

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

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Space-X Dragon Cargo Capsule okayed for 1st docking mission to International Space Station, November 30th

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Uncovering the Secrets of our 2-faced Moon →

We are doubly fortunate to have a moon, which is anything but boring, and one that has its most photogenic and geologically varied side always turned towards Earth. Now there is a new theory that tries to uncover why the two sides are so different. If true, it might explain a lot of things about the Moon that we could only wonder about before. *See page 5*

IN FOCUS 📷 The Moon: What's in it for Earth?

By Peter Kokh

, To most people, the Moon is a pretty sight, even romantic, but otherwise quite irrelevant. We need to show them how and why it isn't so, that opening the Moon is very relevant to us all. [= > p. 2, col. 2]



Moon Miners' Manifesto

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www.MoonSociety.org/publications/mmm_classics/

• **MMM Glossary: new terms, old terms with new meanings:**
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• **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 National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization.
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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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√ CDs, DVDs, /or typed hard copy must be mailed to:

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⇒ In Focus Editorial continued from p. 1.

To do this, we need to we need to firm up our own understanding of "What's in it for Earth?" Below are some key talking points. We may add to this list, and we will expand on each in upcoming articles, starting in this issue.

• **Continuing our Frontier-opening saga:** Humanity's "home world" is Africa. Over more than a hundred thousand years, we have expanded to one continent after another. This expansion has increased our cultural diversity, and, more importantly, our capacity to adapt to frontiers with differing sets of resources, and different plant and animal species. This Epic has demonstrated the all but unlimited capacities of the human endowment to adapt. In many ways, the Moon is just another continent across another kind of sea, and it is part of Greater Earth. Not to open the Moon would become humanity's first significant failure.

All past generations of youth have enjoyed the options offered by new frontiers. Do we have the right to close the frontier door for generations of youth to come?

• **Booster shot for World Economics:** The Moon is the ideal and most environmentally friendly source of raw materials with which to realize the maximum economic potential of GEO, already a significant contributor, nearing \$300 Billion a year, to the world economy, through various kinds of satellite operations.

It would take 1/23rd the rocket fuel to bring needed materials down the gravity well to Geosynchronous orbit as it would to bring them up the well a much shorter distance from Earth - and without the air pollution so many rockets might create.

• **Technologies for Healing our Environment:** Sadly, to many people, the ever-increasing degradation of our environment is not a pressing concern. Yes, we worry about passing on to our children a shattered economy, but not about passing on a shattered environment.

There are several ways in which opening the Moon can help on both fronts. On the Moon, pioneers will live "downwind and downstream of themselves." There will be nobody else's back yard to dump in. The pioneers will have to learn to live in harmony with nature within their mini-biospheres under pain of death. We can learn from them what we would never bother to learn for ourselves because we do not feel the ill effects of our bad stewardship in the near term.

• **Zero-G Exports from Lunar bases and settlements:** Some, many in fact, doubt the economic feasibility of developing usable construction materials from moon dust. Not only has most needed research into lunar on location materials languished in the early theoretical stage, but little homework has been done on a step-by-step process to "bootstrap" lunar industries, except by the Moon Society's St. Louis Think Tank.

Be that as it may, there are some "Lunar Exports" that are immaterial but still of significant economic value. And we take this up in this issue.

The bottom line is that the answer to "the Moon, what's in it for Earth?" is "one heck of a lot!"

PK

Marketing the Moon



By Ken Murphy

The Moon occupies a strange place in space activities. Astronomers aren't particularly fond of it, as its light and size makes some observing difficult. Solar system scientists got some Moon science as part of their foundation in planetary geology, and so think they know all there is to know about the Moon.

Politicians crafting space policy are generally more concerned with their legacy than crafting a national policy that enables commerce and development, and so are focused on firsts – the biggest rockets, new locales (asteroids, Mars), things that haven't been done before, and the Moon offers few such opportunities. The deck is stacked against our Moon throughout society, and so The Moon Society has a quite a task for itself – advocating for people living and working on the Moon – when the populace, globally, is largely ignorant of the potential.

When a company faces the problem of having a phenomenal product to sell to an audience largely ignorant of the opportunity available, it calls in the marketers. Since The Moon Society (TMS) doesn't have a corporate budget, it has to rely on the efforts of its members to spread the word.

The problem we face is a populace largely ignorant of space activities in general. In the K-12 educational system, *the middle school years (6-8 grade, varies by region) are typically the last time space is taught as a topic.*

Very few are the high schools that might have a space class. The last opportunity for most folks is an Astronomy elective in college, and there are other 'science' electives that require less math.

So, in general, the bulk of the population has something approaching an 8th grade level of knowledge about space, 'supplemented' by what appears in the popular media.

Ignorance can be cured by knowledge

The situation is not entirely grim, however. Ignorance can be cured by knowledge, and is a fertile breeding ground for curiosity. It is this curiosity that The Moon Society will seek to tap into, by providing the knowledge that sates that curiosity.

1. Revamping our website

There are a couple of ways of doing this. The TMS website contains a wealth of knowledge and information, and is currently undergoing a revamp to organize the information in ways that make it easier to find. To that end, please forward all suggestions to

president@moonsociety.org

2. What Chapters and individual members can do

Another way is for TMS members and chapters to get organized in arranging talks and lectures about the Moon in their communities. One way the Society can help chapters in this regard is to provide a set of prefabricated PowerPoint presentations on several Moon topics.

Then, at the TMS website, a member would be able to go to the chapters section and find some presentations and helper scripts on:

- Moon 101
- The Moon & Science
- Moonbases
- Cislunar Space
- Moon Exploration

[See this month's editorial pp.1-2 for additional ideas]

3. Finding Audiences

With these presentations in hand, members would be able to go to local libraries, community centers, and other locales and give educational presentations about the Moon. This approach faces the ignorance problem head on overcomes it with compelling facts and info.

Each presentation would be 20-30 slides: very simple; mostly imagery with a few bullet points. The details would be provided in the helper script.

- Moon 101 would provide a simple overview of the basics of our Moon, but in sufficient depth that people leave with excitement about what they've learned.
- The Moon & Science would be largely driven by the NRC's 'Scientific Context for the Exploration of the Moon' from a few years ago.
- Moonbases is of course where TMS would shine, and could start making business cases for the Moon.
- Cislunar Space would provide filler, so to speak, on the space that lies between the Earth and Moon, all of the space assets that lie therein, and transportation strategies.
- Moon Exploration is where we would cover the history of exploration efforts, and more importantly, their future.

Moon Society members are encouraged to participate! This can be done in several ways:

- Contributing slides and suitable artwork
- Contributing helper script (with sources noted)
- Knitting together the presentations
- Reviewing the presentations for accuracy

Providing these tools helps to facilitate efforts to inform the public about the Moon and why it is important. It also helps set the stage for The Moon Society to become increasingly recognized as THE place to go for Moon information.

Do your part to make it happen.

KM

NOTE: Existing Moon Society presentations (which do not cover the above basics) can be found at:

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

The following article touches on options that may push some buttons among the thoughtful.

The Moon: What's in it for Earth? Part I Zero-G Export\$ from Lunar Outposts & Settlements to Earth

By Peter Kokh

Many space enthusiasts are skeptical about the economic feasibility of producing anything on the Moon to send back to Earth. That's another article, but read pages 6-8 for clues. Here we want to cite those products that "ship free". Know-how processes and technologies that could be developed on Earth, but will not be, as the perceived need is less urgent.

• Environmental technologies developed first on the Moon where the urgency is immediate

Lunar Pioneers will learn to live in harmony with Nature within their mini-biospheres, and learn fast, because they have no choice. They will be "living downwind and downstream of themselves" and there is nobody's back yard to dump pollutants, especially organic compounds made of elements scarce on the Moon. The processes and technologies they develop, because they have no choice, can then be exported to Earth and as they are adopted on Earth, make a very critical and significant contribution to the preservation of Earth's fragile environment for future generations.

These technologies will include stale air and used water treatment, products and new production processes that make "total recycling" feasible and easy. They will also produce a mindset, beginning at a very young age, of ingrained personal responsibility to preserve their fragile mini-biospheres.

• Moon-appropriate building materials and variants that could find a niche on Earth as well:

As so many of the materials that we use on Earth include chemical elements rare on the Moon, we must make do with substitutions. Glass-glass composites ("glax") is a promising area of research in which only minimal demonstrations have been done to date. We might make habitat modules, furniture, vehicle bodies, and other useful products form this material, which could be pre-developed here on Earth as it has advantages such as a substitute for wood. Read:

http://www.moonsociety.org/publications/mmm_papers/glass_composites_paper.htm

New types of concrete types; new metal alloys that do not use alloy ingredients rare on the Moon such as copper, zinc, even carbon, are some options. Once developed on the Moon where the need is urgent, such materials may well find a market on Earth in nations less well endowed with mineral wealth.

• Technology options using elements not rare on the Moon (i.e. excluding elements rare on the Moon)

Even given confirmation of surprisingly large quantities of water-ice in permanently shaded craters at both lunar poles, and recent evidence of unsuspected quantities of water bound up in lunar materials in micro-drops, water will be harvested with much greater effort on the Moon than on our water-rich planet. New ways of conserving water and recycling it

with ever-greater efficiency will be an effort that is pursued religiously as need grows with population.

As to mining, pioneers will treat the tailings with respect, as they are necessarily enriched in all elements not yet extracted. When no more elements can be affordably extracted, pioneers will find ways to turn these last-generation tailings into products that are useful. And some of the technologies and processes so developed will help reduce our "trash problems" here on Earth. The "throughput"* footprint of the settlement is thus reduced, with the result that population for population, the lunar landscape will be far better preserved than has Earth's been. And perhaps some of these technologies applied on Earth could in time "recover and restore" significant portions of industry- and wastes-wrecked lands here on Earth.

