerly located in Utah, is now in Silicon Valley and attempting to revive the Bay Area Moon Society.

International Chapters, Outposts and Local Contacts

One deletion because of no longer valid email contact information and, website no longer online.

On the bright side, we have the start of what may become our star international chapter, in India.

NOTICE to all Local Contact Persons

for Chapters and Outposts of the Moon Society

The Moon Society appreciates your service. A local accepts a responsibility to reply to inquiries from curious and interested persons But if you have spam blockers on your email account that reject email from unknown addresses, you are unable to serve as a contact.

If you have such a spamblocker, you must choose between it and your service as a local contact. If you would rather be free from incoming mail from persons you do not know, please email chapters-coordinator @moonsociety.com and we will remove your listing.

Lunar Map Pro™ v. 3.0

http://www.starrynight.com/
imaginovastore/lunarmappro3.html

Shipment to U.S. & Canada only

Walking on the Moon is a small step with Lunar Map Pro. It is a complete and comprehensive lunar mapping and 3D terrain modeling software, developed for those amateur astronomers, astronomy students, and lunar observers who wish to deeply explore our nearest celestial object in astounding detail. Designed and built on a Geographic Information System, it provides pin-point navigational accuracy (libration and ephemeris) and offers high-resolution maps to match your telescope view.

With a database of 8,200 + features including landing sites, the complete USGS database domes and the Charles A. Wood Lunar 100, it has the most comprehensive lunar library to date.

Features:

- Emulates the view through your own telescope and eyepieces.
- Accounted for Libration
- Creates 3D terrain model and visualization of lunar surface
- Provides Orthographic view of the lunar globe from anywhere in space.
- Contains extensive database of nearly 8,200 nearside and farside features
- Shows real-time lunar phases for any time and date between 1970 AD and 2100 AD.
- Provides NASA lunar texture map, 3 interactive geology maps and RITI vector map
- Delivers flip and reverse map view.
- Measures the distances and sizes of lunar features.
- Provides real-time ephemeris data for your location such as moonrise, moonset, RA, DEC, Age of Lunation, Illumination %, and more
- Prints maps or 3D images or export as a JPEG
- Organizes your image collection and personal notes

System Requirements: ***Unavailable for MAC OS***

- Operating System: WindowsTM 98, 98 SE, ME, NT, XP
- Browser: Internet Explorer 4.0 or later, for Resource Browser
- CPU Speed: 1 GHz (1.5 GHZ for 3D or High-Resolution Geology)
- RAM: 256 MB (512 MB for High-Resolution Geology)
- Hard Drive Space:370 MB
- Screen Resolution: 1024 X 768 pixels
- Screen Color: at least 16 bit
- Graphics Card: 16MB of video RAM minimum

for "anyone with a serious interest in lunar studies, whether the studies involve visual observation, lunar photography, or just armchair observing."

GREAT BROWSING !

Sagan's Rationale for Humans to Mars

"…every surviving civilization is obliged to become spacefaring — not because of exploratory or romantic zeal, but for the most practical reason imaginable: staying alive."

http://www.thespacereview.com/article/261/1

More than you ever wanted to know about the Lunar Module

(A few pages are a bit blurred)
(Warning: 37 megabyte PDF file)
http://www.btinternet.com/~ursine/LMhandbook.pdf

Constellation Services International and their 'Lunar Express' Mission

http://constellationservices.com/

Bigelow releases the rules for his $50 million 'America's Space Prize'

http://www.space.com/spacenews/
businessmonday_bigelow_041108.html

Science Fiction Bookstore and Writer's Workshop On The Internet

"a good site for finding hard Science articles for SF"
http://www.scifi-az.com/sfaz-05.htm

Will Govt.-sponsored Space Prizes Fly?

http://www.thespacereview.com/article/270/1

Will Bush Spend Some of his "Political Capital" on the Space Exploration Vision?

http://www.thespacereview.com/article/267/1

The Long History of "Colonization" and its Implications for Space

http://www.thespacereview.com/article/266/1

Conclusive Proof of Methane on Mars: A Biological Source Most likely

www.newscientist.com/news/news.jsp?id=ns99996669

Make a Paper Model of SpaceShipOne

http://www.currell.net/models/ss1.htm

Space Elevators on the Moon?

