

Starting a Dialog

Between the Environmental & Space Communities

Peter Kokh – kokhmmm@aol.com 414-342-0705 December 23, 2007

PART I: CONSIDERATIONS IN DESIGNING A CONFERENCE

(After this section, Part II will address Pre-conference actions and activities and Part III, Conference structure and programming.)

Conference Design involves a Philosophy

What follows are my thoughts as both a passionate environmentalist and a passionate space enthusiast, about the issues that should be addressed, and constructive actions we should take beforehand that will telegraph our sincerity to the environmentalist community.

I see the proposed conference as an opportunity to identify Individual, community, *and global* approaches to continuing environmental degradation in the atmosphere of “a Conversation” between the Environmental and Space Communities, both dedicated to the survival of our homeworld as a green paradise supporting our continued existence.

These considerations suggest a conference that includes instructive seminars and roll-up-the-sleeves workshops as well as presentations and panel discussions.

It is essential that we take the stance that our space-involving proposals will “solve assist” in mitigating environmental problems. To believe that we have “the” (i.e., total) solution is both naive, arrogant, and more importantly, demonstrably incorrect.

Foreword – a mutual love of our home planet and a mutual concern for the survival of humanity

Space enthusiasts have zeroed in on three ways to promote that survival

- 1) Use space resources (The Moon) to contribute to Earth’s need for clean energy and to help slow and reverse environmental degradation through dirty energy generation methods
- 2) Protect Earth from a catastrophic asteroid impact
- 3) Plan the establishment of another viable exclave of humanity on another world (Mars) should we fail at one or both of the previous attempts.

Environmentalists are suspicious of (1) because of the way mining operators have wrecked local environments on Earth. *We should have a presentation that shows how mining and settlement activities on the Moon would be quite different, and respectful of the Moon’s natural beauty.*

In short, ***“our devotion to Mother Earth involves Father Sky.”***

Environmentalists stress changes in individual and community culture and near term programs that reduce or slow the growth of the problem

Space enthusiasts have stressed national or international programs which might contribute long-range solutions.

TOPIC AREA #1: BIOSPHERICS

We too have a way to address the culture of the individual and local communities. Every future space frontier pioneer will have to be the ultimate dedicated environmentalist. Within Earth's enormous planetary biosphere with its seemingly bottomless atmospheric and oceanic sinks, we can get away with a lot of bad behavior because consequences are slow to become a problem. In space frontier mini-biospheres, on the other hand, we will be living "*immediately downwind and downstream of ourselves*" and there our environmental sins will haunt us in very short order, not years later. Out of sheer necessity, *space settlement pioneers will quickly evolve sustainable lifestyles*. Charts and graphics about the very close water and air cycles will help. To the extent that we push Biosphere research, we will have the blessing of the environmentalist community.

The environmentalist community was keenly interested in the privately financed Biosphere II project. Our collective negative criticism of that project, our concentration on what was not achieved instead of what we learned, was not helpful. Nothing is a failure unless we fail to learn from it. We collectively failed to put the best face on the results, which seemed to broadcast that self-sustaining mini-biospheres are impossible (and by inference, that settlements in space or on the Moon or Mars are impossible.) In retrospect, a far-better choice would be to have come forward with suggestions for a second try, a third try, whatever it takes. We collectively showed that we did not have the right stuff. Environmentalists keep trying and trying until they get it right. If we are to deserve their respect, we have to do the same.

I suggest that much of our criticism was motivated by the same counterproductive "Not Invented Here" mentality of which we frequently accuse NASA.

Biospherics research legislative action item:

Congressional Budget restraints on NASA have forced the agency to abandon the goal of a permanently manned lunar outpost, substituting a permanent structure that would be intermittently occupied, not a situation that allows maintenance of a Biology-based Life Support System (BLSS) and so the agency summarily halted all further work and funds for its own BioPlex project in Houston, and for university programs such as NSCORT at Purdue. That there was not a whimper from the space activist community sends a signal that we are not really as interested in establishing settlement biospheres on the Moon or elsewhere as we pretend to be. *We need to fix that, and lobby for restoration of BLSS research funds, and funds for a permanently manned outpost.*

Then we can talk to our Environmentalist friends of what all we will learn about living in a sustainable fashion with nature from our mini-biospheres within which we will have little room for environmental mischief. In such situations we will learn lessons on how to do it right because it will be a short-term life-or-death matter. Yes, we could learn those lessons on Earth, but we won't, because a) the experimentation is expensive and b) because there is no immediate need. We say we love our children and grandchildren but our economically motivated deeds give the lie to that.

