

Introduction to the motion to the National Space Society Board of Directors

December 15, 2006

According to repeated surveys, public perception of America's Space Goals places SSP construction clearly as America's top space priority¹:

2002	2005	What should be America's Goal in Space?
32%	35%	Build satellites in Earth orbit to collect solar energy to beam to utilities on Earth
23%	17%	Develop the technology to deflect asteroids or comets that might destroy the Earth
13%	10%	No Opinion
4%	10%	Send humans to Mars
2%	7%	Search for life on other planets
6%	7%	Build a human colony in space
3%	6%	Develop a passenger rocket to send tourists into space
5%	4%	Build a base on the moon for humans to use for moon exploration
11%	2%	None of the above, we should stop spending money on space

Space Solar Power must be a commercial or public/private company, as Comsat was. Several organizations, such as NASA and DOE are vying to assume control of the space solar power / wireless power transfer research venue to enlarge their empires. Neither organization would move space solar power an inch closer to commercial reality because neither organization would "win" by doing that. Rather, placing space solar power / wireless power transfer "research and development" under their control will delay the formation of a power satellite industry, delay the lowering in cost of orbital space transportation, delay the formation of innumerable other cis-lunar industries, including asteroid protection, and, finally, incidentally for NSS, delay space settlement in general. NASA doing anything in space costs ten times as much compared to commercial enterprise doing it. **IF** commercial enterprise can do it, then commercial

¹ Source: Matula, Thomas L and Karen A. Loveland. " Public Attitudes toward Different Space Goals: Building Public Support for the Vision for Space Exploration (VSE) " in the Proceedings of Space 2006: 10th International Conference on Engineering, Construction, & Operations in Space, Houston, TX, March 5-8, 2006

development is the way to go. (Some things, like the Apollo program, telescopes on the moon, or Mars development cannot be done commercially.) So Space solar power and many other goals await organizations chartered and committed to doing those things.

For example, if NASA could support 6 settlers on the moon for 2 billion dollars per year, commercial (public/private) enterprises could do it for one tenth of that cost. The 10 to 1 ratio applies across the board. Most importantly the development is ten times more easily sustained by reason of the lower cost. And actually probably a hundred times more likely to be sustained, since NASA has no significant history of income-generating activity.

