IN SEARCH OF THE RIGHT RUBBER-MOTOR FOR YOUR OUTDOOR SCALE MODEL

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Sometimes in the course of learning to fly scale model airplanes we come across valuable bits of information that give a sudden boost to the performance of previously lackluster aircraft. Recently my fellow Bay State squadron member, Larry Peavy, offered me some advice that has coaxed two of my crates out of the doghouse and into the competition, The nucleus of this advice was simple, yet unknown to me, It goes like this: "For outdoor FF scale the weight of the rubber-motor should be at least 20% of the weight of the ballasted aircraft with it's prop". Now that's what I call a handy rule of thumb that points the way to a lot of interesting possibilities. In particular, the most intriguing possibility was that the 20% idea could help answer my three most persistent questions regarding rubber-motor selection;

— What width of rubber-motor to use? — What length of rubber-motor to use? — How many loops of rubber to use?

Unfortunately the 20% rule of thumb alone won't give all the answers, We need to link it up with four other preconceived "Opinions" in order to really make it work for us. These Opinions might be debatable in detail, but are generally usable, The 4 Opinions are:

1) Pack as much rubber as possible into each plane and make-up the longest and thinnest motor possible that will still allow the plane to fly well. This kind of motor will give the longest motor run.

2) The wing-load value should be no more than .5 grams per square inch.

3) The rubber-loop length should be at least 2 times, but not much more than 3 times, the distance from prophook to rear-hook (the closer to 3 times the better).

4) Use a single loop of 3/32" rubber for peanut scale, and a single or multiple loops of 3/32" or 1/8" rubber for anything bigger. These standard widths simplify the initial selection, although we may want to resort to our strippers later on.

Now we want to find out (the 3 rubber-motor questions), and we know the general limits of where we are willing to look for the answers (the 4 opinions), we are ready to start searching for that just-right power source, First we need to measure 3 things on the aircraft in question;

A, The weight of the model to the nearest tenth of a gram (including ballast and prop, but no rubber),

B. The area of the wing in square inches (the whole wing, including the area that connects to the fuselage),

C. The distance from prop-hook to rear-hook in inches, Once these values are measured we can begin to make an educated guess as to what a good motor might look like by using the following 5 steps;

Step 1- Multiply the model weight by .20. This is the minimum weight of rubber for the model.

Step 2- Add this rubber weight to the weight of the model. Now you have the total weight of the aircraft.

Step 3- Divide this total weight by the area of the wing. This is the wing-load value for the model in grams per square inch.

Let's pause here. If your wing-load value is .5 grams per square inch or less give yourself a laurel and hearty handshake because conventional wisdom says your model has good duration potential. At this point you might seriously consider adding more rubber to the model until the wing-load approaches .5 grams per square inch. This could be used to give a longer motor run (by adding more length), or to give more oomph (by adding more width), depending on what you feel your model needs. You could leave it just as it is (nice and light) but if it's duration you're after then pack in as much rubber as possible without violating the .5 gram per square inch guideline. If your wing-load is greater than .5 grams per square inch then your model is somewhat overweight according to Opinion #2. In terms of the Motor, one thing that can be done to fix this is to simply reduce the weight of the rubber until the wing-load drops to an acceptable value. Unfortunately this eats

into the 20% rule of thumb, but since no one has ever heard of a Flying Ace actually building an overweight model this consideration is only hypothetical. Now on to step 4.

Step 4- For Peanuts: Divide the rubber weight you've chosen by .0160 (the weight of I inch of 3/32" tan rubber)*. This will give you the total rubber length. Divide this length by two to get the length of the loop. This loop will hopefully be at least 2 times, but not much more than 3 times, the hook to hook distance. If your loop length is too long or short then adjust it to fit within the guidelines as best you can.

For Bigger Models: According to Opinion #1 we want to use the thinnest and longest motor possible that will still allow the aircraft to fly well, so let's begin by seeing what a 3/32" motor would look like. Divide the rubber weight you have chosen by .0160 grams (the weight of 1 Inch of 3/32" tan rubber). This will give you the total rubber length. Divide this length by two to get the length of the loop. If the length of your loop is more than 2 times, and not much more than 3 times, the hook to hook distance then try using it as a single loop. If your loop is a lot longer than 3 times the hook to hook distance then try dividing it into multiple loops (2 loops, 3 loops, 4 loops, etc.) until the loop length falls between 2 to 3 times the hook to hook distance closer to 3 times if possible).

Step 5- Install the rubber-motor in the model and try it out. If the motor is too strong (the launch speed of the model is too fast) there are three ways to fix this;

a) Try using fewer loops of the same motor, but keep the motor length not much greater than 3 times the hook to hook distance.

b) Try a slightly longer and thinner motor, but keep the rubber weight the same. In order to do this we need to crank up our strippers and experiment using thinner and thinner motors until we find the thinnest and longest motor possible that will perform well.

c) Try a slightly slower prop, that is, a prop with a higher pitch and/or a larger diameter. If the motor is too weak (the launch speed of the model is too slow) there are three ways to fix this;

- Try using more loops on the same motor, but keep the motor length at least 2 times the hook to hook distance.

- Try a slightly shorter and wider motor, but keep the rubber weight the same. A simple way to do this is to switch to 1/8" wide rubber. Just divide the rubber weight you have chosen for your model by .0814 grams (the weight of 1 inch of 1/8" tan rubber)* and jump back into step 4.

- Try a slightly faster prop, that is, a prop with a lower pitch and/or a smaller diameter.
Continue experimenting by adjusting the number of loops, width, and length of your rubber-motor until the most satisfactory rubber/prop/model combination is found. As you do this keep the four Opinions in mind and try to stay within their guidelines. If you happen to disagree with any of the Opinions, that's no problem. Just plug in your own favorite values for wing- load, motor length, etc. The method is still the same.

In conclusion, this is just one of the many methods that can be used to search for a good rubber-motor. It is based on the assumption that the rubber-motor dimensions and wing-load play important parts in allowing a model to realize it's full duration potential, and when we build a model as light as possible it allows us to pack in a longer rubber-motor and still keep the wing
load value low.

** Ed. Note: Your friendly Thermalier editor didn't have any 3/32 Super Sport rubber handy to weigh, but did calculate the weight of 3/16" and 1/8" Super Sport to be .1231 and .0818 grams per inch respectively. This includes the weight of the Dow 33 lube on the rubber. Since the weight of the lubed 1/8" SS rubber is very close to the weight shown above for Tan rubber, one might speculate that the weight shown above for 3/32" Tan is approximately the same as lubed Super Sport of the same size.*