"Expanding the Human Economy through Off-Planet Resources"

Moon Miners' Manifesto

& Moon Society Journal

#159 October 2002

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In Focus Chickens of ISS Downsizing may be "Coming Home to Roost"

When the Bush Administration ordered NASA to unilaterally renege on our agreement with the Space Station International Partners and cut both the four-berth U.S. Habitat Module and the seven-seat Assured Crew Return Vehicle (X-38 program), we took the optimistic "glass half full" view. Indeed, at first there where signs that Italy and others would rise to the occasion and fill the gap.

Unfortunately, with the worldwide downturn in the economy, this unilateral act, taken without bothering to consult our partners, is now being taken by the partners as "permission to follow suit."

The first indication that Bush's devaluation of America's Word will turn out to haunt us, comes with Russia's announcement that it can no longer afford to pay for two Soyuz launches to ISS each year, six months apart. The Soyuz was intended as a stopgap 3-seat assured crew return vehicle until the U.S. X-38 derivative was operational. Now the period of reliance on the Soyuz has effectively been extended indefinitely. It is also residual fuel in the Soyuz and its Progress freighter twin that are used to reboost the station to a higher more stable orbit.

NASA, and the Bush Administration, now find they have backed themselves into a corner of their own making. Either we must further subsidize the Russian operation, or, as the Russians themselves suggest, we should buy a pair of Soyuz spacecraft -- they are reusable -- in order to guarantee (1) that space station crews, now capped at three persons, have assured emergency safe return to Earth, and (2) a way to maintain the station in a safe orbit -- without periodic reboosts, ISS' orbit would continue to degrade until it entered the upper reaches of the atmosphere to meet an end à la Mir.

Decisions have consequences, something the Administration is hopefully beginning to realize. The International Partners, including Russia, are now threatening to sue the United States for breech of contract. *It is in our own best interests, to lose that suit!* If we were to prevail, a slippery slope awaits. And where it leads is not pretty.

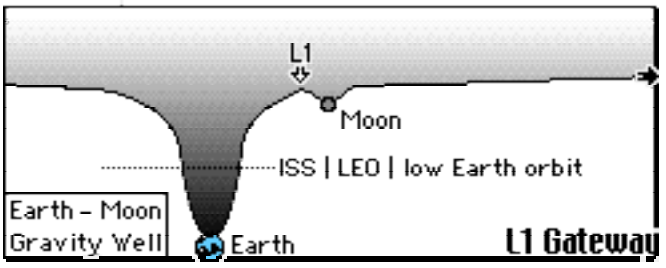
Let's sketch it out, so that we are all clear about what could be at stake.

1. The U.S. stands firm, insisting that the Russians continue to provide two Soyuz spacecraft a year and pay the bill for them in toto.

[=> p. 2, col. 2]

Expanding Manned Space to the L1 Gateway

Robert A, Heinlein is often quoted as saying "once you are in low Earth orbit, you're half way to anywhere." He might have gone on to point out that once you are at L1 you are 90% of the way to anywhere. In our illustration, L1 perches on a "gravity divide" hillcrest, equally handy to the Moon and Mars. For more on NASA's new plan, see pp. 6-8



Moon Miners' Manifesto

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fi IN FOCUS Editorial continued from p. 1.

2. The Russians stand firm and the Administration, and/or Congress, balks at picking up the tab.
3. While the station continues to lose altitude, fingers are pointed, and we concede too late.
4. Continuing to cast blame on others, we watch ISS plummet through the atmosphere. We righteously maintain our dignity as the world's opinion of America as a can-do nation plummets as well.
5. With no place to go, the Space Shuttle fleet comes under the microscope of budget cutters as an exorbitantly costly way to put payloads into space. The Space Transportation System is phased out and we are left to do what the rest of the world does, rely on expendable launch vehicles.
6. NASA's Manned Space operations are shut down
7. The "Great Pause" in the Space Age begins. It's anyone's "wishful thinking guess" when humans will return to space.

We share everyone else's hope that it does not come to that. Yes, private enterprise may find a way to put people back into space, first as tourists, then as prospectors, miners, factory workers, and settlers.

The question is whether not having NASA to continue blazing the trail will delay things or, to the contrary, accelerate the pace of commercial space development. If indeed we have been using NASA as a crutch, and have been allowing ourselves to be discouraged by the high costs of government space, then the temporary end to the Manned Space Age, 1961-? could be short-lived. "Nature abhors a vacuum!" "We will be back!" *We hope and pray!*

Meanwhile, in advance of slippery slope step #2, we can all hope *and actively lobby* that the Bush Administration, Congress, and NASA wisely agree to buy a two-craft Soyuz fleet from the Russians. (The bad side of that, of course, is that it may mean the end to $20,000,000 tourist rides to the station.) *And* that the four-berth U.S. habitat and Assured Crew Return Vehicle are both reinstated! - PK

Oops! -- MMM #158 misprint

We did not notice, when we printed out the master copy of the September issue, #158, that static in the printer caused a serious overprint in the first sentence of our IN FOCUS editorial "Bush's ISS Downsizing & Slow Economy Stall Commercialization"

The sentence should read:

"The International Space Station, although still incomplete, is already larger in usable volume than Russia's former Mir Space Station."

The second line was somehow doubled back on itself and totally unreadable. There was/is nothing at all wrong in the word processor document from which it was printed, nor in the pdf file, for those of you receiving it by subscription agreement.

Congressional Committee Votes to Fund Pluto–Kuiper Belt & Europa Missions

http://www.planetary.org/house_vote.html

Oct. 8, '02: The House Appropriations Subcommittee on VA, HUD, and Independent Agencies, has recommended increasing the NASA budget to permit the Pluto-Kuiper Belt mission, New Horizons, to proceed and to re-initiate development of a Europa orbiter.

Passage of the bill in the Appropriations Subcommittee has to be followed by the approval of the missions by the full Congress before the fiscal year 2003 NASA budget is final. That budget has not yet been acted upon, and is caught up in the logjam of appropriations bills in the Congress. The Senate Appropriations Subcommittee has already voted to add funds for the Pluto-Kuiper Belt mission.

Louis Friedman, the Executive Director of The Planetary Society remarked:

> "Congress's support and the public interest in Pluto and the Kuiper Belt, and in Europa, has been steadfast. We hope this will end the Administration's opposition to new missions for outer planet exploration. ... Yesterday's announcement of the discovery of a large planet-like object beyond the orbit of Pluto further enhances the scientific importance of exploring the Kuiper Belt. There is so much out there in our solar system to be discovered and revealed."

The added funding for the Europa mission is especially significant and promising, as funding for the project had previously been canceled by the Administration. This issue will have to be resolved in conference with the Senate, which did not include such funding in its recommendation.

The Europa orbiter would launch later in the decade, after the Pluto-Kuiper Belt mission. There is strong evidence that Europa has an ocean beneath its icy surface, and the Europa mission would determine the location and distribution of this ocean in order to pursue the notion that this ocean might harbor extraterrestrial life. **<TPS>**

Issue Background

We reported in the March issue* that the Bush administration's rational for canceling "for now" all outer solar system missions was to prioritize the development of propulsion technologies that should allow such missions to be flown in much shorter time frames in the future, possibly (no promise) arriving before missions launched sooner using today's rocket technology.

* See MMM# 153 MAR. 2002, p 1. IN FOCUS: Mars, and NASA's new "Nuclear Systems Initiative"

There can be little quarrel with the need for superior propulsion technologies. At the speeds attainable by present technology even with planetary billiards gravitational boosts along the way, such missions take years to reach their destinations and frequently well over a decade from mission conception to realization and attainment of scientific objectives. The longer this period is, the more stretched out the science game becomes. New probes seek answers to questions raised by their predecessors. Waiting for answers slows everything down to a crawl.

The Bush strategy, while it get rave reviews if it works "on time" to get a delayed mission to Pluto before that planet's seasonal atmosphere freezes out as it recedes even further from the sun on its very elongated elliptical orbit, will, if it fails to deliver the hoped for new propulsion technology in the form of a tested and proven rocket *on time*, merit eternal rebuke from scientists and those interested in the scientific quest for the following two centuries when at last there will be another launch window.

Congress seems to sense the need not to take that chance better than the Administration does. We have, after all, already one blemish on our otherwise spectacular spacefaring record - the cancellation of the probe to Comet Halley. Now we pay the penalty of having to wait three quarters of a century before we get another chance.

In the case of Europa too, Congress seems to understand. If there is one space issue "button" that has consistently gotten through to Congress it is the search for extraterrestrial life. It is the unquestionably immense philosophical significance of "any" answer that drives Congress' strong support for the ongoing ambitious Mars robotic exploration program.

After Mars, Europa is at the top of almost everyone's list of "most intriguing worlds." We are close to unchallengeable certainty that its icy crust caps a global ocean. We have learned that life can begin without oxygen, fueled by other kinds of metabolic processes, witness the the thriving communities of exotic life around Earth's own ocean bottom hot spots. Not only does Europa's ocean, estimated to be sixty miles deep, hold more water than our own, but if it holds even microbial life, the implications for life in the Universe at large are enormous.

Both Europa and Pluto are at the top of the list of Outer Solar System "must visit" destinations. As we learn ever more about Titan from afar, that moon of Saturn may join the list. And as/and if we reach fusion breakthrough, Uranus (the smallest of our System's four gas giants) will take its spot as a source of helium-3 that could take millions of years to exhaust.

