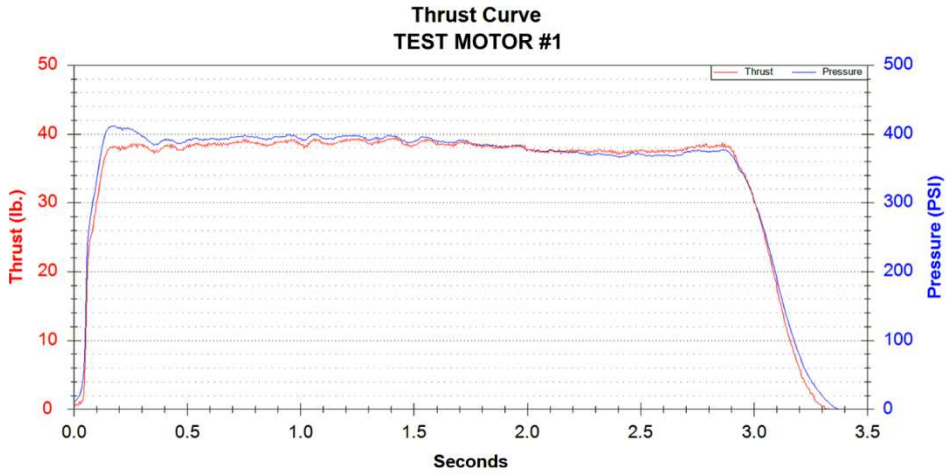
SELECTING AREA

This is an integral document for preparing TC LOGGER USB files for use with PROPEP 3.

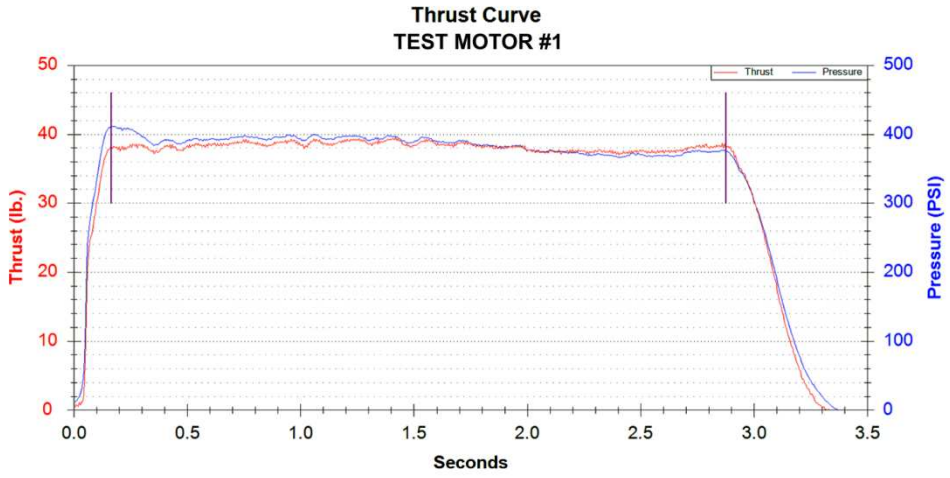
To most of us when we look at a Thrust Curve we automatically look at all of the area under the Thrust Line and assume that is the power of the motor. This is basically true however, when you are looking to Characterize a propellant it does not represent the optimum power delivered by that propellant. This is because of what we call Ramp Up, the motor coming up to "speed" in the beginning and Shut Down, the time at the end were the motor dwindles of life.

While a Thrust Curve is able to deliver a classification to a motor from the overall presentation of the area under the Thrust Line and the time the motor burned, for Characterization purposes we need to be more precise. To do this we need to select a specific area of the Thrust Curve that best represents the maximum flat area of Thrust over the time of the Burn. This is called the Plateau.

