

Moon Miners' Manifesto

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Above: artist rendering of Russia's PTK NP (PPTS) 6-person successor to the venerable Soyuz Capsule

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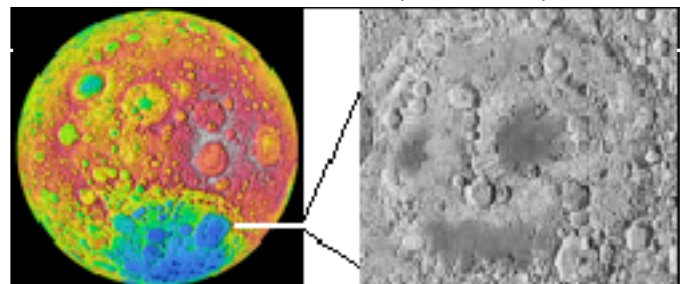
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Apollo Crater on the Moon's Farside - right

This crater, within the South-Pole-Aitken (SPA) basin, the deepest on the Moon, has the areas (darker gray) which are the furthest below "lunar sea-level" or mean elevation. Some expect to find material on its surface, which comes from the mantle, which in general lies below the crust. But some expect that crater central peaks, found on nearside as well, may be upthrust mantle material, not yet sampled. We are curious!

IN FOCUS For the Sake of Science, Science should not be in the driver's seat in Lunar Outpost Establishment

While this topic may seem irrelevant now that NASA has been redirected away from establishment of a permanent structure on the Moon, it begs discussion. The lunar science community has strongly favored a south pole location because it lies on the rim of the vast South Pole-Aitken basin, the deepest on the Moon, most of it in the farside southern hemisphere, [= > 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 this directory:

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

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

• **MMM retains its editorial independence.** MMM serves many groups, each with its own philosophy, agenda, and programs. Participation in this newsletter, while it suggests overall satisfaction with themes and treatment, requires no other litmus test.

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• **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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Moon Miners' Manifesto, c/o Peter Kokh,
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⇒ In Focus Editorial continued from p. 1.

These scientists see a South Pole site as a jumping off point for overland expeditions that would probe the SPA's secrets. What's special about the SPA other than it being the Moon's deepest basin? There is an expectation among some that there are mantle materials to be found here and there on its surface. On the nearside, the mantle lies miles below the surface. What seems puzzling is that scientists are supposed to be "smart." Yet the Apollo crater in the NE part of the SPA, where the deepest areas are to be found, is on the order of a thousand miles from the pole, across really rugged terrain.

In general, the south polar area is extremely rugged, and as moths that need the mythical "eternal sunshine" they would not get far from the pole before they would have to turn around to get back *before dark*.

But that is not our point. To these scientists, establishment of a permanent lunar frontier is a low priority if they give it any priority at all. Yet, the more people on the Moon, in the more places, for an open-ended period, the more science will be supported and in the more places. If Europe had sent a dozen science expeditions to both North and South America each, but never settled, how much would we now know about these two continents compared to what we, as inhabitants, have learned over the centuries? One can only conclude that as these scientists, however brilliantly focused in the short term, are obviously myopic when it comes to looking further ahead, their advice needs to be weighed against other more practical considerations.

We do need lunar science to help identify key locations on the Moon with the various resource concentrations that would make them ideal for industry-based settlement. No spot on the Moon has all the needed mineral resources. The lunar frontier must be global in character. The South Pole, as attractive a site as it seems to be, has some severe drawbacks. The polar ice does not seem to be a *near-term* resource. That some very rocky anything-but-flat areas get a lot of sunshine is irrelevant if there are no "buildable" locations nearby, locations large enough to support considerable expansion. And because the pole is so extremely atypical, learning how to erect and maintain a base there does nothing to help us prepare to establish human presence globally.

The renewed call for a "fly & flunk" program

Some lunar mission advocates, well-intending, but destructively impatient, have convinced some U.S. senators that the Constellation program should be reinstated. This effort may be sincere, but in our opinion is seriously misguided. Why spend our limited funds on a program to "fly & flunk" when we should be laying foundations for a Moon Program that will patiently and deliberately phase in permanent human settlement based on industries that will help tackle Earth's most important problems: environmental degradation and limited clean energy reserves.

The motivating factors behind this effort to reinstate Constellation are clear: the careers of some planetary scientists and some involved in the old program are at stake: career-based self-interest. It has become more important to some lunar enthusiasts to see something happen in their lifetime than to face death, *not having seen the favored frontier open, but knowing that we are on the right track to doing it right, doing it to last, doing it to fulfill all its promised potential.*

PK

Calcium Reduction for Processing Lunar Regolith

Geoffrey A. Landis

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A lunar base, and eventual long-term lunar settlement, will require the ability to process available lunar resources to produce useful product to reduce the requirements for resupply from Earth. It is well accepted that the most useful product that can be produced from lunar regolith will be oxygen. Oxygen is the major, by mass, component of rocket fuel; it is also required for life support, and finally it is the main (again by mass) component of water, which is also required for life support. Oxygen is an abundant component of the lunar surface; lunar rocks and regolith consist of about 45% oxygen by mass. However, the oxygen is tightly bound in the form of silicates. Because of the network-forming properties of the silicate, silicate rocks have high melting temperature, and reduction of the rock to produce oxygen (and byproduct metals and silicon) is difficult.

While the first material to be produced from lunar regolith will certainly be oxygen, in the long term development of lunar industry, it will be necessary to produce other materials as well. Some volatile materials, the gaseous elements adsorbed onto the surface and implanted into grains of regolith (presumably originating from the solar wind), will be easily produced by heating the regolith, although in small quantities. These will be of considerable use for replacing life-support consumables. In addition, hydrogen (in the form of water) is known to be available in cold-traps near the lunar poles.

In the longer term, other desirable elements to be produced from regolith are aluminum, iron, and titanium for use as structural metals; silicon for use as a semiconductor; aluminum for use as an electrical conductor, and oxides to be used in glassmaking. It may also be valuable to produce metals or silane [SiH₄] for use as a rocket fuel. Thus, we want a regolith reduction process that produces highly-reduced byproduct that can be further refined to useful materials, rather than a slag material of mixed tightly-bound oxides.

Many processes to produce oxygen from lunar regolith have been proposed. The most well-developed, hydrogen reduction of ilmenite, has the disadvantage of requiring high temperature, and reducing only a small fraction of the oxygen available in the soil, requiring a separated feedstock. Another problem is that it produces as byproduct a partially-reduced iron titanate slag that is not a useful material for further materials production. Other proposed processes, such as carbothermal reduction, have similar problems. Is it possible to suggest a new process that uses lower temperatures, extracts a higher fraction of oxygen, and produces reduced materials in a form that can be used for later refining into useful product?

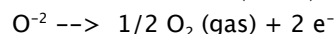
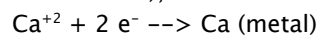
In earlier work, I had suggested that regolith reduction might be done using fluorine substitution reactions, converting oxides (primarily silicates) into fluoride salts, with oxygen as a product. The fluorine reactant must then be recovered by molten-salt electrolysis of the fluoride. That process has several advantages over other proposed reduction methods, but also has some disadvantages.

Another process, which has considerable advantages over existing processing, is calcium reduction. This process proceeds in two steps:

- (1) *Metallothermic reduction*. This is done by heating the regolith in the presence of (liquid) metallic calcium, converting the silicates into metals plus calcium oxide.
- (2) *Molten Salt Electrolysis*: The oxygen is produced in the second step, electrolyzing the calcium oxide in a molten salt at 825–900 °C, recovering the metallic calcium for reuse in step 1.

These processes require considerably lower temperatures than direct electrolysis reactions, and produce oxygen with considerably higher efficiency than hydrogen or carbothermal reduction methods.

Metallothermic reduction has been used on Earth, for production of rare earth elements, manganese, chromium, vanadium, zirconium, and niobium. Following the reaction, the oxygen is chemically bound in the form of calcium oxide. To generate free oxygen (and recover the reactant calcium), this oxide is electrolyzed:



This can be done in a molten calcium chloride/calcium oxide mixture, with a eutectic point of 750 °C, commonly done at temperature from 850 to 900 °C.

The two steps need not be done separately: a single reaction crucible can be used to accomplish both steps simultaneously, in the same molten-salt solution. This combined processing describes the FFC ("Fray, Farthing, Chen") electrochemical reduction process, which has been used to produce metallic titanium, molybdenum, and tungsten from oxides.

Such a calcium sequence has the advantage over many other proposed reduction processes that it does not require beneficiation or selection of a particular mineral for feedstock (although it would be desirable to use lunar fines for feedstock, rather than bulk rock, since the reaction rate is proportional to surface area) but is able to remove the oxygen from all the mineral components found in average soil. This means that it has very high oxygen yield. And the primary reactant, calcium, is itself a component of lunar soil, and thus reactant that is lost in processing can be replaced by material generated from local resources.

More importantly, though, since the reaction should result in nearly complete reduction of oxides to metals, the byproducts will be highly reduced alloy of metals and silicon, and hence suitable feedstock for further refining into materials of industrial use.

References

Fluorine substitution: Geoffrey A. Landis, "Materials Refining on the Moon," *Acta Astronautica*, Vol. 60, No. 10–11, 906–915 (May–June 2007). See also NASA Technical Memorandum TM-214014, December 2005.

Calcium reduction: Geoffrey A. Landis, "Calcium Reduction as a Process for Oxygen Production from Lunar Regolith," to be presented at the AIAA Aerospace Sciences Conference, 4–7 January 2011, Orlando, FL.

About the Author:

http://en.wikipedia.org/wiki/Geoffrey_A._Landis

Landis is also a member of the Moon Society Board of Advisors

Casting Metal on the Moon

By David Dietzler

Engineering details might seem dull or trivial, but they can make or break us. There won't be any ISRU and bootstrapping on the Moon without metal casting. Three dimensional printers that use lasers or electron beams (which require vacuum, free on Luna) to fuse powdered metals, glass and/or ceramic into small parts that can fit in the hand and medium size parts with dimensions of one or two feet will be used to produce all sorts of parts on the Moon. Barring the creation of giant 3D printers we will need to cast large metal parts on the Moon like vehicle chassis frame members, axles, wheels, struts, etc. When we can we will use rolling mills and/or extruders to make things, but we might want to cast up the rolling mills and extruders with lunar materials rather than ship these massive devices to the Moon!

