Re: sci space policy targeted by disinformation experts?

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* *From*: Willie.Mookie@xxxxxxxxx
* *Date*: Fri, 28 Mar 2008 08:45:24 −0700 (PDT)

On Mar 27, 7:59 am, Ian Parker <ianpark...@xxxxxxxxx> wrote:

> On 27 Mar, 02:52, Willie.Moo...@xxxxxxxxx wrote:
>
>> 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?
>>
>> Thats 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 its stationary in the flow. By the time it reaches the thrust structure at the rear of the aircraft, its mixed with an oxidizer − you stablize 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 Cd = 0.095

Drag force is equal to

F = 1/2 rho V^2 * Cd * 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

Mach 6 is around 1,800 m/sec, and rho=0.01 kg/m3

So,

F = 1/2 * 0.01 * (3.24e+6) * 0.095 * 30
  = 46,170 newtons
  = 4,701 kgf
  = 10,343 lbf

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 thelower 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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We can only argue plausably in this. 0.095 is in fact quite good for supersonic speed. It should be recalled that a typical subsonic aircraft has an L/D of about 20. Flying wing configurations improve this as the drag from the fusilage is eliminated.

It will be recalled that Concorde was about 7:1 and with most of its take off weight fuel just about limped to Washington from Heathrow. We don't know whether Aurora was 10.5:1 or some worse figure. Discussing an L/D ratio for hypersonics is a little bit misleading as airflow is so integrated with engine performance.

− Ian Parker− Hide quoted text −

− Show quoted text −

The figure for the X−15 is accurate, and that was at hypersonic speed. Cd(min) for subsonic speed was for the X−15 was 0.0645.

I figured the Aurora if it exists would do at least as well since it built on this base.

Blended body design probably helps too, as does an integrated propulsor. That is, no fans or inlet ducts, just energizing the boundary layer with high speed fuel injection and detonating the air/fuel mix at an appropriate spot, but according the helmhold equation, aspect ratio helps even more.

Here are the Cd(min) which all occur at subsonic speeds, for the various re−entry bodies tested in the USA;

M2−F1 M=0.15 Cd(min)=0.0618
M2−F2 M=0.45 Cd(min)=0.0645
HL−10 M=0.60 Cd(min)=0.0496
X−24A M=0.50 Cd(min)=0.0400
X−24B M=0.50 Cd(min)=0.0252
X−15 M=0.65 Cd(min)=0.0645
Shuttle M=0.50 Cd(min)=0.0604

Of course, having re−configurable wings, also helps in subsonic speeds. The X−24B is an amazing aircraft.

http://www.nasa.gov/centers/dryden/history/pastprojects/Lifting/X24/index.html

I thought it would be used for a 'siamese twin' two−stage launcher. That could have been done at far less cost than the Space Shuttle.

Take two x−24B airframes and mate them belly to belly. The same airframe size. One use a high density fuel, like kerosene, with LOX, the other use a low density higher performing fuel, like hydrogen, with LOX. You get an almost perfect two stage to orbit RLV.

The Skunk Works took over the X24 after they proposed an X24−C with scramjets and a top speed of Mach 8

http://en.wikipedia.org/wiki/Martin−Marietta_X−24

Crew: one pilot
Length: 37 ft 6 in (11.43 m)
Wingspan: 19 ft 0 in (5.79 m)
Height: 9 ft 7 in (2.92 m)

Wing area: 330 ft² (30.7 m²)
Empty weight: 8,500 lb (3,855 kg)
Loaded weight: 11,800 lb (5,350 kg)
Max takeoff weight: 13,800 lb (6,260 kg)
Powerplant: 1× Reaction Motors Upgraded XLR−11 four−chamber rocket engine, 8,480 lbf (37.7 KN)

Maximum speed: 1,164 mph (1,873 km/h)
Range: 45 miles (72 km)
Service ceiling 74,130 ft (22.59 km)
Wing loading: 205 kg/m² ()
Thrust/weight: 0.71

Even though the top speed is quoted here as 1,164 mph, the X−23 lifting bodies were based on the Air Force X−23 manuverable re−entry vehicle program.

http://en.wikipedia.org/wiki/X−23_PRIME

this also had applications in MIRV vehicles, since warheads could manuver across large distances, increasing throw−weight of launchers to targets, and increasing weapon flexibility.

The thrust to weight is a function of the rocket engine used.

Space travel applications was the 'siamese twin' program, which I read about in the day, but can find absolutely no mention of even in the literature. Which is amazing.

