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

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

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Classic Chesley Bonestell Painting, from *Conquest of the Moon* (1953) – "Lunar Expedition in Sinus Roris"
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Feature Articles in This Issue

Apollo-13: Three 3rd prize winning Essays

Space Settlement Corridors and Passageways

It is hard to imagine a science fiction movie or episode of a science fiction television series in which a good part of the action does not take place in some hallway or corridor. Modular complexes can be built without them, perhaps, but in the pressurized modular complexes on the Moon or Mars, the corridors may host an appreciable amount of the total biosphere mass, and be endowed with other amenities to keep settlers happy. See pp 5-8.

IN FOCUS An International Effort to Prepare for a Return to the Moon

By David A. Dunlop
Moon Society Director of Project Development

If we look historically, NASA established the Lunar and Planetary Institute at about the same time as Apollo 11 landed. This year was the 41st anniversary of LPI's Annual Science Conference to stimulate interest both interest and research arising for NASA's science program. Now, two generations later there is a global international community of interest in the Moon (and other subcommunities interested in Mars [=>p. 2, col. 2]

Moon Miners' Manifesto

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

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

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

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

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

• **MMM retains its editorial independence.** MMM serves many groups, each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test. [Opinions expressed herein, including editorials, are those of individual writers and not presented as positions or policies of the **National Space Society**, **Lunar Reclamation Society**, or **The Moon Society**. **Copyrights** remain with the individual writers. Reproduction rights, with credit, are granted to NSS & Moon Society chapter newsletters.]

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

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

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

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

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

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

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√ Mac compatible CD / or typed hard copy must be mailed to:
Moon Miners' Manifesto, c/o Peter Kokh,
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⇒ In Focus Editorial continued from p. 1.

the other rocky planets of the inner solar system, the Gas Planets, the outer Outer Solar System).

Now one traditional institution cannot control enough resources to easily keep track of this growing set communities including LPI and LSI.

NASA's set of research centers work on the research and engineering problems associated with lunar and planetary research. We realized that the international academic and research firepower spread around the world associated with the Moon would be equivalent to a formidable dedicated University. a virtual University of Luna. David Morrison, the current Acting Director of LSI indicated that a number of different individuals had suggested something similar, and this was one impulse associated with the creation of the Lunar Science Institute at AMES with a number of international nodes.

1. I concluded that a consistent and significant base of resources would be needed (something on a Google Scale Commitment) to keep up with the large volume of lunar associated activity and research.
2. It was clear that the MS did not begin to command such resources and only had its voice as an advocate of such development.
3. It would be necessary to keeping trying to bring the need for a virtual institution to the attention of the international lunar community community.
4. At the Lunar and Planetary Institute Conference last March we proposed that an open source data base be developed that looked at the community of lunar interest as being defined by individuals who had an interest and proposal to go to the Moon to utilize scientific instruments, conduct experiments (including commercial), and develop technology needed on the lunar surface (as elsewhere in the solar system).
   Both LEAG NASA's official lunar science advisory group and lunar science representatives from ESA's lunar program expressed interest in developing such an open source (not ITAR constrained) database and work is underway at present to do so. Though the cancellation of the Constellation Program sends very mixed signals about the flip-flop nature of the US political process and "will" to return to the Moon, I am confident that the international momentum for a lunar return will prevail, even as the technologies funded by the new Obama budget advances needed technologies essential to a human lunar return.
5. Our MS challenge is to grow internationally to reflect this global community, as well as take reasoned positions on what the US government is doing. and facing our own challenge to keep abreast with the actions and efforts of the global lunar community.

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No July Issue

MMM #237 will be published in August.

MMM is published ten times a year: monthly, except in January and July, to give the editor a "burnout-prevention" break, time to regenerate. **Instead, we expect to publish MMM Classic #21, re-editing and republishing all the non-time sensitive articles from Issues #201-210, our 21st year of publication, in pdf format.**

Manned Space Exploration Is Worth the Risk

Tom Burkhalter, Hickory, NC

3rd place winner (3-way tie)

Since 1960, 101 people, mostly Russians and Americans, have died either during the course of space flight or in accidents related to preparations for space flight. According to NTSB statistics, almost that many people in America alone will die, in a single day, in automobile accidents. In a single week in this country, based on U.S. Labor Department statistics, more people will die in workplace-related accidents than have ever died in space flight related accidents. In a single year in this country, based on U.S. NTSB statistics, more people will die in airplane accidents than have died in space flight related accidents. Any argument that manned space exploration is physically "too risky" would therefore require us to ban, by the same argument, driving to the supermarket to shop for eggs, to work for a living or flying a Piper Cub.

Manned space exploration is without doubt expensive. Economists would ask, what is the benefit we obtain at the risk of the money spent? As for that risk, one spends money to make money. The technological spinoffs of the Apollo program alone created more jobs and economic opportunity – in short, made more money – than has ever been publicly acknowledged. Input the term "Apollo program spinoffs" on any Internet search engine and consider the ways in which our economy benefitted from that one program. As an humble example, today's athletic shoes are based on materials derived for use in the space suits NASA astronauts wore on the Moon; at the other end of the spectrum, magnetic resonance imaging depends on digital signal processing techniques developed for Apollo. What is the economic value of early diagnosis of a brain tumor?

Arguing the technological benefits of manned space exploration, however, might be beside the point in assessing the relevant economic risks. Adjusted for inflation, the Apollo Program would have cost about 300 billion dollars in 2008. Congress, just before Christmas of 2008, gave over three times that amount to bail out a banking industry that made bad business decisions. The decision to undertake the risk and bail out the banking industry was made after only the most minimal debate of the risks and consequences. What benefit will we, as taxpaying Americans, receive for that economic risk?

There is risk and expense involved in manned space exploration but the risk appears to be no more than that present in those everyday activities described as "business as usual." Perhaps, though, since it seems evident that even this level of risk is considered unacceptable by many people, one should identify what manned space exploration actually does for us as human beings.

Manned space exploration, by definition, takes us where no one has gone before. Perhaps it isn't so obvious that it increases not only the store of human knowledge and experience, but the level of human potential. "Human potential" in this context means the scope of what we dare to dream of accomplishing, for ourselves and for our children. Manned space exploration is not only the stuff of dreams, but in a very literal and much more important sense, the stuff from which dreams originate.

Before Apollo "going to the Moon" was only a dream, an idea belonging to science fiction. But on July 20, 1969, we *knew* that human beings were on the Moon. "Going to the Moon" passed forever from the nebulous realm of science fiction into the factual realm of human history and experience. To look at the Moon during the Apollo landings was to *know*, and not merely to have *faith*, that *anything is possible to human beings*. What Apollo did for us then is what all manned space exploration does for us: When dreams are made real previously unknown dreams become possible. The human potential increases.

To explore, redefine and expand our full potential as human beings, to restore and maintain that spark of the heroic within not just some of us but each of us, is therefore the benefit conferred by manned space exploration, and that is worth the risk. Manned space exploration proves to us that whatever our problems, we can find a solution. Manned space exploration is the living, dynamic symbol of hope for the future, of that better tomorrow that is the fundamental promise of America. To acknowledge anything less is to deny our full potential – and what that potential might become in the future where no dreams have yet reached. **TB**

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Manned Space Exploration Is Worth the Risk

By **Dorothy Diehl**, Mt. Angel, OR

3rd place winner (3-way tie)

Exploring the unknown has always been fraught with risk for Homo sapiens over the last one hundred millennia. It is true that back then, humans lived in tribal societies and stayed on familiar terrain until environmental conditions changed and threatened their survival. Faced with doom if they stayed put or the possibility of survival if they explored the unknown, early humans left their homes on the plains of central eastern Africa and migrated south or north. In the north, subsequent generations pushed on westward or eastward across Asia eventually finding an Ice Age land bridge to the Americas.

Down through the ages this human willingness to take risks to escape hunger, poverty and/or persecution motivated many peoples to face what they did not know and, in spite of death decimating their peers, the survivors conquered that unknown. Sometimes, the driver for human exploration was the possibility of obtaining great wealth like gold and spices. Usually there was a comercial element lurking behind many expeditions of exploration, such as the great Lewis and Clark Expedition of 1803-1806. Yes, they drew maps of previously uncharted terrain and recorded many observations of previously unknown plant and animal species. However, the purpose of that expedition—to find a water route connecting the upper part of the Missouri River to the Pacific Ocean — was a commercial one. The ensuing wealth that would come to the United States, if a Northwest Passage were discovered, was more important than the many risks posed by such an expedition.

In our own time, the decision to send men to the Moon and return them safely to Earth was driven by the military threat of the Cold War when the Soviets success-

fully launched Sputnik, the first artificial Earth satellite. Our national prestige was ranked as more important than the personal safety of the astronauts. If the stakes are high enough, humans will run any risk that arises. The public did not vote for the Apollo Program; it was an executive order by President Kennedy.

Since the end of the Apollo Program, space exploration has been relegated to robots as cheaper and more expendable than human astronauts. Many robotic missions have been extremely successful. Now there is no driver to risk human lives to explore space beyond Earth. Of course, we are curious about what's out there, but the robots are slowly and partially satisfying that curiosity. And we are safe as clams on our lovely home world, the Earth. The fact that human explorers could, at great expense and great risk, make many more discoveries much faster in space than all the robots sent there has no traction with U.S. citizens.

However, if a group of people, perhaps from some other nation, decides to go to the Moon to explore ways to make a permanent settlement there and they succeed; then, the reports of that success will raise the possibility of new real estate and exciting jobs. Like the opening of the Oregon Trail in the nineteenth century, a permanent human settlement on the Moon in the twenty-first century will stir us to action. Those who come in on the ground floor of a new frontier not only acquire wealth but also make names for themselves in human history.

