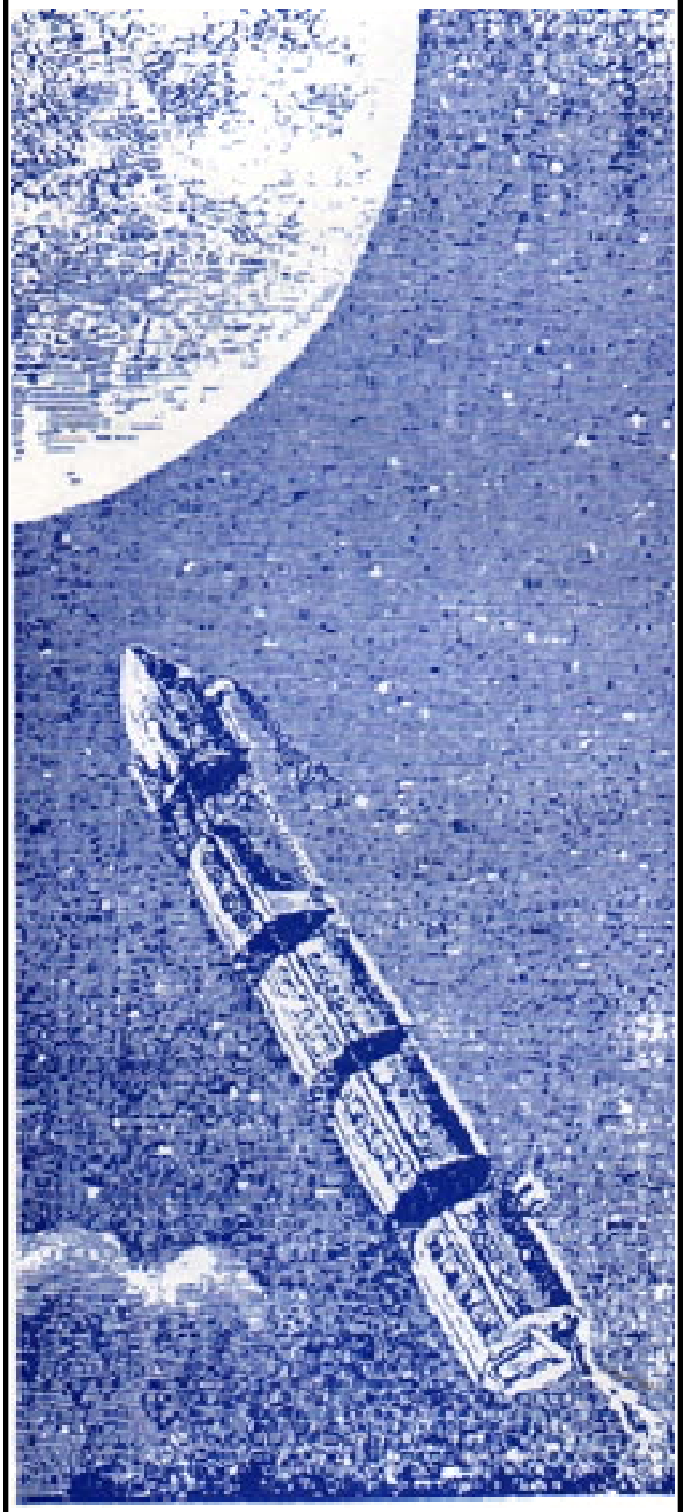
Moon Miners' REVIEW
& Moon Society Journal



#32 July 2003

In This Issue

The **Moon Miners' REVIEW** is published semi-annually each January and July by and for the members of the **Moon Miners' Manifesto** family of **National Space Society** chapters, for the members of **The Moon Society**, and for individual subscribers worldwide.

The REVIEW provides a semi-annual burnout prevention and regeneration break for **Moon Miners' Manifesto**'s editor.

Moon Miners' Manifesto will return next month (August, 2003) with issue #167.

E-mail: KokhMMM@aol.com

E-mail submissions preferred *with text in the body of the message,* not *as an attachment.*

Hardcopy submissions: MMM, c/o Peter Kokh,
1630 N. 32nd Street, Milwaukee WI 53208

Fundamental Planning Issues for a Lunar Police Operation

http://www.asi.org/adb/02/11/01/planforcops.html
by Robert Lancaster < Fixerbob@worldnet.*att.net*>
Printed with Permission of the author

The first essay of this series, "The Need for Police in a Lunar Community" [http://www.asi.org/adb/02/11/01/needcops.html] looked at the "why". Now, we'll look at the "when", the "who", and some of the "how". Assump-tion #1: The decision is made that a Law Enforcement presence is or will be needed. Assumption #2: This decision has been made before the outpost is at a point where the need is immediate, because several of these issues need to be worked out well in advance to allow for research, development, planning, and in some cases legislation.

The issues to be considered are:

1. At what point in the outpost's development should a police entity be put in place?
2. How large should that police entity be?
3. What level of legal authority should they have and
   3a. What is the source of that authority?
4. What levels of force should they be capable of employing?

In these issues, some or all of the following factors can be considered, to varying degrees:

A. Population size, composition, and activities
B. Insurers'/Stockholders' mandates
C. Wants of the on-site community
D. And, as unlikely as it seems now, any potential external threats from individuals, groups, or other nations
E. Other specialized factors from an analogous example in modern University Law Enforcement [1]

1. When to put a Police entity in place

"Management" can decide when the population reaches a point where it is beyond the span of control of a single mission commander or base manager, but the matter is too complex to set simple threshold values on population size; people who share similar backgrounds, culture, and values are likely to need police less than a more diverse group of the same size. Edward Hudgins, in his paper "Martian Law" presented at the Mars Society Founding Convention, describes something similar as the "sense of community" [2]. Activities undertaken by the population are a planning factor from the standpoint that mining and processing Lunar Thorium into nuclear fuel will likely be more sensitive than other activities.

The mandates of insurers and stockholders will be in the interest of reducing their liability and risk. There will obviously be substantial investments of capital here, and the remote and hostile nature of the environment makes safety and security a prime concern.

While some people would not think so, the wants of the on-site community must be considered in the planning, because modern law enforcement is a joint effort between the serviced community and the policing agency in order to be successful. This is another example of Hudgins' "sense of community".

Potential external threats is a broad term encompassing both the visitor from the neighboring outpost and the possible military or security personnel from other spacefaring countries.

RECOMMENDATION FOR PLANNING: "Management", in a development Master Plan, should have criteria established in advance to determine what milestones drive further planning for, and finally emplacement of a police entity. There should also be enough flexibility in the planning to allow rapid response to unforeseen developments or threats. In "The Lunar Base Handbook", four phases of Lunar Base Development are discussed; the Precursor, Pioneering, Consolidation, and Settlement phases [3]. Using this timeline, one could establish a milestone for police presence towards the end of the Pioneering or beginning of the Consolidation Phase.

For the next three issues, valuable insight can be gained from the evolution of modern University Campus Law Enforcement; in a campus environment, the police are a "Special Entity" agency, apart from the regular city, county, and state agencies. Many of the issues faced in their development can be used as examples for our discussion here.

2. How large should the Police entity be?

This is a complex question as well, because there is no simple ratio of X population to Y police officers. In "Campus Security and Law Enforcement", Powell discusses the following factors to help determine the size of a department [4]:

- General layout, because a self-contained area is easier to protect.
- Nature/Type of terrain can provide natural buffer zones between different elements of a community. Here, the local environment is an ultimate natural buffer between Colony A and Colony B, which might be near each other but not connected physically.
- The type of security operation. This will be covered in more detail under the question of authority; ordinarily, a low-level guard operation requires fewer people than a department of commissioned officers because outside law enforcement agencies are available. In this discussion, the degree and effectiveness of outside police coverage depends on another settlement having a police agency of sworn officers or a government agency, possibly U.S. Marshals or Coast Guard (as has been a postulated future role for them), being in place.
- Age, type, and architecture of buildings. Here, the point is that newer structures are easier to secure because different aspects of physical security have been or will

be incorporated into their design. This can certainly be done with a Lunar settlement.

- Electronic Protection Devices. Sensitive areas being covered by alarms, access control, and CCTV reduces the number of personnel necessary because an officer can be rapidly dispatched to investigate versus being posted there full-time.

The population's activities will drive the staffing level depending on any critical biological, chemical, nuclear, or other assets requiring protection. Also, the external factors of insurers'/stockholders' mandates and potential threats will possibly also have an impact.

RECOMMENDATION FOR PLANNING: Based on all these factors, we can start to figure our staffing size by focusing on the physical size and layout of the facility. The physical space can be broken down into individual patrol zones whose sizes are such that it will take an officer no longer than a specified period of time to respond to an alarm or emergency call. The general rule of thumb is no more than 5 minutes, but the distance covered in that time will be greatly affected by the nature of the structure (airlocks, hatches) and how fast one can move in a 1/6th G shirtsleeve or pressure-suited environment. The number of patrol zones will give us the number of patrol officers per shift, but we also need to ensure 24-hour coverage. While the shift schedule might be different in a Lunar environ-ment, let's assume for the sake of discussion that we use three 8-hour shifts for 24 hour coverage of X number of patrol zones. Does that mean 3 times X officers? Not quite, because we have to consider days off, vacation, and sick time. We need to start with 5 times X officers [5], and that's not including supervisory and support staff yet.