I mentioned if I were to build an Aurora type plane, I would have used a booster rocket to get it to speed, and switch on my scram jet.
Well, if I were asked to build one, I'd turn to the X−24B (and C) and use one in rocket mode, to lift the pair belly to belly in a vertical take off, and then release the second stage at Mach 8 and turn on the boundary layer scramjet.

That may be what the Air−Force/National Security Agency did, and may be why the few reports of the Siamese Twin launcher disappeared from the radar screen.

But, who knows?

Even though the structural fraction of the one man test vehicle was 0.616, a larger version built with the best available technology of the day would likely get down to 0.125, and using the best available technology today, would likely get down to 0.062. Rocket engines have thrust to weight of 80:1 and MEMs based rockets as well as boundary layer scramjets, are likely to have thrust to weight of 800:1 or more for very sound technical reasons.

So, here's an interesting Siamese Twin system based on the X−24B

Stage 1
Crew: one pilot
Length 175 ft (53.0 m)
Wingspan 88.2 ft (26.8 m)
Height 44.5 ft (13.6 m)
Wing area: 7,109 ft² (661.4 m²)
Empty weight: 850,000 lb (385,500 kg)
Loaded weight: 11,800,000 lb (5,350,000 kg)
Powerplant: 14× Rocketdyne F1 rocket engine, 1,500,000 lbf (6.7 MN)
or 12x Glushko RD−171 rocket engine, 1,776,665 lbf
(7.55 MN)
or 12x Rocketdyne F1A rocket engine, 1,792,260 lbf
(8.00 MN)

The F1 has 265 sec Isp at lift off and 310 sec Isp at altitude.
The RD−171 has 309 sec Isp at lift off and 337 sec Isp at altitude
The F1A has 270 sec Isp at lift off and 310 sec Isp at altitude.

Stage Propellant Volume is 155,722 cubic ft. (4,411 cubic m) in each stage, based on the ellipsoidal shape of the major airframe volume.

Volume of an ellipsoid = pi/6 * (major diam x minor diam x height)

So, put in numbers based on the span, height and length compute the volume and divide by two − for a first order approximation − I used 100 ft x 75 ft x 80 ft as the fuel volume within the airframe − and divided by two so the 80 ft became 40 ft. .

LOX Kerosene has an optimum oxidizer fuel ratio of 2.56 to 1.00 The density of LOX is 1.14g/cc and Kerosene is 0.806 g/cc − this gives an average propellant density of 1.02g/cc. That's 1.02 metric tons per cubic meter − which gives the weight.

So this is a consistent system.

Oxygen hydrogen has an optimum oxidizer fuel ratio of 6.00 to 1.00 and hydrogen has a density of 0.07g/cc so the mix has a density of 0.28 g/cc. So, the same 4,411 cubic meters has 1,235,080 kg or 2,717,176 lbs added to a lower 650,000 lbs of vehicle weight, along with any payload. The weight is lowered due to the lower masses of fuel to handle − principally anti−slosh baffles.

I like the German Saenger ATCRE with
Thrust(vac):1,280.000 kN (287,750 lbf).
Thrust(sl): 1,068.400 kN (240,186 lbf).
Isp: 490 sec.
Isp (sea level): 409 sec.

You'd need 10 to 12 of these,

alternatively you could use the 10 SSME,
or 2 RS−XXX

Isp is lower in all these other engines.

The engines nozzles I imagine would be blended spaced along a spanning rib with exhaust blended into the tail section, using the airframe as a partial aerospike for the SET of engines. Varying mass flow rate through the engines vary thrust vector for the SET− and the blended body is equipped with fins as in the vectored thrust jet engines− so, no mechanical gimballing is required of the engines.

So, the vehicle lifts off vertically on the Lox Kerosene engines. It accelerates to 3.4 km/sec − with air drag and gravity losses actual speed is likely 2.0 km/sec. It then separates, and the hydrogen oxygen system is throttled up and carries 40,000 kg − 88,000 lbs to LEO.

Both stages are fully reused. The orbiter portion lands in a method very similar to that of the space shuttle, but it has far less cross− range. The booster portion re−enters down range and is picked up by a tow plane − and the pair is flown back to the launch center and reused straight away after minor refurb..

http://www.dfrc.nasa.gov/Gallery/Photo/M2−F1/HTML/ECN−408.html

Not only would the development costs have been far lower than the Shuttle − the J2 is also a respectable second stage engine for this − operational costs would be far lower as well. We didn't need the SSME, nor did we need heat sheild tiles to make this thing work. We had adequate thermal systems for this body shape to withstand re− entry, and then glide with a very respectable Cd(min) of 0.0265 !!

