

Re: How Rockets Differ From Jets

Source: <http://sci.tech--archive.net/Archive/sci.space.shuttle/2005-11/msg00053.html>

- *From:* "tomcat" <jlavine@xxxxxxxxxxxxxx>
 - *Date:* 3 Nov 2005 14:28:35 -0800
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Brad Guth wrote:

- > >you really need the cryogenic fuel for cooling purposes.
- > >You have to rid the hull of heat build up.
- > Good freaking grief and almighty Christ on another stick. LH2/LO2 are
- > not the one and only cold substances, whereas extremely good insulative
- > R-Factors that are capably structural do actually exist that are
- > extremely thermal tolerant to boot. What is your problem? Do you own
- > stock in slush LH2/LO2?

A hot day is about 100 deg. F. An oven roasting a turkey is about 450 deg. F. Molten steel is about 2500 deg. F.

The hull of a SSTP spaceplane has to be capable of 20,000 deg. F. It is a whole new ballgame! You need everything you can get, including copious amounts of LH2.

- > Slush H2O2 and even slush C12H26 is plenty cold, especially considering
- > the massive tonnage requirements, but I'm thinking such forms of slush
- > are not nearly as cold and as thermal energy transfer efficient as good
- > old LRn, that which I believe can beat your slush LH2/LO2 per kg and
- > then some because, at least LRn can be manufactured via nuclear energy
- > on the fly. Primarily using H2O2/C12H26 doesn't exclude your
- > all-or-nothing spaceplane from hauling a sufficient supply of slush
- > LH2/LO2 or even LRn for hull cooling. Why is it that folks like
- > yourself assume upon only the absolute least effective usage and worse
- > possible outcome of whatever's not your idea, and or continually focus
- > upon such a narrow all-or-nothing mindset. Doesn't the words
- > 'composite' or 'matrix' actually mean anything?

I am not opposed to other sources of extreme cold fuel/refrigerant such as H2O2. But I like the proven capability of the SSME. It works. It is manufactured by Rocketdyne. It weighs about 7500 pounds. It is good for 50 burns. And, it never failed on any of the Shuttle Missions. And, I believe, it may be capable of burning 'atomic' hydrogen as well --- without modification.. I wish NASA would do a test and see. Maybe they have and aren't telling. I like 5X!

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- >>Space flight isn't for everyone.
- > How true. In your case it's only for benefiting the uppermost 0.1% of
- > humanity, and even at that perhaps as few as 0.1% of those folks will
- > actually afford the ticket to ride within your tomcat-spaceplane that's
- > going to cost these folks roughly \$250,000/km of accommodating their
- > body and whatever personal luggage mass, thus even a role of toilet
- > paper is going to get spendy although apparently roasted to death along
- > with everything else by the 500+deg.F. interior that you're planning
- > upon creating if there's ever insufficient slush LH2/LO2 to go around.
- > Therefore, you're talking about accommodating all of 0.0001% of
- > humanity (6,750 possible clients as crew and passengers) which should
- > be sufficient if each of those as passengers and/or as equivalent
- > payload forks out 100 million bucks. Of course bringing back a load of
- > He3 from the moon should certainly make this all worth while.

I estimate the (Cost) of a 100 ton load of HE3 to be 12 billion U.S. dollars, give or take 5 billion or so. Remember, you have to do an initial flight to put the mining equipment and miners up there. Then add yet more equipment and supplies for the miners with the second mission, before you can take any HE3 back to Earth.

The expected (Gross Profit) of the venture will be 400 billion U.S. dollars. This makes a worse possible case of reward (Net Profit) to be 383 billion U.S. dollars. It will be a little more if everything is clockwork.

- >>Tomcat's spaceplane will be able to land 'itself' on the Moon using
- >>VTOL thrusters. For the Moon SSME's are out because the Moon's gravity
- >>is just 1/6th that of Earth. 4 much smaller engines will be selected.
- > 1/6th gravity and nearly zilch worth of aerobreaking still isn't all
- > that insignificant for a multi-hundred tonne spaceplane. Trust me
- > again, you'll be needing the likes of nearly one SSME as your primary
- > VTOL source of thrust energy, especially if you're planning upon
- > lifting off with a GVW of better than 1200t, which isn't exactly
- > accommodating of all that much reserve capacity of slush LH2/LO2. If
- > the dry/inert mass of this spaceplane is 200t, plus a 100t payload
- > leaves just 900t of slush LH2/LO2, thus $1200/6 = 200t$ (440,925 lbs)
- > worth of initial thrust requirement and you're nearly at the maximum
- > capability of what one SSME can manage at 104% consuming 487 kg/s from
- > 900t worth of slush LH2/LO2 isn't going to last very long if you're
- > also going to require post reentry retro-thrust and hull cooling on the
- > home stretch.

