Building a Better Bertha

The Estes Big Bertha has been a popular rocket for more than 30 years. For many rocketeers, it was their first big rocket, and it holds a special place in the hearts of countless BAR's. With three in my collection plus a BT-5 Baby Bertha and a Quest Big Betty, it is one of my sentimental favorites. I've had the one show here since circa 1970.

A recent article in the NAR's Member Guidebook illustrates bashing the Big Bertha into its nearly indentical twin, the Ranger. Key modifications include a 3-motor cluster. Another common mod is to install a 24mm motor mount.

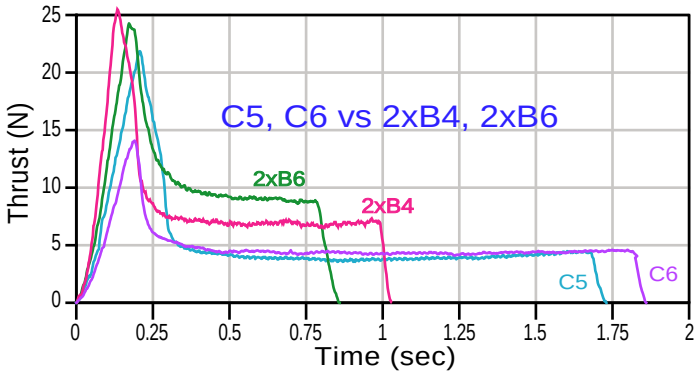
My regular Bertha (not shown) has a 24mm mount and has logged many flights on the Estes D12, but for small field flying, it is easy to use an adaptor and fly it on 18mm motors. Seems for me that that option results in marginal flights. On more than one occasion, the C and B motors have failed to completely eject the laundry resulting in core samples and repairs. On the other hand, D motors will easily overfly small fields such as the one at Bob Woodruff Park in Plano.

What would be ideal is a high thrust, low impulse motor to get the rocket moving quickly for stability while keeping the altitude down to an acceptable level. The forthcoming Estes C11 might be just the ticket, but they're not available yet. A pair of B6 motors might be a good alternative, too, and the double ejection charges should get the chute out with authority.

All this got me thinking: Is there a way to build a Bertha with changeable motor mounts? It would be great if a 24mm mount could be installed for club launches on large fields where D, E and F motors can be flown. A twin 18mm mount could be installed for small fields using two A or B motors, and a triple mount for Ranger nostalgia.

So, I began to analyze what would be required. The key would be a bulkhead at the forward end of the fin can section with a piece of 2-56 all-threads affixed. The engine mounts would all be built to mate to the all-thread so that the mounts could have postive retention. The mounts in turn would contain the necessary retention for the individual motors.

The entire modification kit is shown above. The motor mount length was set to 5 $^{7}/_{16}$". This will accomodate the 24mm F32 motor as well as 24mm RMS. The other two mounts were then set to the same length.



The thrust curves show the twin B6 motors to be the best combination for replacing either C motor. This should accelerate the rocket quickly and avoid the problem of weathercocking just off the rod which often occurs here in windy North Texas.

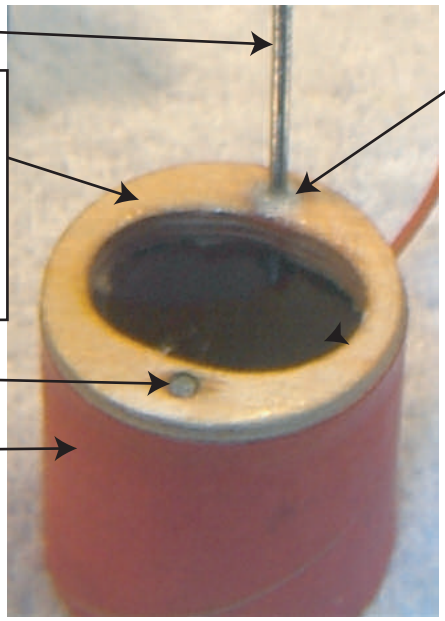
Two B motors will cost a little more than a C, but it's cheap insurance against core samples.

2-56 all-thread.

