

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

# Moon Miners' Manifesto

& The Moon Society Journal

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**Above:** Arthur C. Clarke's novels and short stories have inspired and motivated many a space enthusiast.

## Feature Articles in This Issue

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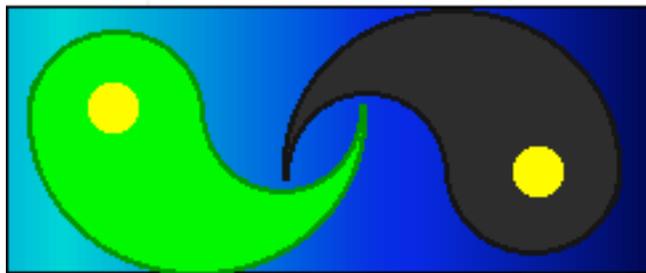
### Earth's Environment & the Space Connection > "Mother Earth and Father Sky" Putting Yin & Yang Together

This is the theme of a Moon Society/National Space Society Conference proposal submitted to EPA, the US Environmental Protection Agency, in response to their call for broadly based Climate Change conferences, for which Substantial funding is available. We met the first of three deadlines, January 8, 2008. See page 11.

## Guest Essay - The Passing of Arthur C. Clarke (by Robert Zubrin)

I knew Arthur Clarke, albeit from a distance, but on the basis of our limited acquaintance I can only support all the many commentaries from his closer friends as to what a truly fine man he was. Certainly, I shall always be grateful to him for his generous spirit in stepping forward and volunteering to write the preface to The Case for Mars, an endorsement which was substantially responsible for launching me into my current role.

My debt to Arthur Clarke, however, [ \* p. 2, col. 2 ]



# Moon Miners' Manifesto

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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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- **The National Space Society** is a grassroots pro-space membership organization, with 10,000 members and 50 chapters, dedicated to the creation of a spacefaring civilization. National Space Society, 1620 I Street NW, Suite 615, Washington, DC 20006; Ph: (202) 429-1600 - [www.NSS.org](http://www.NSS.org)
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⇒ Guest Essay continued from p. 1.

goes much deeper than that. He was a formative influence in my life. While I was growing up during the 1960s, I read his books, all of them, some many times. In them, I found a vision, convincingly explained and powerfully expressed, of a human future vast in expanse of space and time, infinite in potential, adventure, hope, and promise. To this vision I enlisted my soul. I am very glad that I did.

One of my favorite Clarke works was his short novel *Earthlight*, which concerns intrigue surrounding an incipient Mars colonial revolution against terrestrial authority taking place in and around an astronomical observatory near the Lunar crater Aristarchus. In 1970, Apollo astronauts visited Aristarchus, and apparently one of them had read the novel too, for he commented on it, and "how proud Arthur Clarke would be if only he were alive today, and could know that men were finally visiting the scene of his novel." Arthur got a chuckle out of that one. "Yes, I certainly was," he commented a few years later. "But if anyone had told me in 1940, while I was writing that book while manning a radar station in England during the Blitz, that thirty years later, people would actually be walking on Aristarchus, I would have thought it was the most wild poppycock imaginable."

Yet they did. In 30 years, humanity went from world of the Blitz to that of moonwalks, thanks in no small part to the vision laid out by that young radar man. It is a phenomenal achievement of the human imagination, mind, and spirit. Clarke and his visionary associates in the British Interplanetary Society, actually realized their slogan "From Imagination to Reality." In the beginning, there was the Word. >From words, they created the Space Age. From words, they created the prospect of an open human future, a grand hopeful alternative to the totalitarian Malthusian nightmare that was threatening the world in 1940, and which, in different form, is threatening it again today.

Yes, in 30 years, we went from the Blitz to Aristarchus. But we have gone no further in the 38 years since. To truly honor great men, we must do more than hail their accomplishments, we must reaffirm them by committing to do likewise ourselves. So, in celebrating the life of Arthur Clarke, let us resolve that he did not live in vain. From imagination to reality. Let us make the vision real; to the Moon, Mars, and the infinite stars that wait beyond.

RZ

*Thanks, Robert*

You said what was in my mind and heart also, but in words much more eloquent than I could have chosen. PK

## Classic Clarke

June 9, 1952 AP file photo shows Clarke holding a copy of his "Exploration of Space." He would go on to become one of the most influential and inspiring science-fiction authors of our time.



# Expanding Beyond the first Outpost: Aspects of An Early Lunar “Community”

by Fred Hills <FredHills7@aol.com>

## A Starter Community:

A small group (say 30 people) should be able function successfully as a community if certain conditions are met.

Each person can be alone some of the time (e.g. I am, at this time, alone in my home office while the rest of the family is sleeping.)

Sleeping space is subdivided (i.e. not more than 4 people to a space). e.g. The US Navy designs ships with 2 and 4 person state rooms, and a bathroom for each. There is desk and closet space as well. Compact and efficient, much like college dorms.

Normal work groups are small and groups may vary over time.

Physical space is divided into compartments so that groups function with minimal awareness of other groups. (i.e. work spaces, sleeping spaces, eating space, exercise room, etc. are isolated to some extent.)

## Communication:

Communication with Earth: Telephone, television, radio and internet available 24/7.

A cell phone tower will provide communication between people as well as machines in the base area. As the actively used area grows more towers can be added.

## Inside work:

Office work, laboratory work, managing/controlling outside work.

## Maintenance: Lots of it.

All the office and life support equipment in the base will have to be maintained. All those machines running around the lunar surface will need help as well. They could brought into a repair shop through a suitable air lock for service.

## Outside work:

Construction and mining done with remotely operated machines controlled from the base or even by operators on Earth. Remotely controlled equipment provides a vicarious experience and should be sufficient for most tasks.

Human operated machines will probably be needed, and a small cab could be provided. (Think of those folks that spend their day operating a tower crane at a construction site.)

## Out-vac work:

Workers in space suits may be about as rare as scuba divers on Earth, although some jobs are outside. The expense, inconvenience and time needed is burdensome. Space suits will be very expensive and require a lot of maintenance. Outvac workers will have to be extensively trained I think as were the Apollo astronauts. (I have been snorkeling in the Caribbean and scuba diving in Hawaii. Both fun when one happens be in a suitable location. But scuba diving is expensive and can be dangerous.)

## Production:

Oxygen, aluminum, building blocks (sintered regolith) and other materials will be needed to expand the facility without massive amounts of material from Earth.

## Transport:

Robots can move supplies, outvac equipment, etc. around, and pressurized vehicles (minibuses?) can move people around.

Out-vac workers may use vehicles similar to Apollo Moon buggies.

Facilities: may cover a fairly large area.

Experiments strategically placed

Mines wherever conditions are best and reasonably close.

Road graders can create smooth paths for vehicles between facilities and work areas.

## Training

Education and training is likely to be an ongoing activity.

## Food:

A learning experience: Humans will have to learn how to live on the Moon as they go. (American colonists could rely on Indians to find good water, fishing, hunting, and places to gather wild fruits or vegetables We won't have that luxury on the Moon.)

Plants on Earth evolved to grow according to the seasons. Since the lunar day doesn't match any of the Earthly cycles we will presumably have to develop plants that do well on that schedule. Plants can also be grown under artificial light during the lunar night.

## Entertainment:

Group activities should also be encouraged: e.g. dancing, concerts, movies, and plays (as in colonial times). This requires significant space. There should be ample time for this during the lunar night even as 'night work' continues. <FH>

[**Editor**: While in general, MMM articles on civilian settlements have looked further into the future, we have published a series of articles dealing with what will be involved in breaking out from the constraints of an early science outpost, to begin crossing the divide towards civilian settlement: “**The Outpost Trap: Technologies Needed for Breakout**” – Readers will find these articles in the following recent issues:]

MMM #198 September 2006, pp. 3–6. Parts 1, 2, 3

MMM #199 October 2006, pp. 3–8, Parts 4, 5, 6, 7

MMM #200 November 2006, pp. 3–6, Parts 8, 9

Note: All three of these issues can be freely downloaded (without username and password) in pdf file format, from the following directory:

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

It is our firm conviction that we will not get from here to there unless each phase is designed “to be pregnant” with the next phase. While NASA does foresee future developments, it is designing only what the budget will allow, and this shortsightedness is likely to end in a *cul de sac*. **PK**

[ FICTION – a special treat for our readers! ]



**Perseid Calls**  
By Frederick Hills

**Scene: Moon Base Gamma**

**Location: Mare Nubium (Sea of Clouds)**

**Date: August 11th**

**Time: 7:30 AM Central Time (Houston Time)**

Jeff Miller stood by the door of the newest module at the base. He had worked on this project for years. As an Olympic swimmer he had long thought that someone should build a pool on the Moon. After all people need more than a plain old exercise room for keeping fit or providing diversion from the normal work routine. There is a more important consideration too: when tourists start coming to the Moon they will want the whole lunar experience - everything that makes the environment here different from Earth.

Humans retain their normal strength on the Moon. But here the force of gravity is only one sixth that of Earth and one can jump far higher. Perhaps one could leap out of the water as dolphins do on Earth. Jumping into the water would produce a splash covering an area far larger than on Earth.

NASA began listening once the factory on the Moon began producing metals from lunar regolith (the pulverized rock that is the Moon's surface). These metals could be used for new construction without the cost of transporting it from Earth. The thing that finally did the trick was an offer from Far-out Adventures Company to pay for that material. They were now busy lining up well-healed adventurers for such excursions.

Jeff had been on the Moon now for almost a year leading the construction effort in addition to his 'job' as engineer in charge of electrical power for the base.

"Good morning"

Jeff turned. It was Chuck Smith the man in charge of the diesel generators that provided power through the lunar night.

(The generators ran on bio-diesel fuel. During day bacteria in large vats multiplied in the sunlight. Some of it was drawn off and processed into fuel, which was put in storage tanks until night-time. Then the diesel generator running on the fuel and oxygen produced electricity as well as exhaust gasses carbon dioxide and water. These were then stored until the next day when they would be consumed by the bacteria and completing the perpetual cycle.)

"Oh hi", Jeff replied. "You are just in time for the big event." He spun the valve open to transfer water from the reservoir into the pool. Gurgling sounds were heard and water soon started flowing in.

"Can I take a dip this morning?"

"No, the pool won't be full until tomorrow. I'm going to breakfast."

They both turned and headed for the dining hall in the adjacent module.

