

“Towards an Earth-Moon Economy – Developing Off-Planet Resources”

Moon Miners’ Manifesto

& The Moon Society Journal

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#244

Special Space Tourism Issue

APRIL 2011



Above: Mir: 25 years after first launch, 10 years after junking it in the Pacific: “Legend or Lemon”?

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Agriculture and Teleoperated Factories may need less shielding Peter Kokh page 3

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Would’a, Could’a, Should’a – MIR Monument →

On March 21, 2001, the fabled Soviet/Russian MIR space station was deorbited to force RosCosmos to turn its undivided attention to the construction of a joint-sponsored International Space Station. One of the alternatives to deorbiting would have been to use the same engine to apply its thrust in the opposite direction, and boost Mir to a safe high parking orbit to serve as the world’s first space monument. Read page 62 of:

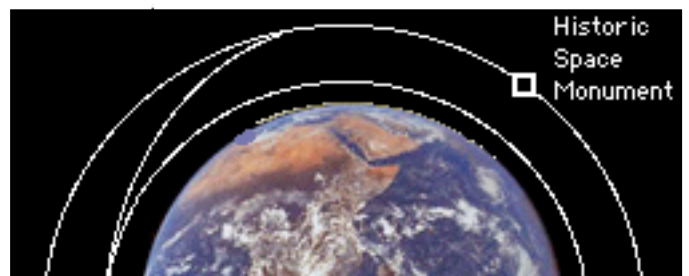
www.moonsociety.org/publications/mmm_themes/mmm_select_editorials.pdf

IN FOCUS The Achievements and Excitement of MIR Remain as a Legacy

MIR was a Soviet/Russian space station, in orbit from 1986 to 2001. Heavier than that any previous space station, *Mir* had a modular design, and was the largest satellite until its deorbit on March 21, 2001. For most of us, its highlight was the “Shuttle to Mir” Program.

http://en.wikipedia.org/wiki/Shuttle-Mir_Program

[=> 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:**
<http://www.moonsociety.org/publications/m3glossary.html>

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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. National Space Society, 1155 15th Street NW, Suite 500, Washington, DC 20005; Ph: (202) 429-1600 - www.NSS.org

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

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⇒ In Focus Editorial continued from p. 1.

Shuttle-to-Mir

During the "Shuttle to MIR" program, Russian cosmonauts arrived on the shuttle while an American astronaut flew aboard a Soyuz spacecraft to engage in long-duration expeditions aboard *Mir*. The plan allowed NASA to learn from Russian experience with long-duration spaceflight and to foster a spirit of cooperation between the two nations and their space agencies.

The first such mission started in 1994 and the project continued until 1998. Eleven Shuttle missions, a joint Soyuz flight and almost 1000 cumulative days in space for American astronauts occurred over seven long-duration expeditions.

We encourage all readers who have never seen the inspiring IMAX film "**Mission to Mir**" to purchase a VHS or DVD copy. It was a thrill to see a Russian cosmonaut "fly-swimming" (for want of a better word) through the *Mir* complex *as if he were born to do so*, and hear a succession of Russian folk songs while Shannon Lucid of Oklahoma played American country music! *Wonderful!*

Rag-tag glory

MIR was frequently put down by overly haughty American space enthusiasts as "a ragtag crude station held together by bubble gum and duck tape" etc. To us, *this was MIR's glory, and its hope:* proof that *millions* coupled with ingenuity could allow ordinary people to settle the space frontier without the *billions* that the NASA High Priesthood and its hand-in-glove contractors wanted all of us to believe was needed.

But then, as the Russians had agreed to partner with the US in building an international space station (we can thank Bill Clinton for convincing Congress that this was the only way to keep out-of-work Russian scientists out-of-mischief) NASA, to be sure that Russian attention was not divided, insisted that MIR be deorbited. Given that there were more constructive options, this bit of high-handedness will one day be seen as all but criminal.

A free-enterprise group put together by Eric Anderson and leaders from the Space Frontier Foundation had already given the Russians one-third down towards a purchase of *Mir* to be used as a commercial station. Buy or rent the video "Orphans of Apollo," to hear the story.

<http://www.orphansofapollo.com/>

Another option would have been using the rocket sent to deorbit *Mir*, to boost it to a safe higher parking orbit and declare it the First International Space Monument. Both of these options would have put *Mir* to further constructive use. Nothing was gained by deorbiting *Mir* other than childishly showing the world that NASA was "da boss."

I am sure that many people, and most NASA employees, do not see it this way. But if I were one of them, there would be no non-compliant rag like MMM!

We need to remember *Mir*. It is part of our lore, one small proud part of the long epic march of mankind "out of Africa" and someday "to the stars." We celebrate Yuri's night. **Perhaps we should also honor the death of Mir** - 3 weeks earlier in the calendar.

Yuri was a hero. *Mir* was a martyr if you will. May both be remembered forever as we gradually overcome our barriers in our drive to become the starfolk we were born to be.

PK

Humans need Shielding on Moon & Mars
But some food plants may not, and robotically operated factories may not. If so, the cost of settlement will drop significantly, as both agriculture and industry are acre-intensive

By Peter Kokh

Can we do agriculture in pressurized but unshielded places on the lunar surface? Perhaps! – Source:

<http://www.colonyworlds.com/2011/03/raising-radiation-resistant-planets-off-world.html>



Flax plants thriving in highly radioactive soil
Near the Chernobyl Nuclear Plant in the Ukraine

Lava tubes are useful, but

We have been putting high value on the discovery and use of intact lava tubes precisely because these voids totally reduce the need to erect shielding overburdens to protect human pioneers from the cosmic elements, of which cosmic rays and solar flares are most dangerous. But does that mean that outposts and settlements in areas of the Moon where lava tubes are not to be found must specialize in activities that are less area-intensive than industrial parks and agriculture? Not necessarily!

Agriculture, even in hydroponics setups, aimed at feeding a growing pioneer population, can take up a lot of space. If we use lunar regolith transformed* into good agricultural soil, to make it unnecessary to import those nutrients already in moon dust, we will need even more space. Providing the needed moon dust shielding could be a major construction burden, and cost. Of course, pioneers will not shrink from “doing what we have to do.”

*First sifting out the micro-powder portion to avoid the clogging of drainage systems, then heating the moon dust remaining to a point where a fraction is transformed into Zeolites good at storing nutrients, then adding in composted human and agricultural wastes

But whatever food-growth systems we use, a need to provide radiation protection could be a burden. Now there has always been some indication that the protection of seed stock is much more important than that of plants intended for human consumption. But now this new evidence from Chernobyl gives us some hope that many, if not most agricultural operations may not need a heavy moon dust overburden, and certainly not as thick an overburden as needed for humans.

However, we have to consider more than plants. What about the human workers tending to those crops? We learned from Biosphere II that agriculture takes an unsupportable amount of manpower if not highly automated. We need to reserve humans for other duties.

In addition to automated systems, robonauts, telepresence-operated from the safety of fully shielded operations centers, can take care of those cultivation chores not easily automated. So would this get us “home free” and “off the hook” for providing shielding for agricultural areas? Consider this aging piece of artwork.



In this scene, fruit pickers have zero protection from cosmic radiation. This has always been an absurd depiction. Replace the humans in this scene with robonauts. What now? There is still a problem. Shielding does more than provide radiation protection. It provides some thermal equilibrium inside the structure between high dayspan temperatures of 200°F and above and equally low nightspan dips to -200°F and below. So it seems there is a very essential need to provide some shielding over-burden even if radiation is not an issue. It's a matter of *thermal “insulation.”*

Now for humans on short stays, a couple of yards ~meters of moon dust is enough shielding for radiation protection, but we need to double that plus for those intending to stay years, if not lifetimes. But what about robotic-roboanaut-assisted agricultural and industrial operations? How much shielding do we need to maintain thermal equilibrium? I do not pretend to have any idea, but it may be significantly less than needed for radiation protection. By significantly less we mean an amount that makes a difference in financial feasibility. It would be helpful to know, and a series of relatively simple experiments may give us an idea.

We'd need a simulant to use in our experiments. This need not be a chemical or mineralogical simulant but a medium with very similar thermal absorption and retention properties as does moon dust, figures that we suppose NASA researchers have known for sometime. The ideal insulation level would be one in which in probable living conditions, negligible cooling would be required throughout the dayspan, and negligible heating required through the nightspan – both spans 14.75 24-hour days long. Or more practically put, at what amount of insulation does the cost of providing further shielding balance the cost of providing further heating and cooling.

Of course, the cost of power generation on the Moon would have to be factored in, and we can only guess at those figures as we have yet to determine the least massive and most efficient power generation and power storage methods of the many options proposed.

While we have not settled anything in this article, we have brought to attention a number of unknowns that we need to pin down before we return to the Moon. **PK**

Could the “Space Experience” Sector Open the Moon Faster, for Less?

Paying Working Tourists vs. Paid Astronauts?

By Peter Kokh

How we’ve done things up to now: who builds what

The cost of doing things in space is undeniably increased by the way hardware (rockets, for example) are contracted out with provisions that highly favor chosen contractors, by decisions motivated by political considerations of which state or Congressional District will be most benefited, and selection of winners prior to construction and competitive testing.

The switch to real competition between commercial companies should help to reduce costs and improve equipment by a substantial margin. The NASA-Contractor monopoly has had its chance and given us space transportation systems impossible to continue financing.

In the next few years we will see real competition between a variety of crew reentry vehicles and space planes. Some will be best for this use, others for that. And all will be significantly less expensive thanks to real competition.

Crews: the cost of training and support

The NASA Astronaut Corps is rightly held in very high esteem. There will always be some individuals with problems. That’s neither here nor there. But there has been significant criticism of the cost of the program.

