

How to Build Your Own CD Spool Rocket

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The CD Spool Rocket at first look appears to break a lot of basic rules of rocketry, not to mention get you some inquisitive looks from other rocketeers when you tell them it's a rocket! I can assure you its lightweight, high drag, low altitude, tumble recovery design allows you to see the entire flight & still have a short walk to retrieve it, even on windy days. The spool design is influenced very little by winds during the upward portion of the flight, making for some of the straightest flights you'll ever see and will normally backspin (or in extremely calm weather glide safely to the ground), always landing in close proximity to the launch pad.

GENERAL RECOMMENDATIONS:

- Long burn motors provide the most enjoyable flights. I would not recommend anything with greater thrust than an E9. I don't know if the CDs could handle any more stress than that.
- Expect about 250ft with the 18mm kit built per the instructions below when using standard sized CDs (4.75in diameter) with a C6-x (any delay is acceptable but a short one is best so that the ejection charge blows before landing). If you manage to find the 3in diameter mini-CDs, altitude can reach 500ft with C6-x motors. Only launch the 18mm kit with a 1/8in launch rod.
- Expect about 200ft with the 24mm kit built per the instructions below when using a D12-x (any delay is acceptable but a short one is best so that the ejection charge blows before landing). Only launch the 24mm kit with a 3/16in launch rod.
- I prefer not to use (nor recommend the use of) CA for attaching the CDs to the tubing. My experiences have shown that CA causes the plastic to become very brittle & therefore more susceptible to damage on impact. It doesn't mean that you can't use it, just expect to repair/replace the CDs more often...that's all.
- The CDs will still have quite a bit of flex even after the CA/epoxy cures. This is a GOOD thing because while the CDs provide stability during the upward portion of the launch, they act as the recovery device too. This flexibility will help absorb & dissipate the energy of impact (even though it will almost always come down very gently in a twirling backspin).
- By building the CD Spool Rocket with the painted side facing away from the body tube, it will allow for easier cleaning of any ejection residue.
- If you do not install a motor hook, it's quite likely that the motor will kick from the rocket on ejection. Either friction fit the motor with masking tape or track the motor if it kicks.
- When building the 24mm kit, you can make the rocket "reversible" & fly it backwards! The body tube is just the right length so that the motor block will accept Estes D12 motors in one end or Estes E9 motors in the other end. Using 2 motor clips (one for each length of motor is again optional).

RECOMMENDED MOTORS:

- 18mm kit: A8-3, B6-4, C6-0, C6-3, **C6-5**, C6-7

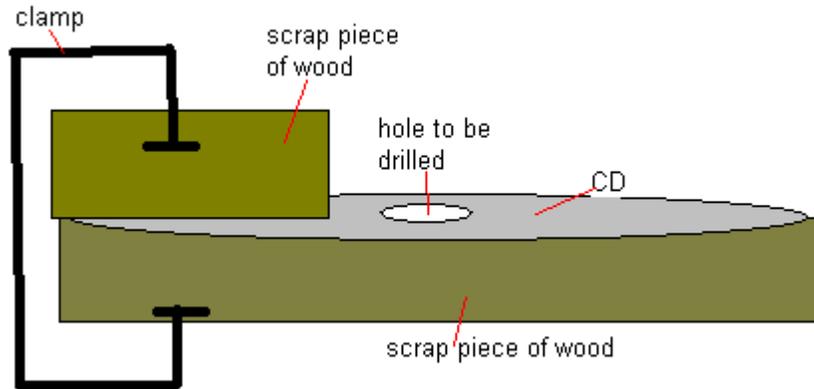
- 24mm kit: D12-0, **D12-3**, D12-5, E9-P, E9-4, E9-6
(Motors in bold are the only ones I've used personally but all listed should work successfully.)