Jeff got scrambled eggs, hash browns and orange juice. He walked across the hall and set his tray down on a table across from Neha. Then without saying a word walked over to the

clock on the wall. The longest hand indicated the current phase of the Moon. The days were numbered 1 to 29. There were also cute symbols for the four primary phases. The new Moon symbol was at the top. He reached up and advanced the hand to day 13 and returned to the table.

Neha was born in Virginia to Indian immigrants and raised there. She earned a degree in computer science from Virginia Tech. She worked for several years with a defense contractor in Maryland and then accepted a job with NASA. She was fascinated with space and jumped at the chance to work on the Moon.

"Good morning Jeff," said Neha. I notice you do that now and then. The time is right. Why isn't the day right?"

"That clock is a simple mechanical, battery operated model. It keeps good time but the lunar cycle is not exactly 29.5 days long. The correct day is displayed next to time on our computer displays, but that clock falls behind by a few hours every month. When it looks too far behind I adjust it."

"I see. The Moon symbols don't seem appropriate though. When we look at the sky it is the Earth we see, not the Moon. In fact I enjoy watching the Earth going through its phases."

"On that I agree completely," said Chuck, who was now seated at the table too.

Their breakfast was soon interrupted by the sound of the klaxon and an announcement. "Attention! Moon Base Gamma is now in condition Zebra. Please check any doors near you and close them if they are not closed at this time. That includes all other fittings in your area marked **Zebra**. Whenever you open a door be sure to close it behind you."

"Reminds me of my days in the U.S. Navy." Said Chuck as he arose to close the door to module 1. The only difference was that the navy was concerned about keeping water out of its ships, while the lunar base was concerned about keeping air in.

"I knew this was coming," said Jeff. "The Perseid meteor shower is in progress." He went to close the door to the pool and took a peek. There was a growing puddle at the far end of the pool, but clearly a long way to go still.

Upon returning to the table Jeff added; "If you have time to look out the window you can see flashes produced by tiny meteorites striking the surface. I saw a few during the Eta Aquarid shower in May."

"What would a one kilogram meteorite do?" asked Neha.

"That would produce a flash that can be seen on Earth with a small telescope. I understand that 200 to 300 objects of that size strike the Moon every month."

"How big a crater would that make?"

"I don't know off hand, but there is a web site that can calculate the approximate results for an object of specified size and approach path hitting the Earth or the Moon. I do know that a one-kilogram object would get burned up in the atmosphere before it hit the Earth. But since the Moon has no atmosphere...bam!" Jeff punched his right hand with his fist for emphasis.

"Oh my!" she exclaimed.

"Time for me to get to work. I need to install a few light fixtures today."

August 12th 6:00 AM CST

Jeff awoke, rolled out of his bunk and dropped to the floor. (He had the top bunk in the cabin.) Each cabin had its own small bathroom and he proceeded to shower. After breakfast he decided pool was full and shut off the flow of water.

Next he tackled the normal routine, checking the status of base electrical systems and orders for the day. Top of the list was replacing the power inverter in the bus that would be needed to receive the arriving passenger shuttle from Earth that was scheduled to arrive in four days.

The task was fairly easy. He grabbed new unit and lugged out to the service bay where the bus was parked. The bus was linked to the air lock so he could easily walk aboard. He lifted the floor panel over the inverters and unbolted the cables. After replacing the old unit, he ran the test program. The test was successful. So within an hour everything was cleaned up and he went on to the next task.

4: 28 PM CST

Neha was working at a computer in module #1.

This was the original module and was divided into sections by curtains. (Solid partitions would have added too much weight to the package.) One section served as the base entry. There was the original ground level door with a dozen space suits hanging along the wall nearby. Toward the back were two more doors, one for the transport garage/service area and the second for the generator room. The fourth was the access to module #2 and the dining room. All four 'doors' were actually air locks consisting of two doors separated by a space large enough for two people. These were essential for going outside of course. Between modules they would allow people in and out even if one of the modules lost air pressure.

It was time to load system updates to the servers. She was required to be at the machine being loaded as a security precaution and so that problems elsewhere on the network would not interfere. She inserted the last of three memory sticks and waited for the load to finish.

The sound of the air lock opening reached her ears. "How is it going, Neha?" It was chuck.

"Fine, what's up?"

"Just going to check on the diesel generators and transfer the load to #2."

As she watched the load timer count down toward zero, she heard the door to the generator room close.

Without warning, there was a loud sound of ripping metal and a thud. She felt air leaving the room and bolted for the air lock to module #2 as the lights went out. She felt weak as she reached for the door handle, thrust herself in and tried to close the door. The cable that she had in her hand was not quite clear of the door and prevented it from closing completely.

Feeling dizzy she slumped to the floor.

Under emergency lights Jeff examined the situation display on his computer. It indicated that air pressure in module #1 was rapidly approaching zero and that both generators had shut

down. He activated the priority lighting in all the modules except #1 and simultaneously called the generator room.

Chuck answered immediately: "Yes, the generators have shutdown. I can't start either of them because whatever hit us must have ruptured the heat radiators on the roof. There is no water in the system." (These radiators serve the same purpose as the radiator on an automobile, cooling the engine. But instead of transferring the heat to air, it is radiated into space as infrared light.)

"Do you realize how close that was?"

"Yes, I'm still shaking."

The director rushed up to Jeff and asked, "What is our status?"

"We are using battery power to provide power to essential services. The generators are not available."

"Can we restart them?"

"No, it appears we have been struck by a meteorite which broke the radiators for the diesel generators and punched a hole in module #1. The air in there is gone."

"Alright, now we need to account for everyone. Call up the personnel location display." (A diagram of the rooms in the base with location markers for personnel.)

"Yes, sir."

The display showed the location of each personal cell phone and icons turned green as each individual acknowledged.

"Oh God no," said Jeff. "Neha is in module #1 and has not acknowledged."

He immediately got up and headed for the airlock to module #1 with the director right behind him. The lights over door indicated that there was no pressure (i.e. no air) in the room beyond it, but there was pressure within it. There was only one ray of hope Jeff thought as he opened the door.

The door opened easily and yes there she was. Sitting on the floor leaning awkwardly against the wall and apparently unconscious. Jeff lifted her out and laid her on the floor as the director called the base doctor.

Within minutes the three of them had Neha on a cart, into the medical center and hooked up to monitoring equipment. Jeff pulled up the pressure record for the airlock, which the doctor now studied. The graph showed that the air lock pressure dropped at precisely 4:31:28 PM when Neha opened the door.

"The pressure got pretty low then followed the programmed restoration path after the door closed." After a thoughtful pause, the doctor continued, "She may suffer some from Hypoxia or decompression sickness."

Jeff recalled the training sessions on decompression they all received before coming to the Moon. There were lots of possible outcomes including death.

Neha opened her eyes, and turned her head.

"How are you feeling?" The doctor asked.

"Cold", she replied.

The doctor placed a blanket over her.

"Why did you have that cable in your hand?" asked Jeff.

"I was fiddling with it while waiting for software to load. I think it stuck in the air lock door."

“You must have pulled it out when you fell. Look there are scrape marks on it near your hand.”

An announcement came over the address system: “Will the facilities team please report to the director’s office.”

Jeff promptly headed that way.

The director and the rest of the team except Chuck were all there as Jeff walked in.

The director queried each member beginning with the Air Handling system and on to power.

“What is our power status, Jeff”, the director asked?

“We are using the battery bank which supplied power through the lunar night before we installed the diesel generators. Although the base is a lot bigger now, the system can meet our needs well past sunrise when we start using solar power.”

“I want to get the generators running as soon as possible so that I can assure NASA that we will be ready for the new crew. They want that assurance before launching the team tomorrow. What are our options?”

Chuck replied over the intercom, “We need to restore the flow of cooling water to the diesel engines. I see two options: Fix the radiators on the roof or find another source of cooling water.”

“What is the status of the radiators?”

Jeff stepped in, “All we know is that the cooling water was lost to space. It would not be prudent to send someone to the roof during a meteor shower, however we could send one of our robots up to get video images for evaluating the damage. An alternative is to use water from the pool. I think there is enough pipe to reach the generator room. The heat will be dissipated via the pool.”

“What do you think of that, Chuck?”

“Let’s pursue both.”

The director sensed that all agreed and said: “Go do it.”

As the meeting broke up, Jeff assigned his assistant to inventory the pipe and then he set down at the nearest computer to request assistance. A robotic grader was available and ‘operator 26’ available to drive it. The operators were in Utah and he opened the communications link.

“This is Jane, how can I help?”

“I need to get pictures of our facility. How long would it take to move grader 3 to the top of module #1?”

“About 30 minutes.”

“Please move it to the base of the ramp to the roof and contact me, I will leave this line open.”

Jeff went and grabbed a sandwich from the kitchen.

He sat at the terminal to eat his lunch. Occasionally Jane spoke as if giving progress reports to herself and eventually announced; “I have the ramp in sight.”

“Good. The ramp surface is loose fill so proceed with caution. Our goal is a pair of radiators on the roof, which are, located a short distance to the left. We believe a meteorite hit them and went through the roof. So look out for debris.”

“Sounds messy. I’ll proceed with caution. Are you monitoring the video?”

“Yes.”

“Oh! Is that a new crater?”

“Certainly looks like it. We will have to study that one day. Move about six feet forward and do a pan.”

“Ok.”

“Stop right there, the radiators have been sliced into pieces . . . by flying debris I assume. What do you think, Chuck?”

“It would take too long to bring them in and rebuild them.”

“Jane, you can leave the unit there. Thanks for the help.”

“You’re welcome. Bye.”

Jeff went to the pool service room and found his assistant. “Do we have enough pipe?”

“No. Not even enough pipe to get from here to there. We need another 14 feet to get there.”

Jeff thought about that for a minute. “Wait, we don’t need the pipe coming from the reservoir now. Lets cut out what we need from that. So we will lay pipe from here to the generator room through the service tunnel, and let the return flow run along the tunnel floor.”

“That should work. We will have to spread the end of each pipe section to make connection to the next pipe section.”

“Ok, let’s get started.”

The two of them setup an anvil and supports for the pipe sections so that one person could do the work. Then they took turns hammering on one end of each to expand them and checking that the untouched ends would fit inside.

This continued through the night. Then they slid the sections into the tunnel. There wasn’t much room in the tunnel and it was cold down there. The assistant climbed in and opened the doors all the way to the generator room. Jeff handed him one pipe at a time and helped force them snugly together. Jeff had already installed a submersible pump in the tunnel by the pool.

