Re: Modest Proposal − Common Interplanetary Booster

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- *From*: Willie.Mookie@xxxxxxxxx
- *Date*: Thu, 4 Sep 2008 05:02:49 −0700 (PDT)

On Sep 4, 2:06 am, Pat Flannery <flan...@xxxxxxxxxx> wrote:

> Jeff Findley wrote:
>
>> You also have to look at the damage caused by moving slowly through the van−Allen radiation belts. The radiation in those belts has a nasty tendency to damage electronics, especially solar arrays.
>
> Yeah, I hadn't thought of the VA belts; that really would screw things up for a slow climb to escape velocity via ion propulsion.
> So much for Ernst Stuhlinger's ion−driven parasol Mars ships.
> Of course WvB had his space station orbiting at 1,000 miles altitude, so that wasn't a good idea either.
>
>> You really want to start your ion engine journey *above* the van−Allen belts. Say one of the earth−moon Lagrange points?
>
> That would probably be as good a point as any to start from. Just make sure you don't collide with the Moon as you spiral out.
>
> Pat

There's also the cycle time.

Operating commercially to GEO there is a cost penalty in tarrying too long at any one stage of the journey.

While 2 days versus 70 days may not seem like such a big deal with low launch rates, especially in the present anti−space environment, that changes in a commercial operation.

You don't make money waiting.

Putting up a powersat a week or heaven forfend, a powersat a day, which is what's needed to supply the power needs of a growing planet, means that one or two of the chemical boosters will be needed while 10 to 70 ion boosters are needed for the same mass flow rate to GEO..

Now, the savings achieved sending up twice the payload to GEO per ground launch which is what ion gives you, pales in comparison to the costs of maintaining 10 to 70 of them in transit to maintain your mass flow rate to GEO.

As costs drop, demand increases. Withi increasing demand, there is an increasing mass flow rate from Earth to GEO in this case. A similar analysis is done for luna and mars and NEAs and Ceres etc. Each system has an order of battle dictated by the astrogation requirements, the technical requirements, and the business requirements.

At present we have intelligence and communications assets at GEO and MEOI and LEO. I am contemplating global network assets, energy assets as well as material resource assets, and a human presence at MEO, GEO and beyond. This changes things.

As I said previously, at some point increasing specific impulse makes sense. With a successful powersat constellation on orbit it makes sense to use available spare laser capacity to implement a variety of laser propulsion technologies. These include;

1) laser thermal 1,000 sec isp 44.5 MW/tonne
2) laser detonation 2,000 sec isp 89.0 MW/tonne
3) laser electric ion 5,000 sec isp 222.5 MW/tonne
4) laser light sail (infinity isp) 1.47 GW/kgf

We have increasing power levels for a given thrust at higher specific impulses. This is analogous to a gear in a transmission. So, a gigawatt at 1,000 sec Isp produces about 50,000 lbf engine. That same gigawatt at 2,000 sec Isp produces only 25,000 lbf but better gas mileage. At 5,000 sec Isp, we have 10,000 lbf engine and with a laser light sail the same GW produces 680 grams of force.

With the energy source removed from the rocket, and power delivered by laser beam, we have the ability to increase thrust to weight − which shortens boost times and mission times − which maintains flight rate and cost efficiency − providing balance of system costs are kept under control.

The launcher therefore benetis most from laser thermal, the upper stage, laser detonatoin, and kick stage laser−electric while interplanetary and interstellar stages use laser light sail.

This only makes sense economically when the cost of laser photons from solar pumped space lasers drop below a certain price.− throughout their entire cycle of use.

This along with the other considerations determine the 'order of battle' in introducing the technology. Also open issues in each system described determine R&D efforts and maturity of the technology determines the level of R&D effort.

To get an idea of cost − consider that a barrel of crude oil contains 6.1 GJ of energy. It costs these days in excess of $122 − that's $20 per GJ. A 300hp engine costs about $2,350 − that's $10,000 per MW. At these prices we have built the automotive age − though during its peak costs were more in the $1 per GJ range.

For laser detonation engines to operate at the same cost as automobiles requires that each tonne of thrust cost less than $890,000 and each second of illumination cost less than $1.78

At these prices we can begin to consider the use of laser detonation in our rockets, both on the ground and in deep space.

Now a short range ballistic flier is possible with this system. To travel further requires more energy than is typically used in automotive travel. So to get reasonable costs, for daily driver rockets prices have to drop. Which is another way of saying that prices have to drop for demand to increase. This is an unremarkable statement. However, what should the prices be? The answer is around 1% the cost of what we pay for energy and power in automobiles. That is a tonne of thrust with a laser detonation engine has to cost around $8,900 and each second of illumination by a space laser to drive it has got to cost about $0.02 At these prices, we can begin to realistically consider personal ballistic transport off world, and to any point on world. The age of the daily driver rocket will have arrived.

The way to achieve these prices is to invest in technologies that lower the cost of generation and increase power to weight. I have engaged in a 12 year program to cut the costs in terrestrial solar power

http://www.usoal.com

and I have developed a business model to implement this technology for profit

http://www.ohiochamber.com/governmental/pdfs/William%20Mook_021308.pdf

my intent is to continue my research into creating low cost laser powersats and low cost launchers to support them.

Terrestrial solar at 7 cents per peak wtt produces energy at 1/3 to 1/5 cent per kWh − , that's $0.92 to $0.56 per GJ − which is cheap enough to electrolyze water into hydrogen and oxygen, and use those chemicals in a variety of ways to make synthetic fuels of exceptionally high quality − and do so at a profit! And restore the price points for energy that prevailed in the 1950s and 60s − restoring our economic vigor.

I am not content to rest there. Lower costs are possible! The same terrestrial arrays that will resolve our energy problems today, will be the basis upon which we will grow into the future! Adding a power satellite on orbit, the same area as the terrestrial array allows the terrestrial array to produce 16x more energy in a year. Do this with only twice the cost, and the cost of power drops to 1/8th the figures above − doing in the 2010s what we should have done in the 1970s − made power too cheap to meter!! Of course the costs of meters have dropped since the 1950s, and the uses we'll put this energy to is unimagined in the 1950s yet, at $0.12 to $0.07 per GJ − we are at a price point that makes personal ballistic transport a reality. Also, resolving the cost issues associated with the powersat in the first place, helps solve some key issues to make laser detonation − especially when done in MEMs arrays − I like to call propulsive skin − gets the price for an engine to where it needs to be as well.

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