"Towards an Earth-Moon Economy - Developing Off-Planet Resources"

Moon Miners' Manifesto

& The Moon Society Journal

www.MoonMinersManifesto.com

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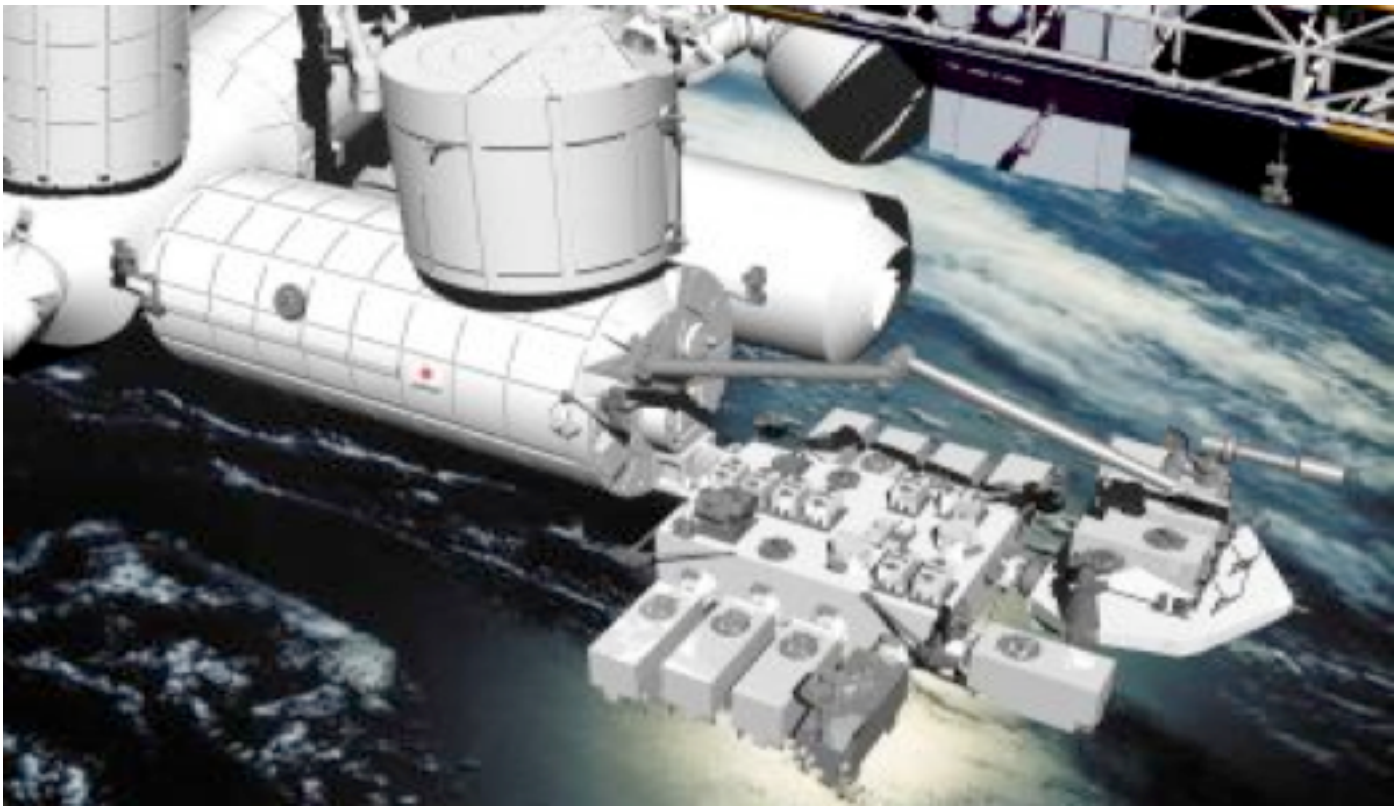

Above: Japan's Kibo LAB Porch Added to ISS

Feature Articles in This Issue

ISS: Did we build it just to trash it?

The first module went up in 1998: first crew in 2000: completion next year. Then we are to trash this after 6 years more of full operation? It seems as if NASA is being forced to consider this premature termination because of really insane budget pressures coming out of the political process. We must accept it as our job to help develop alternative options for the government to consider. See editorials pp. 1-2, p. 16, and article, p. 6

IN FOCUS "None of the Above," Signals Augustine Commission

http://cumbriansky.wordpress.com/2009/08/13/wave-the-moon-and-mars-goodbye/

There has been much disappointment, anger, disillusionment, and confusion over early leaks of what is in the Augustine Commission assigned to advise on Directions for NASA's Manned Space Program. In the past year, the input to the Obama Commission on Space has been multi-voiced to say the least: we should go to the Moon; we should go to Mars; we should [=> p. 2, col. 2]

Moon Miners' Manifesto

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• **Moon Miners' Manifesto CLASSICS:** The non-time-sensitive articles and editorials of MMM's first twenty years have been re-edited, reillustrated, and republished in 20 PDF format volumes, for free downloading from either of two locations:
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• **MMM's VISION:** "expanding the human economy through off-planet resources"; the early era of heavy reliance on Lunar materials; early use of Mars system and asteroidal resources; and establishment of permanent settlements supporting this economy.
• **MMM's MISSION:** to encourage "spin-up" entrepreneurial development of the novel technologies needed and promote the economic-environmental rationale of space and lunar settlement.
• **MMM retains its editorial independence.** MMM serves 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.
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National Space Society, 1155 15th Street NW, Suite 500, Washington, DC 20005; Ph: (202) 429-1600 - www.NSS.org
• **The Moon Society** seeks to overcome the business, financial, and technological challenges to the establishment of a permanent, self-sustaining human presence on the Moon." - Contact info p. 9.
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fi In Focus Editorial continued from p. 1.

go to the asteroids. No one is the winner. We are all to be the losers, *not because the Commission is anti-manned space,* but because the past administration, and past Congresses have not given NASA enough money to do either, and still finish the Space Station.

There basically just two ways this situation can play out: (1) The Administration asks for a major increase in NASA's Manned Space Budget, a hard sell given the current state of the economy and concern over an out-of-control deficit, or (2) NASA's role is totally recast.

We think that the latter would be more productive. Space Activists have been calling for NASA to get out of the Space transportation business for over twenty years: "NASA should fund much more research in new propulsion technologies and encourage the Commercial Sector to further develop them." NASA would then contract transportation commercially, whether for the next probe to Mars, or for delivery of goods and crew to the Space Station. The COTS program, begun as lip service to this idea, is the right direction and the program should be expanded to cover all of NASA's space delivery needs, not just those to ISS. In this scenario, NASA would turn over Constellation program projects to the highest bidder, if indeed any commercial provider is interested. This is doubtful given all the technology problems sofar identified with the Ares 1 and Ares 5 systems.

Those of us, who want NASA out of Space Transportation, would redirect the agency to R&D of enabling technologies, much as NASA does in its Aviation arm. More research on tether systems, on ISRU-technologies to produce key elements out of lunar regolith; on biological life support systems needed for long trips beyond Earth-Moon space; new space suits, etc.

NASA, in an effort to do what it could with critically deficient budget allowances, has been forced to postpone these kinds of research. The result down the road was already clear. NASA would put a visitable shelter on the Moon and then spend the next forty years scratching its head, about how to enable crews to stay there continuously. There simply was no point to such a program, which essentially would have been "Flags & Footprints II." Enthusiasm over NASA's Return is self-blindfolded trust based on the glory of the Apollo days.

If NASA is kept busy developing enabling technologies, no time will be lost. Indeed, it is possible that Commercial efforts could arrive on the Moon, *and do something constructive and profitable there,* much sooner than if we just gave NASA the money *it* needed. Why? Because the culture of this middle-aged bureaucracy makes it certain that any NASA initiative will cost several times what should be needed to do the trick.

In the excitement over NASA's early achievements, many of us have lost sight of the fact that a nationalized program does *not* fit the paradigm of the "American Way." *NASA does have a role,* a very important one, in advancing technology developments, and in unmanned robotic exploration. But Manned Space and Cargo Delivery should be fully entrusted to the Commercial sector. Yes, government subsidies and incentives programs will be needed, as they were in the early days of railroad network expansion. The government and private industry must be partners: NASA does not really understand the meaning of the word. **<PK>**

For a different take,
see Dave Dunlop's analysis on page 16

[Continued from MMM #227, Parts 1-4]

It's Not Getting Done: #5a

The Future -- ??

By, Martha Adams

When Apollo 11 went up, the future in space looked good. For one thing, the Apollo Program offered a constructive choice and a way out from the Vietnam debacle. We are now several decades into that future and it's something else than hope offered. Today we seem to have jointly two war debacles and an economic debacle, among other matters gone wrong or failed. I hear elements of American stability and life quality compared to a banana republic. I don't see progress there. In brief, I've lived long enough to find myself actually in the future that I once imagined, and I think it's pretty crummy. So I wind up my "It's Not Getting Done" series by outlining some of my observations concerning where this future might go from here.

To look for the future, don't look toward Washington. As described in Robert Winter-Berger's book, *The Washington Payoff* (a must-read, if you haven't already), Washington has its own objectives. The book's reader quickly realizes a space Settlements program will not be one of them.

I hope some of us will find ways to make this existing situation less grim than it appears. I regret the immense national cash flow into Washington goes ...where it goes; but let's act from what reality is, rather than sit around swapping regrets about what reality could be. To look for the future, look up toward space. Given money; our young peoples remarkable capacity for accomplishment; good leadership; and a few years of time, a space Settlements program with its economic and cultural benefits is only as far away as a lot of work. (That was true in 1970, so why not now?)

Of course, it helps to watch what is, or isn't, in anyone's pipeline. China, Russia, India, America, you name it. The future will not appear, surprise, out of nowhere and no precursor signals. A rabbit out of a hat. In fact, some things must happen before others, and anyone can project a plausible sequence. I've been talking about what must happen before a human culture in space happens. Space is hard but provided the preliminary work is done, it's accessible. (If life were more simple. In reality, there are challenges not about the science and engineering but about money *and*.... See the movie that is out now on DVD: *Orphans of Apollo*. The space community often voices serious angst about Washington's ITAR controls. Whoever thinks about space settlements wants to keep a deadly hierarchy in mind: *Regulation* kills *money* kills *engineering*. For which reason I believe *regulation* may be the showstopper for space settlements, not the science and engineering issues so loudly touted in the news media.)

How much money? *Weigh carefully* what NASA says about costs of space work: it's not necessarily so. Robert Zubrin estimates in his 'The Case for Mars' (1996), that three Settlements missions to Mars could be sent off for around $30 billion in 1990 dollars. Compared to the economic and social costs of today's ongoing wars, or of faith-based money policy in Washington, that's pocket money. Even if over time, it takes more inflation-shrunk dollars to do it. (If you buy your own groceries, you see that inflation now.)

Any thinking about space settlements must recognize the immense practical difference between public money vs private money in action. Go to the current news. Find a few pictures. Compare a SpaceX launch site with the usual Cape Canaveral constructions. There's a large job to do, but maybe the money to do it need not be so large as a NASA follower would guess. In the following sections I explore some related topics I've had on my mind lately:

Leader

Hurtful governmental regulation may be overcome, one way or another. This will not happen by lucky accident nor mere time passing. Sheer need for change may or may not suffice. A core Settlements requirement against obstacles of bureaucracy and basic physics is strong leadership.