Finally the setup was complete.

Jeff called Chuck. “We are ready. Start the diesel and see if we can get the water circulating.”

After a minute Chuck confirmed water was flowing through.

Jeff watched the water rise at his end and confirmed that the pump started after it became covered by water. By the time the water flowed through the tunnel, the pool, and back to the diesel engine, it was reasonably cool.

August 13th 8 AM CST

Jeff and his assistant had been watching their handiwork run for some time now. Too tired to move. Then the Jeff’s cell rang and he lifted the device to his ear.

“This is Rick. I took some food to Chuck last night and noticed the hole left by the meteorite was fairly clean. So with the director’s approval I got a helper and we patched it. The ceiling is as good a new and pressure has been restored.”

“Golly. That is good news. I will restore power there.”

“By the way, our resident astronomer is in there already gathering up the pieces of the meteorite.”

August 16th 8 AM CST

The sun had been up for 3 days now, and everyone at base was excited about the impending arrival of the new group. The command channel was on the public address system so they could follow progress.

“We have acquired the beacon at Lunar Base Gamma.”

Minutes later: “Now we see the markers at the landing site.”

Above the swimming pool and behind the 10-meter dive platform was a small observation deck where Jeff and a few others were trying to spot the arriving spacecraft. The sun was now in the same part of the sky where the spacecraft should be, which made the search tricky. “I see it,” said Chuck.

Jeff soon spotted it below, left of the sun and followed it to touchdown at the marked landing site 200 hundred meters northeast of the base.

Soon, the new arrivals, three women and five men, filed into the dining room where the director was ready to greet them. Introductions all around took place. Then they were shown their quarters and allowed to settle in.

The director invited them to meet him at the pool after lunch for a relaxing swim.

After being cooped up in the shuttle for six days a swim sounded wonderful.

3: 30 PM CST

The director, in his swimsuit, arrived at the pool to greet the guests again. “I see you folks are still getting used to walking where gravity is only one sixth of Earth’s. Now you can sample the joys of swimming on the Moon. The water is fairly warm today...mostly because it was cooling our generators until a few days ago. Jeff, the pool director and silver medal winner at the Olympic games in Mexico City, is up on the ten meter platform to demonstrate proper form.”

Jeff stepped off and rolled forward. It looked as if he was in slow motion. The weak gravity here took its time pulling him down. He wrapped his arms around his knees and like a cannon ball hit the water. Gushers shot up and majestically spread until everyone in the room was wet.

He jumped out of the pool and addressed the group. “Welcome. You are free to use any of the four diving boards. Those that want to swim should use this end of the pool. No running please, especially on the diving boards.”

The group had a great time in the pool and contemplating what the next two years here would bring. *finis*

Note 1 - *Why Central Standard Time? a) that is the time at the command center in Texas, b) since most members of the team on the Moon have family in the USA it is convenient, c) -since the lunar day has no relation to human sleep cycles, why not?*

## What? FICTION in MMM?

You may have noticed something unusual with this issue: the inclusion of a three and a half page short science fiction piece! Not that we haven’t run a few shorter Sci-Fi pieces before, especially when they helped illustrate points we were trying to get across.

On Easter Sunday, my laptop was stolen from my home in Milwaukee. I had backed up a couple of weeks earlier with thumb drives (my CD/DVD combo drive was on the blink and I didn’t want to put the machine in the shop for two weeks.) I did buy an external hard drive, but the thief got that too.

The version of this issue which had been saved included pages 14 and 15. So at least I didn’t lose that much. But I did lose a half dozen other pieces. To make that loss up in a short time would have been a challenge. I was considering running a shorter 16 page version (MMM is printed on 11x17 sheets containing four pages each). But then came this cool short Sci-Fi piece from Larry Hills. I did a work count and realized it would fit. Then I read it, and liked it, so voilà!

Some years back, during the Artemis Society days, we had *Artemis Magazine*, a hardcopy rag that came out quarterly for a few years. But now that effort is just a memory. This got me to thinking.

*Should we find an online space for realistic, near-term, inner solar system fiction, without the fantasy and impossible physics? Apparently something is in the works -- a new website spin-off of Lunapedia.org. The domain name of the new site is **Exofiction.org**. We own the domain, but nothing is yet online. So ...*

*If you love Sci-Fi and have a penchant for writing, it’s time to get out pad and pencil, or keyboard and fingers. We’ll be interested in short pieces.*

The Society is looking for more ways to get members with various aptitudes and interests involved, and this fits right in with this objective. Science Fiction that helps realistically illustrate the possibilities of life on a future civilian lunar frontier, has a valued place in the Society’s pursuits of its goals! And as MMM editor, I can say that it certainly fits in with the vision of MMM!

And, no, you don’t have to be a Moon Society member to submit! Everyone is welcome. We will be keeping you posted. The new site will state its submission guidelines up front, so that you don’t waste your time by sending us something in which we’d have no interest.

### A couple of pieces we ran in years past

In MMM # 21 we ran "My Flight on the A. F. Jules Verne," republished in MMM Classic #3 pages 4-8.

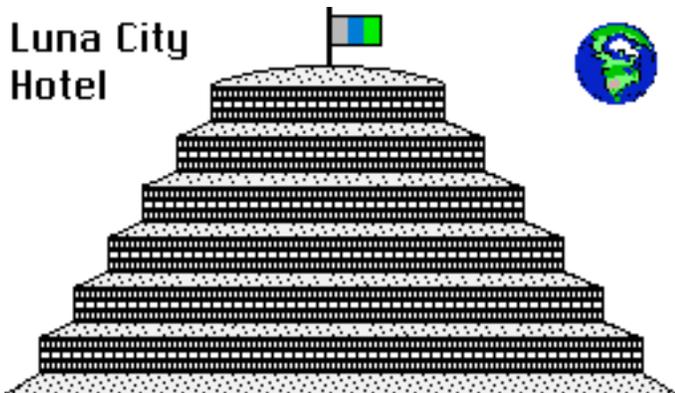
In MMM #132 we ran "An Email from Home," republished in MMM Classic #14 pages 15-17. You can download these pdf files from

[www.moonsociety.org/publications/mmm\\_classics](http://www.moonsociety.org/publications/mmm_classics)

## Revisiting a Sketch for a Luna City Hotel

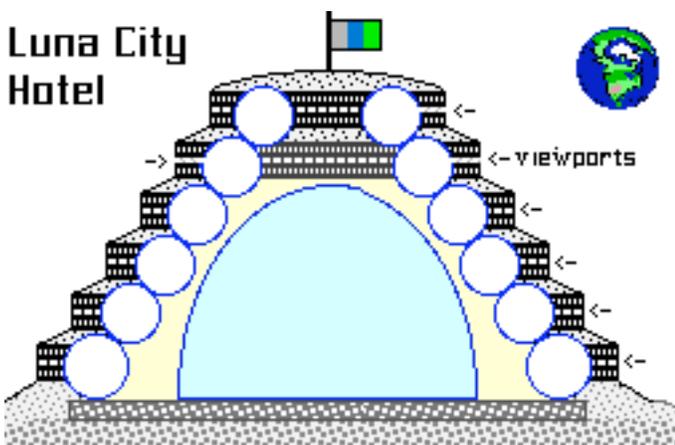
by Peter Kokh

### Luna City Hotel



Above: The original illustration is from MMM #111, p. 4 Lunar Skyscrapers: Shattering LoExpectations, Dec. 1997

### Luna City Hotel



Above: Rerendering showing interior Cone of stacked torus rings, two floors each. They would be supported by a conical truss system which incorporated elevator shafts on an angle at four points: N, E, S, W. Within this conical complex is an ovoid dome with translucent, not transparent, glass with a sky blue cast. Lighting would be outside the dome but within the cone structure. Inside would be a multilevel park like setting incorporating waterfalls and fountains, various trees, and a variety of plants. **The exterior of the hotel** shows caisson rings that are filled with moon dust for shielding the hotel. Window openings through the caisson are provided at intervals, and though the path is direct, very little cosmic rays will make it through these narrow openings. Keep in mind that the hotel rooms are for occupants on short stays. **Atop the hotel** is a flag. There is no official lunar flag, nor a Moon Society flag. We used the ad hoc flag design that flew at the Mars Desert Research Station during our "Artemis Moon base Simulation in early 1996. It is a tricolor, following suite with the Mars Society flag, with gray (regolith), blue (water), and green (vegetation).

Lunar hotels may not look like this, but our purpose was to stimulate thinking, and show that fully shielded structures could be designed to "stand proud."

**Now it's your turn!**

**MMM invites the architect in you** to submit other "skyscraper designs." We'll publish the best of them and give you full credit. Maybe we'll make a model of the winning entry for exhibit!

<MMM>

## Protecting Lunar Surface Facilities from Sandblasting by Landing Rockets

by Peter Kokh

[www.space.com/scienceastronomy/080212-st-lunar-sandblast.html](http://www.space.com/scienceastronomy/080212-st-lunar-sandblast.html)

### The evidence

When Apollo 12's Lunar Lander *Intrepid* set down as planned, just 600 feet from Lunar *Surveyor 3*, the visiting astronauts (Conrad & Bean) photographed *Surveyor* from all angles and took back the lander's camera an scoop for inspection back on Earth. It was clear that the spray of fine dust kicked up by the landing *Intrepid* had sandblasted clean a dark hue over the rest of *Surveyor* due to exposure to cosmic radiation. Landing photos showed that the LM exhaust moved rocks up to six inches in size. This spray had to have traveled at a third of the speed of a bullet, 1,300 ft per second.

### The verdict

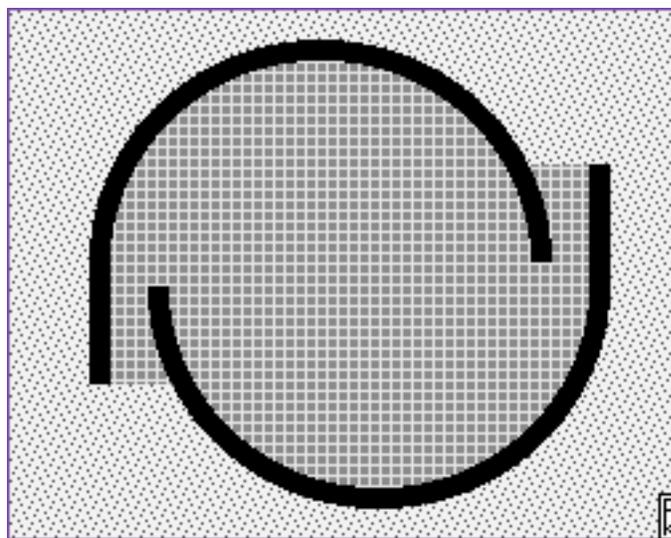
The implications are that equipment delivered on the Moon including habitat modules, should be protected from the exhaust of future landers. Modules covered with regolith for shielding purposes will be safe if their airlocks do not face the launchpad. But in general we need to have landers arrive and depart out-of-line-of-site. And, of course, personnel waiting for the landing craft must be protected behind some sort of bunker wall.