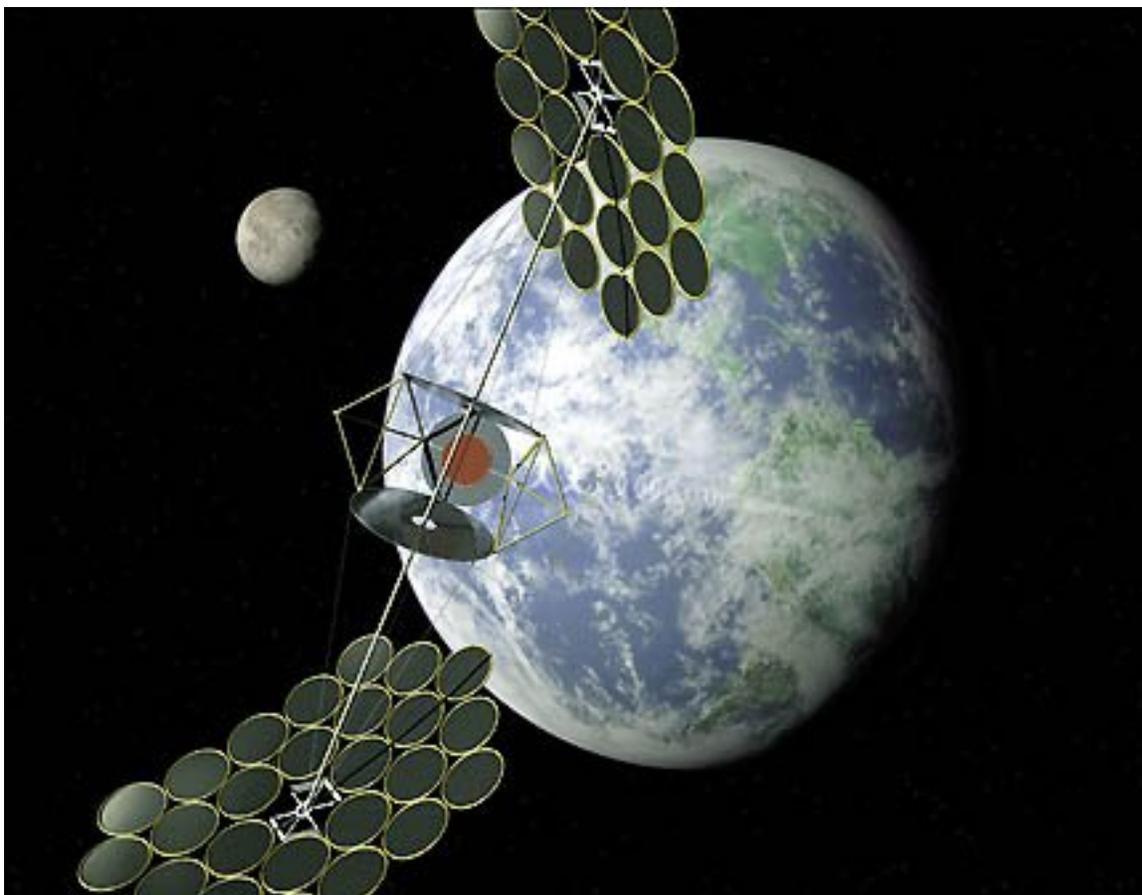
A renaissance in commercial cis-lunar space markets beckons. If and when SSP is built, greatly reduced launch costs will provide unprecedented access to space and space operations - from in-situ resource utilization and improved observation and communications to space settlement, and many products we can only dream of today - beginning with SSP – promising to provide reliable power delivery and global energy security with improved international prosperity at greatly reduced environmental impact. Therefore we present and commend the following motion to the Board of Directors:

Motion to recommend the chartering by Congress of a Space Solar Power Corporation.

The National Space Society recommends the enactment of legislation by the Congress to charter a Space Solar Power Corporation. This corporation would be directed to research, design, develop, build and operate a Space Solar Power System (SSPS). The corporation would receive special financial incentives designed to coordinate a lowering in commercial launch to orbit costs commensurate with, and as a direct result of a massively expanded market.

A draft copy of this legislation resides at

<http://www.sspi.gatech.edu/sunsat-how.pdf>



Recent satellite design, the Integrated Symmetrical Concentrator in Geosynchronous orbit. NASA Concept by artist Pat Rawlings http://64.40.104.21/sps/large/ISC_in_GEO.lrg.jpg

Background

Space Solar Power (SSP) is a simple idea, offering many benefits. Instead of collecting solar power on the ground, SSP would collect it in Geostationary Orbit (GSO is 35,000 km above the earth). Microwave generators feed a highly directive satellite-borne antenna, which beams the energy to rectifying antennas (rectennas) on the ground. There microwave energy is converted to feed terrestrial electric power grids owned by contracting local power companies, which control delivery via a coded phase locked loop. SSP is safer, cleaner, and more reliable than any other energy alternative. While ground solar can provide electric power for many, SSP has special advantages:

1. About 9.6 times as much power is collected over a 24 hour period by a given rated collector at GSO compared to ground, due to night, clouds, dust etc., with low attenuation of the microwave beam by the Earth's atmosphere.
2. twenty-four-hour energy availability, except briefly around midnight during the equinoxes; (about 98% availability, compared to only 90% for other baseload energy sources.)
3. very low carbon dioxide emission per unit of power generated, similar to hydroelectric dams;
4. many Terawatts of clean energy – enough to power the entire earth – for a billion years into the future.
5. zero fuel costs.
6. SSP would stimulate a popular renaissance in space development:

