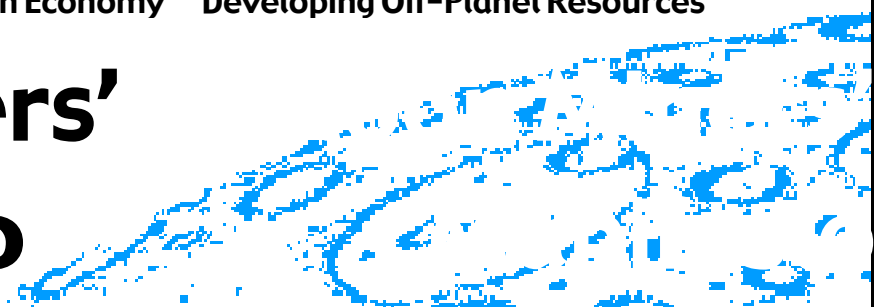


# Moon Miners' Manifesto



& The Moon Society Journal

[www.lunar-reclamation.org/mmm/](http://www.lunar-reclamation.org/mmm/)

# 180

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## In FOCUS: The Bush Re-election: Implications for Moon-to-Mars?

Perhaps most space activists enthused about the President's new space vision, are relieved at the outcome of the election, and expect clear sailing ahead. But even before the election, we cautioned that a Congressional "Rubber Stamp" was anything but foreordained. Congress jealously guards its perceived constitutional mandate to "micro-manage and second guess -- and to review programs over and over again, each budget cycle. This program, as conceived by the Administration, will take at least three presidential terms beyond Bush's second term to realize: plenty of time for Congress and/or future presidents to derail things.

We have pointed out that Bush's initial Space Exploration timetable was already discouragingly drawn out -- even before the almost certain program cutbacks, redefinitions, and stretch-outs. Yet the initiative has real and significant value in that it changes NASA's focus and direction from the "yo-yo space" of up and down, up and down to LEO, from preoccupation with the Earth-hugging boundary space layer, to real "outer space" destinations and activities. This is a long anticipated and overdue sea change, and we applaud it.

But getting back to the election (last night, as I write this on the "Morning After." The election proved to

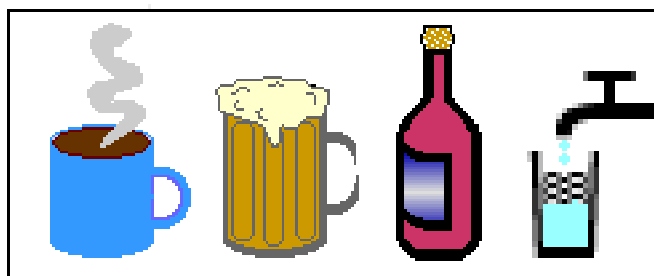
be much less close, in the popular vote, than anyone expected. And the apparent source of these larger state by state popular vote majorities now seems to be clear. Those who made the difference were less concerned about the war, about terrorism, about the economic doldrums, about the assault on the environment, about the corporate free-for-all, than about "Family Values." This concern gave the present not only a clear victory among white voters, but it gained for him an extra 5% of African-American voters. Bush also made inroads in the Latin-American vote.

So what does that have to do with anything? It is clear that the Republican Party's core constituency is now not just business-centered, but Christian Right centered, with a respectable Latin-American constituency. This development now makes explicit a shift that has been underway for some time. Our point is that neither the Christian Right nor the Latin-American constituencies have been supportive of Space or science in general. In fact the Christian Right has always been suspicious, if not hostile to both. I predict that the Republican Party will soon respond to this shift and no longer be a political Pro-Space force to be taken for granted.

Space supporters must reach out [ => p. 2, col. 2 ]

### The Early Frontier - "What's to Drink"

One highly individual thing is our attachment to various beverages. That attachment can be well cultivated and go beyond the generic to specific brands. Or it can be very all-imbibing. Those with more generalized tastes will make for happier pioneers. But the quest for better quality beverages and a growing variety of them will be a major driver for frontier entrepreneurs. See page 8.



# Moon Miners' Manifesto

**Moon Miners' MANIFESTO/ Moon Soc. Journal** is published every month except in January and July.

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• **Moon Miners' Manifesto CLASSICS**: Beginning with 'July 2004, we have begun an effort to re-edit, reformat, re-illustrate and republish the timeless articles of MMM's first ten years, with the intention of publishing two issues, each covering one year, in PDF format only, for free downloading, each January and July.

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

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

• **MMM retains its editorial independence**. MMM serves several 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. Any presumption that participating organizations can be labeled by indirect mutual association is unwarranted.

• For the current space news and near-term developments, read *Ad Astra*, the magazine of the **National Space Society**, in which we recommend and encourage membership.

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

=> [www.lunar-reclamation.org](http://www.lunar-reclamation.org)

• **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 40 chapters, dedicated to the creation of a spacefaring civilization.

The National Space Society, 1620 I Street NW, Suite 615, Washington, DC 20006; Ph: (202) 429-1600 <= NEW HQ

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• **MMM's desktop publication** has received computer hardware and software support from the **Space Frontier Foundation**, 16 First Ave., Nyack NY 10960; 800-78-SPACE - SFF seeks to open the space frontier to human settlement as rapidly as possible.

[openfrontier@delphi.com](mailto:openfrontier@delphi.com) => [www.space-frontier.org](http://www.space-frontier.org)

• **The Moon Society** is "dedicated to overcoming the business, financial, and technological challenges necessary to establish a permanent, self-sustaining human presence on the Moon." — See contact information on page 9.

• **NSS chapters** and **Other Societies** with a compatible focus are welcome to join the MMM family. For special chapter/group rates, write the Editor, or call (414)-342-0705.

• **Publication Deadline**: Final draft is prepared ASAP after the 20th of each month. Articles needing to be keyed in or edited are due on the **15th**, Sooner is better! - No compensation is paid.

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⇒ IN FOCUS Editorial continued from p. 1.

to potential congressional space legislation sponsors and cosponsors on both sides of the aisle. Senators and representatives tend to be very aware of the feelings of those who have elected them, and the Christian Right disinterest and suspicion about space and science in general will translate into a general reduction of support among Republican legislators.

So what can we do in this new climate? We suggest the following agenda:

- **work to confirm broad based support for NASA's new change of focus**, to an outbound, destination-driven one. It would be a great strategic error for us to take this redirection of focus for granted, not that the President has been re-elected. There are too many Republicans, and Democrats, in the new Congress who are not convinced that this sea change is wise.
- **Postpone activism on behalf of specific destinations: the Moon, Mars, or Moon and Mar**. Until the change of direction is "ratified" by Congress, and ratified with a margin that does not invite repeated questioning, we are building on sand by focusing on Moon and/or Mars.
- **Continue to support the findings of the Aldridge Commission**, that "whatever NASA does," the agency must seek to maximize involvement of Private Enterprise at every level and turn. It should never be taken for granted that NASA "knows what this means."
- **Push financial incentives for Private Enterprise to rise to the occasion**. We must be busy brainstorming and developing additional legislation that will capitalize on the new Venture Capital interest in space projects that has developed in the aftermath of the successful X-Prize project.
- **Follow-up on Lunar Prospector**, not just as a mission, but in the manner in which this mission was developed outside NASA. Our goal is to develop new missions designed to find and map resources and other assets on the Moon that could make the Moon a more viable and attractive place for resource development beneficial to an expanded Earth-Moon economy. Here, we must work with Principal Investigators and their university or industry associations to bring the proposed mission to the state of maturity where it would become attractive to NASA to fund and fly it. Higher resolution geochemical mapping, sensitive to more elements, and in particular to those most strategically important; mapping near surface lunar lava tubes; ground truth missions to the suspected polar ice-fields, and unsampled mantle upthrust materials, etc.

Here is a program to direct our political activism and a new business, industry, and academic activism. We cannot, must not, take Congress for granted! - PK

# Lunar Nuclear Fuel, At Last

by Dave Dietzler < Dietz37@msn.com >

## From Seawater to Lunar KREEP

From the excellent book "Megawatts and Megatons" by Richard L. Garwin and Georges Charpak, we find that French and Japanese scientists have successfully experimented with the extraction of uranium from seawater with plastic filters. From one kilogram of plastic filter they obtained 3g uranium, 2g titanium, 6g vanadium and 6g of cobalt. The metals are extracted and the plastic filter is reused many times.

Not only does this mean that we can have a massive supply of uranium for nuclear power on Earth obtained more cleanly than by mining which causes the release of radon gas from mine tailings, it means great news for us moon miners. You see, KREEP [Potassium (K), Rare Earth Elements (REE), and Phosphorus (P)], although it is richer in uranium and thorium than other forms of moon dust, is still a very low grade ore. See the table below (info from Van Nostrand's):

Constituent	Anorthositic Rocks	KREEP
Al <sub>2</sub> O <sub>3</sub>	>25%	15-20%
FeO	0-5%	8-10%
MgO	2-8%	7-13%
P <sub>2</sub> O <sub>5</sub>	0-0.06%	0.3-2%
K <sub>2</sub> O	0.01-0.2%	0.2-2%
Uranium	<0.4 ppm	2-6 ppm
Lanthanum	0.1-4.5 ppm	40-80 ppm
Hafnium	<0.01-5 ppm	10-30 ppm

An abundance of 2-6 ppm of uranium does not seem very significant, but seawater only has 3.3 milligrams per cubic meter or ton. That's just 3.3 parts per billion. If we can get that uranium out of seawater we can certainly get it out of KREEP which has a thousand times as much (that's 3.3 ppm/ 3.3 ppb = 1000)!

KREEP consists of complex minerals made mostly of silicon, oxygen, aluminum, iron and magnesium with some other good stuff like phosphorus, potassium, uranium and rare earth metals like lanthanum (used to increase the refractive index of glass) and hafnium (used for reactor control rods). What we must do is break down the crystal matrix like we do with other minerals by melting, quenching and grinding.