### Neutralizing the problem

One idea is to put the space pad inside a suitably sized crater. Craters smaller than several miles in diameter tend to have a bowl-shaped floor. So the crater floor would have to be graded level and cleared of rocks and boulders. Compacting the surface and passing over it with a magnetometer to sinter it into a crust could help.

In the absence of a suitable crater, a berm could be constructed with a simple bulldozer, given time. But if we are looking at continued growth of the site complex and increasing traffic, building a proper spaceport facility becomes a priority.

In the illustration below, a wall of sintered blocks surrounds the launch pad (of whatever size) with a pair of buffered entry points for cargo and personnel vehicles. The graded, compacted, and sintered floor is covered with thick cast basalt tiles. The inner surface of the surrounding walls might be covered with such ties as well. Of course, there will be those who say that this just shows that "doing the Moon" is too difficult, unrealistic!





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 individuals and organizations which have contributed to the advancement of the exploration, research, development, and habitation of the Moon, as well as scientific and technological developments related thereto.

## Our Vision says Who We Are

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

## Moon Society Mission

Our Mission is to inspire and involve people everywhere, 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. Radey, Society Vice-president\

## Strength in (Borrowed) Numbers

by Peter Kokh, President

"There is Strength in Numbers." We've all heard that bit of wisdom before. So while we are now steadily growing in numbers, the question becomes, "how do we combine our efforts with those of other groups so that our efforts become more effective, more successful?"

Over the past nearly four years, we have been on the alert for projects that would be of interest to other groups as well, so that with combined resources, we had a real chance for greater results. This has been our game plan in conducting our Moonbase Exercise at the Mars Desert Research Station in early 2007, in providing a Lunar Study and Observing Program Certificate, in access for our members to other publications, etc.

Now we are working with the National Space Society on a hybrid conference to begin "a conversation" with Environmentalists (page 11, column 2), and with MarsDrive Consortium on our new Google Group: Rail-roading on Moon and Mars. Our effort to design a working Solar Power Beaming Demonstration unit arose from our joining, at NSS' invitation, the Space Solar Alliance for Future Energy (SSAFE). When the idea of a demo unit was put forth, we grabbed the initiative. Our newly proposed "Game plan" to work towards a vision of a Solar Power Satellite Network built with lunar materials (pp 10-11) also flows from our membership in SSAFE.

Under consideration with LunarWire.com is cosponsoring Orbital Refueling Station Design Competition with attractive prizes. Those last three words are the key, and when we have all our ducks in a row, there will be an announcement.

Another collaboration which is in the conceptual stages, is the idea of collaborating somehow with one of the Lunar X-Prize contenders. There are a lot of pitfalls in hooking up with a for-profit enterprise, and we are in the early stages of looking at doable options. It is too early to be optimistic or pessimistic about such an initiate.

## Suggestions welcome!

Why don't we hook up with The Planetary Society? There is no more productive and successful space organization out there. Frankly, they don't need any help, and have ignored requests for collaboration with smaller organizations. We have concentrated on collaborations in which there is something to be gained by both (or all) parties.

If you have a suggestion for a collaboration on any project with any organization, please do not hesitate to share it with us! Meanwhile, we are ever on the alert for new opportunities. The governing motive is "to make a difference." We owe that to our members. It's why you have joined the Society!

PK

# The Moon Society Chapters & Outposts Frontier Report

## A Project-Focus & "Game Plan" For the Moon Society

### Introduction

On March 2, 2008, Director Dr. Peter Schubert challenged Society Leaders to concentrate our focus on efforts that would command respect and grow enthusiasm for Society Projects. His suggestion was that we take the lead in promoting

*a vision of a network of Solar Power Satellites constructed largely from lunar materials*

What follows is a suggestion of how we can break down this proposal into logical action items to pursue in promoting that suggestion. Without a list of action items, continually revisited, any proclamation of that goal would be so much empty talk. We need to use all the resources at our command to advance that vision.

### First things first – updating our assumptions

Over twenty years ago, SLuGS ( the Seattle Lunar Group Studies), a brainstorming group of the Seattle L5 chapter, with a high percentage of members coming from Boeing, presented their report that *92% of a solar power satellite could be built with materials made from lunar regolith at a weight penalty of only 8%.*

We have contacted the remaining people in this group, asking them to redo the study, considering new information about lunar resources and fresh ideas of how to process lunar regolith into usable building materials.

With a fresh updated study, the next step is to take a hard look at just how "ready" these "lunar appropriate" materials technologies are.

### Research Status of Lunar Building Materials

#### • Lunar concrete:

This is the *only* in situ lunar "building material" research that has continued through the past two decades, thanks to Dr. T. D. Lin.

#### • Glass fiber / glass matrix composites:

No significant research on this technology has been done since Brandt Goldsworthy produced an ice cube size sample that proved to be significantly stronger than steel -- back in 1985, I believe. Through the years, we have been highly critical of SSI's plan to import lead to drop the melting point of the matrix, when reasonably abundant lunar sodium and potassium could drop that point almost as much. The point is no further research has been done so far as I know.

In the SSI plan, glass composites would be used to make the spars for space frames from which the support structure of an SPS would be made.

In 1988, we proposed a "business plan" by which glass-glass matrix composites technology could be pre-developed by entrepreneurs strictly *for the potential profitable terrestrial applications.* Meanwhile, this R&D would put a close analog of what we can do on the Moon, "on the shelf." This process reverses the direction of "spin-off" and is what we have called "spin-up."

#### • Photovoltaics or Solar thermal:

We not aware of research that confirms which is the best technology to pursue, photovoltaics, or solar turbines --- "best" being determined by the most power

per weight, weight being the principal component of overall cost. It is possible that lunar component sourcing might support one option over the other in away that would reduce the percentage of total mass of an SPS that can be lunar sourced. We don't know. *We need to know!*

#### • Solar photovoltaic technology:

We have made a major advance in this technology area over the past three decades. More to the point is finding which technology is transportable to the Moon.

#### • Metal Alloy Research:

As to alloys, the significant thing is not that the Moon has abundant iron, aluminum, magnesium, and titanium, but that the alloy ingredients we are accustomed to using with each may not be sufficiently available on the Moon. Steel needs carbon. Most aluminum alloys use significant portions of copper, which, so far as we know, are present only in parts per billion.

### Our public posture

Instead of boasting that:

"The Moon Society is promoting the use of lunar materials for construction of solar satellites."

We should state that

*"The Moon Society is promoting a major acceleration in research on the production of lunar materials that would perform well enough to be used to construct the majority of the component mass of a network of Solar Power Satellites at a significant cost advantage over Earth-sourcing."*

We further need to determine what sort of capital investment would be needed to set up production facilities on the Moon for each candidate building material. The results of this research could point to one direction or another as the most promising avenue for further development. It would also provide one component of the overall cost of lunar sourcing.

### Addressing shipping costs and methods

Another cost consideration is the choices of launch methods into space, and then to GEO. Now we must be careful not to say that we already know the outcome of such research!. The economics depend very much on (1) the quantity we will need and (2) in what amount of time. we will need the items in question.

Once we are in very high gear, at maximum output, the O'Neill scenario of mass drivers, mass catchers, and factories in space might be most efficient. But in the near term, such a grandiose scheme would be so inefficient in terms of output per capital cost as to be science fantasy, and not needed for a demonstration.

The demonstration lunar-sourced SPS need not be full size. We will not in this instance be demonstrating that power beaming works, but that using lunar materials will not reduce performance appreciably and could reduce overall costs by enough to justify the capital expenditure.

As the old saying goes, "garbage in, garbage out." We all *believe* lunar materials will do the job. But until we have more solid research data, we will persuade only those willing to be convinced. This is something we have to do, not just to command respect by others, but because we owe it to our own dreams to do so.

# The Moon Society Chapters & Outposts Frontier Report

## Getting the needed research done

We are not in a position to do this research on the Moon! We need to do as much as we can here on Earth, first using pinches of the real stuff from NASA, then using production size amounts of really good lunar simulants of specific types: highland, mare, KREEP. That means finding researchers who are interested, and then helping locate funding their research.

## Conclusion: An itemized GAME PLAN

- **Announce our intention** to push the needed technologies involving near term relatively economic options.
- **Further work on Solar Power Satellite designs** (power collection) so that we get the highest performance for the least weight. That benefits us either way, Earth-sourcing, Lunar-sourcing
- **Continue pushing power beaming technologies.** We need to satisfy the concerned that this is a technology safe for humans, wildlife, and agriculture.
- **Identify possible profitable terrestrial applications and markets** for the needed lunar technologies. If we can encourage enterprises to develop and prove these technologies, not for use on the Moon, but for profits here on Earth near term, (a process we call "spin-up," the opposite of "spin-off") the result will be putting needed technologies and practical production experience on-the-shelf.
- **Implications for choice of site.** Solar power satellite products are not something we can produce, or ship economically, from either lunar pole. We should *unlink* the Society from support of a NASA polar site plan. The easiest place to start may not be the best.
- **Support an International Lunar Campus, open to enterprise "partners"** (not enterprise "contractors"). This could lead to a more permanent, larger lunar presence at the kind of location where we need to be to manufacture SPS components.

## Conclusions – summary

In short, just saying that the Society favors lunar sourcing, without real convincing demonstration that this is the direction to go, does risk giggle factor reactions. Showing that we are honestly pushing research to determine whether production and use of lunar building materials is a practical way to go, will command respect, especially if we are alone in doing so. Furthermore, it will be showing that we are *working*, not just spouting a "cult litany" of "unproven" beliefs.

## Where other Society Projects come in:

A focus goal of the **University of Luna Project** is to promote "spin-up" research into needed lunar technologies, mainly in the area of in situ ("local" of "on site") materials, getting students and entrepreneurs involved

Another proposed activity of the Society is to deploy its own **Lunar Analog Research Station**. Some of the research proposed above could be done at, or field-tested at, such a facility.