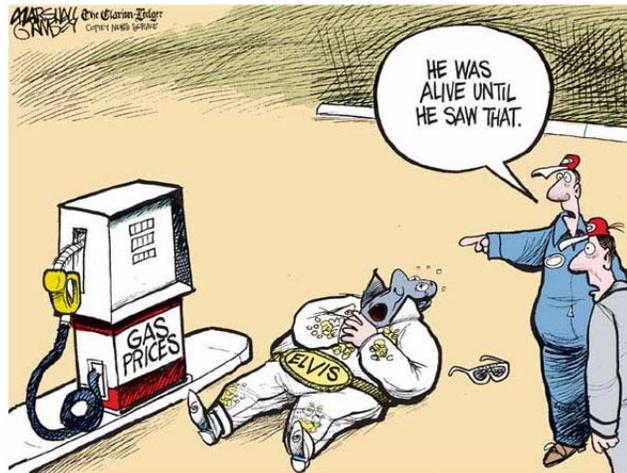
An SSP system could address many difficult problems which concern Americans. Depending on your particular experience, interests, wealth and knowledge of various technical debates, SSP should be understood to directly address many current energy-related, environmental, and socio-political problems, which are not being effectively addressed by current energy resources or alternatives. Briefly, we may compare SSP with other alternative energy technologies:

	Clean?	Safe?	Reliable?	Baseload?
Fossil Fuel	No	Yes	Decades remaining	Yes
Nuclear	No	Yes	Fuel very limited	Yes
Wind Power	Yes	Yes	No, intermittent	No
Ground Solar	Yes	Yes	No, intermittent	No
Hydro	Yes	Yes	No; drought; complex scheduling	

Bio-fuels	Yes	Yes	Very limited quantities possible. Competes directly with food production. ²	
SSP	Yes	Yes	Yes	Yes

The stated goal of the National Space Society (NSS) is to build settlements for people to live, work and play in space. If the NSS wishes to succeed in this unusual goal we must animate and effectively join that goal to national priorities.

1. Peaking Global Oil (~ liquid hydrocarbons) Production
2. National Energy Security
3. Oil Dependency
4. Rising Oil and Gas prices



5. Micro Global Climate Change - Food availability and nutrition.
6. Macro Global Climate Change (Weather) - from drought to “global dimming”
7. Lower launch costs to stimulate cis-lunar commercial markets and enterprises.
8. Reducing the threats, problems and dangers associated with nuclear proliferation, nuclear waste, and nuclear fuel supply.

Among many, perhaps the most immediate driver for SSP is Peak Oil. A few web sources for this discussion are:

[Energy Bulletin](http://www.odac-info.org/) - Extensive information on all types of energy

<http://www.odac-info.org/>

The Oil Depletion Analysis Centre (ODAC), for example has a new report called *National Security Consequences of U.S. Oil Dependency*, from the *Council on Foreign Relations*

http://www.odac-info.org/bulletin/bulletin.htm#CFR_oil_dep_rep

² E.g. Credit Suisse Group states, "We believe we are in the beginning stages of major changes to agricultural markets caused by rapidly expanding production of biofuels," from "Corn Is Booming as Ethanol Heats Up", by Scott Kilman, November 4, 2006 <http://online.wsj.com/article/SB116260858542413472.html>

Many cities such as Portland, Oregon have formed Peak Oil task forces to plan for declining oil and gas supplies and rising oil and gas prices. Many other cities are considering forming one. While we are not certain when global oil production will peak, remember that it will take ten to twenty years to prepare for dealing with a global peak in oil production. As the Hirsch report stated we are way behind the curve in getting ready for the shocking decline which follows peak oil.

Sincerely,
Darel Preble
National Space Society
Director, Region 5 Chapters
<http://www.nss.org/about/bod.html>

FAQ

Question 1 - Economics. How Much Money Will Be Needed, Over What Period Of Time, And From What Sources? To What Extent Will The Funds Come Out Of The NASA Budget That Otherwise Would Go Towards Creating A Permanent Outpost On The Moon Or Mars?