Then we can carbochlorinate the stuff by mixing it with carbon dust, exposing it to a stream of chlorine gas (both C and Cl will be carefully recycled, and any losses replenished by scavenging solar wind volatiles adsorbed to the fine particles in the surface covering regolith blanket, whenever we are moving lunar soil around) -- see [www.asi.org/adb/09/06/02/03/023/gas.html](http://www.asi.org/adb/09/06/02/03/023/gas.html) and heating it with solar reflectors or lenses. This will convert the stuff to

chloride salts like that which we find in seawater.

The silicon tetrachloride will boil off at only 56.9 C. It will be decomposed with solar heat to get pure silicon for solar panels and recover chlorine gas. Carbon monoxide will also form and vaporize off to be recycled by reaction with hydrogen for conversion to methane and water which can be pyrolyzed and electrolyzed respectively to recover carbon and hydrogen, and get some oxygen.

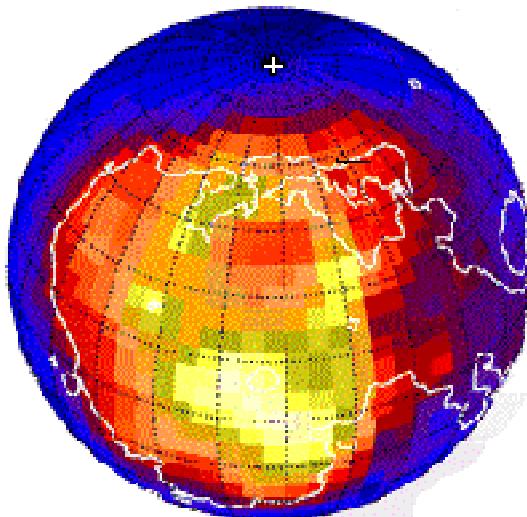
The chloride salts that remain will be dissolved in water and pumped through plastic filters to get the uranium. We can imagine other plastic filters that will absorb phosphorus, potassium, rare earths, thorium and other trace metals perhaps.

## Byproducts of Uranium Production from KREEP

After uranium filtration, the salt laden water will be boiled down, condensed, and the metallic chloride salts are decomposed with extreme (mirror-concentrated) solar heat in a ceramic retort to recover **chlorine**, or they will be subjected to electrolysis. Aluminum chloride can be electrolyzed to get **aluminum**. The iron salts could be removed with magnets and that would pull out any salts of **nickel** and **cobalt** that might be present. These could be broken down with heat and treated with carbon monoxide gas to make **liquid carbonyls** that can be separated by distillation.

Note that the nuclear scientists also filtered titanium, vanadium and cobalt out of seawater, so we should capture these in the process of filtering out uranium if they are present. Separating those metals from each other could be problematical. Uranium can be fluorinated to make UF<sub>6</sub> which has a low boiling point, so we could just do that to roast it out of the mix of metals we filter out of our salt solution. Uranium hexafluoride can then be run through gas centrifuges which use only 10% as much energy as gaseous diffusion to enrich the uranium for use in nuclear power reactors and nuclear rocket engines. Another barrier to lunar industrialization seems to have fallen by the wayside!

## Lunar Prospector - Thorium in Western Nearside Maria



Globe is tilted with North Pole (+) towards viewer

Area coincides with the splashout reach from the Mare Imbrium impact event.

## • **A Prospector's Visionary Tour of The Inner Solar System**

Dave Dietzler < Dietz37@msn.com >

### **Have Mercury and Venus been Prematurely written off?**

Most space travel advocates these days have just about written off Mercury and Venus while focusing on the Moon, Mars and orbital space. The blazing hot Sun on Mercury and the corrosive atmosphere and heat of Venus make these two planets seem like worthless territory.

### **The Case for Mercury**

Actually, they offer much to mankind in the future. First of all, they have unique positions in the solar system. Solar energy is 6.7 times more intense at Mercury than in Earth orbit, therefore a silicon solar panel or foil solar thermal collector can gather almost seven times as much energy from a given area as would a solar panel at Earth's distance from the Sun or on the Moon. About 9000 watts of energy falls on a square meter at Mercury. If the solar panel is 15% efficient it will generate 1350 watts. A 100% efficient solar panel would be needed to do that on the Moon or in Earth orbit. Foil collectors will reflect about 95% of the light falling on them.

On airless Mercury or in solar orbit at that distance robotic factories will be rich in electricity and solar energy for direct application to smelting and melting of metals for casting or alloying. Moreover, Mercury seems to be 60-70% iron and 30% silicates. The planet is a storehouse of heavy metals waiting to be mined and launched into space with electromagnetic mass drivers.

### **The Case for Venus**

Venus is enshrouded by a thick atmosphere of CO<sub>2</sub> that contains far more carbon than is available in Earth's fossil fuels. At Venus, solar energy is twice as intense. Many schemes for terraforming Venus have been devised. We could also build balloon borne robotic factories floating at high altitude where the pressure is only one atmosphere and the temperatures reasonable. Chemical processing equipment could be used to extract carbon and nitrogen from the Venusian atmosphere as well as some hydrogen and sulfur from sulfuric acid in the Venusian mists. Oxygen could also be extracted. A simple 19th century chemical process involving catalysts to spur the reaction of CO<sub>2</sub> with hydrogen to form methane and water which are then easily decomposed to hydrogen which will be recycled, carbon and oxygen is all that's needed.

Rockets using nuclear thermal engines and liquefied CO<sub>2</sub> could orbit those payloads. Carbon dioxide is easily liquefied by expansion and pressurization, thus it is easy to separate from nitrogen which must be much colder to liquefy. It is essentially inert and will not corrode nuclear thermal engines or their cooling jackets since it doesn't decompose to carbon monoxide and oxygen until about 3000

degrees C. The rockets could also have jet-atomic engines. Nobody is going to be harmed by power from uranium, plutonium and thorium on Venus!

Cf. "Rehabilitating Venus as a Human Destination" - a compilation of articles about Venus that have appeared in past issues of MMM --

[www.lunar-reclamation.org/papers/venus\\_rehabpaper.htm](http://www.lunar-reclamation.org/papers/venus_rehabpaper.htm)

### **Mercury: Grand Central Station of the Solar System?**

Transportation of metals from Mercury and of carbon and nitrogen from Venus to other places in the solar system will not require vast amounts of rocket fuel. Slow "interplanetary barges" using a combination of mag-sails with solar sails affixed to the mag-sail staying lines could use the free and intense solar wind and light of the Sun to ride out to other places in the inner solar system where space colonies were being built, Earth and the Moon, and beyond.

The AI [artificial intelligence] robots that do the work will originally be built of lunar materials and sailed down to Mercury and Venus. Once mining and transportation between Mercury and Venus is established, metals from Mercury could be used to build more replicating robots and rockets for Venus and Venusian [Veneran?] carbon, nitrogen and perhaps hydrogen and sulfur can be used by robots on Mercury to make chemicals and synthetic materials like silicones.

### **Accessing Resources in Mercury's big iron core**

Mercury will be more than a big chunk of iron. When combined with carbon we have steel. It gets better than that. The iron core of Mercury (relatively larger than Earth's iron core and much closer to the surface) is bound to be rich in nickel also. Like iron meteorites, it will be rich in siderophile or "iron loving" elements like sodium, zinc, germanium, arsenic, selenium, bromine, silver, cadmium, indium, antimony, tellurium, rhenium, osmium, iridium, gold, thallium, bismuth and tin. The crust will contain more silicates and the mantle magnesium-silicates, but the mantle of Mercury is thin, the core huge, and internal heat not much greater than the Moon's thereby enabling extremely deep mining by the AI robots that work tirelessly. There will certainly be places where core material upwelled in the past. If we must, we can use nuclear explosives to bore deep shafts into Mercury.

### **What about mining the asteroids?**

It may be argued that iron asteroids are easier targets for metal mining, but these don't have the strategic locations that Venus and Mercury have. Even so-called "near Earth asteroids" are not near Earth most of the time. In a cruel cosmic Catch 22, the closer two orbits (Earth and a near-Earth asteroid) are in period, the less frequent the launch windows between them. The advantages of Mercury and Venus's locations are indicated in the tables below.

### To and from Mercury

Planet	days between launch windows	days to/from*
Venus	144	75
Earth	116	105
Mars	110	170
Jupiter	90	855
Saturn	89	1965

\* via minimum delta V Hohmann transfer orbit

### To and from Venus

Planet	days between launch windows	days to/from*
Mercury	144	75
Earth	593	150
Mars	337	217
Jupiter	238	931
Saturn	230	2015

### Mars is not the springboard to the Outer Solar System

It takes more energy to travel between Mercury, Venus, Earth and Mars but time of flight is low and launch windows frequent. Launch windows between Earth and Mars are 778 days apart and a Hohmann trajectory flight takes 260 days! And while you might think that Mars is a "springboard" to the outer solar system, launch windows from Mars to the outer planets are 800 to 700 days apart. Mars does not have the intense solar winds and light pressure to drive sails on their way without any fuel.

### Resources in the Outer Solar System

What do the outer planets have that would be of interest to inhabitants of the inner solar system? Mostly hydrogen. Ice could be mined on Callisto, safely outside Jupiter's hot radiation belt. Hydrogen extracted and launched in tanks to orbit around the Jovian moon could be loaded on freighters that use nuclear powered electrodynamic tethers to move around amongst the Jovian moons (Jupiter has a powerful magnetic field) and even spiral out to escape velocity. A VASIMR drive using hydrogen could also help the freighter. The "interplanetary barges" loaded with liquid hydrogen would use foil shaded radiators exposed only to the depths of space to reliquefy boil off from the massive LH2 load with out much energy at all. They would not need to drag along retro rocket fuel and the higher initial fuel load that this would require. Upon entry into the inner system the barges would just unfurl their rolled up solar sails and energize their mag-sails and brake for free into orbit around Mercury or Venus or space colonies in solar orbit and unload their hydrogen cargo. Since they would head back out to Jupiter with tanks empty the sails won't have to acquire too much thrust from the

Sun's light and charged particle streams to get up to speed. Traveling by capture orbits they won't need retro rockets on return to Jupiter. Once captured into orbit by Jupiter's gravity they'd get around by electrodynamic tethers and rendezvous with space stations for more hydrogen.