* *The percentage of raw materials mined that ends up in landfills as a negative indicator*

To conserve energy, lunar industrial parks may be arranged so that waste heat from those operations that require higher operating temperatures supplies those that need somewhat less, in a "Thermal Energy Cascade". It would make sense to design industrial parks on Earth to do likewise: reusing and reusing waste heat, which is potential energy.

• Education of youth in environmental responsibility.

The lunar settlement experiment will surely fail if living right, given the strictures of the lunar environment does not quickly become "second nature," and anything but a resented burden. This means raising children and youth accordingly. A "4th R" ~ **recycling**, must be added to the curricula. Assigning recycling chores, a year of "universal service" in the water/air treatment systems or in bio-waste recycling operations would make sense. Survival is at stake.

• Art Form Options that work on the Moon/Mars, will also work on Earth

Art forms that are totally inorganic will have their own unique beauty and could catch on here. Check out:

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

• Social Experiments to maximize productivity of all inhabitants

Making a frontier economy work will depend on everyone doing their part: no room for slackers and/or those who add to the burden. This means taking cradle-to-grave steps to minimize anti-social behavior. "Out-the airlock" solutions may seem severe, but chain-gang labor should not be dismissed for the stubbornly uncooperative. Handling the handicapped so that any burdens are offset with plusses will be a challenge. The lessons for Earth will be significant.

• Retirement must mean switching to more relaxed forms of productivity.

Better child-care options (such as pre-retirement part time grandparenting?) are needed to free adults in their prime for economically productive activities. Retirement should be a transition to other forms of productivity freely chosen

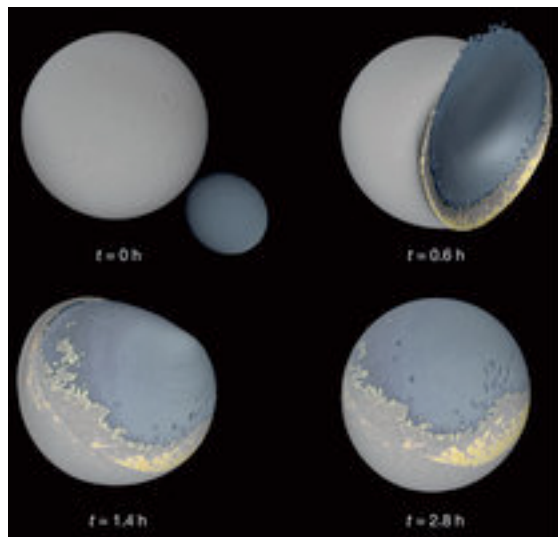
The above is not meant to be an exhaustive list of "Zero-G Exports from the Moon to Earth. PK

The Moon: Once there were 2! Did Luna Swallow Lunetta?

By Peter Kokh

Forming the lunar farside highlands by accretion of a companion moon – M. Jutzi & E. Asphaug

<http://www.nature.com/nature/journal/v476/n7358/full/nature10289.html>

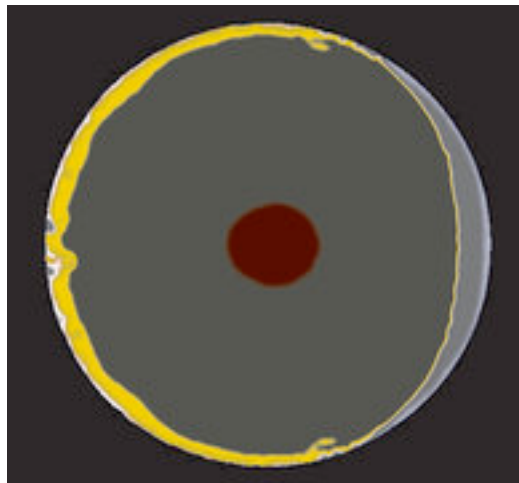


The most striking geological feature of the Moon is the terrain and elevation dichotomy [1] between the hemispheres: the nearside is low and flat, dominated by volcanic maria, whereas the far side is mountainous and deeply cratered. Associated with this geological dichotomy is a compositional and thermal variation [2, 3], with the nearside Procellarum KREEP (potassium/rare-earth element/phosphorus) Terrane and environs interpreted as having thin, compositionally evolved crust in comparison with the massive feldspathic highlands.

The lunar dichotomy may have been caused by internal effects (for example spatial variations in tidal heating [4], asymmetric convective processes [5] or asymmetric crystallization of the magma ocean [6]) or external effects (as the event that formed the South Pole/Aitken basin [1] or asymmetric cratering [7]). Here we consider its origin as a late carapace added by the accretion of a companion moon.

Companion moons are a common outcome of simulations [8] of moon formation from a protolunar disk resulting from a giant impact, and although most coplanar configurations are unstable [9], a ~1,200-km-diameter moon located at one of the Trojan points could be dynamically stable for tens of millions of years after the giant impact [10]. Most of the Moon's magma ocean would solidify on this timescale [11, 12], whereas the companion moon would evolve more quickly into a crust and a solid mantle derived from similar disk material, and would presumably have little or no core. Its likely fate would be to collide with the Moon at ~273 km/s, well below the speed of sound in silicates. According to our simulations, a large moon/ Moon size ratio (~0.3) and a subsonic impact velocity lead to an accretionary pile rather than a crater,

contributing a hemispheric layer of extent and thickness consistent with the dimensions of the farside highlands [1, 13] and in agreement with the degree-to crustal thickness profile [4]. The collision also displaces the KREEP-rich layer to the opposite hemisphere, explaining the observed concentration [2, 3].



2-dimensional view of the post-impact distribution of layers of target and impactor materials for the case of the head-on impact simulation. The companion moon collided from the right, accreting as a pile and producing the farside lunar highlands

The complete article can be purchased from **Nature** magazine for US\$32.00

Comments by Peter Kokh

This shows that whatever our current picture of anything is, it is at best partial and presumptive. This new hypothesis that better fits the data is a thrilling conclusion and makes a lot of sense to me.

In fact, much of the debris that has created the pockmarked face of the Moon could have come from this accretion disk, rather than from errant asteroids.

That may be so of the cratered surfaces of all other rocky planets and moons.

Although many observers put this era of bombardment between 4 and 3.5 billion years ago, which would be long after most of the Earth-impact accretion disk material had found a home in the Moon.

The Moon is largely responsible for the rise of life on Earth. While the sun produces tides also, they are much lower and the gestation of life in tidal pools may have taken longer and been more at risk.

The Mars people have to realize the fundamental difference between a Moon that belongs to its primary planet, and planets that belong to the Sun. Earth and Moon have evolved together and the existence of "a Mars" would seem to have been quite irrelevant to that evolution. That Gaia (Earth-life) could expand to the Moon is much more natural and significant than that it also expand to include Mars and other bodes in the Solar System, *which it will do in time*.

I talk about the shifting of gears of human expansion from intercontinental to interplanetary. In this context the Moon belongs more to the intercontinental paradigm, than to the interplanetary one.

The Moon is an offspring of Earth, Mars but a brother.

PK

Ten Billion Dollar\$ to Industrialize \$pace?

By Dave Dietzler

Where are we? What do we need?

Preceding a solar power satellite building enterprise we really need;

- 1) **Lower cost launchers** than those available today or in the near future
- 2) **Inflatable LEO hotels**
- 3) **Electrodynamic tether systems** to collect all that steel and aluminum junk in orbit that is estimated to be 1000 tons or more. Let's say that successful space tourism enterprises are doing things that prove they can do the job, what's next?

What if in the future, the dream of a reusable HLV that can orbit say 100 tons for \$10 million is realized? For \$8.7 billion, the amount of money to be made from the sale of electricity at ten cents per kilowatt hour in one year from a 10 GWe solar power satellite we could afford to launch massive amounts of cargo. Let's be more realistic and consider transmission losses and a slightly lower price for the electricity. Let's expect \$5 billion. We could orbit 50,000 tons with RHLVs at the price stated above. It would be possible using NEP [Nuclear Electric Propulsion] or tethers and reusable Moon landers fueled with LUNOX and metal powders to put at least 30,000 tons on the Moon and in GEO where the construction shacks were located. In all likelihood, mostly robotic construction shacks will be located in GEO where the powersats will be finally located. Lunar mass drivers could launch to mass catchers at L2 that then haul payloads to construction shacks in GEO. If we could orbit 100 tons for \$100 million we could still get 5000 tons in LEO and 3000 tons on the Moon and in outer space and bootstrap industry.

Three thousand tons is still a lot of cargo. Self replicating seeds of lower mass have been imagined. NASA's Advanced Automation for Space Missions study in 1980 estimated 100 tons for a self-replicating robotic seed on the Moon and there were no 3d printers even back then! Let's say we did have 3000 tons of robotic and manned equipment on the Moon and in space at L1 and GEO and then we crank out one hundred 100 MWe SPS and/or power relays and get it done within 20 years to pay off the bond holders. After that we make clear profit for continued reinvestment and expansion until growth becomes exponential and the Moon and Earth orbital space is highly industrialized. The next step is Mars, the solar system at large and then on to the stars!

One of the keys to success is to maximize the use of lunar materials. Lightweight electronics will be upported [shipped up the gravity well]. Massive unitary simple things will be made on the Moon. Regolith refining processes often require chemicals such as chlorine and fluorine. These would be recycled but there will be leakage and to expand the industrial SEED to build FACTORIES we will need more and more chemicals upported at high cost.

