PEAK OF FLIGHT NEWSLETTER

ISSUE 463 | Februrary 20th, 2018

IN THIS ISSUE

Compact Baffle for a Short Rocket

www.ApogeeRockets.com/Rocket_Kits/Skill_Level_3_Kits/Space_Ark_Jr

Apogee Components, Inc.
Your Source For Rocket Supplies That Will Take You To The "Peak-of-Flight"
3355 Fillmore Ridge Heights Colorado Springs, Colorado 80907-9024 USA
www.ApogeeRockets.com e-mail: orders@apogeerockets.com Phone: 719-535-9335 Fax: 719-534-9050

PEAK OF FLIGHT

Compact Baffle for a Short Rocket

By Mike Moran

If you're anything like me, you like to launch a lot of rockets at your club's monthly launch. And, like me, you don't want to spend lots of time prepping your rockets or pouring tons of wadding down them. To reduce that prep, I've been installing baffles in almost all my rockets. Not only does it save me time and money by not using wadding, it also reduces the wear-and-tear on my chute, shroud lines, shock cord, and Kevlar line. Seriously, it is an amazing difference! Most of the recovery materials in my baffled rockets still look brand-new.

In terms of flight stability, most baffles are mounted near the front of the rocket, adding a little forward weight, all while keeping the recovery laundry nice and close to the nose cone. I personally feel the latter is the single biggest reason for the reduction of recovery failures. Chutes and cords are much less likely to get stuck in the tube.

Most baffles are installed during the rocket build, but many have been retrofitted to older kits. I use all sorts of baffles, depending on the application: half-moon, dual strainer, vented-cone, in-line, etc. Even my BT-20 tube rockets have them. Some are prefabricated such as those from Apogee Components at https://www.apogeerockets.com/Building_Supplies/Parachutes_Recovery_Equipment. Some are home-made and, contrary to some, I've found both to be very reliable and effective. The data from my club's launch records prove it: for 2015 and 2016, I had 66 total launches with zero failures. Using 13, 18, and 24mm motors, I launched 25 different rockets, and all but one had some type of baffle. One design I have used that I find to be very versatile, especially on large tube rockets, is the flute and strainer type.

This is basically a vented stuffer tube that is an extension of the original engine mount tube with a strainer ring and a stopper attached to its forward end. What's neat about this design is that it uses the area between the engine and the baffle for venting, thereby saving body tube area up front for the recovery materials. The stopper also acts as a solid bulkhead, allowing you to use an eye bolt to secure the shock cord. It's great for short rockets with large body tubes, and on long rockets, the flute and strainer baffle can also serve as a stuffer tube to help maintain the ejection pressure. Not to mention it's fairly easy to install. On a short rocket, though, things can get a little trickier.

Some considerations when installing a baffle are the minimum distance required between the engine and the baffle, maintaining enough room between the baffle and the nose cone shoulder for the recovery materials, and providing sufficient venting area on the baffle. Some rule-of-thumbs I have heard for these include at least 3.5 inches of distance between the engine and the baffle, at least 5 inches of body tube between the baffle and the nose cone shoulder, and matching or exceeding the vented area of the baffle to that of the engine tube. I know there are other formulas out there, but I have used these successfully many times. However, some prefabricated baffles only have venting area about 50-75 percent of the engine tube area, depending on the engine application, so I'm not so sure about the vent matching requirement.

But with that in mind, let's do some quick figuring. The 3-inch diameter body tube for this rocket is 17 inches long. So after 4" for the engine mount, 3" for the nose cone shoulder, 3.5" for the distance from the engine, and 5" for recovery materials, I'm left with only 1.5 inches of body tube to build a baffle! Not gonna work.

Continued on page 3

About this Newsletter

You can subscribe to receive this e-zine FREE at the Apogee Components website **www.ApogeeComponents.com**, or by clicking the link here Newsletter Sign-Up

Newsletter Staff

Writer: Mike Moran
Layout/Cover Artist: Chris Duran
Proofreader: Will Franks

Compact Baffle for a Short Rocket

Continued from page 2

So here's where the flute and strainer baffle comes in handy. With its net length of 4.25 inches, it will still meet or exceed the first two considerations.