An “excess of astronauts — and what they do with their non-flying time — costs the space program far more than money. Their influence throughout the agency contributes to a NASA culture that is artificially enthusiastic, overconfident, contemptuous of outside advice and excessively obedient to short-term goals (as defined by the pilots) — often at the price of sound engineering.”

www.usatoday.com/news/opinion/editorials/2003-07-30-oberg_x.htm

How much does such a system add to the cost of missions to the International Space Station? How much would it have added to now-cancelled Moon Missions? *We don’t pretend to know.*

But if we are going to switch to commercial providers of hardware, how about also switching to commercial suppliers of trained astronaut crews? We need both, commercial equipment and commercial crews to break out of the amazingly non-American paradigm of “socialized space,” which, as much as we are all proud of NASA, is what it is has been, *from day one.*

Beyond Commercial Crews

Providers of commercial crews must factor the cost of personnel training, and attrition into the price for their service. While this cost could prove to be a fraction of what it costs NASA to train astronauts and to maintain an oversized astronaut corps, it would seem that there is a way to do even better, in fact,

a way to zero out the cost of crew training and support, so that the cost of a mission reflects only the cost of purchasing competitive space transport systems, and tools and equipment that crews will need.

Zeroing out Crew Training and Service Costs

We are all now familiar with the “Space Tourism Industry.” It began with Space Adventures arranging to bring Dennis Tito to the International Space Station. “Tito

joined Soyuz TM-32 on April 28, 2001, spending 7 days, 22 hours, 4 minutes in space and orbiting Earth 128 times.[8] Tito performed several scientific experiments in orbit that he said would be useful for his company and business. Tito paid a reported \$20 million for his trip.”

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

Tito paid for his training as part of the price for his ticket, and also was required to make himself useful while onboard ISS, and all space “tourists” to ISS since have done likewise.

The “Space Experience Industry”

Right now, we are approaching the dawn of commercial flights to the edge of space. Perhaps it is time to junk the term “Space Tourism” in favor of “Space Experience.” The future of the Space Experience Industry seems to us unlimited. Thanks to John Spencer, the president of The Space Tourism Society, for this term!

Now in the near future where the focus will first be on prolonged zero-g flights to the edge of space, then orbital flights, finally commercial space hotels and resorts, we will be talking primarily about people on “the vacation of a lifetime.” They will do this to enjoy, not to work! Yet crews and staff catering to their needs will also benefit. While flight crews will most certainly be paid as these will be steady occupations, some “staff” – for space hotels, for example – could be paying volunteers, paying a bit less than tourists, for the privilege of staying in space longer, in trade for working assignments.

The pay-to-work Paradigm already exists

For some time now, individuals have volunteered, and some even paid, for the privilege of participating in archeological and paleontological “digs.” Something quite similar is common on “Windjammer Cruises” where tourist crews man the sails and do other jobs – everyone works, and they do so with enthusiasm for the privilege of a vacation experience otherwise out of reach.

Paying to work in Space

Now most of us need to “get paid” for work, and are hardly in a position to “pay for the privilege of working.” But make no mistake. Those who pay to work do get paid! *Their pay is an unforgettable experience!* Yes, of course, this is an option available only to those with enough income or resources to pay for the privilege. That this is not an option open to most of us is quite irrelevant. The point is that there is a population class growing in size that has begun fueling a “pay-to-work” sector of the economy that is growing year by year.

Fast forward a bit: we foresee the emergence of commercial companies that supply personnel who have paid for their own training, and who are ready to pay for the privilege of using that training on actual assignments – in space. Some will staff budget space hotels and resorts. And beyond that?

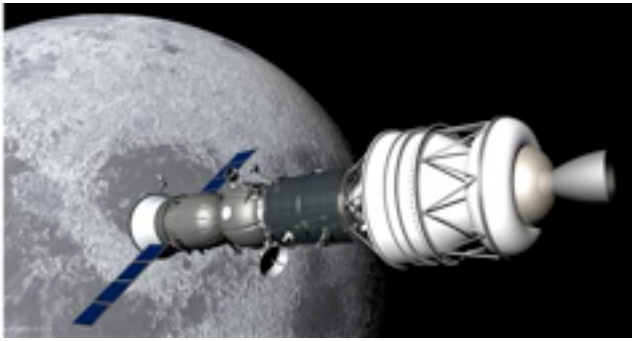
Space Adventures’ 1st Private Moon Expedition

“Make history as the world’s first private lunar explorer.

“Witness Earth rise as you emerge from the far side of the moon.

“Become a catalyst for humankind’s expansion into space.”

“Space Adventures invites you to join us for the most significant private expedition of our time – launching the first private mission to circumnavigate the moon.”



Space Adventures, working with Russian providers of the vehicle and service module needed, have already signed up one of the two tourists, who, with a Russian astronaut pilot, will make the first commercial Apollo 13 type loop-the-Moon trip. (Apollo 8 made several orbits about the Moon before returning.) A second customer is said to be ready to sign. **Watch this Space Adventures Video:**

http://www.spaceadventures.com/videos/LunarMission_no_ZG_msg_300kpbs_480x270.mov

This flight could occur within the next to years, and will be the first presence of humans near the Moon in forty years, many years before *any* national space agency.

What next for the Space Experience Industry?

Once this flight is history, or perhaps even before out of anticipation, there will be a growing interest and demand among “experience-seekers” willing to pay the price for lunar landing excursions. Now there will be no on site facilities to cater to them. So what would be the cheapest way to provide such facilities? You got it! The ideal site for an ever-growing tourist complex having been identified in advance, the first paying experience seekers will plot out the site, photograph the site in detail and do additional investigation to supply architects on Earth with the information they need to draw up plans for the first structures, and a game plan for additional expansion. Perhaps this first crew could also leave a robonaut behind to be telepresence-operated by persons back on Earth to continue making site improvements in advance of the arrival of a second private crew again paying not only for their own training, but for the privilege of working on arrival at the selected site.

For an ideal site location idea, read “An ‘All-in-One’ Moon Resort” pp. 82-85, **MMM Classic Themes - Lunar Tourism**, a free download at:

http://www.moonsociety.org/publications/mmm_themes/mmt_tourism.pdf

Because “pay for the experience” tourists will be taking on serious work assignments, and have even paid for the training to allow them to do so, their tickets to the Moon (resort) will be cheaper than those of purely passive tourists. Those willing and able will pay-to-prepare, pay-to-build, pay-to-explore, pay-to-prospect, and pay-to-deliver services.

Yes, these people will come from the wealthy, as few of the rest of us will be able to compete for these positions. But the point is that in this manner, lunar surface facilities including not just tourist resorts but science outposts, even initial factories, will get built sooner and at far less taxpayer expense (translate that to freedom from political veto power).

As we have suggested, pay-for-experience tourists will be accompanied by and work with robonauts

who will do the boring, repetitive, and dangerous tasks. They need no life support, no rest or recreation, and no need to return to Earth. They also require less room aboard the craft that bring pay-to-work tourists to the Moon. Thus robonauts promise to greatly multiply the cost-effectiveness of this approach, and bring down all costs even more. So we can add to the “pay-to” list, pay to teleoperate, and pay to maintain equipment.

This scheme can serve to expand science on the Moon as well as tourism. “Pay-to” personnel can also go to the Moon for the privilege of collecting specimens, of prospecting, and doing all sorts of scientific research. They can also pay for the privilege of testing equipment to turn moon dust into usable materials - “ISRU” - “in situ” [on location for those of you not familiar with Latin] resource utilization. Thus people may “pay-to” develop building materials with which to expand habitat and outpost complexes with far less “upports” from Earth.

We do not pretend that this scenario is certain to develop. The World Economy is too near implosion, and that could put off all plans, commercial as well as tax-supported inefficient government programs.

Wikipedia “**Extreme tourism or shock tourism** is a type of niche tourism involving travel to dangerous places (mountains, jungles, deserts, caves, etc.) or participation in dangerous events. Extreme tourism overlaps with extreme sport. The two share the main attraction, “adrenaline rush” caused by an element of risk,”

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

Yes, there will be space tourists in the traditional sense who want to just enjoy and sightsee and they will pay even more to go into space. But here we talk about those who will pave the way and create places for others to visit. Here we talk about space tourists willing to pay for own training, pay their own insurance etc.; who pay (rather than get paid) for work and assignments.

How do we cover cost of equipment, vehicles, etc.? A first answer would be the commercial companies and consortia who want to operate lunar resorts, and deploy factories on the Moon, mining operations etc. Keep in mind that this is an introductory article aimed at getting further brainstorming in high gear. We offer this article as a contribution to a **Commercial Model for settling the Moon**.

Addenda: Opening the Moon to the less-well-to-do

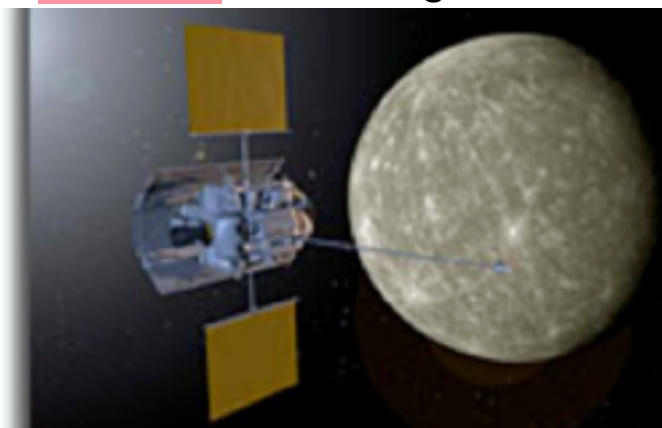
The overwhelming majority of us would never have the resources to participate in such a scenario. But there could be **lotteries**, with drawings to be held when the combined entry fees exceed the costs to be covered. Winners who did not pass medical and other tests, could sell their rights to the highest bidder. But there could also be limits on those who could enter, to minimize such situations.

When Weight is an Issue

One thing we have not discussed is the simple hard fact that transporting anywhere in space those who are bigger and heavier goes up in proportion. Should otherwise capable midgets, dwarfs, and just smaller individuals pay less? For passage perhaps, but maybe not for training.