Another lesson we will get across in this way is that we do not intend to go to the Moon and Mars with house plants. We intend to set up biospheres, mini-"Gaiacules" if you will, in which to reencradle ourselves. Then we will be talking their language instead of talking over their heads.

Before we announce any conference, we should mount legislative activist campaigns, with a lot of public fanfare, to **restore NASA money for BLSS research, as well as funding for a permanently occupied outpost within 5 years of our first return.**

Power storage technology – a major motive behind NASA's selection of a polar site for its first outpost is the desire to reduce the need for power storage to a minimum. But it should be implicit in the mandate that NASA establish a permanent moonbase, that NASA "open" the Moon. It cannot do this without biting the energy storage bullet. Doing so would give us the key to the lunar globe, not just to two very constricted polar ghettos from which there will be no escape *until we do bite that bullet.*

Legislative Action item: NASA should be tasked with developing a full cycle (15 day capacity plus) lunar power storage system with backup (i.e. a first and second choice means, e.g., flywheels and fuel cells) and given the funds to do so. In general we should work to have the NASA outpost defined as a gateway, not as a dead end.

TOPIC AREA #2: GREENHOUSE GASES

1) Carbon Dioxide buildup – let's not argue about how much of the problem is geological and how much human. *We are contributing* to the problem and it is only our contribution that we can do anything about.

Not just fossil fuels but also fossil materials:

We need to stop right now thinking that fossil fuels for vehicles and power plants are the major part of the problem.

The use of fossil materials, such as limestone (calcium carbonate), are also factors. Indeed, production of the number one construction material worldwide, namely Portland cement-based concrete, emits more CO₂ than any other human source. In the process we take limestone Ca(CO₃) and roast it to CaO (lime) and CO₂. Yes, some of this CO₂ is reabsorbed as the concrete cures.

CO2 Retention: Destruction of CO2 sinks

Even if geological (e.g., volcanic) sources contribute more CO2 than fossil fuels and fossil materials, these latter sources are not the only way human activities aggravate the problem. The problem is not only a matter of CO2 production, but also of CO2 retention in the atmosphere. Destruction of CO2 sinks by deforestation and spreading desertification are significant factors in what is happening; Reforestation is a countermeasure, as are such community programs such as “green roofs” in Chicago’s and New York City’s high rise areas, and green driveways, where sod is protected from compaction and rutting by emplacement of an open grid-work sections made of high impact durable plastic. Reclamation of paved spaces by such means can help reestablish CO2 sinks, as well as reduce rainfall runoff problems. Every little bit helps. Every improvement means that much more that is not part of the problem.

NASA R&D could probably help with this effort, as well as orbital monitoring not just of deforestation and desertification, but also of reforestation and regreening efforts as well. We have to commit to **legislative activism to expand NASA’s budget to do so.**

Boasting about NASA’s monitoring activities is not helpful. Everyone knows about it. Boasting about it serves no purpose other than to reinforce the suspicion that this is the only good card in our hand. We need to identify other things and factors that NASA could monitor from space, and actively work to expand NASA’s budget to do so.

WHAT WE THE SPACE COMMUNITY BRINGS TO THE TABLE

It is in not in our favor to appear that we are strictly a spokesman for NASA. It is **in our interests to identify what NOAH can do, what DOE can do, and so on.**

NASA and NOAH: *Nor should we rest on NASA’s or NOAH’s laurels!* It behooves us to **identify what NASA and NOAH could do and are not doing**, and adopt **legislative action** programs to see that NASA and NOAH are fully funded to explore these options.

