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NEWSLETTER

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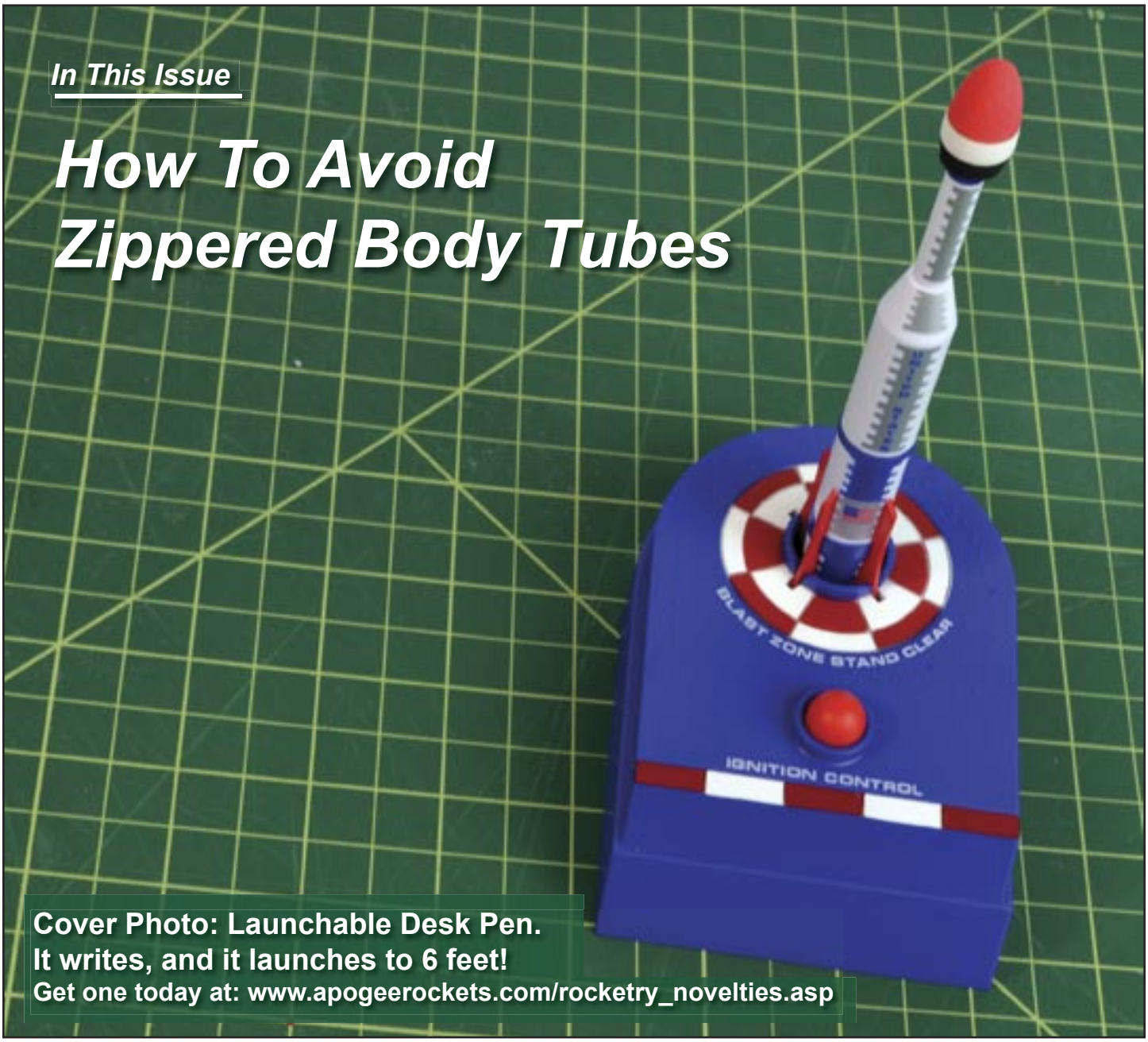
How To Avoid Zippered Body Tubes



