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

Moon Miners' Manifesto

& The Moon Society Journal

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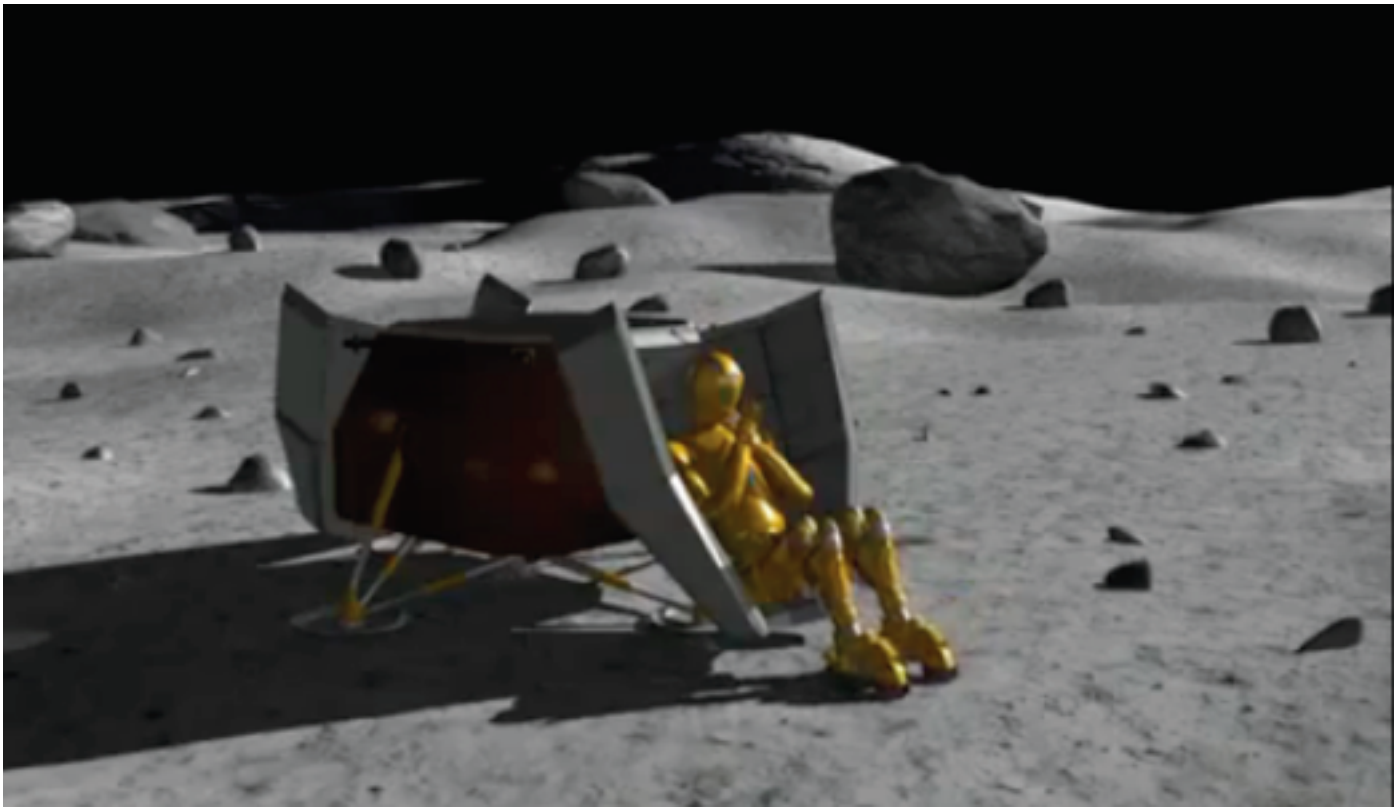


NASA JSC Project M - Putting **telepresence-operated "robonauts"** on the Moon to prepare the way for humans
Do watch the Video: http://www.youtube.com/watch?v=kFPNcWN7QnM

Feature Articles in This Issue

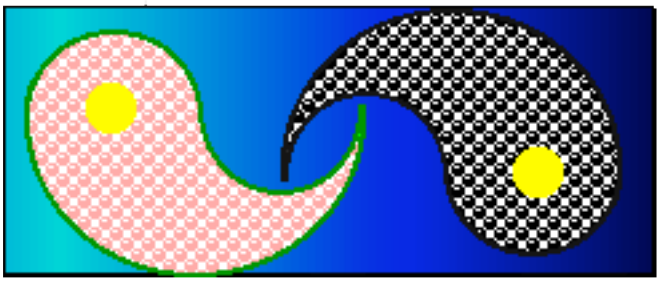
The Yin and Yang of Humans and Robonauts ➔

In this issue, we look at the role of teleoperated equipment, telepresence-operated robonauts, and robots in opening the Moon: taking care of preparatory, routine, and boring jobs, as well as dangerous high-risk tasks.

We also look at their role in constructing Solar Power Satellites. Humans may be needed, but probably not any number of large, massive, and hyper-expensive "Space Settlements". See pages 3-4, 7-8.

IN FOCUS ◎ Telepresence-operated "Robonauts" will revise all "Scenarios"

At first impression, those of us who want to see human frontiers develop "and prosper" on the Moon, Mars, the asteroids and elsewhere in the Solar System may think that the emergence of robonauts threaten that dream. But quite the opposite is likely. These "stand ins" will pave the way at far less expense, [=> p. 2, col. 2]



Moon Miners' Manifesto

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

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

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

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

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

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

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

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

We have already integrated "teleoperation" of equipment" into our expectations. Japan and Russia, as well as our own Carnegie-Mellon robotics team, have suggested that site preparation and many construction chores could save substantial amounts of time and money. It costs a lot to put a human on the Moon! Humans are most effectively assigned to chores that cannot be teleoperated. Teleoperated equipment will allow humans to go to the Moon to begin at once to do what only they can do.

Enter the "robonauts" and telepresence! Here the human controller on Earth "sees what the robonaut sees, and feels what the robonaut feels." This is ideal for scientific tasks – for example, where it is not the size, shape or weight of a rock which is of interest, but its chemical-mineralogical makeup." Robonauts can collect samples of special interest thus freeing humans of that tedious chore, so that when they arrive, they can examine a pre-selected collection, without wasting hours and days in field work.

Roboanuts do not need food, rest or relaxation. They can work around the clock, through a team of telepresence operators on Earth. They do not get bored. Thus the quality of their work is more likely to be high. As to teleoperated equipment, there will be many chores which cannot be done into their manipulation tools, one of a kind chores, that could not be foreseen, or which will be so uncommon that it would not be cost-effective to further specialize those tools and programs. A robonaut with hands human-like in their degrees of motion, can use hand tools for a limitless list of special tasks. Robonauts can do things to dangerous or risky to be assigned to human crews. In the lead article in this issue we show how these companions can relieve humans of all sorts of risky and tedious chores.

In his article "O'Neills High Frontier Revisited and Modified" pages 7-8 in this issue, Dave Dietzler shows how the emergence of robotic technologies also radically changes that scenario of how solar power satellites will be produced and deployed. We may not need the extremely expensive Space Settlements, a requirement that could delay the construction of SPS systems by many decades. Humans will still be involved, but in lesser numbers, and with far lower thresholds of support.

To sum up, lunar resources are still a best bet to lower SPS construction and deployment costs, but the cost of accessing those resources will fall by an order of magnitude or more by reducing the amount of human workers involved.

Consider that *a lunar settlement can begin very small and grow as needed, module by module.* In Contrast, a Space Settlement has to be built to a set size, whether it is occupied by a starter crew, or at full capacity. Space Settlements have *a built-in high threshold, greatly exacerbated by the insistence on Earth-normal gravity levels.*

Now we have previously attempted to remediate these problems in our paper, "**Reinventing Space Oases**."
http://www.moonsociety.org/publications/mmm_papers/reinv_so.htm

Just as the cyber-revolution has vastly increased human productivity, so will the robotics revolution. We have nothing to fear! **PK**

Role of Robonauts & Robots on the Moon Once Humans have settled in to stay

By Peter Kokh

We have realized for a long time, at least since the early Apollo mission days, that radiation exposure on the Moon from cosmic rays and solar flares was a big problem. The week or so of unprotected vulnerability could be tolerated. But it would be better to provide some sort of shielding for persons intending to stay a while. Two meters of moondust overburden should protect those within habitat modules for stays up to a few months. But long term, 4-5 meters would be better.

We've known this for some time and most moon-base plans have some sort of shielding incorporated as part and parcel of the plan. This need has also made the possibility of locating human installations within lava tubes very appealing. These voids, whole networks of them, are common in the lava flow sheets that filled most large nearside basins, creating the maria (MAH-ri-a, singular MAH ray, mare) or"Seas." But these handy hollows are not to be found at or near either lunar pole, both poles being located in highland areas.

The inspiration out of which the original Moon Miners' Manifesto was born, was that while we had to live "underground", we would not have to live like moles, as Robert A. Heinlein had suggested in his classic novel: "The Moon is a Harsh Mistress," as there were ways we could take the sunshine and views "down under with us." http://www.moonsociety.org/chapters/milwaukee/mmm/mmm_1.html

But surely we have business out on the naked, radiation-washed surface! We need to explore, to prospect for minerals, to build roads, to trade with other settlements! No people, and surely not the Moon's people, will freely be virtually imprisoned full time. How do we handle this? *Read on.*

Radiation Exposure Limits and Monitoring

Perhaps every Lunan settler or pioneer or visitor will be required to wear a wristband or other device that monitors one's accumulated radiation exposure. Those whose exposure is under set levels will be allowed to go "outside" – "out-vac" on the exposed, vacuum and radiation-washed surface for limited times, and on limited occasions.

Jobs and Careers

There are those in any population that feel most at home "outdoors" and/or "on the road." But living such a life-style – having such an occupation, could result in radiation sickness and even premature death. *Unless!*

There are three ways to sidestep this nasty fate.

(1) Outside jobs could be managed from the safety of shielded habitat spaces, by telepresence operation of robonauts or avatars.