Meanwhile, Mars remains a priority. But suddenly it has company. The planetary science community has reached consensus that Apollo has left too many questions unanswered, and that NASA must return to the Moon to sample the unique crust penetrating South Pole Aitken basin on the farside.

We hope that the Bush Administration will see the light and accept Congress' lead. **-** PK

MOON POWER

Dave Dietzler <Dietz37@msn.com> 9/22/2002

The Global Warming Challenge

Energy from the Moon is vital to the world's future. Dwindling oil supplies, global warming, pollution, coal burning and strip mining, nuclear waste and the threat of meltdowns cannot simply be ignored. Winds, tides, geothermal, dams, OTEC, ground based solar, biogass, high-temperature superconducting cables, switching to household fluorescents and LEDs, thicker home insulation, and conservation can help, but they cannot solve the problem entirely. World demand for electricity due to rising standards of living worldwide will increase manyfold. Fuel cell powered cars as well as heating that is now provided by shrinking natural gas supplies will increase the demand for electricity even more.

Fusion Power?

Fusion could be the answer. The temperatures required for fusion have been produced. To achieve the necessary plasma densities and confinment times in TOKAMAKS may be as simple as using larger, more powerful magnets made of YBCO cooled by liquid nitrogen. The strength of the magnetic field is central to confining the plasma, so larger magnets carrying higher currents are the way to go.

Fusion reactors will be enormous machines. The IETR (International Experimental Thermonuclear Reactor) will stand three stories tall and have magnets that amass 10,000 tons, but it will only be a demonstration reactor capable of generating 500 megawatts. A TOKAMAK that can crank out 1500 MW would be even more gigantic. Obviously, it would also be expensive. The IETR budget is several billion dollars.

If deuterium and tritium are fused, neutrons and radioactive waste will result. Although the quantity will be miniscule compared to the waste from fission reactors, there will be problems with reactor materials becoming radioactive and giving off heat. This could limit the lifetime of these huge and expensive TOKAMAKS.

Lunar Helium-3 to the rescue

Helium 3 from the Moon is the solution. This substance when "burned" with deuterium or fused with itself produces virtually no neutrons. A fusion reactor that can use helium 3 will have even more massive magnet assemblies than a deuterium/tritium fusion reactor because helium 3 plasmas require higher temperatures to ignite and are more difficult to contain. Laser fusion reactors might someday be less massive that TOKAMAKS, but laser fusion lags behind magnetic fusion.

The Solar Power Satellite option

If a fusion solution does not turn out to be feasible from both an engineering and economic standpoint, solar energy is our world's only hope. As O'Neill made clear, the best place to base solar power collectors would be in GEO where the Sun shines 24/7 unobscured by clouds, and from where power could be beamed down via microwaves. Lunar materials would be the key to this enterprise.

Industrial Operations on the Moon needed

Since we don't know if fusion will ever pan out, but there is no theoretical reason SPSs would not work, it makes sense to industrialize the Moon now. Decades of development on the Moon may be needed to do the job. If HE-3 fusion is commercially possible and profitable, we will still need SPSs. To power the world of the 21st century with helium 3, about 300 tons a year would be needed, and this would entail the mining of 30 billion tons of lunar regolith every year. That might be prohibitive.

O'Neill's orgininal 5,000 MW turbogenerator SPS would only amass 80,000 tons and last for decades, perhaps centuries. The aluminum reflectors and structure would not corrode at all in space; only the turbines and electronics would need replacement. Since inert helium would probaby be the working fluid, the turbines might run for over 50 years as the TVA dam turbines did before first-time overhaul.

An SPS should be a good long term investment. To produce as much energy as 300 tons of He3-5,700,000 MW years, 1140 five gigawatt SPSs spaced 145 miles apart in GEO are needed. About 91 million tons of material, mostly aluminum, would be needed to build these powersats. Obviously, we won't have to do as much Moon mining to build these SPSs and it is a one time or once a century job.

SPS Limitations

Cities in the arctic regions might still get along better with helium 3 fusion*. Microwave beams from GEO powersats would have to pass through more atmosphere to reach receiving antennas in the higher latitudes. Beams would spread out at the more oblique angle of the Earth's surface in those regions and much more rectenna area would be required.

Fusion reactors would also provide the benefit of waste heat that could be fed through underground steam loops to buildings in arctic cities. Since a fusion reactor cannot explode or melt down and HE-3 fusion will generate virtually no radioactive waste, the fusion plants could be located in the hearts of arctic cities. The best possible future would be one in which SPSs and He3 from the Moon allowed the generation of vast amounts of clean energy. The Moon is worth trillions of dollars yearly, and the preservation of the Earth's biosphere. **<DD>**

150 Ton Magnet Pulls World Toward New Energy Source
www.spacedaily.com/news/energy-tech-02p.html

* [Editor: another solution: use SPS rectennas in the tropics to power electolysis of sea water to produce Hydrogen shipped to the arctic as a power source.]

Lunar Cement & Plaster

Dave Dietzler <Dietz37@msn.com>

Gypsum as a byproduct of Silica production

In the process of leaching silica out of regolith with sulfuric acid there will also be the formation of barely soluble calcium sulphate. Calcium sulphate is also known as gypsum when found in nature or plaster of Paris when roasted and dried. There are 80,000 tons of calcium in a million tons of regolith. Without going into the details of stochiometry, this is enough to make 272,000 tons of artificial gypsum. We could plaster a lot of porous walls in lava tubes with that and add a coat of sodium silicate based paint. The CaSO4 powder can be wetted to make a slurry, laid down on paper, coated with another layer of paper, allowed to dry and the result is wall board, also called sheet rock. Besides plaster, CaSO4 is used as a soil conditioner and Portland cement is made with about 5% gypsum.

The problem is separating the CaSO4 from the silica. Since about 0.66 grams of calcium sulphate will dissolve in a liter of water, it may be possible to use recycled water and waste heat from nuclear reactors to wash the gypsum out of the mix to get a pure sand for glassmaking. This will be slow and energy intensive. Fortunately, the stuff is actually where we want it to be-mixed with silica-for cement making. We will need far more cement than plaster or glass to make settlements in lunar lava tubes. From Van Nostrand's Scientific Encyclopedia, 8th edition, we find that:

> "In the Muller-Kuhne process [for making cement], gypsum is mixed with clay and silica in quantities necessary to make cement, along with coke to reduce CaSO4 to CaO."

During the roast the carbon reduces the gypsum in the mixture to lime (CaO), the necessary ingredient for mortar and cement; and sulfur dioxide, carbon monoxide and CO2 form. The SO2 can be converted back to sulfuric acid and the CO & CO2 can be reacted with hydrogen in a Sabatier reactor to form methane and water. Methane can be pyrrolized to recover carbon and water electrolyzed to recover hydrogen-or just left as is because water rather than hydrogen will probably be what we need-carbon recovery is the main thing. We will already be doing this very same thing in the process of aluminum refining to recover carbon from electrodes that burn up during electrolysis, so we can use some of the same equipment for both jobs-two birds, one stone. A mixture of silica, lime, regolith, water and a little CaSO4 should make decent cement.

Getting the needed Reagents

So where are we going to get all that hydrogen and sulfur for sulfuric acid to make the stuff? Other sulfate compounds formed when the lunar dirt is leached will be decomposed to recover the sulfur, and water that forms during the reaction of oxides with acid will be boiled off and saved. If we make 272,000 tons of CaSO4 we will use up 64,000 tons of sulfur. At 500 ppm, that much sulfur could be roasted out of 128 million tons of regolith during He 3 mining, or about enough to produce one ton of helium 3. We will need 196,000 tons of sulfuric acid containing 128,000 tons of oxygen and 4,000 tons of hydrogen. That much oxygen could be extracted from 320,000 tons of regolith and the hydrogen could come from polar ice or be roasted out of 100 million tons of regolith. We can recycle the hydrogen by using water that forms from the reaction: CaO+H2SO4=CaSO4+H2O As long as we are producing fresh sulfur and oxygen to make sulfur trioxide, SO3, which then reacts spontaneously with water to make sulfuric acid, we're in business and we don't have to worry about mining so much hydrogen, even though we will mine every bit we can for its many uses. Most of the gypsum will be reduced to lime for cement and the SO2 recovered to keep up acid supplies.

Cement rather than plaster could be used to coat lava tube walls. Cement could be poured to make smoothe floors, solid walls, swimming pools, fish pools, furniture, etc. Calcium sulfate washed out of the silica mixture could be reduced with carbon to get lime (CaO) which can be mixed with sand and water to make mortar for stacking cast basalt bricks. Lime can also be used for white wash and glass-making. It can also be reduced with aluminum to get pure calcium metal for highly conductive cable.