3. What level of authority should these officers have?

Again, referring to Powell, there are 5 basic approaches to security. Watchman/guard operations, Contracted guard services, Contracts with local police agencies, Proprietary security departments, or Proprietary police agencies [6]. Powell's factors to weigh for the need for police authority focus largely on the differences between police arrests and citizen's arrests. Without police auth-ority, security personnel have no more arrest authority for crimes committed in their presence than the average citizen and this creates liability for claims of false arrest and imprisonment, battery, assault, etc., as well as jeopardizing otherwise solid court cases [7].

The citizen's authority for arrest for crimes not committed in their presence is also much more limited than a police officer's and again opens up liability for false arrest and imprisonment and unlawful use of force. With only citizen's arrest authority, arrested persons can only be detained pending release to an appropriate police agency, and there are no provisions for longer term detention or questioning.

Citizen's arrest authority does not authorize the use of force to the same extent as police authority.

Finally, the complexity of the laws and the consequences of not fully understanding them creates liability which could be easily reduced with the use of well-trained commissioned police officers.

RECOMMENDATION FOR PLANNING: This is one of the most important of the four key issues. Based simply on the remoteness and need to be self-sufficient, a propri-etary police agency is strongly recommended. This is easier said than done, as we will see next, because there's one thing needed to grant that level of authority, and that is a body of government.

3a. What is the source of that authority?

The settlement will very likely need police services before it has matured and developed into an independent city-state, with it's own elected officials, therefore some mechanism for establishing the authority of that police agency has to be developed.

Other professionals such as doctors and lawyers must be licensed by some recognized authority before they can do their jobs. In the case of police officers in the state of Texas, there is the Texas Commission on Law Enforcement Officer Standards and Education (TCLEOSE) [8], which licenses people to perform the job of police officer. Since it is assumed that the settlement will also need doctors and lawyers on-site during it's period of pre-independence, those individuals will have to be licensed by authorities back on Earth. The same licensing can be done for the settlement's police officers, but there are some legal issues to be worked out, involving the need for a body of government to carry that officer's commission.

First, let's expand on why police officers need official government authority to do their jobs. Quite simply, it's in order to secure the "consent of the governed" and to provide the necessary oversight to ensure that everything is done legally and people's rights are protected. For example, if an individual were to be detained and evidence discovered without legal authority, an otherwise valid case against the person could be jeopardized. Likewise, an innocent person might be unjustly accused. Official authority, therefore, establishes police as "public servants", protects individual rights and provides some measure of protection against liability for the organization.

The ultimate source of that authority is the people, and we derive the "consent of the governed" as follows:

In the United States, for example, we start with the Declaration of Independence, then the U.S. Constitution, followed by state constitutions, and finally statute and case law. It's helpful to look at each of these before any further discussion of off-planet analogues.

The Declaration of Independence - Here, it states that authority of a government stems from the consent of

the governed; "Governments are instituted among men, deriving their just powers from the consent of the governed."

The U.S. Constitution-Authority here is stated in the preamble where "We the people of the United States" "establish justice" and "do ordain and establish this Constitution for the United States of America". The Constitution, especially the Bill of Rights, establishes the rules by which the government must operate-it's authority and the limits on that authority.

The State Constitutions-Essentially, these are reiterations of the U.S. Constitution but with variations specific to each state. The source of authority here is again based on the consent of the people.

Statute Law-These are the laws passed by legislatures at the city, county, state and national level.

Case Law-When a court of law makes a decision on a case brought before it, case law is made. It serves as a precedent against which future conduct in similar situations is compared.

Now back to the lunar scenario. An individual employed by the settlement might be licensed as a police officer back on Earth just as the doctor or lawyer, but in the case of the police officer, he or she must be employed and commissioned by some body of government (i.e., elected officials, in order to have the "consent of the governed") to be able to act as a police officer.

In the example of campus law enforcement, this problem has been solved with state-level legislation [9]. Both state and private institutions can have proprietary police departments with full police authority within their jurisdic-tions. If we look at the example of Texas in the United States, we see the following in their statutes:

From the Texas Code of Criminal Procedure:

Art. 2.12. Who are peace officers.

The following are peace officers:

(1) sheriffs and their deputies;

(2) constables and deputy constables;

(3) marshals or police officers of an incorporated city, town, or village;

(4) rangers and officers commissioned by the Public SafetyCommission and the Director of the Department of Public Safety;

(5) investigators of the district attorneys', criminal district attorneys', and county attorneys' offices;

(6) law enforcement agents of the Texas Alcoholic Beverage Commission;

(8) officers commissioned under Section 37.081, Education Code, or Subchapter E, Chapter 51, Education Code;

(12) airport security personnel commissioned as peace officers by the governing body of any political subdivision of this state, other than a city described by Subdivision (11), that operates an airport that serves commercial air carriers;

(16) officers commissioned by a board of trustees under Chapter 341, Acts of the 57th Legislature, Regular Session, 1961 (Article 1187f, Vernon's Texas Civil Statutes);

The whole list is rather long, and none of the situations are immediately applicable in this context. However, paragraph (8) allows educational institutions to have police departments and paragraph (16) upon further reading discusses port authorities used to commission peace officers. This shows how acts of legislation can create specialized niches in the law for what are referred to as "Special Entity" police agencies, even those agencies working for private institutions. This level of authority also helps establish the "rule of law" as the officer's top priority in the event of contradictory, unethical, or illegal guidance from their employers. In "The Moon: Resources, Future Development, and colonization", there has been discussion of Lunar and Space Economic Development Authorities, in comparison to the Tennessee Valley Authority; these are possible sources of law enforcement authority [10].

RECOMMENDATION FOR PLANNING: Assuming we are granting full police authority to our Lunar police officers, let's consider the following scenario specific to the Moon Society and the Artemis project:

Given:

1. Lunar Resources Company is incorporated in the state of Texas and functions as the parent corporation/business entity for the project.
2. The Texas Code of Criminal Procedure, as shown, defines numerous specialized categories of Peace Officers.

Proposal:

The creation of a Texas Spaceport Authority, with enabling legislation in the Code of Criminal Procedure to create a new category of Peace Officers with specific jurisdiction over state spaceports, aboard private or state-owned spacecraft (while anywhere off-world) licensed, launched, or recovered in Texas, and at any off-world facility owned or maintained by any business entity incorporated in the state of Texas. Peace Officers working for private companies would also be commissioned under this authority, but their primary jurisdiction would be limited to property owned or maintained by their employer. Training and certification of peace officers will be in compliance with TCLEOSE rules and regulations. Also, the Spaceport Authority would have to maintain some sort of oversight of private-sector law enforcement to ensure the priority of "rule of law". Either way, specialized peace officers in this area will be vital given the highly technical and potentially hazardous endeavor they are charged with protecting.

The governing board of directors for the Spaceport Authority, through their officers, enforces the Texas Statutes and other localized rules and regulations applicable to the highly specialized environment. The off-world, as well as the terrestrial, locations could be freed of the burden of

numerous regulations and especially taxations in order to stimulate development and start over with a clean slate. Particularly with the off-world locations that could eventually develop into independence, I refer again to Hudgins [11] and the idea of starting over with the basics such as murder, theft, etc. in order to minimize regulation.

To the question of "What about individuals not of the United States", it could be a matter of establishing the following as a condition of employment/residency at Artemis Moonbase: "I understand and agree to abide by the laws, rules, and regulations either assimilated from the statutes of the parent-company state or those locally implemented" Again, we're not talking about a huge book of statutes.

4. What levels of physical force should be available for use?

One of the first tools needed by a police officer is the authority and ability to use some form of force to affect arrests, prevent damage or destruction of property, and protect lives, including his or her own. A wide range of options is needed to cover various scenarios, so the modern use-of-force continuum for law enforcement consists of the following:

Officer Presence: The simple on-scene presence of a uniformed officer is considered a use of force because of the implied potential for the use of physical force.

Verbal Commands: Also considered a use of force because of the implication that failure to follow verbal commands will result in physical force.

Open-Hand Techniques: These are the apprehension and restraint techniques used to put an unarmed but physically combative subject under arrest.

Non-Lethal Techniques and Weapons: Non-Lethal is a misnomer and no longer the accepted terminology because any non-lethal method applied incorrectly can easily be lethal. The more accurate term is Less-than-lethal, or Less-lethal. These methods include impact weapons such as batons and beanbag rounds, chemical agents such as Mace and Pepper spray, and electrical stun guns and Tasers.

Lethal Force: This is the last resort. It can be used if other measures have failed, or more likely, if immediately confronted with a lethal threat and there is no time to employ intermediate measures or those measures would obviously be ineffective. Unfortunately, lethal force is necessary because it is currently the only established, proven way to guarantee the immediate and complete incapacitation required to stop a person from pulling a trigger, detonating an explosive, or anything else which is immediately catastrophic. Imagine the perpetrator in a pressure suit who is about to irreparably damage a power or life support system or cause an explosive decompression; they would likely be invulnerable to less-lethal measures, even some lethal measures given the ballistic protection a spacesuit can provide.

RECOMMENDATION FOR PLANNING: Police Use-of-Force differs greatly from that of the military, because the primary objectives of the police are to keep the peace and bring offenders to justice. The least amount of force necessary to accomplish those objectives is there-fore the rule, so the use of lethal force must be kept as an option. Proper arms and ammunition selection can be used to minimize any danger to the enclosed environment or others.

CONCLUSION: The four initial planning issues discussed are the most critical requiring workable answers well in advance because of their potential to cause problems if not adequately addressed in time. There will be enough unanticipated issues arising in this process; the more we deal with the ones we know about now, the better.

It also serves us well to learn the sometimes bloody lessons of previous frontier expansions where law enforcement was an afterthought.