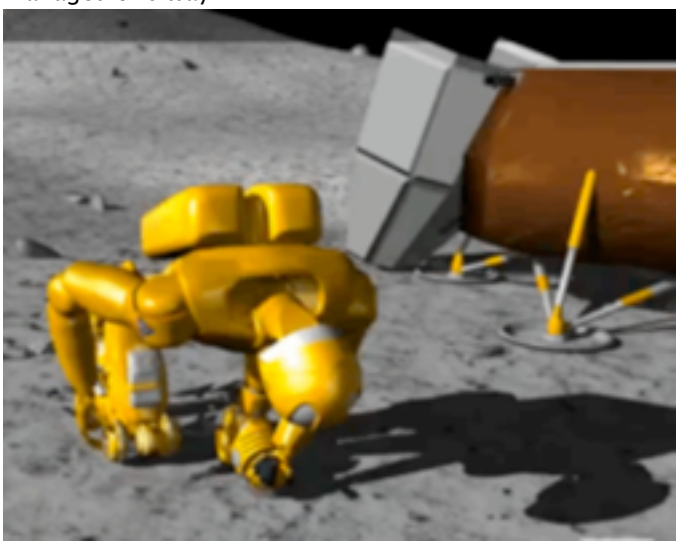
(2) The cabs of over-the-road trucks, motor coaches, trains and construction equipment could be jacketed by water (somehow kept from freezing or boiling). The jacket need cover only that portion exposed to the sky.

3) Outside jobs could be filled by rotation from among a large pool of persons, who would do safe "inside" work most of the time. This would not suit those who wish to be out on the surface regularly, but such types could work in jacketed conditions as described in (2) above.

At left, a concept for a protected railroad passenger wagon to be used by frequent travelers at a "first class" rate.

Infrequent travelers could safely make overland trips without such protection.

We might expect to see some out-vac duties preferentially entrusted to robots and telepresence-controlled robonauts that can be put to work "24/7" without fatigue, boredom, and errors, and some to be filled by humans on restricted shifts, but from within the safety of shielded mobile cabs. Routine prospecting, mining, extensive construction, and road-building, are some of the high exposure activities that could be managed this way.



NASA-JSC Project M robonaut: ideal for prospecting and field science controlled from a shielded mobile unit.

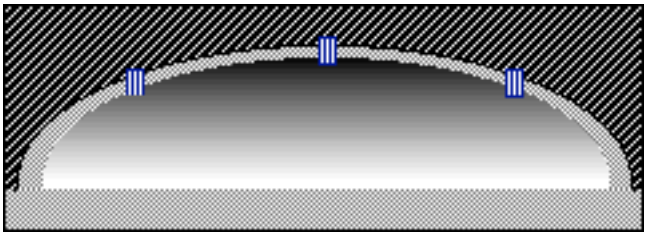
Thus a truck cab could be shielded even if there were no need to shield the cargo containers. How is this different from human workers guiding deep sea well-drilling from the safety and comfort of a pressurized submersible at depths at which human divers could not work? Clearly, those who say we can't work out of our element, have already been proven wrong again and again. Wherever there is something to be gained, we will find a way to conduct our business safely.

Those who rarely travel by train or coach could ride in unshielded units at a bargain price, while busnessmen who travel frequently could ride in shielded units at a first class rate. Common sense and a close watch of one's rem-exposure monitors, will allow most pioneers to enjoy an almost natural familiarity with the great lunar out-vac and with its magnificent desolation and spectacular sterile beauty.

Recreation and Sports

In this situation, out-vac leisure activities such as rock collecting, hiking, road rallies, camping out under the stars, and prospecting for the fun of it, would have to be exercised with caution and sparingly. We won't become "Lunans" until we are "at home" on the Moon, and that means "at home" out on the surface as well as in cozy urban burrows. Even so, the availability of a mobile shelter when not actually engaging in the out-vac surface activity in question would make for good policy.

As to sports, the out-vac provides not only one-sixth gravity, but also vacuum, and pioneers will invent interesting and fun sports for such conditions. But here too, there is a way out: pioneers could build a shielded but unpressurized stadium in which low-gravity vacuum sports could be played.



Cross-section of shielded but unpressurized sports arena

Are Demron-layer spacesuits be the answer?

Recently, there have been a flurry of reports that a new polymer fabric offers sufficient radiation protection. But Wikipedia introduces its article with the following warning:

"This article is written like an advertisement. Please help rewrite this article from a neutral point of view. For blatant advertising that would require a fundamental rewrite to become encyclopedic, use {{db-spam}} to mark for speedy deletion. (June 2009)"

"**Demron** is a radiation-blocking fabric made by Radiation Shield Technologies. The material is said to have radiation protection similar to lead shielding, while being lightweight and flexible. The composition of Demron is proprietary, but is described as a non-toxic polymer. According to its manufacturer, while Demron shields the wearer from radiation alone, it can be coupled with different protective materials to block chemical and biological threats as well. Demron is roughly three to four times more expensive than a conventional lead apron, but can be treated like a normal fabric for cleaning, storage and disposal. More recent uses for Demron include certified first responder Hazmat suits as well as tactical vests. Demron is proven by the United States Department of Energy to significantly reduce high energy alpha and beta radiation, and reduce low energy gamma radiation. When several sheets of Demron are laminated together the result is a much more powerful shield, though Demron cannot completely block all gamma radiation."

There is an enormous difference between the kind of radiation hazards found here on Earth such as exposure to radioactive wastes from nuclear power plants and exposure to high-energy cosmic rays coming from all directions of the space or the lunar sky.

In MMM #238 Sept 2010, pp. 4-5, "A Fresh Look at the Spacesuit Concept" ee suggested a two-garment approach: an inner "skinsuit" counterpressure suit, and a loose outer suit to handle thermal exposure and provide puncture proofing. Perhaps a Demron layer incorporated into such an outer suit would allow the wearer to stay out on the surface a longer time before accumulating "x" amount of radiation dosage. But Demron has not been tested in realistic space conditions in Earth-orbit much less beyond the Van Allen Belts. It may or may not help, but certainly won't be a cure-all.

A lesson some have not learned

At the 2010 International Space Development Conference held in Chicago last May, a speaker confident of what he was saying, crossed off Moon and Mars as future settlement territory on the grounds of surface radiation exposure "unless we wanted to live underground full-time." Nonsense. If there is one thing the history of the human Diaspora beyond Africa, and even within it, has amply demonstrated, it is that resourceful, ingenious, and determined people can learn to make themselves "at home" and comfortably so, in the most seemingly inhospitable environments. Settlers on Moon and Mars will defy the warnings of such persons, even as have the Eskimo and Inuit of our Arctic regions. "Where there is a will, there's a way. And we will find ways to survive in environments much more unforgiving and hostile than Moon and Mars.

On frontier after frontier, we have been faced with new climate conditions, new geological and mineral resources, new plant and animal species. Where old tools did not work, or work well, we forged new ones that did. True, some frontiers would not support large populations. But everywhere, people have learned to live happy and productive and fulfilling lives.

Radiation will be a problem for those living and working on the Moon or Mars only until we have learned to deal with it "as if by second nature." Sure Arctic and Antarctic temperatures can kill! But who would go outdoors in those places without adequate clothing and protection!

Lunan pioneers will soon learn what they can and can't do in their challenging environments. More, they will continue to find new ways to push "this envelope" ever further and further, to the point few would see surface radiation as a game-stopper. Doing the right think, the safe thing, will have become second nature. The pioneers will have become Lunans. And the same transition will occur on Mars and other even more challenging locations.

Take anyone "as they are" off the streets of Mumbai or Cairo and set them down in Antarctica, and we have a problem. But someone from Edmonton or Irkutsk might fare better.

Unlike specialized animal species, *humans cannot be defined by their habitat.* We are adaptable, and neither the Moon nor Mars defines the limits of that adaptability. We will learn to handle the risks of the lunar surface "as if by second nature" under penalty of death, just as the Innuit have adapted to the Arctic. We will not be at home on the Moon until we do.

To coin a word, we are a **prokalo-trophic** species: ***we feed on challenges.*** And those who warn us that we "can't" do this or can't do that, do us all a favor, by spurring us on to prove them quite wrong. And in that sense, science-fiction stories, which can get pretty wild, do us a service. They make us, even if only some of us, confident and determined to spread the human ecumene – the human ecosphere – beyond the four corners of Earth, beyond the seven continents and the seven seas, to wherever our ingenious heavenly chariots will take us.

The Moon, as a humanized world, will become more interesting and nourishing a life-environment because we have accepted radiation-protection as a challenge. *The more formidable the challenge, the sweeter the victory!* We would still be in the caves or swining from the trees if it were not so.

So thanks for the warning. "Bring it on!" **PK**

Cooking on the Moon

By Dave Dietzler

We don't have to rely entirely on space food sticks and freeze dried meals from little foil pouches.

Most early industrial operations on the Moon will be primarily robotic, but it is likely that a small manned presence will be necessary to do jobs the robots can't, service and repair the robots and even rescue the robots that have gotten stuck. Physiochemical air and water production and purification systems will be used at first. Years, even decades, might elapse before a closed ecological life support system is established.

Food will be upported during the early years of bootstrapping development on the Moon and it is likely that most of this food will be freeze dried or dehydrated and mixed with recycled water to reduce upport costs. My opinion of freeze-dried backpacker food is that it isn't very good. Perhaps some men and women could be happy living off this kind of food for years, but not me. If we must feed the crews freeze dried meat I think it will be necessary to spice the stuff up real good and spices will not add a lot of costly upport mass to the project's budget. Freeze dried fruits and vegetables might use spicing also. My experience with the texture of these kinds of foods is that their quality is less than appetizing. Perhaps slow steaming will allow the freeze-dried foods to plump up. All I ever did was add water or immerse freeze dried foods, and that was long ago--an experience I never cared to repeat.

We don't have to rely entirely on space food sticks and freeze dried meals from little foil pouches. There are many dried foods in the supermarket that most of us consume regularly like pasta noodles such as spaghetti, elbow macaroni, lasagna, etc. The problem here is twofold: we will need sauce and freeze drying might not mean high quality. There are condensed sauces that aren't so bad, but we might also go straight for a small tomato garden.

Lighted cabinets for producing fresh salad greens have been demonstrated and I think those are a good idea from the start. Why not a tomato cabinet(s)? Moon dust can be sieved, steamed to form vermiculites and fertilized with upported plant food and later with hydrothermally treated and/or composted wastes to provide an excellent growth medium.