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3355 Fillmore Ridge Heights
Colorado Springs, Colorado 80907-9024 USA
www.ApogeeRockets.com e-mail: orders@apogeerockets.com

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Avoiding The Zippered Body Tube

By Braden Carlson

We've all seen it. A person is walking their new, beautifully finished rocket out to the pads. It's a pretty large diameter rocket, and a pretty small motor, so he's going to use a short delay. Everything is ready to go and you hear the countdown. Suddenly the rocket climbs off the pad at an exceptional speed and it looks beautiful. It finishes climbing and begins to arch over; now would be an excellent time for the parachute, but it doesn't deploy. No big deal, he's still at a decent speed as it starts coming back down, waiting for the parachute, and it's not coming out. Everyone is thinking the worst as the rocket is coming upside down. Then, out of nowhere the ejection charge goes off, darn those bonus delays, and the nosecone deploys. The shock cord starts to come out as the booster continues to fall, when the parachute is fully extended the parachute opens. Everyone lets out a big sigh of relief, this thing may just fly again. The owner goes to retrieve it, and comes back with an upset look on his face. You see the rocket, and the shock cord has torn into the body tube, it's the rain on your parade, the snow on your tailgate party, the dreaded zipper.

Figure 1: Even a short zipper can be a nuisance.

The zipper can even occur on flights that appear to be perfect. It's just the (bad) luck of the draw. If you are looking for a few simple ways to prevent this horrible experience, look no further.

The zipper is a horrible experience, and not an easy one to repair. The easiest way would be to cut down the body tube, but some people don't like to do that, as it will affect the look of the rocket. However, if you take the proper safety precautions when you build the rocket in the first place, you may just prevent the zipper from happening at all.

The Anti-Zipper Design

The anti-zipper design is one tried and true method for avoiding a zipped tube. All you need extra is a tube coupler (www.ApogeeRockets.com/Tube_Couplers.asp), and a bulkhead to fit inside the coupler. When you are building the rocket, if it has one solid body tube, measure the biggest motor you want to fly in the rocket, and cut a tube long enough to accommodate the motor. This will be the separation point. Assemble the motor mount and fins as normal on

Figure 2: A typical zipperless design.

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Newsletter Staff

Writer: Tim Van Milligan
Layout / Cover Artist: Tim Van Milligan
Proofreader: Michelle Mason

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that tube. Now, when that is finished, take the tube coupler, and glue half of it inside the tube with the motor mount and fins, or booster.

Now find a bulkhead (www.ApogeeRockets.com/bulkheads.asp) that will fit in the coupler and put an anchor in it. When gluing in the bulkhead I recommend you recess it into the coupler about 1⁄4 to 1⁄2 inch. If you are using electronic deployment, you can go ahead and put in your screw eye. But if you are planning on using motor deploy, you will need to drill holes in the bulkhead to allow the gases to get by to blow the parachute off. The way I would do it is by placing the screw eye in the middle, then drilling holes around it. Be careful not to make these holes too small, if they don't allow sufficient gasses to go through the bulkhead, you could blow the bulkhead out of the tube and watch your nosecone and upper airframe fly away under the chute.

To hold on the nosecone, you can use masking tape, or small screws (2-56 thread size, 1/4 inch long).

With this design, if the rocket separates at a high rate, there is no tubing the for shock cord to bite into on the booster tube. Cool, Huh?

Reinforcing The Tube

This is zipper prevention in its simplest and oldest form. Modelers have been doing this forever, simply strengthening the upper part, or entire length of the tube.

There are various methods of doing this. One of the easiest techniques is simply cutting the steel band off of a hose clamp, and wrapping it around the end of the tube. This technique is pretty effective, and will definitely work better than leaving the tube without any modification to strengthen it, although it isn't the prettiest to look at.

Another effective way of strengthening your tube to prevent zippers is using carbon fiber, or fiberglass cloth. The fiberglass only needs to be maybe two to three inches wide, and long enough to go around your tube at least once.