The above is a condensed version of the Plan put before Society Leaders, open to improvement. Input is welcome from both members and visitors. Game Plans are always "provisional."

<PK>

## Last Call for Nominations to Society Offices

If you are considering running for a board seat of for an office position, contact [president@moonsociety.org](mailto:president@moonsociety.org) as soon as possible. The Ballot must be in the next issue of MMM. See the March issue for details, or write us.

## "Mother Earth & Father Sky"

### The "Planet Earth & Space" Conference Proposal

From Peter Kokh, Moon Society President  
Member, NSS Board of Advisors

#### An Opportunity

Last December, Board member, Dr. Schubert first identified an opportunity for us to apply for EPA funds for a "broad-based" conference on "Climate Change" remediation measures, and, with enthusiastic NSS support and engagement, and input from a handful of others, we put together a specific proposal dubbed the "Planet Earth and Space Conference."

#### Rising to the Occasion

From the outset, we saw this as a perfect opportunity to start a constructive and productive "conversation" with the environmentalist community. Two of us on the committee, Lorreta Whitesides, wife of NSS Executive Director George Whitesides, and myself are dedicated members of both communities and have insight into why, both groups, equally dedicated to preserving our home world, continue to talk past one another. We come from different cultures. Lorreta and I separately listed areas in which we thought conversation might be especially fruitful, and with that input, Peter Schubert drafted the specific proposal which was endorsed by everyone on this ad hoc committee.

We then approached a "bridge group," the Earth and Space Foundation whose leaders are personal friends of the Whitesides. They enthusiastically cosponsored the proposal. We managed to get the sponsorship of an environmental group also just in time for the January 8, 2008 first (of 3) submission deadlines.

#### The Waiting

We are awaiting word from EPA, that our proposal is accepted. This conference, if approved, and if successful, would bring together two constituencies that while driven by different cultures, are both focused on preserving Earth for future generations.

The conference will address individual and local here & now approaches as well as long term space-based measures. We would show how development of some technologies needed in space will help here on Earth. If this conference goes forward, and is successful to the point where we want to do this every other year, that will be a big feather in our cap, promotion wise.

This conference may include workshops focused on potential benefits here and now of predevelopment of some of the technologies listed in the "Game Plan" above, as well as of biological life support issues and biosphere sustainability technologies. If we can get even some elements of both very stubborn constituencies to start talking to one another, that will be an achievement.

Until we get a positive response from EPA, we are postponing talk of "when" and "where" such a conference might be held. To do that now would be to get ahead of ourselves. *It won't be in conjunction with and ISDC!*

We will keep you posted.

<PK>

## Chapters & Outposts

### Moon Society St. Louis Chapter

<http://www.moonsociety.org/chapters/stlouis/>  
Contact: Keith Wetzel <kawetzel@swbell.net>

**New meeting day as of April 10th**

Meetings **2nd Thursday** monthly at Buder Branch Library  
4401 S. Hampton, in the basement conference room

### Moon Society Phoenix Chapter

<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  
Saturday **April 19th, May 17th, June 21st**  
at Chompie's at 1160 E. University at 3: PM.

### Moon Society Houston Chapter

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

**Next Meeting Place & time**

**Monday May 19, 7 pm, Freeman Branch Library, Clear Lake** (16616 Diana Ln, Houston 77062, 281-488-1906)

### Bay Area Moon Society Outpost

<http://www.moonsociety.org/chapters/bams/>  
Contact: Henry Cates <hcate2@pacbell.net>

BAMS' March Meeting postponed to Thursday, April 3rd  
to allow Henry to attend Space Access Conf in Phoenix.  
He will be giving a comprehensive report.

### Moon Society Tucson Outpost

Contact: Ben Nault <bnault@comcast.net>  
We welcome new member, *Ingrid Saber!*

**Why not start a Moon Society Outpost in Your area?  
All it takes is one person - you!**

### For news of our NSS Partner Chapters in

**Portland, Milwaukee, Minneapolis/St. Paul, see p. 18**

### 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/](http://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, Information, etc.

Moon Society Program Services  
PO Box 080395, Milwaukee, WI 53208, USA

### Growing Your Chapter or Outpost Helpful Hints from the SPACE CHAPTER HUB <http://nsschapters.org/hub/>

by Moon Society Chapters Coordinator & Hubmaster

The Space Chapter Hub website is something we put together as a result of a promise made to the NSS Chapters Assembly back in 2000, when I was serving as its chair. The idea was simple. We personally belonged to all three major space organizations with chapters

#### Moon Society, Mars Society, National Space Society

As an active member of each we had noticed that while the focus differed, activists of each faced the same challenges, and had the same set of tools to work with. The Hub from the outset was designed to serve all three.

You will have noticed that the Hub seems to have an NSS we address. *Not exactly!* It has an "NSS Chapters" address. It had to be *somewhere*, and NSS is the biggest outfit, plus the location was offered to me. "No brainer!"

Most everything on the site is useful to chapter leaders and local contacts of any space organization. However on each page, material especially appropriate for one or the other is so noted.

#### Space Chapter Hub Menu (Page Topics)

Chapter Handbooks	<a href="#">Meetings &amp; Agendas</a>
Newsletters	<a href="#">Project Menus Unlimited</a>
<a href="#">Events Calendar</a>	Publicity/Media Contacts
Political Contacts	Educational Contacts
Annual Report Tutorials	<a href="#">Growing Your Chapter</a>
Other Chapter Activities	<a href="#">Chapter Scrapbooks</a>
Downloadable Flyers	Transparency Sets
Slide Sets	PowerPoint Presentations
<a href="#">Display Blueprints</a>	<a href="#">Models &amp; Exhibits</a>
Chapter Made Videos	Music & the Arts (U.C.)
Speakers Bureau	<a href="#">Space Conferences</a>
<a href="#">Science Fiction "Cons"</a>	<a href="#">Move/Create a Free Website</a>
Website Templates	Website Director Express Demo
Web Page Backgrounds	Image Libraries
Animated Images	Web Sales
Website Assistance	Chapter Merchandise

If your chapter or outpost is new, *or*  
If you are new to chapter/outpost leadership  
May we recommend perusal of underlined pages above

If you feel you would like to discuss your needs  
or situation with a veteran, feel free to contact myself at:

[kokhmmm@aol.com](mailto:kokhmmm@aol.com) [414-342-0705 "Peter"] *or*  
Craig Porter [Moon Soc. Phoenix] at [portercd@msn.com](mailto:portercd@msn.com)

We'd be happy to help you anyway we can.

If you like dealing with people first hand, starting, joining, and/or working with and for a chapter may be just what the doctor ordered. That said, space chapters differ quite a bit from one another. Each person brings a special set of interests, abilities, free time budgets, etc. Some love public speaking; some making exhibits; or making models; or composing flyers; or making PowerPoint presentations; or creating and maintaining web sites; or writing letters to the editor or newsletter articles. Your chapter will necessarily be unique! *And that's great!*

< End Moon Society Journal Section >

## GREAT BROWSING

**New insights into mass & origin of Saturn's Rings**  
[www.astronomy.com/asy/default.aspx?c=a&id=6104](http://www.astronomy.com/asy/default.aspx?c=a&id=6104)

**The Reinvigoration of the West through Outer Space Development** - 144 page pdf file  
<http://www.hudsonfla.com/thesis.htm>

**Building a Base on the Moon, Pt. 4**  
[www.universetoday.com/2008/03/22/building-a-base-on-the-moon-part-4-infrastructure-and-transportation/](http://www.universetoday.com/2008/03/22/building-a-base-on-the-moon-part-4-infrastructure-and-transportation/)

**Scotland to Join Google X Prize Moon Race**  
[www.sundayherald.com/news/heraldnews/disay.var.2086682.0.scotland\\_set\\_to\\_join\\_race\\_to\\_the\\_moon.php](http://www.sundayherald.com/news/heraldnews/disay.var.2086682.0.scotland_set_to_join_race_to_the_moon.php)

**A One-Way, One-Person Mission to Mars**  
[www.universetoday.com/2008/03/04/a-one-way-one-person-mission-to-mars/](http://www.universetoday.com/2008/03/04/a-one-way-one-person-mission-to-mars/)

**Return to the Moon Short Story Contest**  
[www.spaceref.com/news/viewpr.html?pid=24910](http://www.spaceref.com/news/viewpr.html?pid=24910)

**Earth and Moon, As Seen From Mars**  
[www.universetoday.com/2008/03/05/earth-and-moon-as-seen-from-mars/](http://www.universetoday.com/2008/03/05/earth-and-moon-as-seen-from-mars/)

**U-Arizona to enter Google X Prize contest on Carnegie-Mellon "Astrobotic Technology" Team**  
[www.tucsoncitizen.com/daily/local/78677.php](http://www.tucsoncitizen.com/daily/local/78677.php)  
<http://gizmodo.com/364282/a-one-way-one-person-mission-to-mars-who-wants-in>

**Planets around Alpha Centauri A/B?**  
[www.universetoday.com/2008/03/10/if-alpha-centauri-has-earth-like-planets-we-can-detect-them/](http://www.universetoday.com/2008/03/10/if-alpha-centauri-has-earth-like-planets-we-can-detect-them/)

**New lunar south polar maps from SMART-1**  
[www.spaceref.com/news/viewpr.html?pid=24954](http://www.spaceref.com/news/viewpr.html?pid=24954)

**Getting to Alpha Centauri will be hard**  
[www.space.com/business/technology/080313-tw-centauri-travel.html](http://www.space.com/business/technology/080313-tw-centauri-travel.html)

**Internat'l Network of Science Nodes on the Moon**  
[www.livescience.com/blogs/2008/03/11/international-lunar-network-science-nodes-on-the-moon/](http://www.livescience.com/blogs/2008/03/11/international-lunar-network-science-nodes-on-the-moon/)

**Phoenix Mars Probe Lands Successfully**  
<http://phoenix.lpl.arizona.edu/blogsPost.php?bID=180>

**The plan to close Areceibo Radio Telescope**  
[www.orlandosentinel.com/news/space/orlarecibo2408mar24,0,6016660.story](http://www.orlandosentinel.com/news/space/orlarecibo2408mar24,0,6016660.story)