While we are talking about Italian food, why not a mushroom cabinet(s) as well? Mushrooms require preformed carbohydrate but no light. Since electrical power demands by night for crop illumination can mean some massive power storage systems, mushrooms become appealing. These high protein items in the hands of a really creative chef might become a staple on lunar dinner tables. Fresh salad greens, tomatoes and mushrooms sound good, and we could even grow algae by day and stock up plenty for night as long as we save some for reinoculating the algae tanks when the Sun rises again.

Algae can double its mass every few hours, so producing large algae harvests won't take too much time--as long as we have the water, tankage and nutrients. However, I don't know if green slime is all that appealing although Miso soup isn't too bad. It might be possible to keep some breed of hen alive and healthy on a primarily algae and mushroom diet; in which case with a small chicken coop and a few hens we could have plenty of real fresh eggs for our small crew during the early stages of lunar industrialization and bootstrapping.

Other dried supermarket foods with which most of us are acquainted include instant coffee, drink mixes (Tang), Jello, powdered milk, dried beans, brown rice, whole wheat flour, corn meal, instant mashed potatoes, stuffing and dried gravy mixes. I like eating these. There are complete pancake and waffle mixes but without syrup and butter these are not very satisfying. There are also foods like oatmeal and cream of wheat, but once again without sweetener and cinnamon these aren't too great.

Quinoa is similar to cream of wheat and contains complete protein, but the flavor is not too rewardng, in my opinion. Perhaps we will just have to foot the bill for shipping syrup and butter to the Moon, unless we can produce genetically engineered algae strains that secrete syrup and honey!

But, for those who don't like margarine, what about butter? It will be a long time until goats or cows are kept on the Moon, or will it? There are **Nigerian dwarf goats** that give two quarts of milk a day. Adults weigh about 75 pounds. Within a couple of years of manned lunar base development we should be able to keep dwarf goats on the Moon. Since livestock can be 100% grass fed it seems livestock could also be 100% algae fed. Then we could have our butter as well as milk, cream and cheese. We will need kitchen countertop milk processors for butter and cream production and cheese molds. The first Moon miners won't just be technicians; they will have to be culinary hobbyists.

http://en.wikipedia.org/wiki/Nigerian_Dwarf_(goat)

There are also light weight calorie dense foods like peanut butter, soy jerky, hard salami, meat jerky, olive oil, cheeses like Cheddar at about 115 cal/oz. and Parmesan at 130 cal/oz., crackers, dense bread, dried fruit (that includes raisins), nuts (e.g. cashews, almonds) and chocolate; preferably dark chocolate. Cheese is very tempting. If we have salad greens, tomatoes and mushrooms some shredded cheddar would be fine for salads with olive oil dressing and we could even make

small pizzas by baking these on dense breads. If we have pasta and tomatoes for sauce we'll need some Parmesan. Whole fat powdered milk will be desirable until goat milk production exists.

Whole grain cereals with dried fruit and nuts will be good for breakfast especially for those who don't care for cream of this and cream of that or other forms of warm glop.

At: http://www.adventurealan.com/sample_food_list.htm we find an interesting no-cooking food list for back-packers consisting of: Cookies, Fig Newtons, Sunshine Raisin Biscuits, Peanut M&M's, Power Bars, Pemmican Bars, Fruity Gummy Candy, Gorp, Cashews, Mincemeat, Prunes, Dried Apricots, Dried Figs, Raisins, Dried Cran-berries, Peanut Butter, Jelly, Hard Salami, Turkey Jerky, Gatorade, bulk (2.1/qt), Grape Nuts, Familia, Milkman Milk, Inst. Pudding. (needs 2c. milk), Chocolate Milk, Cheese, Crackers (triscuit, wheat thins, etc.) Dense Bread, Caffeine Pills, Vitamin C. This food list was designed for 5 days and 4 nights on the trail for one person and supplies over 3000 calories per day at an average of 123 cal/oz. and a total mass of 6.35 pounds. That would be about 460 lbs. of food per year for one Moon miner. For Moon miners getting less exercise than backpackers this could be reduced.

We must wonder if it will be cheaper to upport frozen foods along with refrigeration systems and power supplies, or canned and tinned foods? Some whole foods in addition to freeze-dried and dehydrated foods will be good for morale. I don't mind eating out of cans. Refrig-erated foods can get freezer burned after awhile. I believe freezer burn can be prevented thru vacuum packing. Of course, canned food won't go bad if something happens to the refrigeration unit and I tend to favor reliability over risk, and since the loss of the food supply could halt the project at a cost of millions of dollars per day perhaps, the reliability of canned and tinned food over frozen food appeals to me.

Since whole canned food will be largely water some will say this is a "no-no," but somewhere along the line we have to stop being so damned efficient and allow a little fat in the budget for the sake of human pleasure! Based on this philosophy, a few bottles of real wine for the holidays at least should be rocketed to the Moon! Some beer making equipment and supplies might be included too. Executives receive enormous paychecks. Workers on the Moon could at least have some booze and some real steaks at company expense!

Eventually we will set up farm modules that produce a variety of foods for a tasty and nutritious diet that is primarily plant based. Except for hens, dwarf goats, fish tanks and as some have suggested- guinea pigs, I don't foresee large animals like cows or large herds of animals at least until we start sealing lava tubes that are hundreds of feet in diameter and miles long and eventually build domed cities[1] like those seen in science fiction art and movies. Even then, meat cultured in petri dishes might replace livestock. Edible chicken nuggets have already been produced this way and the future meat supply on Earth as well as in outer space might come from vats of cells in factories rather than from grazing herds and slaughter houses. DD

1 The Classic Sci-Fi Dome will be most unlikely on the Moon and Mars as it sets up a single point of failure that could doom everyone within. Risk must be distributed, not shared.

Articles on Food & Cooking from past MMMs

The following articles are preserved in the MMM Classics volumes which you can freely download from

www.moonsociety.org/publications/mmm_classics/

Moon Garden, P. Kokh – MC#1 pp 3-4

Animal Life, P. Kokh – MC#1 p 23

Saving Money on Food in Space, P. Kokh – MC#4 pp 58-9

Food Animals in Biological Life Support Systems, S. Love – MC#11 p 51

The Independent Lunar Farmer, P. Kokh – MC#15 pp 25-26

EARTHPATCH: Anchoring Lunar & Martian Homesteads, P. Kokh – MC#15 pp 40-44

Homestead Gardens & Early Cottage Industry, P. Kokh – MC#15p 3-4

Farming on the Moon, D. Dietzler – MC#16 pp 39-40

(Lunar) Food is Mostly (Lunar) Water, P. Kokh & D. Dietzler – MC#17 p 56

Beverages on the early Lunar & Martian Frontiers, P. Kokh – MC#18 p 63

Cooking on the Moon, P. Kokh – MC#19 pp 44-45

The first BBQ-Grill Restaurant on the Moon, P. Kokh – MC#20 pp 9-11

"What's for Dinner" may seem to be a trivial topic at first. But to most of us, when the day is done, and we are tired out and in need of serious regeneration, "what's for dinner?" trumps "what happened on the stock market today" anytime. And we also want to be assured that what's-for-dinner is flavorful, varied, and palate-pampering. Some pleasures are essential, after all!

This will be all the more true on the Lunar and Martian Frontiers for pioneers who have already given up many of the pleasures of life on Earth that can't easily be replicated on the Moon or Mars. Resourceful pioneers will produce a great variety of tasty dishes. **DD / PK**

O'Neill's High Frontier Updated and Modified

By Dave Dietzler

Choosing the machines for the lunar industrial seed[1], designing them and building them will require years of careful consideration and a small army of engineers, but there is no fundamental scientific or philosophical reason that this cannot be done.

Introduction

It has been over thirty years since "**The High Frontier**[2]" was published and during that time most of the people I've discussed it with have agreed upon a modified version of things. In discussions and e-mails most of us have agreed that

The 100 million ton plus space colony is out of the picture and most SPS assembly work should be done in GEO with teleoperated robots.

O'Neill and others focused on the space colony and kind of slighted the Moon.

They figured the mining machines and mass driver would be launched from Earth with low cost Shuttle Derived Vehicles landed on the Moon in pieces and assembled by a crew of about 50 Moon miners3.

Raw regolith would be launched into space where it was processed into metals for construction, oxygen for rockets and excess raw regolith and slag that would be used for space colony radiation shielding as well as mass driver propelled space ship reaction mass. Regolith processing would be done at L5 construction shacks. These modular construction shacks would be launched from Earth, assembled in LEO and propelled with arc-jets to L5. The space colony would come next and 10,000 workers would be transported from Earth to do the work of SPS construction. Solar Power Sattelites built at L5 would be moved down to GEO to sell power and start accruing profits.

The Moon plays a much more complex role in our vision. We will include tourism, astronomy and scientific research, SETI, asteroid mining, asteroid deflection and materials for ships to Mars and other destinations in the solar system. Moon mining will not be limited to simple open pit mining of regolith. Mining bases will be located on mare coasts where aluminum and calcium rich highland regolith as well as basaltic iron, magnesium and titanium rich mare regolith can be accessed.

There will be polar ice mining camps, KREEP mining in the Imbrium rim, mining of pyroclastic glass for native glass and elements that can be extracted from the surfaces of glass particles more easily than by extraction from complex minerals, and possibly even drilling for volcanic gases. Mining of vast areas of the mare for solar wind implanted volatiles including normal helium 4 and possibly helium 3 that are not likely to be found in polar ices of cometary origin – these all feature prominently in our vision.

Numerous mining bases will be linked by dirt roads and railways to mass driver sites and a circumlunar power grid will emerge for 24/7 power. All materials, or at least the 99.5%, needed for bootstrapping of lunar industry, creation of construction shacks and space tugs, and for SPSs will come from the Moon and possibly from the asteroids as well.

We are not certain about launching materials and finished products to L5. It might be possible to launch to L2 mass catchers and then haul cargos down to GEO or even launch directly to GEO. It might also be more plausible to launch to LLO (low lunar orbit) and collect the payloads, and then haul them down to GEO.

