"Expanding the Human Economy through Off-Planet Resources"

Moon Miners' Manifesto

& Moon Society Journal

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In Focus ▣ Distributing Risk – Lessons from September 11th, 2001

"Those who do not learn from history are condemned to repeat it." One of the things that jumps out from the kamikaze airliner attacks of September 11th, is the very different results between the two targets: total destruction of the World Trade Center towers, *relatively* minor damage to the Pentagon. Yet both facilities were of a similar order of magnitude in total square footage and occupancy numbers.

The towers were essentially *vertical* structures where a local failure *at any height* inexorably doomed the entire structure. Gravity acted on cue to cascade the initial local damage throughout. Here the "Failure Mode" risk was *shared*. Additionally, in each tower there was only one escape route, and when that route was severed by the invading aircraft, those above that point were doomed.

The Pentagon is essentially a *horizxontal* structure where gravity worked to collapse only the local sections damaged. In this case the Failure Mode risks were distributed. Additionally, the Pentagon is essentially a loop-type structure, with escape routes in either direction (clockwise, counterclockwise).

The use of large airliners loaded with both people and fuel as piloted missles was something unexpected by the architects in either case. Yet even so, air accidents have always been at least a remote possibility. Too remote to design for, perhaps.

On the Moon or Mars, where there may be no one to pick up the pieces or come to the rescue of possible survivors, and where impacts from the sky cannot be ruled out even though the odds are low, it would be insane to design a settlement megastructure with a *shared* failure mode: *failure anywhere dooms everyone*. The popular artist-inspired vision of lunar and Martian cities under glass domes are an example of fate-tempting architectural bravado. Puncture the glass "firmament" anywhere and poof!

On the other hand, settlements built of interconnected modular elements, would, if connections could be sealed, distribute the risks. Some, perhaps most, would survive all but the most unlikely strike. This is not to say that we won't see any domes at all. Domes anchored to bedrock in order to resist the outward push of air pressure could someday appear over parks and city "squares." Such domes would be quite local, and surrounding sections could be sealed off if the dome's integrity were compromised.

Given that it makes sense to go modular in the first place because that is a method of construction that suits growth patterns, a modular [=> p. 2, col. 2]

Goodies from Homestead Gardens

What do fruit jellies and preserves, deserts with special ingredients, herbal teas, specialty wines, organic dye stuffs, specialty house plants, craft papers, gift items, and family morale have in common? They are all possible products of space frontier homestead gardens pursued as cottage industry enterprises. For more, see pages 5-8.

Moon Miners' Manifesto

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fi IN FOCUS Editorial continued from p. 1.

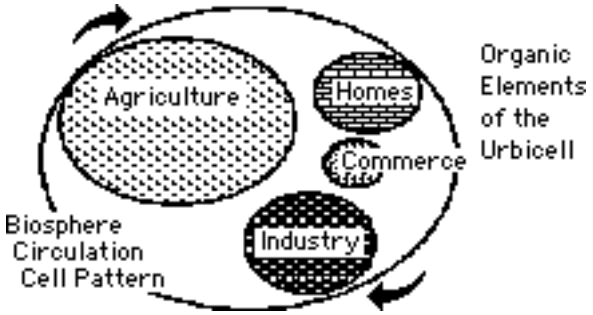
settlement may select from any number of overall plans. A *linear* plan of expansion along a spinal transportation corridor might be highly efficient. But given the lessons from the Pentagon event, such a plan risks cutting the settlement into two mutuallly isolated sections if there were a breach anywhere. But any "urban plan" which provided multiple inter-connectivity between various sections, a loop being the simplest of these, would preserve the continuum of the settlement, no matter where compromised.

Building architectures are not alone in their vulnerability. In human chain of command / informa-tion structures, strictly vertical chains risk collapse if there is a failure at any level. Communist party "cell" architecture, with its multiple connections, is an early 20th Century parable worth learning from.

Decentralization and Polycentric Infrastructure

On the Moon and Mars, the integrity we need to protect includes the pressurization "hull-plex" and also the utility systems: fresh and waste water lines, fresh and stale air ducts, electrical power and communications. Again multiple connections will serve us well whereas an efficient and cheaper linear settlement plan would magnify any catastrophe.

In MMM #53 March 1992 pp. 4-6 "Xities and XITY PLANS: settlement layout options" ["xity" being our word for any settlement that has to provide and maintain its own biosphere], we suggested that it might work much better to design neighborhood scale utility systems. Instead of one central plant for each utility system, we would simple build additional plants as we added additional neighborhoods. Our intent was to accommodate variable growth patterns *and*, not to commit the settlement to soon outmoded systems. If the settlement's utility structure was also modular, newer areas could have the benefit of improved systems when available. For this to work, each neighborhood cell must have all the "zones" it takes to function as an autonomous biosphere unit: residential, industrial, commercial, agricultural.



But in the light of the recent attacks on New York and Washington, the idea of neighborhood-scale utility systems and nerve centers makes even more sense. The "urbicell" plan, as we dubbed it in the back issue cited, avoids putting all our utility eggs in one basket. On the space frontier this will be

much more important than in the Pentagon. Because we live in a planetary biosphere, the utilities could all shut down and we would be only inconvenienced. Not so on the Moon or Mars. We have to make sure that everything that makes the settlement or outpost work is polycentric so the destruction of any center remains a non-critical, survivable matter.

The same goes for the intrasettlement transportation infrastructure. We court trouble not only if we design a linear system, but also if we design around one central hub. If, as the settlement grows, we had additional neighborhood hubs, we will be able to recover from the crippling of any one. Consider L'Enfant's plan for Washington D.C. as an example.

[Grid Highlighted by MMM Editor]

Admittedly, Washington acquired a downtown along the way, to the north of the White House. But in today's world, with the Internet and other electronic means of teleconducting business, commerce and finance, such concentrations of office and commercial space are less essential, if at all. "Infrastructure lasts forever," and while in the past decade many urban downtowns have seen a major renaissance, this rediscovery is driven more by the perceived plus of clustering entertainment and cultural activities than by the traditional pillars of commerce, finances, and transport hubs. Stuck with these relics, we have been voting in ever larger numbers to put them to good use.

On the Moon and Mars, where we can build with a clean slate, it makes more sense to build a series of hubs. While this make sense from a security point of view, it also avoids the historic pattern of city growth in which an ever growing downtown ends up swallowing the residential neighborhoods that surrounded it at the start, much like a black hole keeps swallowing up hub-hugging stars in a galaxies nucleus. With a modular urbicell plan, this pattern of continual displacement becomes something of a past. Neighborhoods are free to be the *stable* life-fostering zones they should be.

Not only should the frontier city grow a number of co-equal hubs, the hub and spoke patterns of various systems should not overlay one-another. In New York, new subway lines and stations were built at the time of construction of the World Trade Center, routed to conveniently run through the Center complex's basement levels. These stations and tunnel sections are now in ruins. They should have been nearby, not under. That is hindsight, but hindsight we can learn from. Thus electrical substations, transport hubs, water and sewage pumping stations and treatment facilities, communications centers etc. should all have their own grid systems, so that the damage from any breach of the settlement pressure hull-continuum inflicts minimum damage, and is as survivable as we can make it.

None of these considerations are put forth to ensure survivability of our settlements from a "terrorist" attack. There may be human terrorists in space someday. But our real concern should be the non-human "mindless" terrorism of events of cosmic weather, including larger meteorite impacts.

Again, we must ever keep at the forefront of our attention the absolutely critical difference between settlements on Earth and settlements elsewhere in the Solar System. The former enjoy a given, surrounding planetary biosphere. One can flee to the "outside" and survive. In the latter, the "outside" is a life-snuffing environment, not a life nurturing one. Fleeing a disaster is much less of an option. Our only option is to disperse all our assets in as decentralized and polycentric a pattern as we can.

That said, even after we have planned as dispersed a network of functional assets as we can, there is another scalar level of risk that comes from population density. The conventional wisdom of science fiction writers and professional thinkers as well is that off-world settlements are going to be very compact. We'll be living cheek by jowl and have to get used to sardine can living because building on the space frontier will be expensive.

As always with conventional wisdom, the above consensus rests squarely on commonly shared assumptions that are to say the least, questionable. We need to develop building materials, architectures, and construction methods that will allow us to build new pressurized spaces and modules by relatively inexpensive and labor-light methods. We do not have to model off-world construction on methods and practices that work on Earth. "Elbow Room" is a quality of life issue that should be a major goal. Not only will it make for better morale and mental health, the lower population density will be safer.

Unfortunately, we're a long way from building settlements off planet. But even much more humble outpost structures should be designed and built so as to distribute risks and failure modes where possible to minimize chances of *total catastrophe.*

Fire and Smoke

The Pentagon incurred only limited impact and collapse damage. Unfortunately, there is more to the story. Fire and smoke spread through extensive sections of the building to either side of the impact zone. Designing a building to isolate risk is one thing. Designing its utility infrastructure accordingly is another. Utility disconnects and automatic duct sphincters or fire and smoke barriers are another. The damage at the Pentagon was much greater than it had to be. Fire also spread through unbaffled chases in the roof structure.