"Pipelines" of slow interplanetary barges would emerge between Mercury, Venus and Jupiter's moons. We won't get enough hydrogen to douse Venus with water but we will have enough to supply miners on Mercury and Venus as well as space colonists in giant toruses with thousands of inhabitants orbiting within the orbit of Earth or Mars.

Lunans might also use imported Jovian hydrogen for rocket propulsion, although the Moon can use aluminum-oxygen rockets, mass drivers and perhaps space elevators in the future. With Jovian hydrogen, Venusian carbon and abundant lunar silicon and oxygen it may be possible to build huge silicone "eco-spheres" on the Moon shielded with water or transparent silicone oil that isn't effected by the the Moon's temperature extremes

How much would all this cost? I can only believe that these things will be possible in a world that has controlled its population growth rate and planted colonies in space and on other worlds for the excitement of doing so. Artificially intelligent robots would do most of the mining and factory work on Earth and in space. The robots would produce such a vast wealth of material goods that poverty is abolished, freeing us to pursue the arts, sciences, sports.

Many people will have information technology jobs and do the fine handiwork the robots cannot do. If a man builds a robot and the robot goes to work night and day producing metals and finished products, that man will be highly productive. People would still work but the work they do would be far more valuable than planting rows and picking cotton or slaving away on an assembly line. I don't suggest androids that climb ladders and build skyscrapers, but I do suggest robots that can crank out steel beams, building materials and modules so fast that the price of these things becomes negligible and robot assisted human construction workers become more productive than ever.

Imagine human crane operators assembling a pre-fab modular skyscraper. The cost of high rises would plummet and the supply would be enormous. Anybody who wants an office on the 100th floor or a penthouse could have one. Technology designed for space could be applied on Earth. We envision modular habitations on the Moon made of steel and glass-glass fiber composites assembled by robots with humans moving in later. What if we did that on Earth? We could have more mansions than people to fill them!

Population growth will not be limited by housing but by food production which will be increased with GMOs and the freedom to do more than work in a rice paddy and have kids, half who die young. We will go beyond working to support our kids to working to have fun. That's the best reason for colonizing the galaxy!

<DD>

# Sail the Solar System: the Grand Tour

Dave Dietzler < Dietz37@msn.com >

## First a bit about Physics terms & notation

- Force =  $2(P \cdot A)/c$
- P (power) = 1400 watts/sq. meter at 1 A.U., {Earth's distance from the Sun)  
(at Mars' orbit, P= 600 watts/sq. meter)
- A = sail area in sq. meters
- c = lightspeed 300,000,000 m/s
- 0.21976 pounds of thrust per newton

## Now for the fun

At Mercury, P = 9000 watts/square meter. A 10,000 tonne (or 10,000,000 kg. or 22,000,000 pound) solar sailing barge with 50 km. by 50 km. sails would reach:

$$\frac{2(9000 \cdot 2,500,000,000 \text{ sq. meters})}{300,000,000} = 150,000 \text{ newtons or } 32,964 \text{ pounds of thrust.}$$

$$\frac{32,964}{22,000,000} = 0.0015 \text{ G}$$

or 0.0147 meters per second per second acceleration

In 90 days we will reach  $0.0147 \cdot 3600 \cdot 24 \cdot 90 = 114,182$  m/s or 114 kps or 410,000 kilometers per hour!!! That's 255,000 mph!

Since we will be moving out away from the source of sunlight our rate of acceleration will continue to diminish, but if you tried to launch from Mars you would disappear into the dim regions of the solar system and lose thrust, especially with light falling off with the inverse square of distance from the Sun

I don't know how fast you could actually go with a solar sail or how much faster you would go in combination with a mag-sail, but I have no doubt that barges could launch to Jupiter, travel between Venus, Mercury and Earth, and brake into the inner solar system when coming in from Jupiter's icy moons.

How do we make the sails? Glass filament reinforced foil? Aluminized plastic? Carbon fibers? Details! We will make them.

According to my computer program, you need 17.43 kps over and above Mercury's orbital speed about the Sun to get on a Hohmann transfer trajectory to Jupiter. You need to lose 8.193 kps to go from Jupiter to Mercury. Haven't figured out how much to overcome Jove's gravity but we get the idea. I don't know much about the capabilities of electrodynamic tethers, but my intuition tells me they could be used to escape from Jupiter. I did double check my calculations, so this is correct and amazing.

## Our Grand Tour Begins

In Arthur C. Clarke's Imperial Earth he describes a fusion powered space liner that leaves Earth, flies by Venus and Mercury, stops at Mars, if I remember right, and then goes out to Titan. Could we actually do that? I don't know about fusion but we could certainly use nuclear elec-

tric ion drives and solar sails to leave GEO or L1 ( or L2). I would prefer to take a trip to the Moon first (since this is a luxury cruise Grand Tour) then exit from L1 and get some gravity assist from Earth. Swing down to Venus and use sails to brake into orbit there. More courageous passengers could fly down to the AeroCities floating just below the cloud decks and see the Venusian surface. \* That really can't be more dangerous than re-entry I guess. It's all a matter of perceived dangers.

Past MMM articles about the possibility of subnubilar (below the cloud deck) floating cities over Venus are republished in the following online paper:

"Rehabilitating Venus as a Human Destination"  
[www.lunar-reclamation.org/papers/venus\\_rehabpaper.htm](http://www.lunar-reclamation.org/papers/venus_rehabpaper.htm)

We could then use the sails to fly down to Mercury and after no more than 144 days at Venus and spend no more than 110 days at Mercury before getting a launch window to Mars. (In both cases, the wait for a launch window could be much shorter.) Then race around the Sun and head out to Mars at high speed. We could brake into orbit around Mars with nuclear thermal rockets stocked up on Venusian CO2 or hydrogen from the pipeline from Jupiter's icy moons.

Waiting on Mars for a launch window to Jupiter would take up to 814 days. Some can stay on Mars, others go back to Earth on the next cycling station, and others can make the long haul to Jupiter. Or we could fly straight to Jupiter after no more than 90 days on Mercury and do it fast with sail power. Then we can cruise around in the Jove system, visit cities beneath the ice of Europa, go to Callisto, etc. Getting back to Earth will be done by spiraling away from Jupiter with electrodynamic tethers and using nuclear electric engines. We will brake into orbit around Earth with the sails so we will burn up all the fuel we can to get some speed back to Earth instead of lugging retrorocket fuel.

Our Sail-liner would have thick radiation shields and artificial gravity. A ten thousand ton ship constructed of magnesium, aluminum and titanium would be quite large. It might amass more than that. It could even use active magnetic radiation shields instead of massive solid material for shields to reduce mass and give us more tonnage devoted to habitable volume.

## Putting the brakes on Imagination

I don't think the women will be wearing Victorian fashions, but to me this is not an overly pessimistic or optimistic vision. It's based on real science and engineering possibilities. We just need the wealth and space infrastructure needed to do such things.

I don't believe in vacuum energy, antigravity, or antimatter. I am pessimistic about low mass fusion drives. Fission using a vapor core reactor like that being researched by Dr. Travis Knight and others at the University of

# A late 21st Century Moon Rocket for 200 Tourists or Pioneers

by Dave Dietzler  
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Florida's Innovative Nuclear Space Power Institute is my choice for power. The vapor core reactor can get over one kilowatt per kilogram of system mass and that is an order of magnitude better than other fission systems.

There's enough uranium in seawater to power human civilization for thousands of years. There's four times as much thorium in the Earth's crust than uranium. When we mine Mercury, the Moon, Mars and perhaps some asteroids we will have even more fission fuel for space propulsion. [Lunar Prospector found thorium highly concentrated in and around the nearside western maria.]

Cf. MMM #116, July '98, pp. 7-8 "Uranium and Thorium on the Moon" - More in MMM #123

Human civilization will probably be powered by solar and fission. We can use low mass fission power systems for spaceship propulsion in addition to solar sails and mag-sails (which need a source of electricity). We have plenty of fission fuel -- uranium, plutonium and thorium, to power interplanetary travel for a long time.

If we ever do get low mass fusion reactors or even vacuum energy we will use them, but I am only trying to illustrate the possibilities that exist with foreseeable technology, and those possibilities are tremendous. I didn't even mention beam riders in the Grand Tour sketch above.