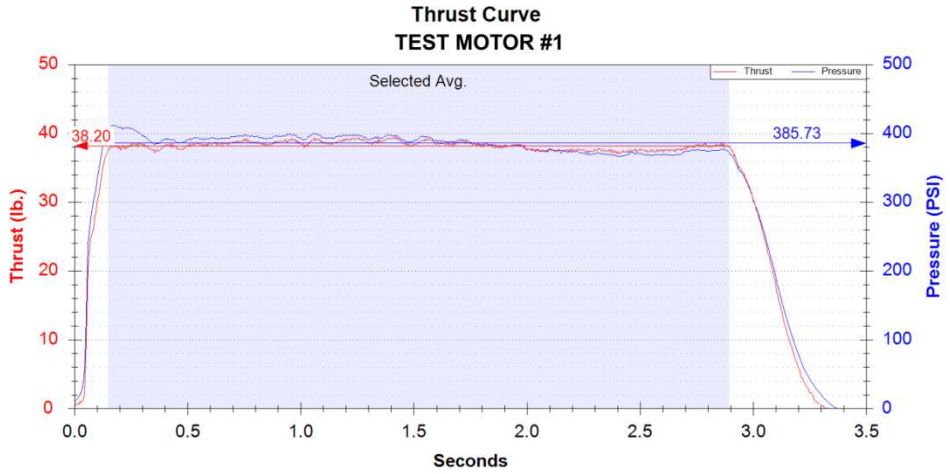
To acquire a nice flat Thrust Curve you must design your Test Motor as a Bates Grain. A BATES grain (BAllistic Test and Evaluation System**)** consists of two or more cylindrical grain segments with the outer surface inhibited, but free to burn both on the segment ends and the cylindrical core. Such grains can be configured to achieve a neutral burn creating a Thrust Curve having a near flat line of operation as shown here.



This is an example of an actual near perfect Flat Burn Thrust Curve. Both the Thrust (Red) and the Chamber Pressure (Blue) match really close. Deciding the Plateau is almost a no-brainer. You would start where the Thrust reaches top and end where the Thrust drops off. The following image shows these two points.



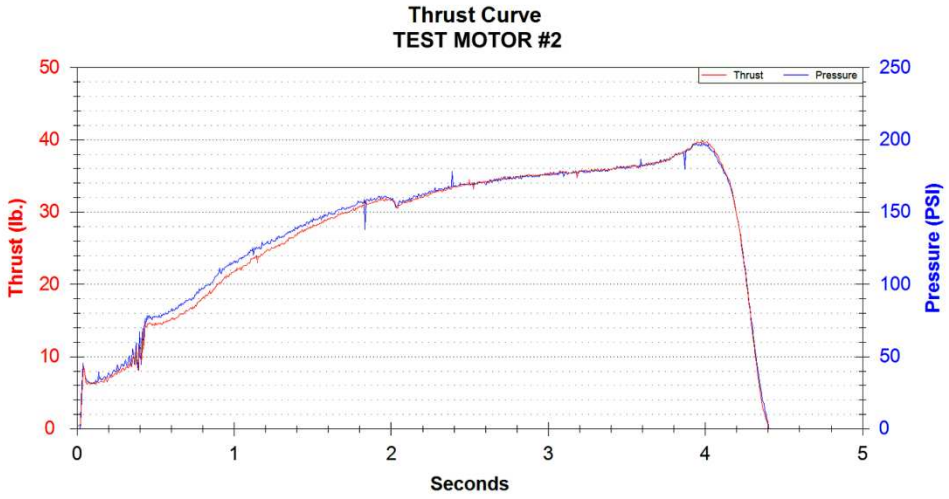
With the two points selected TC LOGGER USB will compute the Selected Area and present the results as shown in the next Chart. You will see the Selected Average Thrust is 38.20 lbs and the Selected Average Chamber Pressure is now 385.73 PSI. (Before selection the Average Thrust was 35.79 lbs and Pressure was 363.84 PSI.)



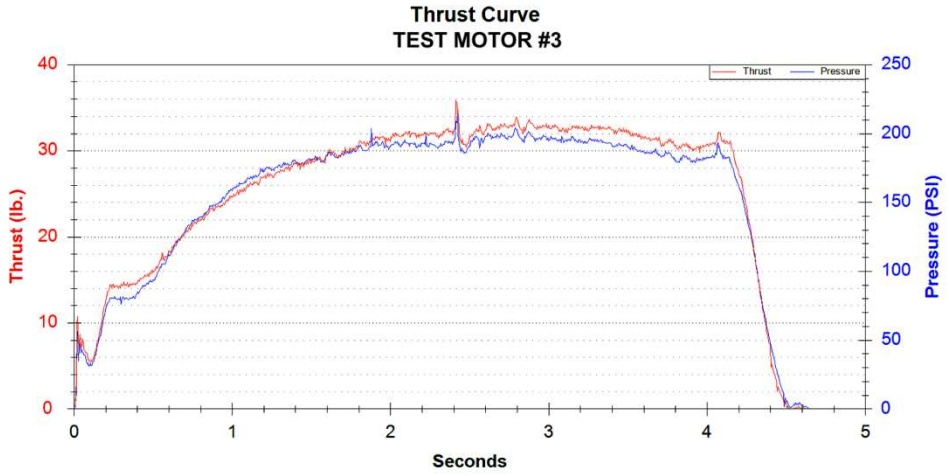
POPEP 3 needs to see Thrust and Pressure in a steady state environment. By selecting the Plateau area we capture this. We will not go into the theory and math of this process suffice to say PROPEP 3 handles it all and returns true actual data for the Characterization Process.