Finding sedimentary gypsum deposits on Mars

We might find natural sedimentary deposits of gypsum on Mars, but on the Moon we will have to make the stuff. Plaster is used for tooth impressions, casts for broken limbs, pottery, lamp bases, molds for casting non-ferrous metals, patching and grouting compounds, pharmacuetical-tablet diluent and even tofu. As for the sulfates left over after filtering out the silica/gypsum mixture and boiling down the liquid, I leave the task of separating that mish-mash to the future. Any suggestions? **<DD>**

For those who want to see the math:

Ca=40 S=32 O4=64 CaSO4=136 SO4=96

80,000 tons Ca/x = 40/136 x=272,000 tons CaSO4

272,000-80,000=192,000 tons of SO4 32/96= x/192,000 x=64,000 tons S

192,000-64,000=128,000 tons O since regolith is 40% oxygen by weight:
128,000/0.40=320,000 tons regolith

H2SO4=98 x/192,000=98/96 x=196,000
196,000-192,000=4,000

40 ppm H, 40 tons hydrogen
per one million tons of regolith

100 million tons dirt = 4,000 tons hydrogen
and one ton He3 **<DD>**

Expanding the Manned Space Envelope:

The Earth–Moon L1 Gateway

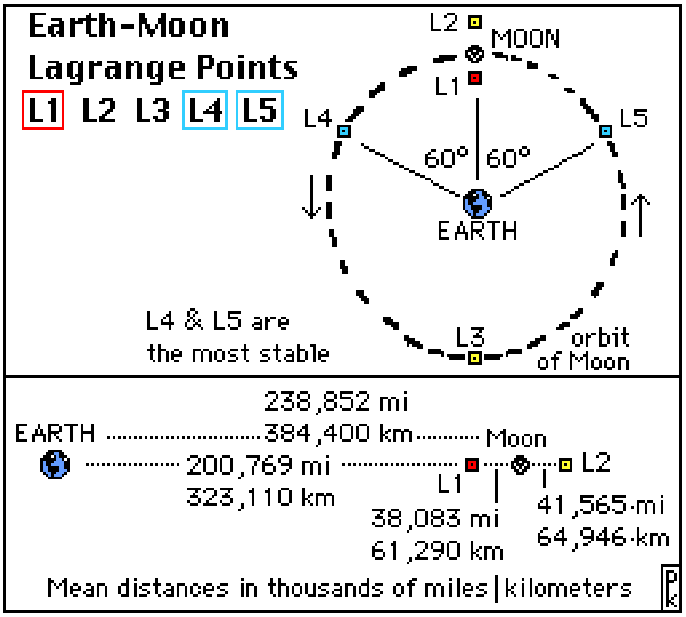
www.space.com/news/beyond_iss_020926-1.html
NASA's New Plan for the Moon, Mars & Outward
and www.space.com/businesstechnology/technology/moon_next_020923-2.html (*)

Article & Commentary below by Peter Kokh

(*) "NASA is developing a progressive plan for placing humans back onto the Moon. NASA Exploration Team (NExT) members at the Johnson Space Center have scripted a breakthrough strategy ... [that] makes use of existing launch capability and existing technology to establish a staging point at a so-called Earth-Moon Lagrangian Point, L1.

"Here's why L1 is important: In each system of two heavy bodies (the Sun and Jupiter, or Earth and its Moon) there exist five theoretical points in space at which a third and small body, under the gravitational influence of the two large ones, will remain approximately at rest relative to them.

"From the Earth-Moon L1 point [between the Earth and the Moon], a window to any spot on the Moon is reachable with minimal rocket energy."



Note: the distances given between L1 and the Moon and L2 and the Moon are calculated from the Moon's center. For mean distance to the nearest point on the Moon's surface, subtract 1,089 mi = 1,728 km.

A Plan in its Infancy

NASA's Exploration Team [NExT] has done little more than identify the *need*, and the *location* where that need can best be met. Any plan to build and erect another "Space Station" - this one at the Earth Moon L1 Lagrangian Point Gateway would have to be approved by Congress in order to become a budget item. There is probably no reason to begin planning implementation strategies, until NASA is ready to talk to Congress about the idea.

What it does and does not mean

That thee L1 point is ideal as a gateway for flights to anywhere n the Moon's surface, NASA's interest in this gateway does not mean that the agency has made a decision to return to the Moon, over, or before, sending humans to Mars. The beauty of the L1 Gateway is that it is also an ideal spot for staging missions to Mars. In other words, the establishment of an Earth-Moon L1 Gateway would enable all competing scenarios for the expansion of the Manned Space Envelope beyond low Earth orbit.

Usefulness of a Lunar L1 Gateway Station

(a) Research & Logistics

- testing the radiation environment in high Earth orbit (HEO) and techniques for maintaining a habitat environment safe for humans beyond the Van Allen belts - Apollo astronauts have been beyond that protection for no more than several days per mission.
- teleoperation via relay of SPA (South Pole-Aitken Basin) return sample mission (MMM #157 p. 4) and other surface probes
- teleoperation via relay of Farside radio telescope

(b) Manned Lunar surface Operations support

- teleoperating prospecting & mining equipmentin surface locations remote from manned outpost
- Staging | rendezvous for maximized efficiency configuration for space to lunar surface ferries
- a cryogenics fuel depot to provide braking fuel for craft bound for the lunar surface at much less cost than bringing that fuel all the way from Earth's surface (LUNOX: liquid oxygen produced from processed moondust) | LH2)

(c) Mars Mission support

- ideal quarantine site for Mars Sample Returns
- assembling larger Mars-bound spacecraft in an
  - environment free of orbital debris at a
  - facility that needs much less station keeping fuel than in low Earth orbit with
  - more frequent & wider launch windows to Mars
- refueling (topping off) Mars-bound missions with lunar liquid oxygen and possibly hydrogen brought up from the Moon's surface at a fraction of the fuel cost of getting them all the way "up the hill" from Earth

That such a gateway could enable and facilitate so many space mission/manned mission options, makes it a win-win idea certain to gather much more widespread (if less enthusiastic) support than either a Moonbase or Marsbase proposal could garner. This very aspect of "positive indeterminacy" (my terms) makes it a safe proposal for Congress persons to get behind. It pushes our future without making premature choices, leaving those choices to sort themselves out on their own merits.

The Space Frontier Foundation has already issued a supporting policy statement. Our recommendation is that the National Space Society and the Moon Society do the same.

Our suggestions for go-withs and phase-ins

- L4/L5 relay sats - small Data Relay Satellites at the Earth-Moon L4 and L5 Lagrange points would facilitate dedicated relay covering the farside flanks of nearside, reaching 60° past the east and west limbs of the Moon. They could be equipped with simple Dust Counters to qualify the "environment" of these possibly very dusty "Sargasso Sea" regions. Weight allowances and commercial sponsors willing, they could include teleoperated Amateur Telescopes to train on this beyond the limb reasons for the first time.
- An Unmanned Help-Yourself Fuel Depot be established first: this would be consist of a LUNOX tank farm to allow less expensive Earth-Moon and Moon-Earth flights. Attached station-keeping* thrusters would tap this fuel supply to keep the fuel depot "at" L1 as this position is not as stable as the L4 and L5 areas.

  * [L4 an L5 can be described as "bowl-shaped gravity valleys" - any deviation from the center causes a drift back to the center. However L1 (and 2 and 3) are better described as "saddle valleys" with the saddle perpendicular to the Earth Moon axis. Any movement to the side causes a drift back to the center, whereas any movement in the direction of the axis will keep gaining momentum and send the object on a collision course with Earth or the Moon as the case may be.]
- A Tool & Common Parts Crib could be added
- A Habitat Module could be added which would be for the use of personnel in transit and occupied only while a manned ship is docked at the station
- Crews could arrive at L1 a proper amount of time before the start of temporary assembly jobs, e.g. of larger ship consists headed out to Mars, returning to Earth when the job is done.
- In other words, this Gateway need not start out as another permanently occupied Space Station. This more modest, just in time staffing proposal would be far more likely to be approved by the keepers of the purse strings.

Implications for a Free Enterprise venture to open the Moon to resource-using settlement:

If the L1 Gateway is pursued in the form of a robotic facility open to use by all who pass that way, it can serve the cause of a commercial lunar overture just as easily as that of a NASA-led manned expedition to Mars.

NASA has been bragging, a bit prematurely we think, about having commercialized the International Space Station. What NASA seems to understand by "commercial" is not the same as what most proponents of free enterprise access to space mean by it. But by careful and judicious writing of the enabling legislation, *something with which it behooves all of us to be involved*, we can end up with a "positive-neutral" facility genuinely helpful to all types of ventures. We need legislation that does not pick winners and losers, which does not exclusively suit the world view of a socialized space program.

NASA does have a role, valued by all and not in dispute, to play in opening the Moon, of course.

- First we need a number of follow up orbiter-lander missions whether designed by NASA or elsewhere but flown as NASA Discovery missions:
  - South Pole Aitken basin sample return
  - "ground truth" polar lander probes to quantify and qualify potential ice resources
  - Oregon L5's proposed Lunar Lavatube Locator mission
- Beyond that it will be largely a NASA task to set up optical, radio, and other astronomical observatories on the Moon.

If NASA *opens* the door to space rather than keep posing *as the door,* the L1 Gateway could be, in Martha Stewart's words, "a good thing." **<MMM>**

OnlineReading:

Strategic Considerations for a Cislunar Space Infrastructure by Wendell Mendell
http://ares.jsc.nasa.gov/HumanExplore/Exploration/EXLibrary/DOCS/EIC042.HTML

[as a staging point for Mars missions, ISS] "has features which diminish usefulness and longevity, thereby limiting its ability to support long-term piloted spaceflight. These include:

• "Lunar/Mars launch window constraints: Launching vehicles to the Moon and Mars from an LEO "shipyard" is complicated by continuous changes in the alignment of the space station orbit relative to the desired trajectory [limiting] the number and duration of available launch opportunities.

• "Orbital debris: Artificial space debris is an increasingly significant threat to LEO facilities as space traffic increases. Space Station Alpha will carry rockets for collision avoidance and a substantial mass of shielding.

• "Atmospheric drag: LEO stations pass through the outermost reaches of Earth's atmosphere, so suffer drag and eventually decay from orbit and burn up if not periodically reboosted."