It is probable that L5 will not be very important and that construction shacks will all be located in GEO and that these will be mostly robotic.

While the nearly three second lag time that exists for teleoperation of robots on the Moon will hamper robotic operations on the Moon but not prohibit them entirely, the fraction of a second lag time for teleoperation of robots in GEO will not be a significant barrier to robotic construction in space.

Transportation System

Earlier it was thought that the space shuttle or a space shuttle-derived vehicle would launch cheap and that LH2/LOX fueled rockets would be used to propel cargoes from LEO to the Moon. Our view is quite a bit different. Launch costs are high, even with Falcon rockets that offer the lowest price to LEO at present.

- We propose the use of **electric drives** to move cargoes from LEO to an L1 space station economically. Propellant masses for electric drives will be only a fraction of the mass of the cargo. Chemically propelled rockets would require propellants that amass several times the cargo mass and subsequently the cost of launching this extra mass to LEO would be several times higher than with electric drives.
- At **the L1 station** space storable water from lunar polar ice would be converted to LH2 and LOX for landers. The first payloads would consist of solar panels, digging machines, regolith refining equipment and fueling systems for aluminum and liquid oxygen powered reusable landers.
- **Lunar fuels** must come on-line early to eliminate the cost of launching propellants for landers from Earth's surface to LEO.

Bootstrapping and ISRU [In Situ (Latin for "on site") Resource Utilization]

We will not ship a complete mining system to the Moon and then focus on space construction. To reduce upported[4] mass and costs, we will land an industrial seed that will include manned habitat to bootstrap up industry on the Moon.

We will start out with small mining machines and build bigger ones. We will even build the mass driver or drivers on the Moon. We will mine at **multiple sites** (poles, mare coast, pyroclastic glass fields, KREEP terrains, crater central peaks, lava tubes, perhaps even drilling near volcanic domes) to get all necessary materials and link the mining sites with railroads to the mass driver sites.

Several years, perhaps decades, of work will be needed to build up industry on the Moon to the point at which SPS construction can begin. Long-term bonds will have to be sold to finance this project along with support from international governments.

The bootstrapping and ISRU concept will be applied to the SPS construction shacks too. We will launch the "bare bones" for these stations from Earth and enlarge them with metals and finished products from the Moon until we have the space infrastructure needed to build SPS. The construction shacks will be located in GEO. Lunar mass drivers will launch materials into space and mass catchers will haul those materials to GEO instead of L5. The GEO construction shacks will house only enough humans to supervise the robots that are teleoperated by Earthside crews with only a fraction of a second lag time for radio waves to travel from Earth to GEO and back.

More Brains Equals Less Payload and Lower Costs

The construction of lunar industry and SPSs will require a lot of planning and intelligence to figure out just how to do; But physically, it will involve no more time, energy, robot labor and manpower than building a giant space colony for 10,000 people would!! Why build that space colony when we need more infrastructure on the Moon and 90%+ work in space can be done with teleoperated robots and ground crews around the world connected by the internet???

We need more than just a single strip mine in the mare. While the **mare** can supply plenty of iron, titanium, magnesium, silicon and oxygen and lesser amounts of aluminum and calcium, the **highlands** can supply more vital aluminum and even cement produced by roasting highland soil in solar furnaces. There are highland areas where the regolith is 98% anorthite and this would be ideal feedstock for aluminum, calcium, silicon and oxygen production.

Calcium might become the conductor of choice since it is a better conductor than copper and highland soil is richer in this metal than mare soil. Calcium metallurgy and manufacturing for out-vac cables and perhaps even mass driver coils must be developed. So the coasts become attractive.

There might even be blasting into hard rock with magnesium/LOX-based explosives if we find rock outcrops rich with industrial metals. The Imbrium coast is attractive because it contains lots of KREEP that can supply rare earth elements, potassium, phosphorus, thorium and uranium.

The Aristarchus pyroclastic glass fields that could supply nickel, copper, zinc, gallium, chlorine and other elements and the Marius Hills beneath which there might be chambers of volcanic gas evoke curiosity. Crater central peaks have never been sampled. Could they contain heavier elements thrust up from the mantle? I have speculated that since chromite is found in mare regolith, and this heavy mineral sinks in lava to form thin layers like those of the Bushveld igneous complex in South Africa, there might be layers of chromite deep beneath the mare that have been thrust up in some crater central peaks. If so, this would be quite a find, since chromite is a source of the vital industrial metal chromium.

The best mining sites and the best mass driver sites might not match so it will be necessary to build **a system of roads and railways** to link them. While it has been stated that mineral processing would be best done in space where solar energy is constantly available, a system of cables and solar power plants at the limbs of the Moon could supply energy to mining and mass driver bases constantly and when we are looking at things on this scale it should not be impractical to build a lunar power grid. It's also possible that a lunar power beaming system might prove to be superior to GEO powersats. The major obstacle here is not the construction of vast solar power farms at the limbs of the Moon for LPS but the construction of transmitting dishes miles in diameter. Perhaps large farms of small phased array dishes could do the job of transmitting microwaves 240,000 miles to reasonably sized rectennas on Earth but I am no expert when it comes to this so I might be way off target.

Choosing the machines for the lunar industrial seed, designing them and building them will require years of careful consideration and a small army of engineers, but there is no fundamental scientific or philosophical reason that this cannot be done. Three dimensional printers guided by computers that can crank out parts made of basalt, glass and metals could be at the heart of the bootstrapping lunar industrial seed. Robots will be key to assembly work.

Metal casting seems likely, but we will rely on cold working like forging and extruding as much as is possible. A manned presence will also be essential. Skilled human workers are the ultimate multipurpose robots. Humans might need biological sustenance, rest and recreation, but we are very versatile. Robots tend to be better and rapid repetitive jobs where high accuracy and reliability are required. **DD**

Footnotes & comments by editor:

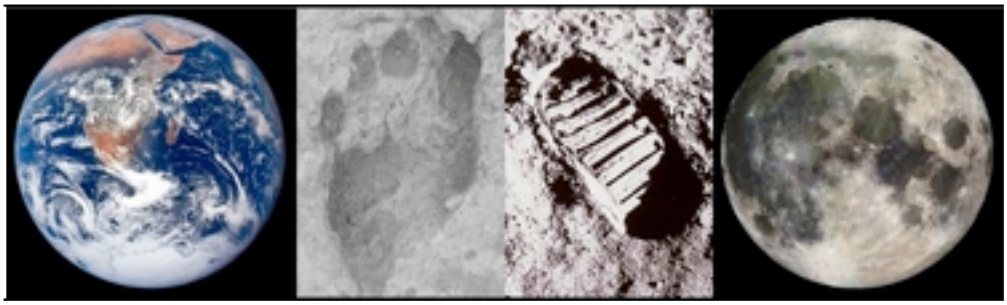
1 **The (Lunar) Industrial Seed**:
"Defining the Lunar Industrial Seed", Part 1, D. Dietzler, MMM #229 Octoboer 2009
"The Lunar Industrial Seed", Parts 2, 3A, D.Dietzler, MMM #230, November 2010
Note: these issues of MMM are only available by member username and password from http://www.moonsociety.org/members/mmm/
However much of this material is also available from http://groups.google.com/group/international-lunar-resarch-park?pli=1
Also check out these Google Dox files https://docs.google.com/document/edit?id=1n3OXV0zYqfMCNCjj4Znaqf3IVw8s_0u7ChuGwMXKDzQ&hl=en#

2 **The High Frontier** by Gerard O'Neill, an Apogee Books Publication: "In the mid-1970's the late physics Professor Gerard K. O'Neill published his book High Frontier. In it he laid out a possible road map for human settlement." http://www.apogeespacebooks.com/Books/Highfrontier.html

3 O'Neill branded people who preferred living on a natural world to living inside constructed space settlements as "planetary chauvinists." He firmly believed that as few people as possible should be stationed on the godawful Moon, and then in short tours of duty only. To this day he has a strong following. For our critique of his space settlement concepts see: "Reinventing Space Oases" http://www.moonsociety.org/publications/mmm_papers/reinv_so.htm

4 "**upport**, upported, upports" – shipping "up" Earth's steep gravity well. (and thus, "downports" as well

From Africa to the Moon, the Human Epic, told in footprints, Continues to the Stars!



Our Goal is Communities on the Moon involving large scale industrialization and private enterprise.

Objectives of the Moon Society

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

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

Moon Society endorses Paul Spudis' Plan to Return to the Moon in an Affordable Way

http://www.moonsociety.org/reports/Spudis_plan_endorsement.html

http://blogs.airspacemag.com/moon/2010/12/21/can-we-afford-to-return-to-the-moon/

http://www.spudislunarresources.com/Papers/Affordable_Lunar_Base.pdf

On January 5th, with Moon Society Officers and Directors in unanimous assent, we posted the above announcement [top link.] Spudis is a widely known and respected Senior Staff Scientist at the Lunar and Planetary Institute in Houston. He has asked, "Can we afford to return to the Moon?" and answered the question above with an emphatic yes. But we have to do it in incremental steps, he says, steps that build capacity and capability in a logical way. We will need missions that employ robots and teleoperated equipment to prepare the site, deploy the utility systems, and then construct the base.

When that is done, Human crews can come, and freed of these manual chores, they will be able to get down to doing what they came to do: explore their surroundings, experiment with lunar materials, and learn how to live off-Earth. In this respect, Spudis' plan is in synch with Russian and Japanese thinking. But Spudis and his colleague Tony Lavoie have much more to say about the kind of staged transportation system that could make all this not only possible, but affordable.

The key to his plan is accessing lunar polar ice reserves for use as fuel both to return to Low Earth orbit and to refuel Moon-bound ships there. That greatly reduces the amount of fuel and the number of rockets making the expensive climb up from Earth's surface. This males great sense. and reduces the reliance on hyper-expensive jumbo rockets. [2nd and 3rd inks above]. ●

On the Lunar Upbeat

A new Section on our Homepage
http://www.moonsociety.org
By Peter Kokh, President

We have already put up a new section on our home page, just below the **Moon Society Announcements** section, dubbed, "On the Lunar Upbeat" where we have begun to post the links for positive and encouraging proposals including those of Dr. Spudis. *Look for the text above in bold yellow font against the blue background.*

At this writing, 5 items are posted, with more to come as we find them. It is vital that members, former members, and visitors know that "all is not lost." The Constellation Project was going nowhere. It was under-funded but deservedly so. *It was a brute way to return to the Moon on a low flight rate plan to do nothing.* ➔

While we do not yet have a national resolve to return, an *international thrust* is afoot. *Humans are going back to the Moon, and sooner or later,* the US will choose to be involved in that great open-ended venture.