FOOTNOTES

1. John W. Powell, Campus Security and Law Enforcement (Boston: Butterworth Publishers Inc., 1981)
2. Edward L. Hudgins, Martian Law (Proceedings of the Founding Convention of the Mars Society, 1998) 849
3. Peter Eckart, The Lunar Base Handbook (New York: McGraw-Hill, 1999) 225
4. John W. Powell, Campus Security and Law Enforcement (Boston: Butterworth Publishers Inc., 1981) 68-69
5. John W. Powell, Campus Security and Law Enforcement (Boston: Butterworth Publishers Inc., 1981) 70
6. John W. Powell, Campus Security and Law Enforcement (Boston: Butterworth Publishers Inc., 1981) 19
7. John W. Powell, Campus Security and Law Enforcement (Boston: Butterworth Publishers Inc., 1981) 79
8. WWW.TCLEOSE.STATE.TX.US
9. John W. Powell, Campus Security and Law Enforcement (Boston: Butterworth Publishers Inc., 1981) 81-83
10. David G. Schrunk, Burton L. Sharpe, Bonnie L. Cooper, Madhu Thangavelu, The Moon-Resources, Future Development, and Colonization (Chichester: Wiley-Praxis, 1999) 279-290
11. Edward L. Hudgins, Martian Law (Proceedings of the Founding Convention of the Mars Society, 1998) 849

Bob adds: I just volunteered to take over the list for the [ASI] Gov & Politics Discussion team and hope to get some discussion going there. Also, I'm going to be attending Return to the Moon V in Houston this summer and hope to see some Artemis/Moon/Mars Society people there.

Bob Lancaster, San Antonio Moon Society Outpost •

"The Need for Police Services in a Lunar Community"
http://www.asi.org/adb/02/11/01/needcops.html

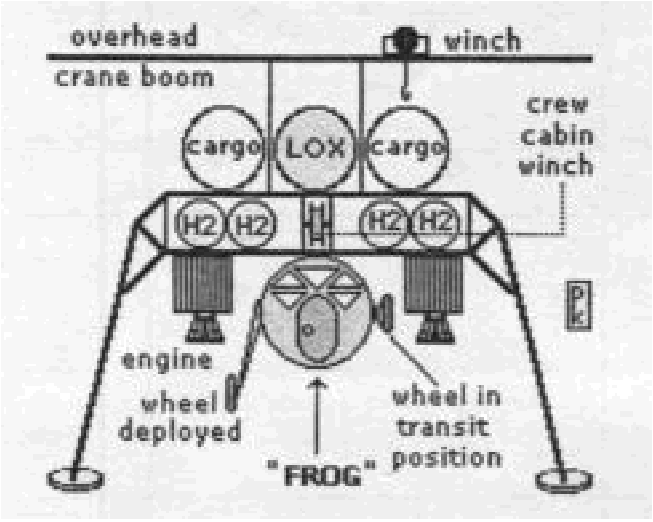
• "Fundamental Planning Issues for a Lunar Police Operation"
http://www.asi.org/adb/02/11/01/planforcops.htm
(The Paper printed just above)

The Frog–and–Hostel: Part II:
How Much Can a Frog Carry On Its Back?

by J. Craig Beasley < bginstitute@ev1.net >

In the May 2003 issue, I began a more detailed look at Peter Kokh's Frog-and-Hostel (F&H) system, {paper: www.lunar-reclamation.org/hostels_paper1.htm] wherein two different vehicles were used to build a colonization structure. The Frog is the colonists' transportation system, and is used for three different mission segments:

- Cislunar Human Transit
- Lunar Surface Mobility
- Primary Command-and-Control for the Frog-and-Hostel complex



The Hostel, in its most primal form, is simply an Earth-to-Moon cargo-carrier, and requires the attachment of the Frog to be an inhabit-able structure. Together, they make a spacious base of operations for lunar colonization. When the Hostel is even-tually left in place when the Frog heads back into space, a durable infra-structure on the Moon is created.

The first article was only a summary view of the F&H in the sketchiest of technical terms, and what we'll start looking into now are the details that need to be considered in designing a baseline version. Of course, my baseline differs to some degree from PK's, in the idea that I don't see a need to place all of the human operation burdens upon the Frog, while leaving the Hostel a dumb structure. Indeed, it seems that such an approach is technically out-of-bounds in optimizing the system.

FROG Division of Labor

It seems that the first place to start would be in considering the requirements of the Frog, as it's the vessel holding the Moon colony's most precious import: the Colonists! There are certainly some preliminary technical issues to explore. Let's examine them below:

1. Communications Center, Navigations Systems, First Aid & Trauma cabinet - Absolutely, these belong with the Frog, as it acts as the transit craft in all situations, meaning the crew will be near it or in it at all times.

2. Environmental Control and Life Support Systems (ECLSS) - Certainly, the crew will need to breathe on the way to the Moon, while it's on-site, and when it returns to space. A concern with this system is the possibility that in trying to provide this function for the Hostel as well, the ECLSS may be heavier than optimal for the Frog's transit modes. Two separate ECLSS systems may be needed for each half of the F&H, or possibly the early Hostels will have machinery to assist the life-support services from the Frog.

3. Thermal Management Controls - The thermal systems for space transit are likely going to be different than those for lunar surface duty. As such, the chance for interchangeability will be low, so expect a separate system for the frog, relying to some degree on the old "barbecue-roll" technique. Trying to add the appropriate thermal control system to accommodate the Hostel would apply an unnecessary technical burden onto the Frog. {See Editor's Comment at end of this installment.]

4. Computer Bank - Given the low mass and high capability of current technology, the computer system on the Frog would serve well as the control system for the entire F&H for the initial missions. As time goes by, an independent computing facility could be added to the Hostel side of the equation.

5. In–Transit Entertainment Console with a Limited Media Collection - In a similar vein as the computer system, this could be easily accommodated. As a matter of fact, hard sources of audio/video entertainment may not be needed at all, assuming that the Frog is to be equipped with a high-bandwidth digital receiver and a DirectTV subscription!

6. Galley: Meal Prep, Scrap Disposal, Fresh Food Locker - In the absence of occupants when the Frog is away, this is a facility that has no need to be based in the Hostel. Early on, it may not be needed at all.

7. Toilet Facilities - This is always a touchy subject: How much accommodation does one make for elimination functions? Perhaps a good approach in this case would be to follow the lead of Apollo and keep the toilet facilities on the Frog as simple as possible, for two reasons. First, the elimination needs on the transit legs to and from the Moon are rather short-term, so the complexity and potential weight could be counterproductive. The second, and perhaps most valid, reason to have separate toilet systems is that the fundamental operation will be different for each division of the F&H. In the microgravity environment of the Frog-in-transit, the transport of wastes is achieved by suction, while such activities on the Moon should be a subtle modification of the gravity-fed toilets used on Earth. The two methods of operation are dissimilar enough to bar the effective use of one type of toilet facility in all scenarios.

8. Cab windows, both ends - In manned spacecraft design of previous times, viewports were only provided in the forward-facing part of the ship. The heat shield was situated at the other end, and was a bad place to put a window. For the needs of the Frog, however, we'll need views through at least both ends of the vehicle, if not on four sides, to make it more "car-like" as you travel the lunar countryside. Heat shield access is thankfully no longer an issue, as the Frog is never meant to return through an atmosphere.

Capacities incorporated in early frogs, and gradually switched to the hostel structure:

Of course, if the Hostel is simply too massive to transport certain items that are not cross-functional, a modular, standard stowed arrangement for such hardware could be part of a Frog's cargo compliment. A stowage modularity could be established, where hardware would be prepackaged to fit into a stowage slot, similar to the mid-deck lockers on the Shuttle or the Racks installed on ISS.

This general principal of modular stowage should apply to the equipment below.

1. EVA Airlock for Moonwalk Sorties - It might not be a bad idea to include the EVA airlock into the F&H docking tunnel early on, to reduce preparation time and potential loss of consumables. The larger the volume of air to evacuate from an airlock, the longer it takes to pump into storage. If the airlock is a dump system, the implications of a large volume are even more serious. I am using the term 'Dump System', to refer to an airlock that is depressurized by venting the atmosphere to space. A precious resource, we should always strive to preserve our air.

The interior volume of the Frog will be greater than the volume of the docking tunnel. This tends to push the airlock to the docking tunnel during design of the Frog-and-Hostel system.

2. Isolation Berths - I'm not convinced that this is an issue for something like the F&H, simply due to the developmental nature of the system. Two settlers or development crew would most likely know each other, and modesty and/or privacy on such a short trip would be unnecessary. In the case of a multi-gender crew, the simple addition of a curtain or partition in the vicinity of the restroom facility would suffice.

3. Wet/Dry Compact Workstation - This would be a valuable item to carry in transit, and could be made modular for later use in the Hostel upon arrival on the Moon. A simple set of hoses, one potable in, another non-potable out, with a non-potable return line, they could be attached via quick-disconnect fittings to either the Frog or Hostel plumbing.

4. Moon Sample Experiment Lab - Unless there was a pressing scientific need to perform analysis in-transit, I am sure there would be no valid use for such equipment on the Frog. Given this lack of shared functionality, perhaps this equipment should be on the Hostel, if possible. However, a set of stowage locations should be provided for returning any samples for later study, and these stowage areas could be used to transport equipment for the first leg of a given mission, if need be.

5. Fuel Cells for Use When Decoupled - Certainly, since power is life in space, having a portable fuel cell system to use in each segment of the F&H complex would be a good thing. Perhaps excess power generation capacity could be provided to easily power the joined F&H and auxiliary systems. Obviously, this would drive the mass and size of the fuel cells upward, but it would foster a more confident stance operationally.