I write the following with no particular person in mind. Since I know of several people who partially meet my proposed requirements, I wonder if a small committee could do the job. This question is a can of worms and in the following, I'm going to stay with "leader." (And I'm going to say, "he." In this culture, for this settlements objective, the man has an advantage that will be needed. Also, my text grammar is more simple given this choice. I think that in a nicer world than we have today, a woman is the better choice for this Settlements objective.)

A Settlements Program leader must be charismatic. Have you noticed, a few people stand out in a crowd? Here, it's a job requirement. And he wants a phenomenal memory for names and people; also, a capacity for clear expression of rational thinking. (Compare Bush II vs Obama: no contest.) His age at startup time wants to be in a narrow range of 40 to 50: old enough to have had serious life and business experience, young enough to accomplish a difficult plan and its setbacks over many years.

The Settlements Program leader cannot be a career person who hops from job to job with pay and social status increasing along the way. He must have chosen to devote his life to his objective. He will know "things happen" and set a goal at the top of his list to make himself replaceable. He will have his successor nearby, ready to step into his shoes at need; which need may not be foreseeable! I recall a new hi-tech company that nearly failed after one of its principals took a short business trip by air on 2001 September 11. Things happen!

The Leader person must be a gifted engineer. To appreciate this need, you want some engineering experience yourself. Then you can listen to Elon Musk to hear the richness between the lines as he speaks. A listener without engineering background won't hear how Musk chose between options to settle on what was going to work. I hope to see a Musk autobiography someday because I'll learn a lot from it.

Such ability as Musk brings to his success, is not in the usual run of people. The essential process of the Settlements program is a series of engineering choices. Few people can see the options, make a series of choices in real time, and get them right enough. Musk is notable because he does it. I don't think even a good consensus group could do this. It falls on the Leader. Success is everyone's but the Leader gets the direction right. Else, the Settlements program fails.

Industrial Campus

After money and a Leader, the Settlements program needs a place, a location. I have heard "virtual" organizations mentioned in this context. "Virtual" refers to an affiliation over the internet of people far apart over Terra's surface. It won't work.

It will fail because it loses the essential ingredient of immediate human personal interaction. Only a "real" organization can carry out this program. And it will require a large place to do it. I envision four engineering campuses (Site; Habs; Power; Business) and a central Offices campus. These five all together as one, each accessible on foot to the others. The old-fashioned way!

Further, the Center being a heavy manufacturing location, it must be placed where the large Settlement structures built there can be moved out to launch location. "Central," here, means the center of the organization, not the center of the country (which I hope is America). Thus as I write, I see the "Central Location" being somewhere south of New York City, probably not as far west as Texas (hurricanes) and directly accessible by water to Cape Canaveral. (And no low bridges.)

I realize this sounds like bricks-and-mortar smokestack industry from the mid 1800's to the mid 1900's. I am not going into a lot of industrial theory here. Firstly, whoever builds such an industrial base today has much more management know-how to work from than anyone did back then, and so can do it better. But secondly, this structure with its strong hierarchical elements, seems to me, most appropriate for a dedicated-purpose organization that must accomplish a well defined and difficult objective at minimum cost. "Old-fashioned" is tested, a solid base for a visionary new objective.

This space Settlements objective has a lot of dreams behind it. How the accomplishment in fact, will accommodate practical engineering realities to those dreams, remains to be seen. But I believe that if we don't do this, now, then maybe, nobody will ever. (Or people might do it, whose interests entirely neglect Terra as a whole. Small examples come to mind. Someone is making a huge mint of money selling AK47's and heavier military hardware. In 2009 May, think of Pakistan's collection of about 100 nukes.)

I believe that if we don't do settlements in space, then we're gone. In the immense and violent processes natural to our universe, it's easy come, easy go. If some local cranks don't accomplish it first. And the second reason is, of course, outlined in Winter-Berger's book which I mentioned earlier. Who goes to Washington, and why? I would like to see "national service and the wellness of America" at the root of it. I'd like to see that.

Research and Development

I think that here in America, there has somehow developed a conservative attitude that if we undertake something new, that means change; but change is just too hard to do now. So let's spend that money where it will serve some purpose. (Another war? More corruption?)

One might argue that any boat needs an anchor, so the conservatives do have a point there. However, their point expands too easily into authoritarian and rigid social policy. Fortunately, we yet have people in America who are innovators and ambitious. People who can recognize that off-Terra is accessible to anyone who can do the work to get there. (And find ways past serious bureaucratic obstacles to do it.)

Today we have seen demonstrations that rockets can fly in space without an atmosphere to push against. The demonstration was hardly necessary: Newton wrote the mathematical theory of it going on three centuries ago.

We have seen people go out to space and then return, still quite recognizably human. To go to space and then stay there, makes good sense and the engineering to do it is developed today far beyond speculation and outline. The cost to do it seems well within parameters set by recent economic adventures to prop-up large financial institutions that had better names than management. (...Has that really changed?)

The people who can do the job are here now. They are our young people. The Apollo people who built the Saturn booster averaged out to about 26 years age. Young people! We have no greater treasure in our human world than these young people, and we have today an appropriate task for them to undertake. And some of them are doing it.

Space-oriented organizations today range from large installations (SpaceX comes to mind), down to informal groups of grad students in rooms full of books and experimental hardware. I'm developing a Links section in Adra so that anyone interested in space settlements work can find others in the field.

I think people working at space, face an occupational hazard. It is the risk to Do Something but what they do isn't directed to need. Lacking focus, they turn their energy to social activities and catered banquets rather than to the work.

It's Not Getting Done: #5b

People!

People living in space puts us, the human species, into a new ecological niche. As we do this, we can expect some surprises along the way. Birds that live in the wild are different from their cousins in the barnyard. Watch some fish that seem entirely comfortable in their environment, and think about how they might get along in a different environment. Humans in space will become different from humans who remain here on Terra, and right now is not too early to be thinking what those differences could be. And about when those differences will ...make a difference.

I expect the differences to be already significant *before* anyone goes out to live in space. We will see this in the long-term analog settlements we must try as we learn how to live in a space environment. In fact, I expect the people who first go out to live in the first off-Terra settlement, will *already* have demonstrated a strong likelihood that they can do it by living several years in an analog settlement.

As I write, I have not yet seen anyone working on this topic of the culture of later human generations living in space. I expect to. It is because the difficult effort to build and place those first settlements, will require it.

Hardware

Hardware built to go into space faces the challenge that very many people working together must design good hardware. In fact, this is a difficult challenge. Us humans don't seem to be very good at choosing between complexification and appropriate useful design.

For example, look at machines of all sorts that were built within the wartime constraints of WW2. At aircraft and ships; at cars and trucks and buildings.

Restraints of time and materials urged the designers to simplicity, relevance, and effectiveness. There is a sparse beauty to those designs which is lost in modern practice, pushed out by an overblown complexity.

Since WW2, design practice has changed. Earlier in Adra I mentioned the old W20 Radiation Laboratory building at MIT which was replaced by ...well, a very different kind of building. In (popular) computer technology one sees the transition from efficient command-line control in computer systems like MIT's ITS and unix to today's "Graphical User Interface" (which gave Microsoft an opportunity for vendor lock-in and DRM additions, and they took it). (The character of their operating systems is why there is no place in critical space systems for Microsoft.)

In space, our designers and engineers will be forced to seek elegant and simple design again, under much harder constraints than seen by WW2 engineers. Some of the machinery must be designed for maintenance by people in spacesuits working through pressurized gloves. Our business and cultural tendency to complexification *cannot go into space*. It's too dangerous; too heavy; too hard to use; too unreliable. The hardware that goes into space; the hardware that is made here to serve there, must be the simplest possible and most robust possible that anyone knows how to make.

Settlements

We make space ours by living there. That's simple enough. We need no supernatural permissions, nor interventions to do this: it's straightforward technology. Reasons to do it are compelling enough; the central issues are matters of detail, and that's where the difficulties begin to come in. If we tackle those difficulties directly, they will immediately become smaller and more manageable: we know that, don't we? We know the first most central step to doing something is to say what our objective is, then start working at it.

The key to progress is *settlements*, not indefinitely extended "exploration," which is better done from out in space anyway. We go about getting into space by putting out viable settlements *and* a human economic and business network. Because space is harder than Plymouth or Jamestown or (back in history) Europe and England, we must do this with a little more foresight than served humans here on Terra a few centuries ago. That is what the analog settlements and gaming I've mentioned earlier are all about (if you arrived here in the middle of things and haven't read earlier Adra pages yet)

After all the work that I have outlined above, one opportunity remains for a really serious error. It is, to send out *just one* settlement and then, wait for something good to happen. The initial project to send out the first settlements will operate under severe time, money, and regulation limits. Such limits will encourage a minimalistic approach to the work: beware *too* minimalistic. The perceived need to send out just one settlement, will be intense. That's too risky, and over the longer run, it fails the most basic reality test.

Just as a finger held close to the eye blocks a large visual field, thinking about a single settlement hides the basic that we are up to something here that is very much larger than that. The topic is the emergence of our human species out of our local Terran environment and into the far larger and different environment around our Sol. (A prelude, hopefully, to our reaching much farther out than that.)

Just one settlement somewhere “Out There” won't do it. That's too small and in view of the hard space environment, too risky. We need several Settlements, *and* a whole business, economic, and scientific culture. It is, after all, what we're really up to, isn't it? In the hard environment of space, the central elements of these Settlements will be highly interactive -- and highly supportive, each one of all the others. If we don't get that right to start, we risk not getting it at all. Failure. For which reason, "Settlement" is a wrong term: the reality requires the plural, "*Settlements*", right from the start.

In his *The Case for Mars*, Robert Zubrin describes a plan for sending out consecutive Settlements to Mars that he places within travel distance, one from another. His purpose is to plan against some failure of the travel machinery. Such planning is necessary, but I think Zubrin's recognition of need (when he wrote *The Case for Mars*), does not go far enough.

Time

The future is as close as today's next minute. "Today is the end of the world as we know it." The future is change. It is change that we create ourselves in our busy human world. It is change that happens in our universe, which we don't understand yet. In the past, both varieties of change have included very unwelcome elements. They will again. These two varieties of change relate only marginally, one to the other.

What will we become, all of us now on Terra? I'd like to feel our grandchildren and later descendants will see a much better world than exists today. It's possible in concept. However, I can't feel optimistic concerning what will develop here on Terra in reality. It gives me a sense we need an independent alternate branch. We need settlements and a business ecology in space, able to survive over long time separately from whatever happens on Terra. Will it happen? Soon enough? Time will tell.