While the Obama administrations has reversed the earlier national policy commitment of the Bush administration to return permanently to the Moon with humans, we are sending an encouraging number of new robotic precursor missions (LCROSS, LRO, GRAIL, LADEE, ILN) and joining other nations as part of the accelerating international thrust to the Moon. Sooner or later the US will choose to be among those nations that open the lunar frontier to human scientific exploration, industrial and commercial development, and settlement.

Meanwhile, drawing on these positive proposals and our own insights, the Society is putting together a "Back to the Moon" Position Paper which will be posted as a "WIP", a "Work in Progress", as more of the required elements become clear. ●

Lavatube Skylight Explorer
Engineering Competition Proposal Update

See the previous report in MMM #241, DEC 2010, p. 9

By Peter Kokh

In the past two months (since the December issue of MMM) we have made some progress. We are lining up other Moon- and Mars-focused organizations in support of this proposed competition. But as we have not run an engineering competition before, we were beginning to worry that it would take us some time – meaning unwelcome delays – in getting all our ducks in a row when it came to designing the competition constraints and rules, finding a place for the teams to demonstrate their devices, as well as drumming up enough prize money to attract serious student teams.

New Moon Society director Bryce Johnson of Rockord, IL has been of great assistance here. He has put us in touch with Rockford Robotics, with the well-known and respected FIRST Robotics organization, which has thousands of teams worldwide.

http://www.rockfordrobotics.com/

http://www.usfirst.org/

Bryce arranged a meeting with Adam Czerwonka in charge of the Rockford team. They know how to run these competitions and gave us much helpful device, and may come aboard as a partner. There is a regional meeting of Robotics teams in Milwaukee the weekend of March 11-13th and we hope to be on hand to talk to organization leaders.

http://www.wisconsinregional.com/

As to a demonstration site, where competing teams could test their devices, NASA Glenn, Cleveland, which has a 510 ft drop tower, showed interest at first, but has been unresponsive of late. We need options.

Milwaukee, WI has a 330 ft (100 meter) deep underground storm water tunnel system, with shaft access from the surface.

http://v3.mmsd.com/deeptunnelhowitworks.aspx

I have been down the access shaft and into the tunnel in Milwaukee in the early '90s. We will be looking into this option. Chicago has such a system as well. ●

Funding an Analog Lunar Research Station as a Commercial Enterprise

By Peter Kokh

Revisiting Project LETO

http://www.moonsociety.org/projects/#leto

Project LETO [L.E.T.O. = Lunar Exploration & Tourist Organization] was a proposal by Moon Society Founder and President Emeritus Gregory R. Bennett. The idea was to establish a major space-theme park on the outskirts of Las Vegas (maximum tourist traffic) that *would include* a Lunar Analog Research Station. I have always opposed this juxtaposition of research and tourism unless careful safeguards were designed into the complex keep tourists from interfering with ongoing research or even from distracting the research crew.

But the project had another fatal flaw: it was too ambitious and needed many millions, not hundreds of thousands, of dollars to get started. On the other hand, funding the construction and outfitting of a research only complex is also a discouragingly high threshold.

Starting smaller: a Motel/Visitors Tourist Center

The "Claire de Lune" (French: moonlight)

Something orders of magnitude easier to finance would be a motel designed to showcase how we would build on the Moon, and furnished where possible with products and materials that we could produce on the Moon near term: cast basalt products for example, and other surface treatments, even artwork. The various parts of the motel, including rooms, would be in connected cylinders. The complex would include a gift shop, book store, and a meeting and presentation room. This would work not only to pay the bills, but also to increase public familiarity with the Moon Society and its goals, and help recruit new members, some encouraged by what they see to become active members.

The site should be in a basaltic area, and we have many of these in the US West as well as in Hawaii. My first suggestion would be "*as close as possible"* to the entry to Craters of the Moon National Monument in Idaho. This location includes intact lava tubes open to tourists.

Why a basaltic area? Simple. The next step would be to attract an enterprise that would take local basalt (on private land) and produce hewn, sculpted, and cast basalt products for use in the complex and for sale to the world at large. Such an industry is well established in the Czech Republic.

Other research into the use of "In Situ" (on site) lunar-available materials would be welcome. And nearby, as profits from this motel-enterprise venture allowed, we could begin constructing our Lunar Analog Research Station, expanding the structure and its capacity to support ever more directions of research.

The motel slash visitors center would also be funded as an enterprise "franchised" by the Moon Society, so that we would continue to have a say in its design, development, and expansion.

Where you come in

This writer is hardly an entrepreneur, let alone a businessman of any kind. Those of you with talent and expertise in the related areas are invited to critique this concept so that we can improve it to the point where it is ready for prime time. Reply: president@moonsociety.org

Moonscapes #5 released January 21st

This issue was a month late for several reasons, among them, Dennis Groves' many trips abroad on company business. We have had some problem with the color of the text changing in some browsers, but we have hopefully corrected this.

If you are missing an issue, they are archived at: http://moonsociety.org/publications/moonscapes/

Your input is appreciated! ●

Moon Ties

[Not a plug, but a member service announcement]

The MMM Editor has had #1 for a couple of years now, and wears it to meal functions at the annual International Space Development Conferences.

1) http://www.thespacestore.com/mosutie10si.html

2) http://www.thespacestore.com/mowatie10si.html

Chapters & Outposts

Moon Society St. Louis Chapter

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

Contact: Keith Wetzel <kawetzel@swbell.net>

Next meetings – Dec 16th, Jan19th, Feb 16th

Meetings 3rd Wed monthly at Buder Branch Library

4401 S. Hampton, in the basement conference room

The chapter met on **Thursday, December 16th** as another organization grabbed our usual Wednesday slot. Rufus contributed a projector, Bob the powered speakers, and they watched the DVD "Orphans of Apollo", a documentary about the entrepreneurs who, as children, were thrilled by the Apollo events and were dismayed when it was canceled. The group had come close to purchasing MIR from the Russians to turn into a comercial space station, when NASA summarily ordered the Russians to junk it, so that their attention would be focused single-mindedly on the construction of ISS.

On **Friday evening, January 7th**, Moon Society St. Louis participated in the annual **Moon Madness** event. MSStL brought the Gravity Bricks and other exhibits. On hand was an amazing array of space experts for the New Horizons in Space Forum and even more space experts in the Exhibit Hall. The Moon Madness Night invitation stated "...and surprises." And Voilá!

- Actual Moon rock samples from Johnson Space Center – these small rocks are in a lucite case to keep them safe, but they are still amazing to look at. Just think, a piece of the Moon! Visit NASA's website to learn more: http://curator.jsc.nasa.gov/lunar/lun-fac.cfm
- Lowell Grissom, Gus Grissom's brother, was in the Exhibit Hall representing the Apollo One Memorial Foundation. Gus is a national hero – one of the original seven astronauts, the first person to travel into space twice, and much loved by everyone who met him – but sadly died in the Apollo One fire. Lowell spoke informally to people and autograph photos. More on Lowell and Gus at: www.suite101.com/article.cfm/residence_space/73713 .
- The Robots are Coming! unit officially began on Wednesday so we had some fun robots in the Exhibit Hall. "Reincarnations4U creates robots from salvaged metal tins, old auto parts, typewriter parts, and almost any cool old thing found in junk yards, flea markets, and garage sales. These whimsical figures appear at art shows and are ready to be delivered into their new life with the people who fall in love with them." From the website: http://www.reincarnations4u.com/

Our participation was arranged by member Christine Nobbe, off Rockwood K12.. This year's event was held at: Selvidge Middle School, 235 New Ballwin Road, Ballwin, MO 63021, 20 miles west of downtown St. Louis, about 6 miles beyond the I-270 bypass.

Moon Society Phoenix Chapter

New website http://www.moonsocietyphoenix.org/

designed by Mike Mackowski and put up by Ben Nault

Contacts: Craig Porter portercd@msn.com

Chuck Lesher: chuckmiester999@yahoo.com

Don Jacques:

Meeting the **3rd Saturday of the month**

Moon Society Phoenix' next meetings are on Saturdays **Feb 19th, Mar 19th, Apr 16th**

Moon Society Phoenix meets the 3rd Saturday of each month, 3 pm, Denny's on Rural Rd just south of US 60. The regular monthly meeting was held January 15th. Present: Don Jacques, Patti Hultstrand, Mike Mackowski

New Website: Mike announced a new, static site for the chapter is up at http://www.moonsocietyphoenix.org

The site has these pages: An **introduction** to the group, a **projects page** listing the Telepresence project, and a page including **links** to the National organization site, the Yahoo Groups site among others. The short-term goals are to have our presence available on the web with this basic, minimalist structure as we finalize elements and design for future use. More dynamic content such as file/presentation uploads could be encouraged/maintained on our Yahoo groups site. Members are encouraged to review and submit comments/suggestions for additional content to mike@spaceinminiature.com

Yuri's Night, April 12th: An invitation from Veronica of the NSS, to participate in a Yuri's Night celebration (50th Anniversary) was discussed. Mike offered to follow-up with Veronica for coordination. Mike also stated he would propose a sponsorship, and/or speaker from the AIAA. A possible venue was proposed in the Arizona Museum for Youth in Mesa. Mike will pursue this possibility and report back to the group.

Don suggested that with the current demise of the Constellation program, and the current slowdown in the Government sponsored manned spaceflight program, we need a new message; a message that embraces a "frontier approach" to space exploration/expansion with an emphasis on the acceptance of some risk up front, rather than NASA's attempt at the elimination/downplay of most risk. Further discussion is encouraged.

Upcoming Events:

Our next meeting is scheduled for February 19, 2011, 3-5 pm at the Tempe Denny's US 60 & Rural Road.