It is inevitable that new discoveries on the Moon will lead to new technologies, new ways of life, and eventually to Mars and the asteroids. Destiny will beckon to those who dare great achievements. The innate urge to explore the unknown that is buried in our genes will finally express itself again. We will relegate robots to support roles where they belong. Yes, we will consider the risks and take them in stride as the shuttle astronauts did when they assembled the ISS and repaired the Hubble Space Telescope. Instead of crawling centimeter by centimeter onto the Space Frontier exclusively with robots, we will finally sprint there with human explorers.

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The Case for Manned Space Exploration

By Valentin Peretroukhin, Toronto, ONT

3rd place winner (3-way tie)

"Space, the final frontier" has fascinated the minds of Mankind since antiquity. The 20th century saw great leaps of innovation that allowed humans to not only travel to space, but to also set foot on a completely different celestial body and return home safely. During incredibly unsettling times of war, violence, and social unrest, these audacious accomplishments were an inspiration to the masses and a true symbol of human ingenuity. At the climax of the "space race," the public's exuberant sense of hope and excitement for human space travel allowed governments to invest a considerable amount of money into fostering new ideas and technologies. In the decades following that era, the world's social dynamics and demographics evolved and many factors that initially promoted space exploration disappeared, along with much of the unified excitement for exploring distant frontiers. With the general public's support dwindling, it is now becoming exceedingly difficult for many developed countries to justify funding manned space endeavors.

Around the world, the American lunar landing of 1969 certainly marked the peak of public interest in space exploration. Over 600 million people, a record television audience at the time, watched as Neil Armstrong stepped down the ladder of the lunar module and uttered the iconic phrase, "One small step for man, one giant leap for mankind." Upon their return to earth, the astronauts reception was akin to the welcoming of renaissance explorers, filled with extravagant parades and glorious stories of strange foreign lands. The awe and excitement that surrounded this first trip slowly dwindled with later Apollo missions as the process was inherently repetitive and suddenly seemed entirely accomplishable. Beginning in the mid 1970s, the extent of human space exploration began to shift focus to creating inhabitable "stations" in low earth orbit and building various efficient ways of transporting humans to these stations. Though interplanetary exploration continued, it was, and still continues to be, fulfilled entirely by unmanned space probes.

As human participation in space exploration declined, so did the inherent public interest for any extraterrestrial missions. The reason for this can be found on magazine stands, in arenas and schools around the globe: Mankind is an incredibly social species. Our evolutionary supremacy on this planet stems from our competitive nature, our ability to work in groups and our ability to share information and pass on relevant knowledge. Furthermore, the intrinsic ability to put ourselves in the perspective of another person – the concept of empathy – is one of the key distinguishing factors that separate humans from other primates. For people to be able to relate to, and empathize with, the accomplishments of said space explorations there must be a human face attached to them.

One of the main arguments against human-based extra planetary travel, and perhaps why no country has attempted it since the Apollo missions, is the shear cost of developing technologies safe and practical enough to send humans to another world. The money for space endeavors is there, yet the public is extremely wary of spending billions of dollars on unmanned missions that often fail because of careless mistakes and miscalculations. In a manned mission where all decisions are scrutinized and much more rigorous precautions are taken, and the public is empathetic of the risk of human life involved, justifying high expenses is a much easier task. Additionally, more than just appealing to the public, astronauts bring an entirely different approach to exploring different planets and moons. Humans are incredibly dynamic and can perform many things that a robot simply cannot do. An astronaut can provide a holistic overview of a new unknown environment – in addition to the simple images, videos or other sensory data of a probe - that can be incredibly helpful in understanding its various characteristics.

Apollo 15 Astronaut James B. Irwin, staring back at our world through his command module window, described the earth as "a marble, the most beautiful you can imagine. That beautiful, warm, living object looked

so fragile, so delicate…" From this incredibly unique and bonding view point, all of Mankind, no matter what race, sex or creed is a part of Earth: a beautiful, vibrant, diverse world in the dark empty abyss of space. In his book, *Cosmos*, the great astronomer and popular author Carl Sagan writes of this phenomenon, "if a human disagrees with you, let him live. In a hundred billion galaxies, you will not find another." In times of distress, a country's investment in exploring distant frontiers serves as an inspiration and a vital source of hope for many of its citizens. The best example of this occurred in the late 60s in the United States. This decade was marked by several prominent assassinations, a much disputed war in a completely different continent, the threat of nuclear annihilation, a struggle to eliminate segregation and a multitude of oncoming social reforms. Throughout all this turmoil, the Apollo Astronauts were seen as heroes, unifying the nation and providing hope when all else seemed to be in a state of disarray.

Thus, in just over 150 years after its conception, space exploration is now a crucial part of the development of Mankind. In a dynamic, multi-dimensional world it is imperative that we continue to challenge ourselves to explore distant frontiers and not be intimidated by the prospect of human space travel. Space is no longer simply a bragging right for the most developed nation – it may contain many answers to the daunting challenges our species will face in the next millennia. The future generations of Mankind will rely on our courage and our ingenuity. In the words of H.G. Wells, "life, forever dying to be born afresh, forever young and eager, will presently stand upon this earth as upon a footstool, and stretch out its realm amidst the stars." **VP**

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Thanks to these and other persons who entered our essay contest. Chuck Lesher, editor of our science-fiction publication, ***Moonbeams***, has now published these five and six more entries in issue #5. This is a free download from:

www.moonsociety.org/publications/fiction/

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Some Hallways & Corridors of Sci-Fi Fame

Moonraker above, **Emprie Strikes Back** below

HALLWAYS & CORRIDORS

http://www.denofgeek.com/movies/313130/in_praise_of_the_scifi_corridor.html

By Peter Kokh

It is quite possible to build a modular outpost with no hallways, corridors, tunnels, skywalks, or other types of pedestrian passageways. To do so has a disadvantage:

- passing through one habitat or activity module to get to another one is disruptive and distracting to the activity and personnel in those modules. And the path, whether down the middle or to one side takes up valuable space.

On the other hand, the separation of modules that pedestrian passages afford offers these benefits:

- Isolation of decompression and other types of emergencies or catastrophes or;
- Opportunity to add additional biomass, in the form of living walls, for example; the opportunity to add storage in the form of lockers: a growing and busy complex can never have too much storage! Witness the International Space Station
- Vertical space to add galleries of paintings, photos, and other types of artwork;
- Corridor intersections can provide seating for conversation, snacks, reading, or simply people watching

All of the above benefits are important. In the current designs for a proposed Moon Society Analog Station and the proposed Moon/Mars Atacama Research Station in Chile, the opportunities for extra storage and additional Living Wall units two major drivers. The additional advantages are "frosting on the cake." The result will be a more pleasant place to live and work.

In contrast, he one-module MDRS facility, has no halls at all, discounting the open framework of the "simulated" Heinlein tunnel connecting the Hab to the Greenhab, built in 2006 by the Moon Society crew.

http://desert.marssociety.org/media/mdrs/fs05/images/crew45/c45d13str01.jpg

Hallways and other pedestrian corridors, as an opportunity for additional biomass in the form of Living Walls, are at the core of the "Modular Biospherics" architectural approach which is especially appropriate for a Modular Architecture, one that can expand and grow as the size of the crew (outpost population) and the variety of its research and activities grow. In contrast, one-size-fits all approaches to the mini-biosphere equation have all been dismal failures.

Living Walls, vertical arrays of vegetation with built-in irrigation systems, do not compete for floor space, save in a minimal way. Existing examples show an amazing variety in system design as in the variety of plants used and the way they are decoratively arrayed.

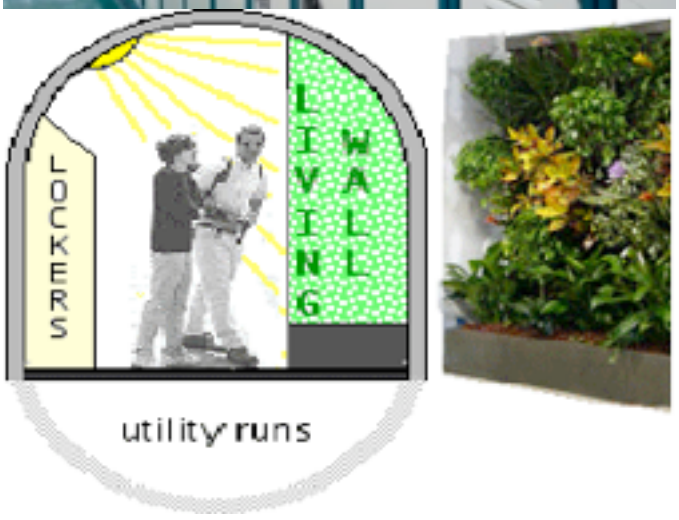
In an analog facility, with room for many such units in various hallways, provides an ideal opportunity to test many system designs and plant choices to see which do the best job of cleansing the air, keeping it fresh and pleasant, and which require the least care, Research of this kind is what an analog station should be about: not just a place to test field equipment and procedures, but to test modular outpost and biosphere schemes.

Beyond the Outpost: Settlement Pedestrian Ways

There will, of course, be pressurized settlement streets for electric vehicles, bicycles, and even mass transit. These two are likely to be generously vegetated, both along the curving sidewalls, and in traffic medians and pedestrian sidewalk borders. A settlement will have farm areas, of course, and these areas will contribute greatly to the overall biomass. But the contribution of plantings along streets and other pedestrian ways will add a significant extra. The more diverse and physically dispersed these biosphere contributions, the less likely any overall system failure due to blight or plant disease or other points of failure; *and,* the more "Earthlike" and reassuring the setting will be for day-in, day-out, outpost or settlement life; a*nd,* the happier outpost personnel and pioneers are likely to be.