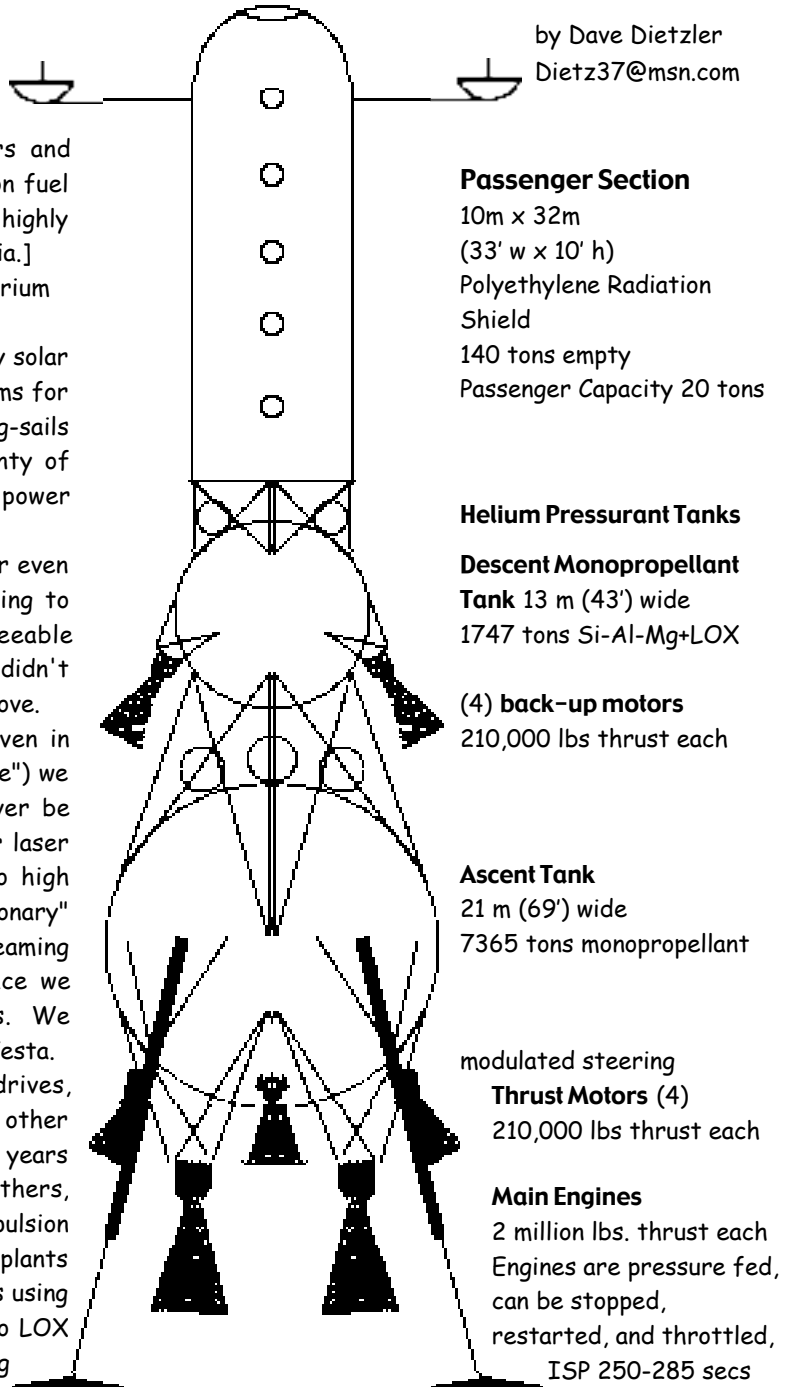
With power stations on other planets or even in free space (firing opposing beams to stay in "one place") we could build power plants so massive they could never be useful on a ship, but they could direct microwave or laser beams at the sails of a spaceship and propel it to high speeds. Perhaps this is how we will use fusion-"stationary" fusion power plants to energize the beams. With beaming stations on Deimos, Phobos and the Martian surface we could propel ships from Mars to the outer planets. We could even put beams on minor planets like Ceres and Vesta.

In my humble opinion, matter-antimatter drives, trans-luminal travel, antigravity, inertialess drives and other science fiction staples are going to seem quaint in 100 years or more. The reality will be sails, electrodynamic tethers, ion drives, low mass vapor core fission reactors, propulsion beams and ground based or space based fusion power plants to energize the beams, nuclear thermal rocket engines using whatever reaction mass is available from hydrogen to LOX augmentation to CO<sub>2</sub>, methane or ammonia, cycling stations and rockets burning metals mixed with LOX.

Now, if some science fiction writers would pick up on those technologies and think about the solar system and thousands of cities flourishing on other worlds and fantastic landscapes from Venus to Callisto and even Titan and some neat Space Oases also, they would have a realistic scenario as exciting as the many worlds of Star Trek. No alien monsters to fight every week, but hopefully most of us have outgrown that sort of thing.

We hope you enjoyed your ride and will choose DD  
Spacelines for your next spaceflight!

<DD>



## Passenger Section

10m x 32m  
(33' w x 10' h)  
Polyethylene Radiation  
Shield  
140 tons empty  
Passenger Capacity 20 tons

## Helium Pressurant Tanks

**Descent Monopropellant  
Tank** 13 m (43') wide  
1747 tons Si-Al-Mg+LOX

(4) **back-up motors**  
210,000 lbs thrust each

**Ascent Tank**  
21 m (69') wide  
7365 tons monopropellant

modulated steering  
**Thrust Motors (4)**  
210,000 lbs thrust each

**Main Engines**  
2 million lbs. thrust each  
Engines are pressure fed,  
can be stopped,  
restarted, and throttled,  
ISP 250-285 secs

Gross Lift-off Mass 9,625 tons  
Lunar Weight 1503 tons or 3.53 million lbs.  
Height 92 m (302')  
Dry Mass 510 tons, 85 tons Lunar  
Titanium frame and Aluminum-Lithium alloy skin  
Tanks coated with polyurethane and aluminum foil

More details and more pictures at  
[www.moonminer.com/Moon\\_Shuttle.html](http://www.moonminer.com/Moon_Shuttle.html)

## What's to Drink?

### Beverages

#### on the early Lunar and Martian Frontiers

by Peter Kokh

"What's to drink in this place?" is likely to be the number 1 most frequent first question by new visitors to the frontier. After a long (or very long, as the case may be) to the frontier, whether to quench one's thirst, relieve the stresses built up during the trip, to just relax, and/or to celebrate a safe arrival, a drink will be "just what the doctor ordered." What are the choices?

That will depend on how established the frontier is. At first water and beverages reconstituted from freeze dried powder brought along on this or previous trips. Sound "tangy?" The question deserves more than dismissal. Beverages can have a considerable effect on morale, whether it is a cup of coffee, a Coke™, fresh-squeezed orange juice, tea or herbal brew -- or a swig of the good stuff. ISS and Mir crews have had been there, done that.

On the Moon and Mars we will be in a somewhat different situation, where imports from Earth will have to be justified gram by gram -- they will be that expensive. Assuming that water can be produced locally on both frontiers, we would be talking about import of freeze dried, instant, and highly concentrated beverage stuffs.

Some dry beverage starters could be shipped as packaging, a medium in which to pack delicate items. But other, less dense (and overall heavy) materials such as recyclable and reformable plastic foam pellets or peanuts may get the nod. Co-importation as packing may be more common early on before frontier farms are established.

But with local food production, the holy grail will be the derivation of potable brews from agricultural waste biomass products. Don't expect pressure acreage to be set aside for Coffee, Tea, or Cocoa plantations or Orange orchards. In time that may come -- stress on "in time!"

Meanwhile, once we start building homesteads with modules manufactured from locally produced building materials -- and the rush for elbow room becomes a real frontier economic driver -- homestead gardening will emerge and with it many a garden-based cottage industry begun.

See MMM #148 SEPT. 2001, p 3. "EarthPatch":  
Anchoring Lunar & Martian Homesteads.  
The pdf file for this issue is freely accessible at:

[http://www.lunar-reclamation.org/  
mmm\\_samples/mmm148\\_Sep2001.pdf](http://www.lunar-reclamation.org/mmm_samples/mmm148_Sep2001.pdf)

Individual pioneer (families) will begin to market home made beverages ready-to-drink, in concentrate, and in raw ingredients form. Streetside Farmers' Markets will be a place where one can buy dried leaves, roots, and other home garden products from which to try one's own hand at

beverage making -- or brewing -- whether for one's own consumption or as marketable products.

In the past two decades there has been an enormous expansion of beverage choices for us Earthers. Coffee entrepreneurs have given us espressos, capuchinos, lattés and a seemingly infinite variety of each. Herbal tea makers have been equally inventive, as have producers of ready-to-drink Ice Teas, and flavored waters. Let's speak bluntly. If you are addicted to any of these and unwilling to experiment on your own or make do with substitutes, you are definitely not material for the early, stress on *early*, frontier days of either the Moon or Mars!

But if you have a spirit of adventure and are game enough to try make-do substitutes and be happy with less, you will do just fine. The frontier, any frontier, by its very essence, is a rough and rugged environment where those addicted to the genteel and sophisticated refinements of "cultured civilization" are in for a rude awakening.

#### So what's to Drink?

Follow the Agricultural Trail! Vegetables and Fruits will be top priority, along with adding a variety of both. Beverages can be squeezed out of most vegetables and fruit and so we will see a lot of that in the early frontier both as pure juices and squeezes, with or without pulp, and as creative blends like V8™ and "flavors Mother Nature never thought of, but should have." And these are all healthy, provided that they are not too laced with salt or sugar, both of which are going to be scarce on the early frontier, replaced with garden grown seasoning stuffs (herbs and peppers, etc.) and fructose from fruits.

Plus Soy Milk :- ( Okay, so the health nuts will be well taken care of. What about us caffeine and cocoa (hot chocolate, not cocaine) addicts? The cheapest thing to do would seem to import pure caffeine and cocoa extract without the other coffee, tea, and cocoa accompanying substances, and add them into frontier herbal brews.

#### Are you deaf? What's to Drink?

Alcoholic beverages: some never touch the stuff, Some of us habitually overindulge. Some of us enjoy a bit now and then to relax and/or as a socializing lubricant. Here we are in luck. Because almost anything that can be grown can be fermented. Perhaps in no area have humans been so inventive, and enterprising!

We will see both grain-based and fruit-based alcoholic beverages (yes, grapes too!) on the early frontier. But if you have cultivated a refined taste for Skky Vodka or Jack Daniels Whiskey and no other label will do, just keep your sissy butt at home. But if bar stock is good enough and if your tastes are versatile, you'll do just fine.

Over time, the quest for a greater variety of beverages, and of better quality will be a powerful driver for frontier enterprise and agriculture. *Over time!*

So don't sweat. It'll all be okay.

< MMM >



# The Moon Society



## JOURNAL

<http://www.moonsociety.org>

Please make NEWS submissions to KokhMMM@aol.com

**The Moon Society** was formed in July, 2000 as a broad-based membership organization with local chapters, to spearhead a drive for further exploration and utilization of the Moon in cooperation with other like-focused organizations and groups.

**Artemis Society International** was formed in Aug. 1994 as a forum for supporters and participants in the **Artemis Project™** quest to establish a commercial Moon base as a first step to a permanent, self-supporting lunar community. **ASI** does not engage in any form of commercial business directly, but seeks to build a Project support business team. Registered trademarks of the **Artemis Project™** belong to **The Lunar Resources Company®**

### PROJECTS:

- The Artemis Project™** <http://www.asi.org/>  
• Artemis Reference Mission    • Artemis Data Book  
**Project LETO™**    <http://www.projectleto.org/>

**Moon Society DUES** include **Moon Miners' Manifesto**

- **Electronic (pdf) MMM \$35**    **Students/Seniors: \$20**
- **Hardcopy MMM: U.S. & Canada \$35**    **Elsewhere: \$60**

### Join/Renew Online at

[www.moonsociety.org/register/](http://www.moonsociety.org/register/)

### Or mail check or money order to:

PO Box 940825, Plano, TX 75094-0825, USA  
Please send all mail related to Memberships to:

**Moon Society Membership Services**, address above.

**OUR LOGO above**, shows the Moon in its natural beauty, empty, deceptively barren, waiting for human settlers to shelter and mother. We have work to do!