**Private Moon flights coming by 2030, official says**  
<http://lfpres.ca/newsstand/News/Local/2008/03/24/5089876.html>

**SpaceDev to develop improved equipment seals**  
<http://biz.yahoo.com/iw/080324/0375464.html>

**Three "oldest asteroids" identified**  
[www.space.com/scienceastronomy/080324-oldest-asteroids.html](http://www.space.com/scienceastronomy/080324-oldest-asteroids.html)

**Technical Challenge of Humans to Mars**  
<http://www.thespacereview.com/article/1082/1>

**2-Seater Rocket Planned for Solo Space Tourists**  
[http://news.yahoo.com/s/ap/20080326/ap\\_on\\_sc/space\\_tourism\\_7;\\_ylt=As3Le9bLac9EX8vhLjBkQIUE1vAI](http://news.yahoo.com/s/ap/20080326/ap_on_sc/space_tourism_7;_ylt=As3Le9bLac9EX8vhLjBkQIUE1vAI)

**"The Earth as an Oasis, cared for by a spacefaring civilization"**  
<http://www.earthandspace.org>

## 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/>

**new - Arthur C. Clarke on Space Elevators**

<http://link.brightcove.com/services/link/bcpid537086541/bclid537026504/bctid1463323902>

### ASSORTED SPACE VIDEOS

**HDTV Movie made by Japan's Kaguya Moon Orbiter**  
[news.bbc.co.uk/2/hi/science/nature/7291525.stm](http://news.bbc.co.uk/2/hi/science/nature/7291525.stm)

**Scan the Shuttle Cockpit (JSC Mockup) \*\*\*\*\***

<http://www.panoscan.com/CubicDemos/Shuttle.html>  
(your choice of resolution. +/- in and out; use cursor to pan side to side, over the top, around and around)

"To think of these stars that you see overhead at night, these vast worlds which we can never reach. I would annex the planets if I could; I often think of that. It makes me mad to see them so clear and yet so far."

**Cecil Rhodes,**

Politician, diamond magnate, empire-builder

## 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.

### How to participate in this program

- Send by postal mail only
- Your check of money order for \$10.00/per year
- With the complete name and address of the Library,
- Made out to

**"Lunar Reclamation Society"**

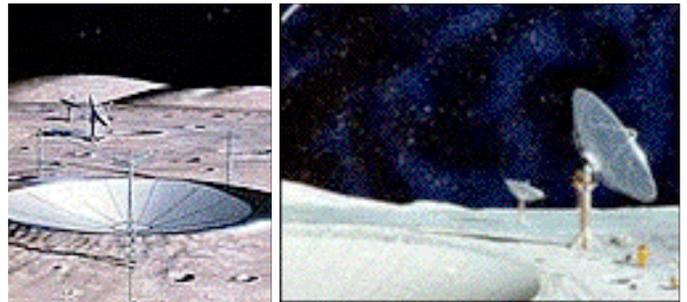
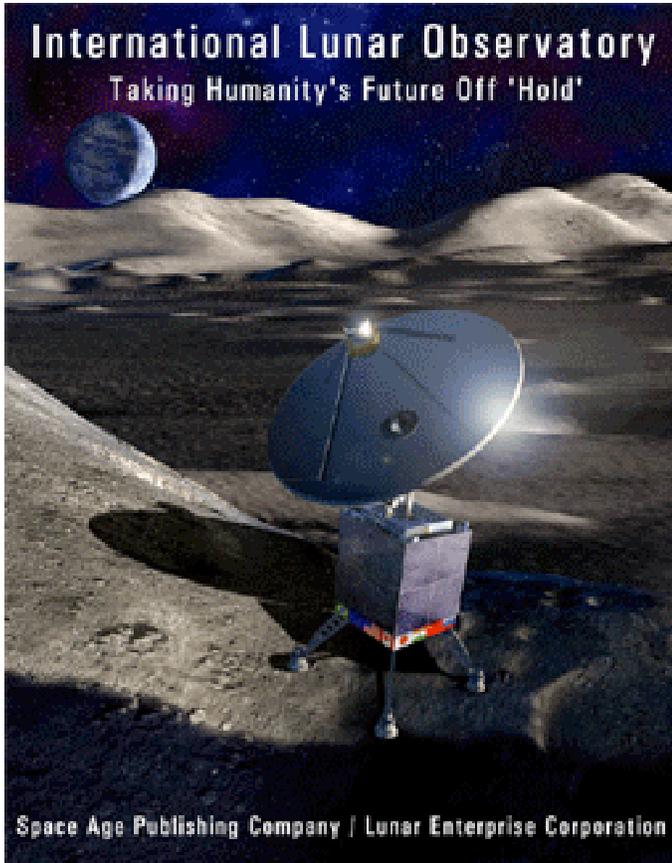
**Attn: Library Subscriptions**

**PO Box 2102**

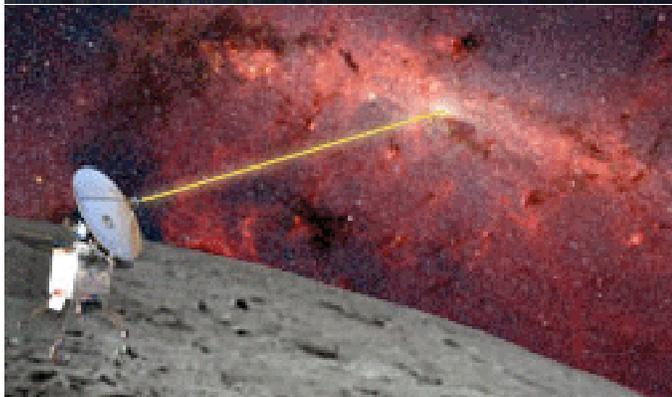
**Milwaukee, WI 53102**

**MMM PHOTO GALLERY**

*Observing Astronomy Day 2008*

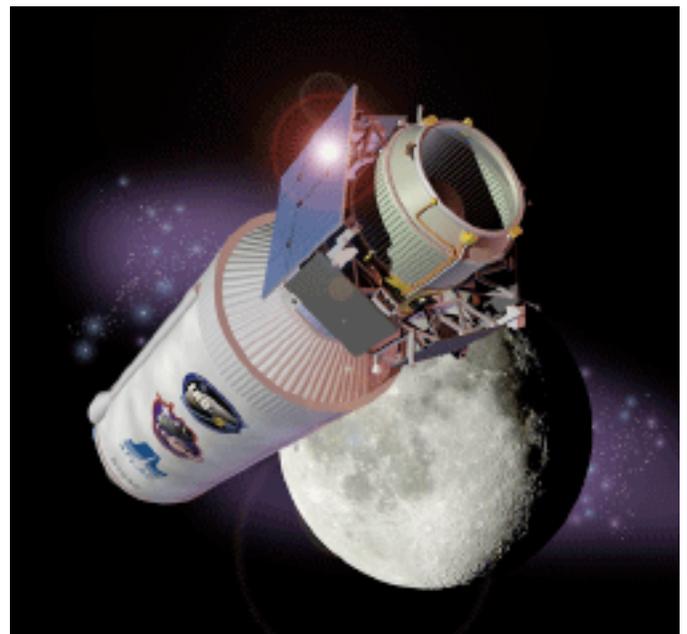
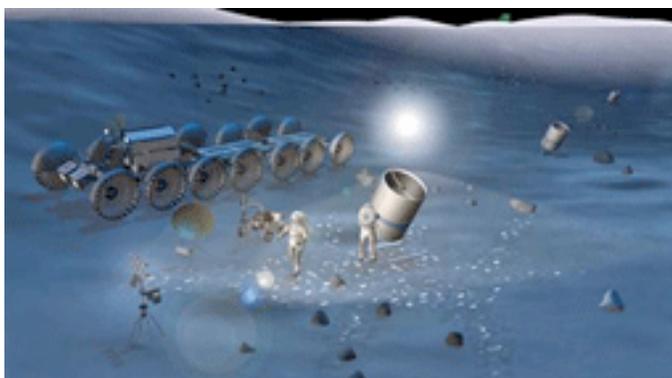


NASA's current new lunar rover design



Sketch of International Lunar Observatory studying the galactic core from its location at the lunar South Pole

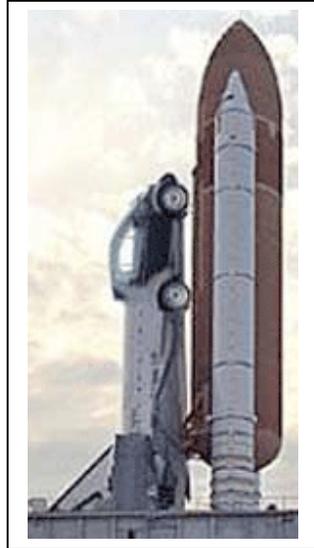
© International Lunar Observatory Assoc, Space Age Publishing



Artist Rendering of NASA's LCROSS lunar impactor which will hitchhike a ride to the Moon with the Lunar Reconnaissance Orbiter, and crash land in a deep south polar crater, in search of water ice vapor and/or other volatiles that may be part of polar ice deposits.

## Smart Car USA to Compete for Google Lunar X Prize

**Bloomfield Hills, MI** –Citing the value of the attendant publicity for a quantum leap in auto sales of the French-built Smart Car, a Smart Car USA spokesperson said that it has identified partners to assist in modifying a basic Smart Car to serve as an instrument-packed lunar rover. The lunar version will be equipped with a suspension system similar to the Apollo manned Moon Rovers of thirty-some years ago.



Smart Car was first introduced in Europe by the Mercedes-Benz company in partnership with the Swatch company.

The stripped interior of a Smart Car body will be packed with instrumentation, a solar and lithium –battery dual power system, and navigation equipment. The suspension system would provide 20” or half-meter clearance, and wire wheels reminiscent of those on the Apollo rover, but of an all new Mercedes-Benz design.

Drill samplers, grapplers, and other tools that will probe the moon dust and examine individual rocks, will protrude out of the front hood and rear trunk, which will remain closed for the ride up through Earth’s atmosphere. In the illustration above, the trans-lunar insertion and descent rocket is attached to the rear of Smart Car. After landing on the Moon, the descent module will lower itself to a horizontal position. The Smart Car lunar rover will detach itself and drive away. The illustration above does not show the wheel fairings, which will drop off once the vehicle has cleared the atmosphere. The first stage will be an off-the-shelf pair of solid rocket boosters that will be mounted to a fuel tank. The combo looks like the space shuttle assembly, but is much smaller in scale.