We hope you enjoyed this article and that it sets off a chain of constructive brainstorming. **See you on the Moon! (I wish!)** PK

MERCURY - A Coming Attraction



MESSENGER (MErcury Surface, Space ENvironment, GEOchemistry, and Ranging) enters orbit about Mercury on March 17th. Science Mission begins April 4th

By Bryce Johnson

We are about to add another planet to the short list of potential New Worlds for human habitation. Much of the planning being done today for lunar bases is founded on data gathered by the Lunar Reconnaissance Orbiter. That mission gave us a global picture of the Moon's composition. With it we are able to strategically plan lunar exploration and settlement using real-world facts, not just wishful thinking. The Messenger mission to Mercury has a similar role. Over the next year, data gathered by Messenger will educate us about Mercury's surface chemistry to a level far surpassing what we knew about the Moon prior to the Apollo landings. Aside from the Moon and Mars, Mercury will be the only other planet for which we have so much knowledge.

Messenger is already an unqualified success. The spacecraft has photographed the Earth and the Moon, flown by Venus twice and Mercury three times. The three Mercury flybys have revealed details about Mercury's atmosphere; the presence of relatively recent volcanic vents; higher than expected abundances of Titanium and Iron in Mercury's regolith; the presence of a molten outer core and a much better understanding of Mercury's weak, but persistent, magnetic field; all that in less than a week's worth of combined encounter observations.

The orbital mission is expected to last a year and the spacecraft is healthier than expected. In particular its existing fuel reserves are about 40% of what they were when the spacecraft left Earth. This is better than expected and is owed to the incredible accuracy with which Messenger has hit its planned targets during its long flight. The targeting has been so accurate that 21 of 38 originally planned Trajectory Correction Maneuvers (TCMs) were cancelled as unnecessary.

A possible result of this efficiency is that Messenger may have enough propellant on board after its planned mission to support an extended mission of at least 90 days – an entire Mercury year. This has yet to be suggested by the science team, however. The science data likely to come from the orbital mission is planned to dwarf the data already in hand from the flybys. It will take a year to shake out firm conclusions about Mercury's history and present phenomena. However, as a foundation for human development, what is in hand to date portrays Mercury as a potent venue for industrial scale resource development.

“Understanding Mercury is fundamental to understanding terrestrial planet evolution.”

For starters, Mercury is evidently the most Titanium-rich planet in the Solar System. According to one report from the University of Arizona, there are at least three locations on Mercury's surface where Titanium concentrations exceed 25% of the regolith bulk material. Most of this is contained in oxides of Titanium, such as rutile or mineral garnet. In one particular region west of the Caloris Basin, rutile concentrations of up to 37% were derived from both mid-infrared telescopic observations and data from the second Messenger flyby. Pure rutile is 60% Titanium by weight. This would imply that a metric tonne of regolith in this region would contain as much as 222 kg of actual Titanium metal. For other regions of Mercury, rutile seems to have roughly the same compositional role as ilmenite does on the Moon. Ilmenite has also been suggested in noticeable quantities elsewhere on Mercury. This was initially evidenced by spectrographic observations made shortly before the probe's launch.

Iron in Mercury's regolith was previously thought to be in concentrations limited to no more than 3% iron-oxide. Messenger data now indicates concentrations may be more like those in “high titanium/high-iron” lunar mare basalts, such as those collected by Luna 16 (15.1% iron) and Apollo 11 (15.45%). Actual iron oxide (FeO) abundances on Mercury may be between 7 and 10 percent.

Mercury's iron is apparently distributed differently. Rather than average amounts mixed more or less evenly through the regolith, Mercury's surface iron appears to be in the form of ‘blebs’ or tiny bits of iron situated inside basaltic rocks much like tiny bubbles of air might be seen frozen into an ice cube. This could explain the seeming conflict between the historical observations indicating low iron content in the regolith and Messenger's data. As with so many similar mysteries, the orbital phase of the mission should provide some conclusive answers.

Generally, Mercury's surface mineralogy includes magnesium-rich orthopyroxenes and olivines (the latter curiously low in concentration inside the Caloris basin); clinopyroxenes rich in calcium, magnesium and sodium; potassium feldspars and sodium-bearing feldspars. Both calcium- and sodium-rich garnets, such as pyrope and grossular, are also apparently present in insignificant quantities. Actual percentage abundances have yet to be confirmed and will require consistent data from a number of robots by Messenger to be characterized with certainty.

Messenger's second flyby also revealed the astonishing presence of water in Mercury's atmosphere. The word “water” is something of a misnomer here as what Messenger actually discovered were hydroxyls – various molecules that include the (OH) hydroxyl radical, minerals which may have formed in the presence of water. The particular instrument that revealed the presence of hydroxyls was the Fast-Imaging Plasma Spectrometer (FIPS) that measures energetic ions. Water or hydroxyls are detected by first collecting energetic ions in Mercury's atmosphere, then determining a ratio of their mass to their charge.

What the FIPS instrument discovered were ‘free radical’ ions corresponding to molecular weights of 16 and 18. Oxygen has an atomic weight of 16 while water molecules have molecular weights of 18. No plausible elemental combination has been envisioned for these

particular readings, leading the Messenger science team to conclude that there must be a source of water molecules on Mercury itself. The abundance of the hydroxyls is roughly one for every three or four sodium ions in Mercury's atmosphere. This is likely to be more than can be reasonably expected from solar wind deposition alone. Getting more definitive data for the presence of water is a high priority for the orbital phase of the mission.

Messenger's orbit over Mercury will start out with a highly elliptical near-polar orbit with a perihelion [near Mercury] distance of 200 kilometers and aphelion [away from Mercury] of about 15,000 kilometers. It will be oriented more or less over the terminator with about six degree inclination referenced to it. In other words, the orbit will be inclined to Mercury's equator by about 82 degrees. This will bring it over both of Mercury's poles and it should allow confirmation of any polar ice deposits, if they exist. The low point of Mercury's orbit corresponds to a point on Mercury's surface centered at about 60° north longitude. Messenger will be in constant sunlight while not having to be too severely heated by sunlight reflected from Mercury's surface. The same orbit strategy might be followed by early manned missions to Mercury as well, particularly if a polar site is chosen for the initial base.

Physical features on Mercury include an astonishing system of over 200 "graben", or trench faults, radiating from the crater Apollodorus located inside the Caloris Basin. There are similar features of this type elsewhere in the solar system. Scarp formations have been identified all over the planet and the overall picture is that Mercury at one time went through a period when the planet's crust uniformly shrank.

To date no lavatubes have been identified, but that is not surprising as they are subsurface features sometimes betrayed by local "skylight" collapses on very high resolution photographs. Mercury's gravity is similar to that of larger but less dense Mars - 3/8th G. So lavatubes on this planet like those on Mars are expected to be of intermediate size between smaller ones found on Earth and much vaster ones found on the Moon. Mercury has extensive areas covered with lava sheets so it would be surprising if we did not find equally extensive tube networks in time.

Taken as a whole, Mercury is a planet with all the energy and resources needed to economically construct advanced facilities; sustain agriculture and comfortable, large-scale habitats; support large-scale space transportation systems; conduct valuable solar, planetary and stellar science programs and, eventually support numerous industries.

Mercury's solar flux is perhaps its single greatest asset, averaging 8.2 times the solar flux at Earth's distance. This flux generates temperatures on Mercury's equator over 700° Kelvin, 427° C, 800°F. It would be easy to focus this energy to process metals out of the regolith (surface rock powder blanket.) Surplus energy combined with the presence of workable resources generally results in export-scale productivity. In Mercury's case, even relatively low-grade oxides can be worked economically due to the super-abundance of energy available. What is then needed is an economical transportation system that can transfer substantial masses of product to consumers.

The high velocity requirements for trips between Earth and Mercury do not favor 'high-impulse' transpor-

tation systems such as LOX.LH2 rockets, at least for very large payloads. However, solar sails are capable of delivering hundred-tonne payloads to Mercury from Earth. Sails starting from Mercury can deliver payloads to any planet in the solar system with flights departing every 116 days to Earth 145 days to Venus, 101 days to Mars and just over 8 days to just about everywhere else. The time of flight for solar sail missions is a function of the area and mass of the sail and the mass of the payload. Typical solar sail missions usually involve spiraling orbits around the Sun requiring trip times that can be several times longer than classic Hohmann transfers. This is why solar sails are often relegated by some writers to unmanned cargo service.

In truth, solar sails can be considered for manned flights from Mercury if it is assumed the manned payload has its own propulsive system and the sail itself is left on a high velocity, flyby trajectory past the target planet. Since solar sails require no in-space servicing, repair or refueling and since they can, in all likelihood, be used for several flights, they do not have the recurring cost issues that plague all other reusable, high performance technologies. As a result, in net terms, Mercury can produce anything made with the metals and alloys commonly used in industry today. Silicates and silicate composite materials are also possible. Cast metal items are bound to be common products.

Glass is a much better bet on Mercury than on the Moon, owing to the greater abundances of the additives used for special properties. For example, high quality optical glass requires 318 parts of pure silicon, 125 of potassium, 56 of zinc, 37 of sodium, and 9 of boron per 1000 parts of product, the remaining 545 parts being oxygen. With the probable exception of boron and zinc - together just 6% of the total - all the rest is available in Mercury's surface material. Since boron and zinc are likely available on Mars, there is potential for coordinated trade. The high grade optical glass produced would be available for construction of truly large mirrors used in telescopes that would easily have several times the size and power of the Hubble ST. And Mercury's 88-day-long nightspan makes it an ideal platform for astronomy of all.

Volatiles are still a major unknown. Hydrogen has been detected by Messenger in Mercury's atmosphere. Surface resources of hydrogen are another matter. The quantity of free hydrogen has been estimated at around 200 atoms per cubic centimeter but this predates Messenger and it is not clear that this is an estimate for the surface or at orbital altitudes. This does not sound like much, but it is way more than can readily be explained by solar wind implantation alone given the high temperatures of Mercury's surface. Evidence has accumulated for water ice deposits in shadowed craters near both poles. Whether this ice contains any other volatiles remains to be determined. However, Mercury does have a resource of carbon, hydrogen, nitrogen and chlorine available; Venus' atmosphere.