Answer 1: Please see the [draft Sunsat Corp. budget spreadsheet](#) showing a preliminary budget for the first seven years after Sunsat Corporation is chartered into existence. This draft business plan assumes that the project begins on that charter date. It includes a wide variety of typical assumptions which would be reviewed and adjusted during the charter and bidding process, not least of which are financial assumptions relating to power generation financing.

Financing a Space Solar Power System (SSPS) is like building a system of hydroelectric dams – such as the Bonneville Power Authority (BPA). There is immense patient capital required up front, and also the resulting electric power generated is very clean -while the financial payback is slow. We would expect very low cost power, eventually.

And much closer to baseload capacity factors than hydroelectric can typically provide in the US or other well developed countries. Hydro has many higher priority demands than power generation - from drought and flood control to salmon ladders and recreation.

We estimate that, globally, at Sunsat inception, about half of all then current RLV orbital flights would then be flown by US, and other Sunsat, partners. (In the US, in 2005, one commercial space flight took place. http://ast.faa.gov/rep_study/qlr.htm) However, SunSat flights would quickly dwarf other space transportation orbital customers, but perhaps other industries will grow faster. That would be even better.

About half of *those* flights would be ~commercial, and thereby, eligible for “subsidy” under and by US, and Sunsat partners, legislation. We currently recommend that those commercial orbital flights receive a 75% subsidy (in the form of SunSat stock purchase) down to, and until, the normal price to GSO is \$100/kg in dollars at par with Sunsat charter date. (Firms accepting that subsidy exchange it for shares in their corporation, which must be held for ~ ten years before sale.) They are not required to participate and may not be eligible, depending on rules Congress could adopt.

Another assist that could be obtained, to more swiftly lower the price of orbital space transportation, is the creation of a Lunar Development Authority enabling even greater participation in expanding the orbital space transportation market. Such an LDA would be similar to SunSat in having public and private elements. This is beyond the scope of your question, however. SunSat would have no direct financial interest in lunar development - or any business outside of providing clean solar energy from GSO to waiting electric utilities on earth. That is just a suggestion to people interested in lunar development.

As the [draft Sunsat Corp. budget](#) chart portrays, Sunsat will need large additional equity infusions in order to maintain the rapid power delivery growth we expect will be desired, due to the equity intensive nature of the power generation business. We anticipate no problems in obtaining that, considering the energy/environment picture we currently see.

The SunSat draft bill envisions no money coming from NASA's budget. NASA would not participate in SunSat Corp. The initial money would come from public and private investors buying shares in SunSat Corp, just as public and private investors bought shares in Comsat when it was chartered in 1962 (AT&T owned 29% of Comsat). The big money needed for construction of the SSP System would come from bonds being floated on the contracts signed by electric utilities wishing to buy and receive clean electric power from SunSat Corp. Financially, this is like building many huge hydroelectric dams, like Hoover Dam was built in 1930, or BPA, except these are built in GeoSynchronous Orbit (GSO), and financed by bondholders.

Question 2 - Is it a normal way of doing business for Congress to create a corporation? Isn't that private enterprise area? Has this been done before? If so, an example please.

Answer 2: Congress has created a wide variety of such public/private corporations. Several good historical examples are the transcontinental railroad act in 1862 and Comsat in 1962. Please read the chapter at <http://www.sspi.gatech.edu/sunsat-how.pdf> for a fuller and more interesting answer with references.

Question 3: To What Extent Will NSS Support Of Sunsat Hinder, On Account Of Financial Investment Or Use Of Limited Political Capital, Its Ability To Support A Permanent Outpost On The Moon Or Mars?