That the principal benefit, more than sufficient to justify the expense involved, is the robustness of the contained mini-biosphere, is crucial. If the only advantages were pleasant surroundings and happier personnel, the budget weasels would quickly ax such features. We say that with contempt because these people overlook that the most important "system" of all is the human system. Kill or starve crew morale, and the most soundly designed physical structure will be for naught.

Now perhaps the locker row walls would survive that cut, but to what use if the biosphere crashes?



Above: cross-section of a minimal connecting hall.

Where lockers are not needed, as in areas too far from where the contents might be needed, art, photo, and sculpture galleries are an option. We see things like

that in some urban metro/subway stations, though, more commonly such space is given to paid advertisements. Advertising, especially of cottage enterprise products, might be a healthy sign in those pedestrian connector intersections that have high traffice. Let's hope that we see both. And why not together? Paintings of fruit along side an ad for Mrs. Jones Jams and Jellies! A frontier is a place to start over. If ever ad sponsored an accompanying piece of artwork, how refreshing that would be!

A matter of words

We will see pedestrian passageways in many forms, and here on Earth we have many names for them: skywalk, tunnel, pedestrian bridge; Hall and hallway are rather generic. The Latin word, cunniculus, refers to an underground passage such as a rabbit tunnel or mine.

While there will be assembly halls and other recreational spaces in which people will mingle, it will be in the hallways that most people assigned to a lunar outpost, especially a multi-national one which is the center of research and innovation, will meet and strike up conversations. It will be in its hallways, that a frontier outpost begins to feel something analogous to home. Coffee or juice bars would help!

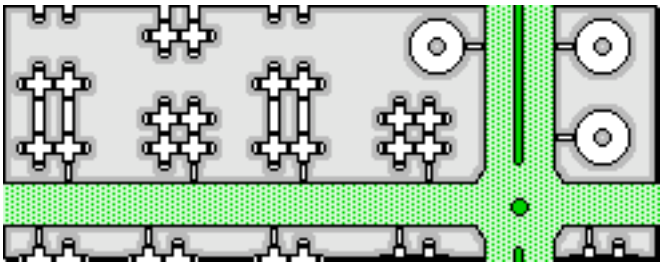
Pedestrian passageways, especially those that form a convenient loop, may also be frequented by walkers before they start their day's work. Indeed, these spaces will provide many of the perks of "being outside." They will be where one "gets out of the house," gets away from the office or shop. On a world where you just can't put on a jacket and cap and go "outdoors," these pedestrian networks will function as an "outside."

Some will be wide enough to have merchant kiosks down the middle, or at intersections, as do most shopping malls. Indeed, many a needed pedestrian trafficway might be expanded to include the mix of social and shopping needs "mall halls" provide, with shops to either side. As cottage industries arise in a young settlement, selling products produced in free time, something of the sort is sure to arise.

We've already mentioned scattered seating: for readers, coffee sippers; conversation, and simple people-watching. You won't see much of this if any at all in a small outpost; but within the more extensive framework of an International Lunar Research Park, it would be surprising if we didn't see these kinds of development. Here there will be people of many nations, who had not previously known one another, on assignments of different lengths of time. The social mix should be interresting, more so perhaps than at McMurdo in Anatarctica.

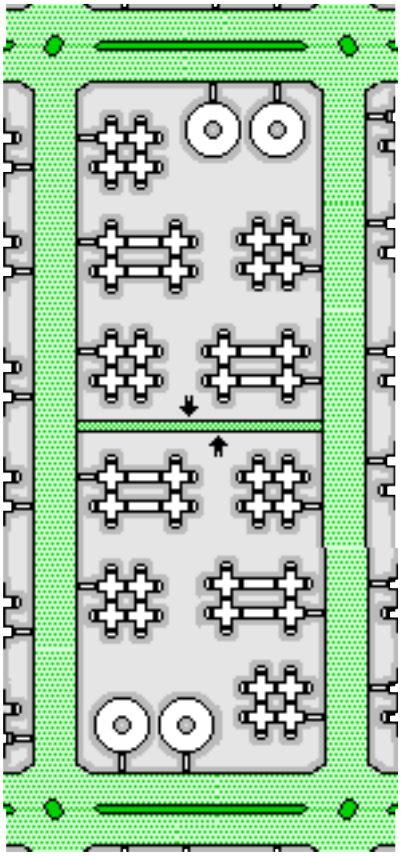
Hallway architecture

And once the settlement or the research park develops real "streets" with vehicles, park like sidings and intersections will take all this to the next level. There could be waterfalls, trout streams, and more. To the point they would ramp up the biosphere component to keep pace with the growing population.



Where would Pedestrian Passageways be bult?

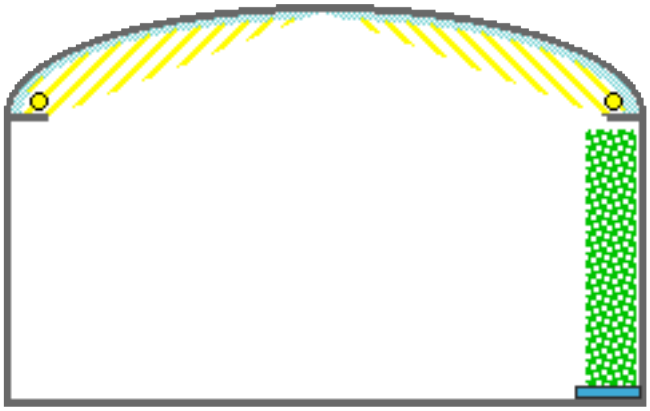
The answer is simple: wherever there is a need. They could connect office complexes, factories or schools and/or parks. They might connect street sidewalks through the middle of long residential blocks, as is shown in this illustration ➔



In this "map" the green areas are the major hosts of biosphere support vegetation. Plantings could be ornamental and/or include fruit trees and bushes, herbs and spices, or other plantings to supplement what is grown in the main agricultural areas or "farms." This contribution to biosphere mass and air quality is significant,

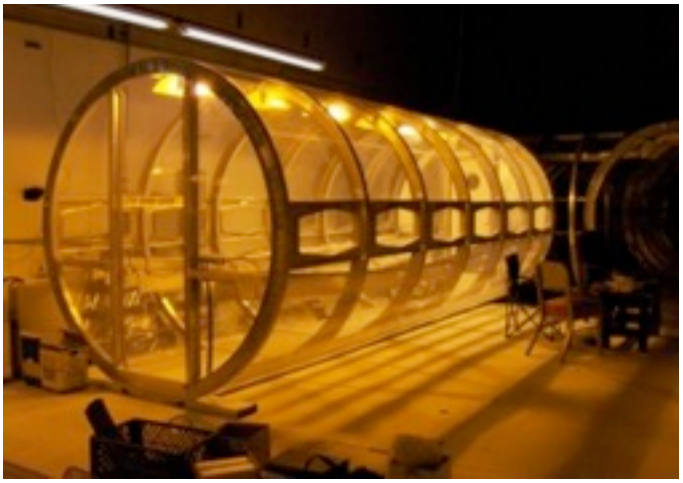
Ambience is essential

We've written before of "the black sky blues." In addition to the refreshing and reassuring inclusion of abundant vegetation in the form of "Living Walls" and the water features that could easily be incorporated in their hydroponics systems, hallways and corridors could be designed with arched or vaulted ceilings. Painted matte "sky blue" and uplit by cove lighting, they would bring welcome eye relief to those born on Earth and used to the open skies and their eye-comforting blue tones.



Pedestrian passageway construction

Pedestrian corridors or tubes could be assembled from fixed length cylinders: But they could also be made of inflatable sections: lighter, and thus more length for the shipping dollar. Phil Sadler had pioneered an interesting option. In connection with CEAC, the Controlled Environmental Agriculture Center at the University of Arizona in Tucson, he has designed an "expandable" circular framework for a lunar Greenhouse.



The unit travels compact, the ring frames up against one another, then pulls out to the desired length and is covered. Another idea would be an expandable slinky, as its continuous frame could carry electrical and other utilities. Much will depend on the pace at which new lunar building materials come on line.

ISS as an example not to follow:

The International Space Station has connecting passageways too. But with lack of foresight they are shorter than they might be, and narrower. Clearly, there is a market for inflatable corridors just as there is for inflatable modules. As a result, on ISS, every cubic foot not needed for a space to "swim through" is given to storage. No perks, no amenities, no décor, no plants, Just storage. Take a look at the following video [3 parts]: http://www.youtube.com/watch?v=JgBgmw-2U8c

The lesson is to disperse the modules to be connected so that longer corridors are needed, and for the same or lower price (less weight per linear foot) wider inflatable corridors. This suggests a possible refit that would make ISS that much more livable.

Jumping back to large complexes on the Moon, it would be wise to design in a peripheral or self-rejoining corridor route for morning and evening walkers: one-way in the morning, other way in the evening?

Hallways and corridors are the lubrication that makes large complexes serve their purposes well. We tend to take them for granted, ignoring their potential to serve complimentary functions. Nor should the potential of corridor nodes or junctions be overlooked. They are natural meeting places so should have nooks were people can sit and chat, or just people watch; kiosks for coffee, tea, snacks and more.

As a complex grows, maybe there should be lanes for bicycles, or trikes with bins for groceries and other shopping loot. On the settlement level, there might be a pedestrian network as extensive or more as the road system, and complementing roadside sidewalks.

Pedestrian Passages & Galleries

Some of these passageways could become favorite places to post artwork and crafts, whether just for show, or for sale on consignment to an agent with the power to sell them. Such a setup would work to greatly increase the amount of arts and crafts activity in the settlement, as well as to personalize individual homes, apartments, offices, and more. They could also become places to show and sell other home enterprise products from home-canned preserves, herbs and spices, teas and other beverges, and even dyes and custom fabrics. Home made products assisted by this kind of exposure and sales opportunities could help accelerate the transition of some cottage industries into mainstreet businesses. And they could be a favorite hangout of budding pioneer musicians and singers, hoping to catch the ear of some booking agent.