In an industrial development scenario, there is incentive for cislunar facilities to tap Venus' atmospheric resources preferentially to Mars'. Venus does have a light mission energy advantage, over seven times the solar flux, a slightly more frequent launch window frequency to Earth when compared to Mars. The problem is that with the notable exception of high solar flux, the advantages enjoyed by Venus over Mars are usually less than a factor

of 1. This means that, from the point of view of real costs of access and develop either planet, there is not enough difference between the two to ignore the inaccessibility of Venus' surface.

Mercury, on the other hand, has every incentive to access Venus' atmosphere and would probably not need any materials from Venus' surface. Flight opportunities between Mercury and Venus are six times more frequent than from either Earth or Mars to Venus. Solar sails are still quite efficient as mass transporters from Venus and some sail materials can actually be produced from Venus' atmospheric carbon.

Venus' atmosphere can also slow down an inbound spacecraft even at the velocities characteristic of Mercury-Venus transfers. The net effect is that a routine transfer of materials between Mercury and Venus can be an economically competitive option. An ongoing combination of Mercury's resources and energy abundance combined with Venus' atmospheric resources and energy abundance would have massive implications for progressive exploration and settlement in the Solar System.

Colonization of Mercury rests on the need for a variety of bulk materials, manufactured products and operational characteristics represented by Mercury's unique environmental attributes or its location in the Solar System. Other planets have 'hard' vacuum available on a scale equal to Mercury's. Other planets have high heat of day available; ditto intense cold at night. But no other planet outside of Earth-Moon space contains them all simultaneously. As solar sails become a proven transportation technology, accessing Mercury will become a much easier proposition than is now the case with chemical propulsion.

Mercury is not without dangers. Writers go out of their way to point out how hot it gets on Mercury's surface at noon. What is never mentioned is just why anyone would want to be out on the surface at that time. Science fiction scenarios aside, Mercury's surface does not become deadly hot the second the Sun pops up over the horizon. Since Mercury rotates so slowly compared to the Moon, it actually takes about six weeks before the Sun is high enough above the horizon to raise temperatures to the boiling point of water.

Structures on Mercury do need to be protected from extremes of temperature, ionizing radiation, and micro-meteorites. These are all issues for bases on the Moon as well. Superficially, the only real difference between the two might be the greater thickness of regolith shielding needed by the Mercury facility. Suitably protected, the same technology used to build bases on the Moon can be directly applied to Mercury.

Looking downrange, Mercury can leverage much more rapid development of Mars and serve as a hub for development of the asteroids and outer planets. It can be successfully developed even if more potent transportation technologies, namely nuclear based are not developed right away. It can provide unique and advantageous assets to science and industry.

The research goes on. For now, the nail-biting phase of the Messenger mission no longer preoccupies the work of our ad hoc committee. We are now monitoring the Messenger data return and will be able to answer, more authoritatively, all of the issues raised here, plus a host of others, before many more months. **BJ**

- Bryce is a Moon Society Director from Rockford, IL

MESSENGER LINKS:

- http://messenger.jhuapl.edu/mer_orbit.html
- http://messenger.jhuapl.edu/news_room/Mercury_PK_Web.pdf

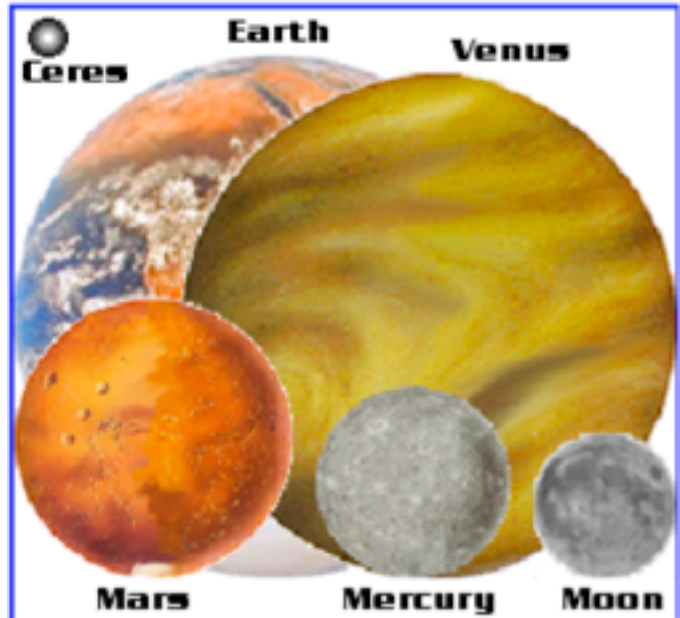
Previous MMM Articles on Mercury

MMM #78 Sept 1994
 MERCURY: the other terrestrial planet, M. Thomas
 DYSON CAPS: ultimate solar power station, M. Thomas
 GATEWAY GRAND CENTRAL: Mercury, P. Kokh
 Preserved in MMM Classic #8 pp. 37-39

MMM #204 Apr 2007
 Three Myths about Mercury, Bryce Johnson
 Preserved in MMM Classic #21 pp 23-26

MMM #205 May 2007
 Mercury Frontier Speculations, P. Kokh
 Preserved in MMM Classic #21 page 27

Download MMM Classics issues free from
www.moonsociety.org/publications/mmm_classics/

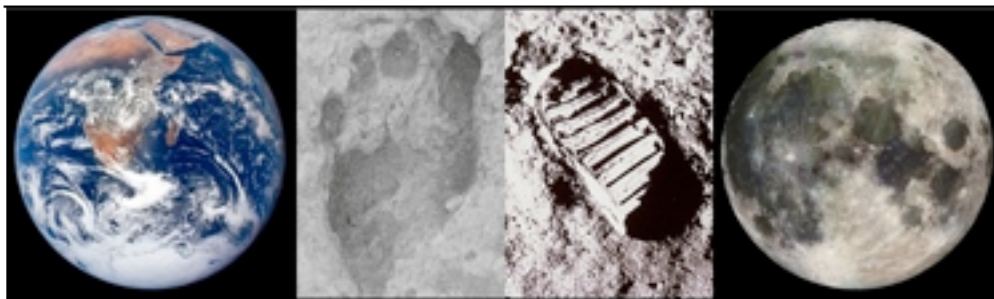


How does Mercury Stack Up?

M	Merc	Venus	Earth	Moon	Mars
Mass 1024kg	0.33	4.87	5.97	0.07	0.642
Diameter km	4879	12104	12756	3475	6794
Density kg/m3	5427	5243	5515	330	3933
Gravity m/s2	3.7	8.9	9.8	1.6	3.7
Escape Vel km/s	4.3	10.4	11.2	2.4	5
Day hours long	4222	2802	24	708.7	24.7
Sun Dist10(6)km	57.9	108.2	149.6	0.384*	227.9
Insolation avg	6.68	1.91	1	1	0.43
Orb. Period days	88	224.7	365.	7.3	68.7
Orbit Speed km/s 4	7.9	35	29.	8.1	24.1
Orbit Inclined	7°	3.4°	0°	5.1°	1.9
Orbit Eccentric	0.205	0.007	0.017	0.055	0.094
Axis Tilt	0.01°	177.4°	23.5°	6.7°	25.2°
Mean Temp °C	167	464	15	20	-65
ATM Pressure bars	0	92	1	0	0.01
Number of Moons	0	0	1	0	2
Magnetic Field?	Yes	No	Yes	No	No

Mercury trivia: Mercury's day, noon to noon, is 176 Earth days long. One need travel only 3.75 kph or 2.33 mph to keep up with the advancing sunrise or sunset, at the equator. **MMM**

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

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

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

Where , as a Space Tourist, would you like to go? And why?



Announcing a new Moon Society Essay Contest

Obviously, many readers will pick the Moon. But some of our readers may also be Mars fans, or interested in other destinations altogether. For this contest, lets rule out destinations beyond our home Solar System.

Give us an itinerary: where you would like to visit, what you would like to do there, what memories you would like to bring home. What kinds of souvenirs would you want to pick up. Would you be going alone? With a tourist group? Would you pick a "routine" tour, of something "off the beaten path?"

Would you consider a "working tour group?" That is, to defray costs, would you accept shipboard chores? How about field work? On Earth, working tours such as archeological and paleontological "digs" are becoming increasingly popular. Some tours may have exploration and/or prospecting goals.

How long would you be willing to be away from Earth, from friends, family, your job?

How much would you spend on a lottery ticket for a free tourist experience of the type you are describing?

Where would such a tour rank in your personal "pipe dream" list? In your "bucket list"?

This essay contest is open to members, former members, visitors, and in short to anyone who hears about it, anywhere in the world.

Contest Specifics

- **Submission deadline: May 1, 2010**
- **Word limit: 1,000 words**
- **Submission form: electronic only** (.doc, .rtf plain text, .html web page, .pdf file -- if your mail program allows, you may also copy the unformatted text of your entry into the body of the email message.) Double-spacing is not necessary.

Space Tourism Essay Contest, continued

- Submission address: secretary@moonsociety.org
- Submission deadline: July 1, 2011
- Include a "code name":
 - ✓ Please pick a code name and put that name with no other contact information *in your entry*.
 - ✓ Put your name and full contact information *in the accompanying email*.
 - ✓ The Editor will compile a list matching code names to real names, which will not be distributed to anyone. This ensures judge neutrality in the event that a judge might recognize the name of an entrant and be influenced favorably or unfavorably by that. Given the code names on entries picked by the judges, the MMM Editor will notify the winners, the Moon Society webmaster by email.

Prizes are modest: new/renewed Society memberships.

