

Re: Stick/CEV Propulsion News

Source: <http://sci.tech--archive.net/Archive/sci.space.policy/2005-10/msg00166.html>

- *From:* "Ed Kyle" <edkyle99@xxxxxxxxxxx>
 - *Date:* 3 Oct 2005 18:22:53 -0700
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Damon Hill wrote:

> "Allen Thomson" <thomsona@xxxxxxxxxxx> wrote in
> news:1128376178.600675.167420@xx:
>
>>
>>> The Methane engine might be a pacing item for CEV
>>> development.
>>
>> I've never designed a rocket engine in my life, so have
>> no clue about the actual problems. But, that said,
>> could someone summarize what might be the difficulties
>> in designing a moderate-thrust CH₄/O₂ (or, I guess, other
>> oxidizer) engine?
>>
>
> <http://www.astronautix.com/props/loxlch4.htm>
>
> We'll assume that the methane is a cryogenic liquid and not
> room-temperature pressurized liquid; the latter may involve
> excessively heavy tankage and plumbing. Japan has an
> on-going program for a small engine using the latter; Russia
> has apparently investigated methane/liquid natural gas in a
> number of designs, none of which ever flew.
>
> Methane (CH₄) is a moderate cryogen and the simplest hydrocarbon.
> Density is much greater than LH₂, but less than half of LOX.
> (Slush hydrogen is not far behind liquid methane, 0.33 g/cc
> vs. 0.41 g/cc; LH₂ is 0.071 g/cc and LOX is 1.14 g/cc.)
>
> Unlike kerosene, methane won't 'coke' or carbonize when used as
> a coolant. Should be similar to a LH₂/LOX engine, but the
> methane turbopump should be no more difficult to design
> than a LOX turbopump.
>
> P&W has supposedly tested their RL10 on methane (or was that
> propane?) with minor modifications. I'd guess converting a
> RS-68 or J-2 to methane might not be very difficult, but less
> optimal than starting a design from scratch. Converting an SSME

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- > to methane would be more complex because of the staged
- > combustion design; it might not be possible to run fuel-
- > rich with partial combustion of methane. Undoubtedly there will
- > be other complications, most of them non-trivial.
- >
- > Because of the higher molecular weight introduced by the
- > carbon, thrust will be higher and Isp lower, in the
- > upper 300s. Slightly better than kerosene, somewhat worse
- > than hydrogen.
- >
- > Methane as a fuel has been described as having most of
- > the advantages of hydrogen, and most of its problems, too.
- > It's been considered before but never made the cut to
- > serious hardware design.
- >
- > --Damon

One of the listed advantages of liquid methane fuel are "long term on-orbit storage". How is this possible, given that both the LNG and its LOX oxidizer will be at cryogenic temperatures? It certainly wouldn't be classified as "storable" like hydrazine (or even kerosene). Is it simply that LNG is easier to store than hydrogen because it can be stored in smaller tanks than hydrogen that would be easier to insulate?

- Ed Kyle

• **Follow-Ups:**

- ◆ **Re: Stick/CEV Propulsion News**
◇ From: Henry Spencer
- ◆ **Re: Stick/CEV Propulsion News**
◇ From: Damon Hill

• **References:**

- ◆ **Stick/CEV Propulsion News**
◇ From: Ed Kyle
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