On the space frontier, we will have to design all our utility systems - water, electricity, communications, and air - to isolate problems and damage quickly and effectively without impairing continued network operation, through alternate routing.

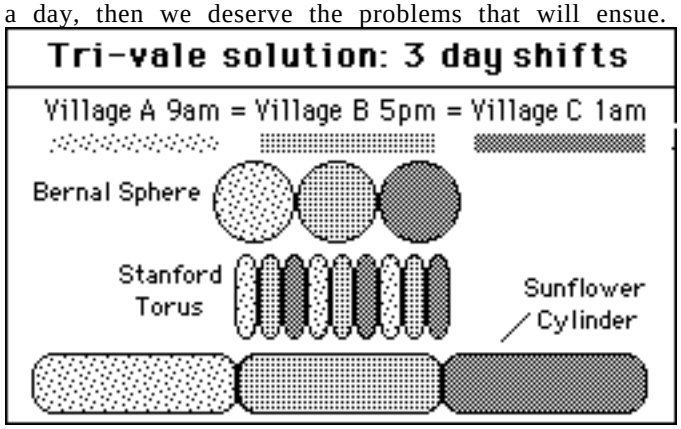
Lavatube Settlements

Lunar lavatube sections that are intact today have been intact for three and a half billion years or more. They are the ultimate "safe houses" in the solar system. Martian lavatubes are a billion years or two younger and probably equally safe. Impacts on the surface above can be expected to produce some spallation, breakoff of some ceiling/roof material, but little more. Modular settlements within these tubes would provide maximum safety. Whole low-pressurized lavatube sections, more likely on Mars than on the Moon because of the scarcity on the Moon of Nitrogen for air, should also be fairly safe.

Vulnerability of Space Settlements

The "classic" space settlement designs known as the Bernal Sphere, the Stanford Torus, and the Sunflower cylinder - Gerard O'Neill & Co.'s "Island I, Island II, and Island II", respectively, are all unitary mega-structures. As such they put all occupants at shared risk for any critical failure.

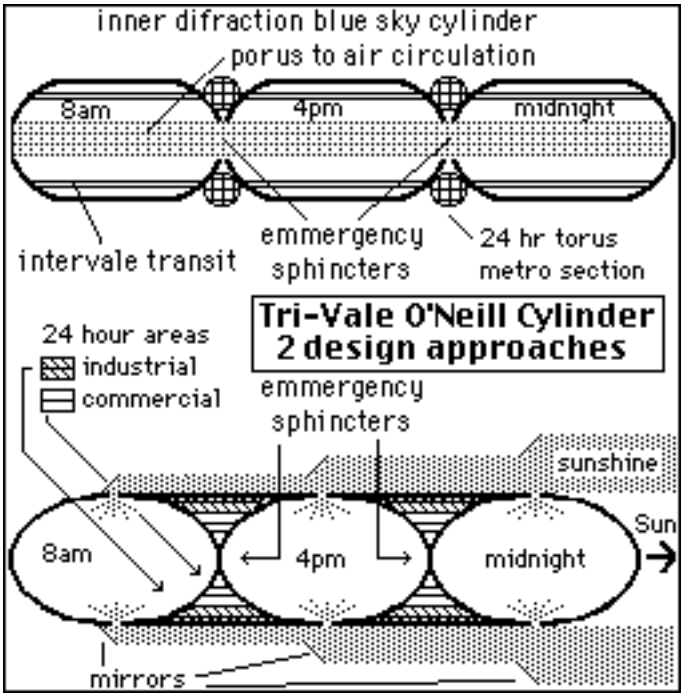
While these designs are revered, it *must be said* that academics, businessmen, bureaucrats, and many others envision things encumbered by the horse blinders of what we have called "day shift chauvinism." These structures will be expensive. If the stores, shops, schools, playgrounds, factories and other expensive investments are used just 8-12 hours a day, then we deserve the problems that will ensue.



The only sensible approach is to segment each space oasis into three residential parts (or multiples thereof) with staggered time zones, and with all these expensive facilities in 24 hour zone areas. Happily, if we do that keeping risk distribution in mind, we will come up with new architectures that are more efficient *and* have a significantly lower construction and cost threshold (for implementing the first of the three parts, at least) *and* are safer, more survivable.

See MMM #87, July '95, pp. 3-8, "Space Oases: the Next Generation"] and the LRS White Paper at:

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



This, of course, is much easier to say than do. We do not pretend to have solutions to the architectural challenges of such major redesigns, e.g., how to redirect available sunlight to triplicated units. Our purpose was merely to point out that classic designs leave much to be desired operationally, i.e. for how human settlements actually operate, *and* financially.

We also focused on the jump-the-gun decision to design for One standard Earth gravity without any concrete evidence that fractional gravity is as bad for the human physiology as zero gravity (no person has spent more than a few days in fractional gravity, i.e. the Apollo Moon astronauts.) This decision, coupled with tolerance limits on the rate of spin or rpm, mandates that 1 G structures in space be immense, and therefore unnecessarily prohibitive to build - indeed insuring that they never will be built. If experiment shows that at 1/6th g (lunar) or 3/8ths g (Martian) levels, physiological deterioration levels off at an acceptable plateau, we can build smaller, lighter oases, putting less people at risk in any one location. We lost too many lives on September 11th. But we can learn from this tragedy how to save many times more lives on the space frontier. **<PK>**

Homestead Gardens & Early Cottage Industries

by Peter Kokh

Revisiting our Assumptions

This month we want to delve into the economic benefits of equipping lunar homesteads with garden spaces. But first, lets revisit our assumptions.

The common expectation that the first people to return to the Moon will be living in very spartan and cramped quarters is most probably right. Habitat space will be brought up from Earth, sized to fit either the Shuttle payload bay or top-mount farings of big boosters. We *could* sneak in some elbow room via telescoping modules or rigid-inflatable hybrids of the TransHab or Moonbagel types. But chances are that extra elbow room would be used for operations, lab-space, storage, and other non private purposes.

It will only be once we have mastered the many tricks of handling mischievous lunar regolith and processing it into suitable building materials and coming up with modular architectures that permit fast, manpower-light construction with quick occupancy that personal quarters will start becoming more truly livable on a rest-of-one's life basis.

Once we reach this threshold of learning how to live off the land, the holy grail of lunar construction will become "spaciousness". Here on Earth, we can tolerate closer quarters when need be because we can go "outside" if needed to get relief from interpersonal pressures. Walk out the door and go for a walk, putter around in the garage, do some gardening. On the Moon, all our getaway relief spaces will have to be in pressurized structures. If we want a garden, be it for growing food or just for enjoyment, that garden has to be "indoors" and lit either by artificial light or by channeled sunlight, or both.

Last month, we talked about the "Earthpatch" or "patch of Old Earth" atrium garden space as the heart of the lunar homestead. It will take a while to get to that point, But make no mistake, if we do not reach that stage of "gracious living" in due course, the prospects for *permanent, healthy* human civilization on the Moon are not good. Hardships that are endurable on a short term basis become unbearable if there is no real hope of ever getting past them.

A garden is what one makes of it

Not every homesteading family on the Moon who gets to move into a new modular home equipped with an atrium garden space is going to want to be growing fruit, vegetables, herbs, and spices. Many, no doubt, will be quite content to enjoy relatively carefree greenery and some perennial flowers, perhaps. (and why not songbirds?) Even purely ornamental gardens will serve the essential purpose of producing sweet fresh air and pretreating waste water.

Some, however, will be anxious to try their hands at growing vegetables and fruits not planted in the settlement farms, in search of a more interesting diet and more varied menu choices. Among these will be some "green thumb" types who are good at it, good enough to produce surpluses worth selling to others as raw fresh produce, canned goods and preserves, juices and ciders, or other garden byproducts.

So while the original dual purpose of having an "Earthpatch" is to provide healthier homes and citizens with higher morale on the one hand, and to ensure that each home functions as a modular organic cell of the settlement biosphere at large, for some, these homestead gardens, "yours to do with as you please", will becomes a real foot in the door for off-hours and weekends "cottage industry."

Cottage industries enrich the lives of those who engage in them, provide the benefits of harvest to themselves, and by sale or trade (barter) enrich the lives of others. They also provide real personal satisfaction that may be lacking in their "day jobs."

Roots of Opportunity: the Quest for Variety

The settlement agricultural areas are likely to take a minimalist approach: providing a balanced diet in as efficient a method possible. That is likely to involve a relatively short list of basic crop "staples." While these staples will provide for all nutritional needs for the body, we all know that there is much more than that to human eating patterns, and there always has been. Food has to be more than nutritious. We want it to be tasty, and reasonably varied. But at first, providing for varied, interesting menu options and "cuisines" will rank as secondary.

This understandable priority will leave a lot of pioneers wanting more, and wanting it badly. Of all the pleasures we humans enjoy, the most regular and most consistently valued, is good tasty food with plenty of variety. The vacuum left by the short "basic" list will create an insistent demand which will surely intensify over time. Yet importing treats and specialties will be prohibitive. But we can expect to see some freeze dried specialties make it to the tables of pioneers for special occasions and holidays.