- **1st Prize:** 3-year renewal, or 3 year new Moon Society membership – a \$105 value
- **2nd Prize:** 1-year renewal or 1 year new Moon Society membership – a \$35 value
- **3rd Prize:** offered by the Lunar Reclamation Society, publishers of Moon Miners' Manifesto: a hardcopy subscription to MMM* – a \$15 value

*Conditions. This 3rd prize is available to only to those who are not members of the Moon Society. If the 3rd contest winner, as picked by our panel of judges is a member, he/she must assign this subscription as a gift to a non-member or to a Library of his/her choosing.

All three prize winning entries will be published

- in Moon Miners' Manifesto
- on the Moon Society website
- The **top three plus runner-ups** will be published in a special edition of our science-fiction (pdf file) magazine, *Moonbeams*, with pictures and illustrations. This issue will be a keepsake for winners!

Judges:

- **Marianne Dyson:** Noted author and Editor
<http://www.mariannedyson.com/>
- **Chuck Leshner:** Editor of Moonbeams
<http://www.moonsociety.org/publications/ficton>
<http://charleslesher.com/index.php/about-joomla>
- **Third judge to be announced**

Announcements

Awards will be announced on July 15, 2011.

Address any questions about the Contest or its details to president@moonssociety.org

You will find all of the above online at:

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

Do spread the word about this Essay Contest!

The more people who know about the contest and decide to enter, the better the results. And perhaps some of them will join the Society, and choose to contribute in other ways as well.

For chapter leaders, your efforts to publicize our Essay Contest may help you find new chapter members, and gain local publicity.

MMM could gain new regular contributors!

Nominees for Moon Society Officer and Board Positions *still needed*

Even if all incumbents whose positions are up for election this year choose to run for re-election, we will still be short one candidate for **Secretary**, and now the 2nd year of the office of **President** is open – see above

Often enough, we are fortunate to have one candidate per position. Now if we had more than that, there would be one or more real contests, and that would make this annual exercise much more interesting to our members! All positions are for two-year terms, except for filling remaining one year periods of a vacated position.

Eligibility: Anyone who has been a member of the Society for a full year as of August 1, 2010 is eligible to run for a board seat or officer position. This covers all members with a membership number of 1568 or lower are eligible for election. If you are unsure of your eligibility, and have a Moon Society username and password, you can check your membership # at:

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

Our meetings are held in a private and dedicated chat room (in the **ASI-MOO** environment. If you have never been "on the MOO" go to our homepage, scroll down the left hand menu to the ASI-MOO image link. Scoll down the page until you see:

Java MOO client: **Framed Popup**

For newcomers, we suggest the Popup option. You will get a Java screen showing a steaming cup of coffee, a symbol of waiting. When the screen comes on, below the line at the bottom enter **connect** (then your particular) **username** (then) **password** (without quotation marks or commas, just spaces) and click **enter**. This will get you into "The Commons." If you want to see what our meetings are like, let us know so we can arrange access. To get to the meeting room from the commons, type **north** (enter, then) **moon-leaders** (enter) and you will be in our special meeting room (if access is pre-arranged.)

Recommendations: (1) Anyone who is unable to attend our meetings on a regular basis should not run for office. The Management Committee (officers and directors meeting together) meets the 1st and 3rd Wednesday evenings of each month, 9–11 pm Eastern, 8–10 pm Central, 7–9 pm Mountain, 6–8 pm Pacific. Times will be earlier in Hawaii and Alaska, Times in the Eastern Hemisphere will be on the following Thursday: wee morning hours in Europe, morning in India, and early afternoon in Australia.

Recommendations: (2) Anyone who has not previously served in a Moon Society leadership capacity and who wishes to run, is encouraged to join us in our meetings **now**, so that you will be up to speed by election day. To gain access to the Management Committee meetings, please send an email to president@moonsociety.org so that access (restricted) can be granted.

Nothing ventured, nothing gained: If you believe you have talents and or knowledge and understanding or vision that you would like to put at the disposal of the Society, we will welcome you. Our discussions are free-ranging. While we do vote on motions, in general our decisions almost always reflect consensus. Even if as a visitor, you cannot yet vote, your input is valued, and helps us reach a consensus. president@moonsociety.org

Peter Kokh to Retire as TMS President

August 1, 2011, one year before current term ends

To all members:

I have enjoyed immensely serving the Society as its President since August 1, 2004 – seven busy years. Since being elected, I have done my best to expand the Society's membership, the scope of our projects and publications, our chapters and outposts, our affiliations with other organizations such as the National Space Society and American Lunar Society, and expanded our web site as well as our international presence.

But I have had many disappointments as well, including promising projects that did not fully develop.

At the same time, I have continued to produce **Moon Miners' Manifesto**, which will complete its first 25 years of continuous publication with #250, November 2011 issue. I have every intention of continuing with MMM as long as I am able. *Without MMM I'd be lost!*

But one goal has eluded me, however. For more than twenty years, people have asked when I am going to publish "MMM, the Book." As of now, the proposed title will be "**A Pioneer's Guide to the Moon**". But I can't begin to start on this project until I have shed some duties.

I will not be disappearing! I hope to remain active in the Society in many ways.

- I will continue to put out Moon Miners' Manifesto and other Society publications, *But assistant Editors are most welcome!* This is important to ensure continuation of MMM should I at some time be unable to continue for health or other reasons.
- I will also continue to be interested in Society projects and in expanding out affiliations.

I am announcing my candidacy for **Secretary**, a position that has been open for some time. So I will remain involved in the life of the Society *at the pleasure of whomever you elect as our new president.*

This is an opportunity for younger people with great dreams and ambitions to come forward. *Nominations are now open to fill the second year of my current term.* Our small Society is blessed with much talent! **PK**

Moonbeams to begin paying for Fiction

<http://www.moonsociety.org/publications/fiction/>

The Moon Society's electronic (free download PDF file) Science Fiction journal, launched in November 2008, and with 7 issues under its belt, is "upgrading."

Moonbeams is "a short story journal focused on stories about the Moon and High Frontier." Issues come out when the editor, Chuck Leshner, receives enough content. *Leshner will now begin paying \$10 for each accepted piece.* This is a modest amount, but appropriate given the present free circulation. "\$10 per story is not much but it gets us in the game. We could even let the authors have the option of donating their \$10 to the Moon Society."

Moonbeams will also begin carrying some Moon Society News, and links to other Moon Society publications such as **Moon Miners' Manifesto**, **MMM-India Quarterly**, and our new quasi-monthly formatted email newsletter **Moonscapes**.

April is for Yuri's Night & EarthDay Opportunities for Chapter Outreach

By Peter Kokh

Let's begin with an apology. This is an article that should have been run last month, if not earlier. Those of you who get MMM as hardcopy will be reading this after Yuri's Night, always on April 12th, has passed. And this one will have been special, the 50th anniversary of the first human spaceflight, a one-orbit venture by Yuri Gagarin in 1961. But perhaps it is not too early to begin planning for next year's annual event.

It is also too late to plan an Earth Day event, but again, not too early to begin planning for next year! But what can a chapter do.

Yuri's Night

My chapter, the Lunar Reclamation Society (NSS-Milwaukee) has looked at putting on an outreach event only once, in the early days of Meet-Up when use of this online tool was still free: <http://www.meetup.com/> But even with the help of Meet-up, we failed to find a single person outside the chapter who was interested.

The Minnesota Space Frontier Society chapter in the Twin Cities puts on an annual party, but as a rule, only chapter regulars attend, and that is not the purpose! This year, Moon Society Phoenix is making an ambitious effort, with Mike Mackowski planning an all-day affair with speakers and displays. We look forward to a report on this effort, and if successful, it may be a model other chapters can follow. ***Read MSPx plans at right!***

Earth Day

The Lunar Reclamation Society put on a very ambitious program back in 1990, Earthday's 20th anniversary. It was our own Wisconsin Senator and former Governor Gaylord Nelson who founded the event. And we were part of a much larger citywide grass roots effort that year which involved many organizations, exhibits, and a parade. No similar opportunity has come our way in the years since. But that should not have been an excuse for not trying something on our own!

You will find ideas on how to celebrate Earth Day on the Moon Society website on the Outreach Events Calendar page (Main Menu link) at:

<http://nsschapters.org/hub/events.htm#enviro>

There may be some of you who feel (in error, we think) that space enthusiasts and environmentalists must remain enemies and have no common ground. This is an unproductive attitude that gets none of us anywhere. Nor can or should we wait for environmentalists to make the first move. For an ambitious proposal to do just that, see **The Space & Environment Conversation Team:**

<http://www.moonsociety.org/projects/projectteams/enviro-space/index.html>

Something this ambitious could be hosted by a chapter with strong support from the Moon Society and NSS, as originally envisioned when a Moon Society-NSS team sought EPA funding for just such a conference. This is a concept worth keeping alive. It is also an idea that could start with a small chapter-organized local event. That said, my own chapter should clearly make an effort to pioneer an effort that should become a tradition. Of course, any chapter or outpost is welcome to try! **PK**

Chapters & Outposts

Moon Society Phoenix Chapter

<http://www.msphx.org>

Contacts: Craig Porter portercd@msn.com
Chuck Leshner: chuckmiester999@yahoo.com

Meeting the **3rd Saturday of the month**
Moon Society Phoenix' next meetings are on
Saturdays **April 18th – May 21st – June 18th**

March 19th Meeting Report:

At our regularly scheduled meeting we had four members and one guest present. Our guest was Felix Polz, LtCol, US Army Retired. Felix has volunteered to help with the presentation of my panels. Felix has written a papers on the Industrialization of the Moon and Space.

First item on the schedule was Our Telepresence RC Racing Demonstration for the LepreCon SF Convention. We currently have the equipment to conduct the Demonstration with spares. Stuart and Don will handle the Demonstrations.

Second item was my panels for LepreCon. I currently have three scheduled, and our guest; will be helping out on all three of the panels.

#1) "Disaster Strikes, What to do, What not to do, and What is just plain Stupid." I will talk about being prepared for a sudden disaster, what you need and how much, your security and comfort.