Better than the shuttle.

The X−24C disappeared into the Skunk Works, and with the Siamese Twin.

The operational costs would have been astoundingly low as well. The standing army of technicians would not be needed to tend each shuttle. More money spent on launch center infrastructure, upgrades, propellant handling, and so forth, would pay huge dividends.

An airframe twice the linear size of this one would have 8 times the payload to orbit − and both would have been built for less cost than the Shuttle program − which did a lot of good research − but needless research if all you wanted was to get to orbit cheaply.

Aerospace costs today are about $5.3 million per metric ton of structure − if you don't have a lot of R&D to support − and this one didn't.

AT 385.5 metric tons per airframe, each airframe would have a cost of about $2 billion − $4 billion for the pair. A fleet of three would cost $12 billion. Another $2 billion for infrastructure upgrades at the Cape, and total system costs are $14 billion estimate.

With 2,000 flights per vehicle, and 3 day turn arounds, a fleet of 3 would provide daily launches for 16 years and put 14,610 metric tons into orbit every year. The cost of the payloads would be $77.4 billion at this $5.3 million per ton rate.

Which explains why we don't mind creating costly dangerous launchers. It saves the nation money in the long run.

I mean what would happen if we had daily launches of an X24B based TSTO−RLV and an $80 billion a year space budget to keep it supplied with payloads?

We'd do AMAZING things in space. We'd complete the ISS in no time. We'd build stations on the Moon, assemble a fleet to fly to Mars, experiment with power satellites, in short − we'd set the stage to spend EVEN MORE MONEY IN SPACE.

Worse yet, we'd attract ad−venture capital to space investment. The trillions of dollars circulating in the markets would flow into space. We'd have space hotels, super−teledesics, and things we cannot even imagine today.

Meanwhile, with tens of thousands of people flying in space each year, of every sort, there will likely be a handful that will have deep spiritual insights that transform the way everyone on Earth views things. Powerful political movements will be formed, likely not respecting tradition, and totally unpredictable in outcome.

To someone who sees no benefit in any of this, merely a way to expend surplus wealth in entertainment − they would view this as a latter day 'bread and circuses' development, that will lead ultimately to the downfall of the USA, as it finds it is spending too much on butter and not enough on guns.

Public enthusiam isn't limited to the USA. Following the moon landings we got feedback from ALL nations − WE DID IT! − it wasn't YOU DID IT! − it was WE DID IT! Us, humanity, all nations shared. This not only undermines the sanctity of the nation−state by creating global ideas and ideals, which would ultimately involve the US losing its lead role, but strategically, it inspires other nations to ALSO invest in rocket technology that creates problems with our missile proliferation goals. That is the world is still to dangerous to allow universal space access − and especially the technology widely available that allows universal space access.

So its far better in the civilan program to build ferraris around costly technical improvements, rather than chevys around proven systems, while underfunding launch center infrastructure that would reduce operational costs and improve safety. Interesting equipment might even be studied for military application and taken black off loading some of the military budget into the civilian program. Eventually some might hope for the end of a powerful civilian program, as people are separated into two groups, those who view manned rockets the way we now view dirigibles, and enthusiasts who are marginalized along with UFO hunters and science fiction enthusiasts.

This analysis, while saving the nation hundreds of billions of dollars in space operations costs and securing it against widespread use of rocket technology, costs the nation even more in new business opportunities, and maintaining a powerful leading role in the world.

That's what the narrow analysis misses.

There used to be a phrase, you are either part of the problem or part of the solution. You've got to lead, follow or get out of the way.

The USA has taken a passive agressive stance against other nations in this regard, ignoring the clear development path to our future. So, they will over time, be pushed out of the way as others without our help involvement or the control that can provide us, develop space launch capabilities anyway.

This is what Kennedy meant when he said that development of space will go forward with or without our involvement − and it is up to this nation to participate in this development, and where it can, lead the way, and by doing this, maintain our leading role in human history.

Others didn't see it that way. They thought its was the ravings of a rich kid who never had to balance a budget and didn't know he was opening a 21st century bread and circuses that would threaten our leadership.

Rather than debate the situation they shot messenger and figured that would settle the situation since those of the opposite opinion had a very low opinion of the 'enthusiasms' of the American people − .

All it did was delay the eventual decline of our nation, and destroy much of our ability to provide true leadership that would give us geopolitical influence and power far greater than any military force we can muster today.
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