Given this situation, anything for which there is demand but is *not grown* in settlement agripod units, will lure would be entrepreneurial gardeners provided with a gardenable plot. This will include more fruits, additional vegetables, herbs, spices and seasonings, and beverage stuffs. The shortcomings of the settlement food production system will, in effect, create a vacuum. Nature, including human nature, abhors a vacuum. The appetite for *more* will become a necessity that will nourish a lot of inventiveness.

Only one "climate" may be supported within the farms: tropical, subtropical, or temperate. Any of these choices will rule out many crops favorites. If it is possible to support special climates within homestead gardens, one could cultivate items in demand.

To be honest, it may be easier to raise strawberries and other northern food plants that require frost cycles in large separate agripods than in homestead gardens that are integral to living space. But given the incentive, we doubt it would be impossible.

Yet another factor motivating home pocket farming is that some who seek assignment to the farms may be attached to farming or gardening methods that can't or won't be practiced there. The settlement farms may be largely hydropinic, for example. In that case, the homestead garden could provide an outlet for those rooted in the soil.

The Market for Home Processed Food Items

The settlement farms may provide only "raw" produce. It is more likely, however, that in order not to waste fruits and vegetables with low "shelf appeal" yet perfectly nutritious and tasty, that basic "canned goods" items and other lightly processed stables will be available, and sought after. That will still leave a lot of room for specialty products, especially as herbs, spices, and seasonings become available. Thus some homestead gardeners may well concentrate exclusively on raising such taste enhancers to add to store-bought staples in canning homemade taste enhanced labels at premium prices.

We can expect special marketplaces to spring where would look for such specialty items (as well as home produced arts and crafts, and other cottage industry items). Cottage industries of all kinds will seek to fill the shortcomings of settlement stores.

Resources for Homestead Gardeners

Where would homestead gardeners get seeds and seedlings, soil additions, tools, special processing equipment and other things required to support this kind of in-home light industry? Keep in mind that while the settlement fathers may need to concentrate on a few basic crop staples, it is still in everyone's interest that enterprise-grown supplements to this minimal fare be supported and encouraged. It should be settlement policy to provide a varied seed "bank" and provide needed tools - even importing such items until they can be manufactured locally.

Seeds, seedlings, and shoots may be available even for non-food or food ingredient plant varieties. Increasing biodiversity within the settlement should be a major goal in its own right. So it would not be surprising if even those gardeners who are interested only in purely ornamental plants and flowers find official support and encouragement.

Cottage industry, however modest at first, is a primary pathway to economic diversification of the settlement. At first such efforts may arise mainly to fill local pent-up pioneer needs. But in time, many such enterprises could expand beyond their humble homestead beginnings to become major day job operations producing products for export. Keep in mind that anything produced on the Moon could likely be supplied to other off-Earth markets, such as tourist meccas in low-Earth-orbit, at a real cost advantage over equivalent products shipped up the steep gravity well from Earth's surface.

In the U.S. most state universities with agriculture departments have "Extension" programs supporting agriculture and horticulture. Even in its earliest phase, any Luna University should have such an Extension service, as well as support services for home industry entrepreneurs in general. Again, both biological and economic diversification should be the goals of such an institution. Here on Earth, many universities and colleges do see enterprise support as a core function right alongside education and research. Indeed, such support efforts follow from research quite logically.

Even prior to the opening of a "university," a Settlement Economic Development Office should foster such efforts. Given this favorable environment, it is likely that import of requested specialty seeds might be subsidized by the settlement government. The lunar settlement may start as a government-major industry consortium. But human society will not truly be transplanted to the Moon or elsewhere until free spontaneous private enterprise on all scales becomes a co-equal sector of the economy.

We have already seen [in the "Earthpatch" article last issue, and this month's In Focus essay] that even if cottage industry products were not at stake, decentralizing biosphere maintenance is. By supplementing settlement farms and community parks with homestead gardens integrated with point of origin primary waste treatment, we provide a much more flexible, varied, and buffered biosphere life support base. And that translates to security, morale, and long term viability.

Gardening & Food Processing Coops

Okay, you buy all this, but ...! How can a family garden in a small plot that can probably not be expanded, sustain any kind of economically viable food product operation? The scale is just too small.

We agree. In all but very special cases, this does not seem to be a viable way to proceed. But why assume that each family has to operate in isolation and self-sufficiently? On Earth, where family farming with much larger areas under cultivation has become economically untenable, giant corporate farming has made major inroads. But there is another option, and one that has been successful in many fields: dairy, livestock, as well as crop farming. We are talking about coops co-owned by farm families.

Let's say you have identified a market for raspberries, not grown in the settlement farms. Other families could join you to raise raspberry bushes on staggered harvest cycles. Together you could market them as fresh produce and even down the road invest in processing operations outside homestead settings. The tested coop model may work on the Moon as well.

Now of course, this sort of coop-supported activity becomes more realistic as the population of the settlement rises. The amount of such endeavor is likely to grow exponentially as the population soars past a hundred to a thousand, ten thousand, and ... It is a commonplace that beginnings are very humble, and in retrospect, even invisible, unrecognizable, and untraceable. Still it *is* possible for just one family to break the ice and demonstrate the cottage industry path to adding new items to the diet.

It could well be that the settlement fathers will stick to their plan in producing only absolutely necessary basics in the communal farms, turning a deaf ear to those clamoring for coffee, tea, chocolate, wine, beers and other semi-addictive non-essentials. It may be left up to garden coops to take the plunge in such areas, and they will find a supportive market, no matter how inferior their initial products.

Once the first homestead garden coop appears others will quickly follow. New fruits, vegetables, herbs and spices will become available in Gardeners' Markets. Premium lines of canned goods and new processed food items like fruit and vegetable juice cocktails will follow. Coops could produce partially processed recipe makers such as gravies and sauces, soups, condiments. They could also market compost, seeds and shoots, house plants and much more. Thus diversifying the menu and supporting more interesting cuisines for family home cooking as well as for restauranteurs will be just the first area of home garden supported cottage industry.

As versatile food crops increase in number, a wide range of interesting eateries will appear. That can only help the Earth tourist trade and intersettlement tourism as well. The tantalizing aromas and odors associated with these new restaurants will soon become taken for granted. Of course, the first of these eating establishments may well be coop-owned.

Coops will give birth to trade magazines (the "Mother Moon News" and the "Earthpatch Farmer") and offer basic and advanced courses in home gardening. They could organize home garden shows and cook-off competitions such as an anual "Taste of Luna City" event. Coops could conduct fundraising tours of outstanding home gardens, even contract with toourist companies for some gardens to be on one of the regular tour extension circuits.

All such public exposure will surely work to increase the percentage of homestead gardeners engaged in "production." Enterprising individuals in other talent areas will be inspired to follow the cottage industry and coop trail. The excitement of helping build a new civilization will spill over to other areas of the economy. Enthusiasm is contagious

The lesson here is that by bringing together different areas of expertise, by marshaling real economies of scale, and by joint processing and marketing, the coop can combine the seemingly insignificant energies and abilities of individual home gardeners into products and acti-vities that will make a real improvement in the daily lives of most settlers. It will be an improvement that just may tip the scales for many of those weighing the merits of returning to Earth or committing to life on the Moon indefinitely. Perks will be crucially important in creating a population that considers itself truly at home on the Moon. Coop-produced perks can help immensely.

Enter the Realm of Plant Byproducts

Homestead Garden enterprises can be aimed at other than the food, seasonings, and beverage markets. Plants are the source of fiber, with which to make rope, fabric, and paper. They are the source of natural organic dye stuffs like henna and indigo and many others. They exude resins useful in various ways and fragrances. Some plants produce substances of medical and pharmaceutical usefulness.

Gardeners could cultivate plant species as a source of any of the above, harvesting the plants for further processing in coop owned facilities. They might want some of the processed pulp, dyes, and other extracts to use for homestead produced arts and crafts and other uses. There is no one fast model.

Wood is not a likely product of homestead gardens. Hard wood suitable for carving into jewelry value items (on the Moon, wood *would be that rare*) is more likely to come from fruit trees grown in the settlement orchards - apple, cherry, pear, pecan and others. Some of that wood could support cottage artisans making small but valued keepsakes and high-end cabinet hardware (knobs and pulls).

Pulp for home-crafted paper can come from the stems of many plants otherwise destined for the compost piles or biodigesters. Such papers can be turned into gifts or greeting cards by family artists. Some would be sold at the Gardeners' Markets for others to do likewise.

Temporary art (art du jour) materials both for children to use to develop their abilities of creative expression and for short term advertising needs can use dried leaves, corn cobs, dried beans and seeds and other items from the farms. Additional "special" items from home gardens may carve a niche here.

Even byproducts that represent but a small fraction of the total garden plant biomass might prove worth pursuing given that the remainder can find some use as fodder, mulch, compost or simply raw material for the biodigesters producing tofu-like supplemental food products. Such biodigesters will even make cotton raising reasonable.