The Lunar L1 Gateway
Martin Lo/Shane Ross (Space 2001, Albuquerque)
http://www.cds.caltech.edu/~shane/papers/lo_ross_2001_abs.html [abstract]
".. natural Interplanetary Superhighway System .."

Some Past L1 Station Proposals

The idea of a Gateway Station at Earth-Moon Lagrange Point 1, a semi-stable "gravitational divide" 84% of the way from the Earth to the Moon, is not new. To many space transportation system architects, it's a natural concept.

"the Earth-Moon L1 point is the physical entry point into the lunar environment."
Badri A. Younes/GSFC

An L1 station would serve as end terminal for Earth-Moon ferries that remained in space all the time, never touching a planetary surface. On our end, a space station in low Earth Orbit acts as a depot transfer station for people coming from/returning to Earth's surface on a space shuttle of some kind. On the other end, an L1 station acts as a depot for people getting off of shuttles coming up from the Moon's surface, or getting on those same shuttles for the trip down. In between is the domain of the ferries -- and someday, the liners.

This was the original Von Braun idea, but we could never have "won" the "race" to the Moon if we had stopped to build either or both depots. So NASA designed the Apollo command module as both the ferry and as the return Earth shuttle; and the Lunar Excursion Module as the 2-part low lunar orbit to lunar surface shuttle.

A consensus decision was made to put any further exploration of the Moon on hold until these transportation nodes were in place. In retrospect, that was a flawed decision. There is such a thing as "just-in-time" infrastructure. We don't need an O'Hare field, much less a Kansai International - if all we are flying are Ford tri-motors. That's interesting topic for another issue.

Those of you who have seen the 1991 Made-for-TV Disney/Zlatoff film *Plymouth* about a pioneer settlement on the Moon engaged in Helium-3 harvesting, will remember that the last wave of settlers took one ship out from Earth, then transfered to a lunar shuttle at the L1 depot some 38,000 miles Earthward from the Moon.

In the Kubrick/Clarke epic *2001* (1968)*: a Space Odyssey*, Dr. Heywood Floyd takes a shuttle up from Earth to a "real" spinning space station in Earth Orbit, then an Earth-Moon ferry, and finally arrives on the Moon aboard a large lunar shuttle.

The whole point of having a pair of gateways is to gain economy from allowing Earth surface to orbit craft be specialized precisely for that task, Lunar surface to orbit craft be specialized for that run, and to use ferries designed to spend their entire lives in space to economically transferring people in between the two gateway depots.

Yet, until the traffic warrants, the bottom line may favor shortcuts. We'll get our L1 gateway depot in time, but why wait to get started? - PK

A Pause for Inspiration: Quotes worth Pondering

"The best way to predict the future
is to be busy creating it.

"The Best Way to Predict the Future
is to Invent It!"

No grimmer fate can be imagined than
that of humans, possessed of god-like powers,
confined to one single fragile world."
-- Kraft Ericke

The parachute was invented
more than a century before the airplane.

The Earth receives only one-half of
one billionth of the Sun's radiant energy.

Measure a man (organization) by
the opposition it takes to discourage him (it)

Judge a man not by where he has come from,
but by where he is headed toward.

Always listen to experts.
They'll tell you what can't be done and why.
Then do it. - Robert A. Heinlein

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
T. S. Eliot in "Four Quartets"

Vision without action is just a dream
Action without vision is just activity
Vision & Action together can change the world

Absolute faith corrupts as absolutely
as absolute power. - Eric Hoffer

"I believe that from the long straight lines,
severe angles, and cracked surfaces, that
Europa seems to be populated by frustrated
workers from the California Department of
Transportation (CalTrans)."
- Arthur C. Clarke

Be concerned not with what others have
failed to do. That is beyond your power to
change. Be concerned rather with what you
have failed or might fail to do. Then the
world will be all right.

As insignificant as each of us
may seem to be in the scheme of things,
the future becomes history
through the extrusion of individual acts.
Each of us makes a difference
one way or the other.

http://www.moonsociety.org

Please make NEWS submissions to
David Wetnight at newsmonger@asi.org
Other submissions: 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 explor-ation and utilization of the Moon in cooper-ation with other like-focused organizations and groups.

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

Join/Renew Online at
www.moonsociety.org/register/
- $35 USA/Canada + MMM hardcopy
- $60 elsewhere + MMM hardcopy
- $35 anywhere + MMM electronic PDF file

Questions? email: membership@asi.org

The Artemis Project™ http://www.asi.org/
- Artemis Reference Mission
- Artemis Data Book

Project LETO™
http://www.projectleto.org/

Please send all mail related to Memberships to:

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

How to fix MMM Subscription Errors:
www.asi.org/adb/06/09/04/1999/09/news-19990915.html

2002 Moon Society Election Results

10/13/2002 - from Greg Bennett, President

Officers

President: Greg Bennett	re-elected
Treasurer: Scotty Gammethaler	re-elected

Board of Directors:

Greg Bennett	re-elected
Peter Kokh	newly elected
Michael Mealling	newly elected
Randall Severy	re-elected
Arthur Smith	newly elected

As Treasurer, Scotty Gammethaler continues as an ex-officio member of the board along with Vice Pres. David Wetnight and Secretary Amy McGovern. Dana Carson and Ian Randal Strock also continue on the board, serving the second year of two-year terms.

The newly elected and re-elected officers and board members take office immediately upon their election, so I l extend a hearty hand of welcome to the new board members and my thanks to the officers and continuing members of the board!

Special thanks and a round of applause for Amy McGovern for serving as the election official this time around!

Greg Bennett'

Join the Moon Society today!
http://www.moonsociety.org/register/

Making Use of "Free"

by Peter Kokh

Putting up a chapter website or putting together an informational outreach table or exhibit may both seem like tall orders. But each of these "feats" can be achieved more easily with tools that are yours for the asking.

If you've thought of putting up a local chapter outpost, you don't have to join America Online, or go to Angelfire or Tripod with all their disconcerting popups and other annoyances. You can get a free website on the Moon Society server, along with an easy to remember address:

http://chapters.moonsociety.org/yourtown

Your webspace comes already furnished with easy to use website management software that works in your browser window, courtesy of our sponsor CyberTeams, Inc.

And, if you follow the leads on page 11, you will find an ever growing amount of free online and downloadable resources and how-to information with which to launch an effective outreach table.

Free is hard to beat!

Moon Society Chapters Page

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

ArtemisSociety Oregon Update

http://chapters.asi.org/oregon/

Situation: Listed chapter contact no longer available and may now be living outside the area. The website had not been updated since May 2000.

Dick Steffens, one of the listed members of the chapter responded 9-29-02 to the call to get things moving. He writes:

> I agree that it is important to at least have a live body somewhere at the end of a hyperlink just in case new interest develops. I'm happy to be that body for the time being.
>
> I'll have now taken over maintaining the web page, and we'll take it from here.
>
> Regards,
> *Dick Steffens* <rsteff@attbi.com>

Oregon members and readers are encouraged to contact Dick and help rebuild ASI/Oregon.

Moon Society St.Louis News

from Dave Dietzler 9/30/02 <Dietz37@msn.com>

We have a meeting coming up 10/2/02 next Wednesday and we've done a few things. Keith is going to do a presentation on the Artemis project™ at the Archon science fiction convention and he will distribute flyers and cards.

I'm hoping to get a small ad in the newsletter of the St. Louis Astronomical Society and a prof. at school put up a message board announcement. So we are progressing.

Moon Society Milwaukee Outpost News

from Peter Kokh 9/30/02 <kokhmmm@aol.com>

We ran up against a temporary showstopper in our "Sidewalk Astronomy" Project:
chapters.asi.org/milwaukee/msmo_currentproj.htm

The old 4" Coulter reflector I had seems to be "hard-fit" with an eyepiece that provides a 4° field of view, way too wide! I'll try to find a way to retrofit a different eyepiece holder so I can use an eyepiece that will give me about 45' (arc minutes) field of view. The Moon is bout 30' in diameter, so it should stay in the field of view for a minute or two while a visitors is ogling its craters.

In addition to the telescope, I want to put together a suitcase that opens up into a veritable literature kiosk, with that and scope all transportable on a wheeled luggage carrier via city bus.

On good Moon nights (first quarter is ideal) I hope to do some recruiting!

Moon Society "Chapters" ... & "Outposts"

Member John Schrock (Indiana) has come up with an excellent term for "chapters in formation" that do not yet have the required number of members to receive a chapter charter and full recognition from the Society, *and* for active local contacts - "outposts."

We had suggested "cells" in the September issue, a term that implies strong, even revolutionary, activism.

"**Outpost**" is a much better choice. What more fitting word could one think of to describe the isolated scouting encampments here on Earth of a Society dedicated to establishing permanent outposts on the Moon? The Moon Society Board gave the term and category "outpost" enthusiastic approval at its 10/16/02 meeting.

This word gives more status and value to the often lonely position of being an isolated local contact and to those who venture beyond just being accessible, and are actively attempting to find others of like vision with whom to start a local chapter. This word gives recognition.

We still need to clean up the Chapter and Local Outpost list and make it current, of course.

Thanks to John Schrock for a great idea!

A Carrot may do what a Stick cannot: Announcing an "Activity Reward" for Chapters" and Local Contacts

The Lunar Reclamation Society and the Moon Society Milwaukee Outpost are happy to provide *gratis* an Earth-Moon "Gravity Brick" set complete with explanatory flyer in stand, to be used in outreach events to the following:

1. Any one with an existing chapter website that has not been updated within the past two years, who brings it up to date and agrees to keep it current and to attempt at least one outreach informational event in the coming year.
2. Any local contact who agrees to put up a Moon Society Outpost website, keep it current, and to attempt at least one outreach informational event in the coming year.