http://www.universetoday.com/
am/publish/lunar_space_elevator.html

ISS as a Receiving/Quarantine Lab for incoming Mars Return Samples?

http://www.thespacereview.com/article/273/1

Efforts of other Nations to fill in the many gaps in our knowledge of the Moon

Europe's *Smart–1* orbits the Moon

http://www.esa.int/SPECIALS/
SMART-1/SEMEC1XJD1E_0.html

After a long, slow journey to the Moon, courtesy of its novel solar-electric propulsions system, Europe's first lunar probe reached its preliminary orbit about the Moon in mid-November. It is now using this same engine to lower its orbit to the design level by mid-January, at altitudes between 300 kilometres (over the lunar south pole) and 3000 kilometres (over the lunar north pole). Then the lunar science portion of its mission will begin.

http://www.esa.int/SPECIALS/
SMART-1/SEM2BHXO4HD_0.html

How did the lunar surface form?

ESA is aiming at some of the many gaps in our knowlege of the Moon. SMART-1's camera AMIE will enable us to study afresh the Moon's topography and surface texture. It measures visible light at a million points in a field of view 5 degrees wide, and filters can select yellow light, red light or very short infrared rays. By looking at selected regions from different angles, and under different lighting conditions, AMIE will provide new clues as to how the lunar surface has evolved.

With longer infrared rays, the infrared spectrometer SIR will map the surface distribution of minerals ... in far more detail than Clementine did when it scanned the lunar surface at six different infrared bands. SIR distinguishes about 256 wavelength bands, from 0.9 to 2.4 microns. The mineralogy will reveal the effects of cratering and maria formation, and the nature of subsurface layers exposed by fractures in the Moon's crust.

Water–ice and carbon oxide ices at the poles

The trickiest task that the SMART-1 scientists have set themselves is to peer into the darkness with SIR, looking for the infrared signature of water-ice - and perhaps of frozen carbon dioxide and carbon monoxide too.

China's Chang'e 1 Moon Mission

Target launch date December 2006 or sooner

http://en.chinabroadcast.cn/
2005/2004-10-30/110@163660.htm

China's first lunar-orbiting satellite, Chang'e One will be launched in two years. Construction and preparations for the probe are well underway.It will be launched by the Long March carrier rocket 3A from the Xichang Satellite Launch Center in the southwestern province of Sichuan.

Named after the Chinese Goddess of the Moon, it will take 8-9 days to reach its lunar orbit from which it will conduct research on the Moon's physical environment.

India Announces International Projects included in *'Chandrayaan–1'* Moon Mission

Five nations have been short listed for a slot in the India Space Research Organization's (ISRO) first Moon mission, scheduled to launch in 2006-7, according to the *HindustanTimes.com*.

The experiments are:

1. Chandrayaan-1 X-ray Spectrometer (CIXS-2) Britain
2. Near Infra-Red Spectrometer (SIR) Germany
3. Sub-ked Atom Reflecting Analyzer (SARA) Sweden (in collaboration with ISRO's Space Physics Laboratory)
4. Radiation Dove Monitoring Experiment (RADOM) Bulgaria
5. Mini-Synthetic Aperture Radar (Mini-SAR) USA

India plans to put a 525-kg (155 lb.) orbiter, using a Polar Satellite Launch Vehicle rocket, 100 km over the Moon. ISRO had allotted 10 kg and 10 watts of power for space agencies of other nations and will hold final talks with the scientists of these projects at the 6th International Lunar Conference (Nov. 21-25 in Udaipur, India), before zeroing in on the projects that will form part of the mission in December.

Chandrayaan-1 will be devoted to high-resolution remote sensing of lunar surface features in visible, near-infrared, X-ray and low-energy gamma rays. Also, it will search for surface or sub-surface water-ice, especially at the lunar poles.

Cosmos I Solar Sail to Launch March 1st

from Louis Friedman Executive Director

November 12, 2004 - The countdown has officially begun! This week, on the 70th anniversary of Carl Sagan's birth, we announced that Cosmos 1, the world's first solar sail spacecraft, will be set for launch on March 1, 2005. Thank you for helping to make this happen!