Pedestrian Passageway wares and inter-settlement tourism

It is foreseeable that as passageway arts and crafts and home-grown and fashioned products, being highly individual, could become a major driver of inter-settlement tourism: "Shop the fascinating and ever-surprising passageways of Luna City, or of Shangri-Luna or of Port Heinlein!" While walkers and others "in transit" may be the main users during the workweek, on the weekends, browsers equipped with money or credits may be more numerous.

By including a spacious network of pedestrian passageways in settlement city plans, city fathers will be ensuring the development of a happy and healthy population of achievers and producers, and in general, of happy camper pioneers.

Passageway Intersections

We've talked of ships, kiosks, and places to sit down and visit at extra spacious passageway intersection. There might also be musicians, playing for donations, or just for the privilege of playing. Benches and other places to sit and rest may become a favorite arena in which to see and be seen. Here is a setting where dates can be made, as well as deals.

Pedestrian Passages & Exercise

Walking is not as energetic as running or cycling, but does do a lot, if pursued on a regular basis, to maintain overall health. If worked into one's shopping habits or used as an alternative to vehicular transport on short runs, negotiating a well-planned passageway system may add significantly to overall mental and physical health and sense of well being.

Regular walks would also reduce any sense of isolation and help foster a sense of community and good habits of socializing.

The risk of planners pursuing efficiency

Some settlement planners may see pedestrian passageways as unnecessary structures: "just put buildings cheek-by-jowel. Adding "miles of passageways consumes building materials, and other resources inefficiently." But they are wrong. Communities are vital complexes and amenities such as pedestrian passages will be both the grease and the stimulant of ever-increasing pioneer productivity and contentment. **PK**

The Moon Society www.moonsociety.org

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

Objectives of the Moon Society

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

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

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

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

Moon Society Heads to ISDC 2010 With High Degree of Optimism

A message from TMS President, Peter Kokh

We have refreshed exhibits and handout material to convey the upbeat feeling among Society leaders.

Saturday morning, May 22nd, there was a webex-Boeing teleconference between me, Dave Dietzler (Moon Soc. St. Louis fellow brainstormer) and Dave Heck (Moon Society St. Louis and Boeing-St. Louis) to review the semi-final presentation Dave Heck will give at 5 p m Friday *in the Space Business Track* about the Moon Society's proposed **International Lunar Research Park**.

In this concept, a contractor consortium would prepare the site: build a spaceport, power generation and power storage facilities, warehousing site including fuel storage, site grading and initial roads, and possibly even waste treatment facilities. Participating national pace agencies need only bring their outpost modules and plug in, with their astronauts free to concentrate on the research they came to do. The ILRP would have corporate and enterprise and academia, even tourist installations. This is an improved take-off on the International Space Station model, which is cancellation resistant.

The ILRP was my idea originally but has been undergoing significant dedicated brainstorming by our St Louis "Think Tank" (including the two Daves, Burton Sharpe and a half-dozen other mental giants of diverse expertise.) Dave Heck, by virtue of his position at Boeing, frequently visits the world's most advanced and largest "International Research Center" in Sheffield, England, UK

This has given him valuable insights and he has taken this concept well beyond what I had envisioned. He sees it developing first as a Virtual Institution (Phase 1)-, which will require a massive website, as contributors join from around the world, representing many corporations and universities and governments, non-profit organiza-tions like ours, etc.

This will advance and track all research being done on technologies needed to open the Moon. This is exactly what Dave Dunlop and I tried to do with the University of Luna Project when we introduced it at ISDC 2007 in Dallas This university effort stalled, as we too began to realize that it needed a major website with widely distributed posting access, and a significant web sponsor (we had thought of Google)

Well, Dave Heck has also looked at all this. We are likely to get major sponsorship from Boeing and Microsoft to name two big firm to start off with. Both are partners in the Sheffield International Research Park.

So the University and ILRP projects will be merged into one proposal, and into one virtual reality, with the university becoming a part of the ILRP project.

Take a Deep Breath! That's just Phase I

Phase II is an actual ILRP here on Earth, and possibly more than one. This/these complexes will be the

ultimate Analog facilities on a scale and comprehensiveness of operation undreamt of by analog research supporters. Our own analog plans, along with my recent proposal (shared only with Dave Dunlop) to finance our analog station as a "mall" with TMS as the owner, and interested corporations being invited to buy in to share the site and have their own research installations there. Their site leases would then finance our own analog installations and their continual growth) so the Phase II ILRP could conceivably provide us with a free analog operation location as well. Or help pay for our own site elsewhere. So our Analog Research Station Project, our University Project, and International Lunar Research Park Project seem to fit together naturally.

Phase III is one or more ILRPs on the Moon.

A time of mixed moods

Back to where we fans are psychologically right now: Many of us have dared dream only of a small NASA outpost, Little America 2. Some of us have dared dream bigger dreams, of actual pioneer industrial-commercial settlements on the Moon. This is the vision of the Moon Society as stated at the top of our homepage

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

The problem has always been how to get from what I have called "the outpost trap" of that humble superexpensive Little America 2 stage to one where we want to go, something bigger than McMurdo Sound.

Now with NASA out of the way, along with its hyper-inflated expenditures and self-defeating low flight rate assumptions, the way is becoming clear

We start with governments (plural)/contractors/corporations/enterprises/universities -- collaboration first on the web (virtual), then to a real prototype ILRP on Earth, and finally on the Moon, totally leapfrogging the small science go-nowhere dead-end, subject to cancellation at any time outposts to an International Lunar Research Station on the Moon, that can't be canceled by any one partner. *And as more and more civilians become employed at this (or these) locations we will see the morphing of ILRP(s) into the first real lunar industrial settlement(s).* I have put a semi-final version of Heck's talk on the web: www.moonsociety.org/ilrp/index.html Click on the link at bottom of this page

Of course, talking points are not all included. A dry run gives 25-30 minutes for the presentation, leaving 10 plus minutes for questions. Dave Dietzler and I will join Dave Heck in fielding questions.

This could be the development that catapults The Moon Society into the limelight and starts us growing at a substantial pace.

Getting from Phase I an ILRP on Earth to Phase II on the Moon will require a major paradigm change about how we think about Space Transportation. Space Transportation 1.0 where NASA and most all rocket scientists are stuck is based on the infamous mass-fraction rule which is "obviously true" only because it contains an unexamined supposition which turns out to be false. We already have a "piece" of Space Transportation 2.0 in Dallas Bienhoff's (Boeing, again) orbital refueling depot concept. We are giving Dallas recognition at ISDC and you can see a series of 4 videos on his proposal at:

http://gaiaselene.com/GASteroid/GASteroid.html

These videos are one of the more significant results of our Videotaping project at ISDC 2007. His proposal will highlight that the total of economic activity in Geosynchronous Earth Orbit is now over $200 B/yr, enough to rank GEO as #50 among nations (if it were a nation) in Gross Economic Product, and stresses the enormous capacity for GEO economic activity to grow with SPS, power relays, and giant telecom platforms *only by use of lunar resources* that can be shipped to GEO at 1/23rd the fuel cost of bringing them up the gravity well from Earth

So this ILRP proposal also becomes enmeshed with our efforts to advance Space Based Solar Power. We begin to see all the pieces fitting together. And we begin to see something else. TMS is leaving the ranks of "advocacy" to become an organization that is "making things happen."

Lets hope that in the next few years we can grow significantly as a result. TMS already has a percentage of active members 2-3 times that of any other grass roots organization. And I hope that we begin attracting more and more doers, as well as more supporters. And so we go into this year's ISDC with high expectations. **PK**

Sudden Vice President Vacancy Filled

Charles F. Radley who has served us well for the past three years, resigned as Society Vice-President, as his growing involvement in other efforts, notably the Puerto Rico Space Congress set for this October in San Juan, was taking most of his time.

During his tenure, Charles played a major role in our project to build a functioning solar power beaming unit, launched our Moon Society Yahoo Group, put the Society on MySpace, Facebook, Orkut, and Twitter, arranged for our Visa Platinum card, and much more.

Relatively new member, **Jason Tuttle** of Lenoir City, Tennessee (near Knoxville) already very active on our ASI-MOO chat room environment, volunteered his services. Jason is a full-time grad student, with wide experience including grant proposals.

The elections ballot had already been published as Charles announced his resignation. There was one year left to his term. So the Society Board of Directors at its May 19th quarterly meeting, unanimously accepted Tuttle's offer, appointing him to fill out the remaining year of Charles' term. He will be free to run for election to a full 2-year term at this time.

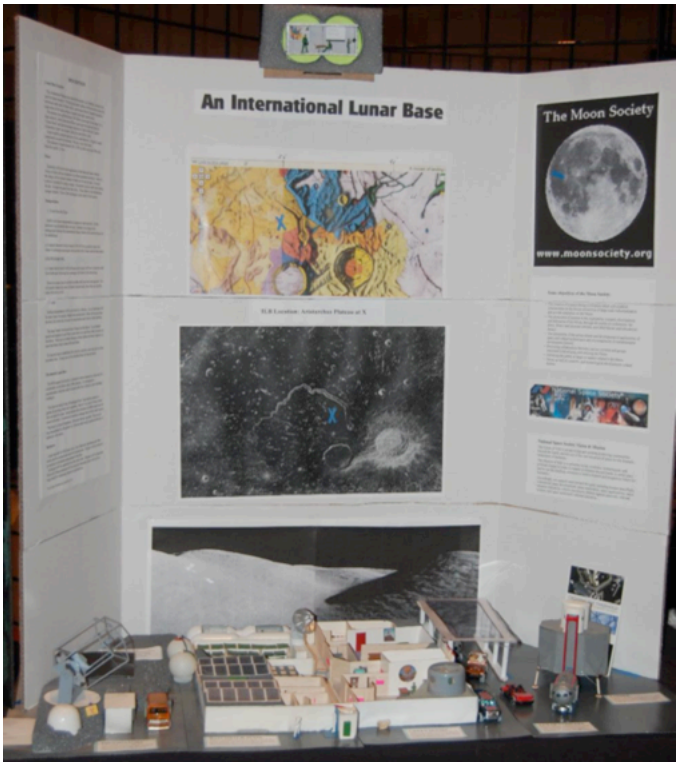
Jason, 31, also brings youth to the Board, joining James Rogers, 27, in this respect. The Board was impressed by Jason's achievements and resume, and we look forward to working with him.