This free two brick set (does not include a matching Mars brick) represents a materials cost of $10 and an average shipping cost of about the same amount, and some hours of donated labor.

Together with ready-to-go flyers you can download from the Space Chapter Hub website (see the following page) and information you can find on the same site on how to set up an attractive and effective outreach table, your "Outpost" will soon be ready to go scouting for "friendlies."

Online Resources for your Chapter

or for your Chapter Starting Information Booth

on the Space Chapter Hub Website

[**http://nsschapters.org/hub/**]

by Peter Kokh, Moon Society Milwaukee

October 7-15th, I uploaded the following 14 flyer and transparency pdf files to the following directory:

http://nsschapters.org/hub/pdf/

This is part of the Space Chapter Hub website which serves as a watering hole for all space chapters, a place they can go to get ready to use resources, ideas, plans, instructions, and more. This site has the endorsement of the Moon Society, the Mars Society, and the National Space Society. It is hosted on nsschapters.org server because it had to be hosted somewhere. This server is provided free by our own Randall Severy.

If you are a Moon Society local contact, or have launched a Moon Society "chapter in formation" or have a chapter that is a going concern, this resource center's whole purpose is to help you.

You have permission to download, print, and use all of these flyers as they are, or to alter them in any way you think will better serve your purposes. At the least, they can serve as a starting point and platform for something you want to create.

MoonSocChapterGoals.pdf
Here is a flyer that lists possible goals of a Moon Society Chapter

MoonGlobeFlyer.pdf
This flyer, either in a vertical acrylic photo holder, or as take with flyer, is a good companion to a Moon Globe, if you have one on your information table.

MoonToStayPetition.pdf
This is a petition LRS has used in the past. Even if you don't turn the petitions in, the act of signing it helps reinforce a positive opinion in the part of the signer, and you get his or her contact information as a fringe benefit.

MoonTreatyObjections.pdf
This was written by Prof. Glenn Harlan Reynolds (law) and helps educate the public

MoonHomesteadFlyerA.pdf
MoonHomesteadFlyerB.pdf
This pair of pdf files (one portrait, the other landscape) forms a double-sided flyer. LRS produced this flyer to explain what the visitor was seeing when he or she looked at our table top moonbase homestead. But with the diagram on the one side, the explanation on the other, this two-sided flyer is informative in itself. Plus it gives the URL for a photo of the table top exhibit.

SpaceMotorcycle.pdf
This is an exciting concept for a minimal lunar ascent vehicle [art by Vik Olliver] that can carry to persons to an orbiting spacecraft. The concept is part of the Artemis Project™ reference mission. Color file meant to be used as a poster or transparency.

MoonPieChart.pdf
The Moon may be "pie in the sky," but oh, what a recipe! Just what we need to make metal alloys, glass, ceramics, concrete and other building materials. The grounds for economic and industrial self-reliance.

20Q_LunarResources.pdf
Answers to 20 common questions about the idea of mining the Moon for its resources - 2 sided

15Q_LunarSettlement.pdf
Answers to 15 common questions about the idea of settlements on the Moon - 2 sided

12Q_LunarLavatubes.pdf
Answers to 12 reasonable questions about the Moon's "Hidden Valleys" - 2 sided

LunarDeclarationSFF.pdf
This is a document produced by the Space Frontier Foundation for the First Lunar Base Development Conference in Houston, 1999.

RelativeSizesPoster.pdf
This color poster (8.5x11, but can be blown up to 11x17 at Kinkos) makes a nice display in a vertical acrylic photo holder. It shows the relative sizes of the Earth, the Moon, and Mars. It is surprising how many people have no idea of their comparative sizes. Most have no idea that the Moon is as small as it is, yet still has as much land surface as it does. Color file meant to be used as a poster or transparency.

SystemTradeRoutesTP.pdf
This shows the potential for trade between Earth, Moon, Mars, and Earth Orbit, based on the resources each has, and accounting for gravity well differences. It forecasts the potential for an Inner Solar System Economy. Color file: use as a poster or transparency.

Make_it_soFlyer.pdf
A good flyer for a freebie table at a Sci-Fi convention

Except for the Trade Routes transparency and Relative Sizes poster/transparency, a blank box is provided on each flyer for chapter information.

There are links to all these pdf files on the appropriate Space Chapter Hub pages (flyer.htm, transparencies.htm, exhibits.htm, etc.)

Artemis and Moon Society Chapters & Outposts are encouraged to make use of the growing amount of resources on the Space Chapter Hub website. There is much to explore on this site as you are brainstorming your own exhibits and activities. Don't waste a lot of time reinventing the Axle!

More Chapter / Outpost Resources to come

More Flyers

On the "to do" list of the Space Chapter Hub are more flyer pdfs, some of them with a lunar focus:

- Lavatubes, the Moon's Hidden Valleys
- Artemis Moonbase
- NASA plan for an L1 Space Station near the Moon
- Observatories on the Moon

Storyboards

For our purposes, a Storyboard is"a panel or set of panels that by pictures, sketches, and text informs the visitor to our information table or booth about a Space Mission or Space Development Project"

Options: single, bi-fold, tri-fold panels of foam core board or other light weight material.

By including photos, art, sketches, and minimal concise text, the Storyboard aims at giving the visitor the gist of a project or program or development in a leisurely glance (as opposed to reading a more detailed flyer, pamphlet, article, or paper about the subject).

Some Storyboard theme suggestions:

- The Lunar Prospector Mission | Finding Ice at the Moon's poles | significance for science, future lunar industrial development, fuel sources
- The Moon's Hidden Valleys - Lavatubes | where, how large | Lunar Lavatube Locator mapping project | Significance for settlements, industry, agriculture, warehousing, archiving
- The Artemis Moonbase Project
- Resources on the Moon | Moon Pie Chart | Building Materials | Scarce Materials | a Lunar Economy | Inner Solar System Trade Routes | resource locations | economic strengths | the Moon as the key
- "Loop the Moon" tours sooner than you think

Storyboard Resources

For each proposed storyboard theme, there will be a webpage giving image thumbnails, and links for image downloading, and suggested text, and layout options. You take all these goodies and use them as you want to put together your own exhibit

Speech and Presentation Aids

> Slide sets

- Artemis Project Reference Mission, if copyright permission is granted - with "talking points"

>Transparencies

- color, image heavy, text light versions of the Lavatube flyer and Artemis Moonbase flyer

> Talk Outlines for various topics

- commercial opportunities involving the Moon
- opening the Lunar frontier
- Astronomy from the Moon
- *More*

All in due course!

"Apollo 13" IMAX Upgrade Opens

(from Navy Pier [Chicago] web site, navypier.com)

APOLLO 13

The future of the movie-going experience is here today. IMAX's revolutionary DMR® (digitally re-mastered) process now makes it possible to see the brightest stars and biggest films on the giant IMAX screen.

Academy Award® winning Apollo 13 was chosen to showcase this new technology at the Navy Pier® IMAX Theater beginning Friday, Sept. 20. Now, "man's greatest achievements in flight" can be experienced by one of the "greatest achievements in film."

Apollo 13 tells the dramatic, true story of the heroic actions needed to bring a three-astronaut crew safely back to Earth after the Apollo 13 space mission suffered catastrophic mechanical problems en route to the Moon. Made with NASA's collaboration, the highly-suspenseful film is scientifically and historically accurate. Apollo 13 features strong performances from the cast, led by Tom Hanks, and brilliantly directed by Ron Howard.

The film runs 1hr 56 minute and is rated PG (language and peril)

Check with your local IMAX for Apollo 13 opening Dates in your community!

Moon Pages Worth A Visit

Return to the Moon Home Page
http://www.space-frontier.org/Projects/Moon/
American Lunar Society
http://otterdad.dynip.com/als/
Oregon Moonbase
http://www.oregonl5.org/lbrt/
Lunar & Planetary Institute
http://www.lpi.usra.edu/lpi.html
Lunar Prospector Home Page
http://lunar.arc.nasa.gov/
Lunar Research Institute (Alan Binder)
http://www.lunar-exploration.net/
Lunar Institute of Technology
http://metalab.unc.edu/lunar/school/
Applied Space Resources
http://www.appliedspace.com
TransOrbital | TrailBlazer
http://www.transorbital.net
Lunar Reclamation Society
http://www.lunar-reclamation.org
The Lunar Stock Exchange
http://www.thelunarstockexchange.com

Meandering *through the Universe*

A Column on the Cooperative Movement on the Space Frontier © 2001 by Richard Richardson

Larry Jay Friesen's article in the June MMM #156, "Crop Selection Criteria for Lunar Settlements," really fired up the gray cells! This month I would like to continue the discussion on the slightly more general topic of *plant selection for space locations.*

We *need* to take plants with us to space. Therefore, we *need* to be conducting intensive research into just what our needs will be, which of our needs can be met by on site agriculture and which plants, group of plants, and/or eco-subsystems can best meet those needs under the conditions available at specific space locations. We also *need* to be giving attention to the problem of making the best possible conditions available for those agricultural species at those specific locations.

Plant/Crop Choice Considerations

Until technology which is still in the realm of science fiction comes along and changes the fundamentals of space transportation, we should not be wasting much time planning for extensive trade of any *essential* commodity. People will die ... whole communities will fail ... if we place our fabergé eggs in that basket. By that I mean, if we leave a space settlement dependent for its survival on the vagaries of technology, orbital mechanics *and* business politics, labor politics, government politics, terrorism, economic conditions, etc., then we not only set ourselves up for tragic failure, but for a failure which could set space settlement back generations.