ITEMS & TOOLS NEEDED:

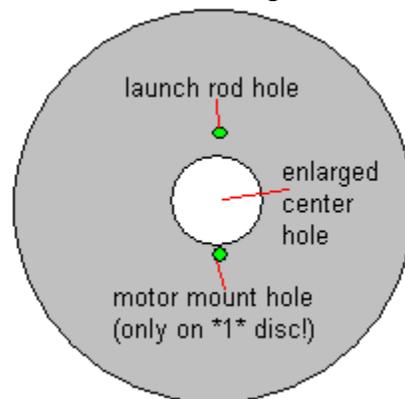
- One pair of AOL CDs (can be picked up at many popular department stores, the post office, & often in your own mailbox)
- Power drill or a drill press
- Small clamps and/or vise
- Scrap pieces of wood (like a 2x4 or 1x6)
- If building a 18mm MMT rocket, you will need
 - 3/4in paddle blade drill bit
 - 5/32in standard drill bit
 - One 4in piece of BT-20 tubing (or equivalent)
 - One BT-20 motor block (can be substituted by a 1/4in sliver of used 18mm motor casing soaked in CA or epoxy to prevent it from unraveling)
 - An 18mm motor casing (can be used or new)
 - OPTIONAL: Metal motor clip to prevent motor ejection.
 - OPTIONAL: Masking tape to hold metal motor clip in place.
- If building a 24mm MMT rocket, you will need
 - 1in paddle blade drill bit
 - 7/32in standard drill bit
 - One 5.5in piece of BT-50 tubing (or equivalent)
 - One BT-20 motor block (can be substituted by a 1/4in sliver of used 18mm motor casing soaked in CA or epoxy to prevent it from unraveling)
 - A 24mm motor casing (can be used or new)
 - OPTIONAL: Metal motor clip to prevent motor ejection.
 - OPTIONAL: Masking tape to hold metal motor clip in place.
- 150 or 220 grit sandpaper
- CA (Cyano Acrylate, a.k.a. "Super Glue"), 5 or 12 Minute epoxy, or JB Weld (& any mixing utensils/devices as required)
- White glue
- Wax paper
- Pencil
- 1/8in and/or 3/16in launch rod

INSTRUCTIONS:

- 1) The center hole of the CD needs to be enlarged to fit the desired MMT. Clamp the CD between a couple scrap pieces of wood being careful not to apply too much pressure to the disc—you just want to hold it in place, not crack it!—so that the center hole is exposed for you to drill into. It is suggested that you have a piece of wood behind the CD to help absorb the pressure of the drilling process. See diagram below.



- 2) Clamp CD to your workspace to keep it from moving during the drilling process.
- 3) Insert the appropriate sized paddle bit (3/4 or 1 inch) into the drill. Make sure that the drill bit is centered over the hole. You want a high rotational speed & light downward pressure when drilling to prevent the CD from cracking. Drill the hole. Take your time with this step. [NOTE: Discard any CDs that contain any cracks.]
- 4) Repeat steps 1-3 for the second disc.
- 5) Swap the paddle bit with the appropriate sized standard drill bit (5/32 or 7/32 inch).
- 6) Drill launch rod hole in BOTH CDs, again with high rotational speed & light pressure. (You can even drill through both CDs at the same time to ensure that they are lined up properly.) The launch rod hole should be within 1/4in of the center hole. Then on ONLY ONE CD, drill another hole on the opposite side of the center hole that is also adjacent to the center hole so that the optional motor clip can flex. You may need to “clean up” or widen the hole slightly with a razor knife so that the clip can fit inside. See diagram below.



- 7) Remove clamps/wood from all CDs.
- 8) Cover your workspace with a sheet of wax paper to contain any potential mess with the CA/epoxy (further referred to as “adhesive”).
- 9) Cut your tubing to the correct length if you have not already done so. Test fit your tubing with the center holes in the CD. They might be slightly loose. This is OK & will allow the adhesive to get between the inside edge of the CD & body tube and/or possibly create a fillet on the outer edge of the CD Spool Rocket.

