

## Cooling effect on the thrust developed by a pop-pop engine

By Jean-Yves

To know this effect we built an engine with a long strait pipe and we immersed more or less this pipe into the test tank provided with a thrust measuring instrument.

The engine was built under Daryl's best engine (#60) influence – without looking for optimization. The drum and first part of the pipe are made of copper. The rest of the pipe is aluminum.



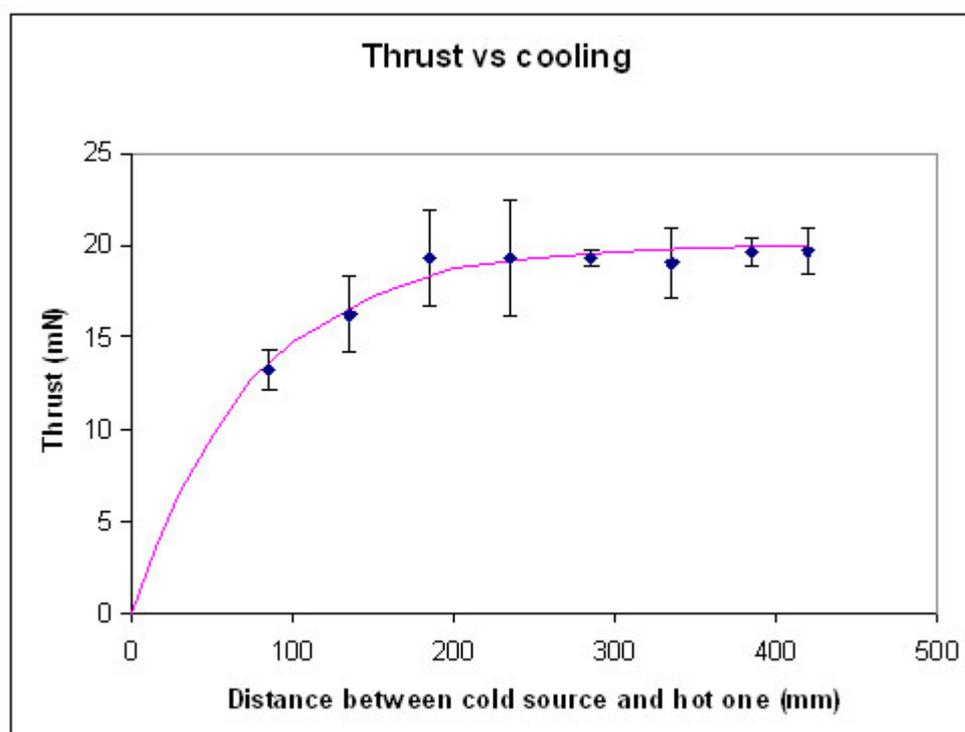
Drum made with a "T" which the two ends are crushed and soldered. The right half of this image is a photo-building because the engine was cut for another tests before we make a picture (!).

### Assessments :

During all the tests the aluminum pipe was cold up to a few centimeters from its connection to the copper pipe.

During all the tests but the last one (connection copper-alu at only 85mm from the tank) the copper pipe was heated at more than 100°C all along its length.

Measuring uncertainties being taken into account, the mean thrust is approximately constant except when the cold source and the hot one are close to each other. Probable explanation: When the distance between cold source and hot source is too short the stroke of the liquid piston is reduced.



Each blue diamond is the average of 3 to 7 measurements. The vertical dashes show  $\pm 1$  s.d.

Due to measurements performed during other earlier tests (for other purpose) we had an idea of the result. Here it was the first series of tests dedicated to the knowledge of the effect of the distance between hot source and cold source. One must bear in mind that the measures concern a particular engine. Performances can be influenced by many criteria, mainly by dimensions and materials. Up to diameter 23.5 we have not met any difficulty. The "law" seems to apply. However, for the very big engines (diameter 40mm built by Loïc and diameter 60 built by Bjorn and Eljoh) steel pipes were used. And yet, the thermal conductivity of steel, as well as the one of water, is too poor to ensure a good efficiency of the cold source (the heat stays in the engine). This led to locating the sources close to each other and involved a performance lower than the expected one. A forced cooling allows to some extent to fix the cold source and increase the performances but the situation of "very big engine" remains widely improvable.