Aluminum and magnesium are often sand-cast but they might also be cast in plaster molds with plaster obtained by sulfuric acid leaching of highland regolith. Plaster, CaSO_4 , is also a cement setting time retardant and Portland cement contains up to 5% of this compound by weight. Iron, steel and iron alloy (e.g. iron-aluminides, iron-silicon, iron-manganese, iron-nickel) casting is going to require sand molds. Foundry sand, also called green sand, is made of either silica or olivine sand, two substances we have on the Moon, water that can be obtained in various ways and rigorously recycled, bentonite clay and sometimes pulverized coal (forget coal on the Moon). We will have to do casting in pressurized chambers with dehumidifiers to recover water vapor from the drying sand mold and powerful cooling systems because it will get very hot inside when working with molten metals and interior pressure will increase as temperature increases. Casting chambers will be built of metal and concrete, not Kevlar!

Here's the detail I am hung up on; there is no clay on the Moon because there was never any water for the hydrological processes that produce clay to occur. Clay is essential to bind the sand mold. We might be able to synthesize clay on the Moon. At:

www.patentstorm.us/patents/6565643/description.html we read that, "U.S. Pat. No. 3,803,026 describes a process for preparing a clay-type material in which an amorphous gel comprising silicon oxide, aluminum oxide, and, e.g., magnesium oxide is subjected to a high-temperature ageing step in an autoclave.

C.R. Acad. Sc. Paris 7 292 describes a process for preparing, int. al., clays comprising aluminum, silicon, and, e.g., magnesium by way of a co-precipitation process." Silicon, aluminum, magnesium and their oxides exist on the Moon. I suspect that it will be more practical to synthesize clay on the Moon than upport it from Earth! It is also possible to bind foundry sand with resin. At http://en.wikipedia.org/wiki/Shell_molding we read:

"Shell molding, also known as shell-mold casting, is an expendable mold casting process that uses a resin covered sand to form the mold. As compared to sand casting, this process has better dimensional accuracy, a higher productivity rate, and lower labor requirements. It is used for small to medium parts that require high precision. Examples of shell-molded items include gear housings, cylinder heads and connecting rods. It is also used to make high-precision molding cores."

The Wiki article states that this is used for small to medium sized parts so we might still need clay for large part casting. Resin could be made in lunar labs and we would need some way to recycle it possibly by leaching unused resin out of spent molds with an organic solvent and by extracting vaporized resin from air and CO_2 from burnt resin. Resin will contain rare lunar elements like H, C and N, and we cannot afford to waste these. If we cast in chambers with inert gas filled interiors the resin won't burn to form CO_2 and other gases.

If we can synthesize clay on the Moon, and I suspect that we can and must, and do it cheaply, then we could even work clay and fire it with electric furnaces into pottery and other desirable items. That would be a nice added benefit. An unconventional approach to metal casting on the Moon might be the use of microwave sintered regolith molds, but data is lacking. This should be investigated.

DD

About the author:

Dave is a core member of Moon Society St. Louis and as the editor's chief co-brainstormer, has had quite a few articles published in MMM over the years. "Dietz" tries to figure out how we are going to do and make all the things necessary to found a civilian industrial settlement on the Moon. A member of the Moon Society Board of Advisors, he maintains his own website: www.moonminer.com, which is really worth exploring.

Dave is also heavily involved the google group - <http://groups.google.com/group/international-lunar-research-park> that focuses on "R&D Projects for an International Lunar Research Park" His efforts have attracted a number of heavyweight co-conspirators, including materials science people, planetary scientists and others. Dave is not afraid goof in breaking new ground. "If we didn't have him, we'd have to invent him."

Could the Best Place to Mine Asteroids be on the Moon?

By Peter Kokh

Hey, the asteroids are way out beyond the Moon! But how do you think the Moon got all its craters? Volcanic origins were ruled out long ago. Yes, asteroids are "out there." But now and then one is gravitationally dislodged into the inner solar system, and sometimes, the Moon or Earth itself is in the way and splat!

The amount of asteroid-sourced material in the moondust or regolith may be relatively small. Much of the impacting asteroid material may have been thrown out into space. But some must remain. Now most of the near Earth asteroid objects seem to be of the stony type, and we have enough rock powder on the Moon! What would be of interest are left-overs from metal-rich asteroids. In general, the Moon is deficient in some of the elements most needed for a technological civilization: copper, zinc, gold, silver, and the most prized element of all: platinum, involved in some 25% of all current manufacturing processes. It is the catalyst of choice for hydrogen-oxygen fuel cells, for example. Copper is so important that a 1% ore on Earth is considered "rich."

PGMs - Platinum Group Metals - are the focus of the recently published science fiction novel by Bill White, a Moon Society member: "Platinum Moon" which was reviewed in the August issue, MMM #237. PGMs were also the focus of Dennis Wingo's work "MoonRush."

Why not mine Platinum and associated metals on asteroids where they are concentrated? John Lewis and many others talk about this extensively. But there are a few awkward details that they aren't sharing with us.

1. **There is an "inconvenient" Catch-22 in Orbital Mechanics that says the closer two bodies (Earth and a target asteroid) are in period (the time they take to go around the Sun, the farther apart on the average are the launch windows from one to the other.** The wait between launch windows between Mars and Earth in either direction is some 25+ months. Between Earth and a really close NEA or NEO that window may open every two decades or longer! The upshot is that NEOs are hit and miss "targets of opportunity" at best.
2. **But the delta V, the amount of change in velocity (or powered acceleration needed) is very low.** Again a Catch-22 – **the lower the delta-V needed, the longer the trip from one to the other.**
3. **But you save so much fuel!** Well, that's okay if you are sending *robotic* prospectors and miners. But if you are sending humans, **the extra consumables you will need to send along will probably outweigh the saved fuel.** The journey could take many months, and the wait for a window home could be years, and then the long trip back.

No one told you that? Hmm! I wonder why? We are not opposed to exploring, mining, and even settling the asteroids. In fact there have been many articles about asteroids and the possibilities for using them in past issues of Moon Miners' Manifesto. We have gathered them and republished them in a special Asteroids theme issue. This is a free PDF file download from

www.moonsociety.org/publications/mmm_themes/

Our point is that lunar pioneers can't afford to wait until asteroid mining has developed to the point where shipments from the Belt or elsewhere can fill the settlements' needs for these metals. There must be areas on the Moon where these metals are to be found in amounts worth prospecting for and extracting. No Lunar orbiter yet flown has been equipped to find these metals, especially in small local concentrations.

What do we need to detect and mine PGMs

Until now, the instruments chosen to fly on lunar orbiters have been selected to map concentrations of key elements we know to be fairly abundant on the Moon: iron, aluminum, magnesium, titanium, thorium; and it is fair to say that the driving curiosity has been what the geography of these concentrations says about how the Moon was formed and how it got to its present condition, rather than a search for "resources." Planetary scientists are in charge, and that is appropriate at this stage of the game. The only element that has *also* been the target of orbital mapping as a *resource*, is hydrogen, which together with overly abundant oxygen gives us water, water ice, and hydrates. But that is because, water is essential to outposts whether they get into the lunar materials industry business or not. Plus scarce water can be stolen from the precious lunar reserves for one-use non-recyclable exploitation as rocket fuel, when, in the Moon's low gravity environment, other more abundant options are available.

Now some of the targeted elements have usual partners: where there is thorium, there is probably uranium and lead, for example. So we know more.

Additionally, Apollo missions 12, 14, 15, and 17 all found KREEP deposits, rich in Potassium (K), Rare Earth Elements, and Phosphorus primarily in the Mare Imbrium splashout zone. Lunar Prospector in 1998–9 mapped these deposits at low resolution.

Could future lunar orbiter instruments detect PGMs and other valuable but less common elements on the Moon? Both the resolution and sensitivity of the needed instruments would have to be very high. But as so much is at stake, even sketchy indications of where best to look with on the surface techniques would be most helpful, by weeding out extensive areas where concentrations are lower. That said, to the extent that PGMs are a gift from the sky and not from the lunar interior, a statement that may not be totally correct, then their geographic concentrations should not follow well-known surface terrane "provinces" such as the highlands and/or maria. Nor will they be found in connection with certain types of craters, as crater types go by size, density, speed, and impact angle of the object creating them, and not by the object's makeup. That said, after a few PGM concentrations are found, it is possible that we will detect a pattern that will suggest where else on the Moon, the "prospecting prospects" are promising.

Do we need an army of human prospectors? This will be tedious work, and until definite concentrations that might be worth "mining" are found, expensive human efforts would be unwarranted and wasteful. So what can we do?

Orbiter instruments that successfully find some evidence of PGMs should be reflown on orbiters with eccentric orbits that carry them very close to the surface, say 10 kilometers (6 miles) or so, and keep adjusting the orbit until the entire Moon, farside as well as nearside, is mapped to produce the first crude map of PGM abundances. This map may suggest where to look on the surface itself. And here we need robotic rovers.

But because we will need many such assistants, and because there is an area as big as Africa and Australia together to cover, we suggest micro-rovers, working in teams, what I have called "robo-ants." I wrote about these handy critters way back in MMM #45, May 1991, almost twenty years ago. An updated version of this article was recently published in our Moon Miners' Manifesto India Quarterly, issue #5, a free download at:

www.moonsociety.org/india/mmm-india/ or directly at:

http://www.moonsociety.org/india/mmm-india/m3india5_Winter2010.pdf

We need to develop these handy "social mini-bots" anyway. They will come in handy as exospeleologist scouts, creating initial surveys of the interiors of lava tubes on Moon and Mars, and going elsewhere in terrain difficult for humans to traverse, and scour, whether in spacesuits or pressurized vehicles. Now of course, human guidance and teleoperation of these handy assistants from a nearby pressurized field vehicle is certainly an option.