### Lunar Photo of the Day

<http://www.lpod.org/>

## Pushing all the Vectors

### President's Message

How do we grow the Society? How do we make it more effective, more productive? Can we really make a difference? The answers to all these questions are inter-related. *Being aggressively positive is essential.*

Our numbers limited, we can multiply our effectiveness by leveraging our contacts outside the Society. And so we are pursuing projects in collaboration with the Mars Society and other groups. Two such projects have been announced and more are under consideration.

We will also, when appropriate, make joint press releases, which will draw fresh attention to our existence. Joint publishing ventures are a possibility; but nothing near term is in the works.

### A Board of Advisors

The founding documents of the Moon Society call for a Board of Advisors, but this has never been activated. Many organizations choose well known persons for their "name-dropping" value. Such selections may gain us shallow respect, but achievements will gain us more. Achievement in mind, we will be inviting people who can help us, through their expertise, experience and connections, in these areas:

- **Project Design & management**,
- **Position Paper** drafting
- **Breakthrough Workshop** definition, design, chairing

While we have a wish list of additional collaborative projects, position papers, and workshops, we'll introduce them one by one, when the time is ripe.

As I write this, a first round of invitations to a dozen persons is ready to mail. Some of the candidates are already Moon Society members. Others know of us. Next month I will introduce those who have accepted.

As our projects and efforts expand, and we gain some publicity and notice for our efforts we will be inviting more people to join our "working" Board of Advisors to help us with yet more endeavors.

### Growing the Membership

Improved membership retention is our first goal. We want to *earn* your renewal! Regaining lapsed members is another. As to recruiting new members, we expect publicity about our various efforts to have some effect.

Personal contact, however, is the most effective way to gain new members. Tell your friends about the Moon Society on the Move.

We value and need those who help us only through their membership dues and project support donations. But we also hope to attract those with abilities they are eager to put at the service of the Society, growing not just our membership, but our talent pool. *Engage!*    Peter Kokh

Be sure to read Ken Murphy's letter  
printed on pp. 13-14 below!

[A movie that got away]

**PLYMOUTH - (1991)(ABC-Disney TV)**

http://www.imdb.com/title/tt0102681/

**Director/Writer:** Lee David Zlotoff (McGyver)

**Plot Summary:**

The inhabitants of the small town of Plymouth have to evacuate their homes. Collectively they move to a moon base. Despite the agreement that no babies should be born there, because of the risks involved, the base's doctor does get pregnant. And then a sun flare hits the moon and everybody has to seek shelter.

**Cast:**

Dale Midkiff\* Gil Eaton  
Cindy Pickett Addy Mathewson  
Richard Hamilton Mayor Wendell Mackenzies

\* Lead (Daren Lambert) in TV Series "Time Trax" 1993-94

**Status:**

Shown only twice, Saturday, Memorial Day Weekend in both 1991 and 1992. The ratings, judged on those who watched, were insufficient to motivate ABC to take it to Series, though it was intended as a series pilot. No VHS recording was ever released. The only available copies are those made privately off one of the live airings.

Those watching, which included a lot of media-science fiction fans used to films involving clashes with alien species and spectacular battle scenes, did not rate the film highly. But this is neither here nor there. As a film, the only one ever produced to treat the Moon as a place to go for resources that could help solve Earth's (energy) problems, *Plymouth* has real value as an outreach tool for space activists. For me personally (Peter Kokh), it pushed all the right buttons and I have watched my copy over and over through the years, enjoying it immensely every time.

Could we get Disney to release it to VHS, or better, to DVD? Those who did not enjoy it, or who consider the ratings the final arbiter, do not think it would be worthwhile to mount such a campaign. But let's push the idea a bit.

How would we go about convincing Disney that the effort would be worth while? How much would it cost them to produce a master? What would be the minimum run considered? It's at least worth an inquiry. All they can do is say "No!" But then they might say "we'll consider it." A noncommittal first response could be encouraging.

What would be gained? Outreach activists would have a video that they could show that portrays the Moon as a world worth living on, as more than a rock pile, as part of the solution to Earth's problems. It would show people making themselves at home in what at first seems a very forbidding place. Nothing ventured, nothing gained. - PK

[New DVD Documentary about the Moon]

**Background:** Several months ago, I received a message from Moon Society member Chip Proser that he would be coming to Milwaukee, and would like to interview me for a new documentary he was working on. As a venue with a great backdrop, I suggested "The Domes," a famous trio of geodesic domes hosting temperate, desert, and tropical plant collections, respectively. Much of the footage shot at the Domes is on this DVD which I have previewed. - PK

**GAIA SELENE :**

**"Saving the Earth by Colonizing the Moon"**

[Gaia: Greek for Earth]

[Selene: Greek for the Moon]

**"There are two and a half ways to save the Earth...  
...and two of them are on the Moon."**

**DVD runtime: 77 minutes**

From: [www.stickymedia.com/gaiaselene/buy.html](http://www.stickymedia.com/gaiaselene/buy.html)

"Our future and the Earth itself are in danger from pollution, global warming, climate change and a looming energy crisis. Space technology and colonizing the Moon have the potential to mitigate these dangers and guarantee a human future.

"Gaia Selene, a new feature documentary shows how we can avoid these threats and create an exciting new frontier of promise for mankind.

"You can preview Gaia Selene in low, medium, or high bandwidth at

<http://www.stickymedia.com/gaiaselene/buy.html>

"If you choose to order *Gaia Selene* (\$24.95), and are a member of the Moon Society (or most any other Space organization) you can select that organization from a popup menu and you will get a 10% discount. StickyMedia will also donate another 10% to the society you've selected!"

**Appearing in Gaia Selene**

Interviewed for *Gaia Selene* and featured in the final version are a number of well known persons including:

- Jerry Kulcinski, Univ. Wisconsin Helium-3 guru
- David Criswell, Lunar Solar Power Array proponent
- Paul Spudis, well known Lunar & Planetary Scientist
- David Schrank, author of *The Moon: Resources, Future Development, and Colonization*
- Alan Binder, Principal Investigator, *Lunar Prospector*
- Peter Kokh, the Moon Society

**Possibility of a Moon Society Blurb on the DVD**

Chip Proser, creator of *Gaia Selene*, has offered to include a blurb on the Moon Society on the DVD. The Leaders Council is working on composing something suitable.

ESA's SMART-1 nears Moon Encounter

www.esa.int/esaCP/SEMMSZ990E\_index\_0.html

Oct. 18, 2004 - ESA PR 56-2004. [Abridged by MMM]

Part I: Demonstrating a new way to get there

From October 10-14, Smart-1's ion engine carried out a continuous thrust maneuver in a last major push that will get the spacecraft to the Moon capture point on November 13, after a long and circuitous journey that began on September 27, 2003, thirteen months ago. The long ride was to test a solar-powered ion engine as a spacecraft's main propulsion system. Ion propulsion is slow but steady.

The SMART-1 mission has also tested the response of a craft so-propelled during gravity-assisted maneuvers, techniques currently used on interplanetary journeys, which make use of the gravitational pull of celestial objects to gain acceleration and reach its final target while saving fuel. Maneuvers in August, September, October were successful.

Thanks to this final thrust, SMART-1 will make two more orbits around Earth without any further need to switch on the engine, apart from minor trajectory correction if needed. The same thrust will allow the spacecraft to progressively fall into the natural sphere of attraction of the Moon and start orbiting around it from 13 November, when it is 60 000 kilometers from the lunar surface.

SMART-1 will reach its first perilune (initial closest distance from the lunar surface) on November 15, while the ion engine is performing its first and major thrust in orbit around the Moon. After that it will continue orbiting around the Moon in smaller loops until it reaches its final operational orbit (spanning between 3000 and 300 kilometers over the Moon's poles.)

Part II: Lunar Science - mid-January to mid-July, 2005

Reaching its operational orbit in mid-January, the probe will study the Moon for six months, starting the first comprehensive survey of key chemical elements on the lunar surface and implications for the theory that the Moon was formed following the violent collision of a smaller planet with Earth, four and a half thousand million years ago.

The lunar surface chemical composition will be mapped more accurately than ever before with the latest imaging techniques. Images taken from many different angles and X-ray and infrared detection work will produce a new three-dimensional models of the Moon's surface.

SMART-1 will be looking at the darker parts of the Moon's south pole for the first time, and mapping the so-called Peak of Eternal Light, a mountaintop that is bathed in sunlight 86% of the time. Around it are dark craters never touched by the Sun, believed to harbor water-ice in the lunar soil. Readings may help scientists to confirm if ice is present. Any water on the lunar surface would be very helpful in the creation of permanent bases on the Moon.

2008 Beijing Olympics Deadline Motivates Chinese to complete Chang'e 1 Moon Mission

[2008 Olympics <http://en.beijing-2008.org/> ]

SpaceAge Publishing in its 10-21-04 newsletter, suggests that hosting the 2008 Olympics in Beijing is providing a powerful incentive for the Chinese to keep the Chang'e 1 Lunar Orbiter Mission on schedule so that its science mission can be successfully completed and results evaluated before the games begin.

The probe will be China's first lunar orbiter and mark a milestone of achievement for this new player on the space stage, now clearly third behind the USA and Russia after China's first successful manned launch last year. China has announced its intention of being an equal player in space and Chang'e 1's success could give them a PR coup.

The Change 1 craft and mission

(various sources including Xinhua News Agency)

Named "Chang'e 1" after a moon traveler of ancient legend, the probe is to be based on the DFH-3 Comsat Bus. Work began earlier in 2004, with the goal of completing the mission in 2007 or earlier. Construction on the ground station is nearly complete. Cost of the orbiter mission is pegged at 1.4 billion yuan (170 million U.S. dollars). The craft is expected to orbit the Moon for at least 12 months.