The Office of Secretary Remains Vacant

Meanwhile, the Secretary post, most recently occupied by Annie Bynum of Little Rock, who had to resign as she had lost her internet services, remains historically the most difficult Office to fill, and keep filled. Taking minutes and keeping records is not an attractive or exciting job. But a they say, *"Somebody has to do it!"* Well not quite, as nobody has been doing it, and we have had to keep working without secretarial services.

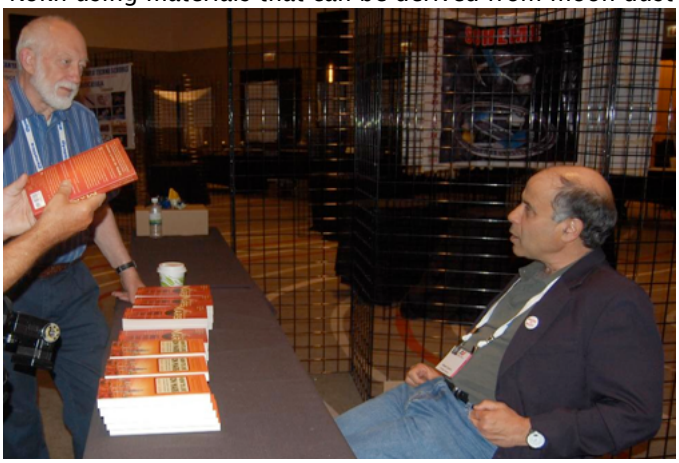
If you are interested in an interim appointment (until next election) let us know; kokhmmm@aol.com

ISDC 2010 Exhibit Room Photos by Ben Huset



Moonbase Exhibit by Director Fred Hills

Two new "**Regolith Impressionism**" paintings by Peter Kokh using materials that can be derived from moon dust



Peter discussing a matter of mutual interest with long-time colleague, now Mars Society President Robert Zubrin

This model of a modular lunar homestead was built by Peter Kokh for ISDC 1998 in Milwaukee, and has not been at a national event since then. Built of lightweight materials (2 plus 36x80" hollow core doors, PVC parts, and Styrofoam, it is still 80 pounds and takes two to lift.

The purpose of the model is not to show how astronauts could live on the Moon, but how pioneers could make themselves rather comfortable: tucked under a moondust blanket, but bringing the sun and moonscapes down inside with them. This was the star of the Exhibit room.

The model was inspired by a unique underground home, Terra Lux, some 20 miles NW of Milwaukee: see:

http://www.moonsociety.org/chapters/milwaukee/mmm/mmm_1.html

Cuttaway Detail revealing Wolverton Blackwater treatment system that fills a sunlit interior with greenery & fresh air.

Rugged battery operated Lunar Rover built by Moon Society member Tom Jacquish and sons (Fort Wayne, IN)

The Moon Society Chapters & Outposts Frontier Report

Chapters & Outposts Map (North America)
www.moonsociety.org/chapters/chapter_outpost_map.html

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>
Next meetings – June 16th, July 21st, August 18th
Meetings **3rd Wed** monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

Our April meeting was held on **Thursday the 22nd** as another group had reserved our usual time slot. Several of us (Dave Dietzler, David Heck, Robert Perry, and Jim Merriman) are getting ready to attend ISDC 2010 in Chicago at which Dave Heck will give a major **presentation in the Business Track** on the **International Lunar Research Park** concept. The slot is 5-6 pm, Friday 5/27.

Moon Society Phoenix Chapter

http://www.msphx.org
http://www.moonsocphx.blogspot.com/
Contacts: Craig Porter portercd@msn.com
Chuck Lesher: chuckmiester999@yahoo.com
Meeting the **3rd Saturday of the month**
Moon Society Phoenix' next meetings are on
Saturdays **June 19th, July 17th, August 21st**

Our official May 15th meeting was cancelled and we conviened an unofficial meeting at **Leprecon36**; the unofficial meeting was "held" **all three days of the Con**. Patti and Don were there with their Dealers Table for Weavers of Dreams www.weaversofdreams.com and Az Publishing Services LLC www.azpublishingservices.com.

Bonnie and David were also there working a MENSA SIG Table for the local group. All weekend long we had visitors stop by and look at our materials and just shoot the Bull with us. Also had people stop and just thank us for being there.

Don was introduced to the Program Chair, Nyki Robenson, for **CopperCon30** where he plans to present a program on "Commercial Space" and maybe even discussing a business plan to make it happen.

Our next meeting will be at Denny's the third Saturday of June at 3:00 PM, on the South East corner of US 60 and Rural Road. See you there.

Moon Society Houston Chapter

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

The Houston Chapter's next **regular meetings (every odd # month)** are scheduled for **Mondays July 19th and Sept. 20th** at Coffee Oasis in Seabrook, 4550 NASA Parkway at Kirby.

Once again, this will be a joint meeting open to members of the NSS and the Mars society. I do hope to see you there!

Whatever your desired level of participation, though, I encourage you to come to the meeting. See you there! -------- Eric H. Bowen

Moon Society Milwaukee Outpost (*meeting conjointly with The (NSS) Lunar Reclamation Society, publishers of Moon Miners' Manifesto)*

http://www.moonsociety.org/chapters/milwaukee/
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com

We have been busy the past month refreshing the Moon Society exhibit for ISDC 2010 Chicago, and also refreshing the Lunar Reclamation Society exhibits for the same event. The LRS exhibits include items created for ISDC 1998 Milwaukee, and an all new "Living Wall" working unit. We have more exhibits available but not enough space at ISDC for all of them. The MS & LRS exhibits will be adjacent to one another and should put on a good show.

Six MSMO/LRS members are registered for ISDC.

Chapters & Outposts Events Page
www.moonsociety.org/chapters/chapter_events.html

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

www.moonsociety.org/chapters/chapter_outpost_map.html

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

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

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

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

Milwaukee, WI **Outpost** (MSMO)
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com

The monthly Lunar Reclamation Society meeting on the 2nd Saturday afternoon every month serves MSMO also

NSS Partner Chapter News – pp. 17-19

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

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

Moon Society Mail Box Destinations:

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

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

< End Moon Society Journal Section >

GREAT BROWSING

How many Universes are there in the Multiverse?
http://www.physorg.com/news174921612.html

Aluminum as Rocket Fuel?
www.space-travel.com/reports/New_Aluminum_Water_Rocket_Propellant_Promising_For_Future_Space_Missions_999.html

Paul Spudis: Caves on the Moon
http://lunarnetworks.blogspot.com/2009/10/paul-spudis-caves-on-moon.html

Bidding war for major radio telescope
http://www2.skynews.com.au/tech/article.aspx?id=446635

Boeing-Bigelow partnership
http://www.space.com/businesstechnology/private-space-stations-bigelow-100120.html

Eight Wonders of the Solar System
http://www.scientificamerican.com/article.cfm?id=8-wonders

Cassini's upcoming ncounters with Saturn's moons
http://planetary.org/explore/topics/cassini_huygens/tour.html

Afe and weight of Saturn's Ring
http://www.space.com/scienceastronomy/cassini-saturn-ring-age-100406.html

New Robot Generation to Explore Moon, Asteroids '
http://www.space.com/businesstechnology/nasa-robot-moon-bonanza-100407.html

Seasons Discovered on Neptune's Moon Triton
http://www.space.com/scienceastronomy/neptune-moon-triton-seasons-100407.html

Coolest and Nearest Rogue Brown-Dwarf located
http://news.discovery.com/space/rogue-brown-dwarf-lurks-in-our-cosmic-neighborhood.html

NASA's New Thrust on Robotic Probes
http://www.space.com/businesstechnology/nasa-robot-moon-bonanza-100407.html

NASA to test repairing, refueling satellites at ISS
http://www.space.com/businesstechnology/on-orbit-spacecraft-refuel-sn-100409.htm l

Private Moon Bases a Hot Idea for Space Pioneer"
http://www.space.com/businesstechnology/private-moon-bases-bigelow-aerospace-100414.html

'RoboAstronaut' Headed to Space Station
http://www.space.com/businesstechnology/nasa-robot-joins-space-station-100415.html

Obama's Space Plan Revealed April 15th
http://www.space.com/news/obama-space-plan-fact-sheet-100415.html

"3-D Printer to Build Base from Moon Dust"
http://www.space.com/businesstechnology/3-d-printer-moon-base-100416.html

Atlantica Expeditions best ever undersea mission
http://underseacolony.com/core/briefings/MissionBriefing_04162010.html

Top 10 Hubble Discoveries
http://www.space.com/top10-hubble-telescope-discoveries.html

Saturn's Moon Titan Is Slushy Inside
http://www.space.com/scienceastronomy/saturn-moon-titan-slushy-100420.html

GREAT SPACE VIDEOS

MOON COLONY VIDEOS - The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) This month's selection below:

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

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

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

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

ASSORTED SPACE VIDEOS

NASA solar observatory (SDO) takes amazing images of the Sun *****
http://blogs.orlandosentinel.com/news_space_thewritestuff/2010/04/nasa-solar-observatory-takes-amazing-images-of-the-sun.html

