Rocket Design:
The Nozzle

Part II

By Ciarán Handley

9th October 2020

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The Nozzle
Chapter 1

For this it is back to basics

Once again we are back to Newton's Second Law.

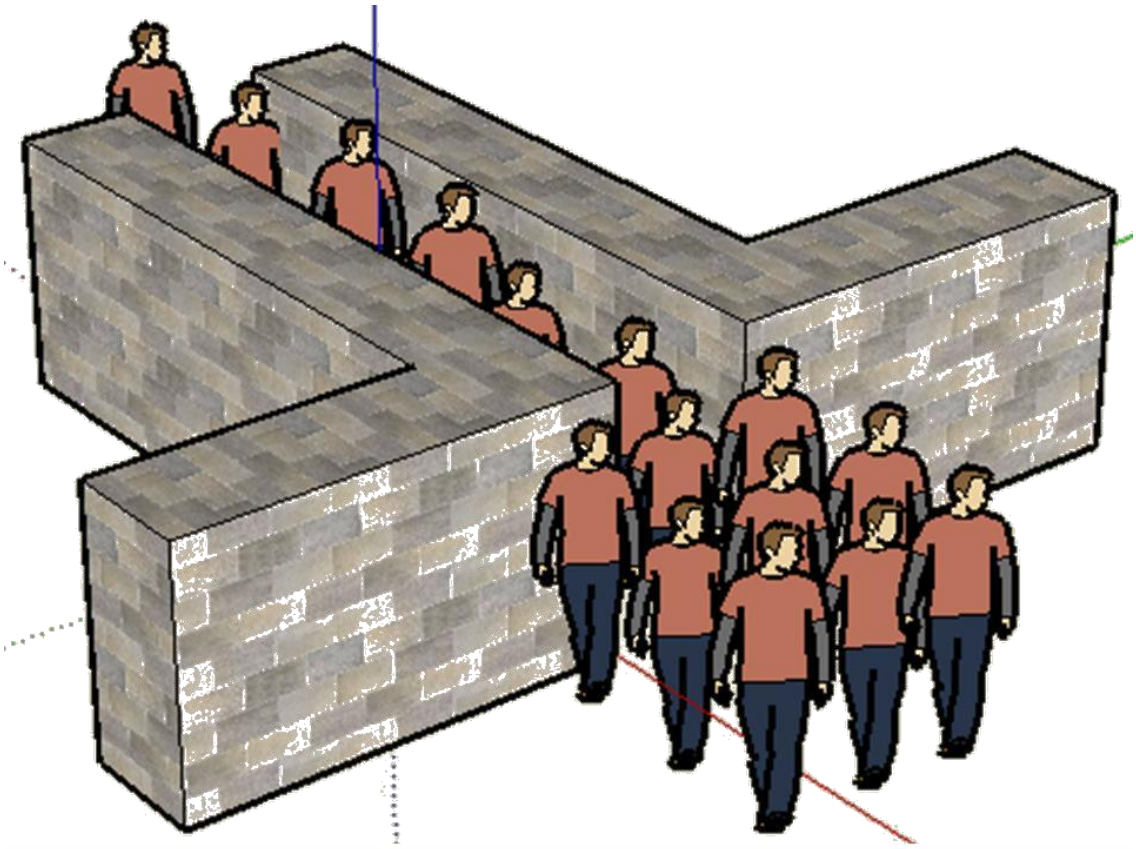
The solution is in three parts.
*One is to **not** disperse the thrust.*
So do not have your nozzle flare outwards.

Have it taper in instead.

That is the first part.