The “Smart Lunar Rover” should be ready to fly in the fall of 2009, well ahead of the timelines of any other Google Lunar X-Prize contender. And yes, Smart Car is working on a manned version to allow future astronauts to ride in a shaded, dust-free but unpressurized environment. Identifying the \$11,000–\$14,000 mini car with the coming age of renewed lunar exploration is expected to give the company recognition and a reputation for excellence that is “priceless.” ###

## A Monastery on the Moon?

**Hakodate, Hokkaido, Japan** –The Trappist Cistercian

Monks at Our Lady of the Lighthouse Monastery, built in 1891, are examining a rather “heavenly” possibility -- erecting a monastery on the Moon’s farside. Their “special” focus would be operating telescopes from a location where Earth is out-of-sight, out-of-mind. Monks can adopt any kind of work compatible with a life of prayer and renunciation.



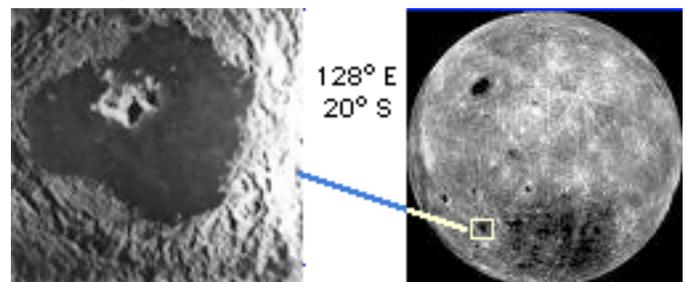
Besides earning some revenue from telescope operation, the monks would maintain an extensive mini-biosphere, and produce specialty foods and beverages for settlements elsewhere on the Moon. Agriculture sales are a mainstay of most Trappist monasteries here on Earth.

The telescopes would include optical instruments and an extensive array of radio telescopes. The Moon’s deep farside is the most “radio-quiet” place in the entire solar system, ideal for searching for “intelligent signals” as well as for probing other stellar phenomena near and far. These instruments would be owned by a consortium of universities (and possibly governments) on Earth.

Only monks who had successfully mastered a multiyear stint at the especially isolated facility now planned for one of the Antarctic Dry Valleys, would be considered for reassignment. Of course, realization of this project is currently far off, but for monks used to contemplating the eternal, as well as accustomed to isolation from society at large, this is not a problem. Their monastery on Hokkaido Island was built in 1891, with its sesquicentennial anniversary coming up in 2041. That’s the timeframe that they are aiming at.

Where on the lunar farside would they build it? “It will be many years before we have to make such a decision,” said their spokesman, “and the needs of the astronomers will have a major say in that decision. If it were left up to us, we’d like to be at or near the top of the central massif peak in the Crater Tsiolkovsky.”

Perhaps the most recognizable feature on the farside as viewed from high above the Moon, Tsiolkovsky is a large 115 mile, 185 km wide crater. The impact that formed it was strong enough to fracture the crust below, allowing basaltic lava to flood the crater floor, producing a dark smooth area extensive enough for a large telescope array. A very prominent central peak, unofficially named Mt. Konstantin (Tsiolkovsky’s given name) was created by the rebound of mantle material below.



A potential disadvantage, however, is that this area is in line of site of radio noise from future facilities at the L5 Lagrange area of “Space Colony” plan fame.

MM S 21ST HAPPY APRIL FOOL'S DAY NEWS

# “Tagging” Asteroid Apophis

Sept. 3, 2006 Planetary Society Announces Apophis Tagging Mission Design Competition

## Framing the Challenge:

“A mountain of rock and iron is hurtling towards us from space. Apophis -- a 300 meter diameter asteroid -- is still millions of kilometers distant. But in 2029, it will make a spectacularly close passage by our planet. When it does, its orbit around the Sun will be affected.

“A shift of just a few hundred kilometers, and Apophis could return in 2036 to slam into Earth, creating widespread devastation.

“Alarming news? Sure. But what's really disturbing about the possibility of Apophis slamming into our planet -- an impact that would unleash the energy of 65,500 Hiroshima-sized atomic bombs -- is the fact that no one, anywhere, knows how to track this asteroid accurately enough right now to properly assess its danger to Earth 30 years from now.

“Which is why we must confirm, one way or another, that there's really no chance of impact. Will Apophis pass through the “keyhole,” the small area on its 2029 path that would cause it to hit Earth on its next orbit in 2036? We have to find out, because if an impact is likely to occur, we are going to need all the time possible to plan and implement space missions to deflect it away from Earth.

“You'd think the world's space agencies would quickly seize the chance that Apophis offers to find a solution to one of the biggest threats our planet faces, but you'd be mistaken.

“So it's up to us, the Members of **The Planetary Society**, to make it happen, to inspire humankind to discover more about those potentially dangerous objects swarming around our solar system.”

## The Results, March 9, 2008

[http://planetary.org/programs/projects/near\\_earth\\_objects/apophis\\_competition/](http://planetary.org/programs/projects/near_earth_objects/apophis_competition/)

“How do you tag and track an asteroid that might be on a collision course with Earth? The winners of our Apophis Mission Design Competition” are announced!

“The Planetary Society has awarded \$50,000 to seven winners of the Apophis Mission Design Competition. First place went to the team led by SpaceWorks Engineering, Inc. of Atlanta, GA, teamed with SpaceDev, Inc., Poway, CA, for their mission entitled **Foresight**. The Georgia Institute of Technology, also in Atlanta, took first place in the student category, \$5,000.

“We hope the winning entries will catalyze the world's space agencies to move ahead with designs and missions to protect Earth from potentially dangerous asteroids and comets.”

## The winning designs

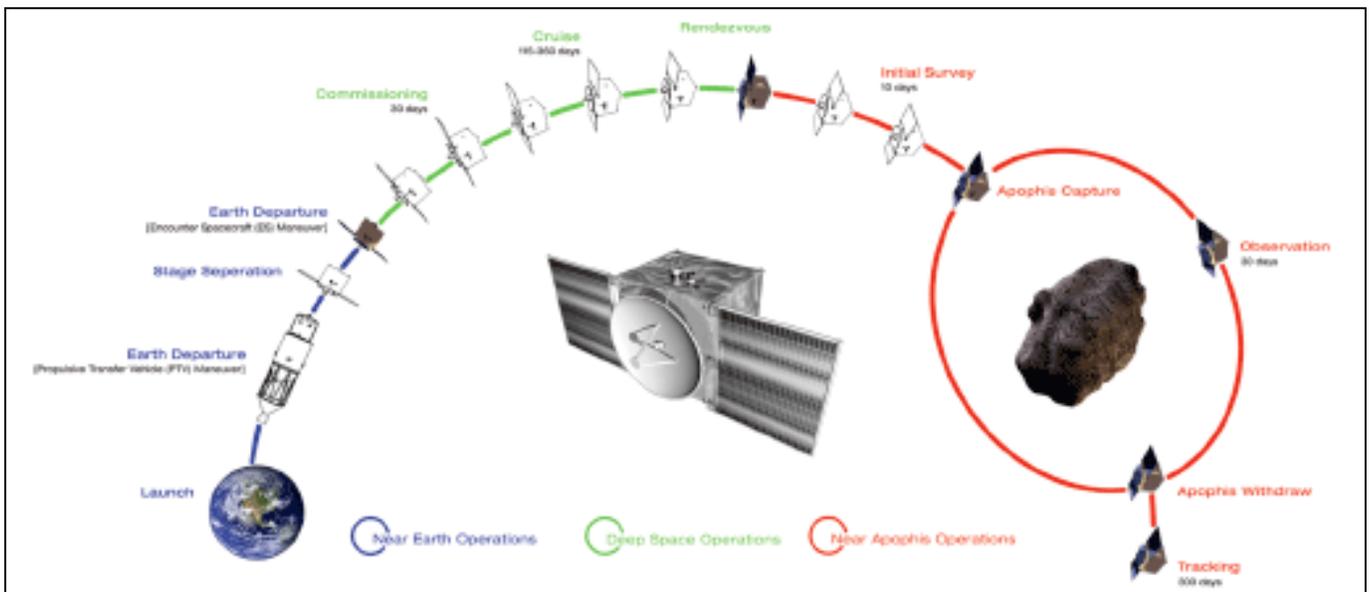
“The 1st, 2nd, and 3rd prize winners ... shared a similar approach to solving the tracking challenge: send an instrumented orbiter to rendezvous with the asteroid and analyze its surface and shape up close. Once the initial survey period is complete, the orbiter would position itself in a stable orbit, after which radio tracking of the spacecraft from Earth would provide the necessary precision of the measurements of Apophis' position. The proposers did not consider it sufficient just to track the asteroid, skipping any initial survey, because, they felt, Apophis' shape and surface properties produce important influences on its future orbit due to the Yarkovsky effect.

“However, the proposers differed markedly in how thorough a survey of the asteroid they planned to perform, which directly influenced the size, cost, and complexity of the proposed mission.

“The winning proposal, Foresight, is a low-cost, conventionally propelled orbiter with only two instruments and a single-band radio tracking system. The 2nd and 3rd prize winners proposed increasingly complex missions, with increasing costs.

## Winning proposal details: (diagram below)

- > cost: \$137.2 million
- > size 0.85x0.85x0.7 meters
- > dry launch mass 100.2 kg ~ 220 lbs
- > chemical propulsion
- > 1.2m<sup>2</sup> solar panel
- > camera, laser altimeter, x-band tracking system
- > launch date May 9, 2012
- > vehicle: Orbital Sciences Minotaur IV
- > rendezvous March 15, 2013



## 2nd Careers for Probes Now Common

by Tom Heidel

### Previous Missions with Follow-on Assignments

The 1994 DARPA mission *Clementine*, had been headed for a follow-on mission. If its lunar survey was successful, and it was, Clementine would be redirected outward, to the near-Earth asteroid *Geographos*. But after successfully completing the lunar mapping phase of the mission, an onboard malfunction crippled the craft.

Most lunar orbiters these days do get a final mission, to crash into the lunar surface at a point visible from Earth to see what of interest we can detect from the impact splashout cloud. Well, that's at least something!

But increasingly, NASA is realizing that giving any probe a "second career" makes sense. Of course, the probe has to be in functional shape, and remain fully powered. Essentially, we get a whole new mission for free. No need to design and build a new probe, no need for an expensive new launch. Just as many retired persons look for and find productive, rewarding new careers, so should mission planners. It is in their own interests as well as the in the interests of science.