The Planetary Society, without government funds but with support of Cosmos Studios and Society Members, put together an international team of space professionals to attempt this first actual solar sail flight.

The coming months will be very exciting, and there is still much to do. Follow the progress of Cosmos 1 online at the Society's website, http://planetary.org/solarsail There is new material about the spacecraft and our mission there now. Please visit us often, as we have much more coming in the months ahead. **‹TPS›**

[COMMENT: Solar Sails may be critical to the opening of the Martian Frontier to settlement. Because they can be dispatched on a wide variety of trajectories without waiting for convenient "launch windows," solar sail cargo craft could create a virtual "pipeline" of supplies to Mars, with the "spigot always open."

Grasshopper inspires Mars Gas Hopper

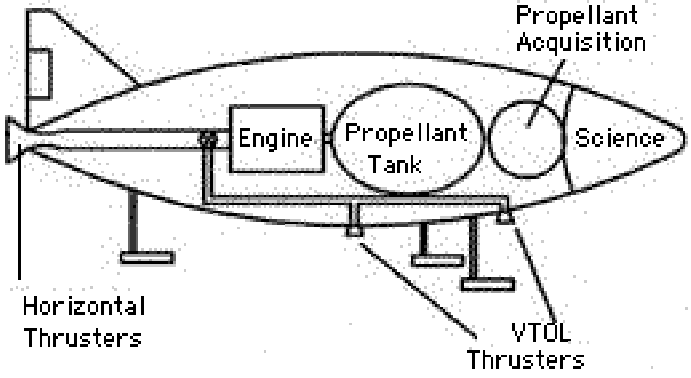
http://www.pioneerastro.com/MGH/mgh.html

commentary by Peter Kokh

Combine a mastery of physics and chemistry, an industrious imagination, and and an inner drive to take us to Mars and the stars beyond, and it is no surprise that Robert Zubrin and his company, Pioneer Astronautics continue to brainstorm and develop breakthrough technologies. It always starts with a stubborn problem being accepted as a challenge. This time, the stubborn problem is that we can send at most a pair of robot rover investigators to Mars each window of opportunity, the windows being just over two years apart. If our probes land intact, as both did this time, they are still severely limited geographically in the amount of terrain that they can investigate, slowed down as they are by the speed of teleoperation over planetary distances. It would take a century at this rate to get a good grasp of Mars, if we want to call the grand sum of 100 sampled sites thorough. If my back of the envelop calculations aren't too far off, that would provide a spacing of 750 between sites on a hexagonal grid. A century!

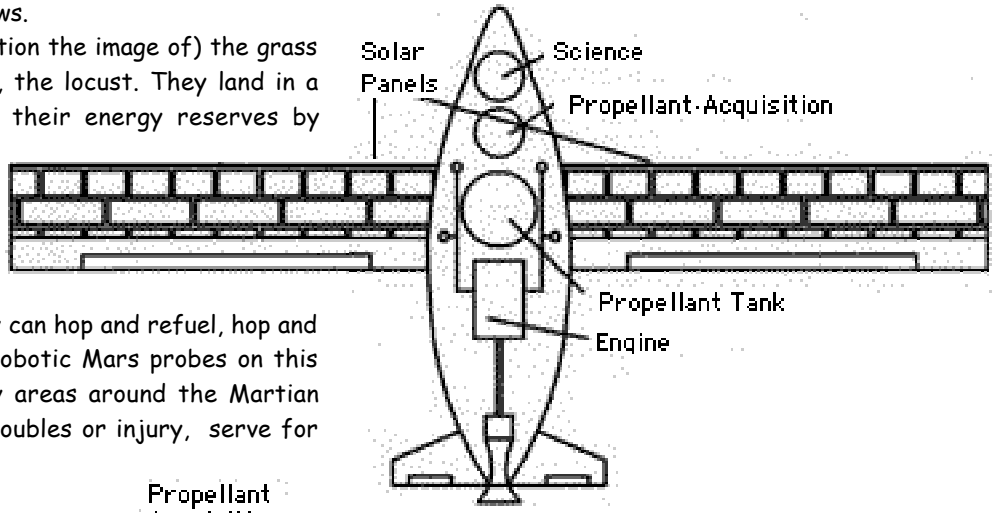
Our present breed of probes, Spirit and Opportunity, are performing well-beyond expectations, but can't go on forever. Power supplies, even refreshed by solar energy, will run out - everything is becoming covered with a thin coat of dust as views o the sundial color calibration device on each rover clearly shows.