Here is my brainstormed, prioritized list of considerations for the selection of species for space agriculture (not just crops):

1. Unique source — Is this species the only one viable as an on site source for a critical commodity?
2. Multiple usefulness — Can the species be used as a source for more than one critical commodity? (usefulness for higher priorities weighted more)
3. Viability — How difficult is the species to grow and harvest/use? All things equal, are there better species?
4. Obtainability — How easy/difficult/expensive is it to obtain the species (here on Earth) in necessary quantities in preparation for deployment to space? And how expensive and/or difficult will it be to transport sufficient numbers of the plant to the space settlement?
5. Food production — a) quantity, b) specific nutritional contribution
6. Waste recycling
7. Toxin sequestering or neutralization
8. Source of necessary medical chemicals
9. Source of raw materials for industry
10. Source of scent — For "pleasure" use as well as to help cover unpleasant smells.
11. Pleasant (or otherwise useful) in color, texture, or other characteristic
12. Usefulness to domestic and micro businesses

Although I have used the word "plant," we also need to be researching the roles played by microbes, fungi, algae, and some small animals also.

This is a very complex problem, but it is one which we can begin sorting out *Now!* Unfortunately, most space enthusiasts don't realize what a pivotal priority it is nor how amenable to research. The bottom line is that opening space to settlement depends on space agriculture. Fortunately, a lot of absolutely fundamental research can be done now, by anyone, requiring nothing more than a little ingenuity and diligence and the willingness to share results so it can join the body of knowledge available for use.

Hydroponics vs. Soil Farming

And now the question of whether 'tis better to use good old fashioned soil or ride with the hydroponic wave. Actually, this question has already been settled. It would be inappropriate to grow everything hydroponically. A question which makes more sense concerns which species should be grown in soil and which should be grown hydroponically.

Even if most of the large scale production agriculture seemed best suited to hydroponics there are serious drawbacks to that approach. Hydroponics are susceptible to the quick and easy spread of disease throughout the system requiring significant preventive measures such as adding various chemicals to the water (which cost money and can pose various threats), occasional thorough cleaning, inspection of hardware, etc.

On Earth this is not as critical because, if there is a problem, a crop can be discarded. At worst, a production facility can be closed or the whole business can fail. No, one's life need be lost. But in space a lot of lives might very well depend on the reliability of agricultural production. Even aside from questions of life or death, a major business failure at a space settlement would be too momentous a proposition to take any unnecessary chances with. Also, setting up a hydroponic system extensive enough to provide the majority of the agricultural needs of a whole space community would almost certainly cost more than an equivalent soil based approach and probably be dependent on Earth sourced replacement parts for a long time.

On the other hand, soil based agriculture tends to be quite resilient, modular, requires fewer non-local components and is easier to apply to multiple simultaneous utilizations. Both alternatives require the addition of nutrients, but a soil based system can be designed such that various species of plants and soil fauna work together to provide each other nutrients, as well as disease and pest control, thereby saving money and reducing the risk of envi-

ronmental contamination from the application of additives. Soil based agriculture can serve as the foundation, and, perhaps, almost the entirety, of an efficient, reliable, and even attractive life support system. Also, the fairly well rounded ecology necessary for a thorough and productive soil based agricultural system provides a solid foundation for the supply of pharmaceuticals, the removal of toxins from the environment, tourism opportunities that would otherwise not exist, the supply of arts and crafts materials, arts staging locations, stress reducing environments ... and whatever else local innovators might dream up. In addition to all of that, there is the significant plus that it is far less susceptible to sabotage, accident, and technological failure. There is just no alternative to soil based agriculture as the core component of sustainable self sufficiency ... though hydroponics will still have a role to play, too.

The knowledge, techniques, and any products which would result from research and development in this area would be very valuable — not only in space, but here on Earth, as well. Because they would be so valuable, it will be necessary to secure permanent legal access to them lest someone secure those rights for themselves and legally deny them to others.

The Open Source Philosophy

There are two philosophies to chose from here. The traditional one is to legally secure *exclusive* ownership before anyone else does. But that is hardly better than someone not interested in space sequestering those rights. Alternatively, it would be possible to take the "open source" route. "Open source" makes the commodities in question available to all (like a public domain vegetable, for example), and specifically prohibits exclusive ownership and exclusive marketing. Also, although end users may freely make any changes or additions to the commodities in question, they may not market the product with such changes or additions unless they are placed under the same open source license *and* are approved by an authorizing committee. That may be a little confusing but all it means is that the knowledge, technology, techniques, products (or whatever) may be freely studied, duplicated, marketed, bundled, etc. — which allows anyone to learn about, experiment with, make improvements to, or base a business on the items in question. But what they cannot do is *prevent* anyone else from having the same freedom. This facilitates widespread distribution. Widespread distribution of the knowledge and use of space technology gets us closer to being a spacefaring species.

But if exclusive ownership of resulting commodities is prohibited even to the developers, then how are they supposed to support their work and generate their take home pay? By selling the secondary commodities associated with the fruits of the research and development. The more widespread the distribution of the primary commodities (say a new technique for making fine grained, nutrient poor soil more fertile, a new hybrid plant, or the details of an effective life support system), the more demand there will be for associated goods and services. Instead of excluding others from access to the core commodities, the developers (and others, if they have the expertise) could market things like consulting, education, individual plants (in the same way a grocery sells a public domain vegetable), agricultural products for use here on Earth (if any result from the research, and it's likely they would), experiment and educational kits, as well as LSS services such as design, maintenance, upgrading, and so on. NASA and others would be interested in these products and services in the near term, if anyone had them to sell, that is.

There's money to be made from research and development in space agriculture and we can't have space settlements without it. Now would be a good time to start serious work. **<RRR>**

[Editor's Comments: The plusses I see for hydroponics are these:

- control
- higher yield in less space

One must concede that the latter point is an important one, but primarily so *if* the present situation continues: all pressurized volume is manufactured on Earth and shipped to the frontier. But we are not likely to expand beyond a first small outpost so long as that continues to be the case. *So it is moot.*

Yes, if inflatables are introduced, that *will* provide more elbowroom, especially for activities like agriculture, with the inflatable presure hull still being manufactured on Earth and shipped to the Moon or other space destination. In a past issue, we indeed talked about "Moonbagel Agripods" - inflatable torus structures where the routines of agriculture could be handled by robotic equipment which would literally make "the rounds" over and over and over, changing operations each pass.

In itself, a larger inflatable structures could serve either farming format, but the availabilty of more space for essentially the same buck would begin to tip the scales towards geoponics at least for those types and varieties of plants which seem to do better in soil. Once we start to manufacture pressure hull modules on location with lunar materials, the cost per square meter of presurized space will drop.

Regolith *as is* is not ideal. We'd want to sift out the powdery fines that would clog drainage and keep the soil too wet. Heating the sifted soil a couple hundred degrees would transform a fraction of it into nutrient holding zeolites. The resulting soil would be better buffered and supply most of the nutrients that *would have to be imported* for hydroponics. - PK**]**

AMSAT Dreams of Mars

http://news.cq-amateur-radio.com/news.htm

AMSAT-DL, the German amateur radio satellite organization, has announced plans to build two new amateur spacecraft, including one destined for orbit around Mars! According to the AMSAT News Service, the so-called Phase 5-A satellite would be launched in the 2007-2009 timeframe and will include subpayloads that would be launched from the main satellite, either to the planet's surface or into the Martian atmosphere. These devices would transmit scientific data back to the "mother ship," which would then use a repeater to relay the information back to hams on Earth. AMSAT-DL officials said the 2000 launch of Phase 3-D (now AMSAT-OSCAR 40) showed that the basic satellite design was capable of a trip to Mars.

In addition, the AMSAT-DL board of directors gave a green light to developing a Phase 3-E earth-orbiting satellite. This would be a more traditional amateur satellite, offering two-way communication links on amateur bands between 145 MHz and 10 GHz. In addition, it will serve as a testbed for some technology for the Mars mission. AMSAT-DL has been the lead AMSAT group on the past three large amateur satellites placed into orbit, AMSAT-OSCAR-10 (still operating), AMSAT-OSCAR-13 (no longer in orbit) and AMSAT-OSCAR-40. No launch timetable has been announced for P3E, except that it is planned to be several years before the anticipated launch of the mission to Mars.

Background information about both missions at:

http://www.amsat-dl.org/p3e/towards-p3e.pdf
http://www.amsat-dl.org/p5a/p5a-to-mars.pdf.

Thanks to Ben Huset, MNSFS, for this story.

Mars Society Convention 2003 to be held in Eugene, Oregon

The 6th International Mars Society Convention will be held August 14-17, 2003 at the Eugene, Oregon Hilton Hotel.

The Oregon Mars Society Chapter will host the event, with Erik Carlstrom and Harold Miller (Mars Society webmaster) acting as co-chairs.

The Hilton will offer conference participants a room rate of $79 per night single / double, and $89 triple or quadruple.

Eugene is Oregon's second largest city, and the home of the University of Oregon.

Also nearby is the Oregon L5 Society, which is centered in Portland. While probably better known for their work on the Oregon Moonbase, Oregon L5 members have produced several papers on topics relating to Mars, notably Martian lavatubes.

This will be the Society's second West Coast Convention. It was held in Stanford, CA in 2001.

