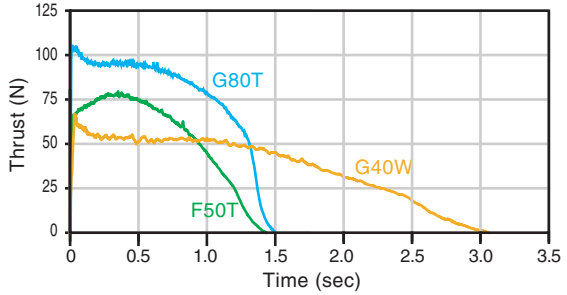
If you want to fly rockets, and do so in conformance with the law, and with the rules of the recognized rocketry organizations - the National Association of Rocketry (www.nar.org) and the Tripoli Rocketry Association (www.tripoli.org) - then you need to understand these basic concepts.

Rocket motors are classified according to their impulse. This is basically the power output of the motor. The impulse can be calculated by multiplying the average thrust by the burn time of the motor.



	Rated Average Thrust(N)	Tested Average Thrust(N)	Burn Time (s)	Rated Impulse (Ns)	Tested Impulse (Ns)	Propellant Mass (grams)
F50T	50	53.73	1.43	80	76.83	37.9
G40W	40	37.17	3.06	120	113.74	62.4
G80T	80	77.50	1.50	120	116.25	57.4

Take for example the F50T above. If you multiply its average thrust (53.73N) by its burn time (1.43s), you get its impulse, 76.83Ns. That is also the area under the green curve above. Also, notice in the table how close the tested values are to the rated values.

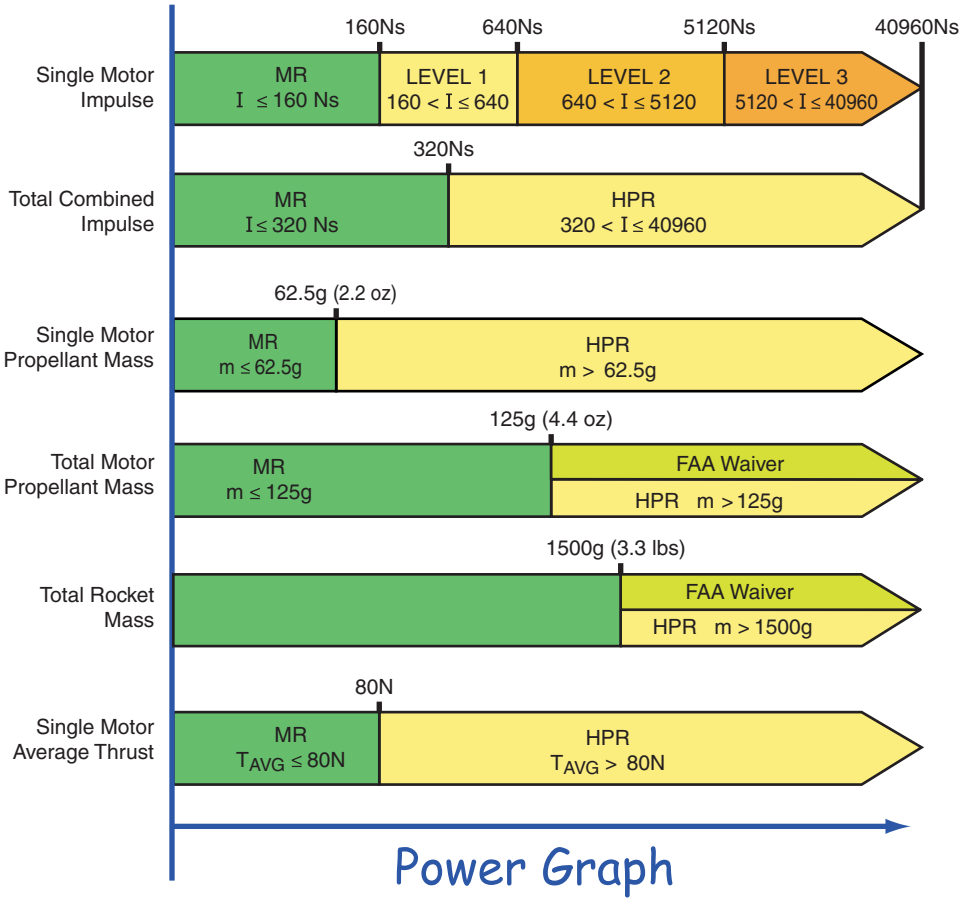
If you are going to fly rockets, you need to understand these numbers because there are rules and regulations based on these parameters.

Most people tend to think of high power rockets (HPR) as anything with an H-motor or larger, and that if they stay under H-power, they are within regulations, but that is not always so. It is true that one must fly an H-motored rocket in order to achieve high-power certification, but there are several other lower-powered scenarios which are also classified as high-power and require HPR certification and/or FAA waivers.

The first line in the power graph shows the certification levels required to use any single motor. Any motor with more than 160 newton-seconds of impulse requires a minimum of Level 1 certification.

The second line in the graph applies to rockets with multiple motors, either staged or clustered. If the total combined impulse of the motors exceeds 320 newton-seconds, certification is required. Black powder D-motors have about 17 newton-seconds of impulse. A hypothetical cluster of 20 would have 340 newton-seconds of impulse and would require HPR certification.

The third line in the power graph shows the propellant mass limits for rocketry. If any single motor exceeds 62.5 grams of propellant, certification is required. Furthermore, as shown in the fourth line, if the total fuel mass – from either a single large motor or from a cluster or multiple stages – exceeds 125 grams, an FAA waiver is required in addition to HPR certification.



Take the black-powder D motor again. It has 21.1 grams of propellant mass. It would take only six of these to exceed the FAA propellant mass limits and require a waiver even though the impulse is only 102 newton-seconds. So there is more than one way to exceed the limits.

The FAA has also set total rocket mass limits. As shown in the fifth line, if the rocket weighs more than 3.3 pounds (1500 grams) with motor(s) loaded, both an FAA waiver and HPR certification are required. Lastly, in the bottom row of the graph, if the average thrust of any motor is more than 80 newtons, high power certification is required.

As you can see from the table of motors, none of these exceed any of the limits for motor propellant mass, average thrust or impulse. They are all considered low power motors. But if you fly them in a cluster, or in a somewhat heavy rocket, FAA waivers as well as HPR certification may be required.

Always check your motor and rocket against these limits to ensure that your are in accordance with the rules. This will help to keep your flying safe and legal.