As successive frogs need to arrive ever less *'loaded,* they can bring along more and more cargo. Finally, a Frog's final mission would end by remaining on the Moon to serve as a pressurized lunar exploration / field trip rover / coach / campmobile. When its crew needs to be replaced, they can go home on the next visiting vehicle. The "frog" would become a "toad" in effect, giving up its amphibious space-faring capacity for a wholly ground-based future. **<JCB>**

NEXT MONTH – Hostel Division of Labor

* The author heads up the Moon Society Houston Outpost.
Web: http://members.tripod.com/bginstitute/index.htm

EDITOR'S Comments: I continue to read with great interest Craig Beasley's series of in-depth analyses of our original trial balloon paper presented at the 1991 International Space Development Conference in San Antonio. It is very gratifying to see improvements made or suggested.

I'd like to take exception, however, to his analysis of the thermal management controls requirements for the Frog (see page 6, column 2, item 3, above). The Frog will spend three days in transit to the Moon, and three days on its return trip. Only then, while in space, can it exercise the "barbecue roll" maneuver to spread the solar heating gain evenly. Depending on the length of the lunar surface mission when it is docked with the "Big Dumb Volume" Hostel structure, it may spend considerably more time parked on the surface where a roll maneuver would seem to be out of the question. Excess dayspan solar heating will have to be managed in other ways.

Radiators, which could also serve the thermal management needs of the Hostel, are just one option. A canopy "carport" (shielded or not) to keep the vehicle in the shade, certainly makes sense. Even if solar input is neutralized, however, it is expected that human activities will produce a heat surplus that will need to be shed, from Frog and Hostel alike. That means that either the Frog, the Hostel, or both must have radiators. I propose that at the outset, the Frog supply these. But perhaps as early as the close of the first mission, they could be transferred to the Hostel as downpayment on gradual transfer of capacity. - PK

A Case for the Moon : Public Interest

by Mark H. Rindner < Heimdall I >

I think I've identified the problem with the whole return to the Moon versus Mars debate. The American public knows more about Mars and we've been to the Moon . Forgive me for saying so but that's crazy. NASA is confused in thinking that the public will take a been there done that attitude. This is only true because we haven't sent any interesting probes to the Moon recently.

We talk about future Mars sample return missions when we can do more much closer to home. We already know what resources the Moon possesses. Knowing that isn't enough. We should take that knowledge a step or two further before we seek to find out similar information about another orbiting body.

We can prove mineral extraction technology on the Moon before we send it to Mars. It would be a less embarrassing a failure if something where to go wrong on the Moon than after many months of in-flirght anticipation. Certainly a replacement would be on site before its Martian counterpart even arrived.

It's this lunar proximity that is more important than any thing we can do on Mars for the next two decades, perhaps even longer given the frequency of Mars launch windows. Consider this series of lunar resource utilization missions.

- The first set testing ore extraction techniques
- The next would refine the minerals into usable form whether it's water, iron, silica, titanium, etc.
- The final set of missions would transform the individual minerals into end products.

Metal building materials in the form of plate or spars, silica glass, microprocessors and solar cells, LOX and LO2 could be the results of this series, basically an embryonic production facility on the Moon that could be built upon. All of this before any Mars sample return mission would even have returned. Metal plate can be rolled and capped to form pressure vessels for fuel or habitation. The construction of inter lunar earth orbit ships would keep humans busy on the Moon and make public relations representatives very happy.

The Moon has about as much surface area as the African continent. More importantly an expanded human space program directed towards the Moon would give us the transportation infrastructure needed to build larger Mars class vehicles at a Lagrange Point.

I am not anti-Mars or pro-Moon . I'm just pro-Space Colonization.

Mark H. Rindner, Allston, Massachussetts

P.S. About my Screen Name: Heimdall was the Norse deity that guarded the Bridge to the Stars. The Moon is that bridge.

Mars Society Convention 2003

Eugene, Oregon — August 14th–17th

Eugene Hilton Hotel

From Maggie Zubrin < MZubrin@aol.com >

Our 6th Annual Conference is almost upon us. We have lined up some fantastic guests this year, including Bill Hartmann, author of "A Traveler's Guide to the Universe", Greg Bear, Nebula Award Winning Sci-Fi author, and Elon Musk, founder of Paypal.com and space entrepreneur.

Member Discounts

For those of you who need to renew your membership prior to registering for the conference at the member discount rate, remember there is a two to three day turn around time for on-line registration processing. To avoid delays and ensure that the early registration rate applies, you can both renew and register by downloading and faxing in the form found on the website.

Conference Hotel

This year, we are pleased to be able to offer special conference rates on rooms at the Hilton Hotel in Eugene. Standard room double occupancy is available for the discounted rate of **$79**.00 per night, for up to 4 days prior to and following the conference. You can book your room using the link provided at the conference website at www.marssociety.org/convention/2003/links.asp . The group code for booking your room is MAR. To ensure the special rate, book your room by July 14th.

Field Trips

In addition, the Oregon Chapter has arranged for a couple of exciting field trips to areas of local interests, including the Newberry National Volcanic Monument, including Lava River Cave and the Pine Mountain Observatory. Information on booking these tours is also available at the conference website.

Getting to Eugene

You can fly into Portland and take the Rapid Transit system to Eugene or fly directly into Eugene for a slightly higher fare. United Airlines is offering us a discounted fare. For maximum discount, book 30 days prior to the conference date. Contact 1.800.521.4041 and use this tour code: 517BE. Discounted travel is good for up to 3 days before and after the conference.

Educators

We will be offering an all day session on Space & Mars Curriculum. A special single day rate is available for this session of $50.00 regular, and $25.00 student / senior.

Exciting speakers

We are working on confirming several other exciting speakers and look forward to seeing you all once again. Feel free to contact me with any questions or comments at MarsSocInfo@aol.com

[MMM Informational Website Summary *without comment*]

The Colony Fund

Investments for the Next Frontier

http://colonyfund.com/index.htm

"Until now, the average investor was unable to take advantage of the opportunities described on these pages. We are taking bold new initiatives to not only ensure the future of private-sector space development, but to secure the blessings of freedom, opportunity and abundance for ourselves and our posterity. We hope you will join us.

"Our goal is to create a "Virtual Community" of Space Investors, consisting of like-minded individuals from all over the globe; large numbers of people, each willing to invest small amounts in order to change the world."

The Colony Fund Vision:

Inclusion, Empowerment, Creativity, Unity

"The founders of ***The Colony Fund*** seek to create an innovative, Space-sector investment Fund targeting both retail and institutional investors. The Fund capitalizes on current global market trends in technology investment and keen public interest in Space exploration and planetary settlement. Our marketing plan utilizes methods proven effective by both e-commerce and brick-and-mortar enterprises. The Colony Fund offers a fiscal foundation for investment in emerging commercial Space enterprises and establishes a foothold in what is planned to be the preeminent market sectors of the 21st century."

Coming soon, to a financial market near you:

"We are working to offer a new, unique class of investment vehicle, a retail, space-sector venture capital pool called "The Colony Fund". In essence, it will be a series of closed-end, long-term offerings, at mass-market prices, to individuals, corporations and governments throughout the world. The Fund is a new concept, but it will share characteristics with similar tech-sector mutual funds. The low minimum investment ($100-$1000) will make the Fund "Venture Capital for the rest of us," easily available to tens of millions of individuals and investment groups in every part of the globe."

Unique features of The Fund:

- "Long-term capital funding targets* (*Accomplished via a series of successive Fund offerings over a 10-15 year period. Colony Fund I, for example, will be a $500 Million offering. If CF-I is successful, CF-II will be ramped up, for significantly higher funding goals. And so on...)
- "US $100 - $1000 minimum investment facilitating the inclusion of small investors around the globe
- "30-year fixed term offering long-term profitability potential to visionary, risk-tolerant investors dedicated to providing consistent levels of financial support unprecedented in existing space efforts
- "Operational revenues for *The Colony Fund* will be derived in much the same manner as the vast majority of retail mutual funds - a front-end load on unit sales, and an industry-standard annual fee for the management of the Fund's equity portfolios and venture investments."

Approximate portfolio asset allocation:

- "~65% - Venture Capital pool, for next-generation, cutting-edge aerospace technology firms whose products, services and R&D efforts enable advancement of the burgeoning commercial space sector.
- "~25% - Investments in "traditional" equities and debt instruments as liquid asset pool between venture investment opportunities.
- "~10% - Investments with selected partners/contractors in highly publicized deep-space-mission projects favoring immediate profit, marketing, or long-term resource potential. Impressive profitable returns are feasible in areas such as: Media events, media creation, Web and Advertising revenues, third party product licensing, sale of Science/Engineering data, extraterrestrial soil samples and special public exhibits and attractions."

Coming soon, to a financial market near you:

"We are working to offer a new, unique class of investment vehicle, a retail, space-sector venture capital pool called "The Colony Fund". In essence, it will be a series of closed-end, long-term offerings, at mass-market prices, to individuals, corporations and governments throughout the world. The Fund is a new concept, but it will share characteristics with similar tech-sector mutual funds. The low minimum investment ($100-$1000) will make the Fund "Venture Capital for the rest of us," easily available to tens of millions of individuals and investment groups in every part of the globe."

"Even when there were record economic gains in other technical sectors of the U.S. economy, venture capital and other funding for space entrepreneurial enterprises was comparatively lacking. The reasons had much to do with the time frame required in the space sector to produce attractive rates of return."