Commercial orbital taxis won't have to **retrace NASA's footsteps**
http://www.msnbc.msn.com/id/36678222/ns/technology_and_science-space/

Hayabusa - 1st Asteroid Sample Return Mission
(and links to 19 other JAXA Videos)
http://www.youtube.com/watch?v=0nHxCQYA2PU

Moonbots Interview with Stevein Canvin from LGO
(with links to many other moonbot-related videos)
http://www.youtube.com/watch?v=-SqKFJOla3A

NASA's Orion Launch Abort Test
http://www.space.com/common/media/video/player.php?videoRef=SP_100505_road-to-pad-abort

George Whitesides, new CEO of Virgin Galactic on near term Space Tourism on SpaceShipTwo
http://www.youtube.com/watch?v=IirXVR4Ci6g

50 Online Places to Explore Space Online
http://www.onlinedegree.net/50-places-to-explore-outer-space-online/

"Do not go where the path may lead. Go instead where there is no path, and leave a trail."
- Mongolian proverb

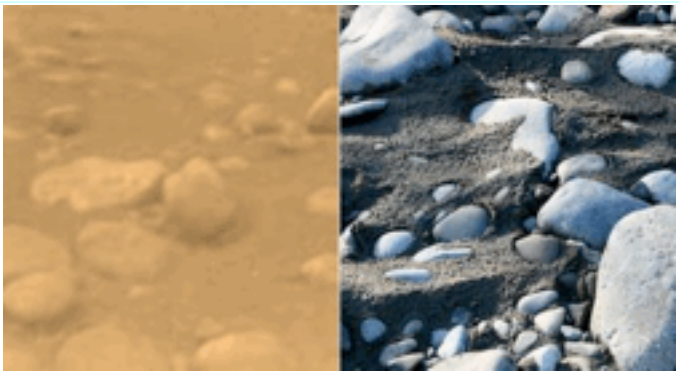
"No grimmer fate can be imagined than that of humans, possessed of god-like powers, confined to one single fragile world."
-- Kraft Ericke

"The excellent engineer knows when better is worse than good enough"

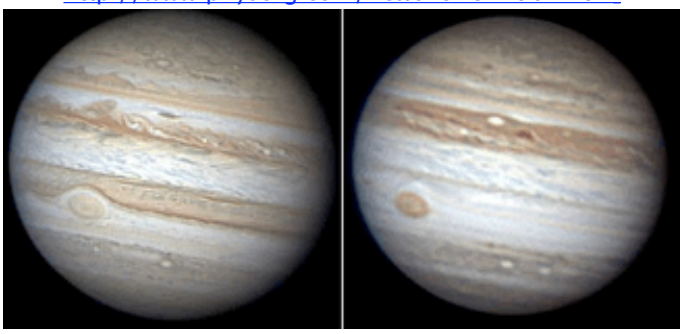
The cure for boredom is curiosity.
There is no cure for curiosity - Ellen Parr

"We're at our best when we're given our biggest challenges." - Rick N. Tumlinson

MMM PHOTO GALLERY

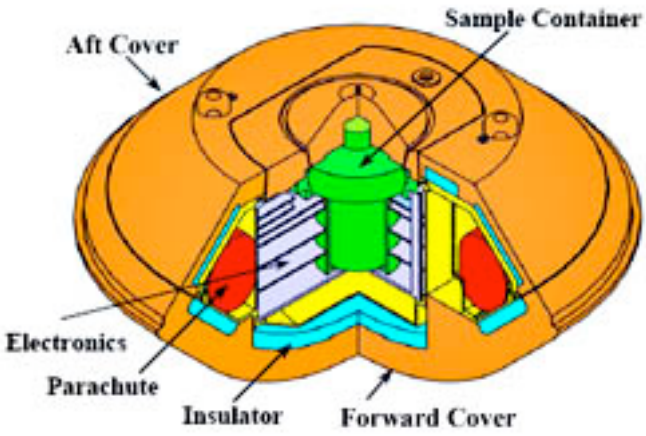


River Rocks on Titan?
http://www.physorg.com/news192812961.html



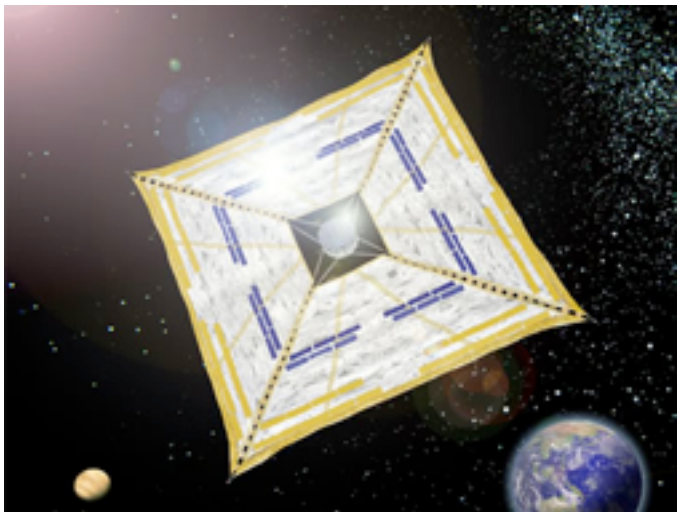
Jupiter Has Suddnely Lost its South Equatorial Belt!

Orbital Sciences "Cygnus" Cargo Carrier (to ISS)

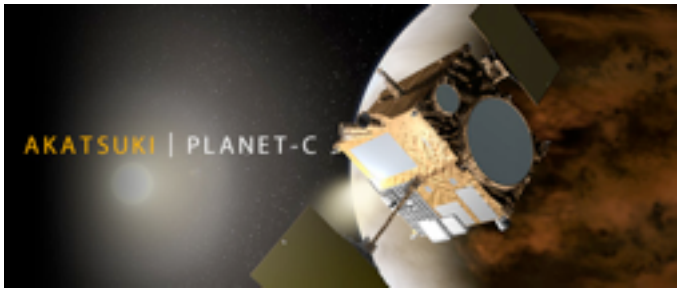


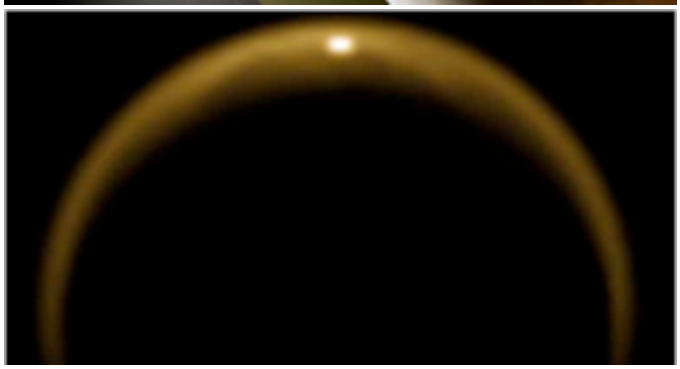
Hayabusa Return Capsule is expected to bring samples from **asteroid Itokawa** when it lands at Woomera Test Range in Central Australia June 13th. These would be the first samples returned from a body other than the Moon!
http://media.skyandtelescope.com/images/Hayabusa+capsule+cutaway.jpg

Orion "Lite" with less radiations shielding than needed for a trip to the Moon and Back may be parked at ISS as an Assured Crew Return Vehicle. Bigelow Aerospace is also interested in this lighter weight version for shuttling its crews to and from its inflatable space stations. Orion may be the only part of the Constellation system to survive.

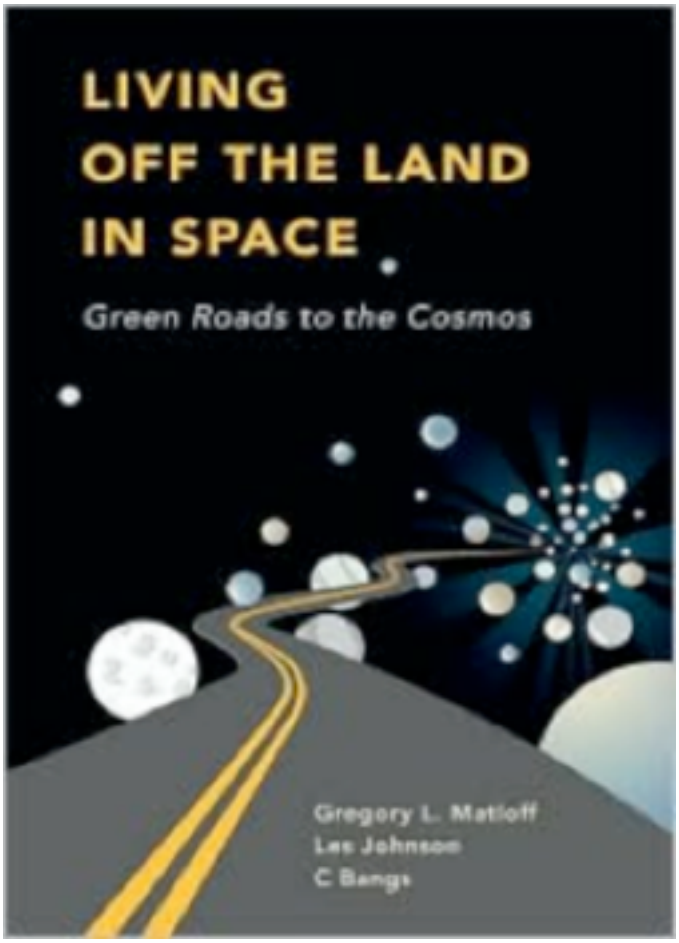


http://www.jaxa.jp/projects/sat/ikaros/index_e.html
Ikaros Solar Sail hitchws a ride to space with Japan's **Akutsuki** Venus Climate Orbiter (below) on May 17th





Reflection off **Kraken Mare**, a liquid sea, Titan's N Pole



"Living Off the Land in Space: Green Roads to the Cosmos"

by Gregory L. Matloff, Les Johnson, C. Bangs

Published June 2007: Publisher: Springer-Verlag, New York
Format: Hardcover, 247 pages
ISBN 13: 9780387360546 ISBN: 0387360549

Review By Ken Murphy

"Living Off the Land in Space: Green Roads to the Cosmos" by Gregory L. Matloff, Les Johnson and C. Bangs. Published in 2007 by Copernicus Books, a Springer/ Praxis imprint, it weighs in at 247 pages all in. A variety of editing errors are scattered throughout.