Our next Con will be **LepreCon 37** in May in Tempe AZ, information at www.leprecon.org. Then, in September, **CopperCon31** in Avondale AZ, information: www.CopperCon. – Donald Jacques, Exec Vice President,

Clear Lake Area (Houston) National Space Society & Moon Society Chapter

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

Contact: Eric Bowen eric@streamlinerschedules.com

The Clear Lake NSS chapter and the Houston Chapter of the Moon Society have officially merged, effective as of our last meeting in November. We are now officially the Clear Lake Area National Space Society & Moon Society Chapter. All members of the NSS or the Moon Society are welcome to participate as chapter members, and as always guests are welcome at any of our meetings. [Merger approved by The Moon Society.]

Our next Chapter meeting will be at 7:00 p.m. on **January 24**, 2011. The meeting will be held at the Conference Room of the Bay Area Community Center in Clear Lake Park. The Bay Area Community Center, operated by Harris County Precinct 2, is located within Clear Lake Park north of NASA Road 1 in Seabrook. The physical address is 5002 NASA Road 1, Seabrook, Texas 77586. The conference room is located at the east end of the building; from the east parking lot enter the side door and take the first right turn in the hallway.

PLEASE NOTE: There are TWO buildings with meeting rooms at Clear Lake Park. The building we are meeting in is NORTH of NASA Road 1. If you are coming from the space center you will turn LEFT at the traffic signal and drive the perimeter road all the way around the baseball fields until you reach the large building with the blue roof at the far end of the property. After five o'clock or so the main doors in the front of the building may be locked. Enter through the SIDE door in the east end of the building directly across from the parking lot. Take the first right turn in the hallway to get to the conference room.

Two announcements:

1. The Chapter is partnering with **SpaceUp Houston**, a weekend BarCamp and UNconference to be held February 12-13 at the Lunar & Planetary Institute. Visit their website at http://www.spaceuphouston.org .

2. The day after our Chapter meeting there will be a **social and dinner at the Gilruth Center** sponsored by the JSC Chapter of the NASA Alumni League. Retired astronaut Ken Bowersox, now with Space-X, will be the speaker. You need to register for this dinner by Thursday, January 20, so don't delay! – Eric

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Chapters & Outposts Map (North America)

www.moonsociety.org/chapters/chapter_outpost_map.html

Chapters & Outposts Events Page

www.moonsociety.org/chapters/chapter_events.html

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

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

Bay Area Moon Society, CA Outpost – South Frisco Bay
http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net
Meeting the 1st Tuesday of the Month at Henry's home

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

Rockford, IL Outpost
Contact: Bryce Johnson lesausl@sbcglobal.net

Milwaukee, WI Outpost (MSMO)
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com
The monthly Lunar Reclamation Society/MSMO meeting on the 2nd Saturday afternoon every month exc. Jul, Aug.

Moon Society DUES with *Moon Miners' Manifesto*

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

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions

Moon Society Membership Services:
PO Box 940825, Plano, TX 75094-0825, USA

Projects, Chapters, Volunteers, and Information

Moon Society Program Services,
PO Box 080395, Milwaukee, WI 53208

< End Moon Society Journal Section >

GREAT BROWSING

Links whose subject is evident in the address

SPACE TRANSPORTATION

http://www.space.com/news/**space-junk-threat-political-recognition**-101223.html

http://www.parabolicarc.com/2011/01/06/**excalibur-almaz-exports-space-stations-isle-man/**

http://www.physorg.com/news/2010-12-**discovery-molecule-efficient-rocket-fuel**.html

http://www.parabolicarc.com/2010/11/24/a**d-astra-rocket-company-reaches-full-power-milestone-vasimr-vx200-engine/**

http://sify.com/news/**superhero-suit-to-prevent-bone-loss-in-astronauts**-news-international-kmcpOvajahf.html

http://www.bigelowaerospace.com/**history-expandable-spacecraft.**php

http://www.space.com/businesstechnology/**spacex-dragon-capsule-inside-look**-101206.html

http://www.foxnews.com/scitech/2011/01/25/**nasa-exploring-lasers-beams-zap-rockets-outer-space/**

THE MOON

http://www.space-travel.com/reports/**New_Analysis_Explains_Formation_Of_Lunar_Farside_Bulge**_999.html

http://www.moondaily.com/reports/**Mining_On_The_Moon_Is_A_Not_So_Distant_Possibility**_999.html

http://www.universetoday.com/82250/**map-of-future-lunar-landing-sites/** [Google Lunar X-Prize]

MARS

http://www.spacedaily.com/reports/**China_Goes_To_Mars**_999.html

http://www.marsdaily.com/reports/**Camera_On_Curiosity_Arm_Will_Magnify_Clues_In_Rocks** 999.html

http://www.marsdaily.com/reports/**Mars_Volcanic_Deposit_Tells_Of_Warm_And_Wet_Environment** 999.html

http://www.marsdaily.com/reports/**Ancient_Mars_Was_Wet_Cozy_And_Life_Friendly** 999.html

http://www.physorg.com/news/2010-10-**martian-lakes-seas-emerging-underground**.html

ATEROIDS & COMETS

http://www.space.com/news/**asteroid-impact-early-warning-system**-101203.html

http://www.nasa.gov/topics/earth/features/**water_ice_asteroid**.html

OTHER PLANETS

http://www.newscientist.com/article/dn19005-**hints-of-life-found-on-saturn-moon-titan**

ASTRONOMY – OTHER SOLAR SYSTEMS

http://www.space.com/businesstechnology/**sun-gravity-possible-giant-radio-telescope**-101216.html

http://www.space.com/scienceastronomy/**alien-contact-will-take-centuries**-100429.html

SPACE STATIONS

http://www.space.com/news/**esa-seek-to-broaden-access-to-space-station**-101027.html

http://www.newscientist.com/article/dn19949-**fledgling-space-firm-will-use-old-soviet-gear**.html

SPACE BASED POWER

http://news.rediff.com/report/2010/nov/02/kalam-nss-initiative-to-tap-solar-power-in-space**.htm**

http://www.newscientist.com/article/dn19497-**outofthisworld-proposal-for-solar-wind-power**.html

GREAT SPACE VIDEOS

MOON COLONY VIDEOS – The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) can be found at.

http://www.mooncolony.tv/

http://www.gaiaselene.com/

NOTE: Some of these videos were produced by Chip on his own, such as the one on "Global Warming" on which the Society has taken no stand because the leadership is split on this issue

Featured this month:

Moonrush (on a Book by Dennis Wingo) in 3 parts
http://www.youtube.com/user/mooncolonytv#p/a/f/1/qKoQUrKeNuQ

The Moonhatten Project (Space Solar Power
http://www.youtube.com/user/mooncolonytv#p/a/8C1DA029520F52B6/0/cnVt8QCYC0w

Lunar Greenhouse (5 parts)
http://www.youtube.com/user/mooncolonytv#p/c/27CD52E1AB65BF59/1/RibT8Uuohio

ASSORTED SPACE VIDEOS

Paul Spudis on lunar polar ice (32 minutes)
http://www.ustream.tv/recorded/11029718

Chris McKay: to Mars & Beyond – 3 videos
1) What Nasa can do; 2) Finding Life on Mars;
3) Making Mars Habitable for Life
http://moonandback.com/section/video/

A One-Way Trip to Mars?
http://www.youtube.com/watch?v=YGpns8KpDw8&feature=player_embedded

Goldstone Radar shows shape and rotation of new asteroid
http://www.youtube.com/watch?v=8INZkAiSoGs&feature=player_embedded

Progress Pioneering Aquatica (Earth's Oceans)
http://www.cnn.com/2011/US/01/11/vbs.sea.colonization/index.html?hpt=C2

Earth's Global Ocean; A World unto itself: Aquatica
http://underseacolony.com/core/VIDindexLRG.html

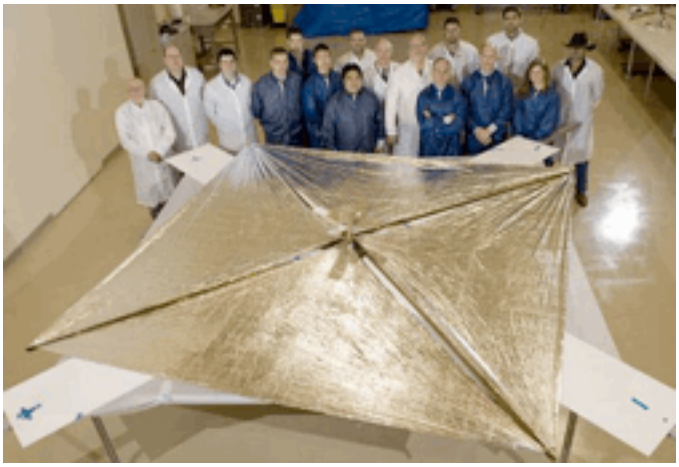
Five amazing Chang'E 2engineering camera videos
http://www.planetary.org/blog/article/00002774/

Space Art with Spray Cans (wild!!)
http://www.youtube.com/watch?v=dY1Lr-yGtd8

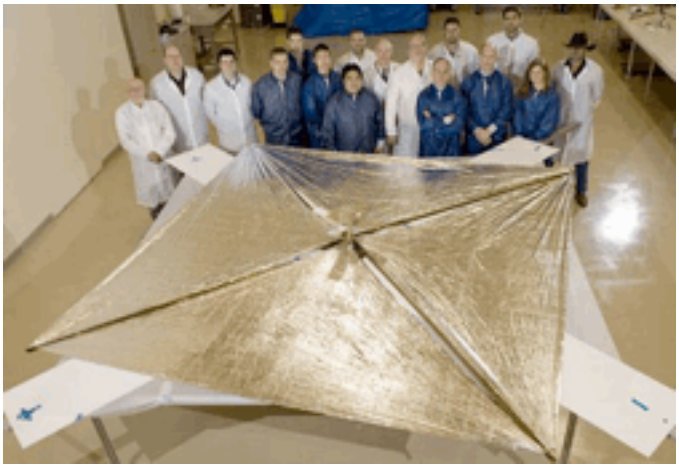
From now on, we live in a world where men have walked on the Moon. And it wasn't a miracle! We just decided we wanted to go.