The Fund has the following goals:

- "To invest long-term in developing technologies that will craft and support a robust space entrepreneurial sector, particularly those that offer the promise of low-cost access to space
- "Provide careful management and due-diligence to ensure that such investments provide the long-term return expected by the Fund's investors, and
- "Ultimately - within 30-40 years - to provide venture funding for enterprises seeking to expand human boundaries - with the express purpose of establishing permanent, and economically self-sustaining, human communities on the Moon, Mars, and/or the asteroid belt, developing and exporting space resources for Earth's benefit." ###

http://www.moonsociety.org

Please make NEWS submissions to
David Wetnight at newsmonger@asi.org
Other submissions: KokhMMM@aol.com

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

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

Join/Renew Online at

www.moonsociety.org/register/

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

Questions? email: membership@asi.org

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

- Artemis Reference Mission
- Artemis Data Book

Project LETO™

http://www.projectleto.org/

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

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

2003 Moon Society Elections

From Peter Kokh, Chair, 2003 Elections Committee Chair
[This letter has been emailed to all current members with known email addresses. It is the obligation of members to keep the Society apprised of any email address changes.]

Dear Moon Society members,

It's that time of year again, yes, election time. The list of Officers and Directors along with term expiration dates is found at:

www.moonsociety.org/about/officers.php3

The officers and board of directors would like to open the floor for nominations for the following positions:

- Vice-President - currently David Wetnight
- Secretary - currently Amy McGovern
- 3 Director positions - currently held by Randall Severy (chair), Dana Carson and Ian Randall Strock

The responsibilities for each of these positions are described in the Moon Society bylaws (specifically pertinent are Sections V, VI, VII and IX) at:

www.moonsociety.org/organizing-documents/bylaws.html

If you are interested in running for any of these positions, please nominate yourself! If you know another member that you think would do a good job in one of these positions, please contact him/her to ensure that they are interested in the position before sending in the nomination. Alert the person in question to the need to compose a statement to be submitted to elections@moonsociety.org by August 1st.

To nominate someone, please send the following to elections@moonsociety.org by August 1, 2003:

- Name of person being nominated
- Member number (if known)
- Position nominated for

Please note that we will ask all candidates for statements this year. These statements will be made available with the ballot. If you wish to mail us your statement of why you want to be elected for this position with your nomination, please do.

We are beginning this process two months late this year through inadvertance. In fact, all officers and directors have been very busy the past year striving to reinvent the Society, its website, and options for member participation in an effort to make the Society more effective.

We would like to send out ballots, both by email and in the Moon Miners Manifesto #167, August 2003 issue as soon as possible after August 1st, so that ballots can be tallied and results announced in the following issue.

Thank you! We look forward to hearing from you!
The 2003 Elections Committee Chair
Peter Kokh.

GREAT BROWSING

The Moon Miner

Space Colonization, Moon Mining, Exploring the Solar System and Beyond

http://www.moonminer.com/

Moon Society St. Louis organizer and frequent MMM contributor Dave Dietzler < Diets37@msn.com > was fortunate enough to find the domain moonminer.com unused and snatched it up without much hesitation. The site is worth bookmarking and as Dave is always busy adding new stuff, it is worth periodic, if not regular, revisiting.

Of note:

http://www.moonminer.com/taxi.html
An Earth-Moon Cycling Station made from External Tanks

http://www.moonminer.com/Moon-trip.html
Takes you on a trip from your home town to one of three spaceports along Earth's equator, then to orbit, transfer to your Moon ship, etc. You can almost imagine it. Have fun and a safe journey!

Other Moon Miner Destinations

- Lunar Resources
- Space Colonies
- Futurism
- Space Tourism
- Rocket Physics
- Populations
- Spaceships
- Starships
- Terraforming
- Lunar Tourism
- Art

Science Article on Lunar Developments

Thanks to Phil Harris < PhilHarris@aol.com >

There was a significant review on THE NEW RACE TO THE MOON by Andre Lawler in SCIENCE, Vol. 300, May 2, 2003, pp. 724-727.

It lists contemporary public sector lunar missions, and highlights the private sector lunar spaceflight this coming year by Transorbitl Corp (www.transorbital.net).

If you are not a current AAAS member, your local library may have a copy of this issue. But you will need to sign up for full AAAS membership ($125) or for free limited access to get any of the following online:

- Summary
www.sciencemag.org/cgi/content/summary/300/5620/724
- Full Text
www.sciencemag.org/cgi/content/full/300/5620/724
- PDF File
www.sciencemag.org/cgi/reprint/300/5620/724

International Lunar Conference 2003
November 16–22, 2003
Waikoloa Beach Marriott Hotel
Hawaii Island, Hawaii

The ILC2003 from 16-22 November on Hawaii Island, Hawaii, USA promises to be a major, decisive event regarding the permanent human return to the Moon as early as possible. This event will be the first of its kind in 3-4 years and the first in the USA in more than a decade. ILC2003 also will serve, with the agreement of the principals most involved, as the 5th International Lunar Exploration Working Group (ILEWG) Conference.

Space Age Publishing Company would like to thank and acknowledge all of the lunar-committed individuals that have so far made various and significant contributions to ILC2003 by means of paid registrations, sponsorships, commitments to register, abstract submissions and all other inquires of interest.

Conference development and Registrations are steadily progressing, with significant participating confirmations from Apollo Moonwalkers Captain John Young (keynote speaker) and Dr. Harrison Schmitt; and top-level space scientists and officials from USA, China, India, Russia, Europe,Japan and elsewhere.

The Call for Papers abstract submission deadline has been extended to 15 August, and full Conference registration is currently being offered at the low price of $495. Please be sure to learn more about ILC2003 by contacting us at the numbers below or by Internet at:

http://www.spaceagepub.com/ilc_2003.html

For abstracts already submitted (and a good look at hour the program is shaping up, go to:

http://www.spaceagepub.com/abstracts.html

Thank you for time and interest in ILC2003, and we hope to meet with you this November.

International Lunar Conference 2003 c/o
Space Age Publishing Company
Hawaii Island, Hawaii, USA
Ph 808-326-2014
Fax 808-326-1825

"It's not the time we have, but what we do with the time we are given."

J. R. R. Tolkien

Utah Outpost &
Brigham Young University Outpost

From Jonathan Goff < jag42@et.byu.edu >

A Moon Society Flyer other Chapters & Outposts can adapt.

After having all sorts of fun trying to make my flyer into a PDF, I finally just wrote it up as a simple HTML file. It is at:

www.et.byu.edu/~jag42/BYUMoonSoc/MoonSocFlyer.html

If other chapter or outpost people want to copy the file and the graphics onto some other page, all they need to do is go in and edit it in Frontpage [or other HTML editor like Claris Home Page] to change the date, or the name of the group.

First Meeting Report - June 27, 2003

The first meeting went fairly well and we had about eight people there including myself. So, not counting me, my fiancee, or the wife of one of the guys who came (though she may eventually become interested too - she's a civil engineer), it was five other people. One of the them is moving to the Florida panhandle this next month. He was the most interested in actually becoming a member of the Moon Society.

The other students were a bit more leery of committing the $35 to join, but they were very interested in working together on some projects. There were also about another 3-4 who wanted to come but couldn't make it.

Chapter Coordinator's comment:

You can have members who do not pay Moon Society dues. But they don't count toward the magic five needed for Chapter status along with an official Moon Society Chapter Charter. This is a problem in many chapters in the Moon Society as well as the Mars Society and the National Space Society. You find people interested in local action and activities with limited funds and/or not uninterested in remote national or international scale projects and activities.

Yet these purely local members can provide the manpower and talent to jump start hands-on local projects (which hopefully will attract those interested in joining the Society at large.) So they can be of considerable value. Once you have them hooked, you can always periodically ask them to consider joining the Society as well as the chapter.

I have had the same problem in the Milwaukee Outpost (2 Moon Society members). Somehow Moon Society St. Louis got it right, and right off the bat. We'll have to find out their secret formula for success and pass it on!

Projects are the life of the chapter, give it momentum, provide enthusiasm, attract new people. For project suggestions go to the Space Chapter Hub:

http://nsschapters.org/hub/projects.htm

Utah / BYU Outposts Cont.

We're looking for a good, tailor-made project

We're planning on brainstorming possible projects for this next year, and picking a few to look into this next meeting (hopefully on the 10th of July). Do you have any ideas for any projects that we could take on? Currently we're mostly mechanical engineering students, but there is one physics guy. Eventually we want to bring in more engineering students from different majors, more business guys, and a few more science guys.

If possible, I'm trying to find an idea that could be worked on that would involve all three groups and get them interacting a bit. **<JG>**

Chapter Coordinator's Project suggestions:

(1) How about some experiments in teleoperating, using a built in 3 second time delay., the kind that mission control people on Earth will experience in teleoperating equipment on the Moon's surface. First just maneuvering, using radio Shack equipment or Rovers you build yourself. For an encore with great publicity potential, construct two or three identical race tracks (on one portable table or platform) and let people try to win a race using the 3 second delay.

(2) Sponsor a design competition for teleoperable shielding emplace-ment. Make a structure (canvas over PVC frame) and see what kinds of remotely operated equipment work best to cover it with sand from a nearby sandbox. You will be looking for what system is most efficient for the weight of equipment, has least problems, breakdowns, and snags etc. Then debug any promising systems it until you've got something worth recommending. Design a full-scale system with minimum weight for a demonstration run on the Moon. This would go a long way to make our first Moonbase truly "permanent."

Do continue brainstorming and you may come up with project ideas that are more realistic for your talent pool and resources. There are ways to tap into outside resources for advice, financing, prizes, etc. so don't assume any project is beyond your reach. Feel free to run any other suggestions by me.