It is now routine for orbiter and even rovers that remain functional after their original mission is completed to be given extended missions, as long as their is hope of significant, nontrivial new discoveries. One has only to look at the present Mars Exploration Rovers, *Spirit* and *Opportunity*. The latter has kept on trekking with one of its six wheels frozen. In fact, that handicap has proven to be an asset as surprising finds have been uncovered in the trench rut left behind!

### Deep Impact morphs to EPOXI

On July 4, 2005, *Deep Impact* released a heavy impactor to blast a hole in comet *Temple 1* at 23,000 mph in a search for clues to the comet's surface makeup. The results told us a lot. After this mission concluded, NASA gave JPL scientists the go-ahead to maintain contact with the probe and plan for a new opportunity.

Now renamed *EPOXI*, the Deep Impact "mother ship" will go through nine phases of alternating hibernation, cruise, and encounter periods. The first hibernation lasted 25 months. The craft was awakened on 9/25/07 to begin a series of three Earth flybys, originally intended to put it in position to fly past Comet *Boethin*. That comet now lost, the new target is the Comet *Hartley 2* with an encounter set for October 11, 2010, two and a half years from now.

On January 28th this year, its first new science assignment began, named *EPOCh* for Extrasolar Planet Observation and Characterization. The probes onboard instruments designed for Temple 2, are powerful enough to study nearby stars suspected of having planet systems.

The original mission cost \$333 million. The new mission will cost only \$32 million. This amply demonstrates how useful it is to design probes that can be nursed along after their original mission assignment is over, for entirely new second careers. We get two for the price of one and a fraction!

Finding money for space probe missions is a challenge. Using "used" spacecraft is, in comparison, a bargain, and this exercise in due thrift is bound to make an impression on the bean counters.

It only makes sense to build probes with enough power and capacity to continue beyond the original assignment, if only as a hedge that malfunctions and field-incidents will not compromise the original mission.

That said, probes that are still functioning have had their careers cut short because sufficient money to continue monitoring their feeds, and to analyze incoming data have been cut off. Everyone who has a part in such shortsighted decision making should have their names forever immortalized on some "shame" list as an example of "penny-wise, pound-foolish" stupidity of which we see so much at all levels of government.

### Requirements for New Mission Assignments

Not every probe, at the conclusion of its mission, can be given a new assignment as opposed to just an extension of its original mission. Obviously, the question of a second career for a lander, rover, or impactor is not realistic. That said, a rover once immobilized could still continue to study its final surroundings, for as long as its power systems, communications, and instruments remain in working order.

Rather, mission reassignments are more suitable for orbital probes of minimal gravity worlds, where climbing out of a negligible gravity dimple is relatively easy. Flyby probes do not even face that challenge.

But reassignment means retargeting. To do that, the probe has to be on a trajectory that, with very little course correction, could put it on a path that will bring it close to a major planet so that a gravitational slingshot maneuver can be used to drastically change its direction. In other words it would have to be on a path that would take it fairly close to one or more of the following: Mars, Earth, Venus, Mercury, the Moon or one of the gas giants or major moons thereof. Most minor moons and asteroids would not provide the gravity well depth to do the trick.

Using foresight, the last visit of a flyby probe could be tweaked to put it on such a trajectory, even in advance of any identification of possible future targets of opportunity. Actually, *Cassini* is being continually retargeted: its recent very close skim over the hot south pole of Enceladus.

### Data Mining from Concluded Missions

Another way to get more science from concluded missions is so-called "data mining." We have archived humongous amounts of data from the Venus *Magellan* mission, for example, that have never been analyzed for clues that might lead to new understanding. The data is there, and for the price of assigning students to study it, a process that could give them a Thesis Topic, we are getting less out of that mission than what we paid for. The same goes for many other concluded missions.

In short, if there is life and capacity to a probe or rover, it makes economic sense that new mission assignments should be considered. And for Missions that can not be extended or retargeted, it makes sense to open any unanalyzed data to students. For nano-pennies on the dollar, we stand to gain more significant knowledge as well as launch young people on promising careers in space science. And that is now a serious concern as Apollo period holdovers are retiring right and left to be replaced with no one, because we have not taken the care to identify and encourage replacements.

We can't count on bean counter foresight. That is something left to us space-focused taxpayers. <TH>



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

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

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

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 TREAS./ Database - \*Robert Bialecki  
 <bobrriverwest@yahoo.com>..... 414-372-9613

**LRS News**

- **Dave Dunlop to be interviewed on the Space Show:** Tuesday, Apr 1st, 9:30 pm CDT. [www.theSpaceshow.com](http://www.theSpaceshow.com). Dr. David Livingston will be asking Dave about issues relating to the Moon, a Moon race, and special projects he is undertaking on behalf of The Moon Society such as The University of Luna Project, and putting together the Moon Track at ISDC 2008.
- **Peter Kokh to be interviewed on the Space Show:** Thurs. April 24th, 11:30 am -1 pm CDT. Peter will be talking about the prospects for the Lunar Outpost initiative surviving in the next administration, and on the Moon Society's focus on Solar Power Satellites constructed with lunar materials. Peter will also be discussing the strategy of collaboration projects with other groups.
- **ISDC 2008:** In Washington DC this year, May 29-June 1, the weekend *after* the usual Memorial Day Weekend schedule. Peter Kokh and Dave Dunlop will be attending.
- **March 8th LRS meeting:** Bob Bialecki brought another great video for us to watch: "**Base Camp Moon**" - great!

**LRS Upcoming Events - April, May, June**

**Saturdays: April 12th, May 10th, June 14th, 1-4 pm**

**LRS Meeting, Mayfair Mall, Garden Suites Room G110**

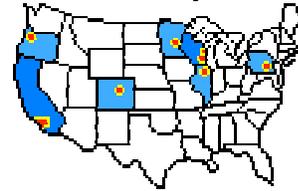
**AGENDA:** [www.lunar-reclamation.org/page4.htm](http://www.lunar-reclamation.org/page4.htm)

- April 12: Bob will show a DVD on the **Orion Capsule**



Interior of one of three pods of the "Undersea Lab" at the new Discovery World Aquarium on the lakefront.

**MMM 8 NSS Chapters Strong**



**NSS Chapter Events**

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

**MINNESOTA**



**Oregon L5 Society**

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

voice mail / (503) 655-6189 -- FAX (503)-251-9901

[ <http://www.OregonL5.org/> ]

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 Bryce Walden <[moonbase@comcast.net](mailto:moonbase@comcast.net)>  
 (LBRT - Oregon Moonbase) [moonbase@comcast.net](mailto:moonbase@comcast.net)  
 \* **Meetings 3rd Sat. each month at 2 p.m.**  
 Bourne Plaza, 1441 SE 122nd, Portland, downstairs  
**April 19 - May 17 - June 21**

**Chicago Space Frontier L5**

**610 West 47th Place, Chicago, IL 60609**

INFORMATION: Larry Ahearn: 773/373-0349

**Larry Ahearn and Geri Haracz** took in the MarsCon Science Fiction event in the Twin Cities, March 1-2 both manning exhibit tables in the Science Room.



L>R: Peter Kokh, Geri Haracz, Larry Ahearn  
 Geri's Spacesuit is a hit as always. Larry's table promoted National Space Society memberships

**CSFS L5 25th Anniversary event - Date TBA**  
**Venue to be announced.**

MINNESOTA



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

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

**MN SFS News & Pictures**

**Ben's Minicon Pix**

<http://freemars.org/mnfan/MiniCon/2008/index1.html>

**Minicon science room Pix**

<http://freemars.org/mnfan/MiniCon/2008/index-sci-rm.html>

WISCONSIN



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

c/o Will Foerster 920-894-2376 (h) <willf@tcei.com>  
SSS Sec. Harald Schenk <hschenk@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 Thursday of the month 7-9pm

**April 17th:** The Stoelting House, Kiel **Cancelled**  
**May 15th:** UW-Sheboygan, Sheboygan **Cancelled**  
**June 19th:** The Stoelting House, Kiel

PENNSYLVANIA



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

c/o Earl Bennett, [EarlBennett@erols.com](mailto:EarlBennett@erols.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: April 19, May 17, June 21**

COLORADO

**Denver Space Society**  
(formerly 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](mailto:eric@boethin.com)

**Monthly Meetings, every 2nd Monday, 7 PM**

**Englewood Public Library, Englewood, CO 80110**

1000 Englewood Parkway

First Floor of the Englewood Civic Center

**Meetings: Tues. April 1st, Mondays May 12, June 9**

CALIFORNIA



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

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

**Odyssey Ed:** Kat Tanaka - [odyssey\\_editor@yahoo.com](mailto:odyssey_editor@yahoo.com)

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

[oasis@oasis-nss.org](mailto:oasis@oasis-nss.org)

**Odyssey Newsletter Online**

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

**Regular Meeting 3 pm 3rd Sat. each month**

**Microcosm, 401 Coral Circle, El Segundo.**

**Next Meetings April 19 - May 17 - June 21**

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

**FRI April 25 8:30 pm - Lecture:** "Planets around other Stars." Dr. Brad Johnson, Bianchi Planetarium, 18111 Nordhoff Street, Northridge CA 91330

**SUN Apr 27, 4-10 pm - LA Astronomical Society Star Party:** Garvey Ranch Observatory, 781 S Orange Ave, Monterrey Park, 91755 - (212) 673-7355

**FRI May 9, (1) 8 pm - "Point of no return: Quasars and Supermassive Black Holes" - LA Valley College Planetarium, 5800 Fulton, Valley Glenn**

**(2) 8:30 pm - Search for Life in Universe (slides narrated by Leonard Nimoy) Bianchi Planetarium (see above)**

**FRI May 16, 8 pm - Mars Phoenix Lander Party, Room 223 Drescher Hall, Santa Monica College Planetarium**

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PHONE#S \_\_\_\_\_

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

Moon Society dues include *Moon Miners' Manifesto*  
Electronic 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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- p 16. Tagging Asteroid Apophis: Contest Winners
- p 17. Second Careers for Used Space Probes, T. Heidel
- p 18. LRS News; MMM NSS Chapters News

**Member Dues -- MMM Subscriptions:**

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

**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

## Moon Miners' MANIFESTO

Lunar Reclamation Society Inc.

PO Box 2102, Milwaukee WI 53201-2102

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Please renew promptly so as not to miss an issue