Answer 3: NSS cheering for NASA's return to the moon is not as productive a way to spend our time, energy and money as supporting Space Goals higher in America's priorities. (Please read the Introduction to the Motion, posted below, if your missed those surveys.) Interest in turning America's and other nation's vast investment in space into useful products, especially clean energy is intense now and rapidly becoming a worldwide battlefield – Check your newspapers. E.g. Wall Street Journal - “As Threats to Oil Supply Grow, A General Says U.S. Isn't Ready” <http://online.wsj.com/article/SB116649475127754123.html?mod=mostpop>
Or last week the massive and authoritative CFR study [National Security Consequences of U.S. Oil Dependency](#)

Finally, merely from the NSS stated goals perspective, there is no question that the swiftest, lowest cost and most productive lunar settlements would result from primarily commercial involvement. NASA has a dismal track record on these scores, just examine the space shuttle or space station finances and operation. This is the basis for the motion – turning toward commercial space development using historically proven paths. Our current aviation industry came about because of Congress chartering private mail routes, taking the US Post Office out of

the Air Mail business. This is detailed in the Space Transportation Chapter and many other places.

Question 4: What Is The State Of The Technology, Especially Compared To The Comsat Analogy? I.E., How Much Of The Necessary Technology Is Known, And How Much Needs To Be Created?

Answer 4: We are far better prepared to build SunSats today than we were in 1962 to build Comsats. Our space transportation understanding is 40+ years more advanced. Our telerobotics understanding is 40+ years more advanced. *Telesurgery* is commonplace. Our understanding of the electromagnetic interaction between the earth's magnetosphere, solar flares and an SSP's intense electromagnetic field is almost perfect. (We had almost zero knowledge of that interaction then.) Our space photovoltaics technology is ten times more efficient and a hundred times lighter in weight. Wireless Power Transfer (WPT) technology is once again unfunded in the US. Creating a real WPT laboratory and industry would be a core component of SunSat Corp, just as a satellite communications laboratory was/is a core component of Comsat Corp. WPT was demonstrated in 1975 by Bill Brown at JPL/Goldstone. For a readable paper on WPT see the [URSI White Paper on Solar Power Satellites](#) which is a bit later than the one on the SSPW website. We are not at a final version because of international disagreements on publishing this work area. Neither version on the web contains much important work done in recent decades, such as Draper et al's work on earth's magnetosphere, solar flares, etc.,

Question 5: What Are The Politics? If This Is Such A Good Idea, Why Has It Languished?

Answer 5: Real change is never easy. This is especially true when it includes so much of our nation. Most of the energy production, aerospace, agriculture, defense, and numerous industries that rely on low cost oil and gas must be rebuilt as a result of the coming global oil, gas and related environmental crunch. When will this happen. Too soon. If you examine the SSP budget projection it will take ten years minimum to have any effect on the many Terawatts scale of energy shortfall which is developing. As the DOE's commissioned "Hirsch report" said last year:

“Peak oil is not a theory; 33 out of 48 of the largest oil producing countries have hit peak. It will require more than a decade to transition our civilization away from our heavy dependence on oil. Nothing close to the efforts envisaged have yet begun³.

Changing our nation and our world's baseload energy generation sources to introduce SSP is a massive battle. The current oil, coal, and gas energy providers, nuclear as well, are not eager to see their baseload investments face competition from SSP, which has zero fuel costs and zero

³ - Testimony by Robert Hirsch, SAIC, at the Pentagon and U.S. Congressional Committee on Energy and Commerce hearing, from the "Hirsch Report", commissioned by the Department of Energy - <http://energycommerce.house.gov/108/hearings/12072005Hearing1733/hearing.htm> and "Peaking of World Oil Production: Impacts, Mitigation and Risk Management www.netl.doe.gov/otiic/World_Oil_Issues/Oil_Peaking_NETL.pdf