If you start attracting any materials science students, I'll have some more suggestions. Good luck!

Peter Kokh < kokhmmm@aol.com >

Chapter & Outpost Resources Online

The Moon Society Chapters Coordinator keeps a log (with active links) to resources appropriate for use by Moon Society Chapters and Outposts on the Space Chapters Hub website. This log is online at:

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

Optical SETI project awaits completion.

From http://planetary.org

The Planetary Society's Optical SETI telescope, at 72 inches, is the largest optical telescope in the U.S. east of the Mississippi River. When the light detectors, camera, and analysis equipment are in and operational, it will be the first custom-built, professional optical observatory ever full-time dedicated to the Search for Extraterrestrial Intelligence.

The day we finally hit the "on" switch, our Optical SETI efforts will leap ahead exponentially. Instead of watching a relative handful of selected stars (less than 0.0001% of all that Optical SETI is theoretically capable of watching) we'll be monitoring a vast slice of the sky each night for a visible sign of intelligent life elsewhere.

This optical searchis a crucial addition to our SETI enterprise. No longer will we be ignoring an extremely viable way for intelligent life to communicate among the stars. We will be listening *and* looking for any sign coming our way.

A groundbreaking computer chip is the cornerstone of our Optical SETI project. This chip is literally history you can hold in your hand. The tiny device can measure an incredible 32 *Billion* voltage measurements *per second*. So a full array of 32 such chips -- the number we'll be installing in the signal processing equipment in our new telescope -- will crank out 1 *Trillion* voltage measurements every second!

The human mind really can't abstractly grasp how large a number that is. So think of it this way: each and every second, this chip array will be able to process the complete contents of every book in print worldwide!

This amazing device -- designed by Project Director Paul Horowitz and graduate student, Andrew Howard -- is so cutting-edge that the fabrication required is extremely complex and costly. This project is worth it - we are literally opening up a new branch of science observations.

What we're looking for may sound like the stuff of science-fiction: a concentrated beam of light - a laser -- flashing in the night sky. But this method of signaling across the vast distances of space is something we on Earth could do right now, even with our relatively young technology. So it makes sense that there may be other civilizations trying to communicate with us in this way.

The job is not quite finished. We're almost there, but breaking new ground for SETI technology -- developing sophisticated equipment that will make this optical search one of the most advanced SETI efforts around -- is a complicated and expensive proposition.

The Planetary Society has raised $250,000 of the $400,000 it has committed to providing for Optical SETI. with $150,000 needed to finish the project.

To help complete this project, go to:

https://planetary.org/donations.html

GREAT BROWSING

Running Water Eroded a Frigid Early Mars

by Richard A. Kerr in Science Magazine

New analyses of the first direct measurements of Mars' topography suggest that precipitation--rain or snow--and flowing water helped shape Mars in its first billion years. The conundrum remains: How could precipitation have occurred on a planet that was so cold?

www.sciencemag.org/cgi/content/full/300/5625/1496?etoc

Ad Astra! – Notable Nearby Stars

A great resource for nearby star enthusiasts

http://www.solstation.com/stars.htm

This site lists stars known within 10, 20, 33, and 65 light years . Click on any star in the table to get a fact sheet of everything known currently, including suitability for planets, and earth-like planets in the life/water zone. For each star, its own nearest neighbors are listed. Links to web pages devoted to individual stars are included.

For a great site on the **Alpha Centauri System**,& graphics showing where life-friendly planets could exist, go to:

http://homepage.sunrise.ch/homepage/schatzer/Alpha-Centauri.html

Oware Links Page

In Last month's MMM #166, p. 5, we wrote about the 3-millenia old African Board Game that we thought would be ideal for the "New Stone Age" of the early Space Frontier. We have put together a page of links to help you learn more about the game, make your own sets, etc.

http://members.aol.com/nbhdcollege/oware_links.htm

"As long as we're here...:" Secondary Profit Generators for Moon and Mars Bases

http://www.oregonl5.org/l5sr02d.html

Interactive Mars Habitat

http://www.exploremarsnow.org/

Wow! *This site will take you there!*

The Moon's Dark, Icy Poles

http://www.psrd.hawaii.edu/June03/lunarShadows.html

Space Evvironment Center, NOAA

http://www.sel.noaa.gov/

LunaBots – http://www.lunabots.com/

Interesting new Europa articles

From: "Bruce Moomaw" <moomaw@cwnet.com>

• J. Brad Dalton reports that Galileo's near-IR spectra of the colored patches on Europa matches the spectra of some bacteria species with surprising accuracy, and that several species of common Earth bacteria can survive being temporarily frozen under Europan near-surface conditions -- although, as he points out, many other substances may also match the spectra and he certainly isn't saying that this is strong evidence for Europan bacteria:

http://www.astrobio.net/news/article200.html
www.lpi.usra.edu/meetings/lpsc2002/pdf/1555.pdf

Dalton also points out that a somewhat higher spectral-resolution near-IR spectrometer on a Europa orbiter could solve a great many of the outstanding questions about Europan surface composition:

www.lpi.usra.edu/meetings/lpsc2003/pdf/2072.pdf

• Leon Buck et al conclude that "catastrophic breaches in Europa's ice crust may produce regions of relatively thin ice persisting up to ~1 million years". The whole paper is now online at www.uwec.edu/math/SFJournal/GRL.pdf .)

• Pierazzo and Chyba conclude that comet impacts could give Europa a large supply of biogenic elements, even if these weren't present at its initial formation. ("Icarus" webpage: http://www.sciencedirect.com/science?_ob=JournalURL&_issn=00191035&_auth=y&_ acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=61cbeb34c69c2a9900ff86b3ab4b024d (the abstract is in the May 2002 issue.)

• ...and William McKinnon proposes that the nebula out of which the Galilean satellites formed in the first place may have been a good deal colder than formerly thought -- raising the odds that Europa may have had a good deal of complex organic compounds incorporated into it from the very beginning: http://gsa.confex.com/gsa/2001AM/finalprogram/abstract_28370.htm

• Chyba and Phillips have an excellent article on the latest evidence regarding Europa's suitability as an "Abode of Life": http://www.kluweronline.com/issn/0169-6149/ (Go to "Journal Contents" on that page, then to the free Feb. 2002 issue, then to the article.)

• Jerome Borucki finds that meteoroid impacts on ice generate powerful electrical shocks capable of synthesizing the production of fairly complex organic molecules -- raising the possibility that this is happening on Europa:

www.newscientist.com/news/news.jsp?id=ns99993421
www.astrobiology.com/asc2002/abstract.html?ascid=170

• "Sea gliders", which can travel impressive horizontal distances without powered engines, are attracting interest as possible future Europa Hydrobots: www.space.com/businesstechnology/technology/sea_glider_020410-1.html

• Space.com report on Arizona State U's "Europa Focus Group" in May '02: www.space.com/scienceastronomy/solarsystem/europa_options_020612.html

• Space.com article on Project Prometheus fails to describe the large degree of skepticism which many scientists display toward it: www.space.com/businesstechnology/technology/prometheus_030207.html

• Paul Schenk reports strong new evidence that Europa's ice crust is 15-20 km thick -- in the form of (1) detailed topographic analysis of Europa's surface from Galileo photos, which show that it is not nearly as smooth as had been thought, and indeed has altitude differences of 2 km; and (2) analysis of the differences in the fundamental form of impact craters above a certain size, big enough to punch all the way through the ice crust into the underlying liquid:

www.spacedaily.com/news/jupiter-europa-02d.html
www.aas.org/publications/baas/v34n3/dps2002/224.htm
www.oal.ul.pt/~eurojove/abs/s4/nnn_abs_Schenk.html

• Barr and Pappalardo point out that the "thick crust" model of Europa's ice crust does *not* mean that useful nutrients synethezied in surface ice by Jupiter's radiation can't be fairly quickly transported down to ocean microbes -- or that large amounts of oceanic microbes aren't carried back up to the surface where surface lander could sample them:

www.astrobiology.com/asc2002/abstract.html?ascid=50
www.lpi.usra.edu/meetings/lpsc2002/pdf/1545.pdf

• ...and so do Gaidos and Nimmo:

http://bullard.esc.cam.ac.uk/~nimmo/paper13a.pdf

• Evidence continues to grow that the thickness of Europa's crust has actually increased dramatically over the past few tens of millions of years, causing its geological feature formation to change during this period from cracking to warm-ice diapir convection that produces chaotic regions. If so, this must be a repeated cyclical process, probably due to the changing rates of tidal heating in Jupiter's three inner Galilean moons as their gravitational interactions keep increasing and decreasing their orbital eccentricities. This ould mean that Greenberg's "thin-crust" and Pappalardo's "thick-crust" models of Europa are correct at different times, with Europa currently in its thick-crust state:

www.lpi.usra.edu/meetings/lpsc2003/pdf/1017.pdf
www.agu.org/meetings/fm02/fm02-pdf/fm02_P71B.pdf
(pg. 2; Figueredo-Greeley abstract)
www.agu.org/meetings/fm02/fm02-pdf/fm02_P72B.pdf
(pg.3; Hussman-Spohn abstract)
www.cosis.net/abstracts/EAE03/11297/EAE03-J-1297.pdf

• Robert W. Carlson maintains that "Ion implantation [from Io] can provide the observed amount of total sulfur [on Europa's surface] in just 30,000 years, suggesting that burial by [meteoroid] impact gardening may be occurring" -- which means that Europa's underlying ocean must be VERY rich in sulfuric acid and other sulfur compounds, which would greatly lower its freezing point, but might also make it

difficult for biologically complex organic compunds to evolve there: (pg. 2; Carlson abstract)
www.agu.org/meetings/fm02/fm02-pdf/fm02_P52C.pdf

• Finally, a 6 Mbyte compendium of all the abstracts at the 2003 meeting of the NASA Astrobiology Institute is at:
http://nai.arc.nasa.gov/institute/general_meeting_2003/AbstractBook.pdf
Of particular Europan relevance are abstracts

- #12816 ("Potential Habitats on Europa: Geological Assessment Criteria"),
- #12891 ("Convective Transport Within Europa" -- another Barr-Pappalardo work), and
- #12367 ("Stress Mechanisms and the Evolution of Europa").