Servicing the Home Garden Market

In addition to activities engaged in by coops, a number of enterprises might pop up to serve the horticulture market. Some of these services may be developed by homestead gardeners themselves out of

necessity. After all, anything one succeeds in doing well for oneself is worth marketing to others.

But those not engaged in horticulture directly may have also applicable expertise, gained from servicing utility systems, manufacturers, and other sectors of the economy. Where there is a need to be filled and a buck to be made by filling it, someone will surely rise to the occasion. In the settlement's early days, many of these needs may go unfilled, and gardeners will find less help. But as the settlement population grows ever larger, the more certain that any identified or perceived vacuums will be filled.

- composting service & equipment
- water handling systems: pumps, filters
- installers of "water features"
- fertilizers and nutrient suppliers
- lighting systems
- thermal management & climate control
- automated systems
- software programs
- canning & pickling supplies: jars, lids, labels
- packaging consultants
- garden doctors and consultants
- garden planners and "architects"
- pollinators and pollination services
- recipe makers
- marketing consultants
- networking clearing houses
- restaurant suppliers

The Bottom Line for the Settlement

Lunar frontier pioneers will not enjoy the immense variety of domestic and imported products to which we are so accustomed here on Earth. The costs of transporting any goods or products, tools or parts *not absolutely necessary* up through Earth's gravity well will mean that the settlers will be largely left to their own ingenuity and creative enterprise if they want to supplement the spartan "issue" items regularly imported. This is true not just for food, but for apparel, furnishings, and entertainment and hobby items. In each of these areas, ingredients produced in home cottage industry gardens will play some role in the campaign to provide the variety that is the spice of life.

Widespread homestead vegetable gardening will create a decentralized Food Growing System to supplement the settlement's farming operations. This will promote the settlers ability to survive blight, plant disease, and crop failure emergencies.

In all these ways then - biological diversity, biosphere decentralization, point-source waste treatment, support of more diversified menus and special cuisines, art and craft materials, apparel choices, art du jour stuffs, even alternative nutrition supplements homestead gardens will be a major player in the transformation of our "intentions" to remain on the Moon indefinitely into genuine viability.

But it is the contribution of cottage industry that to us seems the most important consideration. From the outset, the lunar settlements will be hard pressed to reach the economic breakeven point that will turn them from tentative ventures into outposts of humanity that are truly "established." Garden-based cottage industry will play a significant role in diversifying the economy and intersettlement trade.

The breakeven point will be reached when the total value of items produced on the Moon for export *sustainably* exceeds the value of items that must still be imported both to maintain the settlement and fuel its continued growth. The struggle to reach that point will govern everything, underpin everything.

That strong all-transcending priority means that all "day jobs" will need to be either directly or indirectly supportive of production for export. In other words, we will need all able-bodied or able-handed personnel to be so involved. Vital "indirect" support will be provided by agriculture, utilities, and domestic market manufacturing products needed to sustain a growing local populace.

This does not mean that there is no room for economic activity aimed at filling "non-essential" and discretionary needs of people in search of the good life and greater comfort. It is the fact that people do not live by *bread* alone, no matter how *nutritious* (both these terms used both literally and metaphorically), that will motivate some more talented and more enterprising pioneers to use their off-hours to produce things that will feed the need for taste, variety, and a richer life.

Once the settlement has established itself and seems to be a sustainably viable partner in a Greater Earth economic market, we will see these off hour economic activities emerge into the mainstream. That is, people will engage in meeting these good life needs of their fellow settlers on a full time basis. The domestic market will emerge as the primary market in the economy, with export/import activity assuming the supporting role. When that happens, the settlement will "have made it."

Not by good food alone ...

The homestead garden is but one of several cottage industry enablers. We plan to talk about other likely fountainheads of cottage industry in future articles. As these humble beginnings begin to produce items that can be exported to help tilt the settlement's economic equation, some of these humble "cottage" industries will evolve into main sector day job industries employing many new settlers.

On the Moon, we'll be behind the proverbial eightball. We'll need to work every angle. **<MMM>**

Back Reading

MMM #2 FEB '87 "Moon Garden"
MMM #39 OCT '90 "Saving Money on Food in Space"
MMM #148 September, 2001 "Earthpatch"

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 the further exploration and utilization of the Moon in cooperation with other like-focused organizations and groups.

Artemis Society International was formed in August 1994 as a forum for supporters and participants in the **Artemis Project**™ quest to establish a commercial Moonbase 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®

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

Headline - "Millionaires Aim at Mars"

[http://www.msnbc.com/news/621237.asp]

Why not Aim at the Moon?

by Peter Kokh

In my humble opinion ["IMHO"], the Mars Society's success in attracting a club of millionaires to invest in smaller critical research items in the $1-20 million dollar range flows from its having a ready menu of such research projects begging to be done and to date ignored by NASA. Whether this "orphan" status flows from budgetary reasons, lack of foresight, or of vision is neither here nor there.

It makes no sense for us in the Moon Society to watch this all unfold when we could be following suit. We have to suggest a menu of projects that could benefit from similar scale infusions of capital, and we haven't been doing so. But first this caution: Putting a *very unofficial wish list* in MMM will not do the trick. That said, here are some suggestions:

- experiments to attempt to produce silane from raw Apollo lunar regolith using a version of Zubrin's *in situ* sabatier reactor (an RZ suggestion!)
- research leading to a workable and reliable rocket engine that burns iron powder in oxygen
- developing "gas scavenging" equipment to be integrated with earth-moving construction equipment that will harvest solar wind derived volatiles such as hydrogen, carbon, nitrogen, neon, helium, etc. from the regolith, and sort and store them
- repeat the Translife experiments in low Earth orbit to follow mice through one or more reproductive cycles in simulated lunar 1/6th gravity
- find the best terrestrial analog for moondust with respect to its mischievous properties: clings to everything, gets into everything, abrasiveness etc.
- using this simulant, fund research to find and debug promising ways / materials / equipment to handle regolith in construction & processing, etc.
- funding the design and fabrication of a Moonbase analog station at which capable volunteers could simulate operations especially dust management and "overnighting" [see last issue. pp. 10-12.]
- developing lubricants that can stand the extreme thermal range of lunar dayspan and nightspan
- fund a "ground truth mission" to a lunar pole to settle the ice question.,If the find is positive, determine the volatile and dust ingredient mix
- develop a fuel cell that could be made solely with lunar materials.

This is a quick first trial balloon list with the hopes that it will work to get our members, and especially Society leaders thinking about following suit. I'm sure we will find more items to add to this list. At least it is a start.

ARTEMIS MAGAZINE®

Science and Fiction for the Space-Faring Age
Summer 2001 Issue #5

http://www.lrcpubs.com/artemismagazine.html

Science

Lunar Platform for Astronomical Research: Strategies for Doing Lunar Astronomy and Securing Funding Sources by Robert E. Strong

Understanding Orbital Mechanics by Kirk Pierce
Mr. Steele Goes to Washington by Allen M. Steele
Written Testimony to the Subcommittee on Space and Aeronautics by Allen M. Steele
Hearing Charter: **Vision 2001: Future Space**
The Intrasystem Transport Ring: A Thought Experiment by Roxanne Hutton

Fiction

Gujarat Prime by Rebecca Carmi (art: Bradley Williams)
Revenge Is a Dish... by John Peel
Echoes in a Shattering Silence by Ron Collins (art by Carren Strock)
Pets by John M. Faucette (art by Brian Schrader)
Botanica by John Moring (art by Steve Adams)
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Cover: **The Moon is a Harsh Mistress** by Bob Eggleton

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Artemis Magazine and the 2001 Hugos

LRC Publications Press Release

In the world of science fiction, no award is more prestigious than the *Hugo*, named in honor of the late editor-publisher Hugo Gernsback, commonly regarded as the "Father of Science Fiction.". The Hugo Awards are voted annually by science fiction readers and awarded at the World Science Fiction Convention, traditionally held over the Labor Day Weekend. This year's host city was Philadelphia, PA. [2002 San Jose, California; 2003 Toronto, Ontario.]

In its first year of eligibility, *Artemis Magazine* made an extremely good showing at this year's Science Fiction Achievement Awards, popularly known as the Hugos.

- "Generation Gap" by Stanley Schmidt placed 4th in the Best Novelette category, for a story between 7,500 and 17,500 words.
- *Artemis Magazine* ranked 7th among 56 nominations in the Best Semi Prozine category, for magazines with circulations less than 10,000
- Fred Lerner, whose Artemis Magazine short story "Rosetta Stone" was his first, ranked 12th for the Best New Writer award, out of 1000 nominees
- Editor Ian Randal Strock ranked 12th in the Best Editor category, out of 77 nominees

"Generation Gap" was competing against novelettes and Fred Lerner against authors appearing in magazines up to 70 years old with far greater circulations. The Semiprozine category has been dominated by the same five nominees for nearly a decade, and to rank seventh in this category ahead of much older, more established magazines, is a coup.

