

Re: How big would an SSTO be?

## Re: How big would an SSTO be?

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*Source:* <http://sci.tech-archive.net/Archive/sci.space.policy/2007-07/msg00153.html>

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- *From:* BradGuth <[bradguth@xxxxxxxxxx](mailto:bradguth@xxxxxxxxxx)>
  - *Date:* Thu, 05 Jul 2007 06:11:12 -0000
- 

On Jul 2, 3:22 pm, Len <[l...@xxxxxxxxxxxxxxxxxx](mailto:l...@xxxxxxxxxxxxxxxxxx)> wrote:

On Jul 1, 6:23 pm, Sylvia Else <[syl...@xxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:syl...@xxxxxxxxxxxxxxxxxxxxxxxxxx)> wrote:

Len wrote:

On Jun 30, 6:03 am, Alex Terrell <[alexterr...@xxxxxxxxxx](mailto:alexterr...@xxxxxxxxxx)> wrote:

On 30 Jun, 04:38, Sylvia Else  
<[syl...@xxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:syl...@xxxxxxxxxxxxxxxxxxxxxxxxxx)> wrote:

Len wrote:

On Jun 29,  
6:55 pm,  
Sylvia Else  
<[syl...@xxxxxxxxxxxxxxxxxxxxxxxxxx](mailto:syl...@xxxxxxxxxxxxxxxxxxxxxxxxxx)>  
wrote:

David  
Cornell  
wrote:

If  
someone  
were  
to  
build  
an  
SSTO  
using

Re: How big would an SSTO be?

realistic  
assumptions  
about  
mass  
ratios  
and  
available  
power  
systems,  
how  
big  
a  
vehicle  
would  
be  
needed  
to  
send  
(say)  
three  
people  
and  
a  
modest  
amount  
of  
cargo  
into  
LEO?  
I  
have  
seen  
Apollo  
capsules  
in  
museums,  
so  
I  
am  
using  
them  
as  
my  
baseline.  
Would  
such  
a  
thing  
be  
the  
size

Re: How big would an SSTO be?

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of  
a  
regular  
jetliner?  
Or  
the  
new  
Airbus  
super  
jumbo  
jet?  
Or  
are  
we  
talking  
about  
a  
Zeppelin  
on  
steroids?  
Also,  
how  
would  
these  
things  
scale?  
If  
we  
wanted  
to  
increase  
the  
crew  
from  
three  
to  
four,  
would  
the  
vehicle  
size  
go  
up  
by  
a  
third?  
Or  
more?  
Thanks  
David  
Cornell

Re: How big would an SSTO be?

You  
didn't  
say  
so,  
but  
I'm  
assuming  
you  
mean  
a  
reusable  
craft.  
Disposable  
SSTO's  
seem  
a  
waste  
of  
effort.  
The  
most  
developed  
design  
I've  
seen  
for  
a  
reusable  
SSTO  
is  
[http://www.reactionengines.co.uk/skylon\\_vehicle.html](http://www.reactionengines.co.uk/skylon_vehicle.html)  
It  
has  
a  
payload  
of  
12  
tonnes,  
and  
a  
maximum  
takeoff  
weight  
around  
280  
tonnes,  
similar  
to  
that  
of  
a

Re: How big would an SSTO be?

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777-300.  
It  
uses  
a  
new  
engine  
design  
with  
some  
technological  
challenges,  
but  
they  
seem  
to  
have  
made  
some  
progress  
with  
it.  
They're  
obviously  
financially  
constrained,  
so  
if  
you  
have  
a  
spare  
\$billion,  
I'm  
sure  
they  
be  
interested  
in  
talking.  
Skylon  
is  
an  
automated  
system,  
and  
as  
such  
is  
not  
designed  
to

Re: How big would an SSTO be?

have  
a  
crew,  
but  
could  
carry  
people  
as  
payload.  
This  
document  
[http://www.reactionengines.co.uk/downloads/JBIS\\_v56\\_118-](http://www.reactionengines.co.uk/downloads/JBIS_v56_118-)  
discusses  
that  
application  
using  
a  
module  
carrying  
40  
people,  
though  
that's  
obviously  
in  
a  
transport  
application  
(to  
a  
space  
hotel,  
perhaps).  
If  
you  
have  
space  
tourism  
in  
mind,  
with  
passengers  
not  
leaving  
the  
craft  
and  
floating  
around  
the  
cabin,

Re: How big would an SSTO be?

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then  
presumably  
they'd  
need  
more  
space  
per  
passenger.  
It's  
hard  
to  
say  
how  
this  
scales  
for  
a  
smaller  
payload,  
but  
at  
a  
guess,  
I'd  
say  
you  
could  
get  
a  
craft  
to  
carry  
four  
people  
that  
was  
the  
size  
of  
a  
small  
airliner  
in  
the  
50  
seat  
range.  
Sylvia.

I have  
probably

Re: How big would an SSTO be?

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looked at as  
many  
launch  
vehicle  
concepts  
--rocket  
powered  
and  
airbreathers--as  
anybody in  
the world.  
The devil is  
in the  
details. I  
would not  
consider  
Skylon  
anywhere  
close to  
realistic. As  
for purely  
rocket-powered  
approaches,  
I have never  
been able to  
convince  
myself  
that any  
SSTO  
having a  
gross mass  
of  
less than  
about 800  
tonnes was  
very  
realistic.  
And for  
HTOL,  
some type  
of ground  
cart to  
support the  
vehicle  
at gross  
mass is  
probably  
necessary--thus  
making it  
really an  
assisted

Re: How big would an SSTO be?