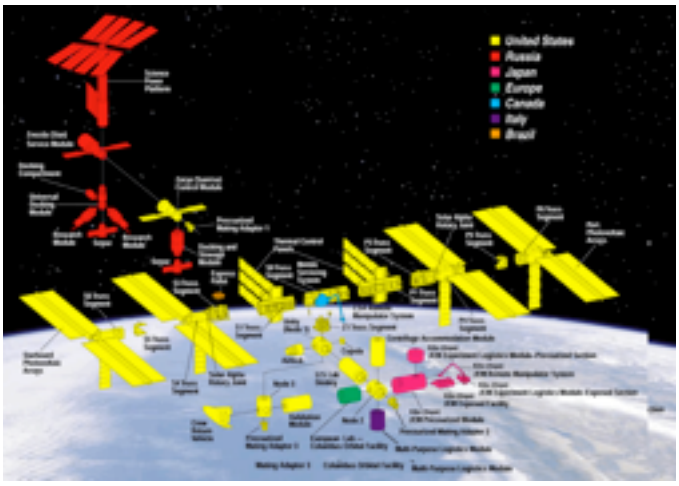
What will our universe bring to us, here on Terra? I'd like to see a peaceful universe that allows us humans to develop our potentials, with no interference from outside. That's a dream. We know today that about 96% of this universe we are in is different stuff from the baryonic matter that is ourselves. We know there are objects moving out there that could pass through our own Terra or through our Sol as if these were a thin gas. (There is reason to believe that on a tiny scale, something like this happened recently.) And that there are less exotic objects -- Near Earth Orbiting asteroids -- that might drop in from some unexpected direction, at several miles per second, to accomplish the same general effect locally as many megatons of TNT. Might this actually happen, someday? Yes: we can depend on it. When? Time will tell.

Finally, we can see the risk of religious ideologists and of opportunists of various kinds. A sort of fulminating ignorance, and worse, empowered by technology anyone can buy who has the money. These are people who imagine, for instance, that if our Terran culture were devastated, then it would magically reconstitute itself as a utopia. This would be an unwelcome experiment. What would come of it? I hope we never come to this, but if we do -- Time will tell.

The key element for these possibilities, and for all imaginable others, is *time*. We *do not know* how much time that is. Is it minutes from now? Then we're lost. Is it millennia? Nice, but unlikely. In any case, time is the wrong thing to be thinking about. The topic wants to be: *Off-Terra Settlements Now.* **<MDW>**

The International Space Station as a Working Model for an International Lunar Research Park: *Good Features & Deficiencies*

By Peter Kokh kokhmmm@aol.com



Above you see a color coded ISS "map" that shows which nations have contributed which components to ISS. For the original full-size image with legible script, go to:

http://www.geocities.com/utcnova3/components_large.jpg

To see this in timeline perspective in a computer-generated animation of the entire ISS assembly sequence (no audio), go to:

www.space-video.info/iss/assembly-animation.html

The story of ISS assembly is amazing. To destroy all this just 6 years after its completion in 2010, would, in our opinion, rank right up there with the burning of the great Library of Alexandria. The arguments that NASA gives for deorbiting this complex and flushing all that expenditure by many nations down the toilet, are quite irrelevant and beg to be refuted. If NASA gets its way, the public will be outraged and never again support a major public space initiative. That price will be much higher than whatever it takes to keep the station in orbit.

Yes, we can, and will build new stations out of less expensive inflatable modules such as those Bigelow Aerospace is testing. But those stations will serve other more commercial and industrial purposes. ISS as an international orbiting science laboratory is priceless.

An effort to declare the US portion of ISS to be a "National Lab" is a good start and should be supported. But if NASA as prime contractor and maintainer needs to be replaced, instead of throwing the baby out with the bathwater, we need to find or create an entity to take NASA's place. This entity could be multinational or international. In 2001, the Space Frontier Foundation floated the idea of an Authority to take over. Whether they had in mind an entity like the Port of New York/New Jersey Authority or not, I am not sure. But the idea begs study. We have six years to get an alternative up and running.

An International Orbital Research Park

The Moon Society is currently studying and developing the concept of an "International Lunar Research Park." If we replaced NASA in the ISS control regime with an Authority, most of what NASA has contributed, the framework, solar panels, some docking ports, etc. would fit in with what we see as a contractor provided and maintained infrastructure into which the individual national space agency facilities would plug, and be able to begin science, exploration, and research, just as they have in fact done at ISS. So instead of an "Authority" type entity, a willing multi-national corporate contractor could buy the NASA-owned infrastructure. A dream? Only if by being passive, we let it remain a dream.

What would motivate an multinational contractor to take on such an enterprise? Well, frankly, just that! Enterprise! The idea would be to support research partly by looking for profitable applications, and partly by expanding ISS to accommodate commercial operations. Such as? Such as a refueling depot, a waste processing facility, a visitors center. What could be done in this regard that did not interfere with the ongoing science research programs, is probably a lot more than any of us imagine, myself included. Here, we might look at another idea floated by the Space Frontier Foundation, even earlier, back in 1992: AlphaTown.

I have put both SFF proposals, in the abridged form in which they appeared in MMM's #92 and 139, online for your review, at this address:

http://www.moonsociety.org/publications/papers/AlphaTownSSAuthorityProps2.pdf

ISS – ILRP similarities and differences

Like ISS, an International Lunar Research Park would be built component by component, phase by phase. It would begin to be operational once the first national space agency science outpost was plugged into the growing contractor-provided infrastructure. Like ISS, the ILRP would grow in structure and functional capacity but in a more open-ended way.

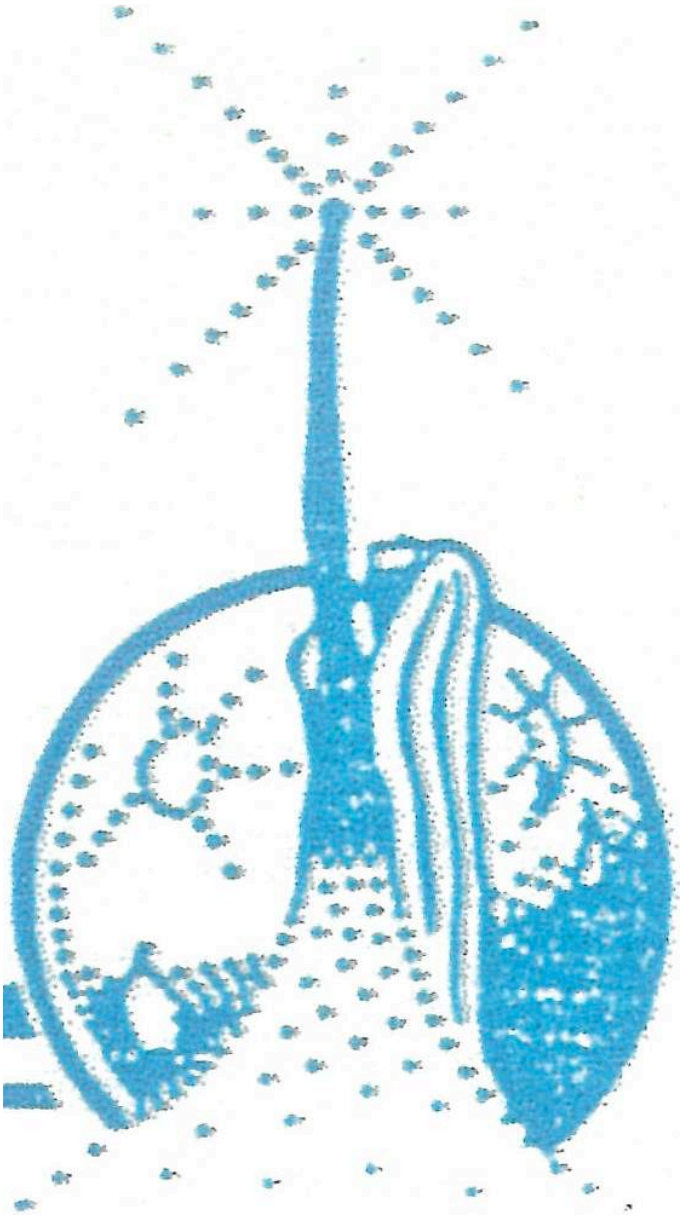
ISS growth could be limited by the capacity to keep reboosting it to its preferred operational orbit. Unlike :Low Earth Orbits, locations on the Moon's surface do not decay, however, if the original site is as limited by typography and lighting as the Washington DC "Mall-sized" area available on the South Pole Shakleton Rim, then growth will stall, or need to be halted, long before operational and functional options have been exhausted.

ISS Growth Vectors: where are we now?

The COTs program, which is intended to incentivize the development of commercial space transportation vehicles to bring cargo and personnel to ISS after NASA's Space Shuttle Fleet is retired, is a step in the right direction, i.e. in the direction of commercialization. There are those who want to postpone the fleet retirement. Their motives are admirable, but in our belief, this would be a big mistake. Europe, Russia, and Japan are building new ISS-access capable vehicles for cargo and/or crew alike. An extension of the fleet retirement deadline would be a disincentive to continue these developments.

Replacing the Shuttle Fleet is the first step. Replacing NASA as owner/operator/landlord with a multi-national contractor is next. Admittedly, this will be a very controversial step. But contrary to common opinion, NASA, as a national "socialized" space program, is simply not "as American as Apple Pie." It is a deviation from the American way that has gathered much support, boding ill for the American "way of life" in general.

Replacing NASA as landlord could open participation in ISS to more international partners. In our opinion, freeing NASA from ISS duties, would be good for the agency, allowing it to move on to pursuing the exploration and research & development. **<PK>**



The Logo of **Lady Base One** Corporation (1987-89)

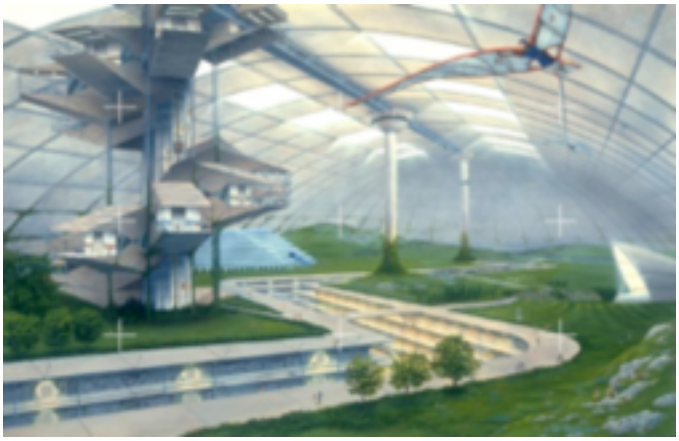
Mother Earth reaching for the stars using the Moon as a stepping-stone.

Lady Base One™ was an early effort to erect not just a commercial Moonbase, but a private enterprise industrial "settlement". This project preceded Gregory Bennett's **Artemis Project™** by some seven years, and with a multi-millionaire as its leader, looked promising for a while. But William F. Mitchell's fortune was made in the Houston real estate market, which collapsed in the recession at the start of the first Bush presidency in '89.

But we are interested here, in the symbolism of the logo, not in what led up to the collapse of a bright dream, that had many of us at the time, very enthused. Mitchell's initiative served to awaken a determination in many of us to see something happen within our lifetimes.

The Myth that Space Settlements are a creation of Human Hybris

Almost everyone thinks of any and all proposals to establish an outpost or any more extensive human presence on the Moon, as just that, "a human effort." Indeed, if we are looking at NASA or other agency designs through the years, or even if we are looking at various science-fiction visions of lunar settlement, with the exceptions of the 1970's classic film "Silent Running" and the 1990 made-for-TV ABC film "Plymouth," what we see and read about are principally more or less elaborate constructions for humans and a few token houseplants.



This depiction of **Moonbase Main Plaza** by Pat Rawlings got more exposure on the cover of Ben Bova's 1989 book "Welcome to Moonbase." But it had debuted previously on the Lady Base One™ poster.

Biosphere I is Pregnant

But in the vision we have outlined in two "Eden on Luna" theme volumes*, a different picture emerges. It would seem that humans can establish themselves securely on the Moon, only if they in turn are "hosted" by reestablished ecosystems in biospherules "budding off" of the home planet Biosphere, "Biosphere 1" itself.