PGMs have not been confirmed on the Moon and that is no surprise. We have not fielded the equipment and technologies needed. But we have every reason to believe that they are there, and that for the very practical reasons outlined above,

The Moon is the best place to mine Asteroid wealth!
The time to start planning how to do this is now! PK

An Asteroid Mission that Makes Sense

By Peter Kokh

Background: NASA's current direction

As of September 3, 2010 when I am writing this, NASA's marching orders are not yet set in stone, but all the indications are that the agency wants to concentrate on a Near Earth Object (asteroid) destination as the most feasible given the equipment resources likely to get the go-ahead for development.

Early in January, NASA released a "**Flexible Path**" evaluation of a 2025 human mission to an asteroid.

<http://www.nasaspaceflight.com/2010/01/nasa-flexible-path-2025-human-mission-visit-asteroid/>

This would be "a NEO mission in the mid-2020s, a full five to six years after the original target date to return to the moon, as outlined in the Vision of Space Exploration (VSE) - ... no longer seen as achievable."

"Today, ~500,000 minor planets are known. Of that number, ~6600 are NEOs; of these ~1100 are PHOs (Potentially Hazardous Objects) - ... objects that come within 0.05 AU (7.5 million km - 4.65 million miles) of Earth. PHOs are in orbits that have the potential to make close approaches to Earth, and are large enough to cause significant regional damage in the event of an impact."

So this is not a mission to identify mine-worthy objects and test mining methods. The primary motivation is Planetary Defense. The pace of asteroid discovery in general has accelerated enormously in the past decade and the list of PHOs is likely to mushroom significantly by the time such a mission is feasible.

As of January, NASA had narrowed the list of potential target PHOs to 38. Since then the list has shrunk by application of relevant mission constraints, to just two! But the list is likely to grow again as new PHOs are discovered, and shrink again as mission constraints narrow in on "doability."

<http://www.foxnews.com/scitech/2010/09/01/nasa-narrows-targets-manned-asteroid-mission/>

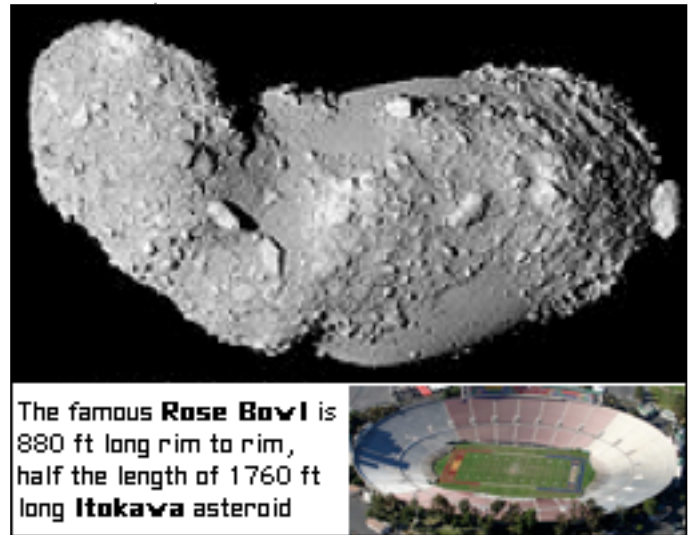
Candidate steroids are in eccentric orbits that do not bring them near to the Earth-Moon system on a regular basis, nor frequently. Of the 38 objects previously listed, only two will approach near enough to be visited on a round-trip of a few months time, within the 2020-25 timeframe. A third would come close enough in 2045. So very practical reasons help narrow it down.

And should we not be ready by 2025, and no other PHO has been found that will approach within crew-reach before 2045, well, then all bets are off. So if the nation adopts this destination mission, there can be no delaying by the usual Congressional or Administration budgetary mischief. It will be "do or don't do" - period!

Another constraint is that the selected target must be viewable by large ground-based telescopes. So such a mission choice demands an irreversible commitment that was lacking in the Back to the Moon directive.

Background: initial mission & target constraints

The target must be an object of a minimum size, about 100 meters in longest axis. Yes, that does seem to offer a choice guaranteed to be *booooooring!* But no larger, more interesting target that is also a PHO will come any where near Earth in the coming two decades. And as this is a human mission, it can't go too far afield if the mass of consumables taken along is beyond a certain limit.

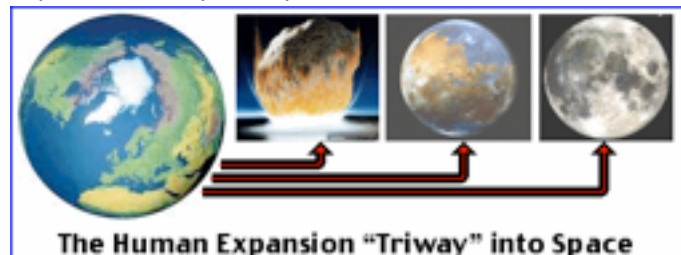


Itokawa, visited by Japan's Hayabusa sample return probe, is the smallest asteroid visited to date. NASA's two candidate objects are significantly smaller and would easily fit on the Rose Bowl playing field. But for this purpose, *size does matter, only smaller is better.*

The smaller the size range, the more numerous these objects are. The odds on a really big object hitting us are far, far lower than those of one much smaller, but still able to pack a significantly disruptive punch.

Why we "Moon people" should care

Back in July of 2007, I put together a PowerPoint presentation and PDF Slide Show called "The Human Expansion Triway into Space"



The point of this presentation is that far from not having our act together, the common impression of the media, of congress, and the public, Moon enthusiasts, Mars enthusiasts, and Asteroid enthusiasts have a common goal: preserving Earth and Humankind. There are three approaches to this directive and all three need to be, must be, pursued. So while each group pursues different projects, these activities demand to be seen as complementary, not as alternatives.

As you go through the presentation, we show how each of these efforts can help achieve the specific goals of both the others. In other words, from a Moo Society point of view, the opening up of a human frontier on Mars is essential, as is the effort to preserve the Earth we all love from significant destruction by mindless errand astrochunks. Even if the asteroid contingency and the Mars contingency does not do us the courtesy of offering corresponding support to the establishment of a lunar frontier, that does not excuse us from doing the right thing. In short, while a mission to a PHO near Earth Object seems like a diversion and distraction, we sincerely believe that the Moon-enthusiast community should support it.

What we should *not be doing*, is to petulantly try to derail such a mission in favor of a Constellation type Moon mission guaranteed to end in “Flags & Footprints 2” but this is precisely what many well-known, and understandably disappointed lunar advocates are doing. It serves no purpose to name names. They are identifying themselves quite freely.

But let us go beyond tacit support of this limited asteroid mission, beyond vocal support, to activist insistence that the mission be done right! And that means that the chosen crew should be equipped to do a lot more than just “nose around!”

Mission Goals: Science

That the crew should “characterizes” the chosen object goes without saying. They would determine its **mineralogical makeup** and class (stony?, carbonaceous chondrite?, etc.) and determine its **physical character** (a solid chunk or a clump of loosely bonded rocks covered with dust – the “bean bag” type. Its basic shape and size and probable mass and rotational axes may have been determined by telescopic observations from Earth but will be determined with greater precision by the crew. The experimental value for its gravitational field will tell us its density and mass distribution (homogenous vs. clumpy).

We should also “tag” this chunk, placing a transponder, so that the object emits a signal that will help us determine its whereabouts with extreme accuracy. A complex multi-axial rotation, common to small objects, may well complicate the choice of a tagging site, as well as introduce some level of risk to crew movements, should there be a “whip” movement anywhere in such a complex multi-axial rotation cycle.

Mission Goals: Critical Experiments

But if these are the be-all and end-all of the mission goals, then we are wasting our money. The real mission, after these preliminary investigations are over, should be to put in place two or more experiments, to be operated in tandem, not concurrently, to test various theories of how best to alter orbits of objects of this size and type. “There are several ways to deflect asteroids, though none have ever been tried. The approaches fall into two categories – impulsive deflectors that nudge the asteroid instantaneously or within a few seconds, and “slow push” deflectors that apply a weak force to the asteroid for many years.” <http://geology.com/articles/earth-crossing-asteroids.shtml>

Planting a nuke, the “macho” masculine choice, makes no sense if the object is not solid. Punch a bean bag and it just rearranges itself. It makes more sense to take two or three of the most promising “slow push” options and install the needed equipment to activate each in turn, not both or all at once, so we can measure the amount of deflection we get per amount of mass of the installed device(es) to enable us to judge with which system we get the most bang for our buck. Now some caution here: any given system may prove superior for a set size/mass range and set physical makeup of the object in question, but work poorly for other types of objects. Our choice of methods to test with this first visit will be affected by their total cargo mass, and ease or difficulty of deployment, as well as the need for time delays. Now none of these experiments will yield really good data, if we do not “tag” the object first so that we can follow orbital deflection changes with a very high degree of accuracy.

The Planetary Society ran a design competition, called “Tagging Apophis” with a significant \$50,000 prize, and announced the three winning proposals in early 2008. It is notable that none of them decided to place the tagging device anywhere on the surface of the asteroid, but instead, all three chose to put the device in a stable orbit around the object. That avoids periods in which the tagging device might be out line-of-sight from Earth. So this gives us a jump-start on this mission requirement.

On the side of these options being adopted:

For once the curiosity of planetary scientists is not the only lobby to which NASA will listen. There is now a very vocal community of scientists and others, some of them within the agency, concerned about developing asteroid deflection options in the event that a NEO is determined to be a near-term threat, that is, on a course that could result in a near-future impact with Earth of a magnitude to cause significant regional or even global disruption and destruction.