Its mission science goals include:

- mapping the lunar surface to get three-dimensional images.
• analyzing the content and distribution of minerals on the lunar surface
• measuring the density of lunar soil and
• exploring the lunar space environment.

The Next Step:

China has announced its follow on goal of achieving an unmanned soft landing on the Moon. Landing an unmanned spacecraft on the moon will take longer preparation and is not expected until 2010.

China launched its space program in earnest in 1992 and had worked aggressively to "catch up." China's space industry now employs many thousands of scientists and personnel in manufacturing and other areas in thousands of factories around the country - as in NASA's "Good Ol' Days."

Meanwhile, in India

India hopes to put its Chandrayan-1 spacecraft in a 100 km high polar orbit around the Moon by 2008. In two years it will produce a global chemical map of the surface. High-resolution remote sensing in the visible, near infrared, low and high-energy X-ray regions will provide data for the creation of A 3-dimensional atlas of "regions of interest," including the understudied S. Pole-Aitken Basin. <MMM>

[A heads up on a coming Moon Society attraction]

## Take a stroll on a Lunar Landscape under a Dome\*. Furnish your own lunar Apartment.

Report by Gregory R. Bennett <grb@asi.org >

Mary Cooper (*grandmamojo* in ASI MOO) is building a 3D, interactive, online lunar world. She would create a world using Adobe Atmosphere, not the MOO.

Right now, you can wander around on a lunar landscape under a dome. She is looking for guidance to build the Luna City Hotel.

Will it offer visitor access, or be for "members only? Cooper suggests a public visitors center and the rest of the world members-only. People could have their own apartments and decorate them they way they want to in the members-only area. It's what we had hoped the MOO could become. But the MOO can't support that.

This simulation is "under construction" at present, but you can take a peek and follow the progress at:

[http://www.artistichabitats.com/Atmosphere/AH3d/Lunar/LunaCity\\_Launcher.html](http://www.artistichabitats.com/Atmosphere/AH3d/Lunar/LunaCity_Launcher.html)

The system requirements to run Adobe Atmosphere simulations are on the narrow side, and many of you, including the editor, may find getting access a challenge.

- ▣ You'll need an "Atmosphere Client" to star off.  
<http://www.artistichabitats.com/Atmosphere/AtmospherePlayer216.zip>  
You can also get the player from the Adobe site, but sometimes the Adobe site can't get through firewalls."
- ▣ You'll also need Cable or DSL access.
- ▣ It may freeze up your Windows. It doesn't work on Linux or Macs, but Cooper expects that there will be a Mac Client by the end of the year.

We'll have more on these requirements and in future progress reports.]

[\* "Domes" as such do not pass the "lunar physics test."

The atmospheric pressure inside vs. the vacuum outside would result in the dome's rupture, or even with the dome being ripped off its foundation and blown up into space (before crashing down in an unsalvageable heap.)

On the other hand, "apparent faux domes," actually "spheres" in which the bottom half is used for utilities, factories and other out-of-sight things below a public landscape on the same plane as the outside lunar terrain, are quite doable. It will merely take some excavation for the bottom half. A right-sized crater might help, but excavating a crater bottom to go deeper may be rough going, given the compacted nature of the crater bottom debris. - Editor].

## Chapters & Outposts

Be sure to read Ken Murphy's letter about what just one person can do on his/her own printed on pp. 13-14 below!

### Ready to Use Outreach Resources for One Person Operations – Download & Print

**Flyers** (information about the Moon, Lunar Resources, Lavatubes, Lunar Settlement, Helium-3 & more.

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

**Slides & Slidesets**

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

**Transparencies for Overhead Projectors**

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

**Setting up an Exhibit/Information Table**

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

**More**

[http://nsschapters.org/hub/hub\\_main.htm](http://nsschapters.org/hub/hub_main.htm)

**Step One:** write [chapters-coordinator@moonsociety.org](mailto:chapters-coordinator@moonsociety.org)

### Moon Society St. Louis Chapter

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

#### Photos back from Archon 2004

<http://www.moonminer.com/Archon.html>

On Saturday, October 2nd, MSS+L fielded an information table at the Archon 28 Science Fiction Conv., across the river in Collinsville, Illinois.

We adjourned for dinner at Schlaffley's in St. Louis afterwards. It was great fun as well as rewarding. Photos of Dave Dietzler, Dave Heck, Keith Wetzel, Chris Nobbe & husband, Burt Sharpe, and special guest, Moon Society President, Peter Kokh.

### Attention Moon Society Members

#### Keeping your Membership Information Current

This is a quarterly reminder for those of you who are online, to check, and update if necessary, your personal contact information that the Society keeps on file, most importantly, your mailing address and your preferred email address if you have one.

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

If any of the information in the box Member Information needs updating, click on the link [Edit Member Info](#)

Don't yet have a Team Director account, you won't be able to log in to My Moon Society, but you will get the login form where you can request a login account

## GREAT BROWSING !

### Early Faux "Evidence" for Lunar Cities

<http://www.lpod.org/LPOD-2004-09-17.htm>

### Turning a surplus ISS space suit into a free-flying satellite:

<http://www.arll.org/news/stories/2004/10/19/1/?nc=1>

### Cassini Titan Flyby 10-22-04 Images

<http://www.jpl.nasa.gov/media/cassini-102504>

### Gourmet Cooking On The Way To Mars

<http://www.spacedaily.com/news/food-04h.html>

### Earth-Sun Lagrange Points

<http://math.ucr.edu/home/baez/lagrange.html>

### The Moon - Moon Bahamas

*"Because you have been everywhere else"*

Opening 2010 off the Northern Shore of Grand Bahama Island (previously planned for a Las Vegas location)

<http://www.moonbahamas.com>

### Answering Questions about Exploring and Settling Earth's Solar System

<http://www.beyondearthorbit.org>

### Robots & Hubble: A Bad Idea?

<http://www.thespacereview.com/article/257/1>

### Book Review: Light This Candle

Biography of Alan Shepherd

<http://www.thespacereview.com/article/256/1>

### Shatner Aims for Real 'Star Trek' 7,000 sign up with Virgin Galactic for 3.5 hr rides in 5 spaceship fleet, 70 mi. up, 6 min. of weightlessness, starting 2008

<http://www.cnn.com/2004/WORLD/europe/10/22/branson.space/index.html>

### Mars Express Data Revelation Water & Methane Maps Overlap On Mars

[http://www.esa.int/SPECIALS/Mars\\_Express/SEML131XDYD\\_0.html](http://www.esa.int/SPECIALS/Mars_Express/SEML131XDYD_0.html)

### Little Green Algae Men on Mars Bacterial Action only Plausible Source of Methane found in Mars' Atmosphere

<http://www.spacedaily.com/news/mars-life-04t.html>

### Your Congressman's E-address, go to

<http://www.firstgov.gov/>



### Space Public Outreach by the Lone Individual.

from Ken Murphy <murphydyne@hotmail.com >

[From the Editor: *I met Ken Murphy, at the National Space Society's ISDC 2004 in Oklahoma City over the Memorial Day Weekend. I was impressed by his one man display of exhibits, pictures, and books about the Moon, and see what he accomplished as a model of individual one person "space outposts," taking activism outside the Chapter Box. His story, in a letter dated 8/217/04, is printed below.]*

To give y'all a better sense of what I'm doing, let me start by saying that I'm currently serving as the Vice-President of the North Texas Chapter of the NSS here in the D/FW metroplex. I have long held a fascination with our Moon, and I want to get us back there.

By us I mean the working men and women of the U.S. of A. I want to go there to get hydrogen and oxygen for Cislunar fuel. I want to mine the aluminum and silicates for vast solar arrays for the permanent power of tomorrow. I want access to new supplies of titanium, rare earth elements, SWIEs, and all the other elements of an advanced technological society. I want to grow specialty spices in regolith soils. I want to export the regolith to Earth to sell at ridiculously high prices to Japanese gardeners (i.e. lunar bonsai [getsumensai?]). I want to manufacture high-precision anhydrous optics and REAL glass (doped with rare earth elements and aluminum) which may give us the capability for tunable lasers. I want tourists to fly in vast underground lava chambers. I want old folks to be able to fall and still get back up. Business and commerce. Industry and trade.

So, how do I carry my message to the masses?

First is the display board. It's black in color, versus the usual white. I cut out the map of our Moon from a National Geographic poster and pasted it on. I then used small graphics and illustrations to flesh it out, from historical missions to possible future ones. Oh, and I used a really cool graphic from a SFF Return to the Moon poster for one of the lower corners. Not too much text, which gives you a greater chance to interact with the viewer.

I got some genuine fake Moon rocks from Jenson Scientific at SCI-Mall online. They're great as they allow the visitor to directly see that the dark vesicular basalts make up the dark mares they can see on the display board, and the anorthosite is generally the whiter areas. (and then you've got lots of breccias, the result of...). You even get a bit of lunar regolith simulant (I don't remember from which source).

Oh, and Mr. Kokh, your obsidian chunk is an enormous hit. It has enough unmelted bits to be able to

show the link between the regolith simulant and the glass.

I have one of the small copies of Michael Light's "Full Moon" that I usually open up to one of the 360 degree perspectives at the front of the display.

I also have scale spheres I got at one of the local crafts stores. An 8" styrofoam sphere for the Earth and a 2" styrofoam sphere for our Moon. I cut up a coat hanger to serve as axes for the spheres, and drew an equator and meridian on each one. Makes it easy to show the comparative tilts of the bodies (and that's why we want to put our bases there, so we can build power towers to get constant power). It takes me about seven good strides (your results may vary) to show the scale distance. When you hold the two close together it's easy to visualize a piece of the Earth's crust coming splashing up into orbit and forming our companion.

We're so lucky. We even get a convenient access point to the Interplanetary Superhighways via EML-1. I took a graphic from a NASA website that shows the gravity levels in Cislunar space and used 8"x11" thin black foam pads (also from the crafts store) to build a topographical model that clearly shows the saddle point of EML-1 and the plateaus of EML-4 and EML-5, but also helps to illustrate the gravity wells that have to be climbed up out of and the concept of energy levels.