Judging from the title, one might think that this is a book on how to make use of the resources found by humanity on its path to the stars to achieve those ends. This is partially true, but we get something quite different instead.

In the introduction, the authors lay out a quick history for those "younger than 40 or so can be forgiven for imagining that space travel has always been with us". This would encompass this reviewer, who is considered part of the 'Space Generation'. It also examines some of the motivations that some might have to strive ever upwards and outwards.

Chapter one looks at 'The Old Frontier', the human history of migrations across our planet and some of the tools they used. This sets the stage for a look at some of the destinations to be found around our Solar system, which are examined in the next chapter "The New Frontier". The usual suspects, such as our Moon, Near-Earth Objects (NEOs), and Mars are visited, but also such farther afield destinations like the outer Solar system and trans-Solar space.

The next chapter turns its gaze to 'The Rocket and Its Limits', which lays out the fundamentals of how rockets work. Not only chemical, but also electric and nuclear/solar-thermal varieties as well. Ultimately, the authors are unsatisfied with such inefficient methods of traveling to and through space, and suggest there may be better alternatives.

We then turn to 'The First "Green" Space Technologies', here in the context of using existing physical phenomenÊ to achieve transport ends. One example is to use a planet's atmosphere to dissipate energy during a landing. Another is to use the gravity wells of planets to increase or decrease one's heliocentric velocity.

Using these basic "Green" tools we've sent a variety of probes throughout the Solar system, and the next chapter catalogues many of these. Once one has sent probes to the full checklist of planets, what's left but to consider probes to nearby stars. The next chapter looks at some of the concepts promulgated to date to propel our probes even further afield, from the Orion concept popularized by Freeman Dyson in the October 1968 issue of Physics Today, to the Daedalus concept that makes of the Bussard EM ramjet, to large-scale sunsails.

The history of human migration is not one solely of sending scouts out into the wilderness to report on what is beyond the next hill, but also of then moving beyond the next hill to make use of what is found there. In chapter seven the authors consider some of the ideas put forth to address how people will move into this next frontier in the human story. The most popular of these are the space cities popularized by Gerard O'Neill, who suggested they could be constructed by a combination of Lunar and asteroidal materials at the Earth-Moon L-5 point (EML-5). Having such space cities, and the industrial infrastructure to construct them, would help to enable a more robust program of Solar power satellites, one of the "green"est technologies around.

Chapter eight looks at 'Thinking Interstellar', and the mind-bogglingly huge distances that exist in space, and some of the studies conducted at NASA to address the transport issue, including one author's contributions to the Interstellar Probe mission. One factor inhibiting interstellar efforts is the capability of our current toolbox of technologies, so the authors then lay out the much-used concept of Technology Readiness Levels (TRLs), which provides a rough gauge of how mature a given technology is, from really cool idea to in current use.

One technology that has seen frequent use is the various aspects of aero-: aeroentry, aerobraking, and aerocapture and the distinctions between them. Another technology that as seen actual application is the ion engine, and chapter eleven provides a primer on how they work. A little further afield is the technological descendent of Hero of Alexandria's famous aeropile, the Solar-Thermal rocket. One technology that should be further along than it is at the moment is the Solar Sail, and chapter 13 gives a thorough overview of this concept.

In sending our probes ever further afield, we increase the possibility that something somewhere will

stumble upon one of our probes. Chapter fourteen examines the Interstellar Message Plaques attached to the Pioneer and Voyager space probes, which even now are approaching the heliopause, the transition zone to trans-Solar space. One suggestion offered for future efforts is the hologram, a very information-rich but low-mass solution. My question is how do they look under other wavelengths than the 400-700 micron range we see because of the light output of our Sun?

Next we look at space tethers, a favored solution in some space circles. The authors explain how an electrodynamic tether works, and how they can be useful for propulsion purposes in some circumstances. Not mentioned in the book, but a notable attempt to prove out the technology, were the efforts by MirCorp, the private lessees of the Mir space station, who were racing to export a tether up to the station to use to boost it to a higher storage orbit. The export license for the tether technology was approved the same day that the Russian government committed to de-orbiting the station. A relative of the electrodynamic tether is the Momentum Exchange Electrodynamic Reboost (MXER) tether, which can be used to maneuver payloads between higher and lower altitude orbits.

Chapter sixteen revisits chemical propulsion, and how various planetary and small body resources can provide a Solar-system-wide network of chemical propellant delivery, while seventeen looks at how aerocapture, Solar-electric propulsion, Solar-thermal propulsion, Solar sails, and space tethers can be used to support human exploration of the solar system. Next up is some of the ideas for Earth defense from the various detritus scattered around the Solar system.

Chapter nineteen looks at the topic of space miners, noting the long tradition of smelting and metalworking in human tradition. The chapter looks at possible locations for near-Earth resources, starting at the Moon and then the NEOs, paying particular attention to the Atens. Chapter twenty looks at exotic propulsion methodologies like plasma sails, magnetic and antimatter propulsion, and even more bleeding edge technologies like antigravity and zero-point energy. All of which is merely preparatory to the topic of the last chapter, voyages to nearby stars.

All in all, the book really seems to focus more on propulsion and transport technologies than anything else. The flow of the read is a bit back and forth as the topics jump around a bit from chapter to chapter. If you're looking for a book on In-Situ Resource Utilisation (ISRU) and how to actually 'live' (the stuff that human beings do) in other places around the Solar system, then this probably isn't the book for you. If you're looking for an overview of some of the less familiar space transport technologies, and how some of the 'stuff' that's out there in the Solar system like Solar wind and magnetic fields can help facilitate those transportation technologies, then this book is a good place to start.

On a scale of L-1 to L-5, this one gets an L-3. **KM**

Ken Murphy is an avid space enthusiast living in the Dallas area and he maintains a comprehensive and ever-growing bibliography of bookd on the Moon and on Space in general. You will find it at:

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

MMM thanks Ken for this comprehensive review.

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

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LRS News

● **Our May meeting continued preparation for ISDC in Chicago**: James Schroeter took on the task of creating a quarter scale working model of a Living Wall system, with Peter Kokh preparing the accompanying trifold exhibit. Peter is going to revisit his experimental "regolith impressionism" paintings, this time painting on a sand-blasted face of a glass pane.

Our big 36"x80" lunar homestead model will be making its first public appearance in at least nine years. The LRS exhibit will be adjacent to the Moon Society one.

Peter, Charllotte and Gene, Bob Bialecki, and James Schroeter will be attending, Dennis Groves had registered but got called out of the country to visit his dying father in South Africa.

● **A Field Trip for this summer?** We used to hold a field trip to someplace interesting, plus a pot-luck picnic every summer. But we had gotten away from this. This summer we are planning our 1st Field Trip in a while. See below.

● **Our lunar-reclamation.org web site may not be recoverable.** We are now using:

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

LRS Upcoming Events
(No meetings in July/August)
Saturdays: 1-4 pm

June 12th -|-|- September 11th - October 9th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA: Report on ISDC 2010, Space News, etc.
www.moonsociety.org/chapters/milwaukee/meetings.htm

July Field Trip - Date TBA

It has been awhile since we did a summer field trip!

This summer we are planning to visit the "Growing Power" complex at 5500 W. Silver Spring Drive, with dates and other details to follow.

http://www.growingpower.org/our_farms.htm

News & Events of NSS "MMM" Chapters

Space Chapter HUB Website:
http://nsschapters.org/hub/

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

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

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings 6:15 PM on Tuesdays
June 29th, July 27th, August 24th, September 14th
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

ILLINOIS

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

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

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

WISCONSIN

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

c/o Will Foerster 920-894-2376 (h) astrowill@tcei.com
SSS Sec. Harald Schenk hschenk@charter.net
>>> **DUES:** "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020
[http://www.tcei.com/sss/]
• We meet the 3rd Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI
Jun 17th - Aug 19th - Oct 21st - Dec TBA

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
Jun 19th, Jul 17th, Aug 21st

MINNESOTA

Minnesota Space Frontier Society
c/o Dave Buth 433 South 7th St. #1808
Minneapolis, MN 55415
David Buth (w) (612) 333-1872, (h) (763) 536-1237
Email: info@mnsfs.org
www.mnsfs.org/

Proud hosts of the MDRS Web Cams
http://freemars.org/mdrscam/

Calendar: MN SFS 2010 Past & upcoming chapter events
www.freemars.org/mnfan/MNSFS/2010-12-Review/

- May 27-31, Chicago ISDC: several of us are going
- June 14th MN SFS Meeting
- July 1st-4th Connie's Quantum Sandbox @ **CONvergence 2010**
- July 12th, 2010 MN SFS Meeting
- July 29th, 2010 ISS-23 / STS-134 Display
- July 30th - Aug 1st **Diversicon 18**
- Aug 5th-8th, 13th Mars Society Conf. Dayton, OH http://www.marssociety.org/portal/c/Conventions/2010-annual-convention/
- Aug 9th, 2010 MN SFS Meeting
- Aug 13th-15th,2010 NorthWoods StarFest

Pix: STS 131 Display

PENNSYLVANIA

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

c/o Earl Bennett, Earlisat@verizon.net
215/633-0878 (H), 610/640-2345(W)
[http://pasa01.tripod.com/]
http://phillypasa.blogspot.com

● **PASA regular business luncheon/formal meeting 1-3 pm**, the **Ist Saturday of every month** (unless otherwise specified) 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/Mitch 215-625-0670 to verify all meetings.