I must admit to having been one of the “asteroid denialists” in the sense that *“the odds that Canada and Northern Europe and Russia will be ‘wiped clean’ by advancing glaciers at sometime in the next 25,000 years is significantly greater than the odds of a really destructive impact in that same period. But no one in Canada, or in northern Europe and Russia is losing any sleep over it.”* I still feel that way. But that is not the point. ***The point is that affordable discretion is better than gambling.***

Asteroids and the Moon

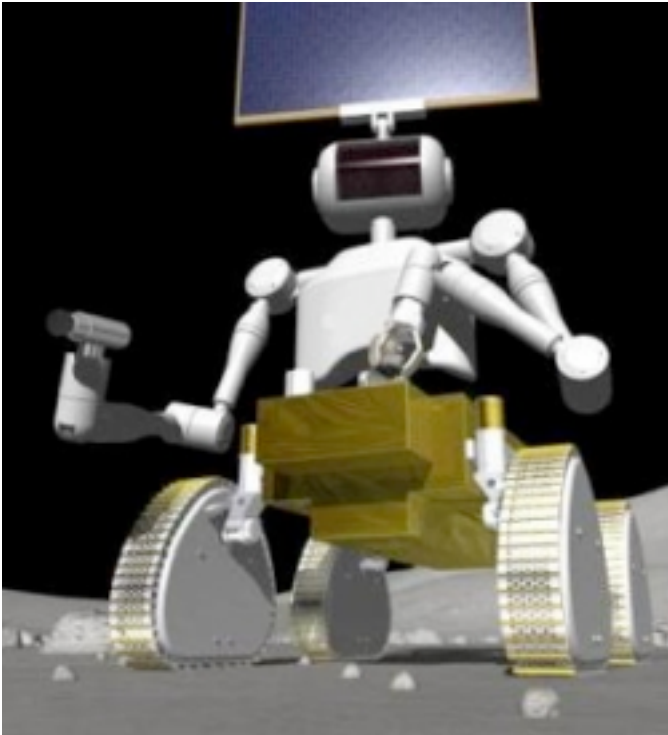
Of course, an errant asteroid could hit the Moon and possibly wipe out a settlement. Actually, Earth’s much deeper gravity well makes Earth a likelier target by 8:1 odds. But the lesson is that Planetary Defense is a good thing for a lunar frontier civilization also. So for Moon-enthusiasts also, there is something in this mission for us as well. So we should support this mission, and if we are going to do this, let’s make the most of it, or let’s not do it at all.

Further, even if we do not go to such a target near Earth object with mining in mind, we are bound to learn things that will prepare future asteroid miners for the conditions that they will face. Now while in the previous article I suggested that near term, we concentrate our asteroid mining efforts on the Moon first. Make no mistake that in time, asteroid sources of badly needed “Moon-deficient” metals and volatiles (notably Carbon, Hydrogen, Nitrogen needed for agriculture and biosphere) will be developed. Earth will need the metals; we will need both metals and volatiles. Trade will benefit all parties and lead to population growth on Moon, Mars, and asteroids as well as “space settlements” in Earth orbit or the Lagrange Points or amongst the asteroids.

Our movement into space cannot be addressed as a set of alternatives. We need to do it all, and each option we pursue increases the long-term viability of the others. The Moon is anything but the “end of the road.” It is the key hub, if not in transportation terms, certainly in terms of trade and the Exo-Terrestrial Economy.

We must stop this adolescent infighting. We must all adopt the Human Expansion Triway to Space mindset. Separately, we will each fail. Together we will each win. The future of Earth itself, and of Humanity and Gaia, whether Earthbound or expanding through interplanetary space, even someday interstellar, is at stake. **PK**

Japan & Russia have Separate Ideas



http://news.cnet.com/8301-17938_105-20006075-1.html – Above, a JAXA illustration from this report

By Peter Kokh

We have been talking for years about the need to automate and teleoperated as many “routine” tasks on the Moon as possible, in order to free humans on the scene to do what only they can do. Human labor on the Moon will be very expensive in terms of transportation logistics and life support. Workers on Earth, at the controls of teleoperation and telepresence devices will be considerably less expensive, and as they hand over the controls to relief personnel, the devices they control on the Moon can keep on doing their thing without relief.

Of course, there is a limit. Someone has to fix and maintain the teleoperated and telepresence-controlled devices on the Moon, and come to their assistance should they get stuck, or otherwise befuddled.

JAXA would go further, butting robotic avatars on the Moon that would allow scientists on Earth to see, pick up, and feel, and probe rock samples via telepresence. Humans would still be needed, and more of them than the devices they control, as they pass over the controls at shift rotations and for lunch breaks so that the work on the Moon can proceed “24/7.” Telepresence operators would experience what it is like to be and operate on the Moon’s surface, at least to some extent.

This kind of “takeover” may well happen for many occupations on Earth as well. No one will be laid off – they will just get to do their thing from the comfort of home or vacation settings. Less time spent traveling to and fro, less gasoline consumed. Of course, there will be some displacements. That is inevitable.

Background Reading

Some of these links include relevant videos

<http://spectrum.ieee.org/robotics/industrial-robots/when-my-avatar-went-to-work/0>

<http://spectrum.ieee.org/static/telepresence>

<http://spectrum.ieee.org/automaton/robotics/industrial-robots/051810-anybots-qb-new-telepresence-robot>

Call this development “**teleoperation 2.0**” if you will. The upgrade is that your eyes will see what your avatar sees; your hands will feel what it feels. For the teleoperator, this will at first be a thrill, then frustrating, as one gets used to the 2.5-second time delay – *light can only go so fast!* – But in time all this will become second nature. We get used to “magic” very quickly.

While it may seem that less people get to go to the Moon, more people will get to enjoy the “avatar experience.” But as there is a limit to what can be done effectively and efficiently by telepresence, every task assumed by a telepresence operator on Earth, means that a human crewmember is freed for non-routine things. We won’t be sending less people to the Moon, but the ones we send will get to do more exciting, less routine things. The upshot is that the same amount of humans on the Moon will get to do more interesting work, as the routine tasks will be teleoperated from Earth.

Now on Mars, telepresence type robotics will just not work, given the 6-minute minimum time delay (when Mars is closest to Earth) to a 40-min maximum, unless, of course, we have a forward base in Mars orbit: a space station or an outpost on one or both of Mars’ two moons. But more on how we will do this on Mars in our next **Mars** issue (every **March**, of course), **MMM** # 243.

The Russians are planning a “robotic” moonbase as well. But this seems to involve teleoperated equipment only, tasked with base construction, and not telepresence tasked with scientific exploration.

Beyond Telepresence to “Droids”

The next step is to make devices on the Moon autonomous, not only doing away with the time-delay, but substituting artificial intelligence for that of a telepresence operator. But hopefully, *Star Trek* had it right, and the ‘droids will be tireless helpers, rather than replacements for humans. We can leave to them those tasks that are boringly routine, as well as those that involve substantial risk or danger, and or unpleasant operating conditions (the heat of high noon, and cold of nightspan; treacherous terrain, etc.)

One thing I can’t see, is droid replacements for my dogs! Or at least I hope to be long gone before that happens. I don’t mind my dogs owning me! Lol!

Site preparation tasks

Current thinking sees involvement of robotic and teleoperated machinery for site preparation tasks such as spaceport construction, grading of the site, digging trenches to hold modules, then covering them with moon dust shielding, or with blocks made from moondust, etc. In short almost everything necessary will be taken care of by robots and/or teleoperated equipment so that when the first crew arrives, they have a ready-to-move-in outpost, and they can concentrate on scientific exploration and experimental production of building materials from moondust ingredients, needed to manufacture more living space for base expansion.

MMM



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



Objectives of the Moon Society

include, but are not limited to:

- Creation of a spacefaring civilization which will establish communities on the Moon
- Promotion of large-scale industrialization and private enterprise on the Moon
- Promotion of interest in the exploration, research, development, and habitation of the Moon, through the media of conferences, the press, library and museum exhibits, and other literary and educational means
- Support, by funding or otherwise, of scholarships, libraries, museums and other means of encouraging the study of the Moon and related technologies
- Stimulation of the advancement and development of applications of space and related technologies and encouragement their entrepreneurial development
- Bringing together persons from government, industry, educational institutions, the press, and other walks of life for the exchange of information about the Moon
- Promoting collaboration between various societies and groups interested in developing & utilizing the Moon.
- Informing the public on matters related to the Moon
- Provision of suitable recognition and honor to 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, and from all walks of life, in the effort to create an expanded Earth-Moon economy that will contribute solutions to the major problems that continue to challenge our home world.

Moon Society Strategy

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

Our Full Moon Logo above:

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

Masthead Design by Charles F. Radley

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.

Your Moon Society Username/Password

By Peter Kokh, President

While the Society has a considerable amount of archived material in free access directories on our website – you don't have to be a member to access or download it – there are some areas of the website for which access is limited.

<http://www.moonsociety.org/members/mmm/>

In this directory, using your moonsociety login, you will find PDF files of all past issues of our newsletter, Moon Miners' Manifesto, from May 2001 – MMM #145 (the first issue to be put in PDF format) forward through the current issue.

Even if you prefer to get your MMM in the mail and to hold it in your hands, if you want to see what might be in these past issues so preserved, you will need to use your username and password.

Your login will also get you to the archived PDF files for past issues of Selenology Quarterly, published by the American Lunar Society, a group of amateur astronomers who especially enjoy looking at the Moon through a telescope.

<http://www.moonsociety.org/members/selenology/>

And you login will get you into

<http://www.moonsociety.org/mymoon/>

At this location you can join or leave any groups or teams, as well as change your own contact information, should you move, get a new phone number, or change your email address. On this page you can also reset your own password.

I can't find/remember my password!

Not a problem!

Simply write president@moonsociety.org and will take care of the matter right away. We will reset your username and password to something easy for you to remember, and email you the combination. Now, if you desire to change it to something only you know, you can go to the /mymoon/ address above, log in with the new combo, and follow the instructions to reset it.