Jim Lovell, in "Apollo 13"

MMM PHOTO GALLERY



NASA's Solar Sail prior to packing. Launched – it refused to pop-out of its carrier rocket until – all is well!



Above, Orbital Sciences' spaceplane which will compete with Sierra Nevada's (formery SpaceDev's) Dream Chaser

Valentine Cave in Lava Beds National Monument, CA has **classic shape** with wall curbs marking former flow levels

Lavatubes **on other worlds** will be larger as the gravity is less: very large on the **Moon,** where they are found in the maria (seas); intermediate size on **Mars** where they are found in the flanks of the great shield volcanoes, and possibly throughout the Tharsis Uplift..

View of the ISS Cupola from outside

An Earthward view from inside the ISS Cupola

Russian-built Space Station Module in shipment to The Isle of Man by Excalibur Almaz which aims to launch it as a commercial space station core, cutaway view below.

US/Canada Conferences 2011

42nd Lunar & Planetary Science Conference
http://www.lpi.usra.edu/meetings/lpsc2011/
Sponsor: The Lunar & Planetary Institute
Woodlands Waterway Marriott Hotel / Convention Center
March 7-11, Woodlands, TX
Moon Society Presence - ***yes***

Space Access Conference
http://tech.groups.yahoo.com/group/commercialspaceplace/message/1746
Sponsor: Space Access Society
April 7-9,
Grace Inn, Phoenix AZ
Moon Society Presence - ***yes***

International Space Development Conference 2011
Sponsor: National Space Society. See column at right ➔
Moon Society Presence - ***yes***

Planetary & Terrestrial Mining Sciences Symposium
2nd annual conference held conjointly with
The Space Resources Roundtable
http://www.ptmss.com/ - http://www.isruinfo.com/
June 19-22, Ottawa, ONT, Canada
Note: This is the premiere North American conference dealing with the use of off-Earth Materials, and Mining Technologies, sponsored by NORCAT, Sudbury, ONT, where the conference was held through 2007.
Moon Society Presence - ***uncertain***

New Space 2011
http://spacefrontier.org/2010/12/01/newspace2011-save-the-date/
Sponsor: Space Frontier Foundation
July 28-31,
NASA Ames Conference Center, Mountain View, CA
Moon Society Presence - ***yes***

Mars Society Convention
http://marssociety.org/
Sponsor: The Mars Society
August 4-7,
Dallas, TX
Moon Society Presence - ***uncertain***

SEDS SpaceVision 2011
No website as of Jan 29
Sponsor: SEDS - Students for the Exploration and Development of Space
November?
University of Colorado
Boulder, CO
Moon Society Presence - ***yes***

Be a doer, not a watcher.
The watcher is likely to be disappointed.
The doer has the comfort of knowing
that he has tried,
and perhaps laid foundations,
for others who follow,
and may reach the goal.

NSS' International Space Development Conference 2011

http://isdc.nss.org/2011/index.shtml

Huntsville, Alabama - May 18-22, 2011

The weekend before Memorial Day Weekend

The Von Braun Center and Embassy Suite Hotel & Spa

http://www.embassysuiteshuntsville.com/home.aspx

Registration Rates through September 30th
Non-member $230, NSS member $180,
Student up to age 22 with I.D. $40

Huntsville Tourist Destinations include the famed U.S. Space and Rocket Center: NASA's Marshall Space Flight Center: home of the Atlas, Saturn rockets and Space Shuttle Main Engines, and possibly the United Launch Alliance (ULA) Decatur, Alabama plant.

Call for Papers
http://isdc.nss.org/2011/callforpaper.shtml

Space Investment Summit
http://isdc.nss.org/2011/SpaceInvestment.shtml

Airlines Serving Huntsvlle:
AirTran, American, Delta, Continental, US Airways, United

Nonstops from Chicago, Detroit, Washington-Dulles, Washington-National, Baltimore, Charlotte, Atlanta, Orlando, Houston, Dallas-Ft.Worth, Memphis, Denver.

At this time, because of the high registration rates and other fees, the Moon Society has not committed to having a presence at this event.

###

MMM Readers' Service Announcement

NewSpace Magazine to Hit News Stands

"Re-discover your dream"™

On March 21st, a new glossy space-interest magazine should be available on some newsstands (every outlet determines which publications to offer.) **NewSpace** is dedicated to **commercial spaceflight** and **space tourism**. It will be published **quarterly**.

"The purpose of NewSpace Magazine is to introduce and explain the newspace industry for people that are not aware of it. The magazine is not about reporting on newspace events but more about the technical, social, political, and economic aspects of newspace. It is also about helping people re-discover their dream of traveling to space," says Martin Chaney, Owner, NewSpace Publishing.

martin.chaney@newspacemagazine.com

http://newspacemagazine.com/

The publisher invites the curious to explore the website above. "Here you'll find interesting articles, interviews, and soon to be educational videos about space tourism. Feel free to reference the articles on the NewSpace Magazine Space Interviews page. We have an RSS feed for the articles and you can access the feed from the lower left corner of the home page."

The annual subscription rate of $27.80 is now discounted to $19.46. On the website, **you can order a single copy**, or take the plunge and subscribe

The site also has a video section in the upper right corner, along with a generous set of linked pages.

Speculative publication of space-oriented magazines for News Stand sales has had discouraging results in the past. We can all hope that times have changed, and that the theme is Commercial space and Space Tourism will stir greater interest, and that this space glossy will be the first to succeed. **MMM**

Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

2010 LRS OFFICERS | BOARD* | Contact Information

PRES. / MMM Editor – *Peter Kokh **NSS**
kokhmmm@aol.com 414-342-0705
VICE-PRES. Doug Armstrong **NSS** 414-273-1126
SECRETARY – *James Schroeter **NSS**
James_Schroeter@excite.com 414-333-3679
TREAS./ Database – *Robert Bialecki
bobriverwest@yahoo.com 414-372-9613

LRS News

● **Our January 8th meeting:** We watched two videos brought by Bob on our new LED projector. Peter mentioned upcoming science fiction films, only a handful of which would pass our definition of the term Sci-Fi which is now mostly fantasy and horror.

● **On January 16th, Peter and Dave drove to Rockford, IL** We had been invited by new Moon Society Director Bryce Johnson who had set up a meeting with the head of the **Rockford Robotics** Team to discuss their participation in the LES-NSS-Moon Society Lavatube Skylight Explorer engineering competition. As these robotic teams do similar things all the time, this was a very productive meeting as it appears this or several area Robotics Teams may scosponsor and help conduct the oompetition. Unfortunately, we left our camera behind in Milwaukee.

One possibility discussed was the use of the 330 ft access shaft on Jones Island to the **Deep Tunnels** of the storm water system. Peter had crashed a tour and gone down that shaft and into the tunnel below back in the early 1990's (not sure of the time frame.) Whether the Metropolitan Milwaukee Sewerage District would allow this is another question. **NASA-Glenn** in Cleveland had shown some interest in allowing to use their 510 ft drop tower, but has been unresponsive of late.

● **Wisconsin Regional Robotics competitions** will be held at the US Cellular Arena the weekend of March 11-13th. Peter will try to find out if we can have a booth at the event, and if so, will probably miss our March meeting that Saturday.

LRS Upcoming Events

Saturdays: 1-4 pm

Feb 12th – Mar 12th – April 9th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA:

www.moonsociety.org/chapters/milwaukee/meetings.htm

News & Events of NSS "MMM" Chapters

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

OREGON

Oregon L5 Society

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

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

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

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

* **Meetings 3rd Sat. each month at 2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, downstairs
Feb 19th – Mar 19th – April 16th

MINNESOTA

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

David Buth (w) (612) 333-1872, (h) (763) 536-1237

Email: info@mnsfs.org

www.mnsfs.org/

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

We did not find a schedule for upcoming 2011 events.

On Saturday, January 29th, MNSFS held their annual MN SFS Space Explorer Memorial Dinner to commemorate Apollo 1 / Challenger / Columbia and all of the heroes of the dream

http://www.mnsfs.org/heroes.html

This year's dinner was held at the Davanni's party room in Brooklyn Center, from 6 to 8 p.m.

ILLINOIS

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

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

WISCONSIN

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

c/o Will Foerster 920-894-2376 (h) astrowill@tcei.com
SSS Sec. Harald Schenk hschenk@charter.net
>>> DUES: "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020
[http://www.tcei.com/sss/]
• We meet the 3rd Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI
Feb 17th - Apr 21 - Jun16th – Aug 18th- Oct 20th
Sat. Dec 10th - Annual Holiday Meeting with Lunar Reclamation Society in Milwaukee, weather permitting

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

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

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings 6:15 PM on 2nd Tuesdays
Jan 11th – Feb 8th – Mar 8th – Apr 12th
Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

PENNSYLVANIA

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

c/o Earl Bennett, Earlisat@verizon.net
856/261-8032 (h), 215/698-2600 (w)

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

Meeting dates and location: Our next meeting is scheduled for February sixth, a Sunday, and we have

chosen the next Saturday, the twelfth, as a snow date. We will meet at the Liberty One Food Court: go to the second level, where the Court is located, and go towards the seventeenth street side of the building. Look for a table marker or known members to find us. This has become a popular meeting location so you will see several groups now (not space related though).

Next Meetings:

November Activities note: We did not have a formal meeting during our November outreach at the **Philcon** Science Fiction Convention. Earl and Mitch where on panels, while several of our members, Dorothy, Larry, and Dennis all came to "man" our table in the dealers room. All of us stopped by, or stayed to talk to the public at various times during the three-day event. There where a number of handouts and freebies, with Earl bringing "R is for Rocket…But T is for Transport." And copies of a response to Dan Durdas' Sky and Telescope article "How to Deflect a Hazardous Asteroid" (December, 2010). His report is very good and describes a number of systems we could use. And getting the deflectors in place would require a lot of space activity! And Dorothy contributed "Why send people instead of robots into space?" Fun!

Speaking of fun: there were several panels that both Earl and Mitch were on, with the last panel, " Vertical Cities: Are Arcologies in Our Future?" being shared. I described (as moderator of the panel) this structure as "a space habitat brought down to Earth". Looking up the concept, and examining its functions and possible problems, would be good practice for seeing what a habitat anywhere might require.