So how do I get to show it to the public?

Four week-ends ago the NSS-NT Chapter bought a table at a Sci-Fi Expo. A little Sci-Fact with your Sci-Fi? By buying the table we were allowed to sell merchandise, but we couldn't have a raffle (gambling rules). We used my display as a backdrop and had a small TV/VCR and a DVD player to show the Apollo 11 movies. I'd lure them in with a small Ni-Fe meteorite from the Sikhote-Alin fall (Psst! Hey kid, you ever held a genuine rock from space before?), move on to the genuine fake Moon rocks (NASA won't let us have real ones, but chemically...), and sometimes they'd linger to pick up some merchandise. Our "Save the Earth...Develop Space" t-shirts did remarkably well (6 sold @ \$10). We easily had 150 visitors that week-end.

Three week-ends ago, the NSS-NT Chapter hosted a display at the Science Place in Dallas right by the front entrance (they really like us). Since it was the first week-end of the anniversary of the Apollo 11 mission We again used my Moon display (as well as an X-Prize display). The space blanket was particularly popular. We had a few more giveaways like coloring pages that time around, and we had the bonus of it being TI Weekend. We did do a raffle that time around, but couldn't sell anything because of the gift shop. We easily had 350 visitors that weekend.

Two week-ends ago the NSS-NT Chapter hosted a display at the Frontiers of Flight Museum at Love Field in Dallas, home of the Apollo 7 capsule. This time around my display was on the floor, but the video was still up on the table. We just had too many giveaways. Easily over 100

visitors that weekend. 600-700 persons in a three-week period.

As far as giveaways goes, what I did was contact some of the regional science museums and JSC, as well as folks like Space Camp, the NASA Academy, ISU and so forth and asked for brochures to distribute to the public. Some have accommodated us, others haven't, but we do have lots of stuff for folks to take home with them. The general public has a short memory without a paper back-up.

Coming up we might be at another sci-fi convention, and we're trying to team up with some of the local Solar System Ambassadors, as well as the Mars Society and Moon Society, the Texas Astronomical Society (over 800 local members locally!), the Dallas Area Rocketry Society, and so forth for World Space Week in October. Better to leverage the effectiveness of our work. Oh, and a local mall has expressed interest in hosting a table at some kind of theme day they've got coming up.

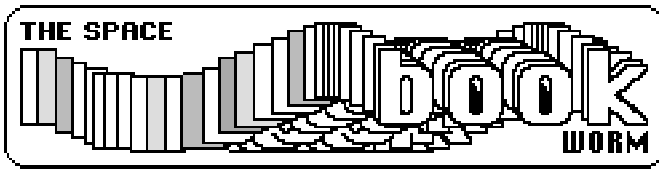
In a rather large nutshell that's what I've done so far. I'll admit that I really haven't had much opportunity to hand out membership flyers for want of space and the cost of photocopies (I can't do it at work). I do however mention the MS as appropriate during my spiel, so I'm at least getting the name out there. Some curious folks might be googling it.

It is a good bit of work, but it's very rewarding. Hearing a youngster exclaim "Cool!" as they pick up the obsidian hunk, or the look of enthralment as the young minds just soak up the wonder of it all.

Coming up we're hoping to have a World Space Week event in October at the FoF museum in Dallas with speakers and everything. I could turn out to be phenomenal, but it's going to take a network of folks to pull it off. Partnering with local organizations is going to be crucial and I'm really not concerned with how the organizations interact at the national level, as long as we all get along here at the local level.

If we handle the publicity correctly we may be able to get a significant turnout. I don't know if we'll be able to convince NASA to send some Moon rocks up to Dallas for the weekend, but it never hurts to ask. Our NSS-NT Chapter president and the VP of the Texas Astronomical Society (as well as Solar System Ambassador) are both Moon Rock Licensed. Of course then we'd likely get thousands of visitors and freak out the local constabulary and Love Field airport officials. I will definitely have a separate Moon Society table at the event.

It's very rewarding work, but it is work. The space community is going to have to talk to lots of people face-to-face to convey to them the potential of space development. Simple positive stories that plant seeds in peoples' minds [Editor's comment: *Let what Ken has done inspire many of you unconnected with local chapters to do likewise. We need to empower individuals!*].



## Space Tourism – Do You Want To Go?

By John Spencer with Karen L. Rugg  
Foreword by Astronaut Rick Searfoss  
An Apogee Book Publication

<http://www.cgpublishing.com/tourism.htm>

### Author's Book SYNOPSIS – Welcome Aboard!

Since the early 1980s a small group of visionaries have been pioneering the frontier of off-world tourism. Overcoming significant obstacles, their quest to start the space tourism industry was achieved on April 28, 2001, when American businessman Dennis Tito lifted-off from Russia into Earth orbit for a week-long voyage aboard the International Space Station. He was the first space tourist. Upon boarding the Station he said "I love space." He paid millions of his own dollars to fulfill his life-long quest to experience space. Since then another space tourist has flown, and many more are lining up for the opportunity.

Several private enterprise space tourism companies have recently been formed, some by multibillionaires including the co-founder of Microsoft, Paul Allen, the founder of Virgin Airlines, Sir Richard Branson, and the founder of Amazon.com, Jeff Bezos. They are spending millions of dollars of their own money. Why? Because they are positioning themselves to be leaders -- the Walt Disney and Baron Hilton of the space tourism industry; an industry destined to be the largest, most prestigious, and profitable industry off-world.

Millions of people from around the world want to go into Earth orbit to have that life-changing experience. To free float in zero gravity, to see the Earth, the Moon, and the stars from space. In the year 2004, less than 500 individuals have had the privilege of going off-world. But that number will significantly grow as private enterprise designs and builds the fleets of orbital access vehicles, orbital super yachts, and space and lunar cruise ships with names such as "Orbital Ecstasy," "Ambrosia," or "Lady of the Stars," which will eventually serve tens of thousands, then hundreds of thousands of space tourist. Many of those will have won international lotteries for their dream vacation.

In the future, space passengers will float and dance in zero gravity, swim in spheres of warm colored water, enjoy games, saunas, exercise, massage, shopping and world class entertainment. They can try zero gravity hair styles, wear the latest in cruise fashions body paint and accessories. Participate in orbital sports, space walks, (floats) the finest dining and of course, make love in the privacy of their orbital cruise cabin. The Moon will play host to lunar

resorts, health spas, and low gravity sports stadiums. The world will be thrilled as powerful racing yachts named "Challenger," "Intrepid," and "Quasar" compete in half million mile long space regattas around the Moon and back to Earth to win the coveted "Solar System Cup."

Today millions of people have space tourism themed experiences spending well over a billion dollar a year flying in aircraft which produce zero gravity experiences, visiting NASA centers, space camps, space theme parks and attractions, space museum's, IMAX films, planetarium's and observatories, going on astronomy cruises, purchasing books, media, and space merchandise. This Earth based space tourism industry will have massive growth over the next decade as a whole new generation of totally immersive multi-day space, lunar, and Mars themed simulation ventures open to the public. For the price of a normal vacation people can become "Simnauts" and participate in futuristic space tourism vacations, adventures, and real research in the emerging "SimExperiences" industry.

This is the first book published in the United States on the space tourism theme. It was written and designed by one of the world's leading authorities and pioneers in the growing field of space tourism, space architect, John Spencer. Founder and president of the Space Tourism Society, (STS) [www.spacetourismsociety.org](http://www.spacetourismsociety.org). In it he premieres his vision, the "Destiny" orbital super yacht design and master development industry plan for expanding the space tourism movement and creating the long-term space tourism industry. His plan offers opportunities for non-rocket scientists to participate today, to make a difference, and to have a wonderful time in the process.

You can reach John Spencer at:  
3153 Purdue Avenue  
Los Angeles, CA 90066  
e-mail: [jssdesign@aol.com](mailto:jssdesign@aol.com)  
[www.RedPlanetVentures.com](http://www.RedPlanetVentures.com)

List \$20.95 -- From Amazon.com \$14.97 (rating \*\*\*\*\*)

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The Lunar Reclamation Society, Inc.

P.O. Box 2102  
Milwaukee  
WI 53201

[www.lunar-reclamation.org](http://www.lunar-reclamation.org)

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

**New list - 2004 LRS OFFICERS / Contact Information**

PRES. / MMM Editor - \*Peter KokhNSS  
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VICE-PRES. Doug Armstrong NSS ..... 414-273-1126  
SECRETARY. - James Schroeter NSS  
< James\_Schroeter@excite.com > . 262-675-0941  
TREAS./ Database - \*Robert Bialecki ..... 414-372-9613  
Newsletter Mailing - Carol Nelson ..... 414-466-2081  
(\* Board Members, & Ken Paul < kenpaul@cape-mac.org >

**LRS NEWS**

• **Welcome New Officers:** We have recently filled two vacant officer positions. **Doug Armstrong** is now LRS' Vice-President. This optional office has been vacant for years. The bylaws allow combining the duties of Secretary and Treasurer, and Bob Bialecki has been doing both for some time. **James Schroeter** is now LRS' Secretary, reducing Bob's burdens. Our thanks to all our officers, present and past for all their hard work and efforts!

**LRS NOVEMBER / DECEMBER Events**

 **Saturday, NOV. 13 th, 1-4 pm**

**LRS Meeting, Mayfair Mall, Garden Suites Room G1 10**

**AGENDA: [www.lunar-reclamation.org/page4.htm](http://www.lunar-reclamation.org/page4.htm)**

- ✓ Update on the National Space Society's internal crisis
- ✓ Update on new Moon Society initiatives
- ✓ Planning our annual pre-Christmas Holiday event

 **Saturday, DEC. 11 th, 1-4 pm**

**Annual Pre-Holiday Potluck and Film Event  
Mayfair Mall, Garden Suites Room G1 10**

This month, we suspend all business, invite all members, former members, area NSS members, and friends to share our annual Potluck luncheon. Bring a dish or side to share! New LRS' displays and exhibits will be on hand along with back issues of MMM. At 2 pm, we will be previewing a new documentary, not yet released: **Gaia-Selene: Saving the Earth by Colonizing the Moon.** 90 minutes, DVD, and super!