Enter (into the imagination the image of) the grass hopper, or its swarming cousin, the locust. They land in a spot long enough to recharge their energy reserves by eating g and off they bound for another location. This type of behavior has real survival benefits. The creatures don't run out of food. But that's not the point. The point is that they can hop and refuel, hop and refuel. Now if we could build robotic Mars probes on this model, they could sample many areas around the Martian globe, and baring mechanical troubles or injury, serve for many years.



How do we do that. Pioneer Astronautics took up this challenge and has come up with a design (c. 2000) that has now caught the attention of NASA as one of 219 research projects selected by the agency for Small Business Research and Development contract awards.

- The Mars Gas Hopper, or "gashopper," is a novel concept for propulsion of a robust Mars surface hopper vehicle which utilizes indigenous CO2 propellant to provide Mars exploration with greatly enhanced mobility. The gashopper will acquire CO2 gas from the Martian atmosphere, and store it in liquid form at a pressure of about 10 bar.
- When enough CO2 is stored to make a substantial ballistic trajectory hop to another Mars site of interest, the CO2 propellant tank will be moderately heated to raise it to 70 bar. The propellant is then run through a hot pellet bed to form high temperature gas that is expanded through a nozzle to produce thrust.
- The gashopper uses its CO2 propulsion system for major liftoff, attitude control, and landing propulsive burn(s), as required. Unlike chemical rockets, the gashopper's exhaust will not contaminate the landing site with organics or water.
- The gashopper has a potential flight range of 10 to 100 kilometers. It can fly over terrain impassible to rovers, imaging as it flies, land to reconnoiter a remote location, and then fly again. Thus, it offers unique capa-bilities for Mars surface exploration.



Combined with greater intelligence, the ability to zero in on more interesting targets, and improved on site analysis systems, a fleet of Martian GasHoppers could vastly increase our current hit and miss picture of this fascinating planet, giving us a much better list of the best spots on Mars for Human-Robot teams to set up shop with confidence. about collocated resources and other considerations.

Pioneer Astronautics built an anchored test stand to test its CO2 engine, and now has built a free-flying version to test its aerodynamic qualities and hopping abilities. For more on this project, go to:

www.universetoday.com/am/publish/mars_gashopper.html

Europe's Venus Express set to launch Oct.'05

First Mission to Venus in 15 Years

www.planetary.org/news/2004/vex_assembly_1014.html
http://www.esa.int/esaSC/120388_index_0_m.html

October 14, 2004 - The European Space Agency's *Venus Express* mission has achieved a critical milestone: spacecraft assembly, integration, and testing were completed by prime contractor Alenia Spazio in Torino, Italy October 4.

The spacecraft has arrived at the INTESPACE facility in Toulouse, France, where it will undergo environmental tests to qualify it for its October 2005 launch from the Baikonur cosmodrome in Kazakhstan.

The October 26th 2005 launch of *Venus Express* will represent Europe's second attempt to send a mission to another planet. The first, *Mars Express*, was launched in June 2003 and arrived at Mars five months later. The one-two punch to Venus and Mars was by design: *Venus Express* was conceived as a mission that could reuse much of the spacecraft design, systems, and even the science instruments from *Mars Express* and its predecessor, *Rosetta* (which has not yet reached its cometary target.)

Venus Express cost 220 million Euros.

Why Venus? Why now?

> "Venus has been out of the limelight during the last decade, despite several scientific puzzles remaining. For example, what are the characteristics of the atmosphere? How does it circulate? How does the composition of the atmosphere change with depth? How does the atmosphere interact with the surface? How does the upper atmosphere interact with the solar wind? Experts have designed Venus Express to be the first space probe to perform a global investigation of the Venusian atmosphere and of the plasma environment, in an attempt to answer these questions."

The oldest crater surveyed on Venus' hot surface is only 500 million years old. In comparison, we find rocks on Earth almost 4 billion years old, and on the Moon almost 4 and a half billion years old. Venus surface apparently gets a volcanic makeover on a regular basis, geologically speaking. So it is not only its hot dense atmosphere that makes Venus unique but also its surface; the two must form a "system."