Figure 2: A fiberglass body tube is already pretty zipper-resistant.

Of course, you can just start out using a fiberglass tube (www.ApogeeRockets.com/Fiberglass_tubes.asp) or a kit made from fiberglass, as that works too. You can also use the material called Blue Tube (www.ApogeeRockets.com/blue_tubes.asp). Fiberglass and Blue Tube are both very strong and nearly zipper resistant. I am almost sure you

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can not zipper a fiberglass tube. I haven't used very much blue tube, but from what I have used, it has been extremely strong, and doesn't chip like phenolic tubing does. I would assume it is way more zipper proof than phenolic tubing is. As far as pricing goes, blue tube isn't nearly as expensive as fiberglass tubing.

The Piston Ejection System

The piston ejection system is a very simple way to prevent zippers. As before, you will need a coupler. Sand it so it slides very easily back and forth inside the body tube of the rocket.

You will then need two bulkheads that fit inside the coupler, and two screw eyes or U-bolts. Start by putting your U-bolts or screw eyes into the bulkheads, make them as centered as possible, and secure them from the back using jam nuts. I recommend you use a thread locking adhesive on the nuts to prevent them from coming loose. Glue the bulkheads in 1/2 an inch from either side.

When the initial epoxy has dried, I recommend a fillet all the way around the bulkhead on both sides for extra strength of the piston.

Figure 4: Piston Ejection system.

After your piston assembly has dried completely, measure the length between the end of your airframe tube, to the point you are anchoring your shock cord. Cut a piece of your favorite cord material two inches longer than the measurement you just took. This will allow excess material to tie the knots with. I recommend Kevlar® (www.ApogeeRockets.com/shock_cord.asp) because it is fireproof, super strong, and fairly inexpensive. When the anchor cord is tied to both the piston, and the anchoring point, the piston should be hanging about halfway out of the tube. Tie your shock cord to the top side of the piston and connect your recovery system. When the ejection charge goes off, the piston will push everything out, and stop at the top of the tube. Therefore, there will not be any small shock cord resting against the tube that could cut into it.

One other thing, you need some vent holes in the body tube near the top end. These will be positioned just below the base of the piston to relieve the pressure of the ejection charge after it has pushed the piston to the forward-most position.

Editor's Note: If you're looking for a kit from Apogee Components that has a piston ejection system, see the Aerotech Sumo rocket (www.ApogeeRockets.com/Aerotech_Sumo.asp)

The Tennis Ball

Assuming your airframe is large enough, you can use nothing more than a tennis ball, a couple screw eyes and epoxy to save your airframe.

To make the Tennis Ball Bumper, start by drilling a hole in either side of your tennis ball. Make the hole slightly smaller than the width of your screw eye. Do your best to make them lined up, and 180 degrees from each other.

Screw in both the screw eyes, then remove them. Drop

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Figure 5: A tennis ball with screw eyes epoxied on.

a generous amount of epoxy into the hole you just made with the screw eye, replace the screw eye and allow it to dry. The glob of epoxy should form a plug to prevent the screw eye from being pulled out.

When the epoxy has dried and the screw eyes are secure, then measure how long it is from your shock cord anchor point to the end of the airframe tube. This will be the length of your leader cord. Again, I recommend using Kevlar® for the leader cord. Cut a piece two inches longer than the measurement you just took (to allow excess for knots). Tie your leader to your anchor point, and then to one screw eye on the tennis ball. Make sure the tennis ball is right at the edge of the tube. Secure your shock cord to

Figure 6: The tennis ball acts as a bumper preventing the cord from touching the tube.

the other screw eye, then go fly!

One thing I would recommend is using a nomex parachute protector (www.ApogeeRockets.com/Nomex_wadding.asp), not only to protect your parachute, but also to protect the tennis ball.

For smaller airframes, I know some pet stores carry small tennis balls, and I am sure there are other balls that could be used to substitute them as well.