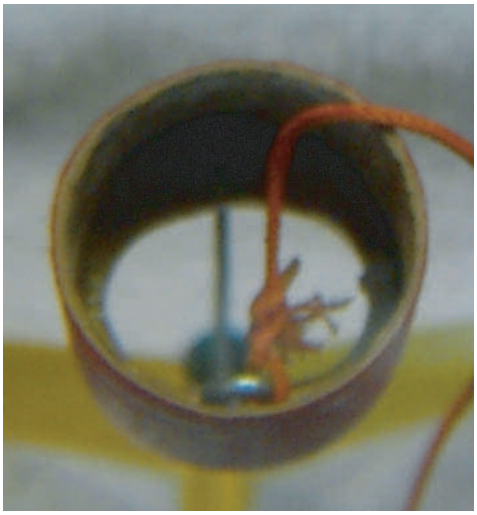
2 pieces of 1/8" birch ply. One is cut to i.d. of coupler. Other to o.d. Hole is enlarged to provide minimum resistance to ejection charges. Epoxy coated to resist corrosion.

Screw-eye (for recovery system) ground flush.

Standard Estes BT-60 coupler.

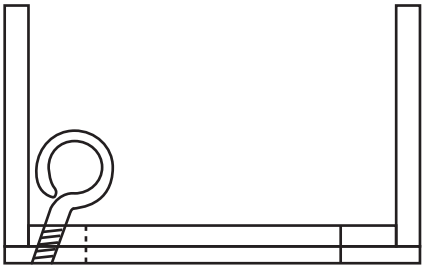


2-56 nut is countersunk flush with bulkhead. Both nuts are epoxied in place, and to the all-thread. Unit must withstand torque of repeated tightening and loosening without coming loose.

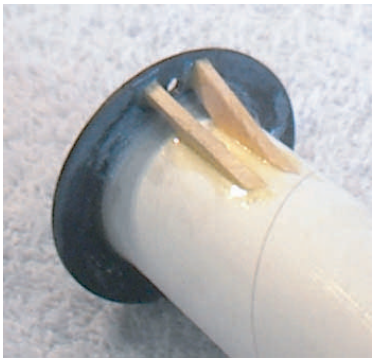


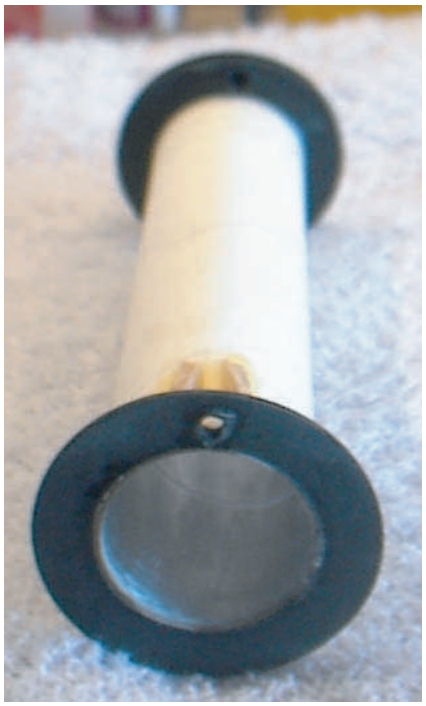
Kevlar recovery harness attached to screw-eye with three half hitches. A few drops of yellow glue will help keep it tied and prevent fraying.

Screw-eye secured with a few drops of slow CA in hole. Hole drilled at slight angle to make it make it easier to install screw-eye.



The 24mm motor tube was the easiest to make. It uses the heavy duty 24mm T-50mf from Totally Tubular and has a foil liner. Since this tube has a larger o.d. than standard BT-50, Totally Tubular also offers special fiber centering rings for it: CR-50mf-60.





Below: The assembled twin mount with retention nuts in place. Rod still needs to be trimmed to length.

In the event of an extra-powerful ejection charge, the aft ring may receive quite a jolt, so popsicle sticks were used to make these gussets and secured in place with yellow glue.

In the case of this mount, motor retention will be attached to the same 2-56 screw used for mount retention.