The goal is to study the Venusian atmosphere and clouds in detail and make global maps of the surface temperatures. The spacecraft will carry seven science instru-ments, five of which are reused from Mars Express and Rosetta, and two of which were developed specifically for Venus Express.

The coast through space to Venus will take five months via the most fuel-thrifty route. Venus is almost the size of Earth, has 90% of our gravity, Two continent-like masses rise well above the rest of the surface. The atmosphere is a crushing 90 times as thick as ours and the surface backs in 950° F temperatures. **</MMM>**

Carving & Sculpting on the Early Frontier

by Peter Kokh

A Gift from Santa – AAC

December 1, 2004 - UPS just delivered a heavy box. An 8"x8"x24" piece of AAC, Autoclaved Aerated Concrete! It weighed 35 pounds (out of the carton) whereas the same volume of water would weigh about 57 lbs and of normal concrete about 127 lbs. I figured its specific gravity at 0.61 (water is 1.0, rock 2.8) and, yes, a chunk of it does float.

I took it down to my workshop right away. With plenty of experience in carpentry and other home repair and remodeling skills, I have been on the lookout for years for a substitute for wood that Lunar craftsmen and others could use. So when Dave Dietzler (frequent MMM contributor from the Moon Society St. Louis chapter) sent me an email some time ago about AAC, I followed the links and noted that one of the hyped characteristics of AAC was its "workability". That was my button! I had to have some to see for myself. Following the online trail, I sent out a few emails. The wait was worth it.

The Unveiling

The block seemed to be heavy because it was so big. A couple of smaller chunks had cracked off in shipment, and picking them up you could tell it was lightstuff. I reached for my tools, and

- You can easily saw it with a hack saw, and even with a regular wood saw.
- You can carve it with a wood chisel or a shaping tool.
- You can cut it with a sharp knife (but it produces granular debris rather than shavings because, unlike wood, the material lacks fiber and an oriented grain.)
- You can easily drill it with a metal bit, and even with a paddle wood bit
- You can pound a spike into it without splitting the material.
- You can drive a screw into it
- Working AAC produces a "sawdust" more coarse than wood working dust, but, surprisingly, not very abrasive.
- You can sand it to produce a smooth surface

And so?

This stuff, if there is no problem producing it on the Moon, will certainly become popular with Lunan sculptors and not just with transplanted chain saw wielders. How easy is it to work? Let's put it this way. AAC is harder than balsa wood, softer than pine., much softer than oak.

Now its ease of carving and shaping is a double edge sword. Being non fibrous, an AAC sculpture could break easily ion impact -- if you dropped it (low lunar gravity to the rescue?) and could be scratched, gouged, marred easily. Could you give it a protective coat or skin, using only inorganic materials producible on the Moon? The brainstorming and experimenting continues. **< MMM >**

The Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

New list – 2004 LRS OFFICERS / Contact Information

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< James_Schroeter@excite.com > . 262-675-0941
TREAS./ Database - *Robert Bialecki 414-372-9613
Newsletter Mailing - Carol Nelson 414-466-2081
(* Board Members, & Ken Paul < kenpaul@cape-mac.org >

LRS NEWS

• Peter's upcoming trip to the Mars Desert Research Station. In working on the Moon Society project to rent MDRS for a 2 week period to conduct lunar outpost simulation exercises, Peter felt he needed to know more about this facility, and applied for a spot on one of the upcoming Mars crews. He will be on crew #34, February 5-20. Average temperatures in the area are higher than in Milwaukee in that period.

LRS DECEMBER & JANUARY Events

Saturday, DEC. 11 th, 1–4 pm

LRS Meeting, Mayfair Mall, Garden Suites Room G110
Our annual pre-holiday pot-luck and film event

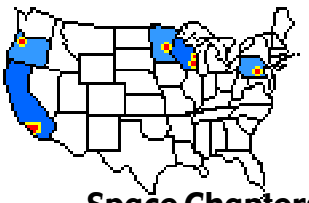
✓ As usual, the members of the Wisconsin Mars Society chapter will be joing us. We've also invited past members, and area members of the National Space Society.
✓ Bring a dish or beverage to share!
✓ New Space Displays will be on hand and MMM backcopies
✓ In lieu of a Sci-Fi classic movie, will be previewing the as yet to be released DVD documentary "**Gaia Selene**: Saving the Earth by Colonizing the Moon." 77 min., starting at 2pm.