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SSTO,  
rather than a  
pure SSTO.  
Staging—even  
subsonically  
at altitude  
or at low  
supersonic  
speeds  
greatly  
relieves the  
challenge.  
IMO,  
staging  
can  
sometimes  
be  
beneficial  
from the  
operations  
point  
of view—as  
well as the  
performance  
point of  
view.  
SSTOs  
are  
undoubtedly  
appealing  
from the  
psychological  
point  
of view.  
However,  
they may  
not be a  
good way to  
run  
an airline.  
At some  
combination  
of size and  
yet-to-be-discovered  
technology,  
SSTOs will  
make  
technical,  
economic  
and  
marketing

Re: How big would an SSTO be?

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sense; but I  
don't see  
this  
happening  
soon.  
Len

Would you care to expand  
on your concerns. At the  
moment, you've  
basically said that you're an  
expert and that we should  
believe your  
claim that Skylon is not  
realistic.  
Sylvia.

I believe Len is an expert and would take his  
word for it.  
Nevertheless, an expansion on the concerns  
would be of interest.

However, I don't see the benefit in SSTO  
when concepts like Quickreach  
2  
(<http://www.astronautix.com/lvs/quickreach2.htm>)  
could reach orbit for  
relatively low cost.

Len – how does Quickreach 2 compare to  
the latest space van proposals?

I have been out of town. I'll respond in more detail  
tomorrow.

As a quick answer, Quickreach should be able  
to launch a nearly twice as large payload a  
couple of years earlier than the Space Van 2011.

We expect to carry 2000-kg—or eight passengers  
—to an ISS-type orbit (not our main mission) for

## Re: How big would an SSTO be?

a price (including ROI) of \$2,000,000 per flight in 2007 dollars. This compares to a Quickreach cost (price?) of \$20,000,000 in 2005 dollars.

The Space Van should be able to achieve much more frequent flights, since there are no expendable parts or reusable parts that require extensive refurbishment between flights.

The Space Van should have good abort options throughout its flight regime—starting with engine-out abort capability just after liftoff with derated engines. The engines are derated for much improved time between overhaul.

As for Sylvia's request, I am not sure exactly what cycle Skylon plans to use, but I suspect that it is some type of combined-cycle engine. The poor-man's approach to analyzing combined cycle performance (except for potential benefits from saving installation space through integration) is to imagine separate rocket and airbreathing engines. The resulting thrust and specific impulse usually equals the goals for the combined cycle engine. This analysis trick allows a quick assessment of how much airbreathing and how much rocket the designer would like to have. If one then goes through some tradeoffs of different ratios and allows for real-trajectory estimates of drag losses and real-structure mass estimates allowing for realistic inlets and the impact of flying the whole vehicle at relatively high dynamic pressures and velocities, I have always found that the best ratio is 100 percent rocket. Many others—including highly knowledgeable people like Henry Spencer—have noted that the airbreathing appeal is rather superficial and vanishes under realistic analyses.

Len

## Re: How big would an SSTO be?

Yet Reaction Engines have gone through the same process, and reached the conclusion that for their craft and engine the numbers do add up. The people involved in the project are not amateurs. If you want to claim that Skylon won't work, you need to point specifically to where Reaction Engines have gone wrong, not make vague claims about analyses of other craft.

Sylvia.

Actually, I do not feel any need to justify not wasting any more of my life on airbreathers for acceleration. The 1960's aerospace plane, the more recent NASP and many other fiascoes spent far more money failing to meet their promises than has been spent on rocket-powered space planes—before finally admitting failure. And then another group come along with the same claims. They are welcome to try; I—and many others—prefer to put our resources into more productive efforts.

The summary reasons that I gave earlier for doubting that airbreathing designed to operate over a significant mach-number range can outperform pure-rocket approaches for acceleration missions are not vague. These are very real, specific and damning.

Reaction Motors may have "reached the conclusion that for their craft and engine the numbers do add up." This claim has been made many times before—only to have such claims quietly fade away when the admittedly complex, somewhat counter-intuitive analyses are made in sufficient detail and honesty.

Normally I am a "live and let live" type of guy. However, NASP type claims have several times derailed much more promising, rocket-powered approaches. Of course, that is in a government-sponsored world. In a commercial world, I am only concerned about being able to attract investment for the approach that I think is most workable in the near future. If investors choose to fund something like Skylon as well, I wish them luck. However, I shall not be particularly

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concerned about real competition.

Len– Hide quoted text –

– Show quoted text –

Your honest input is well taken by way of how I've thought about this SSTO Skylon, as simply being too much fly-by-rocket pie in the sky, especially at their impressive ratio of 23.3:1 for accommodating 12 tonnes worth of most anything LEO, is just way more than a little outside of the regular laws of physics.

Unless Skylon is assisted with a pair of reusable LRBs, there's no way such a SSTO monocrraft is ever going to deliver those 12 tonnes into LEO, especially if limited to LOx/LH2. Possibly 6 tonnes.

Therefore, I still like your 800 tonne SSTO alternative, seems capable of perhaps getting as much as 24 tonnes into LEO.

–

Brad Guth

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