For more information on the Hugos or the World Science Fiction Convention, check out:

http://www.worldcon.org

About Artemis Magazine

Artemis Magazine publishes science articles focused on commercial space and lunar development, and hard science fiction. The magazine is a sponsor of the Artemis Project™, a commercial venture to construct a lunar colony.

http://www.asi.org

[Anyone familiar with today's Science Fiction market knows that "hard" science fiction, based on scientifically plausible assumptions, is a rarity. The overwhelming majority of "science fiction" published today is heavily into fantasy, magic, and escapism. In this context, Artemis Magazine is a return to the roots of science fiction, and is *a breath of fresh air*. We encourage MMM readers to support it. PK]

Lunar Flag Design Contest Update

From: Gregory Bennett <grb@asi.org>

The Iowa Space Grant Consortium will award a prize to the best Iowa entry in the Moon Society's Lunar Flag Design Competition. And, if the *grand* prize winner is from Iowa, they will give the winner a Meade telescope.

As of the end of August, no designs had been submitted, and we were still designing the web engines to take care of the submissions and display them on the web. We need to figure out how to interface these submissions to the database and WSD. We hope to get the design work done before then.

Local chapters can also participate in this activity. Folks could contact the schools in their area, and maybe even visit classes to help lead discussions about living in the Moon.

Those how have the resources might also help with scanning images of the kids' artwork and getting essays submitted.

Making Rocket Fuel from Lunar Soil

Wickman Spacecraft & Propulsion Company
http://www.space-rockets.com/Lsp.html
[website text with assummed permission]

In the late 1980's, John Wickman was searching for propellants which could be made entirely from materials known to exist in lunar soil. Most of the compounds are oxides which could be broken down to yield oxygen. The next task was to find a fuel to burn with the oxygen. He looked at a variety of metals and found aluminum would yield the best performance and had the best chance of working successfully in a rocket engine.

The problem was to find a way to inject the aluminum powder into the combustion chamber in a steady, controlled manner. He came up with the idea of mixing the aluminum powder into the liquid oxygen (LOX) to form a monopropellant. Under NASA contract, safe mixing and storage of aluminum/LOX monopropellant or LSP was demonstrated.

The use of this new propellant was successfully demonstrated in a small rocket engine. The engine was fired several times without incident or any flashback of the flame front from the combustion chamber to the propellant tank.

ILLUSTRATIONS:

Aluminum/LOX Monopropellant (LSP) Inside Beaker
http://www.space-rockets.com/photo/Lsp.jpg

Lunar Soil Propellant Engine Test Firing
http://www.space-rockets.com/photo/Lsp-fire.jpg

Regolith-Handling as Lunar Processing 101 In Learning, Prerequisite Courses are 1st

by Peter Kokh

In MMM # 147 August '01 p. 9. We printed a story about the brainstorming project of the Oregon L5 Society (NSS) to work "in situ enterprise" opportunities into the Artemis Moonbase Reference. And previously, in MMM # 146 June '01 pp. 10-12, we printed the to and fro on the Artemis-discuss email list on the topic "What's in the 20,000 lb. Cargo Container of the 2nd Artemis Mission?"

We chimed in with our own 2 ¢ at the end of that discussion with the advice that energy production and storage equipment should come first, then regolith handling equipment or more of it.

Regolith handling is something taken for granted by proponents of other ventures like oxygen production, metals extraction, cast basalt products etc. It shouldn't be.

On the one hand, the regolith is an enormous asset. It constitutes as is ready to use material for shielding from cosmic and solar radiation hazards. It also constitutes all the pre-pulverized, pre-mined material we might otherwise have to excavate.

On the other hand, the fine powder fraction is insidiously adhesive - it sticks to everything - and abrasive. It threatens to make fast work of handling equipment, exposed engines, gears, and bearings, and to find its way inside our pressurized habitats.

We do need regolith handling equipment that works fairly trouble free as a prerequisite for doing anything else. The problem is that while we already have Earth-proven designs for equipment to handle gravel and sand and similar pulverized material,we have no confidence that type of equipment will stand up to the special punishment that lunar regolith has in store for us.

So it is not a question of bringing up proven regolith handling equipment first. It is a question of bringing up as many different kinds of experimental equipment as we have room for in the ship manifest - equipment designed to meet these challenges. If we are to go on to do useful things in the second mission, an essential and critical goal of the first mission must be to field test these various pieces of equipment and based on the results, suggest modifications.

Don't be in a hurry to field test other kinds of industrial processing, extraction, and manufacturing equipment if they require extensive regolith handling in order to work. Let's put the cart before the horse and be sure we have "tool #1" in place first.

Next? Cast basalt products experiments and sintered powdered iron products experiments are much simpler than anything else.

Pre-landing a Greenhouse on the Moon: Pros and Cons of a Salad Bar Greeting for the 1st Artemis Moonbase™ Crew

by Peter Kokh

Recently, on the Artemis-list email discussion forum, "Matt" <Bluepig4u@aol.com> brought up the idea of pre-landing a "greenhouse" module that would greet the first Moonbase crew with fresh salad stuffs ready to harvest. That certainly would be a great welcome! The fresh food item most craved by astronauts has consistently been fresh salads.

As the discussion cited above went on, the emphasis seemed to shift more to the idea of doing preliminary plant growth experiments. Let's take a look at the idea from both angles and see how practical it is or is not. First, let it be understood that we do not wish to discourage the idea. Our purpose is to play Devil's Advocate and point out all the obstacles and challenges so that we end up with a full-baked concept, not a half-baked one. It won't be easy, but it does seem that going through this brainstorming exercise will prove worthwhile.

Farm Module - Moonbase Interface

First off, it seems obvious that any such plant growth chamber, if its crops are to be harvested, must have *a docking adapter* so that the Moonbase, once landed, can attach to it. Not so fast!

This in turn would seem to suggest that:

- the site must first be graded and prepared so that docking is easy enough on a shared grade
- we must be able to land the Moonbase "on a dime" (a homing beacon prelanded with the growth chamber) and then have some mobility so that it can taxi into position to dock with the prelanded growth chamber - OR
- the growth chamber must be passively mobile so that the Moonbase crew can bring it into position and dock it with the just landed Moonbase

These are tough requirements, but none is a "showstopper." Next: the growth chamber will need:

- air controls: plants inhale and exhale just as we do and the O2 / Co2 balance must be maintained
- proper humidity must be maintained
- proper temperature levels must be maintained through the dayspan-nightspan cycles needed to bring the plants to harvest as the crew arrives
- power supplies must either be independent of the solar cycle (i.e. nuclear) or take advantage of the solar cycle to store adequate power to be able to operate at reduced "maintenance" level at night
- the chamber and its equipment should be "off-the shelf" (SpaceHab module?) and lightweight.

Maintaining the Crops during Nightspan

To what extent can you reduce the amount of light delivered to the plants during the two-week long lunar nightspans so that they retain enough vigor to go on to eventual harvest with alternating two-week long dayspan "light feasts?" This was the topic that in 1990, gave birth to LUNAX - The Lunar Agricultural Experiment Corporation - an offshoot of the Lunar Reclamation Society. The idea was to get high school biology and agriculture science teachers and classes doing experiments and turning in data. Many did do the experiments but did not bother to turn in the data. The data we did get was encouraging. Good lighting for a few hours each nightspan day was sufficient. Previous experiments by the Soviets showed that there was another option: simply go with the thermal flow and maintain a refrigerated (but not freezing) temperature in darkness for the two night periods, and the plants will make it through to the next light feast period.

To make nightspan lighting burdens easier, if we choose to go the reduced lighting hours option, we have since discovered that low-power LEDs of the right color give plants the light food they need with much less power (and much less heat - heat being a measure of lighting inefficiency.)

Other Considerations

The power supply landed with the growth chamber could serve as an emergency low-level backup to the Moonbase power system in emergency.

The plants would be grown hydroponically. As much as the author is a soil-farming advocate, it would be an "advanced project" to prepare raw lunar regolith and introduce it into the chamber as a growth medium. We'd have to robotically sift out the aggregate breccia "pebbles" and the fine drainage clogging powder element. And we might want to preheat it to 150 °C to transform some of the minerals into zeolites. Way too much for a first mission!

Talk on the discussion list centered on the robotics needed. Balderdash! Teleoperation is much simpler, and, at Earth-Moon distances, very feasible. The new wireless webcams would be part of a lightweight tray-mounted teleoperation system.

This *should not be* a mission to determine if plants can grow in 1/6th gravity! Such experiments can be done in a **TransLife** module in low Earth orbit. Nor should it be a mission to do research on other aspects of lunar agriculture. Those experiments can come later, when the first crew is on hand. "Keep it simple, stupid!" is the axiom that should guide us. Our object should be the first one proposed not more elaborate research priorities. The only goal that makes sense for a pre-landed "Greenhouse" is to greet our first crew with a fresh salad feast.

Meandering Through The Universe

A Column on the Cooperative Movement on the Space Frontier © 2001 by Richard Richardson

Space, in the aftermath of September 11, 2001

In these trying times, space seems pretty unimportant to a lot of people. Even more people than in the past are likely to wonder why we should spend money and effort on space when there are so many terribly serious needs here on Earth. Some people will simple feel that expending time, energy, money, and thought on space is somehow disrespectful to the memory of those who were murdered. And some people are just sort of numb and need to concentrate all of their attention on simply carrying on.