Now let's figure the venting requirement for the flute and strainer baffle. The flute will be vented with holes using a standard paper punch (**Figure 1**) and revolving punch pliers (I have tried drill bits and hobby knives, but these work best). This rocket uses 24mm engines, so the area of the motor tube opening is about 452 square mm (12mm x 12mm x Pi). The paper punch cuts 6mm holes, which have an area of about 28 square mm (3mm x 3mm x Pi). So I'll need about sixteen 6mm holes to match the 452mm^2 of the engine tube. I'll also use the revolving punch pliers (**Figure 2**) because it has a longer reach, allowing me to add a second row of eight 4.8mm holes above the 6mm ones, thereby exceeding the 452. Now putting that many holes in a BT-50 tube is not that tough to do when you have a long piece of tube to work with. But when you're trying to keep close to the 3.5-inch minimum rule, a tube that short with that many holes would render the flute tube weak and flimsy.

Figure 1: Using a standard paper punch to cut 6mm holes cleanly into the flute tube.

Figure 2: Using revolving punch pliers to cut 4.8mm holes for a slightly longer reach into the tube.

Continued on page 4

Compact Baffle for a Short Rocket

Continued from page 3

So, to get around this little problem, I'll put a BT-55/BT-50 centering ring around the tip of the original motor mount tube (**Figure 3**) and then put a 5-inch length of BT-55 tube over that.

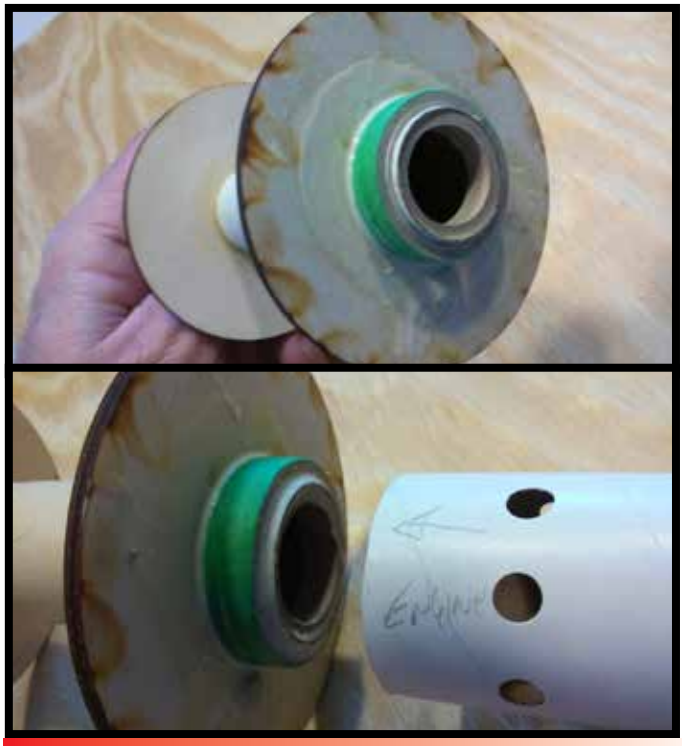


Figure 3: Place a centering ring on the edge of the motor mount tube and then place the flute tube over that.

Now I can use the larger tube for my flute with about 37% more surface area to work with. All the necessary vent holes will fit just fine now and still be sturdy. I made sure to punch holes in both ends of the flute tube (**Figure 2, Page 3)** since neither tool will reach up further than an inch and I'll also need to keep the holes at least ⅜ inch from the engine end to clear the centering ring, and about ⅝ inch from the forward end to clear the stopper. The stopper will be inserted into the flute about 4 inches from the engine, so that satisfies the distance requirement.

For the strainer ring, I'll use ¼ inch balsa sheets simply because that's the thickest stuff my revolving punch pliers will cut cleanly. I have used this thickness before and found it to be pretty strong, especially after reinforcing it with glue. I first trace the ring on the sheet using the centering ring that came with the kit and cut it out on a band saw. Then, I trace out a BT-55 circle in the middle and cut it out using a hobby knife (primitive, I know). Then I sand for fit.

The paper punch won't work here at all, so using the largest hole on my revolving punch pliers, about 4.8mm, the area of each hole is about 18 square mm (2.4mm x 2.4mm x Pi). I'll need about 25 holes to reach the 452! When punching holes in balsa (**Figure 4**), maintaining sufficient distance between the holes and from the edges of the ring is critical.

Figure 4: Use a revolving punch to cut holes in 1/4" balsa to create your strainer ring.