Saturday, JAN. 8 th, 1–4 pm

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

We'll discuss the 2005 Calendar and what it means for us: upcoming conferences, movies, space launches and missions, collaboration with other groups, and more.

U.S. CHAPTERS



NSS
Chapter Events
MMM
6 Chapters Strong

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

["**It get's curiouser and curiouser.**" - This month, I decided to colorize the map above for our PDF file clients). Picking my favorite color, I naturally shaded the states where we have NSS client chapters in blue. As I looked at the result, it hit me. The same states and the same chapter urban areas went blue in the last two elections also. Hmmm! What does that mean? Coincidence? Hmmm?]

OREGON

Oregon L5 Society

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

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

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

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

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

Dec 18 - Jan 15 - Feb 19

MINNESOTA

Minnesota Space Frontier Society

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

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

November MN SFS Meeting Pix:
http://marvin.freemars.org/mnfan/mnsfs/2004-Nov/

Election Results for 2005 Officers:

Executive Director:	Craig Borchard
Assistant Director:	Rich Brown
Secretary:	David Lee Buth
Treasurer:	Tom Greenwalt
State Councilor	Ben Huset (through '08)

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 Thursday** of the month at **7-9pm**
DEC. 16th: The Stoelting House, **Kiel**
JAN. 21st: UW-Sheboygan, Room TBA, **Sheboygan**
FEB. 17th The Stoelting House, **Kiel**

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105

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

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

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

• **December 12th**,we will meet in Center City at the **Marriott Hotel** at 1201 Arch Street during the **Philcon** Science Fiction Convention from the 10th-12th

• **January 16th**, we will be back at our Liberty One location. The Super Science Weekend at the New Jersey State Museum in Trenton New Jersey, where we also have met in January, has been moved to May. More on this later.

• **November 20th Meeting Notes:** We had a good meeting with some news on members and possible members from Mitch Gordon: First Mitch reminded me of, and gave me the address for, Ed Johnson who has visited one of our meetings and who has belonged to N.S.S. for about two decades. I am including him in this posting. Come on back Ed! Mitch also brought news of Jay Haines, a long time group member and our Treasurer: He has developed another interest in health care and is a Reiki Therapist. His card reads "Usui and Karuna Reiki(t.m.) Master" as well as several other areas of practice. Mitch met him at an alternative medicine event at the Valley Forge Convention Center .

Also, at our premeeting talk, I was in conversation with Jim Karcher on various topics including the successful flight tests on the X-43A and the way the Scram Jet works. Even with the material from The Industrial Physicist, brought to a previous meeting, we had a hard time with the talk. This is appropriate in that if it where easy we would not be waiting for its development.

Reports: Mitch Gordon brought a number of things to the table including: A book signing event at the center city Barnes and Noble (Nov. 27th); The Multidimensional Universe" by Paul Halprin. Mitch is using the visiting authors in his talks with local universities, most recently Drexel University, to encourage the institutions in our area to include aerospace courses in there offerings. Mitch has sent a letter to this effect.

On the public outreach front at Philcon: Mitch will be bringing N.S.S. brochures with current contact information (since N.S.S. moved to a new address), and he is also out canvassing the public on there support, or not, of space exploration. We also talked of the possible conflict between Super Science Weekend and the 2005 Balticon Science Fiction events which may be on the same dates.

Hank Smith reported that Philcon has several panels and stand alones that we will be on and several that didn't happen this year: a recurring interest among us that will not happen is "Space Mega Structures", the title of which caused discussions of the meaning of "Mega" in space leading to Larry Nivens "Bigger Than Worlds" article and similar writings, and the possibility that a panel on The International Space Station, which was to occur, may not due to lack of panelists. On the other hand Supernatural Cities will happen (we'll see it and report) and several members will present: Gary Fisher on Mars Homesteading, and Robots in the Military, which I will be on. I believe that Mitch Gordon will also be on a panel and that former member Michelle Baker will do a stand alone J.P.L. Update that is usually standing room only. In the future, Hank says that Philcon may move to the Wyndham Hotel first in December 2005 and November 2006 (yeah!).