#2) "Industrialization of the Moon" Why, How and When.

#3) "Lunar Surface Transportation" Transportation on the Moon from the original "Moon Buggy", to telepresence vehicles, to "Super Moon Buggies" and then to heavier surface Transportation, Rail Roads and Monorails. and how they will be used and when they come into play.

Third item is Don's two panels;

#1) "Lunar Settlement." How the settlement of the Moon can proceed quickly and economically.

#2) "Lunar Hydroponic (Agroponics) farming" How to grow food on the Moon for survival and growth using available materials for Composting and recycling.

We gave our guest a stack of materials about the Moon Society so that he could become more familiar with us and the National society. He is also a member of MENSA's Space SIG.

Our next meeting will be April 16th at our regular spot and time. – Craig Porter

Yuri's Night in Phoenix: A Celebration of the 50th Anniversary of Human Spaceflight

<http://yuriphx.net/>

On April 12, 1961, Yuri Gagarin became the first person to orbit the Earth. Less than a month later, Alan Shepard became the first American into space on the suborbital flight of *Freedom 7*. To celebrate the fiftieth anniversary of these milestones in space exploration, the Phoenix aerospace community is hosting a pair of events on **Saturday, April 9, 2011**.

The first part will be a public event on Saturday morning, featuring speakers on the past and future of space exploration plus an opportunity for audience interaction. You'll meet astronauts, rocket scientists, educators, and space enthusiasts of all varieties. The two-hour event will start at 10:00 am at Orbital Sciences

Corp. at 1405 N. Fiesta Blvd., Gilbert, Arizona. Light refreshments will be served.

This event is free but because seating is limited, advance registration is required. Due to the nature of the host facility, attendees must be U.S. citizens. To register, call 480-282-1343 or send an email to yuri@aerospace-arizona.com. Educators will receive a certificate for two hours of professional development credit.

This primary sponsor of the morning event is the Phoenix Section of American Institute of Aeronautics and Astronautics, and the host is Orbital Sciences Corp. Additional support is being provided by local chapters of the National Space Society and the Moon Society.

Additionally, the Phoenix Section of AIAA is organizing a free Yuri's Night celebration at 8 pm, Saturday evening, April 9 at the Grace Inn at Elliott Road and I-10 in Phoenix. Anyone interested in space exploration and development is welcome to attend. The Space Access Conference will be winding up that afternoon at that hotel, so join other enthusiasts and meet some folks from the NewSpace launch vehicle community.

For more information on these activities, contact Michael Mackowski: mackowski.michael@orbital.com

Days: 480-355-7845,

Evenings: 480-926-4765, mjmackowski@getnet.net

Moon Society St. Louis Chapter

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

Contact: Keith Wetzel <kawetzel@swbell.net>

Next meetings – April 20th – May 18th – June 15th
Meetings 3rd Wed monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

Moon Society Houston Chapter

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

Contact: Eric Bowen eric@streamlinerschedules.com

The Houston Chapter's next regular meeting was scheduled for **Monday, March 21st** in the conference room of the Bay Area Community Center in Clear Lake Park; 5002 NASA Road 1; Seabrook, TX 77586

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

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

< End Moon Society Journal Section >

GREAT BROWSTING

SPACE TRANSPORTATION – SPACE STATIONS ISS

<http://hobbyspace.com/nucleus/?itemid=26786>

Reopening the Space Frontier

<http://www.thespacereview.com/article/1776/1>

Robot to become tourguide at Kennedy Space Center

<http://www.epdonthenet.net/article/38353/Robot-performance-moves-NASA.aspx>

Space Adventures lunar flyby, 1st of 2 seats sold.

http://www.youtube.com/watch?v=xB97UMLJN4w&feature=player_embedded

SpaceX CEO Musk On Commercial Crew Path

<http://moonandback.com/2011/01/17/3150/>

<http://moonandback.com/2011/02/03/top-russian-official-says-negligible-upgrade-needed-for-lunar-trip/>

<http://www.space.com/11029-space-music-astronauts-wakeup-songs.html>

LightSail on NASA short list of upcoming launches

http://www.planetary.org/programs/projects/solar_sailing/20110209.html

World's largest rocket production base in north China

http://news.xinhuanet.com/english2010/sci/2011-03/03/c_13759813.htm

SPACE RESOURCES

Where to go first for accessing space resources.

<http://www.thespacereview.com/article/1729/1>

THE MOON

<http://www.colonyworlds.com/2011/03/raising-radiation-resistant-planets-off-world.html>

10 km~6 mile long intact lavatube section found

http://www.nasa.gov/images/content/521681main_021711b.jpg (photo)

http://www.nasa.gov/mission_pages/LRO/multimedia/roimages/lroc-20110217-chain.html (article)

MARS

http://www.marsdaily.com/reports/Oddly_shaped_Mars_crater_is_studied_999.html

<http://spacefellowship.com/news/art25132/some-of-mars-missing-carbon-dioxide-may-be-buried.html>

MERCURY

<http://www.space.com/11102-mercury-nasa-messenger-mission-infographic.html>

<http://www.floridatoday.com/article/20110318/NEWS02/110318001/0/NEWS02/Messenger-spacecraft-snaps-into-Mercury-s-orbit>

OTHER PLANETS – ATEROIDS & COMETS

<http://spacefellowship.com/news/art25128/voyager-seeks-the-answer-blowin-in-the-wind.html>

<http://www.universetoday.com/83740/nasa-mission-to-europa-may-fall-to-budget-cuts/>

The Grand Tour: Uranus

<http://www.thespacereview.com/article/1766/1>

ASTRONOMY – OTHER SOLAR SYSTEMS

SETI search is worth the effort.

<http://www.thespacereview.com/article/1727/1>

<http://www.physorg.com/news/2011-02-scientists-protocol-messaging-aliens.html>

FICTION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GREAT SPACE VIDEOS

MOON COLONY VIDEOS – The Moon Society

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

<http://www.mooncolony.tv/>

<http://www.gaiaselene.com/>

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

Featured this month:

“Sky-Crane” Drop test for Mars Curiosity Rover

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

Space-X Video Library

<http://www.spacex.com/multimedia/videos.php?id=58>

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 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 & 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 \$10 a year, available for libraries only.

How to participate in this program

- Send *by postal mail only*
- Your check or money order for \$13.00/per year
- With the complete name and address of the Library,
- Made out to “Lunar Reclamation Society”

Attn: Library Subscriptions

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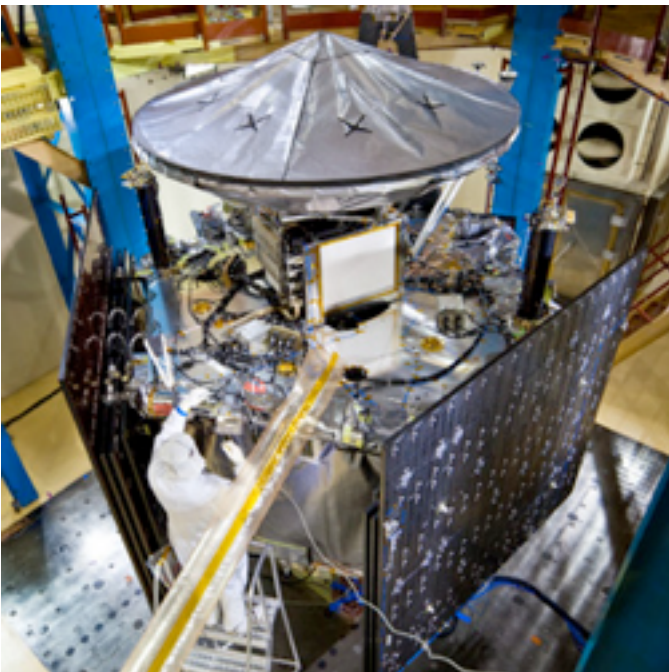
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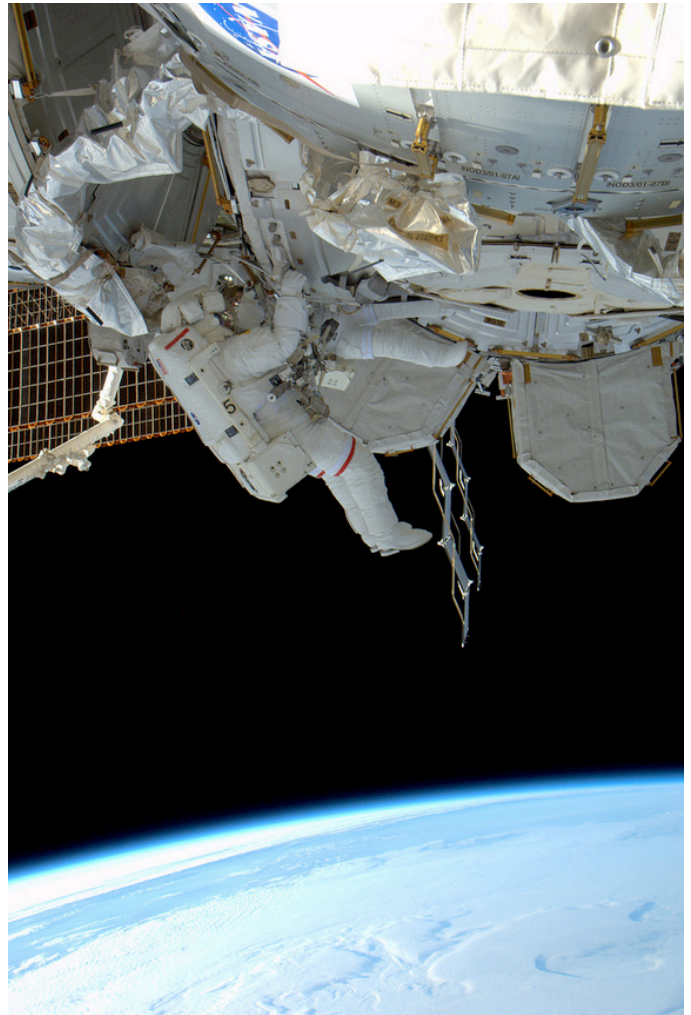
R2 is aboard ISS; partnership with astronauts yet to begin
<http://www.space.com/11023-obama-shuttle-discovery-astronauts-robot.html>



Discovery astronauts pose during spacewalk



Juno (Jupiter Orbiter) ready to launch this summer
www.lockheedmartin.com/news/press_releases/2011/0307_ss_juno.html



Who's afraid of Heights?