[* www.moonsociety.org/publications/mmm_themes/]

In this light, we are not leaving Mother Earth for a barren world, but establishing an exclave of Mother Earth herself, Gaia, if you will, on a world that will, in the process, manifest a hitherto unsuspected "fertility," a fertility hidden all these past 4.5 billion years, by the absence of a fertilizing agent.

We have finally reached the point in the development of Earth-Life, now spearheaded by an emergent species capable of exercising stewardship, and alone capable of bursting through the boundaries of the atmosphere to replant "gaiacule sprouts" elsewhere throughout the Solar System, and someday beyond.

Humanity is not a biosphere cancer

Some look on humanity as a cancer on nature. But in many species, the coming of reproductive capacity brings with it a severe strain on the rest of the system. In fact, in many species, such as the Octopus, the female dies after laying eggs, its work done.

Think about it this way. Earth life cannot possibly sprout beyond the atmosphere except via the emergence of a technologically capable species. That process, especially as that species' technology develops, is bound to be at a cost, imposing stress on many other species populations sharing the globe, and with it, a considerable amount of extinctions. It is a price that, under the most idyllic of imagined alternative situations, would have to be paid. But think of the reward!

In the process, the dominant technological species, must come to grips with its own injurious effects on the

Biosphere, and gradually learn to minimize "co-lateral damage" and to evolve from "blind domination" to "enlightened stewardship." That is the direction in which we are moving now, although not yet without a lot of "kicking and screaming" holdouts who have not yet gotten with "the program," and who are more interested in avoiding personal inconvenience, even at a clearly indicated cost to their own children and grandchildren.

Some people are uncomfortable thinking of humanity as the "reproductive organ" of Nature. I don't understand why. Sexual reproduction is a wonderful thing and has been around for billions of years, and without it all the visible plants and animals we are familiar with, including ourselves, would not exist.

Human space transportation as a door-opener

But if you cannot emotionally wrap yourself around that idea, try this alternative concept: Humanity is a nature-emergent force that has been able to pierce the atmospheric boundary that has confined Gaia to the Earth-space below, and open up hitherto barren worlds beyond. In this paradigm as well, humanity is the first species capable of bursting this bond, and of taking representative eco-systems along, for transplantation and husbanding off planet on new planetary shores.

System-Faring 1 graduates to System-faring 2

Mitchell's point is that Mother Earth is the ultimate agent behind "our" (Gaia and Humans together) breakout into the larger host System. Humans have been a "system-faring species" for a hundred thousand years, the system being one of the continents that share Biosphere 1. Now we are capable, at last, of bursting into the next System Tier: the Solar System.

The Moon is just the first of many destinations. Mars will quickly follow, and prove, no doubt, even more fertile ground. These seemingly bold steps are really akin to Africans first making it through the Sinai and across the Straight of Aden to establish the first early beach-heads in Eurasia. So, as bold as the idea of full-fledged lunar and Martian Settlements may seem, it is bound to be seen, in retrospect, as just the humble beginning. It took us tens of thousands of years to get from Aden and Palestine to where we are now: virtually everywhere on the seven Continents, and moving with ease back and forth within mere hours throughout this First System.

It will be a long time before humans effectively occupy the entire Solar System, when travel between the various "Earth-life colonies" will be as casual and matter-of-fact as it is now between continents. Undoubtedly, establishment of the first true lunar settlement will be a matter of great pride and achievement, an achievement undoubtedly hard won. But it will only be the beginning.

In time our presence, humans hosted by Gaian eco-systems, will span the lunar and Martian globes. In time there will be human-Gaian outposts among the asteroids, on the moons of Jupiter, Saturn, Uranus, and Neptune: and, yes, beyond.

It took us a hundred thousand years from our fist humble steps "out of Africa" to the point we are now as an intercontinental system-faring species. At last we are ready to upgrade to the larger Solar System above and beyond. It may take us well more than a century to develop the means needed to establish ourselves throughout the Solar family and to become as truly "system-faring" out there as we are now down here.

Someday, System-faring 3: *Ad Astra! To the Stars!*

Nor will that be the end, as beyond lays the endless system of interstellar space. This writer is a firm believer that the speed of light is an absolute barrier and that all the talk of time-travel and wormholes and hyper-space is so much theoretical nonsense.

If you mean by "travel" an ability to make *round trips within one's lifetime,* then, for me at least, we will never see "interstellar travel." If we perfect "suspended animation", we may be able to make round trips, in a sense, but still not really, because we will return to a world considerably different from the one we left, to a world that has moved on - our grandchildren's world.

Interstellar "migration" is another thing. This *will* happen, and over millennia and longer, humans bringing Gaian ecosystems with them, will spread slowly throughout the nearer interstellar reaches and beyond. In time, we will have spread so far that mutual contact will become patchy. Old Earth will have become a treasured, even sacred myth with the historical details becoming more a matter of belief. Languages will have evolved differently in different locations. The ability to read the ancient scripts may not be maintained.

The point is that humans will not go alone. We are a Gaian species, inseparable from Gaian ecosystems. We will make the journey together.

What does this say about interstellar ships – or should we be thinking of "arks" and/or "generation ships?" Won't they need to be large enough to support viable eco-systems? That is another question. We may launch interstellar ships with everyone and everything in deep metabolic sleep, to be slowly awakened only upon finding a suitable new setting. We can only guess.

So do not think of humans, of whatever nationality, as establishing a viable lunar settlement. Think instead of the first lunar settlement as the first trans-atmospheric offspring of Mother Earth herself.

And, of course, sometimes a valiant first effort fails. We will try again, even if some time goes by.

Earth and Gaia as Host and Symbiote:
Budding new symbiotes for new host worlds

We can also think of Gaia, Earthlife, as a native-emergent symbiote of its geological host, Earth, a body of rock, water, and atmosphere. Of course, in that symbiosis, Earth itself has been transformed, even if superficially. But now Gaia has matured, having budded a dominant species capable of transporting seedling "gaiacules" and implanting them in other geological host bodies: the Moon, Mars, other bodies in the solar system.

Mother Earth is not a spinster
Mother Earth and Father Sky are inseparable
Attitude is everything!

To all my fellow dedicated environmentalists, we must stop thinking of Mother Earth as a spinster. We must start thinking of Mother Earth and Father Sky as a holistic pair, a pair "made in heaven." In such a vision, there is real room for environmental enthusiasts and for space enthusiasts to come together fruitfully and productively in a common shared greater and more holistic vision, an inspiration that can take us forward together into a future in which a healed and healthier Biosphere I will be surrounded by an ever growing family of healthy human-stewarded mini-biosphere offspring.

How could the future be brighter? **MMM**

The Moon Society www.moonsociety.org

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

Objectives of the Moon Society

include, but are not limited to:

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

Our Vision says Who We Are

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

Moon Society Mission

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

Moon Society Strategy

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

Our Full Moon Logo above:

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

Masthead Design: Charles F. Radley, Society Vice-president\

Australian member Shaun Moss rises to Chairman of the Board

By Peter Kokh, President

At the first post-election quarterly Board meeting (the Management Committee [officers and directors both] meets twice monthly), **R. Scotty Gammenthaler** who has chaired board *and Management Committee* meetings for the past four years, signaled his desire to step down and let someone else take the helm. **Shaun Moss** indicated his willingness to take on these duties, and was then elected unanimously to this two year position.

Shaun brings the new generation spirit to the job, he is currently 37. Born in Brisbane, Quuensland, Australia, and now working in Melbourne, Victoria, Australia, and a long time member of both the Moon Society and the Mars Society (as is President Peter Kokh,) he brings fresh insights and a different range of experience to the job. We all welcome him heartily, and assure him of our cooperation and collaboration in moving the Society forward through the coming two years.

We also wish to express our profound gratitude for the sure hand with which Scotty Gamenthaler led us for the past two years: Under his guidance, we reformed the Society Bylaws, undertook a successful project to design and build a working desktop demonstration model of a solar power satellite. Scotty also created the new template for most of our secondary web pages, with James Rogers contributing the artwork.

We find it fitting that an international member now has this prominent lead position in the society. It comes at a time when we are making bold new moves to become a more truly international organization. Having inherited largely nominal chapters in Europe and elsewhere from the Artemis Society, we are now taking bold steps in Mexico and India, as well as in Chile. Meanwhile, our chapter in Sweden, under **Niklas Jarvstrat**, is making respectable progress in its ambitious plan to turn an abandoned iron mine into a working lunar analog facility.

This Internationalization may lead in time to a major restructuring of the Society, allowing significant decentralization that will allow various national families of chapters to more appropriately address outreach and recruiting conditions in the various countries to which we spread our vision, mission, and goals. Success in this Internationalization venture is not assured, nor is smooth progress. But we are convinced that we are moving the Society in the right direction, from an American Society with token membership abroad into a truly Earth-wide movement to bring the Moon into an evolving Earth-Moon economy or "econosphere."

On this same note, we are happy to welcome **Pradeep Mohandas** of Mumbai, India, to the Leadership Council. With future director potential, he brings both youth and entusiasm to our deliberations and efforts. ##

New on the Moon Society Homepage

http://www.moonsociety.org

If you haven't visited the Moon Society homepage in awhile, there are some obvious and some subtle and not so subtle changes of which you should be aware

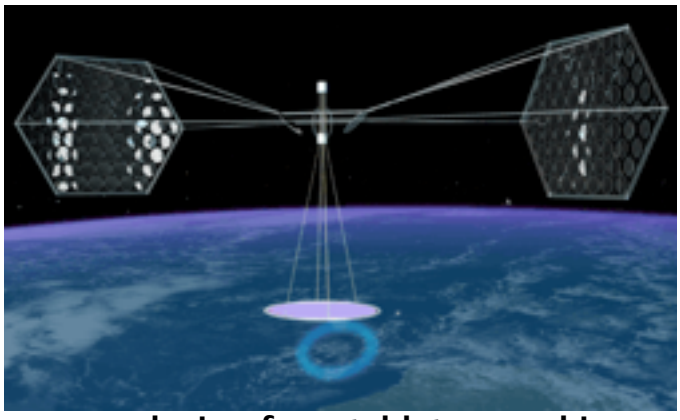
- In the Moon Society News center section below the Moon Colony Video link and the changing feature image, we have added an **image link to a Moon Society Announcement** to call attention to it. We may do this again from time to time.
- Just below The Moon Society News section and above the Today's Space News section, we are now featuring "**teasers**" to various **recent posts on our blog** site. You can reach the blog directly by selecting "check our blog" in the Main Menu. The url is http://www.moonsociety.org/blog/
- In the Destinations Menu, click on **Lunar Directory**. If you have visited this Directory before, you will notice that we have almost doubled the list of organizations and projects listed. New to the list:
  - **Canadian Lunar Research Network**
  - **Clavius Moonbase**
  - **Google Lunar X-Prize**
  - **International Lunar Exploration Working Group**
  - **International Lunar Observatory Association**
  - **Lunar Explorers Society**
  - **Moon Society Forum**
  - **Open Luna Foundation**
  - **Space Resources Roundtable**
  - **Trans Lunar Research**

  Check out these new additions, and the older ones as well, to get a look at how broad the movement back to the Moon really is. We will be adding more as they come online or get our attention.
- In the Destinations Menu in the right hand column below the Moon Phase image, we have changed the ISDC 2009 link to 2010, and added a new destination, our "**Moonbase Analogs**" page intended to serve as a clearing house of analog simulation activities and projects around the world.
- Below the Destinations menu, the **logo link to ISDC 2010** replaces the logo link to ISDC 2009
- Finally, on all linked pages, the **Destinations** Menu is inserted below the **Main Menu** and the **Members Menu**, and above the **Social Networks** link.

