CALCULATING SCALE RUBBER MOTOR SIZES

by Bob Hodes

An article published in the December 2009 Issue of The National Free Flight Society Digest, Don Deloach, Editor

I have come up with a tool in Microsoft Excel that might be helpful in sizing rubber motors for scale models. Five data points are needed:
1. The wing area of the model,
2. The weight of the model (without the motor),
3. The desired motor weight as a percentage of the model weight. (Bob Isaacks, for example, recommends a motor weighing 30% of the empty model weight),
4. The hook-to-peg length,
5. The desired final motor length as a function of the hook to peg length (for example lx, 2x, 2,5x, etc.)

With this entered, the spreadsheet will yield the wing loading without the motor, the predicted wing loading with the motor, and the total length of the rubber strip needed to build the motor, given for four widths: 3/32", 1/8", 3/16" and 1/4". It will also give the number of strands required for each of the rubber widths.

For example, I entered numbers for my Mike Midkiff designed P-51. The wing area is 188.3 square inches and the weight without the motor is 113.6 grams. I entered 35% for the desired motor weight. I entered 18" for the hook-to-peg distance, and 1.7x as the desired final motor length (before braiding).

From this, the spreadsheet showed a wing loading of 0.60 grams/square inch without a motor, and a predicted wing loading with a motor of 0.77 grams/square inch. It also showed that I will need 478" of 3/32" rubber to build up the motor (or 348" of 1/8", or 256" of 3/16", or 183" of 1/4"). I decided to go with 1 / 4", so the final motor will be 6 strands of 1/4" (3 loops). In other words, taking the 183" of 1/4", and forming it into 3 even loops will yield the desired motor weight and length. Something to note here: had I chosen to build the motor from 3/32" rubber, the number of strands came out to 15.6. Obviously, you will have to adjust to the nearest even number to build the motor (16 strands or 8 loops of 3/32").

The calculations are based on weight of the rubber (Tan Super Sport). I had carefully measured out 1 foot lengths of each of the rubber widths and weighed these strips with a gram scale. This yielded grams/inch for each of the rubber widths. These numbers are loaded into the formulas, so nothing has to be entered for this. I know there will be slight differences between rubber batches, but I feel the differences will be minimal. I know some of you with a lot of experience with spreadsheets can no doubt add to and improve this. Be my guest. This was a learning experience for me.

A final note: Some may object to the use of mixed measurement units rather than grams/square centimeter, or ounces/square inch. I used grams/square inch for convenience as 0.5 grams/square inch seems to be an accepted goal for scale Free Flight wing loading.

You can download Hodes' rubber sizing spreadsheet at www.freeflight.org