Among those who might turn away from an involvement or interest in space development, those in the last category are the only ones whose attitude (about what priority space should hold in their world view) is justified. Those who assert that resources should only be expended on earthly needs and never on space are completely deluded — whether through misinformation or self deception.

First, with regard to what is almost universally their inference that *governments* must pay for opening space, I repeat my assertion that virtually no government money should, nor needs to go directly to space programs. Although some government resources should be spent on developing various necessary regulations and the like, and some resources should be used to enforce those regulations, I sincerely believe that we, ourselves, can fund the work we want to do if we are willing to truly commit ourselves to it. If we are not willing to make such a strong commitment, then we have no right to bellyache about insufficient resources.

Furthermore, governments already spend so little on space that it makes virtually no difference to the other needs of people on Earth anyway. And, if they are serious, the people who claim that concern for the many needs right here on the Earth is what motivates them to not want precious resources wasted on space ought to be sure that they are giving all of their time and money that they possibly can toward meeting those needs, ought to be voting for politicians who run on platforms of doing what they can to address those needs, and ought to do no less than turn their cries about wasted money on the sports, candy, soft drinks, alcohol, tobacco and entertainment industries (to name but a few). Otherwise, they are just hypocrites and blowhards.

There *are* serious needs going unmet on this Earth, and to some extent, they help to fuel some of the warped and evil thinking which leads to horrific deeds like those which have visited us recently. People who are oppressed, mistreated, attacked, dispossessed, who find themselves without adequate food, clean water, clean air, medical aid, etc., *do* need assistance from those who are better off then they are. But who will help them more, those who attack what they don't like in the name of the needy, or those who open new frontiers with new jobs and new opportunities for the free practice of customs and new opportunities to remove oneself from oppressive circumstances here on Earth?

Sure, all that space offers at this point is *potential* for better lives — no guarantees. But since when has social work guaranteed better lives for anyone? There just are no such guarantees. Admittedly, space development almost certainly won't end any of the eternal hatreds and jealousies between various groups here on Earth, but it could offer individuals the opportunity to leave behind situations posing gross danger, abuse or other circumstances which promote hopelessness.

And those who think that any moral activity whatsoever can somehow be disrespectful of those who were murdered are simply thinking irrationally. The murderous acts were truly senseless. However, the deaths of the victims will never be in vain if they help to motivate the rest of us to realize and cherish our many blessings and work to share those blessings with as many people as we can. Developing space as a new home and resource for humanity is a powerful and wonderful means of doing just that.

Still, it is understandable if some no longer feel the same about their personal interest in space development as they did before. It's human to change. It's each person's decision and no one else's business. But judging for others what legitimate work is worthy of the memory of the dead, and what is not, is purely an act of selfish egotism and not at all one of sharing. Such an attitude itself, disrespects the victims.

The Frontier as a World Relief Valve

Finally, there are plenty of good reasons to believe that the world would be in far worse shape than it currently is if there had not been a couple of continents in the western hemisphere, and one in the far eastern, for the peoples of the "Old World" to expand into. Yes, it certainly has been a catastrophe for the indigenous cultures, with atrocity after atrocity, and I don't want to gloss over that. But human history might well have been even more calamitous and rife with intentionally caused deaths if there had not been the pressure release valve of a frontier to settle and develop.

Anyway, space has no indigenous sentient inhabitants anywhere in our neighborhood, nor does it even have any indigenous plants or animals — so far as we have yet been able to discover. On the other hand, it is much harder to go to the space frontier than it has ever been to go to any frontier here on Earth. It will be much harder to wrestle profit from the space frontier. It will be much much harder to make a home on the space frontier.

Opening space as a frontier for settlement and economic exploitation is a very tough challenge, but doable. It need hurt no one, for some of us to take full advantage of space as a frontier for settlement, adventure, and profit.

The development of space has the potential to provide vast new realms of opportunity for all of the individuals of Earth. Opportunity helps to reduce the occurrence and severity of hopelessness which helps to reduce the occurrence of violent extremism. And a frontier offers at least the hope of, and often real opportunity to escape from circumstances of oppression and threat from violent extremism as well as from other circumstances of human caused and natural hardships.

The bottom line is, this is not the time to turn away from space but more than ever, now is the time to redouble our efforts to realize space as a new and open frontier for humankind. **<RRR>**

Richard's homepage:
http://richardpatricia.homestead.com

Mail For MMM

Center for Lunar Research

Thank you for talking about the Center for Lunar Research in the August edition of the MMM. I wanted to let you know that we have now updated our website to show the work of our summer 2000 student's work. We also have a pdf version of the application form available for download and will soon have a link to the names of all generous contributors to the Center.

http://www.nss.org/lunar/home.html

We want to continue to advertise the scholarship to the broadest possible audience and hopefully we will receive even more applications from qualified students next year.

Sincerely,

Alison Schutt <NSSASST@aol.com>

What to send on the 2nd Lunar Mission

I have been touring outside the USA and just received the June issue of MMM. I am a member of the Artemis Tourism List and have a standpoint on Lunar development which I hope you will disseminate to a wider audience.

In response to the brainstorming question posed therein, "What's inside the 10 ton container which mission 2 will deposit on the moon?" I would like to suggest a practical, moneymaking answer: TOURISTS!

Just joking. Actually, 5 tons of the payload should be in the form of a tourist module which is not deposited on the moon but merely flys by the moon and takes the tourists back to LEO for transport to Earth. This module would guarantee an income stream from the gitgo, an income stream which would concurrently finance lunar settlement.

I'm sure everyone can see that the revenue stream from lunar tourism would be more solidly reliable than the hoped-for revenue from a PR campaign which is subject to fadism. [For instance, there is a waiting list of people who want to pay $70,000 to go up Mount Everest, one of the worst trips imaginable! They do it because "it is there" and it is uniquely hard to get to. (And we all know Dennis Tito spent $20 million for a few days in orbit.) But little money is spent on the purchase of Everest keychains or posters. A lot of people paid to see the IMAX movie called "Everest!" but once a movie is seen, there's no more revenue stream such as there is with tourism.]

The other 5 tons of the cargo payload shoud be deposited on the Moon and must contain power generators such as solar collectors and photo voltaic arrays. Just as in every historical society, the biggest job on Luna will be to build buildings. Therefore, the Lunar power system's first priority is to operate a kiln for making glass and/or basaltic building blocks. Scientists are nice to have but the majority of the Lunar pioneers will, of necessity, be "hard hats!"

In summation, the Mission 2 cargo module should be split 50/50 between expense-paying tourists and power supplies for making buildings. Indeed, the subsequent Lunar program should largely rely on tourism money to meet expenses. Greg Bennett would surely agree as he lives in the dry desert valley that became Las Vegas -- through tourism!

Cheers
Allen Meece
<Beanstalkr@aol.com>

One must be patient -- industriously! - Anon.

NASA to Open up Space to the Public, with One Very Productive Catch

by Peter Kokh

based on an article by Leonard David

"NASA Spells Out its Space Commerce Agenda"

www.space.com/news/nasa_commerce_010925.html

Enhanced Strategy for the Development of Space Commerce is a new NASA document still in draft form. It recognizes "human space travel as a new area of commerce," and would reestablish a Spaceflight Participant Program.

The idea is to open the door to members of the general public to experience spaceflight for themselves, aboard the Space Shuttle and the International Space Station, not as tourists, but as personnel involved with space commerce and enterprise. Here is the very productive (to our way of thinking) catch. NASA in effect says,

> *You too, can travel to space. Just come up with an enterprising idea to make money in space that will require your presence, and develop that idea to the point of flight-readiness and you may get to go to space.*

This response to the growing public pressure for NASA to open up space to a much wider group of people who are yearning to experience space for themselves, builds on previous experience with non-astronaut *"payload specialists"* of which NSS' past president Charlie D. Walker (a McDonnell Douglas employee) was one, making three trips to space on the Shuttle to shepherd pharmaceutical experiments.

- STS 41D Aug. 30 - Sept. 5, 1984 - Walker operated an electrophoresis unit to manufacture a hormone in zero-G for a new pharmaceutical. This was the "first fare-paying flight" to space
- STS 51D April 12-19, 1985 (Jake Garn mission)
- STS 61 B brought his total time in space to 20 days, still the most for any non-astronaut

For more on Charlie, go to:

http://www.jsc.nasa.gov/Bios/PS/walker.html

NASA is also seeking a qualified non-governmental organization entity to manage the U.S. share of International Space Station utilization. NASA wishes has "commercialized" its operations at the Cape, and will seek "increasing levels of commercialization" of the actual Shuttle fleet flights themselves

According to NASA Administrator Daniel Goldin, opportunities to foster the commercial use of space fall into five sectors: technology, research, infrastructure and facilities, media and communications, and space travel and exploration. Goldin's idea is that such commercialization initiatives can help NASA undertake future objectives as it will "allow NASA to focus increased resources on the higher risk activities that the private sector is unable to pursue."