*The second part is to do with calculating **the length** of the nozzle*

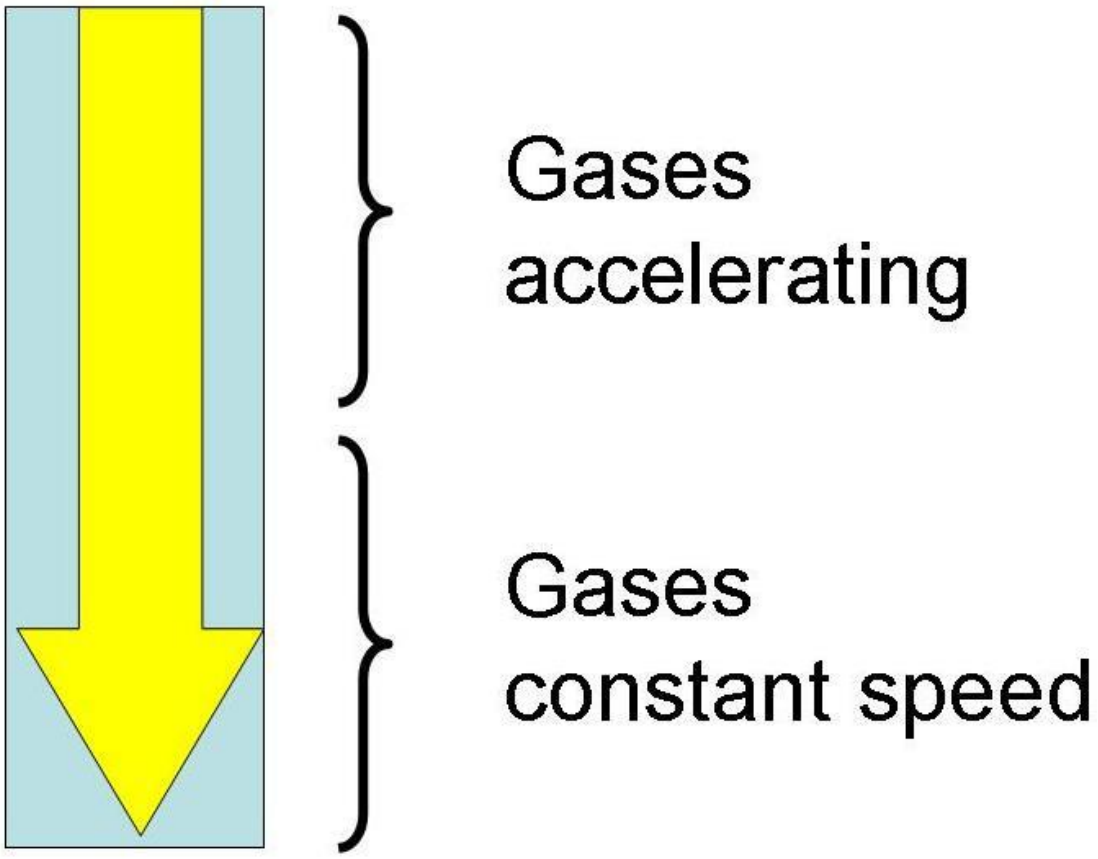
How long should it be?



Remember these guys? When they enter the corridor they need to speed up to three times their speed

But you know what – we're not really that interested in their speed. It's their ***acceleration*** that we are interested in. The part where they speed up. Which is as they come into the corridor.

There will be a part where they accelerate. That is the part we are interested in. After that their speed is constant. We don't really care after that.



I am just showing the nozzle here as a cylinder so as not to distract from this next principle

Which is how long to make the nozzle.

How long to make the nozzle? We are only interested in the acceleration of the gases. This gives thrust. But once the gases have reached a constant speed, no additional thrust is gained.

So we need to make the nozzle long enough so that it encloses the gases ***until they have stopped accelerating***. If you make the nozzle too short, you lose thrust.

In the case of existing nozzle designs, they are ***far too short***. The nozzle ends before the gases have finished accelerating. Which means a loss of thrust. Actually, a very substantial loss of thrust.

Simply by making the nozzles very long one can ***dramatically*** increase thrust.

How long should one make the nozzle?

Long enough so that the gases have stopped accelerating. Force equals mass times acceleration, not mass times speed. Once the gases have stopped accelerating then no further thrust can be obtained by making the nozzle any longer.

If however you have the nozzle so short that the gases have not stopped accelerating before they leave the nozzle, then you lose thrust. This loss in thrust can be very substantial.

One can get the answer without computer modelling the nozzles. Rather one could simply measure the flow of gases in the nozzle. Measure the flow to see at what stage they stop accelerating. That is the point where one can cut off the nozzle. Not before.

This will give a far longer nozzle that is currently used by space agencies.

But one which is far more efficient.

*If this approach is taken then the effective thrust can increase by **eightfold** simply by changing the nozzle shape in this way*

When I say *effective thrust* I am basing that on a number of factors. Key is that I use far less fuel. So rather than having a rocket which is eight times more powerful, I could have the same power rocket but using *one eighth* the fuel.

Small, compact, efficient

It means that my rockets can be *a fraction of the size* of existing rockets.

This is one of the keys to enable me to compete in the Race to Mars.

People will not believe how simple my designs are.

Now, Part III – how to get the power up to *twelve-fold* simply by modifying the nozzle.

We're up to eight-fold already.

Just one more step to go…

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End of Part II