Europa Icepick mailing list: europa@klx.com
Project information: http://klx.com/europa/

Workshop on Europa's Icy Shell: Past, Present, and Future

February 6–8, 2004, Houston, Texas

http://www.lpi.usra.edu/meetings/europa2004/

PURPOSE AND SCOPE -- The Workshop will beheld at the Lunar and Planetary Institute in the Center for Advanced Space Studies, 3600 Bay Area Boulevard, Houston, Texas.

Europa is believed to have a subsurface ocean which could harbor organic chemistry or even biological organisms. Europa is second only to Mars as a target for future exploration. It is also a prime focus of the proposed **Jupiter Icy Moons Orbiter** (JIMO) mission currently in development. Europa's ocean is currently covered by an icy shell of uncertain thickness and it is this icy shell that controls how the ocean and any biological agents within it interact with the surface of Europa.

The purpose of this three-day workshop is to discuss our current understanding of the icy shell, its physical state and evolution, and its interaction with the putative subsurface ocean. Our aim is to bring together divergent and diverse viewpoints to assess the limits of our current knowledge, to advance our collective understanding of this unique environment, and to foster new ideas and future strategies. All aspects of the icy shell will be considered, including composition, physical state (e.g, thickness, rheology), geologic history, present-day activity, biology, and exploration goals. Observational, theoretical, and speculative presentations are encouraged from the planetary and terrestrial communities.

FORMAT -- Invited reviews of relevant data and theoretical constraints, contributed papers, posters,extended discussion periods.Topical sessions each morning and afternoon. A special issue with papers from this work-shop or related research is planned for a major planetary research journal. A dinner on the second evening TBD.

CONTACT INFORMATION -- For information regarding the format and scientific objectives of the meeting, contact
Paul Schenk, Lunar and Planetary Institute
phone: 281-486-2157 -- e-mail: schenk@lpi.usra.edu.
For information regarding meeting logistics, contact
Sue McCown, (281) 486-2144; e-mail: mccown@lpi.usra.edu.

Teleoperating Europa Surface Probes from a Manned Forward Base on Callisto

From Dave Dietzler < Dietz37@msn.com >

According to the Quick Orbits program, the delta V for flight from Callisto to Europa is not that high, about 6 kps. Faster trips would mean less radiation exposure time, so maybe an orbit other than a Hohmann (minimum energy) one. A ship with water stored in Kevlar bags surrounding the passenger section could do the job. Simple nuclear steam propulsion could be used. Since Callisto and Europa are at most about 14.5 light seconds apart, teleoperation of robots will be possible.

[Editor's comment: While both Callisto and Europa have one and the same hemisphere always turned towards Jupiter, the do not share points, other than possibly their poles, always in line of sight of each other. Relay satellites may be needed to keep teleoperation contacts open.]

KokhMMM@aol.com wrote Dave Dunlop:

Know you will appreciate reading this. By Apollo era scientist -astronaut Philip K. Chapman

http://www.spacedaily.com/news/oped-03zn1.html

Dave Dunlop < dunlop712@yahoo.com > replied:

You are right. I did enjoy this article. I think such talk could well stimulate the critics of NASA in congress to out right kill American manned spaceflight. ACCESS as Chapman proposes would be cheaper and better than NASA spaceflight.

This would be another disaster for US-European relations and another sigh that the US is an unreliable partner in the ISS venture and perhaps another partner in decline. Certainly the US seem incapable of either grand vision or a hard as nails grasp practical economic development imperatives.

What would the Europeans, Russian, and Canadians and Japanese do without the US relative to the ISS? I think such as divorce would be very interesting. First I think they would hesitate to scrape the ISS. I think there would be a quick invitation to the Chinese, Indians, Brazilians, and anyone else with some money to pony-up for a seat at the

ISS table. For the rest of the world to take over a strategic initiative from the US would be very symbolic politically.

The ugly political truth seem to be that space as evidenced by NASA's operations is at a best a high tech industrial welfare program.

The US seems to do its best in responding to a challenge and coming from behind.

What we need is $200 a lb access to LEO in order to make solar power satellites economically viable and then plan on Lunar base development and a Lunar Power System.

The private sector however cannot generate a profit if there is nothing someone want to buy or can afford to buy. The US as customer for Access is still a formula for government funding of space.

A combination of political competition and a race for space based solar power on a global basis makes political sense.

Dave Dunlop

The National Space Society's 23rd Annual
International Space Development Conference

ISDC 2004

Memorial Day Weekend
May 27–31, 2004
Oklahoma City, Oklahoma
Clarion Meridian Hotel & Convention Center

737 S. Meridian, Oklahoma City, OK 73108
(405) 942-8511 Room rate: **$65** + tax, 1-4 people
(more for suites & adjacent Hilton Garden Inn)

Programming Tracks Include:

- Advanced Propulsion & Technology
- Commercial Space/Financing Space
- Frontier America & the Space Frontier
- Educating Space
- Space Health & Biology
- Regulating Space
- Solar System Resources
- Space & National Defense

Planned Tours include:

- Oklahoma Spaceport
  (Oklahoma Space Industry Development Authority)
- Oklahoma City National Memorial
  (Murrah Building bombing memorial)
- Omniplex Museum Complex
  (planetarium, space & science museums)
- Sam Noble Oklahoma Museum of Natural History
  (worlds largest apatosaurus & more)

Starting this fall, look for updates on line at:

isdc.nss.org/2004 or www.nsschapters.org/isdc/2004

The Lunar Reclamation Society, Inc.

PO Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

LRS OFFICERS Contact Information

LRS PRESIDENT, MMM/MMR Editor - Peter Kokh*
< kokhmmm@aol.com > 414-342-0705
VICE-PRES/TREAS../LRS/MMM Business & Database Manager - Robert Bialecki*..... 414-372-9613
SECRETARY. - Charlotte DuPree
< cmdupree@netwurx.net > 262-675-0941
NEWSLETTER ASSEMBLY - Charlotte DuPree and Carol Nelson 414-466-2081
(* Board Members, & Ken Paul < kenpaul@cape-mac.org >

LRS NEWS

• **June Meeting Report:** We discussed current space topics in the news, and after a brief discussion of field trip options, decided not to have any chapter events this summer. We adjourned until our next regularly scheduled meeting on September 13th.

LRS SEPTEMBER Events

Saturday, SEP 13th, 1–4 pm

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

• AGENDA: TBD - check online at:
http://www.lunar-reclamation.org/page4.htm

13th Annual Wisconsin Space Grant Conference

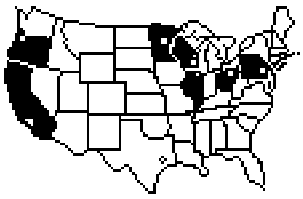
August 14th and 15th (Wed–Thur), 2003
University of Wisconsin–Green Bay
"Our Changing Earth"

$25 K-12 Teachers & Students
$50 Faculty, Professional, Other
$15 Awards Luncheon for non-participants

On Campus Lodging $28 per person (4 in suite)
$56 per person (2 in suite); $112 (entire suite)

Ph: (800) 892-2118; online: www.uwgb.edu/outreach/ProfEd

U.S. CHAPTERS



NSS Chapter Events

MMM 8 Chapters Strong

Space Chapters HUB Website:

[http://nsschapters.org/hub/]

CALIFORNIA

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

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

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

Our Website has Moved. NOTE NEW ADDRESS

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

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

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

Information: OASIS Hotline, 310/364-2290; website. Microcosm, 401 Coral Circle, El Segundo.

- **July 19**, 3:00 p.m. -- OASIS Monthly Business Meeting, location Long Beach. (Time may change.)
- **July 19**, 6:00 p.m. -- OASIS 25th Anniversary Banquet! Come celebrate 25 years of grassroots space education, outreach & activism. *The Proud Bird Restaurant*, 11022 Aviation Blvd., El Segundo. *This event is sold out.*

Recurring Events

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

MINNESOTA

Minnestoa Space Frontier Society

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

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

[www.mnsfs.org/]

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

MN SFS May 17 '03 Business Meeting Minutes
General Agenda Topics

1) Call to Order - 01:26 PM Present were David Buth, Tom Greenwalt, CraigBorchard, and Rich Brown
2) Minutes from April Meeting - David Buth reviewed
3) Call for Additions to Agenda - No changes
4) Introductions - Not necessary
5) Treasurer Report - after last minute deposit of Medtronics Check $1140!!!
6) Status of NSS Annual Report - stalled due to crashed modem in May/June (currently stalled due to 2 move ins at Dave's)
7) Membership
 a) Recruiting – New ideas? - Jim C. and Scott S. working on a pamphlet, pamphlet should be included in New Member Packet as well as Events Flyer, Group Cards and Membership forms
 b) General Meeting Date/Time - June 10th perhaps? I failed to callBoris on topic due to moving issue.Columbia Round Table as possible program - mid July?, August 12th? GrahmChandler Aero speaker?
8) Operations
 a) Officer's Manuals - stalled also due to move ins
 b) Corporate Status: Has annual registration been sent in to Secretary of State? Yes, back in April
 c) Inventory – Storage, everything at my storage from Marscon
 d) Fund Raising:
  i) Employer Contribution Programs - Ben, Craig B. should get a certificate of appreciation
  ii) Donation jar at events - find or make a new one
 e) Handouts - Jim and Scott on Pamphlet
 f) Business Cards - Ben, we need more
9) Events: CONvergence July 5th-7th - Dave B. Room head, Craig Programming Head, we need a party head. Ben getting a Cabanna?
10) Adjourned at 2:30 PM

David Buth - MnSFS Secretary

[MN SFS News Continued]

• (from Ben Huset) **Onan Summer Solstice Pics**
http://www.freemars.org/mnfan/mas/Summer-solstice/

OREGON

Oregon L5 Society, Inc.