This month we celebrate the 25th Anniversary of the Russian MIR Space Station. For Americans, the highlight was the **Shuttle to Mir** Program - the shame, our part in forcing the Russians to scuttle MIR when there were other options: commercial use or the first International Space Monument - See our IN Focus editorial this month.

Celestis Competitor StarAsh to take Human Cremains to Mars

ISLE OF MANN: Trying to “crash” the Human Cremains-to-Space market by identifying methods to reach romantic destinations farther out from Earth, StarAsh, a Russian firm, will offer to take a dozen lipstick size cases of human cremains to the bigger and closer Mars moon Phobos, where they will be laid on the Mars-facing side.

The effort rests on finding a dozen customers willing to pay the as yet undisclosed price so that arrangements can be made before the launch of the Phobos-Grunt probe on which the cremains canisters will hitchhike. If this venture is sufficiently successful, the firm will look for an opportunity to send cremains to the caldera rim of Olympus Mons.

As with Celestis, Inc., only a fraction, a few ounces at best, of the deceased cremains, averaging 3+ pounds in toto, are involved. Celestis has made arrangements with Odyssey Moon and Astrobotics, Inc., both Google Lunar X-Prize Teams, to take cremains to the Moon before the end of 2013.

But if Roscosmos succeeds in launching Phobos-Grunt in late 2011 or early 2012, the cremains of a dozen humans could be on Phobos looking out on Mars, before either GLXP team lands on the Moon. Seen from Phobos, Mars would appear 6,400 times larger and 2,500 times brighter than the full Moon appears from Earth, taking up a quarter of the width of a celestial hemisphere. “And these cremains will look out on this spectacular second homeworld of Mankind forever!”

For its Lunar Service, Celestis charges rise from \$10,000 for 1 gram of cremains to \$30,000 for 14 grams. StarAsh prices will be “about twice as high for a much more romantic destination.” Yet, Celestis has a record of achievement. StarAsh is unproven.

If StarAsh finds a market, we can expect this type of service to gain an increasing number of customers for evermore attractive products.



NASA, US State Dept. Give Okay to China's Space Agency Purchase of Moon Lander Plans and Technologies from Grumman

LOS ANGELES, CA APRIL 1, 2011. Noting that the various technologies incorporated in the Apollo era Moon Lander designed and built by Grumman, were over 40 years old, NASA and the State Department agreed that the Chinese National Space Agency (CNSA) could purchase the full set of plans for Grumman's Lunar Excursion Module in all its versions for some \$50,000,000.

China has already developed a full set of plans for a Moon-lander of indigenous design, but wants the NASA Grumman plans as a guide to reviewing and perfecting its own ideas. China may or may not incorporate some of the Grumman lander features and technologies.

The indigenous CNSA plan would involve three separate launches of the various modules that would then be docked to one another in low Earth Orbit before being boosted into a translunar trajectory. This approach does away with the need to develop an expensive Saturn-5 class booster. NASA decided against space assembly because at the time this would have needed personnel in space to guide assembly. To orbit tele-operated from Earth unmanned. This module would boost the landing complex (Shenzhou/descent module, to lunar orbit, and back to Earth after the return of the Shenzhou capsule from the lunar surface.

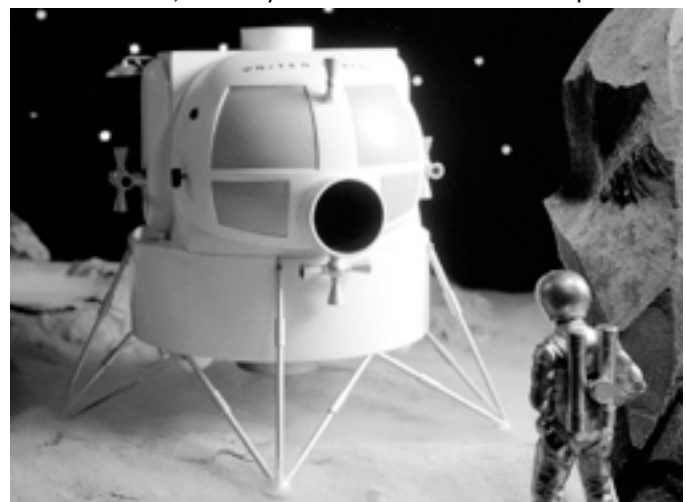


While the descent module would brake the complex to a soft landing, this version of the Shenzhou would lift off with a bottom-mount booster strapped to its ablative shield, needed for a braking descent through Earth's atmosphere. The descent module would stay behind as in Apollo.

After landing on the Moon, the crew would exit via the standard Shenzhou top-mount airlock and climb down (and up) a jetisonable rope ladder to the top of the descent module, then down a ladder to the lunar surface.

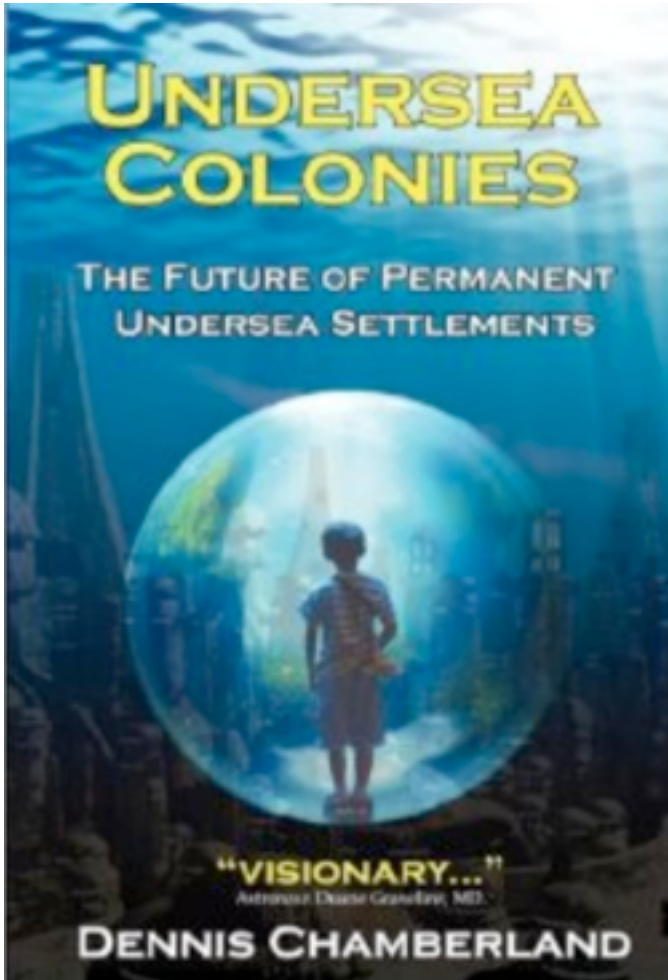
CNSA wants the Grumman plans to compare with its own concepts, and a hybrid version may be the result.

Below, an early NASA moon lander concept.



MMM's 24th Happy April Fool's Day News

THE **book** WORM



Undersea Colonies

(paperback) 376 page 6' x 9' soft cover book with 40 chapters, glossary and comprehensive index

By **Dennis Chamberland**

\$15.99 free shipping within the USA from <http://underseacolony.com/core/book.html>

Amazon.com \$16.19 plus shipping; \$7.99 Kindle version

Online Review at address above

— “The most surprising book of the new century speaks eloquently of a daring migration to an alien world that has been hidden in plain sight...”

“Of all one hundred billion humans who have ever lived, not a single one has gone to live permanently undersea. While we have had the technology to settle this vast, three-dimensional domain for over half a century, it remains empty of outposts, colonies or cities – or even of a single settler. While its immense territory covers nearly three quarters of the globe, no one has ever gone there to stay. In this book, Dennis Chamberland traces the history of the aquanaut from the first tentative 24 hour experiment in 1962 until today. Surprisingly, a careful reading of the record of humankind’s penetration of the oceans reveals misdirected starts, misunderstandings of the human’s capacity to adapt and, eventually, a great abandonment of the quest. But now,

Chamberland unveils a visionary strategy and a fresh, new look at previous challenges that will soon open up the expansive undersea regions called Aquatica*. Here will arrive 21st century pioneers, colonists and families who will become the first Aquaticans* in what may yet prove to be the greatest human adventure in all of history.”

* “**Aquatica**” is their name for *all Earth’s oceans as one*

Follow their efforts at: www.underseacolony.com/

There is a lot to explore on this site, including Videos. This effort has long been past the paper concept stage, and the current seafloor habitat now nearing occupancy stage is only the latest of several such efforts of increasing ambition and elaboration.

There are many parallels between creating livable colonies on the seafloor and on The Moon and Mars, and the experiences of these pioneers can guide us space settlement enthusiasts to design and build more livable outposts beyond Earth.

And there are real analogies between the water ocean and the vacuum of the seas of space. This parallel effort is not only worth following closely, it is worth our support. The Moon Society is looking at the suggestion of our sponsoring a “readers corner” in the **Leviathan** seafloor habitat.

PK



The Daily Show with Jon Stewart Presents Earth: A Visitor's Guide to the Human Race

“Addressed to aliens who visit our planet long after humans have gone extinct, this book is all that’s left to document the world as we know it.”