I like your idea of thrust vectoring one of 4 SSME bottom VTOL thrusters for the Moon. It saves having to reconfigure between missions.

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The Moon, by the way, will require an 8 billion dollar SSTP (Single Stage To the Planets), not an SSTO (Single Stage To Orbit). That is where the extra fuel will be. That is why an SSTP will cost 3 billion more than an SSTO.

The use of Thiokol SRB's for RATO (Rocket Assisted Take Off) units on the SSTP's bottom is a real possibility. You would gain 6.6 million pounds of thrust at a cost of 2 million pounds of weight. The SRB's weight, moreover, will decrease to next to nothing as the fuel is used up, giving you a clean 6.6 million pounds of additional thrust just prior to jettison.

I would like to stay away from in orbit refueling. Not only would the SSTP be dancing with Murphy's Law, but transferring cryogenic fuels in orbit is bound to be difficult at best. The SRBs are a much better choice for the extra thrust.

> A little something other that's bothersome; it seems that slush LH2/LO2
> is not going to remain as slush or even all that liquid for all that
> long. Even if R-1024/m insulated represents a rate of thermal transfer
> that's ongoing until the very last drop of slush is gone. I'm thinking
> your slush LH2/LO2 is nearly worse off than then LRn having a half-life
> of less than 4 days no matters what. Thus in either case it's a use-it
> or lose-it situation, whereas H2O2/C12H26 is good for next to forever,
> as well as in need of hardly any insulation at that, thus volumetric
> efficiency is way better off than any slush LH2/LO2.

The shadow of the Earth, the remoteness of Mars, and the silent blackness of deep space, all have the incredible ability to freeze LH2 into . . . 'atomic' hydrogen. And, 'atomic' hydrogen is very stable at the freeze temperature. And, I have reason to believe that the lowly time proven SSME can burn it . . . as is! This will turn the SSME into SUPER ROCKET. Thrust so powerful you have to work at breathing. Thrust that just keeps on thrusting and the fuel gauge doesn't seem to move. Thrust that can shoot you at 100,000+ mph to the . . . planets!

I sure wish NASA would test this out. "NASA", all you have to do is put a SSME on your test stand, put 'atomic' hydrogen fuel in the test tank . . . and start the blasted engine! Why do you people take forever to do the obvious? And, don't gripe to me about cost because fooling around for year after year will cost far more than an exploded SSME.

>>Ceramic will work. Corelle can take 20,000 deg. F.. And, silica tile
>>can reflect enormous heat and then cool almost instantly.
> The problem is that none of this nifty stuff is all that structural, as
> in worthy of becoming the outer structural and thus do-everything
> spaceplane hull that's supposed to prevent "maroonment" along with

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- > avoiding passenger roasting at 500+°F. I have few doubts that
- > protecting the structural CNT/basalt outer hull is doable, although you
- > still haven't identified nor thereby specified upon that multi-thousand
- > degree tolerant composite binder that'll take such a thermal licking
- > and keep on ticking nearly as well as we've known of what metallic
- > alloys can muster.

There are different kinds of insulation. Ceramics 'reflect' heat. Silica tiles are incredibly good at doing this. Remember, that the Shuttle's 1000 deg. F. meltpoint aluminum is protected from 7000 deg. F. by a single layer of silica tiles.

- >>Landing on the Moon is easier than landing on the Earth. Look for a
- >>nice flat spot. Do a retrofire. Go into VTOL mode and sit it down.
- > Other than the rather obviously advantage of 1/6th gravity, that's way
- > too easily said than accomplished without using up a great deal of your
- > slush LH2/LO2. Then what? Is this where the catchy phrase "in case of
- > maroonment" get's applied?

A little 'maroonment' never hurt anybody. It is the big 'maroonments' that are bad. This is where your ion thrusters come in as a handy auxiliary source of power. It is also the reason a SSTP will have 11 or more SSMEs on it hind end. If only 1 or 2 of them work, then return to Earth should be possible though, perhaps, a little slow.

- > BTW, if you find a sufficient "flat spot", chances are that it's most
- > likely flat due to being little more than a deep pile of moon-dust
- > that'll typically be 10+ meters worth of a carbon/soot, iron and
- > titanium composite that offers almost no surface tension until you hit
- > rock bottom, which in places could be 20+ meters deep. Surface radar
- > imaging should help to locate what's more or less worthy of landing
- > upon without your spaceplane sinking beyond it knees. The SSME
- > retro-thrust should blast away the thick dust, but then you'd be in a
- > fairly deep hole that's refilling itself with some of that same dark
- > and nasty dust, or do you still believe in the NASA/Apollo tooth fairy?