New Technology to the rescue

I favor Dr. Peter Schubert's Lunar Dust Roaster and All Isotope Separator, a device similar to a mass spectrometer but much larger because it doesn't need chemicals—just energy. However, part of the device is made of thorium oxide and thorium is present in KREEPy terranes at just 10ppm to 50ppm. Perhaps part of the device could be made of pure silica, alumina or titania with drilled passages and sulfur dioxide coolant since sulfur is available on the Moon.

At 53 tons for \$100 million with Falcon Heavy rockets we could get 2650 tons in LEO for \$5 billion and say 1500 tons on the Moon and in space. Of that 500 tons could be materials extraction equipment, 30 Genesis 1 modules for living and working would amass 45 tons, the rest would be mining and manufacturing machines, rocket landers and supplies like dehydrated food. Then we rocket Moon made parts to L2 mass catchers then to GEO and build up construction shacks and build mass drivers on the Moon.

Preplanning of a million details and a few million people with a zeal for outer space willing to invest several thousand dollars apiece in 20-year bonds would be required. We will need at least \$5 billion for the Falcon Heavy launches though we might get a modest discount for these 50 launches from Space-X, and we will need another \$5 billion for R&D, hardware (actual payload costs) operations and to foot the cost of transporting humans to the Moon; more about that later. If we can get a discount and launch Falcon Heavies for \$80 million a shot then we would spend \$4 billion to orbit payloads and have an extra billion dollars to invest in R&D, operations, hardware, etc. That discount could make a big difference. A billion dollars is nothing to sneeze at.

Zero coupon bonds pay nothing until the bond reaches maturity. If we offer these bonds to raise about \$10 billion with an interest rate of about 4.7% then after 20 years we'd need to pay back about \$25 billion. This means we need to have 10 GWe of capacity at work by year 15 earning \$5 billion a year so that we can gross \$25 billion in years 16–20. After that we make clear profits to reinvest and expand. Hopefully there will be massive tax breaks to encourage this business. We could start offering stocks and pay dividends and this might attract much more investment. We will continue to build space power systems in years 16 thru 20 so that we will earn a large amount of money. We won't stop at 10GWe in year 15.

Of the 2650 tons in LEO for \$4 billion or \$5 billion we will devote 1500 tons to the previously stated purposes and locations and 1150 tons will be NEP tugs plus propellant or tether systems for travel from LEO to L1 or LLO in addition to propellant for the first automated landers that set up robotic fuel and LUNOX production for the reusable landers to haul cargo arriving at L1 or in LLO down to the lunar surface. Getting humans to the Moon would take a large bite out of things. To get those workers from LEO to L1 we'd need a lunar-fueled reusable ferry system. If tethers could toss a manned capsule to L1 or LLO with a retro system that would save a lot on upported LH2 and LOX or lunar metal powder fuels and LUNOX.

This 1150 tons could consist of 400 tons argon for NEP guessing propellant at about 15% of cargo mass and 250 tons for lander propellant preceding lunar propellant production.* The remaining 500 tons will be for the NEP tugs themselves, mass catchers, and an L1 refueling depot and powersat for lunar night power.* * Instead of NEP a 400 tons tether system would be pretty stout. Everything including upper stages would be cannibalized so we will have some scrap metal to get going. Even so, we'd really need to have 10GWe up by year 15 so we could sell \$25 billion worth of power to make good on those bonds, and that might be a real challenge.

Moon tickets for us humans

Human transport could run a billion dollars for 20 Falcon 9/Dragon flights with 7 men each over 20 years with 35 men doing 5 year stints, so we'd only have \$4 billion for R&D, actual hardware and operations, unless we get a discount. I guess the L1 depot and ultra-light powersat would be no more than 100 tons and the NEP tugs and mass catchers another 100 tons so let's estimate 300 tons for the initial construction shack in GEO. The construction shack would then be built up with steel and aluminum scavenged from Earth orbit with electrodynamic tether spacecraft and parts rocketed up from the Moon. Once the shack was built up mass drivers will launch loads of regolith to L2 mass catchers that haul the material for building powersats. About 90% of the work will be done by teleoperated robots controlled by crews on Earth, in space and on the Moon.

How low can we go?

It might be possible to do the job with much less than 1500 tons on the Moon. For those who would like to read about the mere 443 ton seed that would grow into an over 300,000 ton factory for a self replicating starship, see:

<http://www.rfreitas.com/Astro/ReproJBISJuly1980.htm>

A Self-Reproducing Interstellar Probe www.rfreitas.com
HTML Editor: Robert J. Bradbury

*250 tons to land the fuel and LUNOX production equipment.... with 250 second lsp Al and LOX motors that's 2.45 kps exhaust V to land from L1 about 2.3 kps.....so $e^{(2.3/2.45)} = 2.557$

I said 250 tons of propellant so $(x+250)/x = 2.557$
 $(x+250) = 2.557x$

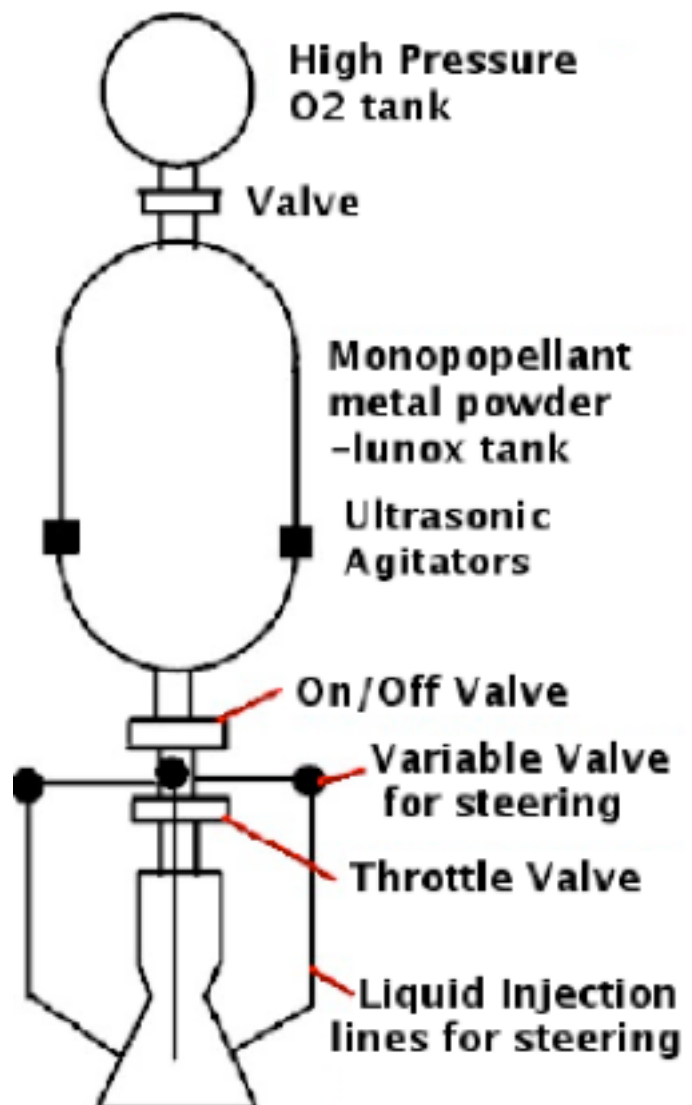
$250 = 2.557x - x$ $250 = 1.557x$ $x = 160$

Thus we can land 160 tons of Al and LUNOX equipment plus landers.... with 250 tons of Al and LUNOX sent to L1.... if the landers amass 60 tons that's 100 tons of monopropellant production gear.. enough to refuel the landers and send them back up to L1 with payload of extra monopropellant in their tanks and transfer that to interlunar ferry rocket or land more cargo....the hard part will be keeping the propellant cold if we go by ion drive from LEO to L1....

*The SPS at L1 will have low mass thin film GaInP/GaAs solar panels.

The L1 station will consist of inflatables... Genesis 1 modules only amass 1.5 tons.

D Dietzler



Appropriate Back Reading

The Industrial Seed

MMM #229 OCTOBER 2009

p 5 Defining the Lunar Industrial Seed, 1, Dietzler

MMM #230 NOVEMBER 2009

p 3. The Lunar Industrial Seed, 2, 3A, D. Dietzler

MMM #231 DECEMBER 2009

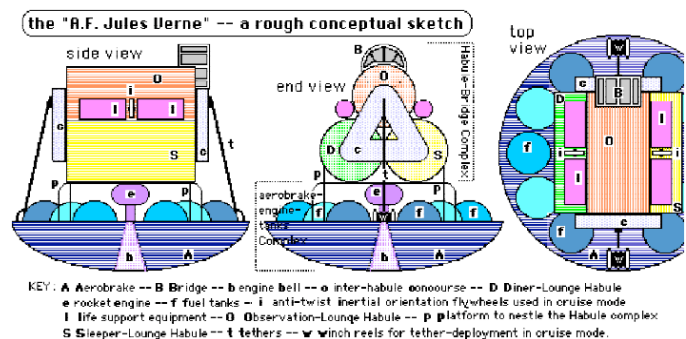
p 3. The Lunar Industrial Seed (concl.) D. Dietzler

Lunar Overflight Tours

MMM # 21 DECEMBER 1988

republished in MMM Classics #3, pp. 4-8

http://www.moonociety.org/publications/mmm_classics/mmmc3_Jan2005.pdf



Author's Postscript to the preceding article Differences between this and former Visions

In the above article, I mention mass driver launch to L5 or GEO, this is not right.† I think the best thing to do would be to aim at' neither L5 or GEO, but at L2, behind the Moon.