“A hilarious *Encyclopedia Humanica*”

182 Reviews on Amazon.com (113 ****)

Hardcopy, Audio, CD, Audiobook



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

www.lunar-reclamation.org

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

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

LRS News

- **No meeting last month:** Peter took in the Wisconsin Regional Robotics Competition (High School Teams) at the US Cellular Arena downtown that Saturday in hopes of making contacts. However, everyone was too busy with their projects and demonstrations. First assessment was “interesting” but probably not helpful to us.
- **Rockets for Schools:** This annual event in Sheboygan will be held the weekend of May 21–22. ISDC 2011 will be going on in Huntsville, AL the same weekend. It is most unlikely that we will be present in Sheboygan.
- **Yuri’s Night Anniversary #50:** Some chapters are going all out for this event. We have never found much enthusiasm for it in Milwaukee. At any rate, it is too late.
- **Peter is stepping down as Moon Society President:** He has given notice that the position will be open as of August 1st, so that election of a new President can coincide with the regular annual Moon Society elections. After 7 years, with some rewards and many frustrations, he wants to focus more on writing. A possible “MMM the Book” may be in the works: prospective title “A Pioneer’s Guide to the Moon.” Apogee Books is interested.

Meanwhile, Ken Murphy 43 of Dallas, chair of ISDC 2007, and former NSS Board member, has thrown his hat into the ring, with full support from Peter and Dave Dunlop.

LRS Upcoming Events

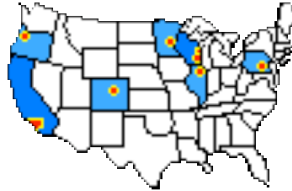
2nd Saturday Meetings: 1-4 pm
April 9th – May 14th - June 11th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA: A look at upcoming event opportunities; possible summer activities – we need to do some “creative thinking!” to get back into **serious outreach!**

As Peter steps down from Moon Society Presidency, he should have more time to spend with the chapter!

Discussion of holding and funding **Artwork Contests**
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
April 16th – May 21st 21st – June 18th

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 2011 Past & upcoming chapter events

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

Challenger memorial, Veterans Park, New Brighton, MN
<http://freemars.org/mnfan/MNSFS/2011-01-Memorial-Dinner/>

Ben’s MarsCon Pix

<http://freemars.org/mnfan/MarsCon/2011/>

April 11th Chapter Meeting, April 12th Yuri’s Night

April 22nd-24th Science Room @ Minicon

ILLINOIS

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

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

WISCONSIN



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

c/o Will Foerster 920-894-2376 (h) astrowill@tcei.com

SSS Sec. Harald Schenk hschenk@charter.net

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

22608 County Line Rd, Elkhart Lake WI 53020

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

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

At The Stoelting House in Kiel, WI

Apr 21 - Jun 16th - Aug 18th - Oct 20th

Sat. Dec 10th - Annual Holiday Meeting with Lunar Reclamation Society in Milwaukee, weather permitting

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)

1 Cherry Hills Farm Drive
Englewood, CO 80113

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

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

Monthly Meetings 6:15 PM on 2nd Tuesdays

Apr 12th - May 10th - June 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>

• PASA regular business luncheon/formal meeting 1-3 pm, the 2nd Saturday (unless otherwise noted) of every

month at the **Liberty One food court** on the second level, **16th and S. Market**. Go toward the windows on the 17th street side and go *left*. Look for table sign. Parking at Liberty One on 17th St. Call Earl/Mitch 215-625-0670 to verify all meetings.

Next Meetings: April 9th May 7th

Our next meeting will be at The Liberty One Food Court on April 9th, and May 7th (Super Science Weekend in Trenton). March and April at our regular location noted above: go to the second floor, The Food Court, and go left towards the windows. Look for our table display.

March Meeting notes: We had two winners of the Oscar H. Harris Award this year, thanks to our judge Dennis Pearson, with one from the middle school level Alexandra Sices and a senior winner Lilly Zhao. They both received a fifty-dollar cash prize, and several other items. Chief among these was a copy of The Pocket Ref compiled by Thomas J. Glover. Why this book? It is a "kitchen sink" reference of many things technologic and mathematical, and is used by Adam Savage to do some of the calculations needed to set up some of the Myth Busters experiments. Lilly loved getting it. Her research was entitled "Becoming an Alien" on possible life forms that could be on other planets. Our Middle school winners were "Ready, Set, Go Green!" on building a solar powered Mars Rover. Dennis contributed for an elementary level winner (James H. Chestek Award) and for the middle school winner. He had to judge alone due to a serious illness hitting our perennial judge, Mike Fisher, just before the events. He is recovering from surgery at this writing.

The George Washington Carver honoree this year was Dr (M.D.) Bernard Harris Jr. If the name seems familiar it's because this doctor is also astronaut Bernard Harris, who has been up several times on the shuttle, and has performed a space walk at the I.S.S. He has been a flight surgeon, a Mission specialist (STS-55), a Payload Commander (STS-63), and has been a part of many other activities to improve Mans' ability to go into space and thrive. He is currently C.E.O. of Vesalius Ventures Inc. among many other activities. Google him or check the George Washington Carver fair site for much more.

Now to our other meeting notes: Larry, our Web master, says we have "rss" now for quick updates as they happen to our site. Just click on the orange dot (for Explorer) and: <http://pasa01.tripod.com/myfeed.xml> for other browsers. Our Facebook link is found on our site's second page. And much more!

Dotty brought lots of tour information from the Intrepid tours and events, to movies at The Rose Center (The Search for life, and, in July, Journey to the Stars) and The New York Hall of Science. This last is at the old World Fair site in Queens, and has Invention Videos till April 24 (one hour programs on weekends) and Nano Days between March twenty sixth and April third on weekends and several weekdays. In all cases check their websites.

Hank Smith brought flyers for The Philadelphia Science Fiction Society and its events and their locations. There is still no guest of honor yet for Philcon, but there are several guess of honor in the arts area. Hank will try to go to Balticon in May, but will try to be at our events in April and May to help out in the meantime.

Mitch will try to get us a space at a good location for the Science Festival here in April. It starts on the sixteenth of April and this could be a great venue. We will have to see how this works out.

Earl brought a number of items including some updates on the Google Lunar X-Prize contest. Among these where: The RoRo Rocket Rover created by Team Selene, a Chinese & German collaboration (see the neat video and engineering drawings: test vehicle and future plans respectively), The Red Rover, in BETA test stage, which will have a social media connection to send out real time mission information. It already has a Facebook connection! (via Astrorobotics, which is developing the rover). This rover also has a ride: They have a contract for a Falcon-9 flight. There was an interesting Q&A between the Part Time Scientists and fans (Fan Friday), and the introduction of Team Plan B. Lots of cool techie stuff.

There where a number of other things but I will limit myself to these: Our Elementary Level Carver Fair winners where: Ian Scott, for Rockets: Big versus Small, and Taera Stanley for How Can I Demonstrate Materials that are Protected by a Magnetic Field? Both received a \$50 cash prize and certificate, while Ian also received an Everything That Flies experimenters kit. I ran across a contest that has a sixteen thousand dollar prize for the launch, into orbit, of a *small* satellite (.35 to .7 oz) by September. See Science Magazine for December 2010. Finally: I have been invited to speak on S.E.T.I. by the Philadelphia Association for Critical Thinking (PHACT) in September. Check out there website). Michelle and I attended a March lecture on disasters in reality versus what Hollywood creates, and it, and the audience was impressive. Lecture by Geologist Jonathan E. Nyquist of Temple University. Did I mention that asteroid impacts where a major feature of this talk? -- Earl Bennett.

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>

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.

Last Minute Registration Rates:

<http://isdc.nss.org/2011/register.shtml>

NSS Members by April 30: \$200; after \$300

Affiliate Members (Moon Society) “ “ \$230, after \$330

Students by April 30: \$40, after \$70

CALIFORNIA

SDSPACE.org

San Diego Space Society

<http://sandiegospace.org>

info@sandiegospace.org

Meeting the 2nd Sunday monthly

Next Meetings: Oct. 10th, Nov. 14th

2:30 to 4:30 pm

Serra Mesa Branch Library 9005 Aero Dr, San Diego

Quarterly Newsletter: *The Bussard Scoop*

The San Diego Space Society partners with other space and science organizations—both local and international—to assist them in reaching students and space enthusiasts in the San Diego area:

- Mars Society Chapter
- The Moon Society
- SEDS
- San Diego Air & Space Museum
- Reuben H. Fleet Science Center
- Project Astro San Diego
- Space Frontier Foundation
- JPL Solar System Ambassadors

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: April 16th – May 21st – June 18th

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

Saturday, April 9, 3:30 pm OASIS LECTURE SERIES, USC Small Satellite Lecture, with Tim Barrett, Assoc. Dr of the Space Engineering Research Center at USC's Information Sciences Institute: Ruth Bach Branch Long Beach Public Library, corner Bellflower Blvd and Carson Street, 1 mile north of I-405 and 2 miles west of I-605.

Thurs–Fri, April 14th – 15th 7 pm Lecture: “Scientific Research and Human Space Flight in the Shuttle Era” Dr. Eugene Trinh, Manager NASA Manned Flight Office at JPL, **Thursday:** Von Karmen Auditorium at JPL, 4800 Oak Grove Drive, Pasadena. **Friday:** Pasadena City College, Vosloh Auditorium, 1570 East Colorado Blvd

Saturday, April 16, 3 pm – OASIS Board Meeting, Home of Bob and Paula Gounley, 1738 La Paz Road, Altadena, CA 91001

Saturday, May 14, 3 pm – OASIS Board Meeting, Home of Lisa Kaspin, 3206 Summertime Lane Unit 206, Culver City, CA 90230

Moon Miners' MANIFESTO

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

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=> For those outside participating chapter areas <=

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- \$15 annual dues

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- \$15 low "one rate"

MINNESOTA SPACE FRONTIER SOCIETY

- \$25 Regular Dues

OREGON L5 SOCIETY

- \$25 for all members

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

- \$28 regular dues with MMM

PHILADELPHIA AREA SPACE ALLIANCE

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

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