Re: Space travel not war

Source: http://sci.tech−archive.net/Archive/sci.space.policy/2008−03/msg00583.html

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- *From*: Willie.Mookie@xxxxxxxxx
- *Date*: Sun, 30 Mar 2008 15:39:28 −0700 (PDT)

On Mar 30, 2:43 pm, "Martha Adams" <mh...@xxxxxxxxxxx> wrote:

> I've been thinking since last year's ISDC that
> solar power satellites may after all, have a
> lot going for them. The environmental cost of
> electric power is becoming a major problem, and
> as population expands, people will ignore (for
> now) the practical necessity for limiting the
> population and they'll keep on wanting more
> power (and water, but that's another topic).
> So where can this power come from? This close
> in to Sol, there's your source. Like the
> space elevator, this is not a thing you can do
> small to test it out, it takes the all−out
> kzinti method: scream, and leap. So it seems
> to me, the topic seems to be only, what can
> you and I do to make this happen sooner?
>
> As for the wars, I believe those are pork wars.
> It's customary to imagine if there's a war then
> we must all rally etc etc; but things have
> changed around here and today these wars are
> just devices to funnel lots of pork money to a
> small number of well−placed military−industrial
> people. Hopefully these pork wars can go away
> soon: we cannot afford those even without we
> look at the future and make provisions against
> what it will bring. If you compare the several
> trillion dollars the recent pork wars are taking
> and going to take, vs the scream−and−leap kzinti
> approach to getting early solar power stations
> up there now, I'd guess even some Republicans
> could see which way the difference stands.
>
> So how about if you guys quit blattering at
> each other and come up with some *thinking* on
> how to make something like solar space
> satellites *happen*? ??

Titeotwawki −− mha [sci.space.policy 2008 Mar 30]

Microwave based systems with conventional solar panels are heavy and beams power only at low densities over large areas. Even at the low power densities microwave levels are far higher than occur naturally, and the response of biological systems to such high power microwave beams over long periods is an issue.

Solar pumped laser systems beam energy in the infra−red windows of the atmosphere that already receive large amounts of energy from the sun. Infrared energy may be beamed at intensities hundreds of times greater than microwave system. Infrared free electron lasers powered by concentrating photovoltaic systems sending band−gap matched energy are ideally suited for powering pre−existing terrestrial solar power systems.

My company builds low−cost concentrating photovoltaic systems

http://www.usoal.com

These systems cost 7 cents per peak watt and produce 180 MWp per square kilometer. Attached to a variable load electrolyzer, and placed in a locale with 1,600 hours of sunlight per year each square klometer efficiently produces 5,236 metric tons of hydrogen from 47,128 tons of water each year with 41,888.of oxygen.

20,944 tons of oxygen is combined with 15,708 tons of carbon in 18,480 tons of high rank coal to form 36,652 tons of carbon monoxide. This carbon monoxide is combined with with the 5,236 tons of hydrogen to make 41,888 tons of methanol. At $500 per ton this is $20,944,000 per year per square kilometer. The cost of water is $0.60 per ton in the US Western States using deep wells, and the cost of coal is $50 per ton from reserves in Wyoming and Montana. In short nearly $18 million per year profit can be made from each square kilometer of surface converted to my solar panels.

The heat of combustion forming the carbon monoxide may also be used to fire an electrical generatoin system.− generating about 12 gigajoules thermal per ton of coal burned in this way. So,585 grams per second is burned in this way per square kilometer.− that's 7 MW thermal per square kilometer − or − 2.67 MW per sq km conventional electrical. That's an additional 23,408 MWh of conventional electrical energy supplied 24/7 per sq km. At $77 per MWh that's an additional $1.8 million per year.

http://www.newmont.com/en/index.asp
http://www.anglogold.com/default.htm

Newmont Mining, and Anglo Ashanti Gold operate large surface mines near Elko and Carlin Trend Nevada totalling over 12,000 sq km. According to the 1976 surface reclamation act, they must reclaim their land and return it to productive use. In 2003 Brightfield Legislation was passed by Congress, which allows those who use land for renewable alternative energy to apply for reclamation of their land. This sets the stage for companies like mine to offer surface reclamation services for up to $4,000 per acre, or $16 million per sq km.

At 180 MW and $0.09 per peak watt − including all balance of system costs,my cost is $16.2 million per sq km. Thus, by taking on the responsibility of land reclamation, i am paid fully to install my system at a profit. Furthermore, gold mining uses electricity to electroplate precious metals onto plates which are then cleaned of the metals. So, these mining operations are also natural uses of the thermally produced electricity 24/7.