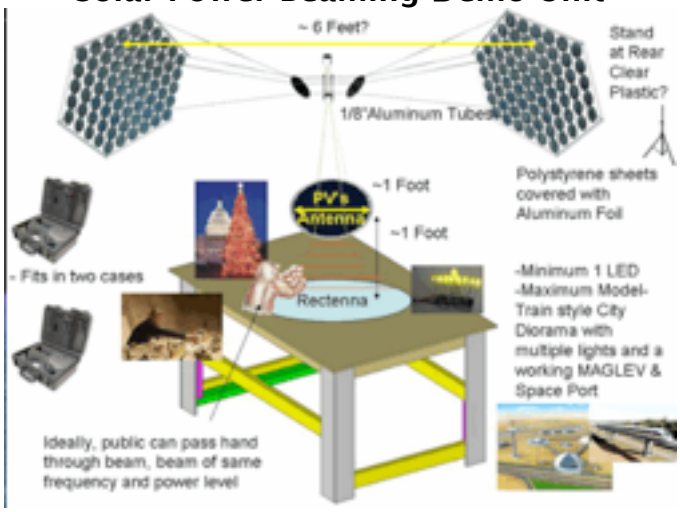
You may have read that the Society is working on a proposal dubbed the **International Lunar Research Park**. We hope to soon announce a major art competition to illustrate this concept in its successive phases. It is just possible that this will lead to the creation of an exciting **Flash Intro page**, with a *skip intro* button, of course.

If you have a constructive suggestion or two for further improvement in our homepage, (or any other areas of our extensive website, as well as pages that need updating) please send you input item list to president@moonsociety.org or, if you are not online, mail us a letter addresse to our Milwaukee PO Box – you'll find the address by clicking on the Contact Us link in the Main Menu <MSJ>

The Inspiration *Cascade:*
Solar Power Satellite in Orbit Artwork



>> a design for a tabletop working Solar Power Beaming Demo Unit



>> Our Working Exhibit at ISDC 2008

>> Our new Online Solar Power Beaming Demo Kit, Enabling others to follow suite

http://www.moonsociety.org/projects/spb-demo/online_kit/

We apologize for taking so long to produce this promised Online Kit, but we were deluged with too many other "also important" projects and tasks – Peter Kokh

Moon/Mars Atacama Research Station Design Progress: Corridors & Hallways

By Peter Kokh

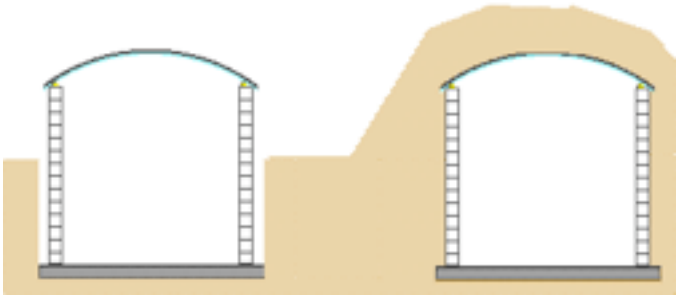
A uni-modular station such as the Mars Arctic and Mars Desert Research Stations does without hallways in the proper sense, although there is the let's pretend pressurized Robert A. Heinlein Memorial Tunnel built by the Moon Society on crew #45 Feb 26- March 11, 2006.

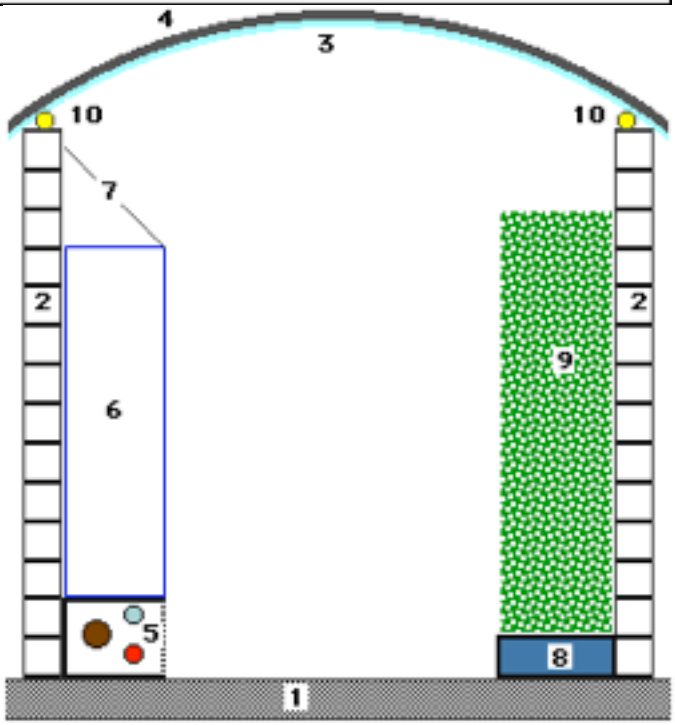
But on the frontier, a first module will remain the only module for a very short time, if the outpost is to become truly functional and designed for open-ended expansion. This means pressurized walkways between modules not directly connected.

For the Moon/Mars Atacama Research Station proposed for northern Chile, the choice of a decommissioned Hercules C130B cargo plane, less wings, for the command module - it is just large enough to serve this purpose, means that there must be additional modules to provide crew quarters, dining, laboratory research, recreation, construction, food growth and other needs.

Walking outdoors from one unit to the other does not really simulate lunar or Martian conditions. Additional modules, unlike the C130B cargo hold, can be set into the ground, and covered over with "shielding" - the material removed from the trenches in which they are set. This shielding provides some measure of thermal management: warmer in local winter, cooler in local summer, thus enabling substantially longer "field seasons." On Moon and Mars, shielding will provide protection from cosmic rays and solar flares as well. .

We will have an ample construction crew, so instead of spending a lot of money on stock items that could be configures into a hallway system, such as semi-truck trailers, we are looking at cement block walls on a cement pad, with an arched roof of curved steel braces covered with corrugated galvanized steel panels.





Key: [1] concrete pad; **[2]** 14-course cement block walls = 9'4" high; [3] matte blue painted underside of [4] corrugated galvanized steel roof attached to curved steel bars 12" x 2" running lengthwise parallel to hall axis; **[5]** accessible wiring and plumbing runs; 6 lockers of various sizes; [7] dummy panel or alternative shelf for sculpture, photos, paintings, [8] water drainig. [9] living wall systems. 10 fluorescent lights

If we are building "pressurized" hallways, we might as well build them wide enough to put to good use the substantial extra linear wall space. In an analog station with a varied research program, there can never be too much storage space. A row of lockers of varying widths could line one wall, lets say to the left when approaching the command module. The right wall could be put to use to support a valuable research program into the utility of living wall systems to keep the facility air fresh. Living walls have been built using a growing variety of watering, nutrient, and plant eco-systems. Schools and Colleges in Chile could each supply a planted module of their own design, both involving students in biosphere research, leading to a growing number of commercially available systems for home and office use.

In addition to refreshing the air, Living Walls will add the visual delight of lush vegetation and color, some with visible water recycling systems manifest as water falls, fountains, and fish ponds. Individual units could be interspersed with small table and chair pairs, for conversation, relaxation, and reading during off hours.

The humidity from plant transpiration can be turned into clean drinking water by dehumidifiers. Meanwhile, the diversity of evident nature will make the MMARS complex, and any lunar or Martian outpost designed in this mold, a more delightful place to work.

Consider the many sci-fi films you have seen, whether full feature or television serial; hallways have traditionally been seen a major share of the "action." Incorporating a full-featured hallway system in an analog station design, could make MMARS a model of things to come. **<PK>**

The Moon Society Chapters & Outposts Frontier Report

Moon Society St. Louis Chapter

http://www.moonsociety.org/chapters/stlouis/
Contact: Keith Wetzel <kawetzel@swbell.net>
Next meetings – Sept 16th, Oct 21st, Nov 18th
Meetings **3rd Wed** monthly at Buder Branch Library
4401 S. Hampton, in the basement conference room

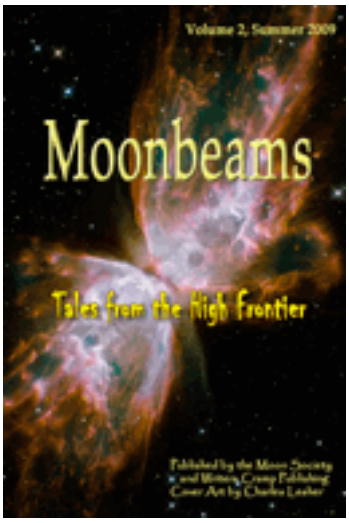
Fri-Sun, Oct 2-4, Archon 33 Science Fiction Convention in Collinsville, IL – MSStL will have its usual display booth and a number of our proposed presentations and panels are under review by the Con Committee

Moon Society Phoenix Chapter

http://www.msphx.org
http://www.moonsocphx.blogspot.com/
Contact: Craig Porter <portercd@msn.com>

Meeting the 3rd Saturday of the month
Moon Society Phoenix' next meetings are on
Saturdays **Sept 19th, Oct 17th, Nov 21st**

Next Meeting: Sat., Sep. 19, 3PM Dennys Restaurant, 4403 S Rural Road – US 60 at Rural Road, Tempe, AZ



Chuck Lesher has just finished another issue of the Moon Society's Science-Fiction rag, ***Moonbeams.*** You can download all issues of Moonbeams at **www.moonsociety.org/publications/fiction/**

We are looking for more short stories.

If you think you have a good yarn in you contact Chuck at email address on above page.

Moon Society Houston Chapter

http://www.moonsociety.org/chapters/houston/
Contact: Eric Bowen eric@streamlinerschedules.com

Next Meeting Place & time – Sept 21st

The Houston Chapter will host its next meeting in the meeting room at Coffee Oasis in Seabrook (4650 Nasa 1 at Kirby) on Monday, March 30, 2009. The room is booked beginning at 6:30 p.m.; meeting begins at 7:00 p.m. and will conclude by 9:00 p.m. All members, guests, and interested visitors are welcome to attend.

The Moon: "Houston, Tranquility Base Here. The Eagle Has Landed" at the Museum of Fine Arts, Houston

From September 27, 2009 through January 10, 2010 the Museum of Fine Arts, Houston will host a special exhibition dedicated to the past 500 years of humanity's fascination with the Moon. The exhibit will feature art ranging from Renaissance paintings up to and including some of artist/astronaut Alan Bean's very recent work. Alan Bean himself is scheduled to give an opening day lecture at the museum. In addition, there will be early scientific instruments, books, moon globes, maps, Galileo Galilei's 1610 treatise on the moon, and objects from NASA on display. The Moon Society has been extended a special invitation to come and view this exhibition, with a discounted admission available if we attend as a group. More information on the Museum's web site at http://www.mfah.org/moon.– Eric Bowen

College of the Menominee Nation-Green Bay* Student Chapter (*Formerly, Green Bay, WI Outpost)*

Contacts: Dan D. Hawk hawkd_0212@menominee.edu
David A. Dunlop dunlop712@yahoo.com

Meeting some Saturday afternoons at the College of the Menominee Nation, 2733 South Ridge Rd, Green Bay, WI

Activities: We are working on **a lunar agriculture experiment** that would be designed to fly on a Google Lunar X-Prize lander. The proposal has received much interest and attention from several respected authorities, including Dr. Lawrence Taylor, U-TN.