Continued on page 5

Compact Baffle for a Short Rocket

Continued from page 4

Too close and the balsa will splinter or even crack. So I'm only able to punch 14 holes on the ring, providing only about 252 square mm of venting area. This is only about 55% of what is recommended, so I added thirteen 4.8mm semi-circle punches on the outside edge of the ring. These will serve two purposes: they will leave glue on the inside of the tube for the trailing centering ring when installing the baffle into the rocket tube, and they will add another 117 square mm of venting, bringing the total venting area of the ring to about 82% of the engine tube area. While this doesn't meet the matching standard, it exceeds what most other prefabricated baffles have, so I'm comfortable with it.

For the stopper, cut a ¾ inch piece of BT-55 balsa coupler stock. I don't have any small eye bolts, so one option is to use an eye screw and attach it to the stopper by first screwing it in, then out, then in again with glue inside the threaded hole. This is commonly used for balsa nose cones, including large ones, so it should be strong. But I want just a little more confidence in the strength of the anchoring, so we'll use a small screw with a nut and washers. Drill a pilot hole using a pin-vise or small drill. I still like to use Kevlar cord here, so tie it to the screw and under the forward washer. Tighten gently and add a little glue to secure it (**Figure 5**). Measure and cut the cord so it will be just short of the top of the body tube. Test fit the stopper, then glue it in the flute tube about ⅝ inch. Make sure not to block any vent holes. Then tie on the shock cord.

Figure 5: Building the stopper piece and gluing it into place.

Continued on page 6

Check out our Facebook page
www.facebook.com/ApogeeRockets

Compact Baffle for a Short Rocket

Continued from page 5

With all the pieces cut, before I assemble the baffle, I'll reinforce all the surfaces with glue. I use a brush for the strainer ring and the outside of the flute, but the best way to do the inside is to just smear globs of glue and spread it with your fingers. Put some on the face of the forward centering ring since it will get blasted with heat too. When it's dry, you're ready for assembly.

Figure 6: Reinforce the strainer ring by brushing the surface with wood glue.

Fortunately, I read *Apogee Components' Peak of Flight Newsletter* regularly, and I recall reading an article in issue #418 that talks about damage to motor mount tubes in rockets with stuffer tubes. Although this flute is technically a stuffer tube, the venting relieves it of the expanding and collapsing pressures that some regular stuffer tubes are exposed to. But if you want the added protection, you can add a 3.5-inch protective sleeve (with the rear vent holes matched) over the flute like the one recommended in the article.

There are several ways to put the baffle together and into the rocket tube. One way is to assemble it from the middle of the rocket using a tube coupler. For a 17 inch main tube, you'll need to cut the main body tube in half about 6 ¼ inches from the top end. Set the short piece aside. You install the motor mount first with the BT-55/BT-50 centering ring already glue in place. Test fit the baffle assembly, the strainer ring should slide easily. Put a bead of glue around the centering ring and on the inside of the flute tube. Put the baffle assembly in from the top, securing the flute tube over the glued centering ring. Add a reinforcing fillet around the top of the strainer ring making sure not to block the outer vent holes. Test fit the coupler, and glue it in, keeping it about ¼ inch away from the strainer ring so as not to block the outer venting holes. Finally, pull the shock cord out and through, and glue the top tube onto the coupler. Roll the rocket on a table to keep the tubes straight and the glue even, and let dry.

Continued on page 7

Compact Baffle for a Short Rocket

Continued from page 6

You can also install the entire completed assembly into the tube from the bottom. Since I don't have a tube coupler, we will discuss this method here. With the motor mount fully assembled, test fit and then glue the BT-55/BT-50 centering ring over the forward end of the engine tube. Make sure to glue both sides for strength. Then spread a bead of glue inside the open end of the flute and slide it over the centering ring. Check to make sure the flute is flush and perpendicular to the forward centering ring. Add a reinforcing fillet around the outside and let dry. Next, glue the strainer ring about a ¼ inch down on the plugged end of the flute tube, making sure not to block any vent holes. Reinforce both sides with fillets (**Figure 7**).