The next easiest mount is the triple 18mm unit. One key is getting the first two tubes glued together. It is important to place them on a flat surface to ensure they are parallel. After that, the third tube is glued to the valley between the other two. The nice thing about this mount is that three BT-20 tubes will fit perfectly inside the Bertha's BT-60. The forward ring is optional. Here, it is another CR-50mf-60 and was CA'd in place.

The next step was to take a small (0.5"x0.5") piece of paper towel and wet it with yellow glue, then ball it up and insert it into the void between the three tubes. This will act as a dam when epoxy is placed in the void to anchor the motor retention stud, another piece of 2-56 all-thread about 2" long.

The aft ring sections are made using homemade balsa plywood (3 plies of 1/16" balsa). A CR-50-60 centering ring was traced on the plywood, then the three tubes were centered over that circle and traced. The three sections were then cut with an exacto knife. The inside arcs were then sanded to final shape using a BT-20 with some sandpaper wrapped around it. These three pieces were then glued into place using yellow glue. Then another CR-50-60 ring was temporarily taped to the end of the tubes flush against the three pieces. This ring acted as a guide while sanding the outside arcs. Finally, a popsicle stick was used to make gussets.

Building the twin mount provides the greatest challenge. Getting the tubes perfectly aligned is very difficult. The first step was to get the spacing between the tubes. I found that two 1/16" square basswood strips were just about perfect. Begin by marking straight lines on both tubes. (I used a door jamb.) The strips were cut to length to allow a gap at the motor end of the tubes. A piece of 2-56 all-thread will be inserted in the gap for motor retention. Glue each strip to a tube. After the glue has set, some light sanding is required to slightly shave down one of the strips. I repeatedly test fit the tubes into a BT-60 until they fit just right. Care must be taken to ensure you sand evenly along the length of the strip. After the sanding is complete, glue the two tubes together at the wooden strips.

The next step is to center the tubes onto a CR-50-60 ring. There is no perfect way to do this, but I found an iterative method which works fairly well. With the ring flat on the table, and the tubes standing vertically, I found a popsicle stick just about right for gauging the distance to each side of the ring. I cut two pieces of scrap balsa to widths slightly wider than the popsicle stick. The trick is to then sand the strips to the proper width.

Sand the strips while holding them together so that they are the same width. Frequently stop and test fit them until they can be placed on either side of the tubes and be just flush with the outside of the ring. At that time, glue them to the ring, but NOT to the tubes.

Just a little wider than a popsicle stick.

Once the glue is dry, trim the outsides of the balsa pieces and sand them to the countour of the ring.

Next, place the ring on the end of the tube assembly where the gap between the tubes is and tape it in place. Trace around the ring onto another piece of balsa ply. Remove the ring and trace around the tubes in the same spot. Then cut the pieces out leaving some excess on all sides. The inside arcs are then sanded to shape as before using a BT-20 wrapped with sandpaper. Do NOT sand the outside edge yet. Apply glue to the inside arcs of the pieces and glue them in place approximately 1/8" from the end of the tubes (the end with the gap). Once the glue is dry, retape the ring to this end and sand the outside of the pieces to the contour of the ring. Then glue the ring to the other (forward) end of the tubes. As an added option, you may wish to reinforce the aft end of the assembly by adding some cut popsicle stick pieces as shown in the picture. Do NOT yet add the gussets.

Next, cut a piece of 2-56 all-thread about 2" long. Add a few wraps of 1/4" masking tape to the end of the all-thread and a few more wraps 3/4" from the same end. The wraps are intended to increase the diameter of the rod so that it fits snugly in the gap between the tubes. After placing it in the gap, soak two pieces of 1/2" square paper towels with yellow glue and place one of them at the end of the wooden strips against the rod. Place the other on the rod at the point it passes through the wooden pieces at the end of the tubes.

Flip the assembly over and add masking tape to the backside covering the all-thread. Be sure to seal it carefully. You may need to add another glue-and-paper towel wad to the rod on this side.

Once the glue has dried, secure the rod in place with epoxy. The tape in the back and the paper towel wads should function as dams to contain the epoxy while it sets.

Lastly, add the gussets to the aft end and drill the holes for the mount retention and you'll be good to go.