Chapters & Outpots Map (North America)

www.moonsociety.org/chapters/chapter_outpost_map.html

Chapters & Outposts Events Page

www.moonsociety.org/chapters/chapter_events.html

===== Moon Society Outposts =====

www.moonsociety.org/chapters/chapter_outpost_map.html

Moon Society Nashville Outpost

Contact: Chuck Schlemm cschlemm@comcast.net

Bay Area Moon Society, CA Outpost – South Frisco Bay
http://www.moonsociety.org/chapters/bams/
Contact: Henry Cates hcate2@pacbell.net
Informal meeting at Henry Cate's home in San Jose
The 4th Thursday every month

Moon Society Longview, TX Outpost
Contact: James A. Rogers jarogers2001@aim.com

Moon Society DC Metro, DC-MD-VA Outpost
Contact: Fred Hills Fredhills7@aol.com

Milwaukee, WI Outpost (MSMO)
www.moonsociety.org/chapters/milwaukee/msmo_output.htm
Contact: Peter Kokh kokhmmm@aol.com
The monthly Lunar Reclamation Society meeting on the 2nd Saturday afternoon every month serves MSMO also

NSS Partner Chapter News

Oregon L5 (Portland), **Lunar Reclamation Society** (Milwaukee), **Minnesota Space Frontier Society** (Minneapolis-St. Paul), **San Diego Space Society**
pp. 17-19

Moon Society DUES with ***Moon Miners' Manifesto***
Electronic MMM (pdf) **$35** Students/Seniors: **$20**
Hardcopy MMM: U.S/Canada **$35** Elsewhere: **$60**
Join/Renew Online - www.MoonSociety.org/register/

Moon Society Mail Box Destinations:

Checks, Money Orders, Membership Questions
Moon Society Membership Services:
PO Box 940825, Plano, TX 75094-0825, USA

Projects, Chapters, Volunteers, and Information
Moon Society Program Services,
PO Box 080395, Milwaukee, WI 53208

< End Moon Society Journal Section >

GREAT BROWSING

Regolith Moving Techniques for Lunar Outposts
http://www.nasa.gov/exploration/library/lss_systems_concepts_workshop_prt.htm
http://astrobotictechnology.com/wp-content/uploads/2009/Astrobotic%20MoonDigger%20Report.pdf

NASA-ASU Archive of Digitized Apollo Images
http://sese.asu.edu/node/465
http://www.nasa.gov/mission_pages/apollo/40th/apollo_films_out_of_cold.html

Countdown of 8 Remaining Shuttle Flghts
http://www.nasa.gov/mission_pages/shuttle/behindscenes/shuttle_countdowns.html

"Making the Moon Pay" - MSNBC
http://cosmiclog.msnbc.msn.com/archive/2009/07/28/2012537.aspx

Asteroid Watch is using Twitter
http://twitter.com/asteroidwatch

2 Earth Mass Planet found
http://www.planetary.org/news/2009/0423_Only_2_Earth_Masses_Scientists_Close.html

After Apollo, New Adventures for Astronauts
http://www.nytimes.com/slideshow/2009/07/13/science/071409_WHERE_index.html

Structural Design of a Lunar Habitat
http://coewww.rutgers.edu/~benaroya/publications/Ruess%20et%20al%20ASCE%20JAE.pdf

FALCON 9 PIX
http://www.wired.com/wiredscience/2009/06/gallery_spacex

Regenerative Life Support System Pilot
http://www.marsdaily.com/reports/Life_Support_Pilot_Plant_Paves_The_Way_To_Moon_And_Beyond_999.html

Apollo's greatest achievement in hindsight
http://www.thespacereview.com/article/1423/1

The Apollo program as a dead
http://www.thespacereview.com/article/1422/1

Reviews: Remembering Apollo in ways old & new
http://www.thespacereview.com/article/1420/1

The new politics of planetary defense
http://www.thespacereview.com/article/1418/1

Lunar Reconnaissance Orbiter: Science vs. Exploration
http://www.thespacereview.com/article/1429/1

Innovative crane system for lunar outposts
http://www.thespacereview.com/article/1428/1

Putting a bounty on orbital debris
http://www.thespacereview.com/article/1427/1

Review: Rocket Men
http://www.thespacereview.com/article/1424/1

1st Exoplanet Discovered through Astrometry
http://planetary.org/news/2009/0611_First_Exoplanet_Discovered_through.html

Rutan predicts commercial Moon loop Excursions
www.astronomy.com/asy/default.aspx?c=a&id=8506

Explore Tranquility Base with Interactive Software
www.nasa.gov/externalflash/apollo11_landing/index.html

Nine Abandoned NASA Projects
www.newscientist.com/gallery/abandoned-nasa-projects

GREAT SPACE VIDEOS

MOON COLONY VIDEOS - The Moon Society

30 plus thought-provoking videos, produced for the Moon Society by Chip Proser (Celestial Mechanics, Inc.) can be found at.
http://www.moonsociety.org/video/
or at:
http://www.mooncolony.tv/
http://www.stickymedia.com/

ASSORTED SPACE VIDEOS

The Moon Again 1
http://www.space.com/common/media/video/player.php?videoRef=SP_090720_MoonAgain

Water on the Moon: Hydorgen, Oxygen and Energy
http://www.space.com/common/media/video/player.php?videoRef=SP_090728_MoonAgain-02

Planning the Lunar Assault; Why Bomb the Moon
http://www.space.com/common/media/video/player.php?videoRef=SP_090730_Moon_Again_ep3

Moon Base Baseball: Why Not?
http://www.space.com/common/media/video/player.php?videoRef=SP_090731_BaseballMoon

I hear, *and I forget*
I see, **and I remember**
I do, ***and I Discover***
- Marquette University College of Engineering, Discovery Learning Center, Milwaukee, WI

Help us put MMM in a Library near You!

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

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

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

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

As membership services are not involved, the cheapest way we can do this is by submitting these subscriptions directly to the publisher at a cost-minus rate of $10 a year, available for libraries only.

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- With the complete name and address of the Library,
- Made out to

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Attn: Library Subscriptions
PO Box 2102
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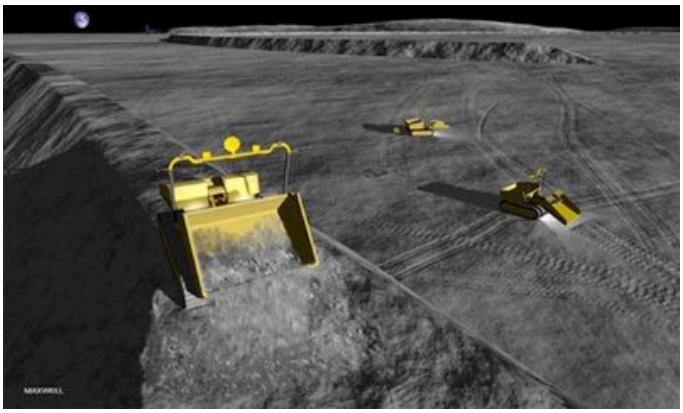
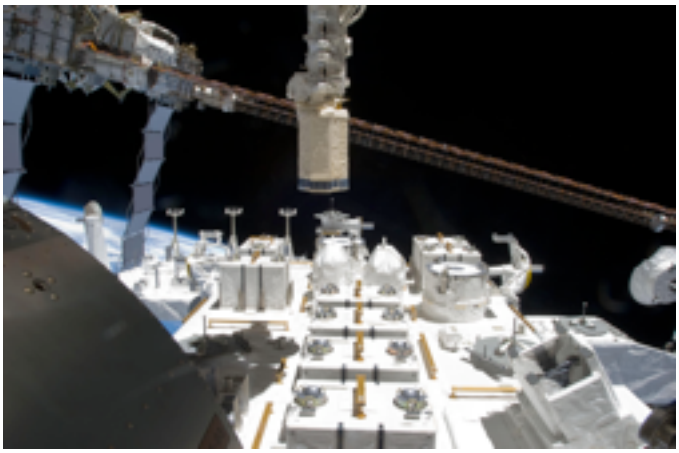
MMM PHOTO GALLERY

Apollo Moon Photos now digitized at 5,000+dpi

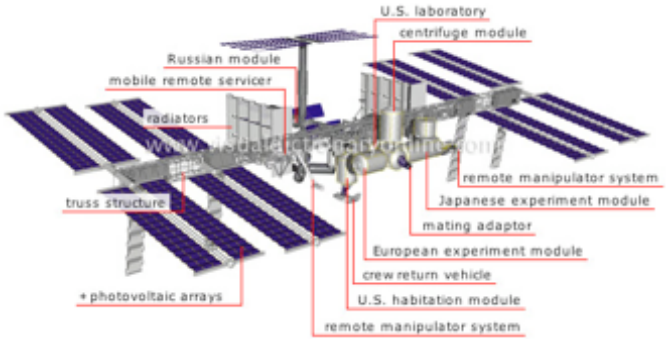
Endeavor and ISS silhouetted against the Sun



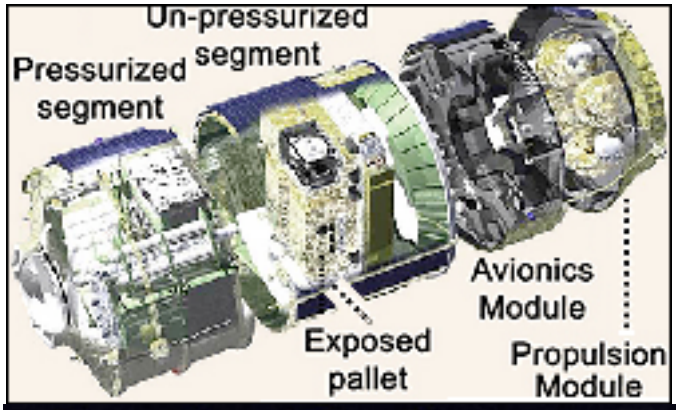
Robotic "Tonka" trucks prepare Moonbase site

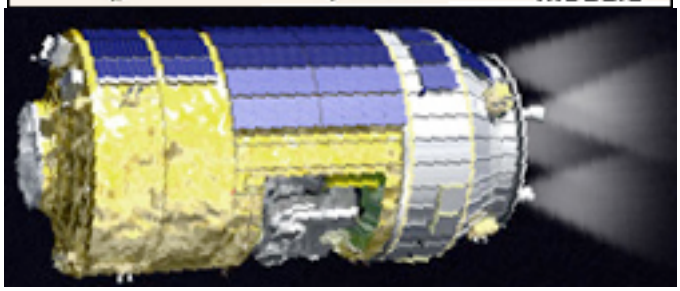


Japan's Kibo Porch module added to ISS



A Closed or Open-Ended Future for ISS?





JAXA's new HTV Cargo Vessel to make first trip to ISS September 11, burn up on way home, one use only.

Read the remarkable Ansari X PRIZE Story!