While the Select process is arguable one should try to capture a minimum 80 to 90% of the Thrust in as flat an area as possible. This is why BATES Grains are required. Yet all BATES Grains do not provide good flat burns and you may need to adjust design altering nozzle throats, Grain Core diameters or even the entire Test Motor itself. Research is Research.

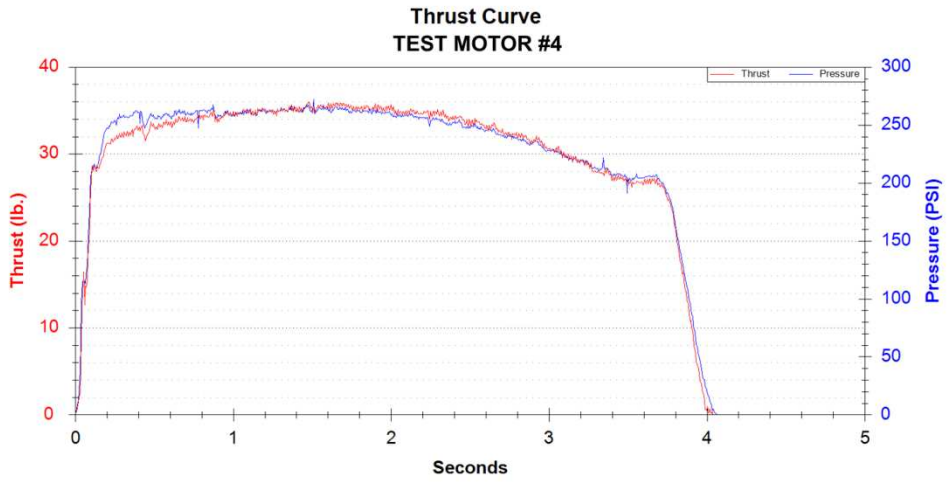
The following show Thrust Curves that are not appropriate for this process. It is obvious, just by looking at them, why they don't qualify for Characterization material.



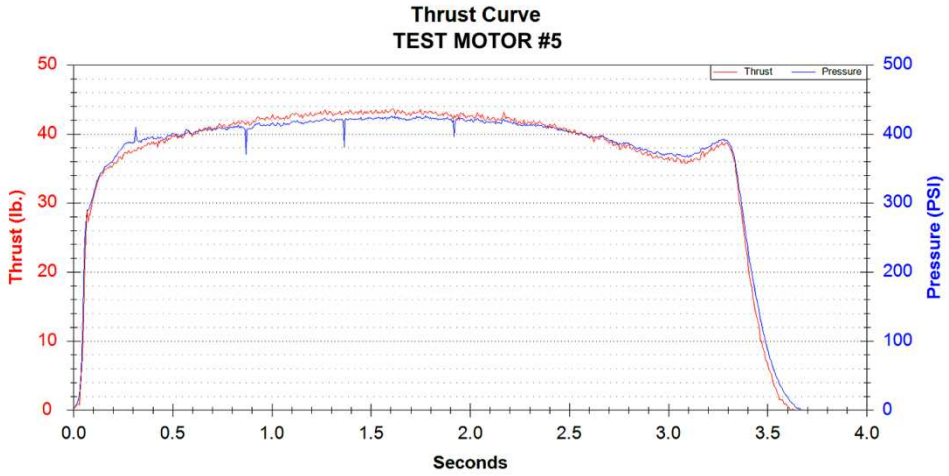
Even though the above Curve was designed as a BATES its operation proves major work is needed to bring it to a truly Flat Burn. This Thrust Curve has no flat area at all to select.



While this Thrust Curve appears to have some flat area to it, it is not a flat burn. Trying to capture a plateau on this would give you less than 40% of the burn. This is not an acceptable amount of data to be accurate.



The above Thrust Curve looks near a flat burn. It could be classified as usable however data could be skewed. Only about 30% is flat enough for selection. If spread to collect 85% it could be used but you want to hope for better.



Here is another example that while not completely flat, could be used to select almost 85%. Again this method is based on the users decisions which will most definitely vary from person to person. Observing and learning what to accept and what not to accept will take experience.

After a short period of time you should be able to ask yourself. If you have any doubts don't use it. Motor Characterization is not a onetime right on process and the serious Motor Research person may have to redo things several times until they get it right.

It's not hard, it's only Rocket Science.