Next Meetings: June 5th, July 11th (2nd Saturday to avoid the July 4th holiday), **Aug 1st**

Meeting times and locations: We will meet on June fifth, July tenth and August fifteenth (a Sunday) at our regular meeting location at the Liberty One Food Court. We meet from one to three p.m. and will put up a table display, such as an N.S.S. poster or Lunar Prospector labeled briefcase standing on a table, to indicate where we are on the seventeenth street side of the Court. In addition to these meetings, Mitch has received an invitation for us to be at The Franklin Institute for there Lunar Landing Event, which will be great, as there is a lot of interest in robots exploring the Moon in the near future (Lunar X Prize).

Our meeting was well attended, with eight people coming including Hank Smith and our two associate members: Janice and Wallace. Due to circumstances, Hank is also an associate at this time but still reports on the Science fiction events here and in other areas. He is waiting on an appointment.

As part of the science programming team for the next Philcon Convention (November 19 to 21 at The Crowne Plaza Hotel, Cherry Hill, NJ), Hank says this years chairman will be Todd Dashoff, who has helped run the event in the past. Hank may or may not attend the great Balticon convention around Memorial Day weekend. However: he is looking forward to the 2011 World Science Fiction Convention, which will be in Reno!

Our report from Larry included an update on our picture gallery (which now includes the Empire State Building in a Lava Tube display (rev. 1.0)) and some other shots from Michelle Baker. He also commented on using Facebook, which has a PASA site and which he and Dorothy also both have a presence, and the possibility of Facebook charging for particapation in the near future We voted against using it if it charges. Larry will soon work on upgrading both PASA's and Dorothy's sites through the use of something called Cascading Style Sheets that should make accessing various parts of the sites easier.

Dorothy reported on events in our area and the Washington/Baltimore region as well as giving me a copy of her Dotty's Dimensions, a mix of travelog & commentary on various activities she is involved in including our group! Contact her at dottymk@yahoo.com, or see the website: http://members.tripod.com/lp_web4us/ For May and June she brought a listing of a number of book signings for the Smithsonian including one for May 29: Beyond: Visions of the Interplanetary Probe, with author Michael Benson at the Gallery 101 Museum Shop from one to three p.m.. Another event of the Smithsonian is a star party in June: Skywatching at Sky Meadows State park on June fifth. This costs five dollars to park at the Virginia location (near Paris, Va.). Other events included movies and planetarium shows, both at the Smithsonian sites and those connected with the Maryland Science Center. I should point out that we will have new shows at The Franklin Institute and The Academy of Natural Sciences and events in the near future.

We had a surprise visit from Dennis Pearson who will be going to the ISDC on Memorial Day weekend in Chicago. He lamented the lack of support for the Solar System Ambassador program, which he joined last year, but will continue his personal outreach activities. His trip to the ISDC will be a stepping off point for other activities including a later visit to Boeing's Seattle site. Go Dennis!

Mitch brought us some of the invitations noted above, and a revised members list that should be sent on to M.M.M. for subscription purposes. We are a rather small organization at the moment and will have to improve our local membership pitch. To help us do this, Mitch is working on the college student aspect again, and has asked us to look out for any new space books we could get the authors in town for signings at Boarders or Barnes and Nobles stores in our area, or at the center city main library. And, for the fall, we are invited to the Franklin Institute for International Space Day in October. Mich also brought handouts on both the President's plans for the space program, including a piece from the Wednesday, April 14 Philadelphia Enquirer on Obama keeping the space capsule of the cancelled Constellation program (by Seth Borenstein and Marcia Dunn), and, from the April 21st paper, the opinion of Derrick Pitts, Chief Astronomer of the Franklin Institue, on Mars as a lofty goal for NASA: " Obama's Space Plan is right to reach for Mars"

Janice is continuing her work on getting more on Apopsis and the possibility of diverting in during its "close" approach to Venus in the next decade. We began discussing impact energy again, with the size of the asteroid and a reference size impactor, the object that created Meteor Crater in Arizona (house size), and what this would mean to the world. Since we considered an American football field sized object, at 30 mps, it could cause considerable damage on most of its projected impact paths. That is very preliminary, as the data to refine these possibilities won't be available until the 2020s or 2030s (impact in the 2036 time region). She will post a NASA report from a researcher on our blog site soon. The deflection idea is nice but, at least at present, requires a national or international effort. Remember, even if it is made of ice at one gram/cc, it weighs 1000 kg per cubic meter, about a ton, so a simplified mass estimate is 72 million kg. As can be seen from this: the sooner deflection starts the better. Check the PASA blog for a more knowledgeable assessment of this subject.

Earl brought a variety of material on a number of technology-oriented subjects including: an ad for a new

3D printing device for making prototypes and feasibility models of software described objects. This device, which can produce printed objects that are 33% larger than could be made with the advertisers previous unit of the same size, works with a plastic material that is put down in layers to make what you describe in your computer aided design files. The Uprint Plus Personal Printer, from Dimension Printing, starts at $19,900 and fits on an engineers desk top. Dimensionprinting.com/pdd3 for more. Also: from the May Sky and Telescope in the "Exploring the Moon column is a report on recent lunar data from several probes and its analysis using different tools (page 51, by Charles A. Wood), and a discussion of new software on page 55, by Paul Deans, called Lunar Discoverer (for both the Mac and P.C.). This is a test report, and the author notes that the software doesn't take libration into account. In spite of this and a few other points Paul will be using this program for doing observations. Versions: basic at $44.95, Deluxe: $59.95.

From the March/April Amsat Journal are several interesting reports, including on the annual meeting for 2009 in Baltimore, which includes a commitment to get more small satellites launched, progress on the ARRISat-1 project(pages four to six) which will be launched from the Space Station this year (it will include two slow scan cameras), an article on a beginner trying to use one of the newer satellites, AO51, on page eight. And from this publication: Gems from the past: UoSAT-Oscar-9 CCD Image Display- 22 years After Reception, by John A. Magliacane. John recorded, on tape, and examining it with modern software after all that elapsed time. Much historic technical detail and a few images to show what we used to hope to see back them. The satellite was built at The University of Surrey, England, by the Electronics and Electrical Engineering Department, pages 26-7. And several articles on energy related topics: from the May Electronic Products: Thin-film Thermoelectrics Cool Optoelectronics, by Dave Koester of Nextreme Thermal Solutions.

These devices, Thermoelectric energy converters, can be used to move heat away from, or to, a place using electric currents, or use thermal differences to generate electrical differences (current flows). This application is to keep the operating wavelength from changing as the ambient varies from some cause. Constructing the device using thin film techniques holds the potential for larger areas of application through automated mass production.

From Wireless Design magazine for March/April a background report on what energy harvesting is, by Michele Kinman of the Energy Harvesting Forum. The full article is at the magazines website, but the short form mentions the use of thermoelectric effect as a power source, piezoelectric (usually piezobenders) generators, and the ever popular solar panels.

And lastly: from the Brainstorm section of Product Design and Development magazine this spring " How can we make solar panels more efficient" with a number of contributors with there thoughts on improving the *overall* efficiency of a solar power system. One author, Steve Liker of Trident Solar, describes using ink jet printer technology to economize on the application of the diffusion and contact making material used to make the cells.. This report some background on what it takes to make a working solar power generator, and this applies to many of our space borne systems as well. See the ECN magazine website for more. I am currently revising the Empire State Building in a Lava Tube display. Submitted by Earl Bennett.

CALIFORNIA

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

Meeting the 2nd Sunday monthly
Next: Jun 13th, Jul 11th, Aug 8th , 2:30-4:30 pm
Serra Mesa Branch Library 9005 Aero Dr, San Diego
Quarterly Newsletter: ***The Bussard Scoop***

CALIFORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS
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Events Hotline/Answering Machine:(310) 364-2290
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Regular Meeting 3 pm 3rd Sat. each month
Next Meetings: Jun 19th, Jul 17th, Aug 21st
thInformation: OASIS Hotline, 310/364-2290; website.

Saturday, June 12th, 1:00 pm. OASIS Board Meeting, Long Beach Public Library - El Dorado Branch, 2900 Studebaker Road Long Beach, CA 90815.

Saturday, June 12th, 3:00 pm: OASUS Lecture; "Space Shuttle Retrospective" by Edward McCullough, Boeing (retired), same location

Monday, June 14th, 7:30-10:00 pm. Los Angeles Astronomical Society General Meeting. Leonard Nimoy Event Horizon Theater, Griffith Observatory, 2800 East Observatory Road, Los Angeles, 90027

Thursday, June 17th, 6:30-8:30 pm. Burbank Sidewalk Astronomers. Observing: Public Star Party. Chandler Vlvd Bike Path, at Lima Street in Burbank.

Friday, June 18th, Meet at 5:45 pm, OASIS Event: **Tour of SpaceX**, 1310 East Grand Avenue, El Segundo, CA 90245

Saturday, June 19, 3 pm OASIS Board Meeting - Home of Bob and Paula Gounley, 17381 La Paz Road, Altadena.

July 1-4, Westercon 63, Pasadena Hilton, Pasadena - We'll once again have a fan table and be doing space programming for this convention. Come join us!

Saturday, July 17, 2010, 1 pm - OASIS Board Meeting Followed by Anniversary Potluck, Polliwog Park, Manhattan Beach, CA

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.
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- $1/extra family member

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