October 4, 2009 marks the ***5th Anniversary of the Ansari X PRIZE winning flight of SpaceShipOne***, which launched a new era in which private human space flight became a reality. The X PRIZE Foundation is commemorating this incredible accomplishment by telling the personal stories of the visionaries and heroes who made it all possible, as well as the transformative impact these individuals had on lives around the globe through a **6 part blog series** which posts today and continues over the next five weeks on The Huffington Post, Next Prize, and Launch Pad.

Guest bloggers include: • ***Anousheh Ansari*** – Ansari X PRIZE $10 Million Title Sponsor, the first woman to privately go into orbit. • ***Will Whitehorn*** – President of Virgin Galactic, which is utilizing the technology developed in the Ansari X PRIZE to usher in a new era of commercial space tourism. • ***Lori Garver*** – NASA Deputy Administrator and "Astro Mom" – longtime supporter of opening space to the public. • ***Brian Binnie*** – who flew SpaceShipOne in the Ansari X PRIZE winning flight and who holds the world altitude record for private space flight. • ***Dumitru Popescu*** – Leader of Romanian team competing for the Ansari X PRIZE, and now competing for the Google Lunar X PRIZE.

MOON MUSIC

Thanks to **Gerry Williams**, San Diego Space Society

Set synthesizer prefs, put orbiter on track and the topography gathered by Kaguya plays out.

I'm hooked.

More at: **http://bit.ly/oTHNx** - [redirects to:] **wms.selene.jaxa.jp/selene_sok/moonbell/moonbell_en.html**

University of Southern California (USC) Viterbi School of Engineering Division of Astronautical Engineering

From Madhu Thangavelu thangavelu-girardey@cox.net

During the Fall 2008 semester, the students of the graduate astronautics class **ASTE 527** (formerly AME 557), **Space Exploration Architectures Concept Synthesis Studio**, addressed the following question:

"What precisely can we do on the Moon, with crew and robots, that can immediately (very short timeframe-2020-2040) benefit not only the science and engineering community, but also inspire humanity as a whole, on a permanent basis?"

The very interesting team presentations, listed below, can be found, in PowerPoint format, on this page:

http://astronautics.usc.edu/concepts-studio/lookingglass.htm

Introduction
Cis-Lunar Ambulance (Nicole Jordan)
Lunar Communications (Amit Patel)
Lunar Geology (Kimberly Albarico)
Lunar Power Peaks (Rajeev Shrestha)
Lunar Rock Transportation & Processing (Corey Harmon)
Lunar RTT (Jeff Moring)
Lunar SS (Dana Pugh)
Magic Envelope (Brandon Hsu)
Primary Infrastructure (Eshete Mekonnen)
SPIDAR (Jodi Enomoto)
Surface Transportation (Melissa Doyle)

Participants:

Professor **Madhu Thangavelu**

Kimberly Albarico	Jeff Moring
Corey Harmon	Rajeev Shrestha
Eshete Mekonnen	Jodi Enomoto
Dana Pugh	Nicole Jordan
Melissa Doyle	Amit Patel
Brandon C. Y. Hsu	W. P. Stuppy

MAIL TO MMM

Lunar Thorium to Fuel Nuclear Rockets to Mars

From Dave Dietzler pioneer137@yahoo.com

Check http://en.wikipedia.org/wiki/Thorium_fuel_cycle

The thermal neutron absorption cross section and resonance integral for Th^{232} are about three times and one third of the respective values for U^{238}: consequently, fertile conversion of the former is more efficient in a thermal reactor.

1. If you study this, you will find that Th^{232} can be bred to U^{233} in a fast reactor, but a thermal reactor is more efficient.

There is a lot to this subject. We would need quite a bit of infrastructure on the Moon to produce nuclear fuels for space ships. Since the chances are that we would be prevented from shipping the large quantities of nuclear fuel needed for a real Mars colonization program [from Earth, through Earth's atmosphere], the Moon would be the source of fuel for nuclear ships. But it won't be easy and it won't be a near term project. However, the benefits would be immense. We could build large nuclear ships to Mars that get there in weeks and have more frequent launch windows to and from Mars. Trying to colonize Mars with slow chemical propulsion woule probably be better off postponed until we got nuclear fuels from the Moon, then things could really ramp up.

You might like this, and have things to add: http://www.moonminer.com/Mars.html

{PK:] Thanks for the links and the technical information. Yes, this would take a lot of infrastructure development, *but, it would have to be paid for by whatever organization wants to settle Mars, and perhaps at some cost to prospective Mars colonizers themselves* As there is no other realistic way to colonize Mars, the problem is not ours, as future Lunans, to worry about. This is just one more, very significant way, that the lunar economy would benefit from the opening of Mars, along with shipment of equipment made on the Moon that would be useful on Mars, such shipments being cheaper from the Moon, in terms of fuel costs, than from Earth's surface.

Now, I am not saying that colonization of Mars is a near term thing. Once people realize that Mars is not as romantic a place as they seem to think, there will be far fewer Mars settler volunteers than those now proclaiming their enthusiasm. Again, Antarctica is a much friendlier place all around than Mars, and no one seems to want to settle there.

[DD:] Peter, I am in full agreement when it comes to tapping lunar nuclear fuels for Mars ships. We will need U and Th to do this. Although Th^{232} is converted to U^{233} more efficiently in a thermal or slow neutron reactor, we need heavy water for such a reactor. Fast reactors use a core in a pool of molten sodium. Though less efficient, I'll bet there's more sodium to be had on the Moon than D2O. Hot sodium is combustible, but not in a vacuum! We could build the reactors in craters located far from habitations. This is a long-term project, but it could yield great things. Faster travel between the Moon and Mars with nuclear ships could speed up commerce in the trade triangle.

See MMM #116 JULY '98 p 7. URANIUM & THORIUM on the Moon, MMM Classics #12 pp. 43-44.

Augustine Commission's "Executive Summary" Suggests a Different Prospect Than the "leaked" Bits & Pieces

By **David A. Dunlop**, dunlop712@yahoo.com
Moon Society Director of Project Development

Having now read the Executive Summary of the Augustine report rather than rely on "leaked" version I fully endorse many of the set of options they presented.

First, they dealt with the issue that NASA is under budgeted by about $3B annually to accomplish what has been tasked.

Second, they strongly favor a competition to develop a manned launch capacity involving both small and large companies to both increase the launch volume and lower the costs. (This could lead to a rapid development of the Falcon 9 Heavy and Dragon capsule as one result)

Third, they provide for the commercial provision of refueling capabilities in orbit. This would put Dallas Bienhoff's "gasteroids" into the strategic picture.

Fourth, they recommend follow-on contracts for the provision of cargo crew and fuel to initiate this commercial using the airmail contracts that were given o pilots in Lindberg's day.

Fifth, they reject any "Mars First" approach in favor of a "Moon First" or a "Flexible path" strategy or some combination of the two. The Flexible path strategy would involve lunar sorties, as well a trips to Near Earth Asteroids, and farther out.

Sixth, they favor an "Ares Lite" be developed which creates a single launch HLLV vehicle of 140 metric tonnes to LEO capability. A Lunar Mission, for example, would use two of these to create a stack with the potential for even more capabilities arising from use of an orbital refueling system.

Seventh, they also emphasize international cooperation and participation as a way of sharing cost and increasing involvement.

Eighth, they recommend the extension of the ISS to 2020, recognizing that to abandon it after only 6 years after a 15 year effort to build it, would cost the US any credibility it might have as a future partner with other significant space faring nations. Why even "2020" is given as a potential termination point. However. is neither explained or justified. Presumably this leaves the door open for further extension.

Ninth, from the standpoint of a Moon return, infrastructure development, and commercial utilization, the Moon First and Flexible path set up paths to success. It is highly significant that commercial providers would become the workhorses for routine LEO & ISS access. NASA's monopoly on manned space would not only be broken, but a refueling infrastructure would extend the capacities of ot launch vehicles, national or commercial.

NASA human deep space exploration missions are enabled by a booster system that could launch 140 x 2 or 280 tons in comparison with a 160 tons Ares V and 25 tons for Ares I for a total of 185. Even more capacity would result from a refueling capacity. Large astronomy telescopes, unnamed military options, as well as Moon and Deep Space missions, would be enabled by such the addition of a refueling system.

This infrastructure not only advances exploration missions but creates a much broader set of capabilities for a cislunar transportation systems. We will need to create tank farms at a variety of location LEO, L1, lunar surface, GEO. We will have a market for lunar produced fuels [LOX] with this transport system. We would have an infrastructure that could also support a Solar Power Satellite Demo project that could provide a MW within a 23 year window if we initiated the program today.

Our proposal to create a Space Port Authority to take over the ISS, is also an initiative that keeps the investment in ISS intact. Our proposal for an International Lunar Research Park fits well with this architecture. A vigorous SPS development initiative should also be part of the US strategic space development plant. JAXA has just announced a $21B Solar Power Satellite Development Initiative. They have just launched their HTV cargo carrier today to the ISS on its maiden voyage along with the H-IIB launcher which made its first launch.

What seemed like a major US retreat from ambitious space goals from "inside track" reports, now seem in fact a sensible set of options and a candid recognition that to develop both HLLV and commercial purchase contracts will take another $3B to NASA's base. These are reasonable goals to achieve for an Obama Administration that expects to be in Office to 2016. If we get COTS and HLLV and refueling we have indeed kicked the can much farther down the road and put critical infrastructure in place.

Now we shall wait see what President Obama will do with a good set of recommendations. I hope that Space Solar Power is part of the mixture of things that they will develop as well. **<DAD>**

Cyborg Exoskeletons May Soon Become as Common as Bicycles

http://hplusmagazine.com/articles/robotics/cyborg-exoskeletons-may-soon-become-common-bicycles

'Great grandma can soon put aside that powered wheelchair she uses to terrorize the residents at her rest home. Japan's robotics venture Cyberdyne's robot-suit "HAL" (Hybrid Assistive Limb) is now available for rent and is being tested on the streets of Tokyo:

"HAL, an exoskeleton, is a mind-controlled wearable machine that gives humans enhanced mobility...

"...HAL comes in three sizes -- small, medium and large and weighs in at 23kg (50.7 lbs). A single leg version rents for 150,000 yen ($1,570) a month, while a two-leg unit goes for 220,000 yen ($2,300) a month. Cyberdyne has yet to announce when HAL will go on sale to the public or what the price tag will be... " [URL above]

Editor's Comment:

Such "exoskeletons" would be most useful for people who have spent major time (or even grew up) on Moon and Mars if they wanted to return to Earth or visit Earth, as an alternative to being bedridden.

We shudder at the idea of putting up with Jovian Gravity, which is 2.6 times Earth normal. But Earth normal is 2.6 times Mars level gravity (the same multiplier) and 6 times Lunar normal. Such a development was foreseen in Ben Bova's Sci-Fi novel ***Millennium***, and the film **Alien II**.

In '69

"We leave the moon as we came and, God willing, as we shall return, with peace and hope for all mankind. ."

– Eugene A. Cernan, December 14, 1972.

We walked on the moon in '69,
Didn't seem like much of a thing at the time.
We had the moon and we never went back.
We forgot our dreams, or just lost track.

Oh, there were rockets, and wonders, and Viet Nam,
Protesting the war, protesting the bomb.
Gotta take some time and just get high,
Had to bust our balls to just get by.