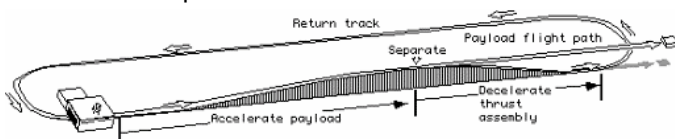
From the northwest Imbrium coast we can mine anorthositic highland regolith rich in Al, Ca and Si, mare regolith rich in Fe, Mg and Ti, and KREEPy regolith rich in potassium, phosphorus essential for solar panels and rare earth elements that have many uses, perhaps even high power vacuum tube filaments in pure form or when alloyed with other more common elements, as tungsten is not to be had on the Moon.

Mass drivers built on the Moon from aluminum rings, titanium or concrete supports, aluminum wire wrapped in silica fiber cloth insulation with high power vacuum tube electronics will amass about 625 tons [reference 1]. There will be at least two mass drivers in case one gets severely damaged so launches can continue on schedule. They will launch over the north pole to L2 where Dr. Peter Schubert's electromagnetic mass catchers are located. The magnetic fields of these devices will draw in iron canisters even if aim due to mass driver exit velocity inaccuracy is slightly off.

Dr. Schubert's mass catcher is superior to the old Kevlar bag catchers envisioned decades ago. Nonetheless, after mass driver launch there will be downrange stations that induce course corrections with various electromagnetic systems to achieve high target accuracy. Iron canisters of plain regolith will be launched as well as canisters of finished bulk products like metal rods, beams, rails, tubes, rolls of sheet metal and foil, spools of wire and cables, rolls of silica fiber cloth, etc. Moon Shuttles will rocket more delicate cargos to the L2 mass catchers, off load them, and the mass catchers when full will haul all this to GEO construction shacks that are built up with lunar materials until they can build SPS and/or power relay satellites.

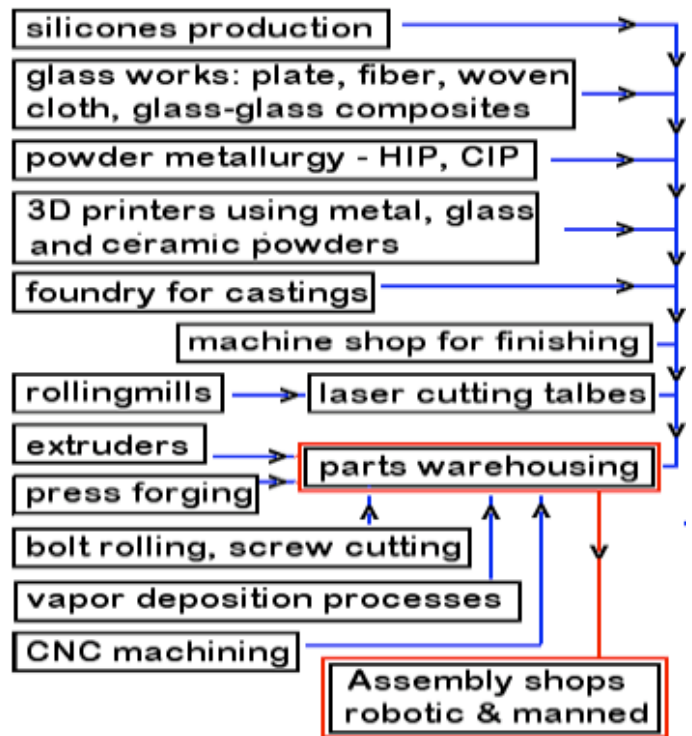
The construction shacks will have small human crews and over 90% of the SPS construction will be done by teleoperated robots controlled by crews on Earth. Radio wave lag time between Earth and GEO is but a fraction of a second so good control of robots will be possible. Moon Shuttles could reach L2 and return but these low performance rockets could not reach GEO and return unless refueled in GEO which is a possibility especially after regolith smelting is begun at the construction shacks. There is no giant 100 million ton space colony with 10,000 workers in this vision but greater emphasis is placed on space robot systems with only minimal human presence on the Moon and in space.

Dietzler



A mass-driver is a means to use solar power to accelerate cargo pods to lunar escape velocity without the use of rockets or rocket fuel, best-located on/near the equator.

Read <http://www.nss.org/settlement/L5news/1980-massdriver.htm>



PRODUCTS: vehicles, mining machines, habitat modules, mass-drivers, more machine shops, mills, extruders, forgers, 3D printers, etc. The chart above is focused mainly on processes that use metals.

Materials from regolith: cast and sintered basalt from mare regolith, melted cast and sintered anorthositic regolith that will form a glassy material, ceramics like silica, alumina, calcia & titania; alumino-silicate glass, iron, nickel, titanium, aluminum, silicon, magnesium, phosphorus, potassium, sodium, sulfur, cement, calcium sulfate, and hopefully chromium, manganese and calcium. Limited amounts of hydrogen, carbon, nitrogen, helium. Alloys will include maraging steel (Fe, Ni and Ti), AlSi, AlMg, TiAl and iron aluminides.

Most of these processes can work in vacuum. Vacuum welding or vacuum cementation will affect metals with similar microcrystalline structures when smooth surfaces contact under pressure or for extended lengths of time. Since maraging steel, Al and Ti have different crystalline structures vacuum cementation will not be such a great problem if for instance aluminum plates are rolled between steel rollers or Al rod is extruded in steel extruders or Al parts are forged in steel dies.

3D Laser sintering of aluminum parts will be done in pressurized modules as Al will evaporate readily in the vacuum.

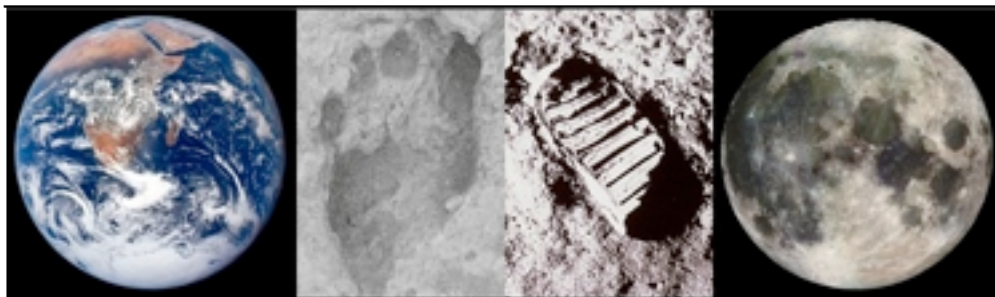
3D electron beam melting of titanium will work better in the vacuum and so will many physical vapor deposition processes to make thin metal parts.

Casting and alloying must be done in a pressurized foundry and machining is best done in some kind of atmosphere with water or oil lubricating coolant. **Silicone chemistry** will be performed in pressurized modules. **Glass** would be poured under pressure. Looms would probably work indoors too.

Powder metallurgy works better in the vacuum. Powder particles vacuum-weld with fewer voids, less porosity in the final product if it is pressed in the vacuum.

Manned assembly shops/garages will have pressure and this will make it possible for humans and robonauts to use pneumatic tools. Electron beam welding and brazing will be done outdoors in the free vacuum by robonauts. Cutting metal plates with lasers could be done in the vacuum also. **D Dietzler**

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



Our Goal is
Communities
on the Moon
involving
large scale
industrializa-
tion and
private
enterprise.

Objectives of the Moon Society

Our objectives include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Interested in having input? Any member may ask to join the Leadership Committee and attend our Management Committee meetings held twice monthly. You may even express opinions. Decisions are often made by consensus, so this input has value. Write president@moonsociety.org

An all -new Moon Society Homepage



Don't check now, as the work is being done behind the scenes, and our new homepage will not appear until we are all satisfied that it is "just right." The basic features are the work of our new President, Ken Murphy. Scotty Gammenthaler is working to make it happen by doing most of the work on code-writing and trial implementation.

Hint #1: the page will be black and white, a fitting combo for The Moon. Ken has suggested a high contrast (black and white, no gray tones) south polar landscape. Maybe a flashing beacon to suggest a first outpost spaceport.

Hint #2: A major feature will be a reorganization of all the pages under 5 or 6 main menu headings. Greatly improved navigation, making it easy to find what you are looking for, is priority #1. In the past seven years, the number of pages has grown significantly, and where they have been placed (in which existing or new directory) may not have been the best choice. It is hard to foresee the shape of a mature tree given only the shape of the seedling. Hindsight is often sharper than foresight. So a fresh overview and reorganization is clearly in order.

Beyond the homepage

The secondary pages are likely to retain their current format

Meanwhile, some additions, notably a set of FAQ pages (Frequently Asked Questions) on which some work has already been done by Peter Kokh with some very helpful suggestions by former Board member Dr. Peter Schubert, is still in the works.

As some announced projects have not been carried through, some project pages may be put in an archive section. A lot remains to be decided, and once the homepage is ready to make its entrance, some reorganization of subsidiary pages will always be a work in progress as is appropriate given our vision and mission.

**We are a Society whose work
will always be "under construction"**

Former Moon Society BYU Outpost leader Jonathan Goff receives \$25,000 Grant



We first learned of Jonathan Goff (who had joined the Moon Society in the fall of 2002) in 2003, when, as a student at Brigham Young University in Provo, Utah, he started the Utah Outpost. He soon took the Brigham Young Space Development Club, which he led, and registered it as a Moon Society Campus Chapter, the Society's first. It was this accomplishment which led the Moon Society to introduce a special \$20 student/senior membership rate. As head of the group, Goff led a project to build a unique igniter system.