**U.S. CHAPTERS**



**NSS**  
Chapter Events  
**MMM**  
6 Chapters Strong

Space Chapters HUB Website:  
[ <http://nsschapters.org/hub/> ]

**MINNESOTA**



**Minnesota Space Frontier Society**

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

Tom Greenwalt (w) 763-784-6244 (h) 763-442-6015  
David Buth (w) (612) 333-1872, (h) (763) 536-1237  
Email: tomg@mnsfs.org [ [www.mnsfs.org/](http://www.mnsfs.org/) ]

- **General Meeting**, Coffman Union UofM Room 324  
**Nov. 9th, Dec. 14th 7-9 pm**
- **Business Meeting**, St. Anthony Park Library's Meeting Room, 2245 Como Avenue, St. Paul, MN 55108  
**Nov. 20th, Dec. 18th 1-4 pm**

**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., 2 p.m, Nov 20, Dec 18, Jan 15**  
**Bourne Plaza, 1441 SE 122nd, Portland, downstairs**

**WISCONSIN**




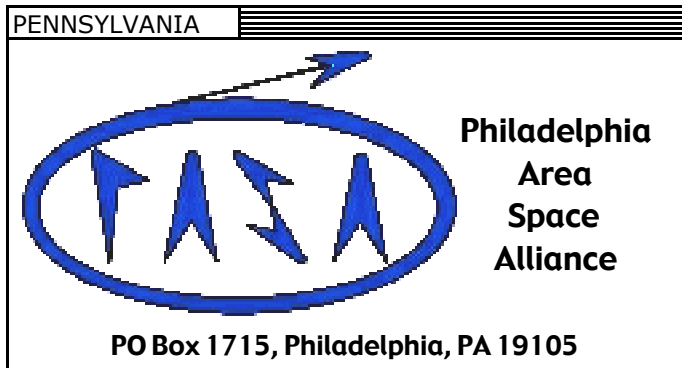
**Sheboygan Space Society**

728 Center St., Kiel WI 54042-1034

c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>  
SSS Sec. Harald Schenk <hschenk@excel.net>


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

-  We meet the 3rd Thursday of the month at 7-9pm
- NOV. 18th:** UW-Sheboygan, Sheboygan Room 6101
- DEC. 16th:** Stoelting House, Kiel



c/o Earl Bennett, EarlBennett@erols.com  
215/633-0878 (H), 610/640-2345(W)

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

 **PASA regular business luncheon/formal meeting from 1-3 pm, the 3rd Saturday of every month at the Liberty One food court on the second level, 16th and S. Market. Go toward the windows on the 17th street side and go left. Look for table sign. Parking at Liberty One on 17th St.**

**Note: in December** we will meet in Center City at the **Marriott Hotel** for the **Philcon** Science Fiction Convention from the 10th to the 12th

**Meeting Dates: Nov. 20 th.** Call Earl or Mitch 215-625-0670 to verify all meetings

•**October 9th Meeting Notes:** We had an interesting and wide ranging meeting. We went from the great pictures of Space Ship One and the illegal/immoral uses of camera technology at one extreme over to macro construction ideas as exemplified in Larry Nivens' "Bigger Than Worlds" from one of his 1970s story collections. Ringworld isn't the only magnificent scale engineering project!

Dotti brought in the material on Space Ship One (somewhat of a misnomer as it doesn't travel in space but just enters it) which, along with my addition of the website for the video from the X prize site, caused a rather large jump in the discussion to legality of micro miniature "spy cameras and the allegation that much of this kind of tool is used by "perverts" of various kinds instead of the great work portrayed by the video. We had a spirited talk on this topic as it bears on the fears and worries about the uses of technology. Our pictures from space and of space are inspirational and desirable for most people. We anticipate the use of near space balloons as camera platforms in the near future There was also talk on future activities as is mentioned in Hanks report.

Hank Smith reported on the upcoming Philcon in December 10th to 12th, with some of us being part of the events. Part of the discussions noted above included subjects that might be incorporated in Hanks topics list including large space structures on and off planet surfaces. This is beyond outposts and research stations. Much talk on possibilities. Mitch Gordon will volunteer if a panel on this

area of space habitation develops as he is very interested in the physical and social aspects of this possible future.

Also brought up were other Cons and events, with the 2005 Balticon being a major event in the Spring. Further in the future, 2007, our area may host a North American Science Fiction Convention which could be held in Ocean City, Maryland. This is instead of World Con in North American , which will be held overseas (possibly in Japan). We'll find out about Hank's ongoing activities and his Philcon events plans. He is in charge of Science Programming and wants our participation. Thanks Hank!

Mitch Gordon was a contributor to several of the discussion threads both on the use and misuse of technology. His first comments were on the NASA budget which was cut by about 1.1 Billion dollars. The budget cut was also referenced later. This should be on the NSS website and members discussion list.

On other topics: Mitch is still working on the introduction of guest authors and speakers to our area. At this point the authors that we had hoped to bring in may come with restrictions by the bookstores based on potential customer draw to the events and the sales engendered. Mitch quoted the need for approximately 50 attendees as a desirable number. We had about 40 at Bob Zimmerman's event but most of us also bought his book *Entering Space* (which earned Bob an E.M.M.E.) . Mitch will continue in this area although the authors agent(s) may work directly with some of the stores in our area.

On a related topic: Mitch gave a presentation on "Space Tourism: Do You Want To Go?" by John Spencer and Karen Rugg. Besides writing this book on the topic John also has the Space Tourism. Society.org website as well as Red Planet Ventures .com. Because of the interest in the topic Mitch will contact John to bring him here. He was very enthusiastic about the book and mentioned that it was available through Amazon.com. Go Mitch!

Larry, our webmaster, told us of the need for more material for the site and he'll work on connecting to the aforementioned website with the hope that this will improve our visit rates. On that subject, he reminded me to inform Moon Miners' that Tripod should be spelled with one "I" in our address.

Earl, President and Technical Director of the group, brought in material on Aerogels from the Industrial Physicist that described some of the background and recent work on this "futuristic" material that is actually over 50 years old! The article includes the beginnings of use of the material in space starting in the 70s leading up to the current Genesis and Stardust probes. On the Earth side of the equation; the authors note that the price of the material must decrease by up to Two orders of magnitude for consumer residential or related applications. This material is a fabulous insulator and can also be mixed with other materials including carbon. This results in excellent

light absorption (99.5% +). The author was Eric J. Lerner in the October/November 2004. T.I.P.

Also in that issue is an interesting report titled "Big Green Energy Machines" by Jesse H. Ausubel on modern, compact, high efficiency power plants intended for revising the Earth-based Primary Power infrastructure. The details of the article are very interesting, especially for those who remember the L-5 Society's and SSI's reports on the alternate possible power converters for the Geosynchronous solar power plants. The designs were actually for photo voltaic or steam turbines. The author's design for Earth might be useful in space (with modification of course). The authors point about multiple uses of the needed infrastructure also has application to our needs in the future and I highly recommend the report.


Also noted was a shift in Nuts and Volts publication of the Near Space column which will appear in the November issue and may be a bimonthly report. As I write this the November issue has the column with "Hacking the Pencam for near space applications" and the success of Space Ship One and the website scaled.com.

Janice, our visiting non member, brought in material from Science on the budget problems at N.A.S.A. which included a \$400 million cut in the Shuttle budget. Check with NSS on this topic. Also referenced from the same Science Magazine (for September) was a report on climatic change and the effect on the Antarctic Ice Shelf. The ice is actually peeling ("calving") off at a high rate that will alter the marine biosphere. Data is being gathered to check this via satellite.

It should be noted that Jim Karcher brought up several of the side topics in our discussions, especially on the helpful uses of the new video technology (he speculated on the use of miniature cameras for internal examinations) and learned that this is indeed happening. He also understood the possible application of the new power plant technology and speculated on it as a solar power converter. Jim joined us just last year and came up with these ideas himself. Its good to have younger, new members!

Submitted by *Earl Bennett*

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/> ]

oasis@oasis-nss.org

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


 **Regular Meeting 3 pm 3rd Sat. each month**  
Microcosm, 401 Coral Circle, El Segundo.

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

- **Nov 19, 8:00 p.m.** -- "Huygens: Splashdown on Titan," by Candy Hansen, of JPL's Cassini Mission. Science Lecture Hall 140, Santa Monica College, 1900 Pico Blvd. 310/434-4003 or <http://www.smc.edu/planetarium/>
- **Nov. 20th, 3:00 p.m.** -- OASIS Monthly Business Meeting will be at Microcosm, 401 Coral Circle, El Segundo
- **Dec 4th, 4:00 p.m.** -- "Mars Exploration: From the Vikings to the 21st Century", a lecture by Dr. John Callas, Mars Exploration Rover Science Manager, Long Beach Public Library, 101 Pacific Avenue, Long Beach


**Photographs from our 26th Anniversary July Picnic** - great photos of our portable Marsscape with our Pathfinder and MER rover scale models.

<http://www.oasis-nss.org/gallery/2004/picnic/index.html>



Be sure to read Ken Murphy's letter about what one person can do on his/her own printed on pp. 13-14 above!

**SOLAR SYSTEM AMBASSADORS**



[www.jpl.nasa.gov/ambassador/](http://www.jpl.nasa.gov/ambassador/)

<b>Michelle Baker</b> Princeton/Philadelphia chaos@cybernet.net
<b>Bill Higgins</b> Chicago, IL higgins@fnal.gov
<b>Harold Schenk</b> Sheboygan, WI hschenk@excel.net
<b>Bill Hensley</b> Kenosha, WI hensley@acronet.net

**See Page 10: New DVD Documentary on the Moon**

We can't realistically get to the Moon without reductions in cost, which will only come from private space tourism."

- Mark Shuttleworth, 2nd tourist to ISS

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\$45 National Space Society dues includes **Ad Astra**  
 \$20 NSS dues if under 22 / over 64. *State age* \_\_\_\_  
600 Pennsylvania Ave SE #201, Washington DC 20003

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

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

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PO Box 2102, Milwaukee WI 53201-2102.

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