We looked back on our planet from out in space
A tiny and fragile and beautiful place
Then we came back home, and sorta forgot,
Didn't really give it another thought.

There were Watergate plumbers, and marches for peace,
Dodging the draft and the Chicago police,
We just had to lay back and just get high;
We were busting our balls just getting by.

We walked on the moon in '69,
Didn't seem like much of a thing at the time.
We went to the moon and just never went back.

Did we forget our dreams, or just lose track?

Geoffrey A. Landis
http://www.geoffreylandis.com

Published in in *Analog* last year (Sept. 2008), you're welcome to run it in Moon Miner's Manifesto if you like.

{Announcement]

Registration Open for NASA Lunabotics Mining Competition

PRESS RELEASE : Friday, August 21, 2009
Source: Kennedy Space Center

NASA is challenging undergraduate and graduate student teams to design and build an excavator that could be used on the moon.

Design teams must include one faculty or industry advisor with a college or university affiliation. Teams must also include two or more undergraduate or graduate students. A group of universities may work in collaboration; multidisciplinary teams are encouraged.

A university faculty advisor or student team may propose to receive up to $5,000 to support a student team. The team can use these funds to design and build a lunar regolith excavator. They may also use the money for travel expenses to compete in the Lunabotics Mining Competition at NASA's Kennedy Space Center in Florida on May 25-28, 2010.

Approved proposals funded on a first come, first served basis. Proposals must be received by Feb. 28, 2010.
http://www.spaceref.com/news/viewpr.html?pid=29033
http://www.nasa.gov/offices/education/centers/kennedy/technology/lunabotics.html

NASA Working on Lunar Dust Exploration Mission

http://www.sciencedaily.com/releases/2008/04/080411092032.htm

MMM Special Report

The **Lunar Atmosphere and Dust Environment Explorer** (**LADEE**) is being readied for a 2011 launch as NASA's next contribution to the Lunar Decade fleet of orbiters and landers aimed at making major inroads into the many mysteries and unknowns about the Moon's composition, its origin, and its makeup.

This relatively low-cost mission "will gather detailed information about conditions near the surface and environmental influences on lunar dust. A thorough understanding of these influences will help researchers understand how future exploration may shape the lunar environment and how the environment may affect future explorers."

The behavior of moondust is something we do not yet fully understand, though we are making progress in learning how to control its behavior through magnetism and microwaves. How much of a problem will be electrostaticly levitated moondust clouds be for future lunar observatories? How do we keep it from invading our airlocks and habitats, and the moving parts of our vehicles? How do we have to design our vehicles so that motors and gears are not fouled by dust? Can we make spacesuit fabrics that repel moondust?

"LADEE will fly to the moon as a secondary payload on the Discovery mission called Gravity Recovery and Interior Laboratory (GRAIL), which is designed to take ultra-precise gravity field measurements of the moon. Current plans call for the GRAIL and LADEE spacecraft to launch together on a Delta II rocket and separate after they are on a lunar trajectory. LADEE will take approximately four months to travel to the moon, then undergo a month-long checkout phase and begin 100 days of science operations."

NASA Ames will manage the mission, build the spacecraft and perform mission operations. Goddard will perform environmental testing and launch vehicle integration. The mission will be established within Marshall's newly created Lunar Science Program Office.

LADEE will hitchhike on the Discovery mission **Gravity Recovery and Interior Laboratory** (**GRAIL**), designed to take ultra-precise gravity field measurements of the moon. A Delta II will be the launch vehicle. #

Lunar Reclamation Society, Inc.

P.O. Box 2102
Milwaukee
WI 53201

www.lunar-reclamation.org

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

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

LRS News

● **Our proposed Apoll0 11 40th Anniversary Moon Party outreach event on July 18-19 at the IMAX-Planetarium on 7th and James Lovell** was cancelled. They "did not have room for our displays," despite the fact that we had made it clear that we would adapt our displays to the space available.

LRS Upcoming Events

Saturdays: 1-4 pm

Sept 12th – Oct 10th – Nov 14th – Dec 12th

LRS Meeting, Mayfair Mall, Garden Suites Room G110

AGENDA: http://www.lunar-reclamation.org/page4.htm

● **Discussion** of the Augustine Commission Findings that NASA would not be able co complete any of the proposed Manned Space Programs because of budget constraints.
● **Possible Video or DVD**
● **Early planning** for our **23rd Anniversary Party** on **December 12th**. Movie suggestion: **"Moon"** – recent Sci-Fi film with limited distribution.
http://www.scificool.com/moon-2009-movie-review/
● **Chapter participation in ISDC 2010** – Chicago

News & Events of NSS "MMM" Chapters

Space Chapter HUB Website:
http://nsschapters.org/hub/

OREGON

Oregon L5 Society

P.O. Box 86, Oregon City, OR 97045

voice mail / (503) 655-6189 -- FAX (503)-251-9901
[http://www.OregonL5.org/]

Allen G. Taylor allen.taylor@ieee.org
Bryce Walden moonbase@comcast.net
(LBRT – Oregon Moonbase) moonbase@comcast.net

Meetings 3rd Sat. each month at 2 p.m.
Bourne Plaza, 1441 SE 122nd, Portland, downstairs
● **Next Meetings: Sept19th, Oct 17th, Nov 21st**

MINNESOTA

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

David Buth (w) (612) 333-1872, (h) (763) 536-1237
Email: info@mnsfs.org
www.mnsfs.org/

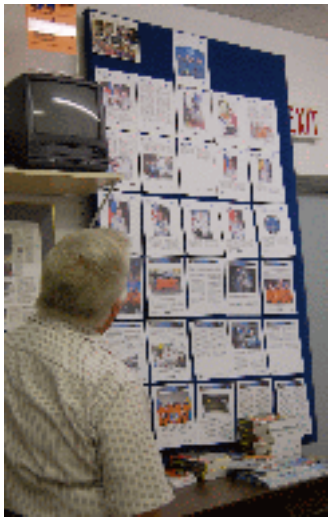
Calendar: MN SFS 2009 Past & upcoming chapter events
www.freemars.org/mnfan/MNSFS/2009-12-Review/e

Sept 19th MN SFS Quarterly EVENT????

Oct 1st ISS 21 Display
Oct 3rd Star Quest/ Sputnik/World Space Wk
Oct 13th MN SFS Meeting
Nov 10th MNSFS Meeting
Board Elections meeting of MN SFS 30th Anniv, Planning for 2010

Left: ISS-20/STS-128 Display at Radio City

Pics from MN SFS STS-128 / ISS 20 display
http://freemars.org/mnfan/MNSFS/2009-08-STS-128-ISS-20-Display/



ILLINOIS

Chicago Space Frontier L5

610 West 47th Place, Chicago, IL 60609

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

Preparing for ISDC 2010 – Chicago!

WISCONSIN

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

c/o Will Foerster 920-894-2376 (h) astrowill@tcei.com
SSS Sec. Harald Schenk hschenk@charter.net
>>> **DUES:** "SSS" c/o B. P. Knier
22608 County Line Rd, Elkhart Lake WI 53020
[http://www.tcei.com/sss/]
● **We meet the 3rd Thurs even # months 7-9pm**
At The Stoelting House in Kiel, WI
● **Next Meetings Thurs., October 15th, December 17th**

COLORADO

Denver Space Society
(FKA The Front Range L5 Society)
1 Cherry Hills Farm Drive
Englewood, CO 80113
http://www.angelfire.com/space/frl5/

Eric Boethin 303-781-0800 eric@boethin.com
Monthly Meetings, every 1st Monday, 7 PM
October 5th, November 2nd, December 7th
Englewood Public Library, Englewood, CO 80110
1st Floor Englewood Civic Center
1000 Englewood Parkway - **Map:**
www.mapquest.com/maps/1000+Englewood+Parkway+Englewood+CO/

PENNSYLVANIA

Philadelphia Area Space Alliance
PO Box 1715, Philadelphia, PA 19105

c/o Earl Bennett, EarlBennett@verizon.com
215/633-0878 (H), 610/640-2345(W)
[http://pasa01.tripod.com/]
http://phillypasa.blogspot.com

● **PASA regular business luncheon/formal meeting 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. Call Earl/Mitch 215-625-0670 to verify all meetings.

Next Meetings: Sept 19th - Oct 17th - Nov 21st

August Meeting Report: Dorthy and Larry and Earl had an informal dinner in July and talked on a wide range of subjects including travel, the future of space flight in the immediate future (without the shuttles), nano-technology and L-Cross scheduled Oct 9 impact possibly at Shakelton Crater on Oct 9 (per October Sky & Telescope.)

CALIFORNIA

San Diego Space Society
http://sandiegospace.org/
info@sandiegospace.org

Meeting the 2nd Sunday monthly, 2:30 to 4:30 pm
Next Meeting: Sept 13th, Oct 11th , Nov 8th
Serra Mesa Branch Library 9005 Aero Dr, San Diego
Quarterly Newsletter: ***The Bussard Scoop***

CALIFORNIA

OASIS: Organization for the **A**dvancement of **S**pace **I**ndustrialization and **S**ettlement
Greater Los Angeles Chapter of NSS
P.O. Box 1231, Redondo Beach, CA 90278

Events Hotline/Answering Machine:(310) 364-2290
Odyssey Ed: Kat Tanaka - odyssey_editor@yahoo.com
http://www.oasis-nss.org/wordpress/
oasis@oasis-nss.org
Odyssey Newsletter Online
http://www.oasis-nss.org/articles.html

● **Next Meetings: Sept 19th, Oct 17th, Nov 21st**
Information: OASIS Hotline, 310/364-2290; website.

Sunday, Sept. 20, 1:30 PM - Columbia Memorial Space Center, 12400 Clark Ave. (corner of Clark and Lakewood), Downey, CA 90242
"Legacy of the X-15": A 50 Year Retrospective, presented by the Aerospace Legacy Foundation. Long-time OASIS member Dr. Jim Busby will present a talk following the path of the X-15 from its beginnings to its current use today.
More info: see Aerospace Legacy Foundation Web site.
www.aerospacelegacyfoundation.com/page11.html

Saturday, Oct. 3 - Peter Eisenhardt of the Jet Propulsion Lab will present a talk on the Wide Field Infrared Survey Explorer (WISE). Read more about WISE at http://wise.ssl.berkeley.edu/

Our Community Live Journal
http://community.livejournal.com/space_above_la/

Odyssey Newsletter Archives
http://www.oasis-nss.org/articlearchive.html

Odyssey Gallery Online
http://www.oasis-nss.org/gallery.html

See Announcement p 12, col A

Moon Miners' MANIFESTO

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Electronic MMM (pdf) **$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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Send proper dues to address in chapter news section

=> *For those outside participating chapter areas* <=

- **$12 USA** MMM Subscriptions; • US **$22** Canada;
- US **$50** Surface Mail Outside North America

Payable to "LRS", PO Box 2102, Milwaukee WI 53201

CHICAGO SPACE FRONTIER L5
- $15 annual dues

LUNAR RECLAMATION SOC. (NSS-Milwaukee)
- $12 low "one rate"

MINNESOTA SPACE FRONTIER SOCIETY
- $25 Regular Dues

OREGON L5 SOCIETY
- $25 for all members

O.A.S.I.S. L5 (Los Angeles)
- $28 regular dues with MMM

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

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SHEBOYGAN SPACE SOCIETY (WI)
- $15 regular, • $10 student,
- $1/extra family member

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