By the fall of 2003, having graduated from BYU, with a Masters degree in Mechanical Engineering and a Bachelor's degree in Manufacturing Engineering, Jonathan had to leave this effort behind as he headed to California to the South Frisco Bay area, where he became president of the Bay Area Moon Society Outpost (BAMS) before leaving to join the new space company Masten Space Systems as one of its co-founders in the role of lead propulsion engineer. Masten went on to win NASA's Lunar Lander Challenge.

Jonathan soon became a recognized expert in the area of cis-lunar architecture and low cost space flight systems. He has been instrumental in the design and testing of the XV500LIT and XVT750LIT engines. And now he has started his own company, **Altius Space Machines** – based in Louisville, Colorado near Boulder.

<http://altius-space.com/>

At the recent New Space Conference hosted by the Space Frontier Foundation at NASA Ames in Mountain View, CA, Altius won a competition for best space business plan, with a \$25,000 payoff – see the photo at the top of this article. You can watch a video of Jonathan's winning presentation at:

<http://blog.altius-space.com/2011/08/biz-plan-pitch-video/>

You can read about Altius' "Direct 2 Station" (D2S) Deliveries Program at:

<http://blog.altius-space.com/2011/08/direct-to-station-d2s-deliveries-system/>



"Changing the way things connect in Space"

Goff writes: "Altius is developing a solution that enables nanosat launch vehicles to deliver small, just-in-time packages directly to the station. Not only does this open a huge new market for nanosat launch developers, but it also enables us to achieve \$20-70M in annual commercial revenue once scaled-up to full commercial operations, and more importantly enable us to change the way space deliveries are made forever."

Go-Go-Gadgettude

The key was Altius' "Sticky Boom Zero-Gⁱ experiment and their "Go-Go-Gadgettude" The idea is not to make incremental improvements on traditional cobweb-laden systems and methods but to brainstorm wild new ideas that just might work in away that blows the lid off of perceived ceilings and barriers. Now here is "New Space" at its best. A parallel that comes to mind is how digital TV blew the "limits" of classical analog broadcasting. If the paradigm says we can't, it's time to look for a new paradigm.

It is people like Jonathan Goff and others with his no-limits mindset that are going to give us the stars someday.

Blogging: "Selenian Boondocks"

Jonathan is also a noted space blogger on –

<http://selenianboondocks.blogspot.com>

now at a new address:

<http://selenianboondocks.com/>

"Selenian Boondocks is the Random Musings from the Warped Minds of Jonathan Goff, Ken Murphy (our new Moon Society President), John Hare, and Kirk Sorensen. If you want a fresh viewpoint on matters of space on a variety of space topics, you might want to make checking this blog a habit".

Home Base in Utah

Jonathan maintains his family and university ties in Utah. As a Great Laker (Midwesterner) (Great Salt Lake has a kindred feel to my native Lake Michigan) and as one who has visited all 50 states, I have a very dear spot in my soul for Utah. Not only is the Salt Lake City – Provo area one of America's best kept scenic secrets, set against the snow capped Wasatch range, but I feel privileged to have served on two 2-week long crews at the Mars Desert Research Station in South Central Utah and have had a chance to see a large portion of this stunningly awesome state: a good place to have roots.

The Moon Society is privileged to count Jonathan as one of our own. From time to time we will post similar stories about some of our talented and achievement-driven members.

PK



Moon Society Lapel Pins on order

At the suggestion of Ken Murphy, we have discussed the idea of lapel pins. At our September 7th 2011 Management Committee meeting, we approved an order of 300 lapel pins.

Expand Your Set of “Gravity Jugs”



By Chuck Schlemm

President NSS Middle Tennessee chapter
Leader Moon Society Nashville Outpost

Chuck writes: “I still have a set of your gravity bricks although I use a set of ‘planetary milk jugs’ more often. This is a set of 5 half-gallon milk jugs, with caps labeled: Earth, Moon, Mars, Mars’ moons, and Jupiter. Same construction as your jugs with Mars’ moons (little Phobos & Deimos) empty (just the minimal weight of the empty jug itself) and the Jupiter jug filled with sand and then water (to make it 2 and a half times as heavy as the Earth jug filled with just water.

“Kids get this too, and all 5 jugs weigh about 15 pounds together and fit in a plastic grocery sack (easy to carry and easy to replace.)”

Editor comments and observations:

Now Venus, Saturn, Uranus, and Neptune all have gravities fairly similar to Earth’s – remember that the giant planets are very low in density! But gravity on Jupiter is 2.52 times as great as that on Earth, about the same ratio as rock to water. So fill a 5th jug with sand. If the weight is less than 2.5 x the Earth jug’s weight, you can start saturating the sand with water. This should get you close enough.

But another way to get this idea across without adding another jug, is to ask them to pretend that the Mars jug is your weight on Earth and then pick up the Earth jug and that will be your weight on Jupiter. For the ratio is almost the same; $1/0.38 = 2.6$

Another fun thing is after they get the feel of how much they would weigh on the Moon, $1/6$ th Earth-normal, Have them pretend that they got used to their weight on the Moon (Moon-jug) then pick up the Earth brick again to show them that they might have to get used to weighing 6 times as much again. The ratios work in either direction!

It’s probably a good thing that it is not easy to make chambers with Mars Air (mostly CO₂) at a 10th the pressure, even better that we can’t easily make a walk-in/out vacuum chamber to simulate the outdoors on Mars and Moon. That would be as fatal as it would be impractical. Demonstrating the gravity differences gets across the “feel of being on Moon or Mars! PK

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

http://nsschapters.org/hub/photos/gravbricks_pic.JPG

<http://nsschapters.org/hub/gravityjugs.htm>

<http://msschapters.org/hub/gravjugs.gif>

Note; I prefer bleach jugs as they have handles. PK

Will We host an ISDC in the near future?

By Peter Kokh

Four Moon Society St Louis chapter members took in the 2010 **International Space Development Conference** in Chicago a year and a half ago, their first, and were quite impressed. In the aftermath, one emailed me and asked if the National Space Society might pick St. Louis for a future venue. I replied that actually, NSS didn’t select cities for an ISDC but solicited proposals from various NSS chapters and made decisions 2–3 years ahead of time on the basis of the merits of submitted proposals.

While there is not (for some time now) an NSS chapter in St. Louis, we do have a very strong Moon Society chapter in this major metropolitan area, and per the 2005 affiliation agreement signed by NSS and the Moon Society, when one society had a chapter where the other does not, it was encouraged to serve as a home for members of the other. MSSStL could reach out to NSS members in the bi-state (MO–IL) metro area and, citing a possible bid for ISDC 2014 (the next open slot) encourage them to join.

Now we have a recent example of a fully merged chapter that belongs to both Societies: the Clear Lake Area (Metro Houston) NSS and Moon Society Chapter. The merger was motivated by “holes” in both preexisting NSS and Moon Society chapters. Each had strengths and weaknesses that complimented those of the other. But in the case of St. Louis, there is no NSS chapter. There is a first time for everything, and St. Louis, if it can attract a core of currently unconnected NSS members from both sides of the river (Mississippi, of course) a St Louis Moon Society and NSS Gateway Chapter could result, with impressive strengths.

Indeed the “Gateway” theme would be a natural from many points of view. But can St. Louis pull it off? Not all MSSStL members are enthused about the challenge. But many a chapter with less impressive assets and strengths has pulled it off before, e.g. Milwaukee and Oklahoma City to name two.

St. Louis Washington University is a hotbed of NASA research. The X-prize and Google Lunar X-prize are here. So is Boeing–St. Louis! The area is asset-rich. And happily, there is already a core of a half dozen MSSStL members who are willing to take the plunge. I personally put the challenge to the chapter in the fall of 2009 and, as chair of ISDC 1998 Milwaukee, offered my assistance. Since then Claire McMurray, chair of ISDC 2004 Oklahoma City has been appointed liaison to the St. Louis team, and working together we will help the chapter put together a winning proposal.

At this time, nothing is locked in, and of course, rival proposals may appear. There is some interest in San Diego and that venue would be a very popular one. There will be other opportunities.

It is very important to know that not all of any ISDC team needs to be local. Many key parts can be managed from afar, such as speaker invitations, etc. And historically, other local groups such as sci-fi fans are eager and willing to help. It is work, yes. But fun too. So stay tuned. PK

Chapters & Outposts

August Reports

Moon Society Phoenix Chapter

<http://www.msphx.org>

Contacts: Craig Porter portercd@msn.com

Meeting the 3rd Saturdays of the month

NEXT: Sept 17th, Oct 15th, Nov 19th

Our August meeting was held on the 20th at Denny's and had 6 members present and one guest.

First topic: CopperCon31 and LepreCon38. CopperCon wants new presenters this year and had no "Fan" tables available, therefore, the Moon Society Phoenix will not be in attendance at CopperCon this year.† LepreCon38 has already reserved a table for us and will most likely have panels to Chair in May 12.

Second topic: was the vote for an official Chapter Logo, ballots were e-mailed to all Chapter members but only three were returned. With my vote, there were 2 votes for one of the logos and one vote each for the other two logos. As a quorum vote was not received, the vote was not confirmed and will be conducted again at a later date.

Third topic: our web site. The two documents in the Life Sciences Department have to be replaced due to a software glitch. More documents and presentations are in the pipeline for release in the near future. The new items include "Lunar Ground Transportation", "Industrialization of the Moon", "Colonization of the Moon" and other unnamed ones.

Fourth topic: posting of Chapter pictures from various events that the Chapter has been part of in the past and in the future.† Not all past pictures have been posted but more will be posted as available.† There is video presentation area by Michael Clark doing interviews and other pertinent videos as available.