emissions and a billion years of steady supply projected. This is why SSP has been unfunded since it was invented in 1968. Carter pushed through the SSP reference study in 1979-1980, but space transportation costs were far too high, and they were forced to plan to use astronauts to bolt it together. This is too dangerous for astronauts outside the protection of the Van Allen Radiation Belts. (The Space Station is inside the Van Allen Belts) People are also too expensive to use for SSP construction. Telerobotics, the real way to assemble SSP, did not exist in 1979. Now it is used in [heart surgery every day worldwide](#) and for a thousand other uses. (The fossil fuel industry has battled environmentalists every inch during our struggle to understand climate change effects. That is their right. Perhaps half the studies are wrong. But half are right.) Most crucially, space transportation costs have stayed too high because there is no market large enough to support a Reusable Launch Vehicle fleet. SSP IS just such a massive market. Robert Zubrin mentions this battle and perspective in “Entering Space”, page 51. He quit space transportation and decided to work on Mars, which has no possibility of commercialization this century. This is detailed in the Space Transportation chapter on the SSPW website also. You can’t make an omelet without breaking a few eggs.

Selected Excerpts From The Sunsat draft (Url Cited Above), Questions Follow: P.7

(e) Low-cost commercial reusable space transportation systems

It is the intent of Congress by this chapter to provide further directed support to the establishment of this power satellite corporation such that low cost commercial reusable space transportation systems are made available in concert with the need for high volumes of freight which are essential to and characteristic of the advent of full scale construction of power satellite systems. **This support may take the form of launch subsidies, transportation systems developmental assistance, tax relief, insurance, and developmental bond relief, separately or in combination.**

Question 6: “May Take The Form”? Who Decides What Kind – The Corporation, Or Congress From Time To Time – And In What Amounts?

Answer 6: As the Excel spreadsheet shows, we have shown a simple stock investment would be the easiest and best path. Congress may choose other methods, and this will likely be negotiated as Sunsat Corp comes into existence. If you look at the real world history, various debt relief and special subsidies have benefited every sector of America. Comsat was quite profitable for its stockholders, compared to the transcontinental railroad which though given additional debt relief, went bankrupt. Whether we are as wise and faithful as those who have preceded us, only time will tell.

Question 7: To What Extent Would This Duplicate, Overlap Or Conflict With NASA Launchers?

Answer 7: NASA launchers will never be cost competitive. There is no overlap. Only commercially developed and operated reusable space vehicles will be in the cost class necessary. (This is the purpose of NASA’s COTS awards, but a handful of launches is not the answer. We need thousands to really lower costs.) There are none in the market today and it will probably take around 3-4 years to get where we need to be to fly those thousands of flights per year. But it

is imminently doable, as the space transportation community is well aware. Read the Space Transportation chapter at <http://www.sspi.gatech.edu/>

P. 7

(f) Demonstration Power Satellites

It is the intent of Congress by this chapter to direct and support the design, development, construction and operation of a demonstration power satellite as rapidly as possible. The overall management of this work will be assumed by the power satellite corporation to be formed by this Act. **This support may take the form of launch subsidies, transportation systems developmental assistance, tax relief, insurance, and developmental bond relief, separately or in combination.**

Question 8: “May Take The Form”? Who Decides What Kind – The Corporation, Or Congress From Time To Time – And In What Amounts?

Answer 8: Same question and answer as 6.

The principle purpose of this first power satellite is to improve the understanding and practice of engineering and technology essential to building efficient and reliable power satellites and related systems, including rectennas (receiving antennas). Ownership and operation of two such completed demonstration power satellites shall be with the power satellite corporation, although the rectenna shall be owned by the client electric power company receiving the power satellite feed. **The debt incurred by the power satellite corporation for the development, design, and construction of two demonstration power satellites shall be ten percentum of the total construction cost of the power satellites. This debenture shall be repaid to the Congress over thirty years at a rate of 3% interest. A developmental launch cost subsidy shall be provided for ten years in the amount of one half of that portion of launch costs including insurance which exceeds \$100./kg to GSO.**

Question 9: What Limits Are There To This Debt?

Answer 9: What limit to the cost of the Space Station is there? Apparently none. The value of the Space Solar Power System should eventually grow to become one of the largest corporations in existence. New financing for this corporation will probably pass off the Federal books onto private investment banks about seven years after inception, as the spreadsheet shows. More likely new competitors to Sunsat will overshadow Sunsat, just as Comsat was overshadowed by other space communications companies.

