Helicopter Flying - A Simple Approach - New for 2025/26: link to helicopter winding video!
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Revised September 2025

This resource is intended to be a launch point to help you get started with flying your helicopters when you are finished building. Once you are comfortable winding and flying, and have optimized your flights with these tips, you can move on to "Next Level Helicopter Flying", another resource on the NFFS website.

General Observations for Helicopter Flying

1) Helicopter flying is significantly different than airplane flying! Helicopter motors are typically wound up much harder than airplane motors, and there is little trimming involved.
2) **Gym time for flying practice is not necessary for helicopter.** Any ceiling height is workable, though a smooth ceiling free of significant obstructions is best. You can fly in a living room, classroom, school hallway etc.
3) Since you don't have to worry about hitting the ceiling, you can wind a lot harder, and put many more turns on the rubber. More turns = more stored energy = longer flights!
4) Data collection is essential to make sense of what you are doing. A good starting point is the Basic Helicopter Data Log Template, also on the NFFS website.

Rubber Selection and Target Turns

5) Your kit probably supplied you with a length of 1/8" rubber. Start with a motor (loop) length as recommended by the kit. If there is no recommendation, you can start with a motor length of 3-5 cm longer than the hook-to-hook measurement of the helicopter. For the helicopter that I'm flying, that's a 35 cm loop.
6) Being conservative, you can wind 1/8" rubber to about 31 actual turns* per cm. (This is 70% of maximum, per the spreadsheet calculator described in the Next Level Resource. For my 35 cm loop, that is 35 X 31 = 1085 turns. I have a 15:1 winder, so 1085/15 = ~72 winder turns**. **This is my "target", the number that I want work toward in the techniques below.**

   * An "actual" turn is one 360 degree twist of the rubber. Each "winder turn" results in 15 actual turns winder.

   ** Adjust this number according to your actual loop length and winder ratio.

7) Be sure to lubricate the motor before winding it. This will greatly increase the life of your motors. Use a silicone based lube such as Armor-all, or similar, without petroleum based ingredients, which will degrade the rubber!
8) Before you wind, record the width, loop length, and motor mass in your Helicopter data log. For an example of a log to get you started, see the Basic Helicopter Flight Data Log, which includes columns for these three parameters.
9) It is highly recommended that you **wind the rubber off of the helicopter,** then transfer it to the copter to fly. This is particularly important to avoid damage in case the rubber breaks. (Details of how to make the winding "stooge" shown in the video are shown at the very end of this document.) Hook the o-ring at one end of the loop* in place, with the other end on your winder.

   * Knot should be in the middle of the loop if your helicopter has hooks on both rotors. If one end is attached to a hook on the fuselage, you will want the knot on that hook, so put the knot at the far end when winding.

Winding

Although the use of a torque meter is highly recommended, the procedure below will assume that you don't have one. I recommend that you read through the instructions below **before** you look at the linked video which illustrates the winding procedure.

10) Stretch the rubber out to approximately 4-5 times its un-stretched length. For my 14" loop, that's about 5-6 feet. Stretching the rubber while winding helps to reduce the formation of knots, which limits how much energy you can store. Stay at this position while you wind half of the target turns, half of 72 = 36 winder turns, per step #6. **It is important to keep the winder shaft parallel to the rubber loop as you wind, to avoid damaging the gears!**

11) Then, continue winding as you approach the restrained end. Your goal is to finish the 72 winder turns when the motor is the same length that it will have when mounted on the helicopter. If you made a winding board like the one shown in the video, you can mark it at this distance so you know where that is.

12) Record the turns to which you wound in your log. If you didn't back off any turns, put the same number in both maximum and launch turns columns, If you backed off, you can subtract backoff turns to get launch terms. **It is essential to keep good records in your log!**

13) That's it, and now you can mount the rubber on the helicopter. If you find that the wound motor is so tight that you have difficulty mounting it on the helicopter, you can back off 1 or 2 winder turns. If you continue to have difficulties keeping a good grip on the tightly wound, lubricated rubber, you may want to consider a pair of hemostats. To help in mounting a tightly wound motor, use the hemostat to grip the rubber just behind the o-ring. Once gripped, rotate a bit to release tension on the o-ring end, and it will slip right off.

Optimizing the Loop length

14) SO airplane events usually limit the rubber motor to a mass of 1.5 or 2.0 grams, **Helicopter for 2025-26 has no such limit.** The general objective is to determine the optimal trade-off between a longer motor, which can store more turns (and more energy), and a shorter motor, which has fewer turns, but also less mass for the stored energy to lift.

15) Using a motor wound as above, launch the helicopter and time the flight. Wind and fly until you are confident that you have a representative time for this motor and winding parameters. **Be sure to record the numbers for every flight in your flight data log!**

16) Next, make a motor that is about 0.2 g heavier than the previous one. For 1/8" rubber, this will make the loop about 1.5 inches longer, so you'll need to cut a piece of rubber about 3 inches longer. It doesn't have to be exact, just make sure that you carefully measure the loop length and mass of the finished motor and record the numbers in your log.

17) Using the loop length that you measured in the previous step, determine the new target for winder turns like I did in step 16. Fly this motor a few times, stretch winding like you did the first loop, but use the new number from step 23 as your new winder turns target. Compare the average flight times. If they are better, increase the motor mass an additional 0.2 g, and keep increasing it until times start to decrease. If they are shorter, tie a new loop 0.2 g lighter than the original motor, and decrease the mass until times start to decrease. In this way, you can determine the optimum mass/length of motor for 1/8" rubber, or whatever other width you started with.

Going to the Next Level

18) Following the procedure above should result in pretty decent times, depending on the design and construction of your helicopter. However, there is still room for improvement. For example, you can wind harder (more than 31 actual turns per cm) than the conservative approach suggested here. A torque meter is very useful for this, as it can help to avoid overwinding and breaking the rubber. A meter will also help with consistency, to compensate for the fact that the loop will stretch slightly with each hard wind, requiring more turns to reach the same result.

19) Another simplification that was made here was to overlook the fact that the density of the rubber strip can vary a bit at different points along its length. As a result, two motors of the same mass, tied from the same marked width of rubber, will vary slightly in loop length. For this reason, a more advanced technique is to characterize the motors in terms of linear density (g/cm or g/in), the mass divided by the length of the rubber strip that was used to tie the loop. This will help to zero in on the optimum motor for longest flights, and to improve consistency. The use of linear density is described in the Next Level Helicopter Flying document, found on the NFFS website.

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Winding Stooge: You can easily make this simple device so that you can wind the rubber separately, which will reduce the chances of breaking your helicopter if the rubber breaks, or if you and your partner pull it in different directions. All you need is a couple of pieces of scrap wood and a cup hook, a common hardware store item. The block is held in place with two screws that extend upward through the bottom side of the base board.

The longer end is about the same length as the rubber when mounted on the helicopter, as shown. The other end can be clamped to a table or other surface, if one is available, or your partner can hold it down to the floor with their foot, if there is nowhere to clamp it.