Must Online Reading

for Anyone Interested in
The Future of Mars Exploration

[These 6 installments posted on Spacedaily.com Sept. 16, 2002 were written by **Bruce Moomaw**, perhaps the most knowledgable analyst/reporter of Planetary Science Exploration. These articles should be read in sequence as each leads to and prepares for the next. We guarantee that you will better appreciate the scope and challenges of what lies ahead. - PK]

• Exploring Mars beyond 2010
www.spacedaily.com/news/mars-general-02f1.html

• NASA Shy To Taking On Martian Pot Luck All Alone
www.spacedaily.com/news/mars-general-02f2.html

• Smart Planning for the GeoBio Survey 2009
www.spacedaily.com/news/mars-general-02f3.html

• Pathways to Mars 2010
www.spacedaily.com/news/mars-general-02f4.html

• Understanding Martian Geology Will Need Ground Calibration Studies
www.spacedaily.com/news/mars-general-02f5.html

• Can Groundbreaker Find A Path To Martian Life?
www.spacedaily.com/news/mars-general-02f6.html

Tom Cruise & General Simon P. ('Pete') Worden Join National Space Society Board of Governors

9/25/02 - The National Space Society is very pleased to announce that actor Tom Cruise and General Simon P. ('Pete') Worden have been elected to the NSS Board of Governors.

Accomplished actor, director, producer and writer, Tom Cruise, recently served as the principal narrator of the 3-D IMAX film, 'Space Station.' In a recent interview, Mr. Cruise stated, 'I've always been fascinated with space, the Apollo program, and I've watched a lot of shuttle launches. I'm not only fascinated by it, I think that it is important for the world. Man has always journeyed, traveled, and conquered. The space program is imperative to this planet. It's such an important aspect of research'. The governors are pleased to have Mr. Cruise join the Board.

Brig. Gen. Simon P. ('Pete') Worden is Vice Director of Operations, U.S. Space Command, with headquarters at Peterson Air Force Base, CO. He is responsible for policy and direction of five mission areas: force enhancement, space support, space control, force application, computer network defense. Gen. Worden has previously served many years as an NSS Director & member of the NSS Policy Committee. He has been an active, insightful and thoughtful voice in NSS deliberations, especially in significant policy matters, and the NSS Governors look forward to his continued involvement in NSS matters. **<NSS/HQ>**

Chapter Science Demonstrations

by Earl Bennett <earlbennett@erols.com>
President of PASA: Philadelphia Area Space Alliance

Launching accelerators and floating things:

The Mass Driver [designed to export materials from the Moon at minimum expense] can be explained as a progression of pulling and or pushing magnets with the first step shown with the floating rings part of the display with the concept of the bucket payload holder and decelerating track to reuse the bucket as is shown in the S.S.I book [Space Studies Institute, PO Box 82, Princeton, NJ 08542]. I use a small can or bucket and put a foam block or, explaining cheap space probe launching for volumes of explorers, a foil coated tube which is another topic.

The Ring Launcher is two concepts: A) A Mass Driver formed into a ring with force being applied by pulsing magnetic fields until the desired velocity is reached. B) The other concept that could be discussed is the Slingatron which uses mechanical motion coupled via magnetic fields. This is more difficult to talk about but an analog of a marble rolling in a Hulla-Hoop may help. the shifting of the Hoop is timed to push the marble against the wall at the right time to impart a small acceleration pulse to the marble on each impact. Slow but steady increases. No demo for this one yet.

To show the concept of magnetic forces doing something that looks space propulsion like, I have set up a Nose Cone shaped model surrounded by a plastic cylinder, with a metal plate at the bottom. The plate and the Nose Cone have magnets attached(same polarity facing). Middle size (~2") units of ferrite material are used. The trick is to make the cone point up, with a clear gap under it. Deceleration is shown with a magnetic drop tube, with a small & powerful magnet dropped first to the table top then into the tube. Big difference!

The use of the launchers to propel any kind of object is explained and the use of thin film construction techniques is developed with material from the Kilogram of Science talk being reused. Explaining that "the bucket doesn't care" what's in it and using the models of foil coated tubes as probes launched one at a time once a day 365 days a year using electricity and magnetic fields and no fuel gets the point across that some things can best be done in space and some methods of production can be done in space to great advantage for exploration.

Arrays are brought in here describing how an array of probes could be launched with safety in numbers (i.e. redundancy) and sending the signal back using the probes as part of a "Phased Array" to do this without a big dish. A group of probes are set on the table with a meteor used to knock out one or more craft. This dramatic device shows why little probes may be best. More! **<EB/PASA>**

Sensing and using Light are the final demonstration topics. Since we have a lot of things that work with magnetic fields, one of the sensors is for magnetic signals from various sources. The low setting picks up fields from transformers and high power emitters. The high sensitivity setting will react to simply moving past a high strength magnet. the lower edge of the sensors back is the right area.

Moving on to light, I usually work in the Photo Spectrometer which gives an output for wavelengths from 400 to 1000 nanometers (+) and has a panel meter read out. I use different light emitters and this device or,with a simple sensor, a group of light sources visible and not. Leading on to the sending of signals and the advantages of Fiber Optic Cables, a source and detector the ability to show transmission and lack of interference from magnets, or radios etc. . Ideal for an environment like the Space Station! Remote sensing through the walls of the Station for things operating on the vacuum side of the universe and coupling data lines through gas tight bulk head feeders is brought up.

This is a rather lengthy set of talking points, could be done differently and doesn't cover everything I talk about. You can add to it! **<EB/PASA>**

SpaceDev eNewsletter

Sep. 2002 - SpaceDev has unveiled its brand new website with a new look and feel and fresh content. Check it out at www.spacedev.com! **Project Updates:**

Cosmic Hot Insterllar Spectrometer microsatellite (CHIPSat) SpaceDev has completed the integration of the CHIPS instrument into the CHIPSat spacecraft. The spacecraft has been shipped to the Air Force Research Laboratory Aerospace Engineering Facility (AEF) at Kirtland to undergo the final full system vibration and environmental testing in preparation for its planned launch in December 2002.

Air Force Research Laboratory (AFRL) SpaceDev is working on Phase I of a contract to develop a Shuttle-compatible propulsion module and we have applied for the fast track of Phase II of the project, and anticipate a response to this application by end of year.

Commercial Project - We are working on a proprietary research program to design and build a hybrid propulsion system for suborbital space applications.

About SpaceDev - SpaceDev (OTCBB: SPDV) creates and sells affordable and innovative space products and solutions to government and commercial enterprises. SpaceDev products and solutions include the design, manufacture, marketing and operation of sophisticated micro / nano satellites, hybrid rocket-based orbital Maneuvering and orbital Transfer Vehicles (MTVs) as well as safe suborbital / orbital hybrid rocket-based propulsion systems.**<SD>**

The Lunar Reclamation Society, Inc.

PO 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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(* LRS Board Members,plus Ken Paul ....)

LRS NEWS

• **September 14th Meeting Report:** Three members present: Peter Kokh, Bob Bialecki, Ken Paul.

Ken Paul accepted the position of 3rd Board member replacing Mark Kaehny, who has been inactive for more than a year. We filled out our annual state report as a Wisconsin 501 c3 nonprofit, as well as our request for meeting dates for the coming year at Mayfair Mall.

Ken passed out CD's of Kennedy's 1962 Going to the Moon speech, this its 40th anniversary.

We had a guest from the newly founded St. Louis (MO) Moon Society chapter, Burt Sharp and local friend Ellen, both enthused and 'on the same page' as far as taking the long ("100 year") view. The resulting conversations and discussions were very lively and stimulating for all of us. We discussed collaboration between LRS and MSSL.

• **More at:** www.lunar-reclamation.org/page4.htm

LRS OCTOBER/NOVEMBER Events

Saturday, OCT 12th, NOV 9th1-4 pm

LRS Chapter Meeting, Mayfair Mall, Garden Suites **Room G11** (lower level, NE part of Mall) near the ground-level entrance below General Cinemas.

OCTOBER AGENDA: • Space News updates: Station & Shuttle, Moon, Mars, Asteroids, Tourism; • Outreach events on the horizon; • Ways to better structure our meetings following the model of Philadelphia (p.19)

U.S. CHAPTERS

NSS Chapter Events
MMM 8 Chapters Strong

Space Chapter HUB NEW ADDRESS:

http://nsschapters.org/hub/

Much New Material Added

In September and October, 2002, a considerable amount of new material has been added to the resources already on the Space Chapter Hub website. The purpose of this site is to share resources and help each chapter do whatever it wants to do better.

Recent additions are mostly in the area of outreach materials. More than twenty fliers on various topics, all with a blank box to imprint chapter name and contact information, have been uploaded as convenient pdf files.

Visit these pages at nsschapters.org/hub/

- flyers.htm
- exhibits.htm
- transparencies.htm
- .gravityjugs.htm

The hub main menu page now posts "updated dd/mm/yyr tags after each menu item so that you can tell at a glance where new matter has been added.