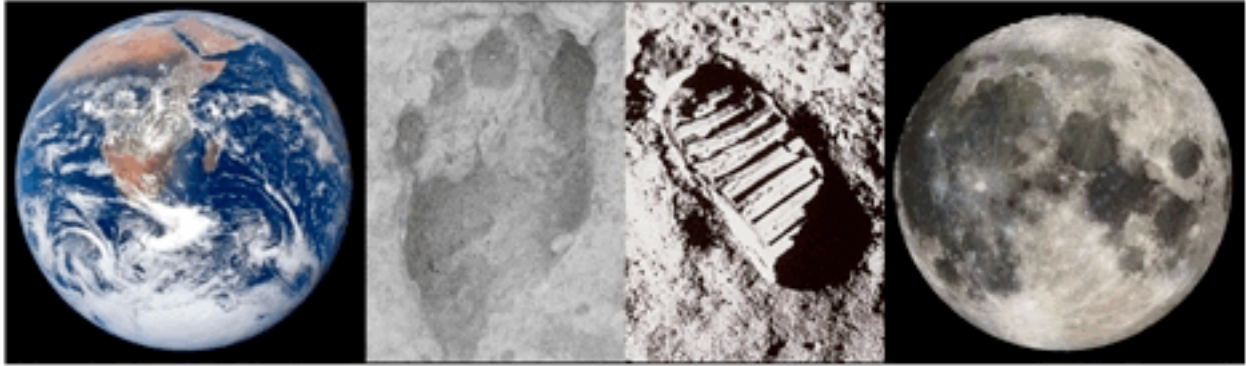
You see, while website managers can see what your username is, the password is encrypted so that no one can see it, including us. That is why we will give you a new set rather than tell you what the old set is.

Tons of Free Stuff!

Whether you are a visitor, unsure if you want to join the Society, or financially unable to do so at the time, there is plenty of free material on our website. The non-time-sensitive (i.e. timeless) articles from the first 20 years (200 issues) of Moon Miners' Manifesto have been republished in 20 PDF file volumes, one per publication year, available for free download at:

http://www.moonsociety.org/publications/mmm_classics/
http://www.moonsociety.org/publications/mmm_themes/

The Moon Society - Lunar Frontier Settlement - www.moonsociety.org



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

If you haven't visited our homepage lately, you will find that it has received a new look with our new Logo Banner

This image incorporates the classic photo taken of Earth by returning Apollo astronauts, and appropriately featuring Africa, our home continent.

It also incorporates a downsized version of the 500 pixel-wide full moon image on which Greg Bennett, Moon Society founder, based the present Moon Society Logo. Note that in this larger banner image, the full moon image is larger and more prominent than that in the previous top left logo image, which had been confined to a 150-pixel menu column width.

The juxtaposition of the two images, the present earliest known human footprint, found in Kenya, and dating 1.5 million years ago, and the famous Apollo 11 bootprint from July 20, 1969 captures the human epic which is now solidifying its intercontinental expansion phase and preparing to become interplanetary. Earth and the Moon appropriately bookcase these footprints.

The message is clear:

The Moon Society is at the forefront of this transition from intercontinental to interplanetary. We are just at the beginning of a new phase, which one day may lead us to reach even further, to the stars!

The juxtaposed foot/boot prints was an idea by Peter Kokh and published as part of our Apollo 11 40th Anniversary Moon Party. It was Dave Dunlop, however, our Director of Project Development, who suggested we take this "iconic footprint pairing" and brand it as part of our identity and mission statement. This suggestion then led to the creation of the banner above, which has had enthusiastic approval from Society Officers and Directors. Scotty Gammenthaler has redone the homepage to feature the image to best advantage.

We have also taken the muted Apollo bootprint background on our secondary pages and are now using it as background for the homepage center column. This complements the banner imagery and creates better continuity between the homepage and secondary pages.

We hope that you like the improvement and that it catches the eye of visitors, and encourages them to join us in the work ahead.

Add the recent major upgrade to our homepage Changing Image feature, along with daily-updates space news links, and our homepage begs to be visited often!

The Moon Society Receives a Bequest

By Peter Kokh

In the Spring of 2005, shortly after the International Space Development Conference in Washington, DC that year, we received a phone call from an elderly couple, Mr. and Mrs. Pietraskiewicz, in Wallhalla, South Carolina, who were in the process of writing their will and wanted my opinion on the best use of any funds they might bequeath for the purpose of advancing the day when humans would be living and working off planet. I pitched The Moon Society, the Lunar Reclamation Society, and the National Space Society. Through the years, we wondered if anything would come of this.

A few months ago, each of these organizations received a letter, that Mrs. Pietraskiewicz had passed away (her husband apparently preceding her) and that the will was in probate. Now the checks have arrived and each organization has received \$7,692.72, a combined total of just over \$22,000. We are very grateful to this couple for their generosity.

How will we spend it? Some fraction will be put in reserve. But to fulfill the wishes of this generous couple we are endeavoring to identify a number of projects that would indeed inch us closer to our goals. Some funds may go to organizing workshops to tackle critical issues; some may be used to organize a special conference. Some may go to art acquisition.

More productive, however, may be a series of engineering design competitions to pre-develop Moon landers and rovers and other robotic and teleoperated equipment to the point where it catches NASA's interest. We had already discussed one such idea in MMM #237, page 11, column B, "An Engineering Design Competition for a 'Lavatube Skylight Explorer' Probe." We can think of several other very promising engineering design competitions.

Some of it may go to carefully defined analog research projects of various types. We have time to give diligent thought to the options and define them so that we are likely to get fruitful results.

The Lunar Reclamation Society will partner with the Moon Society on some of these projects, doubling the money available. And we hope that we can convince NSS to do likewise with at least a portion of its share. None of this money should go to "operating expenses." That would constitute a misuse, if we take this couple's explicit wishes as a guide.

We'll have more to report as time goes on. PK

The Moon Society Journal - Free Enterprise on the Moon

Bequest Story Follow-up

By Peter Kokh

After first contact with Mr. & Mrs. Pietraskiewicz, a quick look at our organizational papers and our website showed that we were not setup to take advantage of this type of unpredictable gift income. We were a charitable foundation, but had never sought bequests previously. In response, we added the **Giving Options** button below the **Make a Donation** button in the left hand menu column on our homepage. Perhaps most members have never explored what lied behind that button. Here it is:

Giving Options

The Many Ways to Give

The Moon Society depends on the generous and thoughtful gifts of members, friends, and corporate sponsors to help advance the day when viable civilian settlements will thrive on the Moon.

Below are some creative ways you in which can support the work of The Moon Society. You can pick the way or ways that are best for you.

Honor, celebrate, or memorialize someone

Make a special donation to honor, celebrate, or memorialize a family member, a colleague, or a friend or someone else whom you admire. Your tribute can be in the form of a general purposes donation, or a donation to a specific project of the Society

Give Stock

Gifts in the form of stocks, bonds, or mutual funds appreciated in value can be an easy way for you to generously support the work of the Society and may also be attractive for tax reduction purposes.

Employee Giving

If your employer has a matching gift program, you can double the value to the Society of any cash or stock donation

Make a Planned Gift

If you are planning the final distribution of your estate, you can include The Moon Society in your will or living trust with a planned gift or bequest. A gift of specified amounts of cash, securities, life insurance, real estate, IRAs, or other property will provides a welcome and much-needed gift to the Society, and may also enable you to retain current assets and save on estate taxes later.

Your gift is revocable with no loss of control over the asset to be bequeathed. There is no immediate transfer of the asset and therefore it does not disrupt your current lifestyle to any great extent.

Planned gifts are enduring ones. They can enable and endow projects or provide the funds to take advantage of unanticipated opportunities to advance the Society's goals. Your memory and legacy are celebrated with your gift to the future.

Endowment/Fund Our Wish List

Craft an endowment, fund a special project, or make a project on the Society's "wish list" come true.

eBay Giving Work: Giving while selling online

eBay Giving Works is a dedicated program for charity listings on eBay, enabling you to list items on eBay and donate part or all of the final sale price to your favorite nonprofit organization.

Consult with us

To consult with the Society about the application of your gift to some special purpose, contact the **President**.

president@moonsociety.org

To consult with us on the amount, type, or tax issues of your gift, contact the **treasurer**.

treasurer@moonsociety.org

As individuals, we may not be among the ranks of the early lunar pioneers. But through our support, we can become their ancestors.

Our Current Economic Troubles Negatively Affect our Ability to Give

These are hard times for many of us. Some of us may have lost our jobs, or are in fear of doing so. Some of us are still employed but at lower income than previously. The damage caused by the greedy well-placed few is probably greater than what we have realized. We know of very few people who feel as financially blessed as they might have felt a few years ago.

But we bring this up for those of you who are still doing well, and who may have been especially blessed over the years. The old saying "you can't take it with you" is so very real. And if we do have something to leave to others, children and other relatives come first.

But if you are especially blessed, do consider that those dreams and goals closest to your heart are, in a sense, your children also. Only you can judge how important it is to you that humanity becomes a multi-world species, that now having consolidated our inter-continental spread, we need to start out on an inter-planetary epic as great and vast as the one which brought us out of our African homeland to where we are today.

We would all prefer to pass, when our time comes, knowing that this important dream is on its way to becoming a reality. If it is important enough to you to consider leaving a bequest to the Moon Society and/or other groups that share our vision, our mission and our goals, then why delay? Start planning now, by finding out what your options are.

As for the Moon Society, we consider ourselves "the Little Engine that Could." Our projects will be small in financial terms, and perhaps in terms of the number of volunteers involved. But we hope to define and organize our projects carefully for maximum benefit and inspiration.

Now we can always use more volunteers: people with discretionary free time and/or abilities that could help us do a better job in this regard, and with respect to all the things we try to do or accomplish.

Feel free to write (president@moonsociety.org)

Or call toll free (1-888-266-2385) (ask for Peter)

7am - 10pm CT.

We would be delighted to hear from you.

The Moon Society Chapters & Outposts Frontier Report

Chapters & Outposts

Moon Society St. Louis Chapter

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

Contact: Keith Wetzel <kawetzel@swbell.net>

Next meetings – Oct 21st, Nov 18th, Dec 16th

Meetings **3rd Wed** monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

Bob Perry writes: **Moon Madness Night** will be held on January 7, 2011. It will be held at Selvidge Middle School this year. It seems we have outgrown the Center for Creative Learning. Moon Madness Night has been a rewarding annual outreach opportunity for us with younger students for many years now.