P.O. Box 86, Oregon City, OR 97045
voice mail / (503) 655-6189 -- FAX (503)-251-9901
[http://www.OregonL5.org/]
Allen G. Taylor <allen.taylor@ieee.org>
Bryce Walden <moonbase@attbi.com>
(LBRT - Oregon Moonbase) moonbase@attbi.com

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

Oregon L5 Meeting Changes

• **July 19** - Instead of the usual meeting time and place, come join us as we help the Oregon Museum of Science and Industry (OMSI) celebrate Space Day. Doors open at 9:00 am, but volunteers may show up at the museum from about 8:30 am onward. For general information on OMSI, check out their web site at www.omsi.edu.

• **August 16** - Our August chapter meeting will be held in conjunction with the Mars Society's International Conference in Eugene, Oregon. MMM Editor Peter Kokh is hoping to be our guest. For more information on the Mars Society and its conference, go to www.marssociety.org.

• **September 20** - The September meeting will finally be held back at our usual time and place, Bourne Plaza at 2:00 pm. Nominations will open for chapter officers, to be elected in October at our Annual General Meeting.

For more information on Oregon L5 and these events, especially their locations, please check our chapter web site at www.OregonL5.org.

Solar System Ambassadors

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

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

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

PENNSYLVANIA

Philadelphia Area Space Alliance

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

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

• **PASA regular** business luncheon/formal meeting from **1–3 pm**, the **3rd Saturday** of every month at the **Liberty One** food court on the second level, 16th and S. Market. Go toward the windows on the 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th St.

NEXT MEETINGS: JAN 18th, FEB 15th, MAR 15th
Call Earl or Mitch 215-625-0670 to verify all meetings

• **Upcoming Meeting Locations:** For **July** we will go to the Rose Center in New York, which is part of the American Museum of Natural History. The site link will be sent later. **August 17th** meeting location to be determined.

• **June Meeting Notes:** We had a mix of attendees this time with Rich Bowers visiting with a friend on the way to the Franklin Institute. As it happens Michelle Baker was also in attendance and had tickets that she had after a morning at the Institute! The result was Rich's visit to renew his membership (thanks Rich!) led to renewal of contact, plans for July being made and help from friends. Rich and Michelle are both past presidents.

Michelle Baker reported on a conference by The American Astronautical Society titled "Space' Tax Revenues at work" which included a presentation on space spin-offs and things that aren't. Velcro, as an example, is not a spin-off. Data from weather satellites and high reliability components now used in entertainment "Direct TV" is part of it to thanks to NASA's studies (as well as the military's) to improve reliability and thus make missions possible and, as an added benefit, improve our understanding of applied science to be used for everyone. Thank you Michelle.

Hank Smith went to San Francisco for the Memorial Day holiday where he went to the Baycon Convention for Science Fiction and briefly attended the ISDC in nearby San Jose. He enjoyed the convention and helping at several activities, but was only able to attend the conference dinner. Next time he intends to go to the ISDC when he can In audition he will attend, as will Dottie and Larry, an event called "Shore Leave" in Hunt Valley Maryland.

000000000Also: Philadelphia may get The World Horror Con-vention in 2006. I doubt we'll get members at

this! Hank is also requesting people interested in the Science Fact Tracks at Philcon to contact him for the December event. He is at hankscifi@hotmail.com.

Larry gave a brief report on website activity and will set up a counter for this. We need more members and will have to increase our content to bring people in. He also mentioned the need for caution due to spamming, especially since the unauthorized use of the Mars Society list to send list members xxx "invitations".

Dottie also reported on one of her areas. The Smithsonian Institutes **Air & Space** Magazine with a June article by Ben Iannotta, "NASA Goes Nuclear" about the various power sources and engines that will be needed, especially from Jupiter out to the Oort Cloud (~1 trillion miles) and beyond. Dottie called post meeting and had just received **The Planetary Report** on which she also reports.

Mitch Gordon was prolific this month with a range of ideas: We will have a "College Festival" in our area this fall on the Parkway (Park Way) and he was alerting us to this event. As usual, cost is a problem for us. This would cost ~$275 per space and we are not in position to do this. We have recently lost several members and will have to build up our treasury to afford this and other desirable events. College students were the life blood of membership up to the early 1990s and so Mitch's focus on this has a historical basis. He also suggested using local cable access with the main part contributed by guests from The World Future Society, and, after group discussion, said that he would consider a variation that Michelle came up with for ten minute clips. on a range of topics, or , as an alternative or in combination with, do a show on a public station that allows local content. We would appear as guest interviewees or panel members. He and Simon are also working on the brochure/handout. and last but not least Mitch also brought up the new Speakers Bureau which N.S.S. is developing for chapter promotion. Mitch will report on **Ad Astra** content when he receives it.

Earl Bennett reported on several topics: from **R&D Magazine** for June on "Nano Scale Wires Made with AFM" which described work done at the University of Kentucky on fabricating "wires" made from semiconductor fabrication photo resist etch control material (called P.M.M.A.). The tool uses the tip of an Atomic Force Microscope to pull an extremely small diameter strand of material from a small bead. This material has the ability to change properties when exposed to ultra violet or other energy sources. It can then be coated or plated with various materials and the "wire" can then be dissolved away leaving a hollow network. In this way a tiny fluid channel, and the piezo mechanical drive system for moving it, can be made. Cooling devices for micron size sensors and "chips" could also be made. The work was done by a group headed by Robert Cohn Director of the ElectroOptics Research Institute and Nanotechnology Center. See www.uofl.edu.

The June issue of **NASA Tech Briefs** has an article in a special section ("Photonics Tech Briefs") on Advanced Rainbow Solar Photovoltaic Arrays by nick Mardesich and Virgil Shields working at Caltech for JPL. The work involved splitting up light with a curved Fresnel Prism with the incident light being dispersed in wavelength as well as directed to the sides of the device in strips. this means that the energy converting cells can be put on as strips (think shingles) which makes fabrication easy compared to layering the cell structures as has been previously tried. The individual energy converter strips presently use fairly exotic compounds, including some Indium Gallium Arsenide mixes and others. Present efficiency is about 20% but could reach 40% per the authors.

In audition: I recently went to The International Microwave Symposium June 11th for professional and personal information. I enjoy the bright people who are at such an event,doing advanced engineering and applied science. I also went to check on possible sources of I.D Tags for a Mars Society application started last fall. Some of the vendors thought it was a neat idea and also listened as I explained what kind of locations this would be in. None had systems available meeting our needs. I will continue looking for other, easy to use, devices.

Finally, I am currently reading "Lifting Titans Veil" by Ralph Lorenz and Jacqueline Mitton. The book details the historic background, and upcoming encounter with, Saturn's moon. The book includes a feature called "Ralph's Log" on varied Titan related things he has worked on or attended. Think of this as prep for Cassini's encounter in 2005.

Submitted by Earl Bennett

WISCONSIN

Sheboygan Space Society

728 Center St., Kiel WI 54042-1034
c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>
SSS Sec. Harald Schenk <hschenk@excel.net>

>>> DUES: "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020

[http://www.tcei.com/sss/]

☞ We meet the **3rd Tuesday** of the month at **7-9pm**

Jul.15: Foerster Academy of Dance, Sheboygan
Aug.19: Stoelting House, Kiel
Sep.16: Foerster Academy of Dance, Sheboygan

OHIO

Cuyahoga Valley Space Society

3433 North Ave. Parma, OH 44134-1252
George F. Cooper III, 216-749-0017, geocooper3@aol.com

NAME _____.

STREET _____.

CITY/ST/ZIP _____.

PHONE #S _____.

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

Join **The Moon Society** - dues address on page 9

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

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

=> for those outside participating chapter areas <=

❍ $18 Individual Subscriptions to MMM/MMR: Outside North America ❍ $50 Surface Mail -- Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CUYAHOGA VALLEY SPACE SOC. (Cleveland, OH)

❍ $15

CHICAGO SPACE FRONTIER L5

❍ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

❍ $18 reg. ❍ $24 family ❍ $15 student/senior

MINNESOTA SPACE FRONTIER SOCIETY

❍ $20 Regular Dues

OREGON L5 SOCIETY

❍ $25 for all members

O.A.S.I.S. L5 (Los Angeles)

❍ $25 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE

❍ Annual dues for all with MMM $20, due in March or $5 times each quarter before the next March

---

SHEBOYGAN SPACE SOCIETY (WI)

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

Moon Miners' REVIEW # 33

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

==> *Mail Carrier, Time Sensitive Material* <==

Non-Profit Org.
U.S. Postage Paid
Milwaukee, WI
Permit No. 3532