P.14

Sec. 734. Financing of corporation

(a) Capital stock; amount of issue; no par value shares; voting rights; dividends; price and public distribution of initial offering; shareholder eligibility

The corporation is authorized to issue and have outstanding, in such amounts as it shall determine, shares of capital stock, without par value, which shall carry voting rights and be eligible for dividends. The shares of such stock initially offered shall be sold in a manner to encourage the widest distribution to the American public.

Question 10: To What Extent Would The Corporation Be Funded By Private Equity And Loans Not Guaranteed By The Government, And To What Extent By Government Subsidy And Government-Guaranteed Loans?

Answer 10: Previously answered. The exact answer will not be known until the stock offering is sold by the winning brokerage firm.

P. 18

Sec. 751. Congressional declaration of policy and purpose

(a) Development and operation of rectennas and their associated electrical grid interconnection machinery, regulatory and environmental needs to serve power satellite downlink needs of the United States and member foreign countries

The Congress hereby declares that **it is the policy of the United States to provide for the participation of the United States in the International Solar Power spAce ReCtenna Owners Organization (hereinafter in this subchapter referred to as “SPARCO”)** in order to develop and operate power satellite rectennas. SPARCO shall promote power frequency allocations consistent with sound environmental regard for both the successful transmission of clean solar power and the environment through which this transmission takes place

Question 11: Is It In Fact Desirable That The U.S. Join Sparco? If So, Why Haven't We? What Are The Consequences And Costs Of Joining Or Not Joining?

Answer 11: SPARCO doesn't exist. It would be created by Congress at the same time as SunSat Corp. or shortly thereafter. SPARCO has much wider international participation, whereas participation in SunSat Corp would be restricted to friendly persons and financially substantial nations sharing intellectual property rights, trading privileges, etc.,.

P. 25

Since our Sunsat Corp. **SSP launch market is aiming for 42,000 flights per year**, nominally, prices would quickly fall below current levels once subsidies established such a market volume. *Many* other enterprises would be enabled. The lowest launch rate curve we seem to be discussing could be a fully reusable mag-lev rail launch, JPA's Ascender, or perhaps even a space elevator, which seems to be making steady progress also. But as you would surely agree, all this is moot unless launch rates move off single digits per year for at least one RLV provider, hence a subsidy for moving a lot of freight into orbit, which is a fundamental part of the proposed SunSat Corp legislation.

Question 12: 42,000 Flights Per Year??????????????

Answer 12: You must start thinking in real space transportation business terms. The Atlanta and Chicago airports *each* fly over a million takeoffs and landings per year. Many millions of flights take place worldwide. We will certainly approach such numbers in space as commercial orbital space transportation is actually encouraged to develop (such as chartering SunSat). Just as Comsat's charter has actually been responsible for virtually all of the current commercial space transportation business, Sunsat's charter will bring a renaissance in space transportation and cis-lunar industry, far surpassing what has been done to date -- unless we delay chartering Sunsat too long. My guess is the peak oil clock is the one we are racing against. For others, like [farmers in Australia facing the worst drought](#) in 3,000 years, the peak oil clock may not matter.

P.26

Bridging the gap in PV Production

Significant work must also be done to develop the SSP PV marketplace. SSP will also require massive quantities of PV thin-film fabric solar arrays, in addition to high volume cargo transport to GSO. This thin-film fabric must be very low cost. This declining PV cost, which we have been witnessing for many years with greater cumulative production is called a learning curve. Between 1968 and 1998, the worldwide cumulative installed capacity of PV modules doubled more than thirteen times, from 95 kW to 950 MW, while costs ($\$/W_p$) were reduced by an average of 20.2% for each doubling.¹⁰ This process is shown in the chart below. Notice the inflection predicted, and now being reflected in market prices, for lower cost thin film.