Don't underestimate NASA. At their best they are very, very good. Yes, Brad, we went to the Moon back in 1969. And, when it comes to sinking into quicksand, a flat bottomed waverider will only sink down to it's . . . flat bottom. The SSMEs, at full thrust, could kick that spaceplane out of the dust in a heartbeat.

- > In addition to various maneuvering thrusters and the fully computer
- > interactive SSME, I'm thinking that this massive craft is also going to
- > require at least 4 fairly massive gyros as being spun and sustained at

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- > 100,000 rpm, and that effort might only require a maximum of 3 MJ for
- > as long as those items need to be utilized. Instead of a rocket fueled
- > energy source, and because the H₂/O₂ fuel cells are not going to be all
- > that great of energy density, this could be where the auxiliary energy
- > can be derived via H₂O₂/Aluminum energy cells at delivering better than
- > 1 kwh/kg, thus 1000 kg = 1 MJhr becomes a highly effective energy
- > solution at requiring less overall mass at hardly any volume.

Actually standard LH₂/O₂ fuel cells are best because they provide clean drinking water for the crew. But if the energy output justifies using H₂O₂/Aluminum cells then perhaps a few of them should be added as well. The Moon mission would not require a reactor, only fuel cells. This might save some weight for SSTP to the Moon. I believe, however, that lightweight reactors have been built by NASA for their satellites.

- > A controlled decent away from the ME-L1/EM-L2 parallel park-n-ride;
- > Departing a sweet-spot that's roughly 60,000 km off the deck and dead
- > centered with Earth, and once having been arriving at an average decent
- > velocity of -6 km/s is going to take 10,000 seconds. Of course allowing
- > the lunar gravity to accomplish it's thing of getting the spaceplane up
- > to good speed, it seems stopping a 1200t craft (worth 200t lunar
- > surface mass) within the last 10 km, as having previously been arriving
- > essentially in VTOL mode at an average of 6 km/s is going to take some
- > impressive retro-thrust energy ($KE = 0.5MV^2$). I'm assuming that you
- > have a fully interactive fly-by-rocket simulator that's running on your
- > PC. Am I right?

How did you know?

- > BTW; Did you try posting any arguments related to having your
- > spaceplane efficiently docking at the LSE-CM/ISS, a 1.28 km diameter
- > borg like sphere that's tethered to the moon, having the 1e9m³ interior
- > abode and to/from lunar surface elevator pods?

Don't anger Murphy's Law.

- > Do you even remotely realize as to what the grand significance of once
- > having established the LSE-CM/ISS represents?

I think the ISS is a good idea. It is a possible refueling stop. And, a SSTO or SSTP crew could, in a pinch, camp out there while their hull is repaired for reentry. BTW, they need to stock the ISS with hull repair equipment and materials.

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- > Do you even realize the importance of what utilizing the mutual
- > gravity—well amounts to on behalf of your spaceplane going to/from the
- > moon?

This is why I get upset when I am told by 'authority' that everything is so impossible. Yes, the Moon has real gravity and this energy can be used by simply 'heading' toward the Moon when you go to the Moon instead of heading in the opposite direction, like these 'authorities' would probably do using some excuse that they have to do elliptical orbits for 2 years before they dare make the . . . jump.

- > Do you require a spendy pop-up book of 3D interactive animation and
- > audio clips as to better explain everything?

I like onboard computers that can tell me everything I need to know about everything. That way I can blame the computer for whatever goes wrong. (Don't tell the engineers I said that).

- > Perhaps I should hire 'LeapFrog' to publish this informative book as
- > another 'LittleTouch? LeapPad®' that's all about the LSE-CM/ISS. Do
- > you think that would help?

My quotes are worth money. But, alas, no one seems to appreciate them.

- > I'm also thinking, if your PC hasn't been infected with usenet
- > spermware, it's because you're MI6/NSA~CIA or perhaps just Skull and
- > Bones and thus brown-nosed certified as being another one of their good
- > guys. Which is it?

I do hobnob a little now and then. It is the only way I can log 'flight time'. Besides, I get lonely out here in the desert.

tomcat

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• *Follow-Ups:*

◆ **Re: How Rockets Differ From Jets**

◇ *From:* Fred J . McCall

◆ **Re: How Rockets Differ From Jets**

◇ *From:* Brad Guth

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- **References:**

- ◆ **[Re: How Rockets Differ From Jets](#)**
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