CHILTON'S CORNER from INAV
By Stan Chilton

PACKING IN THE TURNS

After you've built and tested your model the final moment of truth is when you wind the rubber motor before making your first official flights. If you don't get maximum turns in the motor, the other flyer who does may very well beat you assuming everything else is equal, torque, proper rubber size, rubber lube, etc.

In the last several years I have read about crystallization of the rubber motors, maybe caused by excessive stretching (or winding.) However, I have not been convinced enough to change my style of winding, because the bottom line is simply to get as many turns in the rubber motor as it will possibly take. I have experimented with numerous types of lubricant to facilitate not only getting the winds in but unwinding these same turns with the most efficiency. And I do know something is happening to Tan II more so than other batches of rubber and it very well may be crystallization, as it may break while winding, or on the model 35 minutes later. But don't lose sight of the goal, and that is to get the maximum turns consistently every flight. And every official flight is always wound to max turns regardless of how many are backed off to get the desired torque level.

It seems that every indoor modeler has their own particular method of trying to get the maximum number of turns into any given rubber motor. And it also seems that whatever method one uses, it is seldom talked about.

The situation is really very simple: If you can get 10% more turns into your motor you have a 10% advantage over your competitor. There ate many different ways to wind up a rubber motor. I will tell you how I do it although it may be technically flawed. For instance Jim Clem doesn't stretch out the motor as far as I do. He feels that max stretching causes crystallization of the atomic links of the rubber. Yet i've seen him crank in over 5000 turns on a Federation ROG!

Following is how I wind a motor that I want to put in absolute maximum turns, under these assumptions:
1) The motor has previously been fairly well broken in or stretched to 90% length for 5 minutes and
2) the motor has been lubed with a proven rubber lubricant, preferably with silicon in it.
3) Calculate from a winds chart how many turns this particular motor should take. (For our illustration here we will assume 2000 turns max.)
4) It is helpful to install a brake on your winder so you can hold the winder in your one hand without the danger of free wheeling and losing turns, especially under higher turns and torque.
5) Create some sort of winder-torque meter set up where you can establish a model's hook to hook distance between the winder and the torque motor. The set up must allow the winder to be latched or held firmly at the hook to hook distance but at the same time be easily removable for winding and transfer to the model.

Now for the actual winding. Stretch the rubber loop as far as it can be stretched just short of breaking it. For Tan II this stretched length is close to 10 times the original motor length. Of course the anchored end of the motor is hooked to the torque meter. Do this by holding the winder with motor hooked to it in your right hand and feeling the rubber tension with your left hand.

Now start winding slowly. At about 40 turns (the 2nd winder turn) start coming in as you continue to wind. Keep the rubber slack enough that it doesn't tighten up and break. Put in 500 turns and stop.

A - With your right hand holding the winder again and left hand feeling the rubber, back out (stretch) the motor and again to the max, just short of breaking.

B - Then start winding slowly and coming in at the same time. Put in 300 more turns. Start watching the torque closely now and come in just enough while winding to keep the torque from increasing.

Repeat paragraph A and once again put in 300 turns in the manner described in paragraph B.
At this point while alternating winding, relaxing and stretching drop the turns put in in each cycle to 100.
As you approach 1800 to 1900 turns you will notice the torque increasing in spite of coming in. The torque will increase dramatically as you stretch the motor back out as far as it will go.

The last 100 turns may be put on in 2 cycles of 50. If the motor now appears to be able to take more turns than your chart shows to be the estimated max turns put additional turns on as you think you can get away with, but never more than 100 at a time.

When you feel absolute max turns has been reached your rubber motor length should be at the model hook to hook distance. The motor tension at this point should be fairly tight at the hook to hook distance.
Back off the required turns to your desired torque immediately upon reaching max winds. The winder may now be placed in its stand, or jig with its unwind brake on and the wound motor in place between the winder and torque meter ready for transference to the model.

As you are winding you occasionally notice two things: 1) Knots grapevining out perpendicular to the motor, (Dick Hardcastle calls it "zinging out the side") and 2) Locations along the motor where there will be knots on knots where a heretofore even row of knots bunches up in clumps. Both of those situations occur mostly when you are coming in while winding or nearing max turns.

Here again hold the winder in your right hand and I knead, separate & massage the rubber motor knots with your left hand so you end up with as evenly wound motor

possible. I feel that the rubber gets overstressed and is more likely to break at the knot on knot areas.

Some motors of equal size, length and weight will grapevine and knot on knot much easier than others. Discard these motors when making a serious flight. Causes for the unevenness may be a varying density of the rubber or a varying width or thickness of the strands.

When making an official flight, I always try to have at least 3 identical motors broken in and ready to wind. This allows you to continue to get a flight in spite of a broken first motor.

My technique of winding is similar to that described by R.W. New in the 1989 Free Flight Forum of the Model Engineers Exhibition, London, England. He described his winding technique as the "relaxation method, " but he does not stretch the rubber as much as I. He holds the stretch to not more than 5 to 6 times the motor length, similar to Jim Clem's winding. But he did not have Tan II rubber.

There are two more points to point out in order to get maximum turns.
The first point is to make sure your torque meter's shaft and indicator needle is free and does not bind or drag. I have ball bearings in my torque meter but they are not absolutely necessary.

Once I was breaking motors almost every wind up, sometimes not even close to max turns. I noticed my indicator needle was dragging on the plexiglass face and causing it to jerk erratically. When I freed up the torque meter, I stopped breaking motors.

The second point is 100% mental concentration. Before beginning to wind the motor be sure you have no questions lingering in your mind about your model's adjustments.

When commencing winding, the only thing in the world to think about is your winder, the rubber motor and the torque meter. Focus and concentrate on the winding of the rubber motor.

It requires extra concentration if you have a talkative timekeeper, especially one who likes to tell jokes to other spectators just a few feet from where you're trying to get max turns on a motor!

If someone walks up and asks me questions while I'm winding I invariably will quickly break the motor. So to get max turns shut out every thought except that of winding the rubber. Do not hurry, the rubber motor isn't going anywhere. But it does take effort to coax maximum turns into the rubber motor, not physical effort, but total focusing of one's concentration toward getting the most turns in the motor. Always remember if you never break a motor going for maximum winds you are probably underwinding. (Or you have some super rubber, in which case call me collect.)