Methanol may be dehydrated to form di−methyl−ether (DME) a diesel fuel substitute. DME may be dehydrated for form Butane, a highly efficient fuel. Butane may be polymerized to form Octane, the principal component of premium gasoline.

Each square kilometer in this way, using the processes described above, may produce over 200,000 barrels of oil equivalent in liquid fuels immediately marketed to existing markets for fuels per square kilometer.

The land now leased by Anglo and Newmont in Nevada alone totalling 12,000 sq km, when developed in this way will produce 32 GW of continuous electrical power,from coal with ZERO emissions, along with 2.4 billion barrels per year of gasoline, methanol and other fuels.50% of ALL US imports − 35% of total US use.

The electricity sales to the region, principally Las Vegas, allows the elimination of carbon emissions in the region, even while coal use goes up. The liquid fuels are piped over the Union Pacific rights of way to Oklahoma where they are distributed throughout the United States.

This is all done WITHOUT solar power satellites.

Now, imagine a large disc 8.2 km in diameter − of 99.8% reflective only 7.5 microns thick, with 1 micron of aluminum bonded to another large disc of poly−ethylene−terpthalate (PET) the clear plastic base of mylar − only 7.5 microns thick. The clear film is bonded ultrasonically to the underlying mylar film in two concentric rings, one 8.2 km in diameter and one 8.0 km in diameter. The outer ring is inflated to 1/500th atm, whilst the inner disk is inflated to 1/1,500th atm.

The thicknesses are averages with the thickness varying slightly so that tension in the main disk form a parbolic form that forms a spot 80 meters across at 10,000x solar intensity. The system masses 1,460 tons included inflation gases, which can be used to vary focal length slightly. The system is also equipped with a attitude control system to place the mirror in a spin once on orbit so that it continually faces the sun as it orbits the Earth.

The 80 meter diameter spot possesses 68.76 giga−watt of solar energy. An 80 meter free flying panel with its own ACS intercepts this energy and converts it with 65% efficiency to DC electrical power. It does so with very little heating. The system is equipped with a 6 junction photocell, consisting of a germanium substrate, four gallium arsenide junctions each uniquely doped, and an indium phosphide junction. The enter system is faced with a dichroic mirror optical bandpass filter that efficiently separates out effective and ineffective light (see my patent on this subject for more details)

http://www.delphion.com/details?pn=US07081584__

The secondary satellite produces 44.7 GW of DC electrical power.

MEMS based high efficiency free electron lasers are built into each of the multi−junction wafers,that are 70% efficient. − producing over 31.2 GW of laser energy.

The free electron laser array produces light energy that is matched to efficiently drive the terrestrial solar panels previously described with nearly 100% efficiency. Only a few percent is lost in transmission through the atmosphere. The terrestrial system is silicon based and it has a bandgap energy that peaks at 1,108 nm. This is the operating frequency of the terrestrial system.

The infrared light passes through a phase conjugate mirror that direct the main laser energy conjugate to a reference beam reflected off the solar array on the ground. That is, an 1,108 nm laser light source illuminates the terrestrial panels in such a way so as to reflect the beam from the panels, toward the satellite. The satellite's phase conjugate mirror − using a process called 4−wave mixing − adjusts the phase of the primary laser beam to follow the pilot beam back to the terrestrial panels precisely.

http://en.wikipedia.org/wiki/Nonlinear_optics
http://cns−alumni.bu.edu/~slehar/PhaseConjugate/PhaseConjugate.html

Delivering 30 gigawatts of useful eneergy to any array of panels within sight of the satellite in GEO. The satellite masses a total 503 metric tons. The two systems together 1,963 metrict tons.

The system optics are arranged so that 500 MW of infrared energy arrive on each square kilometer of terrestrial solar collector. This is approximately 70% of what the sun produces in the infra−red region every day so it is not unusual. The energy is nearly 100% absorbed by the terrestrial collectors.

However, this beam provides power 24/7 − except in the brief times cloud haze and sand storms interrupt service. Operational times in Northern Nevada at the 12,000 sq km site previously described 8,700 hours per year − with 66 hours of downtime.

This is a total of 4,350,000 MWh per sq km − enough to inc
The 12,000 sq km produce 6,000 gigawatts of power. Thus, this single installation described earlier can support 200 satellites each 30 gigawatts net power to the ground.