- 10) Mark a straight line down the length of the tubing. Use an Estes marking guide or a doorframe to help draw a straight line. This will be used to help line up the launch rod holes when attaching the CDs.
- 11) Use the sandpaper to scuff 1/4in around the body tube hole on the shiny side of both CDs to help give the adhesive “bite”.
- 12) Mix the epoxy & attach one of the CDs to one end of the tube with the shiny side towards the middle of the rocket (facing the body tube). Make sure of the following when applying adhesive to the CD:
 - a. Line up the launch rod hole with the straight line marked on the body tube.
 - b. Do not get adhesive in the launch rod hole and/or motor clip hole.
 - c. Check that the body tube is perpendicular to the CD.
 - d. You can be generous with the adhesive. Ensure that there is a good fillet on the body tube & CD. The overall weight of the CD Spool Rocket is very light & flight will not be affected with a little extra adhesive.
 - e. Allow the adhesive to cure fully before proceeding. The wax paper will allow the adhesive to soak up into any gaps between the CD & body tube. Don't be surprised if it even creates a small, flat fillet on the outer part of the CD. This will only make the attachment of the parts stronger!
- 13) Attach the other CD to the other end of the body tube. Follow the guidelines in Step 6 for attaching the second CD. After the adhesive finishes curing, you can test alignment with the appropriately sized launch rod. The rocket should slide easily along the launch rod.
- 14) Spread a reasonable amount of white glue inside the body tube from the aft end of the rocket. Put the motor block in the aft end & push it into place with an empty motor casing until 1/4in of the motor is left sticking out of the motor tube. *Quickly remove the motor casing.*
- 15) OPTIONAL: Measure & cut a 1/8in slit in the body tube inline with the notch in the CD for the motor hook so that 1/4in of the motor extends out of the body tube.
- 16) OPTIONAL: Put the motor hook into place & secure it in place with 2-4 wraps of masking tape about one inch from the aft end.

FOR THOSE WITH A DREMEL (& without a drill press):

Steps 1-4 can be performed alternately by using a sanding drum or grinding wheel attachment on a Dremel (or other rotary power tool). Sand at low speed & just a little bit at a time, slowly widening the center hole. Sanding at high speeds will cause the plastic to melt & create undesired results. Launch rod holes (Steps 5 & 6) can be created with the appropriate sized drill bits in a Dremel, other rotary tool, or power hand drill as well.

VARIATIONS ON A THEME (other semi-successful CD spool rocket designs):

- *Single CD with 18mm MMT* – Believe it or not, this one can be built any of 3 ways: with the CD on the forward end, the CD anywhere along the middle, or with the CD at the aft end. See the “Stability Concerns” section below as to why this works. Also, a launch lug is needed to provide directional stability when launching a spool rocket built with only one CD. On a personal note, I find recovery on a single CD spool rocket to be not as graceful, although faster (but still safe) descent, for recovery. This design is as sturdy as a dual disc rocket.

- *Spool design with 13mm MMT* – This one is perhaps the most complicated to build. Performance set a new personal low altitude record for me. Built with 2 standard sized CDs & flown on an Estes A10-PT (Blurzz) motor, I would say that it stayed under 30 (yes, thirty) feet. With 3in mini-CDs & the same motor, I would expect altitude to be in the 60-75ft range. I also would only recommend flying this design where it can land on a soft (grassy) surface and on calm weather days only because of the stress put on the BT-5 tubing. The key to building this design is adding thickness onto the BT-5 tubing so that there are solid attachment points to the CDs.

FINISHING:

- None required. You could paint the body tube but it is not necessary.
- Sometimes I have found that epoxy (but not CA) can soak into the edge of the tubing causing it to swell & make motor insertion/removal difficult. Allow the epoxy to cure fully & then sand the inside edge of the tubing with 400 grit sandpaper to resolve this. Lightly sanding any burred edges of the motor casings with sandpaper should help too.

RECOVERY DEVICES:

None required. The CD Spool Rocket should be visible for the entire flight & with its lightweight design, will recover by either a rapidly tumbling backspin or (on extremely calm days) a gentle, angled glide.

STABILITY CONCERNS:

Spools, both single & dual disc designs, are very stable if not overstable. With the CD spool rocket, the center of gravity (CG) is pretty much in the center of the motor (since the overall design is so light). The center of pressure (CP) of a flat disc, like a CD, traveling perpendicular to its edge is 1.33 diameters behind the forward edge of the disc. In other words, in a CD spool rocket built per the main instructions with standard CDs & a 4 inch BT for 18mm motors, the CP is *at least* 6.65 inches from the forward end of the rocket—yes, that's right...the CP is over 2 and a half inches *behind the aft end of the rocket*, therefore always guaranteeing a stable CG/CP relationship!