Fifth / final topic: an upcoming Forum being planned for the Phoenix area that is tentatively called "A Forum on Space Policy in the Post Shuttle Era,"† The forum will consist of experts in Politics, Planetary Science, Manned Space Flight and NASA Operations.

The panel discussions will center on the forces driving current US space programs in Robotics and manned exploration, the impact of fiscal restraints and the possibility of constructing a rational space policy.

Following the presentations, there will be an extended moderated discussion with questions to be taken from the audience. A tentative time and place has been selected and will be announced when it is confirmed. We have tentatively agreed to help out on this forum in any way it can at this point. **Craig Porter Election time for MSPHX**

I wanted you all to know that at the end of this month, I will be stepping down as President of the Phoenix Chapter. The reasoning behind my decision is that I have been a Chapter Leader for the Phoenix Chapter since 2000 and it is time for another to take the torch.† Too many times I have put up the office that

of Chapter President in the hopes that another would lead but no one took the opportunity.† Thus I remained Chapter President until another highly motivated individual would take my place.† Unfortunately, I can't do that this go-round so I do hope that there is one among you who is willing to lead the Chapter and its members on a true and steady course to promote robotic and human space exploration and settlement.

Open positions:

- Chapter President:
- Chapter Education Outreach Coordinator:
- Chapter Media Liaison:
- Chapter Policy Coordinator: CP

Clear Lake NSS/Moon Society Chapter (Houston)

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

Contact: Eric Bowen

eric@streamlinerschedules.com

The Houston Chapter's next regular meetings are set for **Mondays, Sept 19th & Nov 21st** in the conference room of the Bay Area Community Center at Clear Lake Park.

Moon Society St. Louis Chapter

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

Contact: Keith Wetzel <kawetzel@swbell.net>

Next meetings – **Aug 17th, Sept 21st, Oct 19th**

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

Our regular meeting was held on August 17th at the Buder Branch Library. Karl Strassman, Dave Dietzler, Mark Rode, Jim Merriman, Dabne Tolson, Rufus Anderson, and Bob Perry attending. Dave briefly discussed a semi-solid rocket concept using a slurry of LOX (lunar oxygen) and refined aluminum powder (by weight, highlands regolith is about one eighth aluminum) – further research is required. Rufus brought his projector and powered speakers and Bob his laptop and "Walt Disney Treasures: Tomorrowland" two DVD set. The group enjoyed "Mars and Beyond", especially the part with Wernher von Braun.

We will separate our resources and participate in two events the first weekend in October, Jim will help Earl Mullins with the Space Museum's display at Parks Air College's "Youth Gateway to Aviation Day"

<http://parks.slu.edu/conferences/upcoming-conferences/youth-gateway-to-aviation-day/>

Bob, Rufus, and Tom will have a display and conduct panels at Archon 35.

We may have a social event around Christmas and in January will probably participate in Moon Madness Night at Rockwood Creative Learning Center, where our member Chris Nobbe is a teacher

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/

Or Moon Society [Membership Services](#):

PO Box 940825, Plano, TX 75094-0825

< **End Moon Society Journal Section** >

GREAT BROWSTING

INTERNATIONAL SPACE STATION

www.space-travel.com/reports/New_uses_for_Space_Station_999.html

New Human Exploration & Operations Directorate

http://www.nasa.gov/home/hqnews/2011/aug/HQ_11-264_HEO.html

COMMERCIAL SPACE

<http://www.ibtimes.com/articles/208231/20110904/amazon-founder-s-unmanned-spacecraft-crashes-during-test-nasa-white-house-commercial-dream-jeff-bezo.htm>

Dragon interview with Elon Musk on Dragon-ISS flight

<http://nextbigfuture.com/2011/08/elon-musk-is-interviewed-by-npr-about.html#more>

TECHNOLOGY & ROBOTICS

<http://www.newscientist.com/article/dn20779-nasa-bets-on-metal-hydrogen-and-cosmic-gas-stations.html?DCMP=OTC-rss&nsref=tech>

Humans and Robots – ten-year old advice

<http://www.spacedaily.com/news/oped-01k.html>

Skylon in the crosshairs

<http://www.thespacereview.com/article/1865/1>

SPACESOLAR POWER

<http://space.algobus.net/papers/TowardsAnEarlyProfitablePowerSatPartII.pdf>

THE MOON

http://www.space-travel.com/reports/NASA_Moon_Mission_in_Final_Preparations_for_September_Launch_999.html

<http://www.space.com/12030-moon-photos-nasa-lunar-reconnaissance-orbiter.html>

<http://i.space.com/images/i/395/i02/moon-planet-profile-101111-02.jpg?1289850635>

Did the Moon have a smaller sibling that crashed into it to create two very different hemispheres?

<http://www.space.com/12529-earth-2-moons-collision-moon-formation.html>

www.space-travel.com/reports/Man_in_the_Moon_Looking_Younger_999.html

Could we have afforded to return to the Moon? Satire

<http://scienceblogs.com/pharyngula/upload/2011/07/moonvafghanistan.jpeg>

http://old.news.yahoo.com/s/ac/20110801/us_ac/8897299_spacex_red_dragon_proposal_for_nasa_mars_mission_could_revolutionize_space_exploration

MARS

NASA's latest Mars (Or Moon) Habitat Mockup

www.marstoday.com/news/viewsr.html?pid=38154
<http://images.spaceref.com/news/2011/HDU.desertrats.l.jpg>

Search for Life on Mars to get High-tech Instruments

www.spaceref.com/news/viewpr.html?pid=34516

ASTEROIDS

<http://www.astrobio.net/pressrelease/4180/why-send-humans-to-an-asteroid>

ASTRONOMY

<http://www.space.com/12759-james-webb-space-telescope-nasa-cost-increase.html>

OUTREACH – MEDIA

50 Years of NASA Space Art

<http://www.thespacereview.com/article/1854/1>

Space Center Lecture Series

<http://www.spacecenterlectureseries.com/past.html>

GREAT VIDEOS

<http://www.arabianbusiness.com/videos/nasa-craft-sends-images-of-giant-asteroid-414001.html>

<http://www.space.com/11945-dark-feature-spotted-asteroid-vesta.html>

<http://www.bigislandvideonews.com/2010/02/05/video-hawaii-lunar-like-mauna-kea-hosts-space-tests/> (3 videos: habitats 1, 2, 3)

<http://www.space.com/12744-lumpy-gravity-moon-grail-learn-luna.html>

<http://www.space.com/11242-strange-craft-mojave-sky-theyre.html>

How the Moon was formed and what it did for life

<http://www.space.com/9926-moon-life.html>

Two Sides Has the Moon & Here's What's On Then

<http://www.space.com/9859-sides-moon.html>

First Rover on the Moon (Apollo 15, 40 years ago)

http://www.youtube.com/watch?v=0_YhYBxjpQU&feature=player_embedded#at=30

A Year Over the Moon's North Pole

<http://www.youtube.com/watch?v=Tu3daa98aol>

Vesta full rotation movie

<http://www.youtube.com/watch?v=FaUaoy33gHE>

Apollo 18 sci-fi-horror movie trailer

<http://www.space.com/12748-apollo-18-theatrical-trailer.html>

Major ISDC 2011 Speakers: Gleason, Spudis, Bigelow, both Garriotts, Tumlinson, Harris

<http://www.nss.org/resources/library/videos/2011ISDC.html>

Jeff Greason: A Settlement Strategy for NASA

<http://www.nss.org/resources/library/videos/ISDC11greason.html>

NASA's Orion Multi-Purpose Crew Vehicle U.C.

<http://www.space.com/12223-astronauts-ride.html>

Star Trek Replicators for Spaceships and Outposts

<http://www.youtube.com/watch?v=ZboxMsSz5Aw>

Inside the Space Station from one end to the other

www.youtube.com/watch_popup?v=H8rHarp1GEE

Musk on Mars in 10 years

<http://online.wsj.com/video/elon-musk-ill-put-a-man-on-mars-in-10-years/CCF1FC62-BB0D-4561-938C-DF0DEFAD15BA.html>

Space-X to demolish prices to orbit, anywhere else

<http://www.youtube.com/watch?v=DtoADdSry6g>

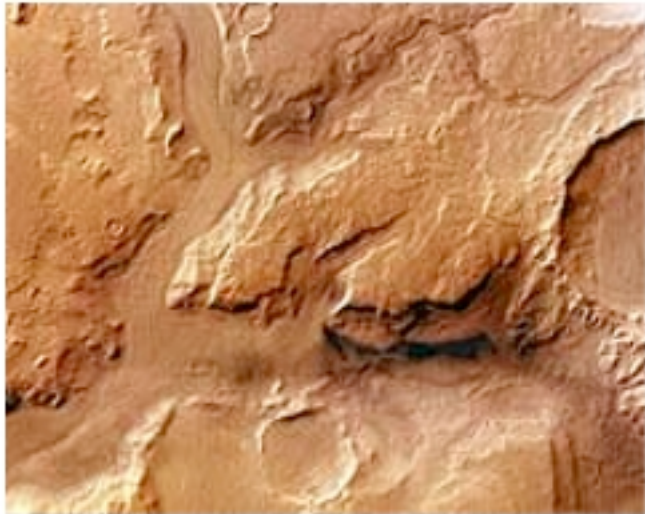
Russian Commercial Space Station Plans (3 videos)