Earl Bennett brought material from various sources including the January/February 2005 Analog Magazine "Where Are They" by Thomas Donaldson on some possible answers to Fermi's question. Recent discoveries about the makeup of other solar systems, especially the distribution of Jupiter and above sized planets in them may, according to research reported in this article, indicate that survivable Earths may be rare.

Also noted from the November NASA Tech Briefs is the ongoing work of Sarah Thakoor on Anamorphic Explorers; this time on flyers" Development of Biomorphic Flyers" which has been in process for some time. The

accompanying photo is of the basic flying platform developed in 2001. On page 55, next to the above, is a report on another device: "Second Generation Six Limbed Experimental Robot"(simulator image not a photo here) and a report on the devices capabilities for this Lemur II Robot..These devices are being designed for assembly, maintenance, assembly and repair. The improved robot has a better drive train that allows more torque to be applied to hardware its working on/with and with higher accuracy. The legs are now arranged symmetrically around the body for improved omni directional capability. And more. This work was done by a team headed by Brett Kennedy et al. for J.P.L..

And, from Nuts and Volts Magazine, in the "Technology 2004" section is a brief write up on work done for Seiko Epson (www.epson.com) on Worlds Smallest Flying Robot which is reported as an improvement over a previous design that was a tethered system. the new flyer, "UFR-II" has an improved motor that generates 30% more lift than the previous design, and more precise altitude control among other upgrade.The Universities cooperating on the projects, and their specialties are listed. Page 14, November issue.

Janice, our non member attendee, brought material from Science Magazine for November 5 the Titan Flyby in the article "Titan Remains Mysterious with a Hint of the Familiar". The phrase "fuzzy " is is being deleted from the language used to describe the moon with the possibility of "seas" or another covering being considered more likely. This report engenders this reminder: The splashdown (we hope) on Titan should happen on or before this material is published in paper format. Time to check the NASA and Space.com and other sites. Who knows? Maybe Ralph Lorenz' surface properties probe, as described in the book"Lifting Titan's Veil" by Lorenz and Mitton (Cambridge University Press), will be able to return first source data from direct gentle impact on the satellite!

Comment: We had a number of other interesting additional topics at the meeting but I would like to bring up Moon Miners and the excellent material by Peter Kokh and Dave Dietzler. In the October issue are several articles on resource recovery and reuse. In the article on "Trashure Creativity & Wasources" was a mention of a product of the early 70s that seemed like a Great Idea of its time : the World Bottle. I first learned of this in a book called "Other Homes and Garbage" that described a number of forward thinking possibilities from businesses and individuals. The bottle idea was based on the use, beer container, and the need; low cost construction materials in poor (in resources) communities. The bottles where rectangular to allow easy stacking. It did not catch on even though sample buildings where shown. I still think the Knock Down concept in the Moon Miners is a good one.

Submitted by Earl Bennett

CALIFORNIA

OASIS

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS

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

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

oasis@oasis-nss.org

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

Regular Meeting 3 pm 3rd Sat. each month
Microcosm, 401 Coral Circle, El Segundo.

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

- **Dec. 18th, 3:00 p.m.** -- OASIS Monthly Business Meeting will be at Microcosm, 401 Coral Circle, El Segundo. Following the busines meeting we will have **our annual Holiday Pot Luck Party**.
- **Jan. 15th, 3:00 p.m.** -- OASIS Monthly Business Meeting, Redondo Beach
- **Feb. 19th, 3:00 p.m.** -- OASIS Monthly Business Meeting.

Looking Ahead

- **May 19–22, 2005** -- International Space Development Conference (ISDC), Washington, DC. For more information, see http://isdc.nss.org/2005/. Registration rates climb steepy after January 1st.

Recuring Events

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

SOLAR SYSTEM AMBASSADORS
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- **Hardcopy MMM**: U.S. & Canada **$35** Elsewhere: **$60**

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LUNAR RECLAMATION SOC. (NSS-Milwaukee)
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PHILADELPHIA AREA SPACE ALLIANCE
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