2024-25 Science Olympiad – Basic Helicopter Design & Construction
By Coach Brian Turnbull for the NFFS, September 4, 2024

Helicopter Design & Construction

What is the best helicopter design?

- If you are new to the event or have a limited amount of time, build a proven good performing design.
- If you have an experienced coach and have a significant amount of time for flying practice a custom design can be considered.
- Success in the flight events is 20% design and 80% flying practice, motor winding and recording data in your log for analysis.
- You can be very successful flying a proven design without customizing.

Should I build a kit or from scratch?

- If you are new to the event and/or have limited time, build one of the excellent kits on the market.
- A "best kit" depends upon build time available and your objectives. A top-level kit can take 8-12 hours to build and will get longer flights. A mid-level kit will take 2-6 hours to build and will fly lower times.
- If time is limited, less time building and more time practicing is recommended.

Kit Manufacturers

- Freedom Flight Models – Top level kit with excellent written and pictorial instructions; a little more expensive and more challenging to build. Helicopters are not shown on the website yet, but should be available soon. Use the "contact" on the website to inquire availability: https://www.freedomflightmodels.com/
- J&H Aerospace - Top level kits with excellent video instructions; a little more expensive and more challenging to build https://jhaerospace.com/product/tornado2025/
- Guru Engineering – Good medium-performance kits; less expensive https://www.guruengineeringtech.com/high-school-helicopter-kits-and-supplies
- Laser Cut Planes – Good medium-performance kits; less expensive and easy to build; Helicopters not shown on the website yet, but should be available soon: https://www.lasercutplanes.com/
- Wards Scientific – Build materials; official kit supplier of Science Olympiad

Simple Scratch Build

- Here is a build video for a relatively simple helicopter from 2014. The design only needs a couple of very minor changes to meet the current 2024-25 Science Olympiad rules. Be sure to read the video description for changes and suggested. A link to the detailed plans for building are included in the video description too: https://youtu.be/H79HbruDXiQ

Complex Scratch Build

- For a more complex, higher performing custom design, you could include elements from these helicopters. These are plans and notes for AMA class helicopters that weigh less than 1.0 gram. Possible sources for ideas though:
    - See page 32 of this for Jim Richmond's helicopter: https://indoornewsandviews.com/wp-content/uploads/2012/10/winning-indoor-designs.pdf
    - https://indoornewsandviews.com/2016/08/27/bill-silins-national-championship-helicopter/

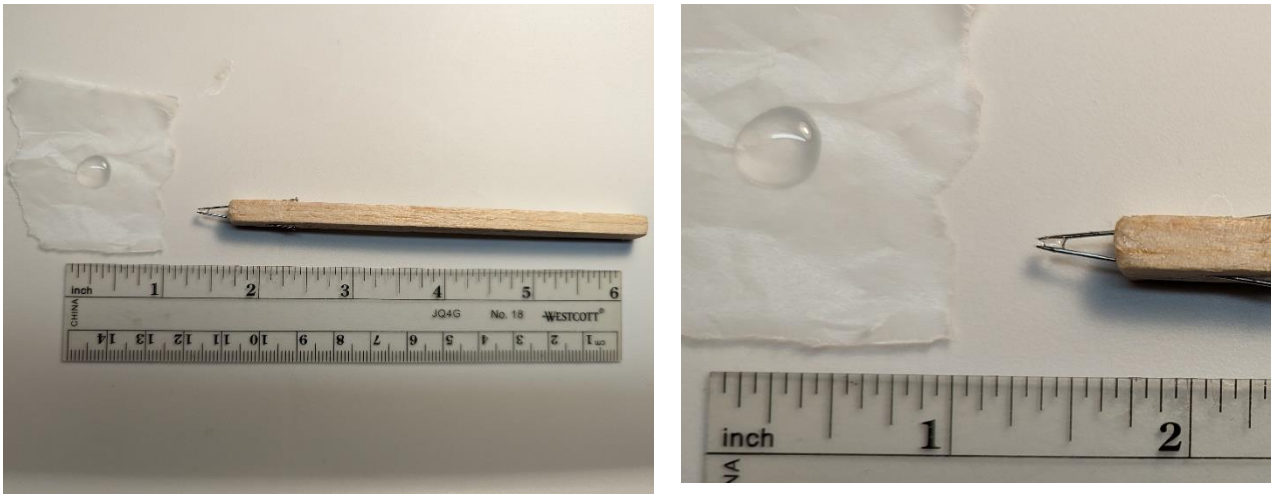
What else do I need to start? What glue should I use? Tips, etc.

- Read the kit instructions twice before starting. Ask questions in the Scioly.org forum here for quick help from experts: https://scioly.org/forums/viewforum.php?f=452&sid=af44a2068789cb71a71df86c331f68da
- Build with accurate alignment and with "gap free" joints.
- Good quality fresh cyanoacrylate (CA or "super glue") for almost all joints. Fresh glue will bond in seconds. Glue that has been sitting on a store shelf for a year will not work. "Thin" CA if carefully applied to accurate joints can be a little lighter. "Medium" CA is also fine.

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Helicopter Design & Construction (cont.)

- Make a simple CA glue tool as pictured below to apply the correct small drop to each joint. Applying glue directly from the bottle adds 5% or more to the airplane weight. Put a medium sized blob of glue on a small square of wax paper and pick up a tiny drop with the tool for each joint.
- Duco Cement is also handy for joints that you need a little time to position. This is a very light and strong glue that dries and cures slower than CA. This you can buy at most hardware stores.
- 3M77 spray glue for attaching ultrafilm flying surface covering, or Elmers, UHU or Gorilla Glue glue stick to attach tissue to flying surfaces. This you can buy at most hardware stores.
- You can build on any flat surface, but a foam project panel is handy and available from the most hardware stores like this https://www.homedepot.com/p/Project-Panels-Formular-1-in-x-2-ft-x-2-ft-Rigid-Foam-Board-Insulation-Sheathing-PP1/203553730
- Another build board option is Hobby Lobby foam core board. Provides a smoother surface than some hardware store boards; 7/16" thick, https://www.hobbylobby.com/art-supplies/painting-canvas-art-surfaces/foam-board/extra-thick-foam-board---20-x-30/p/101650



Figures 1-2: Simple glue tool; 1/4" sq x 4.5" balsa with pins.
Correct size glue drop picked up by capillary action.