<http://orbitaltechnologies.ru/>

Spaceport America Preview

http://www.youtube.com/watch?v=pHa8XatVUXA&feature=player_embedded

MMM PHOTO GALLERY



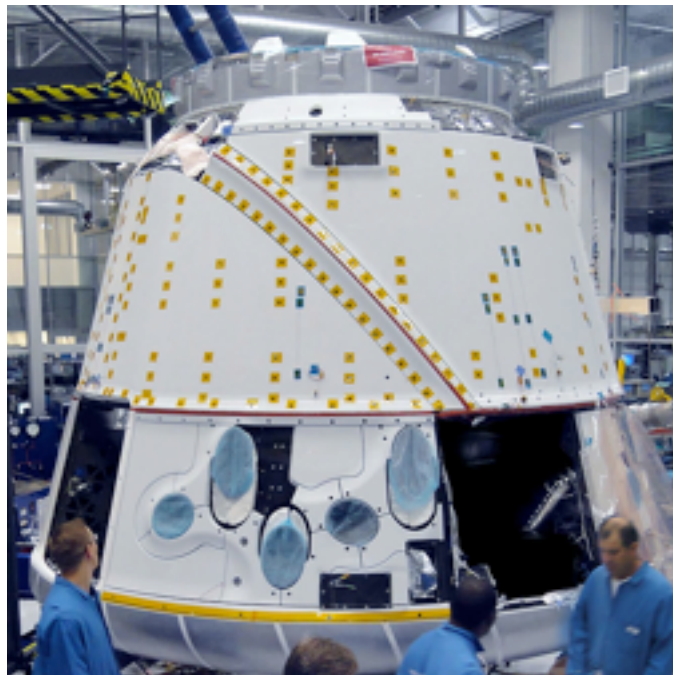
Large river-like channels on Mars may have been carved by massive, swift low-viscosity lava flows
www.marsdaily.com/reports/Lava_not_water_said_cause_of_Mars_beds_999.html



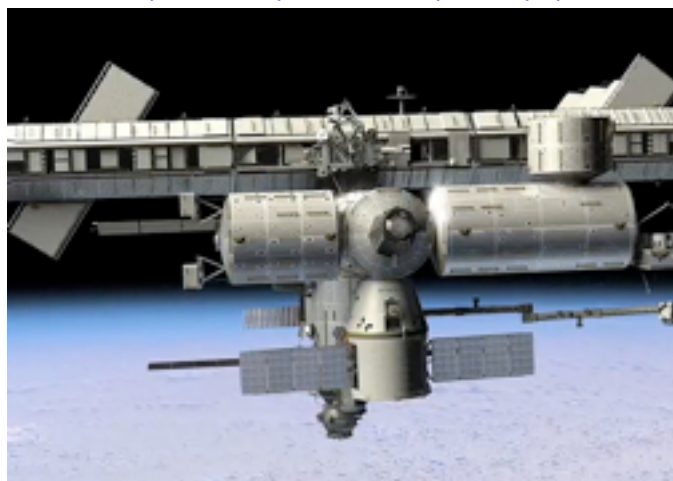
VV 340 (Arp 302) is a pair of Galaxies inching into a collision over the next few millions of years. The Milky Way and Andromeda galaxies will collide in 3-4 by
<http://www.space.com/12609-colliding-galaxies-form-exclamation-point.html>



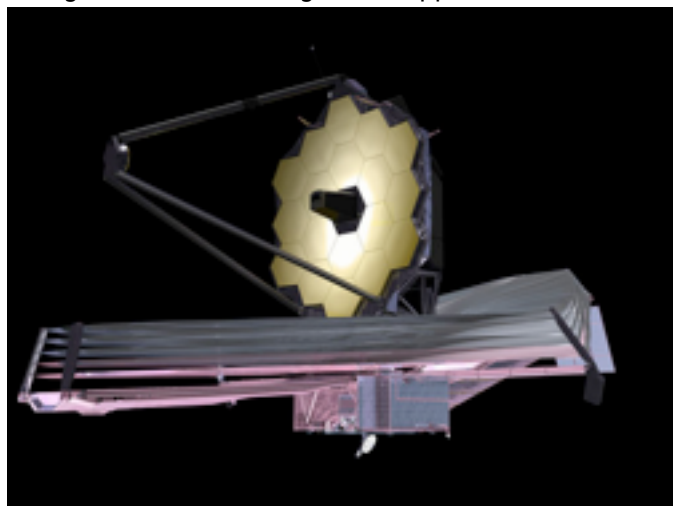
NASA's Gravity Recovery And Interior (GRAIL) mission to map Moon's "lumpy" gravity Sept 8 – Oct 19 window
www.space-travel.com/reports/NASA_Moon_Mission_in_Final_Preparations_for_September_Launch_999.html#Laboratory



Space-X' Dragon Cargo Vessel being prepared for historic 1st commercial docking with ISS in November
<http://www.spacex.com/updates.php>



Cargo Vessel iHow Dragon will appear docked to ISS



<http://www.space.com/12759-james-webb-space-telescope-nasa-cost-increase.html>



Falling to Earth: An Apollo 15 Astronaut's Journey to the Moon

By Alfred Merrill Worden, Et Al.

Apollo 15 is widely regarded as the greatest exploration mission that humans have ever attempted. Worden spent six days orbiting the Moon, including three days completely alone, the most isolated human in existence. During the return from the moon to earth he also conducted the first spacewalk in deep space, becoming the first human ever to see both the entire earth and moon simply by turning his head. The Apollo 15 flight capped an already-impressive career as an astronaut, including important work on the pioneering Apollo 9 and Apollo 12 missions, as well as the perilous flight of Apollo 13.†

Comments by Jesse Clarke of San Diego Space Society.

"Worden has been listed in the Guinness Book of World Records as the "Most isolated human being" during his time alone in the command module "Endeavour". When the orbiting command module was at its greatest distance from Scott and Irwin in the "Falcon", Worden was 2,235 miles away from any other human beings. In completing his three excursions to "Endeavour's" scientific instrument module bay, Worden retrieved film cassettes from the panoramic and mapping cameras performing the first deep-space EVA." – Wikipedia – Alfred Worden

Amazon.com reviews:

http://www.amazon.com/Falling-Earth-Apollo-Astronauts-Journey/product-reviews/158834309X/ref=dp_top_cm_cr_acr_txt?ie=UTF8&showViewpoints=1

Russian Commercial Station Preview

<http://orbitaltechnologies.ru/>





NASA's Latest Mars (Moon) Base Mockup

www.spaceref.com/news/viewsr.rss.html?pid=38154

www.marstoday.com/news/viewsr.html?pid=38154

Called "The HDU" (Habitat Development Unit)

www.nasa.gov/exploration/analog/hdu_project.html

NASA Desert "RATS" Research And Technology Studies

<http://www.nasa.gov/exploration/analog/desertrats/>

In the high desert near Flagstaff, Arizona, Base camp in August 2011 ready for operations. On top the HDU is the X-Hab Challenge Inflatable Loft

http://www.nasa.gov/exploration/analog/xhab_challenge.html

Editors Comments:

- First, to have the upper story of the "Hab" be an inflatable unit is a plus. This lowers both total weight and shipping dimensions en route to Moon or Mars.
- Second, it was a capitol idea to sponsor a student challenge competition to flush out design ideas for the inflatable habitat.
- Third, this is evidence that NASA's heart is still set on Manned Operations in deep space well beyond Low Earth Orbit where we've been stuck for decades!
- While "inflatables" are certainly a great idea, the real future lies in "Hybrid-Rigid-Inflatables" (such as this one, and the several suggestions made in our (Lunar Reclamation Society) paper at ISDC 1991 San Antonio http://www.moonsociety.org/publications/mmm_papers/hostels_paper1.htm

"The Lunar Hostel: An Alternate Concept for First Beachhead and Secondary Outposts"

http://www.moonsociety.org/publications/mmm_papers/hostels_paper1.htm

This section of the paper has been reprinted in MMM India Quarterly #11, pages 30-32

http://www.moonsociety.org/india/mmm-india/m3india11_July-Sept.pdf (a free download)

If the Moon Society, perhaps in collaboration with the National Space Society, OpenLuna Foundation, and possibly other groups, would ever have the funds to construct a Lunar Analog Research Station, pushing the envelope of hybrid rigid-inflatable technologies and designs could be a major thrust of the research program. And we would do well to follow NASA's lead in involving students in flushing out the most creative and promising design options.

Unfortunately, we are a long ways away from finding funds to start on such a promising project. To get started, we need a strong fund-raising team. PK

Dreaming is essential to making things happen!

1st Issue of Space Quarterly Magazine Released

<http://spacerefpress.com/2011/09/first-issue-of-space-quarterly-magazine-released.html>

2 Editions: US, Canada – from SpaceRef.com

Free downloads – Editor's take: "Superb!"

Do check them out!





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Reclamation
Society, Inc.**

**P.O. Box 2102
Milwaukee
WI 53201**

www.lunar-reclamation.org

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

2011 LRS OFFICERS | BOARD* | Contact Information

PRES. / MMM Editor – *Peter Kokh NSS
kokhmmm@aol.com 414-342-0705

VICE-PRES. Doug Armstrong NSS 414-273-1126

SECRETARY – *James Schroeter NSS
James_Schroeter@excite.com ...414-333-3679

TREAS./ Database – *Robert Bialecki
bobriverwest@yahoo.com ... 414-372-9613

LRS News

- **Annual Summer Field Trip HAS BEEN CANCELLED -:**
 Saturday, August 13th to the Milwaukee Metropolitan
 Sewerage District for a tour of Jones Island facilities
 has been cancelled. There will be no tours other
 than Monday-Friday except for **Saturday, September
 24th**, for which reservations are not needed.