NASA is aiming at five strategic goals:

- Remove barriers to space commerce
- Use market tools and commercial strategies in furtherance of NASA's mission and strategic plan
- Provide opportunities for new commercial space markets
- Support free and fair trade in space goods and services
- Strategically align NASA participation in commercial activities with the Agency's mission and values

Over the past 6 months or so, A NASA team led by Courtney Stadd, NASA Chief of Staff, and a Bush White House official, have been working on the new approach and its details. The details and the way they are implemented will reveal how effective the new policies will be at jump-starting space commerce and at getting more non-NASA people into space.

While policy modifications of this sort have been talked about for many years, both within NASA circles and within the pro-space community at large, it is apparent that the new Bush Administration is to be given credit for putting these issues on the front burner and prioritizing real change.

Apparently, the change in attitude and policy will include new openness to entertainment industry initiatives as well. NASA seems willing to talk business with film producers, stage producers, "edu-tainment" software designers, theme park operators, and web page designers about integrating their products with actual operations in space. What that can and will mean, in each instance, is probably up to the entrepreneurs themselves. NASA would try to accommodate, not do our brainstorming for us.

A reluctant NASA has also apparently been directed by the Bush Administration to reactivate the Spaceflight Participant Program - dropped after the loss in 1986 of space shuttle Challenger and its crew, including school teacher, Christa McAuliffe. This would be one way NASA could both satisfy and further whet the public appetite for fare-paying commercial flights into space. Such flights, of individuals with whom the public can more readily identify, should greatly improve the recently negative investment climate for startup companies that would like to develop less expensive commercial vehicles that can take people first to the "edge of space" and then into orbit. This prospect will in turn encourage those who dream of developing free-flying (not attached to ISS) tourist facilities in orbit.

While the agency may be forced to cut back on many programs, including Mars exploration and other programs popular with space enthusiast, these new directives, if aggressively pursued, could work to greatly improve the prospects for the commercialization of the Space Frontier, and on an accelerated timetable. Three Cheers! **<PK>**

♂ Mars, Mars Society News ♂

Mars Society Recovers from Leadership Crisis

The Mars Society, which had been rocked by a series of Steering Committee resignations in late August (just after the 4th annual Mars Convention) seems to have recovered nicely.

Penelope Boston and Gregory Benford have joined the Board of Directors of the Mars Society. Both have prestigious science backgrounds. Their addition is expected to add both credibility and competence to the Society's efforts. You can read all about it on the Mars Society website, at:

http://www.marssociety.org/

What follows is an abridged report:

Dr. Penelope Boston is a Research Associate Professor in the Dept. of Biology, University of New Mexico in Albuquerque. Additionally, she works under the guise of Complex Systems Research, Inc., in Boulder, Colorado. A founding member of the Mars Underground, begun in 1978, she helped organize the first Case for Mars conference in Boulder in 1981.

Dr. Gregory Benford is a working scientist who has written some 23 critically-acclaimed novels, including The Martian Race. He is also a professor of physics at the Univ. of California, Irvine since 1971, in astrophysics and plasma physics theory.

Other issues raised in the resignations, such as liability insurance to protect Board Members and Steering Committee Members is being addressed. ♂

Putting Human Waste to Work on Mars

synopsis of on an online report on MarsDaily.com
www.spacedaily.com/news/mars-base-01b.html

"Waste not, want not!" Precisely how to turn human wastes into food, oxygen and water is aim of an European Space Agency project in a small pilot plant near Barcelona, Spain. The byproducts of the process will be tested on three rats. Their oxygen need and carbon dioxide output is about the same as that of one human. They are to be kept under close veterinary supervision throughout.

The idea is to create a microsystem in which micro-organisms process the wastes so that they can nourish plants on which the rats can feed. Going beyond experimental apparatus on Mir and ISS that attempts to purify but not recycle human wastes, "Melissa" (Micro-Ecological Life Support Alternative) aims squarely at food production.

Melissa's recycling system has five separate, but interconnected, compartments. Waste will be progressively broken down by different fermentation processes in the first three. In the fourth, algae or plants will grow to produce food, oxygen and water. The fifth holds the live consumers -- rats standing in for astronauts on a real mission to Mars. ♂

CO2 / Magnesium Rocket Engines for Mars

http://www.space-rockets.com/Wickmans.html

Wickman Spacecraft & Propulsion Company

Casper, Wyoming is home to an enterprising company founded in 1981 "to develop new, low cost spacecraft and rockets to open Space for exploration and settlement." Wickman Spacecraft & Propulsion Company has several projects going. They include ammonium nitrate solid rocket propellants, their Bantam launch vehicle &series of sounding rockets, a non-polluting (no hydrochloric acid in the exhaust) solid rocket propellant with burn rates and performance comparable to the propellant used in the Space Shuttle's SRBs, rocket engines that can be refueled with liquid oxygen and aluminum powder obtained from processed lunar soil (already demonstrated), and a rocket engine that burns a LOX monopropellant composed of solid kerosene suspended in liquid O_2.

As if that isn't enough, Wickman has also successfully developed a rocket engine that burns carbon dioxide and magnesium powder for use on future Mars missions. They have built and tested a turbojet engine that should be able to operate on Mars for durations of a half hour or longer. This work has led to development of a pulsejet engine ready for use on the Mars Airplane. With virtually no moving parts, the pulsejet promises 30 minutes continuous thrust to allow the Mars Airplane to fly above the Martian surface at only 600 meters (2,000 feet).

Two previously suggested Mars-appropriate fuel options (both can be produced by the automated *in situ* sabatier process) are CO/O2 and CH4/O2. ♂

"Life signs at Mars South Pole," Hungarians

An AOL / Reuters News Item 9/7/2001
An MMM Synopsis

Could we be looking for life in all the wrong places? A Hungarian team of scientists believes that they have found evidence that points to the existence of colonies of creatures that live in the Martian south polar ice cap, both shielded by the ice above from the Sun's intense ultraviolet light, yet getting enough beneficial light to allow them to grow, melting ice for water as they need it.

The three-man team reached their conclusion after analyzing 60,000 photographs taken by Mars Global Surveyor. The pictures "show evidence," they report, of thousands of dark dune spots, similar to organisms found in Antarctica.

During harsh Martian winters, when temperatures plummet to -200 °C (-328° F), these "Mars Surface Organisms" are protected by a thick blanket of ice which then melts as the planet's early summer temperatures climb to just above zero, allowing them to create and enjoy favorable living conditions.

This sounds like a classic case for a "ground truth" mission to investigate, say others. ♂

Millionaires Club Bankrolls Mars Research
< The Life to Mars Foundation >

http://www.msnbc.com/news/621237.asp
An MMM Synopsis of several reports

A foundation is put together by dot.com millionaires who happen to be gung-ho about Mars. They want to help by providing the capital needed to undertake some critical research goals that just don't happen to be on NASA's "front burner." They are willing to spend from one to twenty million dollars on each of these projects to ensure their success.

A Science Fiction dream of some weary and frustrated space enthusiast? Another one of your editor's infamous April Fool's news items?

Not so! It's for real. And this isn't the April issue. The group's first underwriting effort is the Mars TransLife experiment discussed at the recent society convention and adopted shortly thereafter.

See MMM #148 p. 16 or go to:
www.marssociety.org/bulletins/08.28.01.translife.html

Involved are:

- Internet entrepreneur Elon Musk of Zip2.com, which was sold to Compaq Computer's AltaVista division for $305 million in 1999; and X.com, which merged last year with PayPal
- Adeo Ressi, a 29-year-old Internet entrepreneur who founded two companies and sold them for millions of dollars, is another contributing member of the foundation
- other backers "who would prefer to remain quiet, who are involved in some pretty prominent companies"

Musk has made it clear that the Life to Mars Foundation would be in charge of the missions it chose to support, but added that "we'd like to have participation from the Mars Society and probably from the Planetary Society," and other space groups.

The following additional missions are under consideration by the Life to Mars Foundation:

Mission: Mars Oasis

- Test plant growth and our future ability to raise food crops within a protected environment on the Mars surface.

Mission: Mars Communications Satellite

- Send a communications satellite into Martian orbit for future lander, balloon, other mission types to use a communication link with Earth.

Mission: Solar Sail

- Test the capability of a solar sail to be used for propulsion to Mars in deep space conditions.

Mission: Mars Fuel Production Base

- Land a production plant on the surface of Mars to create rocket fuel from the atmosphere. ♂

The Lunar Reclamation Society, Inc.
P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org
www.neighborhoodlink.com/org/lunarbase

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

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(* LRS Board Members)

LRS NEWS

• **Towards More Structured Meetings:** We are going to try to emulate the strategy so fruitfully used by our friends in Philadelphia. Members who belong to other space groups (including astronomy groups) will be asked to report on "what's new" in these areas. Those members who get their regular space news fix from different sources could give reports on recent new books, recent magazine articles, current news group threads, etc. Plus a video. The idea is to spread the responsibility for productive and lively meeting discussions each and every month. *Together!*

LRS OCTOBER / NOVEMBER Events

Saturday, OCT. 13th, NOV 10th 1-4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G110** (lower level, NE part of Mall) near the ground-level entrance below General Cinemas.

