Inside Thruster Engine

Theory

The formula for the thrusters, with respect of the module class, should be:

$$\mathbf{Sp} = (1 - a) + a \cdot (3 - 2 \cdot \mathbf{m})^{b}$$

where **m** is the *mass ratio* (total mass divided by the thrusters's optimal mass) and **Sp** is the *speed modifier* (applied to the ship's base speed), and **a** and **b** are constants according to the thruster rating:

- **Class E**: a = 0.17, b = 0.2350
- **Class D**: a = 0.14, b = 0.5145
- **Class C**: a = 0.10, b = 1.0000
- **Class B**: a = 0.07, b = 1.5100
- **Class A**: a = 0.04, b = 2.3300

Once obtained the *speed modifier*, the ship's top speed (assuming 4 pips to the Engine distributer) can be calculated knowing the base speed (speed of the ship with the default build, which should match either the speed in the Shipyard, even the base speed on Coriolis).

$$\mathbf{Speed} = Sp \cdot (\text{base speed})$$

For brevity sake, in the *thrusters-top-speed* spreadsheet, the speed modifier is named just “Curve” (columns E and F).

Usage

To acknowledge the top speed of your sheep (assuming 4 pips to the Engine distributor) you should:

- **Ref. speed**: write here the **base speed** of your ship. This should be the speed you get either from the Shipyard, either from the Coriolis website when you consider the default layout.
- **Your data**:fill the other yellow cells with your ship's data, which are: the **class** of the thruster module (cell Q5), the **rating** of the thruster module (cell Q6) and you **current** ship mass (cell Q7), which should match your hull mass + mass of all installed modules + current mass of fuel and cargo.
- **Your output**: in cells Q8..11 you get the value of the theoretical **curve factor** (the 1st formula on this page's top), the actual speed modifier (cutting the curve if mass is less than minimal one) and the **top speed** of our ship (with 4 pips to the Engine distributer). Finally you get also the **empirical** value of your *multiplier*. This multiplier allows to you to double-check the formula.

  Example: when your ship's mass matches perfectly one of the the Minimal, Optimal or Maximum mass for your thruster's module, then your *empirical* multiplier should match the *theoretical* Minimal, Optimal or Maximum multiplier for that module.

Engineering

If your thrusters module has been engineered, you can set the values of the Multiplier modification in the cell AA6, and the value of the Mass modification in the cell AA7 (both with yellow background). Then you will be able to compare the parameters of your "bare" module with the parameters of the engineered version, as follows:

- Green cells: values of the "bare" module (not engineered)
- Cyan cells: values of the engineered module

As you should know, increasing the Mass modifier improves the way your ship suffer loading cargo and moving on bigger masses, while increasing the Multiplier modifier result in a big boost of the overall speed. That's why increasing the Multiplier modifier is usually the most popular choice.

Implementation

Calculation has been implemented creating two lookup tables in the Lookup sheet:

- **Masses by module's size (for class E):** gets the Optimal, Minimum and Maximum **masses** of the thrusters module as a function of the module **class**. Moreover, the *Delta* column returns the increase (in tons) of the optimal mass when a module of this size is upgraded to level D,B,C or A.

  Example: thrusters of class 2**E** have optimal mass 48T and a Delta value of 6T. Therefore thrusters of class 2**B** will have optimal mass 48 + 3*6 = 66 tons. This because *three upgrades* are needed in order to get from rating E to rating B (counting levels as E, D, C, B, A).

  The number modelling the "upgrade level" are stored in the cells H18..H22.

- **Multipliers by module's class**: gets the Optimal, Minimum and Maximum **multipliers** of the thrusters module as a function of the module **rating**. In this case the *Level* column shows the factor used to multiply the Delta (cells F6..F12) in order to get the optimal mass of a thruster model (given size and class). See example above for details.

Credits

- Thrusters formula and thrusters's image have been discovered and published by **Taleden (EDSY)**. Original link here.