There was another panel on trying to open the space frontier that was interesting and sobering " why is Private Space Development so Difficult?" There where a number of very knowledgeable people on the panel, and they had a rather downbeat view of the near term (and some said long term) chances of Americans achieving the future we had envisioned for ourselves. Simply put: it really is that difficult to do what we are trying to do. The lack of real (tens of billions) funding is a major problem, with the will to achieve being supported with this money.

On a more upbeat note: Frank O'Brien presented "The Apollo Flight Computer" in conjunction with his new book on the subject ("The Apollo Guidance Computer Architecture and Operation" from Springer). To see how much had to be done to make the system work, and where a lot of the ideas that became the computer revolution came from, was amazing. Frank is also Assistant Director of Information Technology at the Info Age Science/ History Learning Center (infoage.org). We hope to have Frank join us at the spring outreach at Super Science Weekend at the New Jersey State Museum.

Much other interesting talk, from Augmented Reality, to Genomics. A great time! I should note that N.S.S. sent us a package of Ad Astras' that was a well s timed gift. We handed out a number of them.

Submitted by Earl Bennett

Meeting notes: Our December meeting was well attended with new full member Steven in attendance, as well as associate members Janice and Wallace. Hank Smith was also able to come, and Dennis Pearson drove down.

Dotty brought material on several upcoming exhibits in our area and, at our January meeting, brought downloaded flyers on them. Besides the reports on museum events in the Baltimore and Washington area, she had The Franklin Institutes new exhibit information, opening February 5; she also brought the magazine "Time Out New York" (December). For The Institute we have "Leonardo; Da Vinci's Workshop" which includes 3D models of some of the inventors "fantastic" devices as well as interactive exhibits of some of his books of designs (special tickets for exhibit); for the New York Hall of Science there is an exhibit for all ages: "A Thousand and One Inventions" on great inventions from Muslim civilizations. There is also a short film with this exhibit "The Library of Secrets" narrated by Actor Ben Kingsley (special tickets for exhibit). This is through late March. See respective websites for more: fi.edu, and nysci.org/1001.

Hank reported that Philcon did not make money again, primarily due to lack of hotel reimbursements, not lack of membership sales. He did critique the groups outreach operation, saying it should be up and running earlier for the 2011 event (in November), but he also said that it looks good for the location of the event, The Cherry Hill Crowne Plaza, being available in 2011. Stability is always good for such events! He brought up two possible guests for the 75th anniversary event: DR Ben Bova, Science Fiction writer and rocket scientist, as Guest of Honor, and, as Special Guest of Honor< Dr H. Paul Schuch, also a rocket scientist and inventor (and filk composer/ singer). A lot of talk on logistics of events.

Mitch brought copies of Ad Astra for members who had not attended Philcon, and complemented that organization on the location we had in the Dealers Room. For December and January his reports included a special publication from The World Future Society: "The Futurist", Spring 2011, Forecasts 2011-2025. Lots of material on what the future could hold and different areas that you may want to look into: lots of quotes from famous forecasters, and who where inspired by their works, as well as a number of forecasting publications that are free with a new membership. Mitch also brought another of the organizations publication that included space jobs ranging from the "mundane", like Chef on a space habitat, to purely speculative, "Gravity Puller" which pre supposes a way of controlling gravitational effects. Most of these jobs are thought to be opening up in the next twenty years. A number of jobs (25%) in the list are considered space related for the new /future jobs market: "70 great jobs for 2030". He also brought the Enquirer article on the flight of the Dragon Capsule! Two orbits and splashdown in the Gulf of Mexico.

Dennis Pearson told us of N.S.S. requests to the members and local organizations on what the headquarters staff can do for us that would promote our space agendas. Mitch suggested a button or badge to indicate membership, and at the January meeting, also suggested making available some of the great space vehicles and habitats that we have art work for. This is understandable: lots of cool pictures can be had, first from the olden days by getting more literature, and now by going on line, but with no physical reality to touch and handle. Pictures are "easy". Engineering drawings are harder. Feasibility studies are impressive, if you are inclined to reading. Physical models are much more satisfying, and those based on something you may ride, or go to, are the best thing to show people that something could really be built. Speech over.

Dennis also noted that models of the Dragon capsule and the launch vehicle where available. He also reported on the location of the N.S.S. headquarters inside the offices of Navastar Corporation in the Madison Hotel Annex (in Washington D.C.). From the January meeting: he reminds us of the N.S.S. and Space X Alliance Blitz (of Congress) February 27 and March 1. Also from that meeting: the idea of us being part of Yuri's' Night celebrations in April. This will be the 50th anniversary of both the first human flight, and the second one (by Yuri Gagarin and Alan Shepard respectively) so that we, Mitch in particular, will ask if an event is possible at the Franklin Institute. It is possible that our events we will have in April, at the New Jersey State Museum and The Franklin Institute, can incorporate this celebration into our presentations. And: politics. Dennis reports that the new governor of New Mexico wants to put her hand picked selection in charge of the new Space Port out there. This involves the replacement of the Executive Director of the New Mexico Space Port Authority with a "leave or else" style request. The port is owned by the state now, and we'll see what the new administration does with it.

Larry, in January has set up a link for Earl to join a special Facebook site and has extended an invitation for him to join the on-line groups. He will put the Yuri's' Night material on our site. He also commented on the need for models and, with Dotty, suggested a local source and The Liberty Science Center as a possible source of structural models (not just space objects).

In addition: Mitch brought a review of "The Purpose Guided Universe" by Bernard Haisch, which caused some interesting conversations on the why all this is the way we find it. Our new member Steven, who trained in theology, was very interested, and Mitch will buy and report on this book at a later meeting.

Earl brought many things, but for now will report that abook on farming (!) drew a number of comments from the group: The Vertical Farm, by Dr. Dickson Despommier, has ideas that may be quite useful (or lead to inventions that will be) in space habitation. The sub title is "Feeding the World in the 21st Century"

And the professors thesis is that the incorporation of agricultural operations into what amounts to a special purpose sky scraper will be needed to solve the food growth and distribution problems that will continue, and increase, in this new century. There are a number of illustrations and architectural drawings that are worth looking at. And some of these "Vertical Agricultural Zones" (my title for a possible site in municipal area) are being studied for locations that could actually do the job. This would include the countries with oil wealth, and those that have high population densities with high average incomes. Think Emirates, Japan (which has excellent indoor farms already) and several Scandinavian countries. The Green Wall projects

Several space groups are trying, and the more ambitious mixes of plants and permaculture, can cross fertilize to help achieve many of the goals we have in common: a life support system with minimal external inputs except some form of energy and material that is lost in all systems (or is needed for "expansions", also called "children"). And much more, but only the Carver Fair Judges will be mentioned: Mike Fisher and Dennis Pearson will be our primary judges, with Earl as a back up. Submitted by Earl Bennett

CALIFORNIA

SDSPACE.org

San Diego Space Society

http://sandiegospace.org/

info@sandiegospace.org

Meeting the 2nd Sunday monthly
Next Meetings: Oct. 10th, Nov.14th
2:30 to 4:30 pm
Serra Mesa Branch Library 9005 Aero Dr, San Diego
Quarterly Newsletter: ***The Bussard Scoop***

2011 Election Results: At the December 12th general meeting, members of the San Diego Space Society voted in the new officers and directors for the 2011 calendar year. The board of directors now consists of:
Jesse Clark President, Scott Olson Treasurer
Kelley Clark Secretary Adrian Clausell,
Directors: Erik Hall, Saura Naderi, Greg Wagner,
Dave Dressler, Derek Nye

Jan 21st SD Space Movie Night – 2001: A Space Odyssey
7:00 pm to 9:30 pm Space Travelers Emporium
1947 30th St. San Diego, CA 92102

SpaceUp San Diego 2011 @ The Loft at UC San Diego
Feb 12 11:00 am to Feb 13 5:00 pm
SpaceUp is a space "unconference", where participants decide the topics, schedule, and structure of the event. Everyone who attends SpaceUp is encouraged to give a talk, moderate a panel, or start a discussion. Sessions are proposed and scheduled on the day they're given, which means the usual "hallway conversations" turn into full-fledged topics.
http://www.spaceup.org/sandiego

CALIFORNIA

OASIS

OASIS: Organization for the Advancement of Space Industrialization and Settlement
Greater Los Angeles Chapter of NSS
P.O. Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine:(310) 364-2290
Odyssey Ed: Kat Tanaka – odyssey_editor@yahoo.com

http://www.oasis-nss.org/wordpress/

oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html
Regular Meeting 3 pm 3rd Sat. each month
Feb 19th – Mar 19th – April 16th

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

Feb. 18-20, 2011 – Gallifrey One: Catch 22
The annual Dr. Who convention for which we provide space programming. Join us as we discus the Physics of Dr. Who, among other topics. More info at Gallifrey One Website http://www.gallifreyone.com/

No further information available at press time.

Moon Miners' MANIFESTO

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

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- **$45 National Space Society dues** include ***Ad Astra***
- **$20** NSS dues **if under 22 / over 64.** *State age* ___

600 Pennsylvania Ave SE #201, Washington DC 20003

Moon Society dues include *Moon Miners' Manifesto*
Electronic MMM (pdf) **$35** Students/Seniors: **$20**
Hardcopy MMM: U.S. & Canada **$35** – Elsewhere: **$60**
P.O. Box 940825, Plano, TX 75094-0825, USA

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

=> *For those outside participating chapter areas* <=

- **$15 USA** MMM Subscriptions; • US **$25** Canada;
- US **$55** Surface Mail Outside North America

Payable to **"Lunar Reclamation Society",**
PO Box 2102, Milwaukee WI 53201

CHICAGO SPACE FRONTIER L5
- $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
- $15 low "one rate"

MINNESOTA SPACE FRONTIER SOCIETY
- $25 Regular Dues

OREGON L5 SOCIETY
- $25 for all members

O.A.S.I.S. L5 (Los Angeles)
- $28 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE
- Annual dues for all with MMM $25, due in March or $6 times each quarter before the next March

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SHEBOYGAN SPACE SOCIETY (WI)
- $15 regular, • $10 student,
- $1/extra family member

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