Collaborating Milwaukee Area Space Groups

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

U.S. CHAPTERS

NSS Chapter Events

MMM 9 Chapters Strong

Space Chapters HUB Website:

http://www.nss.ac/hub/

A one-stop shopping mall for chapter leaders looking for ideas to help make their chapters more effective and productive. A place for sharing achievements, project plans, and outreach products. A hub that will become more effective, and a better resource as each chapter contributes its experiences and products.

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

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

OCT 16th MEETING at the Stoelting House in **Kiel**
NOV 20th at Foerster Academy of Dance, **Sheboygan**

MINNESOTA

Minnesota Space Frontier Society

c/o Dave Buth, 3331 Cedar Ave. S. #2 Minneapolis, MN 55407

612-721-4772 (Dave Buth) 612-375-1539 (Jeff Root)
Email: mnsfs@freemars.org

http://www.FreeMars.org/15/index.html

OHIO

Cuyahoga Valley Space Society

3433 North Ave. Parma, OH 44134-1252

c/o George F. Cooper III, Phone 216-749-0017
E-Mail: geocooper3@aol.com [new]

☞ Monthly Meetings, the 4th Thursday **7-9:15 pm**, **rm 106**, **Wilker Hall, Baldwin Wallace College**, **Berea**
NEXT DATE: **OCT 25th, NOV date:** ***Call***

CALIFORNIA

OASIS

OASIS: Organization for the Advancement of Space Industrialization and Settlement

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

http://chapters.nss.org/oasis

Odyssey Newsletter Online

http://www.geocities.com/CapeCanaveral/Lab/4005/articles.html

☞ **Regular Meeting 3 pm 3rd Saturday of each month.**
Information: OASIS Hotline, 310/364-2290; website.

- **OCT 20th** -- OASIS Monthly Meeting
- **NOV 17th** -- OASIS Monthly Meeting

• • Recurring Events

- **Daily** (call observatory 323/664-1191 for times) "Oceans of Mars," live, multi-media planetarium show. Griffith Observatory, 2800 East Observatory Rd, Los Angeles. $4 adults, $2 children, $3 seniors. http://www.griffithobs.org/.
- **Fridays, 7 pm** "Night Sky Show." -- **8 pm** Guest lectures. Santa Monica College John Drescher Planetarium, 2nd Floor Technology Building, 1900 Pico Blvd. $4 per show or $7 for both. Info: 310/452-9223 www.smc.edu/events/weeklyeven.
- **Fridays** -- "Mike Hodel's Hour 25" webcast. The world of science fact and fiction with interviews, news, radio dramas, artists, writers, stories, reviews, and more. Info: www.hour25online.com/.

MICHIGAN

Ann Arbor Space Society

P.O. Box 130118, Ann Arbor MI 48113-0118

John Wolter (734) 665-1263 johnswolter@provide.net
☞ 2nd Wednesday (**Oct 10th, NOV 14th**) **7 pm**, MEETINGS at members' homes. Contact above

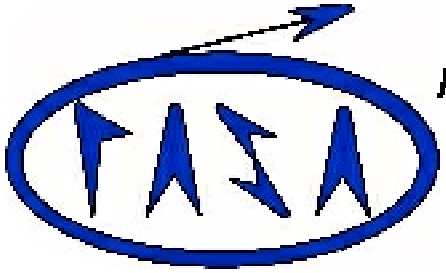
ILLINOIS

Chicago Space Frontier £5

610 West 47th Place, Chicago, IL 60609

Larry Ahearn: 773/373-0349
Call Larry for MEETING INFORMATION

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)

NEW URL http://pasa01.tripod.com

Note : PASA is now on the tripod.com system

☞ **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 17 th street side and go **left**. Look for table sign. Parking at Liberty One on 17th St. Verify meetings with Earl.

NEXT MEETINGS: **OCT 20th, NOV 17th**

Report by PASA President Earl Bennett

• **PASA Activities for October:**We will have a meeting October 14th to do our reports and planning as well as final preperation for **Future Fest** which will be held the **20th of October** at the *Ethical Societies Building on Rittenhouse Square*.This is a joint event with people from serveral space and future oriented organizations speaking and representing their groups.Among these are: *J.P.L. Ambassador: Michelle Baker ,Independance Mars: Gary Fisher*, Professors *Art Shostak* and *Ted Goertzel* in conjunction with the World Future Society. There will be representatives from serveral space and regional planning oriented organizations. The order will be from the Solar System to Earth and then our region. Further information on ourwebsite.

• **Other Activities and Reports**: *World Con !* Philadelphia was host city for the 59th Annual Science Fiction Convention. We only had one speaker at this event (Michelle for J.P.L.) but had sereral members in attendance as well as staff for the event. Since we are space colonization oriented we tend tward the science fact tract and found it most satisfying. I particularly liked the panel on energy titled "California Dreaming" which went over various ideas on energy pinches and solutions over the long haul. Since California had problems this summer some details of what was considered and ongoing solutions where brought out including :navel vessels as emergency power sources and the contiuing push for wind mills as provding systems. Solar cells and S.P.Ss. got some play with an explaination being required for a good part of the audience. Young People! The need to explain some fundamentals was a welcome sign to me at this and some other talks due to the indication that people who had not been arround for decades could find some- thing old but now new. Fresh minds, different approaches. Our group had a table with the new N.S.S. banner on prominant display and Mars Society material panelized by *Gary Fisher* who also manned the table. *Dottie* and *Larry* did table duty as did *Michelle* and I. *Hank Smith* was busy with his World Con duties but set up an N.S.S. party in his room that drew a crowd.

If a World Science Fiction Convention comes to your area consider going or displaying. You may not get members in your area but the result could be great for someone, or their children, and help promote later involvement.

The meeting was held in the *Liberty One Building* on 9/15 . I (Earl Bennett) thought the risk of attack in Philadelphia was small and so we met.*Gary Fisher* told of new members of Mars Society Board: Gregory Benford (scientist and writer) and Penelope Boston (scientist and early Mars Underground member). He also gave financial support for refreshments at *Future Fes*t. Thank you Gary. *Larry Pezzuto* gave a report on web activity and asked that we use a variation on our adress: http://members.tripod.com/pasa01 .Dorothy Kurtz reportedon *Planetary Society* work on its Solar Sail which was under repair. I don,t know which sail this is as we had previously heard that a sail had been. launched from a Russian submarine. Check Planetary site for update. Michelle Baker reported the need for a membership update and N.S.S. activities.Wesubsequently received *Ad Astra* with a great write up of chapter involvement in a wide range of space science and habitation oriented events. Check it out.

Next Months Report: Due to *Future Fest* information the report will probably be late but ,unfortunatly,this would not be unusual.

OREGON

Oregon L5 Society, Inc.

P.O. Box 86, Oregon City, OR 97045
voice mail / FAX (503) 655-6189

http://www.OregonL5.org/

Allen G. Taylor <allen.taylor@ieee.org>
Bryce Walden <BWalden@aol.com>
(LBRT - Oregon Moonbase) moonbase@home.com

☞ Meetings the **3rd Saturday** of each month at **2:00 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs**

NEXT MEETING DATES: **OCT 20th, NOV 17th**

NAME _____ ÷

STREET _____ ÷

CITY/ST/ZIP _____ ÷

PHONE #S _____ ÷

❍ $35 **NATIONAL SPACE SOC.** dues w. **Ad Astra**

❍ $20 NSS dues if under 22 or over 64. *Must state age* ___ NSS, 600 Pennsylvania Ave SE #201, Washington DC 20003 (Make payable to local chapter *for 1st year **free** local dues*) (Offer not honored by Oregon L5 Society)

❍ $35 **MOON Society** dues with **MMM**

❍ $25 **Moon Society** dues for those already getting MMM Moon Soc. Membership, PO Box 940825, Plano, TX 75094

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Member Dues -- MMM/MMR Subscriptions:
Send proper amountto address listed in chapter news sections.

=>*for those outside participating chapter areas* <=
❍ $15 **Individual Subscriptions to MMM/MMR: Outside North America** ❍ $45 Surface Mail -- Make payable to "LRS", P.O. Box 2102, Milwaukee WI 53201

ANN ARBOR SPACE SOCIETY
❍ $10 regular dues

CUYAHOGA VALLEY SPACE SOCIETY
❍ $10 presently; Raise to $15 under consideration

CHICAGO SPACE FRONTIER L5
❍ $15 annual dues

LUNAR RECLAMATION SOCIETY, INC.
❍ $15 regular, ❍ $20 family, ❍ $12 student / senior cit.

MINNESOTA SPACE FRONTIER SOCIETY
❍ $20 Regular Dues

OREGON L5 SOCIETY
NOTE DUES RAISE: ❍ $23 for all members

O.A.S.I.S. L5
❍ $18 regular dues

PHILADELPHIA AREA SPACE ALLIANCE
❍ Annual dues for all with MMM $16, due in March or $4 times each quarter before the next March

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

Moon Miners' MANIFESTO

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PO Box 2102, Milwaukee WI 53201-2102.

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