Archon 34 is October 1–3. Bob Perry will do two presentations, both expansions on YouTube videos

- "Shift Happens" (the future is getting here faster; Moore's Law adapted to other endeavors; and . . . The Singularity)
- "\$pace Entrepreneur\$ (based on Richard Garriott's presentation at TEDxAustin
<http://www.youtube.com/watch?v=yn3EOiCxtHY&feature=related>

Moon Society Phoenix Chapter

<http://www.msphx.org>

<http://www.moonsocphx.blogspot.com/>

Contacts: Don Jacques djmizlplick@yahoo.com

Chuck Leshner: chuckmiester999@yahoo.com

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

Our next meetings are on **Oct 16th** and **Nov 20th**

September 18th, 2010 meeting Report by Craig Porter

We opened the Chapter meeting with a review of CopperCon30 this past Labor Day weekend. As we usually do we had an outreach table at the Con and were busy handing out information. The table was open from Friday noon to after noon on Monday and received many visitors asking questions. Stuart Scott was there Saturday Afternoon to help out with the table, thank you Stu.

As we have been in the past we were again active in the panels. Chuck Leshner had a panel scheduled for Friday evening on the Space Based Solar Power Satellite, but had to cancel out at the last minute due to unavoidable circumstances. Patti Hultstrand and Don Jacques had five panels on publishing, writing and media types together. Patti had two additional panels on publishing and Don had two separate Panels on Science one was on a different method on settling the Moon and the other on the FAA and Commercial Space. And I had three panels on Disasters; two of them "End of the World" scenarios and the third one was "Disaster Strikes, What to Do! What not to Do! What is just plain Stupid!" This panel was about what to do to survive a disaster and involved planning and executing the plan.

Also at the Con was the R2 Club of Phoenix. They build R2D2 type Droids and do charitable work. Plus the Carl Hayden High School High School Robotics Club was there with their Swimming Robots and Soccer Robots.

This past Saturday I went to the Challenger Center to see what the Saturday schedule looked like for us to ramp up our efforts for the Telepresence Remote

Control Racing event this fall. I found out that the Saturday events would not be as they were told to us in August. However, there is the possibility of having the races on November 10th as part of NASCAR Day where they have Race Drivers and Dirt Track Go Carts on display. I need to get back to the new coordinator on this, but no decision could be made on this as our Racing Chair was unavailable today.

Our next Convention will be LepreCon 37 May 6 – 8, 2011 in Tempe, AZ. For further information go to www.leprecon.org/lep37. Then later on Labor Day Week End 2011 we will again be part of CopperCon31. For more information on it www.coppercon.org – We had two visitors, Dave Fischer and Shane Kula, today from the Local NSS Chapter and enjoyed visiting with them and making plans to get together with them in the future.

Moon Society Houston Chapter

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

Contact: Eric Bowen eric@streamlinerschedules.com

The Houston Chapter's next regular meeting is scheduled for **Monday, November 16 at Coffee Oasis at 4650 NASA Road 1 in Seabrook.**

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 =====

www.moonsociety.org/chapters/chapter_outpost_map.html

Moon Society Nashville Outpost – Central Tennessee

Contact: Chuck Schlemm cschlemm@comcast.net

Bay Area Moon Society, CA Outpost – South Frisco Bay

<http://www.moonsociety.org/chapters/bams/>

Contact: Henry Cates hcate2@pacbell.net

Informal meeting at Henry Cate's home in San Jose

The 1st Thursday every month

Moon Society Longview, TX Outpost

Contact: James A. Rogers jarogers2001@aim.com

Moon Society DC Metro, DC–MD–VA Outpost

Contact: Fred Hills Fredhills7@aol.com

Milwaukee, WI Outpost (MSMO)

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

Contact: Peter Kokh kokhmmm@aol.com

NSS Partner Chapter News – pp. 17–19

Oregon L5 (Portland), Lunar Reclamation Society (Milwaukee), Minnesota Space Frontier Society (Minneapolis–St. Paul), San Diego Space Society

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 BROWSTING

Russia's successor to the venerable Soyuz Capsule
<http://www.russianspaceweb.com/ppts.html>

Tp 10 Fantasy Spaceships Headed for Reality
<http://www.space.com/misionlaunches/top10-fantasy-spaceships.html>

Can We Spot Volcanoes in Alien Worlds?
<http://esciencenews.com/articles/2010/09/07/can.w.e.spot.volcanoes.alien.worlds.astronomers.say.yes>

Orion mission to Plyouth Rock asteroid
www.lockheedmartin.com/data/assets/ssc/Orion/Too%20kit/OrionAsteroidMissionWhitePaperAug2010.pdf

Solar Panel self-cleaning technology to the rescue
<http://www.sciencecentric.com/news/10082203-self-cleaning-technology-from-mars-can-keep-terrestrial-solar-panels-dust-free.html>

NASA takes 2nd look at "Shuttle-Derived" option
<http://www.orlandosentinel.com/news/space/os-nasa-redesigns-shuttle-20100912,0,7720708.story>

India gears up to double annual space launches
http://geospatialtoday.com/gst/index.php?option=com_content&view=article&id=1072%3Aisro-to-launch-eight-spacecrafts-annually

NASA Human Exploration Framework Team [HEFT] Proposes changes to Obama Space Plans
<http://www.space.com/news/nasa-team-space-exploration-senate-100913.html>

Space Adventures to sell seats on Boeing Capsule
<http://www.space.com/news/boeing-private-spaceship-space-tourism-100915.html>

NASA takes a fresh look at launch track systems
www.space.com/business/technology/rail-launched-scamjets-new-nasa-technology-100914.html

How microbes could help colonize Mars
http://www.marsdaily.com/reports/How_Microbes_Could_Help_Colonize_Mars_999.html

Peter Garretson: Next step in Indo-US cooperation
www.idsa.in/sites/default/files/OP_SkysNoLimit.pdf

Moon's geology more complex: "the lunar highlands may be less homogenous than previously thought"
<http://www.physorg.com/news203868091.html>

The Moon's Complex Turbulent Youth
<http://www.astrobio.net/pressrelease/3622/the-moons-complex-turbulent-youth>

CEAC researchers build Moon garden
<http://www.physorg.com/news203870299.html>

Moon has more Water than The Great Lakes
<http://www.astrobio.net/exclusive/3529/the-moon-has-more-water-than-the-great-lakes>

"Footprints in the Dust" - 40 years later
<http://www.thespacereview.com/article/1696/1>

Lori Garver: Commercial firms to do routine space, NASA to concentrate on pushing the limits
<http://www.space.com/news/nasa-officials-explain-future-space-plans-100917.html>

Moon's water: good for bases, bad for telescopes
<http://www.space.com/scienceastronomy/moon-water-lunar-telescopes-100920.html>

Could Brown Dwarf (sub-) Stars have Planets?
<http://news.discovery.com/space/brown-dwarf-stars-twins.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.moonsociety.org/video/>
 or at: <http://www.gaiaselenene.com>

The Moon Society & Why The Moon
http://www.youtube.com/watch?v=la-yz3Z5yU&feature=player_embedded

Moon Colonies - from the imagination of member-advisor Chip Proser
<http://www.youtube.com/watch?v=pYPfV0fcC9Y&feature=related>

Colonizing the Moon
http://www.youtube.com/watch?v=VRSNT_9ru2U&feature=related

ASSORTED SPACE VIDEOS

Wheeled Robot tends greenhouse plants
<http://news.discovery.com/videos/tech-robot-gardeners-tend-tomatoes.html>

"It is possible that the first people on Mars should be neither Americans nor Soviets. It's possible they should'nt be people from Earth at all. Rather they should be Moon people."

Isaac Asimov, "lost in Space" Discover, January 1988, pp. 18 and 20

Help us put MMM in a Library near You!

Whether you are a member of an NSS Chapter or of a Moon Society Chapter or Outpost, or a Moon Society member at large, you all get Moon Miners' Manifesto as a membership benefit.

A library subscription to a library in your community will help spread the word, whether about local or national or international Moon-focused programs and projects.

For chapters and outposts such subscriptions will be good advertising for your local efforts.

For Moon Society members, as all copies of MMM include the Moon Society Journal centerfold section, community library or school library copies of MMM will help grow name recognition and invite readers to join.

As membership services are not involved, the cheapest way we can do this is by submitting these subscriptions directly to the publisher at a cost-minus rate of \$12 a year, available for libraries only.

How to participate in this program

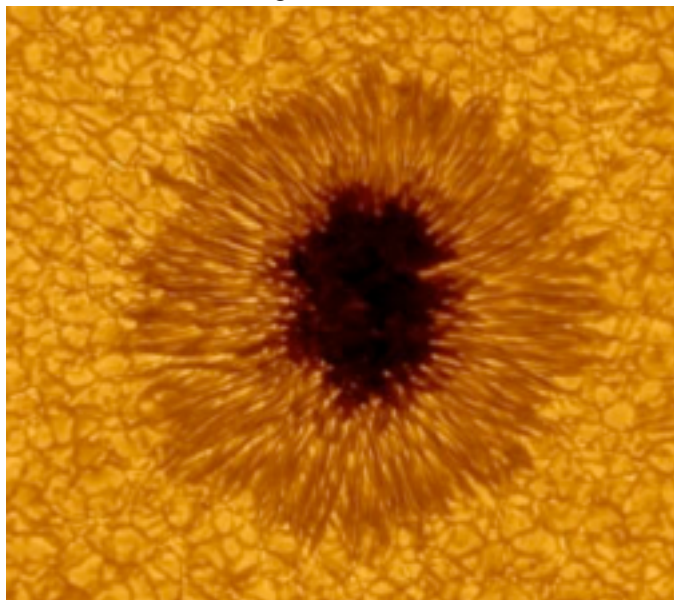
- Send by postal mail only
- Your check of money order for \$12.00/per year
- With the complete name and address of the Library,
- Made out to

"Lunar Reclamation Society"
Attn: Library Subscriptions
PO Box 2102
Milwaukee, WI 53102

MMM PHOTO GALLERY



One of 3 designs for an Improved Japanese Cargo Carrier that could return cargo to Earth after deliveries to ISS