Figure 7: Completed motor mount assembly

When dry, test fit the assembly so it slides easily into the body tube from the bottom. This may require quite a bit of sanding. You are now ready to glue the assembly to your rocket. It may also be helpful to bundle the shock cord during this process to avoid it sticking to any glue. Spread a heavy bead of glue around the inside of the tube just above the fin slots. I recommend Elmer's Carpenter Exterior glue here because it a has a little longer grab time. With the body tube turned upside down and making sure your motor hook is lined up with your launch lug line, push the assembly in from the bottom of the body tube in one smooth motion without stopping until the end of the motor tube is even with the body tube. It may take some fiddling with the rear centering ring to get it inside the tube. Pressing the rocket down on a work table or board can be helpful here. Finally, add a reinforcement fillet around the rear centering ring.

This baffle assembly will add little weight to the mid-section of the rocket. But since the weight of the 18-inch nylon chute and heavy-duty shock cord will be moving 5 inches forward in the tube, it compensates for some of that.

Once everything is assembled and dry, I like to do a bench test of the baffle. Prep you rocket like you would for a flight, except for the engine. Make sure the nose cone doesn't fit too tight. Using a 24mm engine spacer in the motor mount tube, use the "puff" method by blowing a short strong breath into the spacer. The nose cone should pop off. If it doesn't, check the nose cone again for fit, put the spacer in a little more, and make sure your breath isn't escaping during the test.

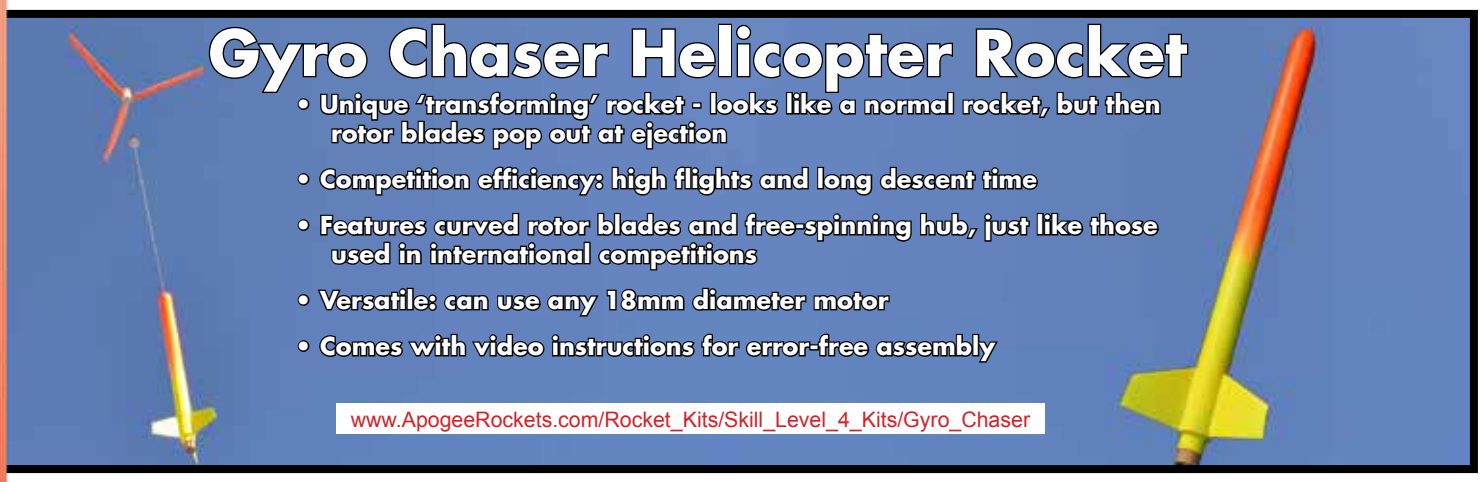
Continued on page 8

Compact Baffle for a Short Rocket

Continued from page 7

When it comes time to launch, you can sprinkle a little dog barf around the strainer ring to reduce the chances of singeing even more. After a few launches, with the spent engine removed, shake out any loose ejection particles from the bottom and top of the rocket.

Okay, so some of you may be asking, "why go through all that when you could just use a Nomex blanket https://www.apogeerockets.com/Building_Supplies/Parachutes_Recovery_Equipment/Reusable_Wadding and a lot of wadding?" And you're right, you could, but this is much cooler, more advanced method of dealing with rocket prep. It keeps your rocket parts looking clean and new and offers a challenge that simply stuffing wadding doesn't.

Mike Moran
Fox Valley Rocketeers
NAR Section #683
YORF: momo

Join Tripoli.org
Mention Apogee Components