THE CONTRIBUTION OF ISRU R&D

I spoke of fossil materials being as big a part of the problem as fossil fuels. Here is where NASA R&D could help. This may seem a stretch, but I think not. Below are just two of many possibilities:

a) Glass-glass composites: Space Studies Institute (SSI) started research on glass-glass composites with a view to their use as a structural building material on the Moon. Research stopped with the testing of the first ice-cube sized sample with very promising results. If we could get either NASA or some enterprise to continue the research, the latter in the hopes of profitable near-

term terrestrial applications, we would not only end up with a ready to go manufacturing, building and construction material for the Moon, but possibly with a substitute for wood furniture (case goods) and other building materials, reducing one of the drivers behind deforestation. (Forests are also being cut for replacement by agricultural land). Many countries are low on forests, rich on sand and rock powder. Glass composites could help them develop both a domestic and export economy.

b) Magnesium-based cements. Congress could provide incentives for NASA and/or industry to develop magnesium-based cements (what we used for many centuries before the development of Portland cement out of limestone) to the point where Magnesium-cements becomes as serviceable as Calcium-cements for a growing number of construction needs. Meanwhile, we would have one more ISRU technology ready to use on the Moon and Mars. The lunar regolith is 8% Calcium and 6% Magnesium by composition, so both are viable options. Dr. T. D. Lin has already demonstrated the production of lunar concrete using lunar calcium. To be gained is a reduction in the production of greenhouse gases from fossil materials.

Again, if we actively took the lead in promoting these lines of research, we would gain considerable respectability from the environmental community, as well as setting ourselves up for the establishment of resource-using industrial settlements on the Moon, to help provide building materials for solar power satellites, among other things.

SPACE-BASED SOLAR POWER

I notice a tendency to equate SBSP with SPS. SBSP should include Criswell's Lunar Soar Array system. Should we be in the business of picking technology winners? Or should we work to enable either?

An especially tasked SPS Design Workshop

A Solar Power Satellite system alarms many in the environmentalist community, particularly astronomers (professional and amateur alike), who cringe at the thought of the celestial ecliptic becoming as studded as a biker's belt with SPS units each as bright as Venus. It would be to our advantage, and gain us respect, if our conference included the first of a series of design workshops and competitions to come up with SPS architectures which minimized reflection of sunlight (as opposed to microwave energy) back to Earth, without significant weight penalties. I suggest that such a workshop be part of our conference and that this topic be part of the Call for Papers.

Vested Interests: an obstacle not to be dismissed

Quite separate from power beaming issues which are certain to worry many, is the idea of generating power in space "to replace" fossil fuel use (oil, gas, coal, tar) for power generation. The vested interests are strong and have much more money to spend on lobbying than we do. They will see SBSP as a threat.

A World Wide Orbital Grid (WWOG)

I have a suggestion that has two principal advantages:

- 1) it will be in the interests of the fossil fuel industry to support it
- 2) it will serve as a platform for either SPS or Criswell's Lunar Solar Array system, allowing us to postpone a technology choice without postponing the final deployment of a complete system.

This suggestion is a World Wide Orbital Grid consisting of platforms in GEO that are composed of rectennas to receive excess power beamed up from the surface and transmitters to beam that power directly (or indirectly by relay through another WWOG unit) to other locations around the globe.

Such a system would prove and debug power beaming and remove it as an issue, separately from the issue of visual pollution in the ecliptic. It would take less mass to erect and could be erected in phases. While a WWOG would not increase the total amount of power generated per se, it would:

- a) Even out distribution,
- b) Lower the average price of peak power,
- c) Level the economic playing field between nations and continents,
- d) And thus buy us time.

However, it could increase clean power generation as well by creating a market for solar and wind power in under-populated desert areas for beaming to other areas of the world as needed. Saharan nations, for example, might enjoy an economic boom as latter day Saudi Arabias. Wind power could also be harnessed on a trial basis from rocky areas of the Antarctic coast.

In short, a WWOG opens many options, leads equally well to either an SPS or LSA system, negotiates opposition, and buys time.

I'd like to present this WWOG option, possibly with Madhu Thangavelu who independently came up with a similar proposal.

We should, of course, present the SPS option, the LSA option, and He3 options.

Either way we win and do not come off as involved in one particular option for reasons of self-interest. Rather we have shown ourselves to be sincerely looking for solutions.

But if instead we go in focused on a single program, we will appear to be close-minded, and even ignorant, in so much as we seem to believe that the problem is simple and therefore so is the solution, when neither is the case.

One thing I think we should avoid is a battle over numbers: “my solution solves 60% of the problem while yours, since it only addresses 15% of the problem is therefore worthless.” This should not be about finding numbers with which to squelch those approaching the problem from other directions.