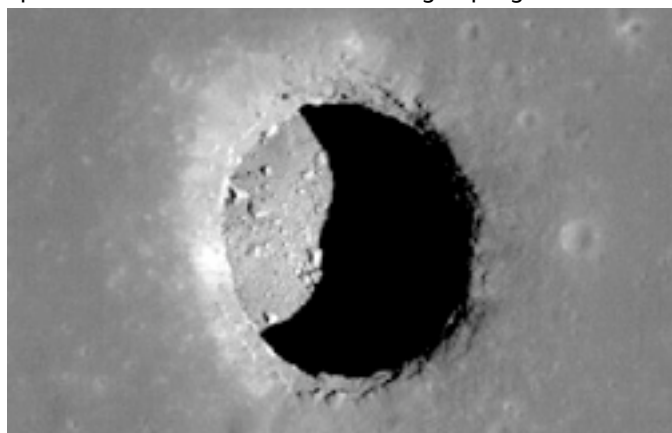
The most detailed photo yet of a sunspot on the Sun's surface taken by new solar telescope - see article"
www.space.com/php/multimedia/imagedisplay/img_display.php?pic=sunspot-image-100903-02.jpg



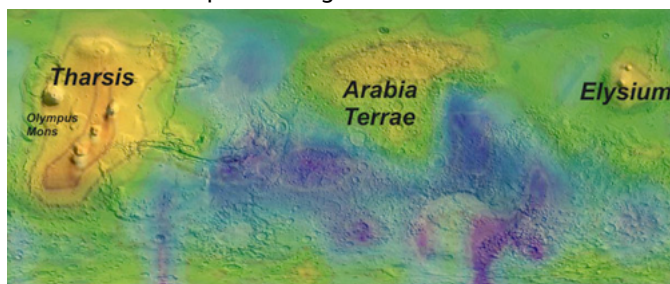
Shuttle-derived "Direct" vehicle being reconsidered



Different technologies to push a spacecraft down a long rail have been tested in several settings, including this Magnetic Levitation (MagLev) System evaluated at NASA's Marshall Space Flight Center. Engineers have a number of options to choose from as their designs progress: NASA



The sharpest photo yet by Lunar Reconnaissance Orbiter of a lava tube "skylight" collapse pit on the Moon. It is about 100 meters across which fits the expected scale of such features. Sunlight reveals the rubble from the ceiling collapse on the tube floor. The list of skylights found by LRO keeps growing. The "Lunar Underground" could consist of many networks of tubes with a total length of many thousands of miles. These features are found in mare lava flows only, so that there will be none near either of the highland-locked polar cul de sacs. The Moon is not just a rubble pile any more! Being near an accessible lava tube would be an enormous asset for any settlement or outpost with growth ambitions.

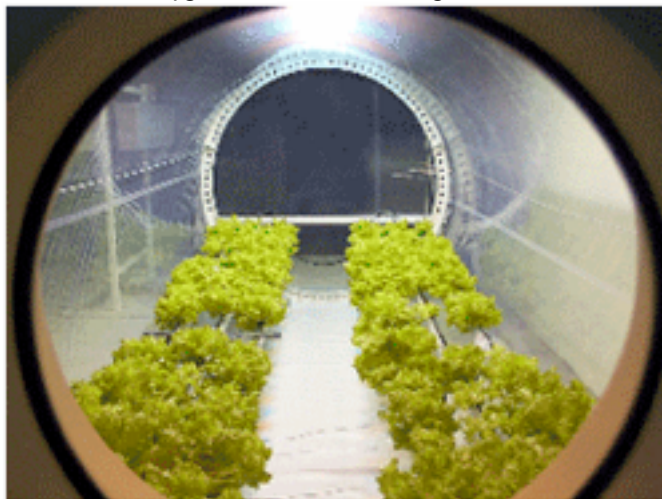


Map of methane concentrations in autumn overlaid on a true color map of Mars. Highest levels of the gas were found over Tharsis and Elysium (volcanic regions) and Arabia Terra (which has large caches of underground water ice). Credit: NASA/Universita del Salento - this evidence suggests a geological origin for Mars methane rather than a biological one, in a debate yet to be settled.

CEAC Researchers Build Moon Garden

<http://www.physorg.com/news203870299.html>

"a robotic mechanism that is providing food, oxygen and fresh drinking water,"



"The researchers designed the greenhouse to operate remotely or even autonomously, so that food could be ready when astronauts arrive.

"The entire system can be collapsed into a four-foot-wide disk, sent to the Moon, and deployed in 10 minutes.

A series of related videos, courtesy, The Moon Society

<http://www.gaiaselen.com/LunarGreenhouse/LunarGreenhouse.html>

"With the option of being monitored from Earth by sensors and cameras, it will then take about 30 days for the vegetables to grow."

"There's great interest in providing locally grown, fresh food in cities, for growing food right where masses of people are living," Giacomelli said. "It's the idea of growing high-quality fresh food that only has to be transported very short distances. There also would be a sense of agriculture returning to the everyday lives of urban dwellers."

At NSS' International Space Development Conference in Dallas in 2007, the Moon Society presented a University of Luna Award to Phil Sader and the CEAC team for their achievements and continuing research. The team had already built and deployed a "Food Growth Chamber" at the Amundsen-Scott South Pole Station in Antarctica. The chamber has produced two salads a day for the crew of 75 for several years now. [Chamber shown below]



Orbitec Greenhouse

NASA Testing "Space Greenhouse."

<http://news.discovery.com/space/greenhouse-promises-fresh-salad-in-space.html>

Discovery News (9/15, Klotz) reported NASA is testing a prototype "space greenhouse" as part of its Desert RATs program. "A team from Kennedy Space Center is tending to the greenhouse, with the goal of getting the system ready for a test run aboard the International Space Station.

The unit, built by Madison, Wisconsin-based Orbitec Technologies Corp., ["Orbitec"] is designed to be lightweight, energy-efficient and very low maintenance." Lead scientist Ray Wheeler said it is performing "very well" so far with "no failures." The article noted, "Initial tests show the nutritional value of the vegetables is similar to terrestrial-grown plants. NASA plans additional studies to make sure plants won't introduce food-borne pathogens into the station."

Bill Nye on VEXAG Workshop

<http://www.planetary.org/blog/article/00002647/>

Madison, Wisconsin was also the site of the recent Venus EXploration Advisory Group (VEXAG) meeting at the University of Wisconsin August 30 - September, 2010. Venus atmosphere, rotation rate, geology and planetary history are topics of intense interest. Planetary scientists are attempting to find new ways to probe the Planet's secrets.

This was the 8th annual meeting for the group. Scientists from around the world were in attendance.

Chronology of Venus Probes through 1996

http://www.daviddarling.info/encyclopedia/V/Venus_probes.html

ESA's Venus Express

http://en.wikipedia.org/wiki/Venus_Express

The mission is currently funded by ESA through 31 December 2012, which will allow it to overlap in time at Venus with already sent Japan Aerospace Exploration Agency (JAXA) *Akatsuki* (Planet-C) mission.

Akatsuki Mission

[http://en.wikipedia.org/wiki/Akatsuki_\(Planet-C\)](http://en.wikipedia.org/wiki/Akatsuki_(Planet-C))

A Disappointment

Prior to the shocking news from the first Venus probes of the early 1960s, we expected Venus to be hot, but thought that the polar regions might be livable. Science-Fiction novels depicted Venus as a hot global desert, or as a steaming jungle, even as a global ocean. C. S. Lewis' novel *Peralandra* was a parable of the Adam and Eve genre, depicting a global ocean with one floating island, on which his Adam was forbidden to set foot.

But prior to the 1960s, Venus was thought of as on the fringe of the habitable region around the Sun along with Mars, bookcasing the jewel of Earth. With the shattering of this expectation, it came down to Earth and Mars. Then with the realization that Europa's icy crust might harbor a deep global ocean with more water than Earth's oceans, it seemed like we might be back to a three-world system again.

Time will tell. We can still deploy floating manned outposts high in Venus' atmosphere. It may be premature to say we can't do this, and can't do that. Editor



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 Huntsville:

AirTran, American, Delta, Continental, US Airways, United

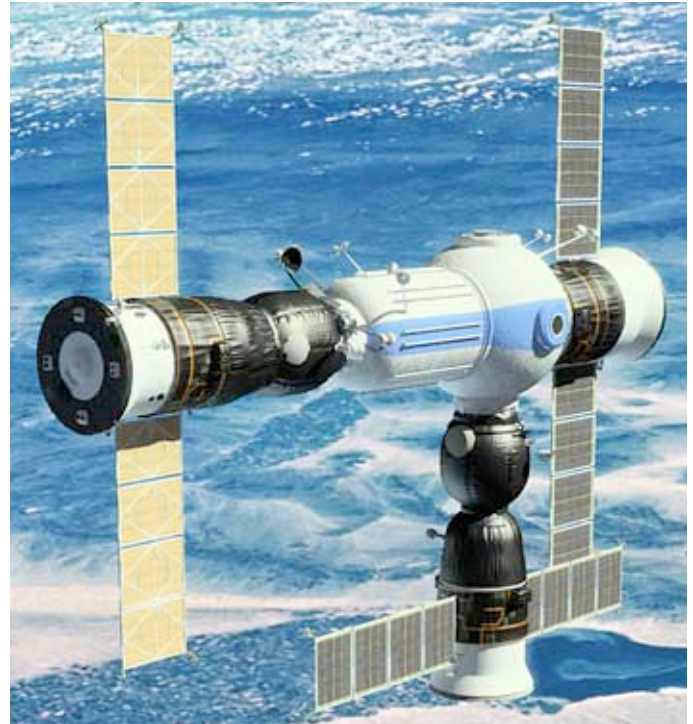
Nonstops from Chicago, Detroit, Washington–Dulles, Washington–National, Baltimore, Charlotte, Atlanta, Orlando, Houston, Dallas–Ft. Worth, Memphis, Denver.

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.

###

Two Russian Firms Plan to Fly First Commercial Space Station

<http://www.space.com/business/technology/russia-space-tourism-commercial-space-station-100929.html>



Russian Commercial Space Station with visiting Soyuz or Progress spacecraft: Credit: Orbital Technologies



Cross-section of the planned Commercial Space Station

The station would fly in an orbit about 62 miles (100 km) from the International Space Station and in a similar inclination, to make any transfers of crew or cargo between to two stations easier.