This is 15.4 times larger than the previous figure − allowing an increase in output 16.4 times. − sufficient to supply the world's energy needs from US sources.

This satellite system is launched by a seven element chemical booster. Each element of this booster is very similar to the space shuttle external tank − except each element is 89 meters long, 13.3 meter in diameter, and equipped with fold away wings and an advanced thermal protection system on its nose, along with landing gear, a propellant cross−feed arrangement, and an annular aerospike engine at its base. The aerospike engine consists of a number of cryogen pump sets and injectors from the P&W RS 68 engine − and configured in this way operates at 430 seconds at sea level and 460 seconds in vacuum. Six pumpsets comprise each annular engine and produces 6,000,000 kgf at lift off.

http://en.wikipedia.org/wiki/Image:Annular−Aerospike.jpg
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While the space shuttle external tank masses only 26.6 metric tons and masses 762.1 metric tons full, the system described here masses 4,000 metric tons full and 240 tons empty − and cost $1.272 billion each.

Seven elements are joined together − when viewed from above they appear as follows;

(1)(2)
(3)(4)(5)
(6)(7)

This system carries 3,500 tons into LEO, and the central booster, number 4, has a kick stage carrying additional fuel in it. .

The 2,000 ton payload along with the kick stage is carried in element four in the intertank space between the oxygen tank and the hydrogen tank. The stretched element carries the inflatable concentrator along with the folded away solar collector array and laser system.

At launch all seven engines fire producing 42,000,000 kgf − lifting the 30,000,000 kg vehicle from the pad, element 1 and 6 feed element 3, element 2 and 7 feed element 5, elements 3 and 5 feed 4. In this way, elements 1,2,6,7 are drained while all engines fire. This is the first stage.

Downrange, the four drained elements separate, and 3 and 5 feed 4, draining them as stage two. The first four elements re−enter down range, slow to subsonic speed, and are then recovered by a tow plane which brings the system back to the launch center for reuse. Meanwhile the second stage, elements 3 and 5 accelerate the vehicle toward orbit, and separate, collected downrange at their re−entry point. Element 4 continues to its release point and ejects the kick stage and payload from the inter−tank space. The kick stage fires entering a Geosynchrounous Transfer Orbit. Element 4 re−enters near the launch point, and is collected as the other stages. The kick stage takes nearly a day to reach geosynchronous orbit. There, it fires again circularizing the orbit, and the satellite deploys at the desired location. The kick stage provides video of this event, and deorbits, recovered in a manner similar to the other elements − and is reused. Depending on the complexity, this may be a manned system, alternatively a teleoperated system may work as well.

At $11 billion per vehicle, and with 1,000 flight capability, along with a 3 day turn around, 100 flights per year are possible with this vehicle. − and a single vehicle may put up the entire collection of 200 in 2 years. An additoinal $4 billion for ground infrastructure, the $15 billion system, along with the $2.5 billion per year operating cost − has $20 billion to lanch the 200 satellites − $100 million each. The concentrator satellite has a cost of $410 million. The solar powered laser satellite has a cost of $2.7 billion. − a total of $3 billion per system, to produce 30 billion watts from an existing terrestrial solar unit. This is a cost of $0.10 per watt − but unlike a solar system that operates only 1,600 hours per year, this unit operates 8,700 hours per year − so, is 5x more valuable!!!

The deployment of one satellite and its successful operation, will allow large scale investment banking financing of all subsequent satellites. The $600 billion price tag for the 200 satellites is a bargain compared to the $4,000 billion per year in fuels. Since fuel demand is growing in China and India at 10% per annum rates, the system described here will need to be augmented well before completion.

In the end the USA could supply a mix of sunfuels, and hydrogen to the world at rates that reflect per capita energy usage world wide equal to that of the USA today. This would give the USA a great strategic advantage going forward, and strengthen out economy.

Beyond beaming laser energy to power terrestrial solar panels, as skill levels grow, beaming of high intensity lasers to laser powered rockets and jets, and directly to end users, world wide,would transition from a hydrogen economy, to a laser energy economy.

Ultimately, the 80 m diamter high intensity satellite, may be operated within 3 million kilometers of the sun, eliminating the need for a concentrator, with energy beamed interplanetary distances to reforming satellites that distribute the power to users as needed.

Bob Forward back in the 1980s worked out ways to beam laser energy interstellar distances to propel starships on interstellar voyages.
These techniques are easily adapted to provide power and propulsion in interplanetary space, and to terrestrial users on the ground.

http://en.wikipedia.org/wiki/Laser_propulsion

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