Our annual December Anniversary/Holiday Party
 – this year #25! - will be on Saturday December 10th :

- ✓ **A PIZZA POTLUCK:** this year everyone is
 requested to bring a 12" pizza (**non-rising crust,
 please!**) of whatever variety they wish – we will
 have at least 2 pizza ovens on hand, along with
 paper plates, etc. You may bring beverages also,
 as you like.
- ✓ **New Exhibits:** Peter's wish list includes a lunar
 settlement interior wall section made of steel studs
 clad with fiberglass-faced cementboard – painting
 experiments using simulated moon dust of various
 natural and steam-rusted shades in a sodium
 silicate medium – a 3-D model of a lava tube;
- ✓ Take-home materials as usual
- ✓ The Science-Fiction film "Paul" if DVD is out

LRS Upcoming Events

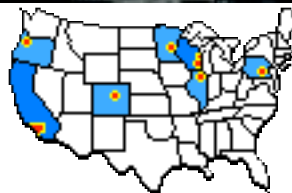
Next Meetings Saturdays: 1-4 pm

Sep. 10th - Oct. 15th – Nov. 12th – Dec. 10th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA:

- Outing to the MMSD's Jones Island Facilities, Sept. 24
- Update on new Exhibits to debut as Anniversary Party
- Update on our challenged Non-Profit Status
- Discussion of the usefulness of a Chapter 1-Day
 retreat to plan outreach and growth for the coming
 year. This has become an annual event for the San
 Diego chapter



**News & Events
of NSS
"MMM" Chapters**

Space Chapter HUB Website:

<http://nsschapters.org/hub/>

Feature Page: Project Menus Unlimited

<http://nsschapters.org/projects.htm>

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
September 17th, October 16th, November 20th

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/

MN SFS 2011 ñ Year in Review

<http://www.mnsfs.org/2011-Review/>

Schedule of upcoming MNSFS Meetings

Monday September 12th

Monday October 10th

Monday November 14th Board Elections meeting of
 MN SFS 31st Anniversary & Planning for 2012

Monday December 12th

ILLINOIS

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

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

WISCONSIN



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

c/o Will Foerster 920-894-2376 (h)

astrowill@tcei.com

SSS Sec. Harald Schenk hschenk@charter.net

>>> DUES: "SSS" c/o B. P. Knier

22608 County Line Rd, Elkhart Lake WI 53020

[\[http://www.tcei.com/ss/\]](http://www.tcei.com/ss/)

• We meet the 3rd Thurs even # months 7-9pm

At The Stoelting House in Kiel, WI • October 21st

Note: In December, in lieu of a meeting in Kiel, we will travel to Milwaukee on **Saturday, December 10th** to join the Lunar Reclamation Society for its annual Holiday Party and this year, its 25th anniversary. (see previous page for party details)c

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, December 9th

Englewood Public Library, Englewood, CO 80110
1000 Englewood Parkway, First Floor Civic Center

CALIFORNIA



San Diego Space Society

<http://sandiegospace.org/>

info@sandiegospace.org

Meeting the 2nd Sunday monthly

Next Meetings: Sept 11th - Oct. 9th

2:30 to 4:30 pm

Serra Mesa Branch Library 9005 Aero Dr, San Diego

CALIFORNIA



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

Events Hotline/Answering Machine:(310) 364-2290

Odyssey Ed: Kat Tanaka -

odyssey_editor@yahoo.com

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

oasis@oasis-nss.org

Odyssey Newsletter Online

<http://www.oasis-nss.org/articles.html>

Regular Meeting 3 pm 3rd Sat. each month

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

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

Sept. 17, 1 pm - OASIS Board Meeting, at the Home of Steve Bartlett and Tina Beychok,

7108 East Peabody, Long Beach, CA

Sept. 17, 3:30 pm - OASIS LECTURE SERIES -Cassini
Lecture by Trina Rey - Location TBD -

Oct. 7, 3:30 pm OASIS LECTURE SERIES - Not Just a Rocket Scientist - Location TBD

Nov. 19, 3pm - OASIS Board Meeting at Home of Steve Bartlett and Tina Beychok, 7108 East Peabody, Long Beach, CA 90808

Nov 25-27 - LAX Marriott - LOSCON 38

<http://www.loscon.org/38/>

"Where's My Flying Car?"

Come join is for this annual science fiction con.

Writer GoH: John DeChancie

Artist GoH: Aldo Spadoni

This year's theme is, of course, *SCIENCE*

Science GoH: Rick Searfoss, USAF Colonel, USAF Retired. Searfoss became an astronaut in July 1991.

He served as pilot on **STS-58 COLUMBIA** (October 18 to November 1, 1993) and **STS-76 ATLANTIS SHUTTLE-MIR SPACEHAB** mission (March 22-31, 1996), and was the mission commander on **STS-90 COLUMBIA Final SPACEHAB** mission (April 17, to May 3, 1998).

Searfoss retired from the Air Force and left NASA in 1998. (Prior to the ISS Era)

Dec 10, 3 pm OASIS Board Meeting,
Holiday Potluck to Follow - Home of Bob Gounley and Paula DeFosse, 1738 La Paz Road, Altadena, CA

"Destiny is not a matter of chance; but a matter of choice. It is not a thing to be waited for, it is a thing to be achieved." - William Jennings Bryant



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

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

- PASA regular business luncheon/formal meeting 1-3 pm, the 1st Saturday of every month unless otherwise noted, at the Liberty One food court on the second level, 16th and S. Market. Go toward the windows on the 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th St. Call Earl/Mitch 215-625-0670 to verify all meetings.

Next Meetings Saturday, Aug 13th, Sept ?, Oct ?

The PASA Report for August 2011

Meeting dates and location: Our next meeting will be on July ninth at the Liberty One Food Court, on the second level of the building. This will be from 1-3 pm.

Our new name and why we changed it:

The name of our chapter will now be **NSS Philadelphia Area Space Alliance**, or **NSS-PASA** *for short*. Our website information will be the same, as will our contacts etc. This is due to changes in some regulations on non-profit groups. Since we are one with limited financial transactions we can use this simple revision to conform to the new requirements (along with obtaining our own EIN number, as part of the requirements, which has been done).

This had to be done by a number of NSS chapters. We were part of a good-sized group that were being helped, by headquarters, to select which of three possible ways to get this done. Larry Ahern was the conference call facilitator, and, explained the choices and how NSS would work with us on this need. Thanks to the work of Michelle Baker, locally, we have put this together and informed headquarters that we can be reconfirmed as a new chapter.

Our next meeting is September tenth at our Liberty One location. Mitch will try to get us into the Market Street side of the food court, where the literary groups meet, for meetings. The noise in the old area is just too high. Later that month: I will be speaking at the PHACT Forum, on SETI, and Mitch is looking into another possible venue. World Space Week will be in early October. This is often a substitute for our regular meeting, we meet instead at The Franklin Institute while doing public outreach, and in November we may meet as usual or, as part of our outreach, meet at the Philcon Convention in Cherry Hill.

Mitch brought information from The Futurist, for Sep/Oct, starting on page two with "Space Junk

Detector" and going on to The Coming Robot Evolution Race (Steven Shaker) with neat pictures of a system that is evolving over time (via technology improvements).

And we have Ad Astras lead piece: "So You Want to go Into Space" on the Space Ambassador program. (Note: not the NASA-JPL Solar System Ambassador program). There are also articles on the Kepler mission ("Exploring Exoplanets" by Marc Kaufman) and "Been There, Never Done This" on what we have talked of doing, and, what we can do (and are actually doing). This by Bruce Pittman, President of the Silicon Valley Space Club, and Chair of the AIAA Commercial Space Group. And more interesting material.

Dorothy brought word on museum activities of local interest and several events in The Smithsonian Institutes space related programs, primarily at the Udvar Hazy Center in Virginia. September 10: "Living in Space", November 12: "The Moon and Beyond." Also: from the Maryland Science Center (Baltimore, Md.), lots of interesting stuff. Check the Space Link Center, in particular, for coming events.

Larry, our webmaster, has placed our meeting information on the first page. We have as many as 500 hits a month on our site now. He has also put the latest pictures on our site. In addition: he brought in information, and a Solar Weather table, one of his interests. The table was on past current and future (projected) activity of the sun's emissions over a thirty-year span. He will work on new business cards for us soon.

At the meeting Earl gave a brief report on material from Microwave Journal (July issue) on why some of the major radio telescopes are located on the Atacama Plateau (northern Chile) where the climate is very dry, and pollution levels are reduced. This results in a chance to receive faint radio signals in the millimeter and sub millimeter wave bands that are normally attenuated severely (in some cases) at lower altitudes. This was from a chart in *iThe 60 ghz Radio market and Technology* by Hans O Johansson of Sivers IMA. More material on this interesting radio spectrum, up through the far Infra Red bands appeared in NASA Tech Briefs for August (up to 670ghz) and, from the July 2011 Laser Focus World on Terra Hertz imaging (with an example of building sensors using a conventional semiconductor process starting on page 37).

Then we have, from Analog for October 2011: "Lost in Space? Follow the Money" by Edward M. Lerner. This is a rather extensive report on the many possible space activities that have been discussed, and, some of the small number that are moving forward now (tourism and Power Sats??). See the well-researched piece. And lastly, from the Amsat Journal: The Small Payload Rideshare Conference Report on what is required currently to put small satellites into orbit as discussed by a number of professionals involved in getting government and private launches done. On the human side is: Amateur Radio and Manned Space, with a history of hams doing contacts with various space expeditions as part of their public service mission. Nice pictures, including Ron Parise making contacts from the Shuttle (Columbia in the 1990s) and lots of children talking to the I.S.S. etc. Enough for now, Submitted by Earl Bennett.

Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.

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Elkhart Lake WI 53020