This Cumulative Production curve predicts \$.30 per Watt PV at 100 Gigawatts cumulative production. Cumulative global PV production will easily pass 10 GW during 2008. If that 10 GW were in space it would produce 100 Gigawatts. Yes, that can't be done for various reasons, but we could educate our government representatives that we need subsidies for commercial space PV production, not just for terrestrial PV production.

This is why we suggest separate legislation to provide an 85% subsidy to new private or public/ private businesses, such as SunSat Corp, which are contracting for space photovoltaic arrays and 30 % subsidy to established businesses contracting for space photovoltaic arrays. These funds would go to those businesses buying space photovoltaic arrays as tax credits, for example. (Another 85% subsidy would be provided to new private or public/ private businesses, such as SunSat Corp, to discount the price of space transportation.) Virtually all energy forms now being manufactured are being subsidized by the government, with the notable and glaring exception of SSP - the only clean baseload solution.

Question 13: What Is The Estimated Amount Of The Subsidies That Would Be Required Each Year?

Answer 13: PV is basically the same deal as space transportation. Low demand for space PV and space transportation is tightly linked to high prices. Expand the market -- lower the prices. See the Excel Spreadsheet.

P.27

If we fail to strongly invest soon in increasing space PV production – **moving terrestrial manufacturing production to space now**, while oil prices are “modest” – we will find it greatly more difficult as rising oil prices all too swiftly increase prices for feedstock, labor, processing, transportation and an endless list of other cost increases.

P.28

Some space analysts have concluded that if some preliminary lunar development were subsidized, as is planned by several nations including President Bush’s “Moon, Mars and Beyond” plan, photovoltaic cells could be provided to an SSPS development at lower cost than the earth could provide these. This may be important, as most of the weight of an SSP system would be photovoltaic “fabric”.

Considering that high purity silicon for PV manufacturing is becoming significantly more expensive and hard to obtain on earth and electric power in space seems to be declining in price, **making PV from lunar silicon may be a very desirable product for an LDA to sell under contract to a SunSat Corp.**

These cells, manufactured primarily from lunar regolith¹⁵ would be useful to moon development, as well. Rather than lift such large masses of components, such as photovoltaic cells, the primary component by weight of SSPs, from earth to GSO, it may be shown to be more profitable to collect raw materials from the lunar surface, and even from asteroids and comets in convenient orbits.

Question 14: Is the enterprise dependent upon lunar manufacturing of the necessary ssp materials? Is the success of SunSat dependent upon lunar resources? If so, then it would seem the very first step is to establish a significant permanent lunar presence. If so, then what is the relationship, programmatic and budgetary, between the vision for space exploration and SunSat?

Answer 14: There must be NO direct financial or material connection between SunSat Corp. and lunar development.

While the US, and other nations, are committed to spending many Billions on returning to the moon, the US is foolish to fail to use our best and strongest means – commercial development to lead lunar development. This is the shortest and most effective means to cis-lunar development and commercial benefit. ... Previously discussed above.

P. 29

A publicly chartered LDA would share and subsidize the cost of infrastructure needed by cis-lunar businesses to facilitate the rapid development of all. Separating this infrastructure development would reduce the risk attached to each and make a massive undertaking manageable. Candidate infrastructure areas might include:

- transport,
- water,
- oxygen (or air),
- shelter, ...
- numerous other services & commodities
- power supply,
- meteorite defense,
- photovoltaic cell production
- legal,

These infrastructure support contracts would support the nascent cis-lunar commercial manufacturing and other services. Under such special circumstances a separate lunar photovoltaic material manufacturer may very well be chartered to become a PV provider to a SunSat type corporation(s).

Question 15: “share and subsidize the cost”? who decides what kind – the corporation, or congress from time to time – and in what amounts?

Answer 15: No Comment. This dialog is limited to SunSat Corp. SunSat Corp has no direct interest in discussions regarding an LDA. I have seen no draft legislation for an LDA. Yet. First things first.