

Re: sci space policy targeted by disinformation experts?

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- *From:* Willie.Mookie@xxxxxxxxx
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A lot of speculation – I recall reading really interesting stuff, that just falls off the radar screen so to speak for no damned good reason. Usually when something doesn't work for a sound technical reason, you can find some arcane journal article explaining why. When you cannot find that, there is a possibility – if the ideas are sound otherwise, they've been taken black.

One way to check that out is to track the researchers. Are they teaching and not doing a damned thing, or are they busy and have moved from where they were to points West and stopped publishing?

That's another inferential point to anyone who cares.

Energy is a problem with high speed flight. Aurora nominally burning hydrogen in air in an external combustion scramjet – and a 10% structural fraction – producing thrust by intercepting the shock waves. You eject the fuel into the stream at the stream velocity – right at the shock wave at the nose – so it's stationary in the flow. By the time it reaches the thrust structure at the rear of the aircraft, it's mixed with an oxidizer – you stabilize that with an expansion shock, and detonate it with a laser or spark or particle beam – and the shockwave and thrust surface are shaped to interact to produce thrust.

Mach 6 and drag coefficient gives you an estimate of power. The X-15 had a drag coefficient at hypersonic speeds of $C_d = 0.095$

Drag force is equal to

$$F = 1/2 \rho V^2 * C_d * A$$

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

area looks to be in the 30 sq m range

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

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

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Mach 6 is around 1,800 m/sec, and $\rho=0.01 \text{ kg/m}^3$

So,

$$\begin{aligned} F &= 1/2 * 0.01 * (3.24e+6) * 0.095 * 30 \\ &= 46,170 \text{ newtons} \\ &= 4,701 \text{ kgf} \\ &= 10,343 \text{ lbf} \end{aligned}$$

at around 50 km altitude

Force times distance is energy.

Force times speed is power

So, 46,170 newtons x 1,800 m/sec = 88.106 megawatts

Hydrogen when burned in air releases 143 megajoules per kg. Assuming 1/4 of this energy is usefully applied to the propulsion system, and 3/4 of the energy is wasted in various ways – means 35.75 megajoules of propulsive energy is available per kg of hydrogen. This gives us a burn rate of 2.46 kg/sec to maintain that thrust. With a 50% cycle efficiency – fuel use is cut in half 1.23 kg/sec

This is the likely fuel consumption of hydrogen for the aircraft at this speed – from first principles.

Going back to our models of Aurora – it likely has a 600 cubic meter fuel volume. and hydrogen has a density of 70 kg per cubic meter which obtains 42,000 kg fuel mass. Enough to power the aircraft for 4 hours and 45 minutes at Mach 6 cruise – at the lower efficiency, and 9 hours 30 minutes at the higher efficiency. Enough to fly 3/4 of the circumference of the Earth at cruise at the lower efficiency, and 1.5x around the world at the higher efficiency.

One can imagine a number of interesting missions for such an aircraft if it exists.

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