The initial module would have systems similar to the Zvezda service module on the International Space Station – solar arrays and thrusters for attitude control.

RSC Energia is the largest contractor serving Russia's Federal Space Agency. It built Russia's Salyut space stations, the MirStation and major elements of ISS, as well as the Soyuz and Progress spacecraft.

Moscow-based **Orbital Technologies** is a firm of engineers, scientists and space industry veterans dedicated to opening space for private enterprise.

MMM



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

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bobriverwest@yahoo.com 414-372-9613

LRS News

● **Bequest:** The Lunar Reclamation Society was named in the will of a deceased South Carolina couple, whom Peter had talked to some five years ago. Our treasury now has funds for equipment as well as funds we might earmark as prize money for design contests and engineering competitions. Additional or improved exhibits are another possible use of funds. However, storage and transport of the exhibits we already have are an ongoing problem. Ideas welcome!

The Moon Society and National Space Society received the same amount. So we may cosponsoring some exciting projects together.

LRS Upcoming Events

Saturdays: 1-4 pm

Oct. 9th – Nov. 13th – Dec. 11th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

October 9th AGENDA:

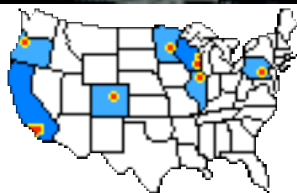
Visitor: National Space Society Board Member **Jeffrey Liss** of Chicago may be attending to talk to us about critical space policy issues.

We may have CDs on some of the key talks at ISDC 2010

We may discuss what kind of projects, contests, and engineering competitions we could sponsor or co-sponsor with these funds.

We also need to discuss plans for our annual holidays potluck luncheon & classic science-fiction movie showing. We need to pick a film! We will be inviting our friends from throughout Wisconsin and Chicago areas.

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

October 16th, November 20th

Peter Kokh of LRS and the Moon Society has invited us to help brainstorm a proposed engineering design competition for an AXEL-type rover that could winch an instrument package down a lunar lavatube skylight.

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 2009 Past & upcoming chapter events
www.freemars.org/mnfan/MNSFS/2010-12-Review/

October 11th, MN SFS Meeting

November 8th, MN SFS Meeting Board Elections meeting
 of MN SFS 31st Anniv & Planning for 2011

November ?? ISS 26 Display

ILLINOIS

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

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

We have had an offer from a "friend" of the chapter to build and maintain a new Chicago SFS website on the <http://nsschapters.org/> website, but he hasn't had time yet to do so.

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/ss/>]

- We meet the 3rd Thurs even # months 7-9pm
At The Stoelting House in Kiel, WI
- October 21st - December TBD

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113

<http://www.angelfire.com/space/frl5/>

Eric Boethin 303-781-0800 eric@boethin.com

Monthly Meetings 6:15 PM on Tuesdays

October 12th, November 9th, December 14th

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>

Next Meetings: Oct 17th, Nov 21st, Dec 19th

Meeting Times and Locations: Our next two meetings will be away from the Liberty One Food Court: **In October we will be doing public outreach on October 9 and 10 at the Franklin Institute.** No formal meeting but lots of talk! We will ask for two tables. **In November we will be at the Philcon Science Fiction Convention November 19 to 21** where we will again do public outreach and volunteering to be part of the event. We will ask for two tables at this event also. Our informal meeting will be at a restaurant on a day to be determined. December will be decided at one of these events.

Meeting Notes: We had a good turn out again with Stephen Mann becoming a member of PASA. Dennis Pearson came down from Reading and Hank was able to join us as well. A

Larry reported on the new website version and asked our opinion about it. I found it very easy to use, and it's worth a look. Mitch has given Larry a URL to add to our site for Space Island One, a site on the construction of space habitats. Larry will put pictures of our events up when we have them. Thank you Larry!

Dorothy brought lots of material on museum events in the area including: The Intrepid Aircraft Carrier exhibits and presentations: till January the exhibits "27 Seconds- The Apollo 1 Tragedy, At the American Museum of Natural History: "Journey to the Stars", an ongoing film presentation, and, at The Rose Center on October 10 an anniversary celebration that includes The Chromatics "science singing group". And other venues, like The Franklin Institute!. We will be there, as part of World Space Week on October 9 and 10. And comments on "Packing for Mars" by Mary Roach. Dorothy and Larry also invited us to join Facebook again.

Dennis reported on planetarium issues in the Allentown and Reading area, where funding is a real problem for several of them. Dennis also reported on his editorial letter to the Morning Call (of that area) where he expounded on the desirability of Solar Power Satellites. The editorial got several responses.

Mitch listened to "A Chefs Table" where Mary Roach of "Packing for Mars" was interviewed about the needs of travelers including various foods and the disposal of its "end products" (my euphemism). Mitch also found the book, available at the Barnes and Noble. He is very interested in the idea of using available space resources and is going to work on forming a consortium of jewelers to work on meteoric material from the Moon and Mars. This will be preparation for imported material from those bodies when we begin bringing materials from them. Gee, I wonder what might have been deposited in those lava tubes we are going to explore?

Hank brought the new Philcon flyers and told us about the head of science programming whom we should contact to volunteer. He intends to go to Capclave next month and will help at the Franklin Institute.

Earl brought several magazines and articles from various sources: from the web, material on some of the X-Prize contestants and there rover designs, including a group called the Rocket City Space Pioneers from the Huntsville, Alabama area. This is a consortium of business and educational organizations working with a carefully selected team to handle various aspects of

lander and rover construction. The team leader is Tim Pickens, who was lead propulsion engineer on the Space Ship One design team. The design for the lander and rover will be about 30x30 by 15 cm and weigh less than 10 kg. The whole effort is part of a plan to build privately funded rovers (!) The other piece brought on the X-Prize topic was the announcement of the 2010 Lunar X-Prize Team Summit (official title), with the "senior executives" (ditto) of many of the 22 teams to meet. This will occur on the Isle of Man, an island off the Irish coast, on October fifth and sixth. More on this meeting (and background about the X- Prize and World Space Week) is available on spaceisle.com, reachable through the main X-Prize site.

Earl also brought *Sky and Telescope*, for October, particularly "The Hunt for Super Earths" by Prof. Sara Seager (illustrated by Don Dixon), and two for explorers: on page sixteen: Rosetta visits biggest asteroid yet, with images (to scale) of the bodies we have sent craft to (a metal asteroid designated 27 Lutetia being the champ in this group), and the column "Exploring the Moon" which has Unmasking Mare Ridges on these features and how digital terrain (Selene?) maps are helping analyze these features anew. Rosetta is from the News notes section is not attributed, while Exploring is by columnist Charles A. Wood.

And lastly, for this month, *Ad Astra*, for Fall 2010, has a front page article on "The Sun's Awakening", which is about the suns' cycles and the start of the next solar (and in consequence Earths') weather cycle. Lots of impressive images of the Sun and one of the probes (Solar Dynamics in this case) used to gather the data by Barbara Thompson. And: "The New Face of the Moon" (article by Marianne J. Dyson) on what we have found, particularly about the abundance of water, on that body. The sidebar, by Marianne J. Dyson, is "Thick Lunar Ice"(!) on the amount of this material that appears to be available in permanently shadowed craters at the lunar North Pole. Of course, if an X-Prize got there and gave us "ground truth" the team would be instantly world famous for more than achieving its arduous initial goal....

And much more. -----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 Dec. 12th

2:30 to 4:30 pm

Serra Mesa Branch Library 9005 Aero Dr, San Diego

Quarterly Newsletter: ***The Bussard Scoop***

Saturday, October 9th our first annual SD Space Members Night at the Space Travelers Emporium

Enjoy cake and light refreshments while chatting with other SD Space members. Win a telescope (provided by OPT), IMAX theatre tickets (provided by the Fleet Science Center), or other fun prizes in our raffle!

Dr. Erick Young, science mission operations director for NASA's Stratospheric Observatory For Infra-

red Astronomy (SOFIA) will join us. SD Space President Jesse Clark will also present an overview of our achievements over the past year.

CALIFORNIA



**OASIS: Organization for the Advancement
of Space Industrialization and Settlement
since 1978**

**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

Next Meetings: Oct 16th 17th, Nov 20th, Dec 11th

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

Saturday, October 16, 3 pm – OASIS Board Meeting,
Columbia Learning Center, Downey, CA – *Pending!!*

Saturday, November 20, 3 pm – OASIS Board Meeting,
Home of Steve Bartlett and Tina Beychok, 7108 East
Peabody, Long Beach, CA 90808

**November 26-28, Thanksgiving Weekend
LOSCON Science Fiction Convention**

Once again, OASIS will have a table, be providing
programming and host a Space Party. Come join us!

**Saturday December 11, 3 pm – OASIS Board Meeting
and Holiday Party**

Home of Bob Gounley and Paula Del Fosse
1738 La Paz Road, Altadena, CA 91001

OASIS on Livejournal.com

http://community.livejournal.com/space_above_la/

OASIS on Facebook

<http://www.facebook.com/pages/Organization-for-the-Advancement-of-Space-Industrialization-and-Settlement/94429898892?ref=nf>

ODYSSEY ARTICLES

The Benefits of Space – By Steve Bartlett, OASIS VP

My Summer Job Working For NASA – By Phil Turek

OASIS Lands at Westercon 2010 – by Lisa Kaspin

http://www.oasis-nss.org/wordpress/?page_id=2

"In space, we know how to 'boldly go' at this point, but we have very poor, demonstrated experience in staying there,"

– Chris Lewicki, team leader of the Singularity University space project

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.

PO Box 2102, Milwaukee WI 53201-2102

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P.O. Box 940825, Plano, TX 75094-0825, USA

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Send proper dues to address in chapter news section

=> For those outside participating chapter areas <=

- \$12 USA MMM Subscriptions; • US \$22 Canada;
 - US \$50 Surface Mail Outside North America
- Payable to "LRS", PO Box 2102, Milwaukee WI 53201

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- \$15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)

- \$12 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

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