On the one hand, we should graciously admit that space-based solutions will take time and that therefore individual, community, and other non-global approaches are invaluable in reducing interim growth of the problem.

On the other hand, the Environmental Community needs to be so gracious as to admit that while individual and community action is vital, that the problem is bigger than that, and that global approaches have their role to play. We can only expect that concession from them, if we make the prior concession in respect to their efforts.

The world’s future is the concern of both communities.

PART II PRECONFERENCE ACTIVITIES SUMMARY

LEGISLATIVE ACTIVISM:

- a) Restore NASA funding for BLSS (Biological Life Support System) research**
- b) Integrate BLSS in Lunar Architecture** by mandating NASA to advance to permanent outpost occupancy within 5 years of first manned return
- c) Mandate and fund NASA to develop a go-anywhere lunar power storage system**
- d) Funding for NASA to continue SSI glass-glass composites R&D** to advance it to a high state of readiness as a versatile lunar building material as well as for terrestrial applications.
- e) Funding for NASA to begin magnesium cement upgrade technologies R&D** for both terrestrial and lunar application.
- f) Identify orbital monitoring/mapping tasks for both NASA and NOAA** and work to increase NASA and NOAA funding accordingly in all areas relevant to the ever-changing state of the environment.
- g) Continue to push the NSSO report** and its recommendations for an in orbit demonstration project.
- h) Work in advance of the conference to expand SSAFE** [the Space Solar Alliance for Future Energy] to international partners.

THE LESSON FOR US: *addressing concerns of the Environmental Community will greatly advance our own goal of establishing Space Settlements.*

PART III: CONFERENCE STRUCTURE, FEATURES, THEMES

Call for Papers

I think that the Call for Papers is vital. It should include all the things we have identified above, plus any topics and investigation areas our environmental co-sponsor(s), if we can find one, will want to add.

✓ Underlined sections below signify the Space Community Contribution

Clean Energy Production with Reduced CO2 Emissions

- Ground-based solar
 - Photo-voltaic
 - Large-scale solar thermal
- Wind
- Geothermal
- Other

Making the most of Available Energy Supplies

- NASA R&D on energy storage for Peak Demand
- DOE/NASA development of a World Wide Energy Grid

Non-Fuel Problem Areas

- Fossil Materials – Limestone-based cement
- NASA/Industry Upgrading of Magnesium-cement technologies

Reestablishing CO2 sinks

- Slowing Deforestation & Desertification
 - Development of glass composite wood substitutes
 - Experimental Wind barriers
- Reforestation
- Regreening low traffic paved areas

Sustainable Lifestyle Research

- Renewed NASA BLSS/Biospheric Research
- Earth-based grass roots sustainable lifestyle research

Future Technologies using new abundant clean energy sources

- Reclamation of deserts with desalinated seawater
- Production of clean drinking water by the same means

Space-Based Energy Options from Earth's hinterland

- Solar Power Satellites
 - Workshop on SPS low albedo design options
 - Lunar Solar Arrays and Relay Satellites
 - Lunar Helium-3 for future 2nd generation Fusion plants

WORKSHOP IDEAS

- Low reflectivity Solar Power Satellite design

- Go-anywhere lunar power storage systems
- Business Plan for a Glass Glass Composites Industry
- Design of a World Wide Orbital Grid
- ????

INSTRUCTIVE SEMINARS by us

- The NSSO Report
- Solar Power Satellites
- Lunar Solar Array
- Moon Mining: how, what, environmental issues

INSTRUCTIVE SEMINARS by the Environmental Sponsors

- Various

THEMES & CATCH PHRASES

“Mother Earth & Father Sky”

“Living Downwind & Downstream of Ourselves”

“Acting Locally, Thinking Globally”

THE PAYOFF

- a) We begin a constructive dialog with a natural ally who has long been suspicious of our motives and concerns
- b) We promote space-based solar power to a powerful constituency who otherwise would not give it much thought
- c) By addressing concerns of the Environmental Community through additional NASA research and a strengthened NASA mandate, we will greatly advance our own goal of establishing Space Settlements.
- d) Preparing and conducting this conference will expand and structure our activist activities in advance and for some time to come.

Peter Kokh - kokhmmm@aol.com 414-342-0705 December 23, 2007