MINNESOTA

Minnesota Space Frontier Society

c/o Dave Buth, 5120 Ewing Avenue North, Brooklyn Center, MN 55429

Dave Buth (w) (612) 333-1872, (h) (763) 536-1237
612-375-1539 (Jeff Root)

Email: mnsfs@freemars.org

www.FreeMars.org/l5/index.html

Next Meeting -- No info as of press time: **Radio City Inc. 2663 County Road I**, Mounds View, Mn. 55122 (763) 786-4475 -- back meeting room. It's north of I694 just off of County 10, between Long Lake and Silver Lake Road, not Hwy. 10, close by, which runs along I-35W. You must be on *County* 10. For more directions or to add to Agenda call: (612) 333-1872

• **From Ben Huset** - MN SFS has put up displays describing shuttle flight STS-112/9A. Display Info is based on the current STS press kit at:

http://www.shuttlepresskit.com/index.html

We have been doing this every flight since STS-26. See them at Radio City (address / directions above)

StarQuest Pictures:

http://www.freemars.org/mnfan/starquest02/

OHIO

Cuyahoga Valley Space Society

3433 North Ave. Parma, OH 44134-1252
c/o George F. Cooper III, Phone 216-749-0017
E-Mail: geocooper3@aol.com [new]

☞ Monthly Meetings, the 4th Thursday each month

7-9:15 pm, Parma Regional Library
NEXT MEETING DATES: **OCT 30, NOV __**

NOTE: The **Oct. 30th** meeting is on a **Wednesday**.

Aug. 26th Gathering Report: We met in Lakewood at the Madison Branch Library for space simulations, at 7 pm in the basement meeting room. As the Lakewood pool closed early, no one partook of the "weightless swim simulation." We used the library computer room for fast graphic Internet access.

We started with the Ad Astra article on space medicine. George showed the AA page "Barriers and Milestones to space exploration." Steven and George designed a Mars Airplane at the NASA quest site: www.quest.arc.nasa.gov/aero/planetary/index.html. Steven's final design flew 32 km in 4 min., earning this site his highest praise. Joe went to cmex-www.arc.nasa.gov for some excellent Mars photos.

Next the NASA Goddard Space Flight Site: cadcd.gsfc.nasa.gov/ESS/journeys/web_version.html. The site had an interactive Hubble telescope feature. We enjoyed the movies there on headphones, as well as those captioned on fido.net. NASA TV was broadcasting. George wanted to return to www.spaceref.com next time. Joe enjoyed most of all the games found through a Vivismo engine search for "kids domain." Steven visited BadAstronomy.com which explored the Moon landing "hoax." We hit www.aero-space.nasa.gov and Math.com (for the Game of Life.)

We adjourned to Burger King instead of the nearby space-theme restaurant Capsule due to resour¢e con$traints. BTW, Mars Avenue looks like every other everyday street in Lakewood.

Oct. 30th (Wed.) Meeting: Parma: NASA Speaker on ISS Experiments

ILLINOIS

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

Larry Ahearn: 773/373-0349

www.astrodigital.org/csfs

Call Larry for MEETING INFORMATION

CALIFORNIA

OASIS

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement

P.O. Box 1231, Redondo Beach, CA 90278
Events Hotline/Answering Machine: (310) 364-2290
Odyssey Ed: Craig Ward - cew@acm.org
E-mail: oasis-leaders@netcom.com

http://chapters.nss.org/oasis

Odyssey Newsletter Online
http://www.geocities.com/CapeCanaveral/Lab/4005/articles.html

> Regular Meeting 3 pm 3rd Sat. each month
Information: OASIS Hotline, 310/364-2290; website.

OCT 20th -- Business Meeting at location TBD
NOV 16th -- Business Meeting at location TBD
DEC 14th -- Business Meeting at location TBD
*Note: This is the **second Saturday** in December.*

Recurring Events

- **The Griffith Observatory** is undergoing renovations and upgrades to reopen in 2003.
- **Fridays, 7 pm** "Night Sky Show." -- **8 pm** Guest lectures. Santa Monica College John Drescher Planetarium, 2nd Floor Technology Bldg, 1900 Pico Blvd. $4 per show or $7 for both. 310/452-9223 www.smc.edu/events/weeklyeven.
- **Fridays --** "Mike Hodel's Hour 25" webcast. The world of science fact and fiction with interviews, news, radio dramas, artists, writers, stories, reviews. Info: www.hour25online.com/.

OREGON

Oregon L5 Society, Inc.

P.O. Box 86, Oregon City, OR 97045
voice mail / FAX (503) 655-6189

http://www.OregonL5.org/

Allen G. Taylor <allen.taylor@ieee.org>
Bryce Walden <moonbase@attbi.com>
(LBRT - Oregon Moonbase) moonbase@attbi.com
☞ Meetings **3rd Sat.** each month at **2 p.m.**
Bourne Plaza, 1441 SE 122nd, Portland, **downstairs** NEXT MEETINGS: **SEP 16, OCT 20**
Good press for Gus Frederick's Skylight Cave Mice Experiments: www.cbsnews.com/stories/2002/09/25/tech/main523274.shtml

PENNSYLVANIA

Philadelphia Area Space Alliance

PO Box 1715, Philadelphia, PA 19105
c/o Earl Bennett, EarlBennett@erols.com
215/633-0878 (H), 610/640-2345(W)

NEW URL http://pasa01.tripod.com

Note : PASA is now on the tripod.com system

• **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.

Next Meetings: Tentatively: **Oct 13**, **Nov 16, Dec**

Scheduled PASA activities: Regular Sat. monthly meetings on above dates. Special event: Philcon 2002, Dec. 13-15 (more info below). Call Earl Bennett or Mitch Gordon, 215-625-0670, to verify all meetings.

September 21st Meeting report: We had reduced attendance compared to last month (almost all members) but had some lively dialog non the less.

Hank Smith reported on the science fiction events he has attended, helped with and was planning to attend and/or help with.Hank works with the Philcon Committee on the Science Fact Tracts. There is speculation allowed in these presentations and panels but a basis in the hard sciences with some presentations also on the "soft" areas like Psychology, Sociology and various future society scenarios (Mega Cities, Alternatives in Energy, ad infinitum)

Anyone considering a looong sea voyage much less a haul out to Mars should appreciate those "soft" sciences! As always we are eager to help Hank as volunteers on panels for various discussions and debates,as well as giving individual and special expertise area talks. Hank has spoken of panels on the future of medicine, on-line education and the future of education,and presentations by Michelle Baker on Voyagers Anniversary and several members including Gary Fisher on Space Architecture.

With Lance Bass,the Once And Future (at this writing!) Space Tourist, we,re sure to talk of that! Philcon will be held in December this year on the 13th to 15th at the Marriott Center City next to the Convention Center . Philcon is at www.philcon.org or 215-625-2900.

Dottie Kurtz Gave two reports: The Planetary Society had the September issue of The Planetary Report devoted to the journey of the Voyager Space craft(s). The cover consists of pictures of the places they have been. They where "The Grand Tour" you may have seen on t.v. if you are younger (as history) or as it happened for a lot of us advocates. Being an engineering type I see the misses as well as the successes. The two craft didn't go to Pluto! Well, we can't have everything, not yet.But the Voyagers are some of the most successful technological projects we have done and the project and people deserve the tribute. The other publication Dottie mentioned was Smithsonian Magazine with an article about astronomy and the publics' enthusiasm by Timothy Ferris who has also just published "Astronomy: Seeing in the Dark"(Simon & Schuster).

We had a short report from Larry on our web activities (minimal) and improving the site. He brought a copy of the content and passed it out for review and approval.

Prospective member Janice Guidotti brought in a report on the effect of plankton on moderating global warming from Scientific American for August. We had a short chat on terraforming with modified algae which wasn't all serious. This due to past discussion of changing oven Venus. Crisped Critters!

Mitch Gordon talked of his contact with The Golden Gate Space Frontier Society to let them know about The World Future Society's' convention coming to their area next year. He also mentioned our areas W.F.S. event in October on "The Future of Medicine". Call him at 1-215-625-0670 on when.We also discussed appearing on Philly Live at some time. This is very preliminary and may be a Spring event. Mitch also reported on the Ad Astra article on the Orbit Awards with Dennis Tito being the first recipient of The Space Tourism Award. Next?

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>

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

NEW >>> http://www.tcei.com/sss

☞ We meet the 3rd Tuesday of the month at **7-9pm**

OCT 21st MEETING at the Stoelting House in **Kiel**

NOV 18th Foerster Academy of Dance, **Sheboygan**

Dec.16th: MEETING at the Stoelting House in **Kiel**

NAME _____ ÷

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○ $38 **NATIONAL SPACE SOC.** dues + **Ad Astra**
○ $20 NSS dues if under 22 / over 64. *State age* ___
600 Pennsylvania Ave SE #201, Washington DC 20003

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- **For members residing in the U.S & Canada:**
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- **For members residing in other locations:**
  Printed **MMM** delivered by postal mail: **$60**
  Electronic (pdf) **MMM** available on website: **$35**

INDEX to #159 OCT. 2002

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Send proper dues to address in chapter news section

=>for those outside participating chapter areas <=
○ $18 **Individual Subscriptions to MMM/MMR:**
Outside North America ○ $50 Surface Mail --
Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CUYAHOGA VALLEY SPACE SOC. (Cleveland, OH)
○ $15

CHICAGO SPACE FRONTIER L5
○ $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
○ $18 reg. ○ $24 family ○ $15 student/senior

MINNESOTA SPACE FRONTIER SOCIETY
○ $20 Regular Dues

OREGON L5 SOCIETY
○ $23 for all members

O.A.S.I.S. L5 (Los Angeles)
○ $18 regular dues

PHILADELPHIA AREA SPACE ALLIANCE
○ Annual dues for all with MMM $16, due in March or $4 times each quarter before the next March

SHEBOYGAN SPACE SOCIETY (WI)
○ $15 regular, ○ $10 student, ○ $1 / extra family memb
"SSS" c/o B. P. Knier, 22608 County Line Rd,
Elkhart Lake WI 53020

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