When you your parachute opens violently, the ball will spread the force of the opening over a larger surface area,

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preventing any zippers from happening. If you attempt this, and by some unbelievable reason end up with a tennis ball sized zipper, please contact me, as I would love to see that.

Anti-Zipper Harness

Another option for preventing zippered tubes is to use a recovery harness as described by Dave Wooten in Peak-of-Flight Newsletter #282 (www.ApogeeRockets.com/Education/Downloads/Newsletter282.pdf). Since it is described fully there, I'll just make mention of it here and let you go take a look at it.

Fixing Zippered Tubes

The easiest way to get rid of a zipper is by simply cutting the tube where the zipper is. Some people don't want to do this, because they may have a scale rocket, or an awesome paint job they don't want to screw up.

If you are worried about the scale length of your rocket, there is an easy way around that. Cut the tube below the about five inches below the zipper, and splice a replacement tube on top with a coupler. Just make sure the nose cone shoulder doesn't interfere with the coupler holding the tubes together.

Or if you are worried about it happening again, build the zipperless configuration (mentioned above) around the coupler you just added.

Another way to repair a zipper, is cut out a square around the zipper. Then insert a coupler wrapped in wax paper into the rocket's body tube. Then, using epoxy thickened with a filler of your choice (I recommend colloidal silica) fill the square hole you cut with the thickened epoxy. Make the epoxy about the consistency of peanut butter, and sculpt it to the shape of the body tube. Most importantly, make sure the hole is completely filled. After the epoxy has dried completely, sand the top of the body tube to make the epoxy flush with the rest of the body tube. Then remove the coupler, and cover the effected area with fiberglass. Then you can sand it and repaint.

Some people have repaired a zipper using the above method, but using chopped carbon fiber or fiberglass, rather than colloidal silica. This would make the epoxy a lot stronger, but harder to sand. If you have a power sander, and don't mind sanding down the fiberglass or carbon fiber, then you should do it that way. Because it will certainly be stronger.

One other method is to cut a square out of the tube like above, and cut a piece to fill the void out of another piece of tube, and epoxy that in place. I would recommend you fiberglass over this one because I'm a little iffy about simply gluing in a new piece of tube and leaving it alone. I think if your shock cord hit it hard enough it would knock it right out.

Conclusion

I hope this article was useful to you. The first time I zip-

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pered a rocket I was pretty upset. I have an obsession with making my rockets the best I can make them look, and as soon as it sustained that damage I was determined to find ways to prevent that from happening. After researching and experimenting this is what I've got in my arsenal. All these methods have been successful, but there is not a guarantee they will work. I am not one to throw away a rocket. If it's damaged, I'll figure out a way to fix it. So don't get rid of your damaged rockets, there's always a way to fix them. Prevent, Repair, and Fly!

About The Author

Braden Carlson is 15 years old and lives in Boise, Idaho. He flies with Tripoli Idaho Rocketry, and has loved rockets since his first one. His dad introduced him to rockets when he was about six years old. His first two rockets were the Estes Baby Bertha, and the Estes ARV condor. Ever since the first flight he has been hooked. In 2004 he was given an Aerotech HV Arcas and an Aerotech Mustang and several G reloads with the case to fly them in. He found out about Tripoli Idaho a couple years after that. The first launch he went to, he saw Vern Knowles fly his rocket Angelfire on an AMW M2500 motor, and instantly decided he wanted to fly bigger rockets. After finding out about the certification system, and that you had to be 18 to certify, he turned to his dad. His dad, who used to fly model airplanes was interested. When he got his first big rocket kit the deal was sealed, and he too has converted to "rocketryism". A year later, his dad is level one certified, and is prepped for his level two cert flight. Building/flying rockets and sharing the experience with his dad is one of his favorite things.

Authors Note

I'd like to thank Tim for allowing me to write a second article for the *Peak of Flight Newsletter*. It certainly is a great experience. Tim is a great guy, and is always helpful with anything to do with rocketry. I'll keep coming back as long as he will let me!

Editor's Note

One thing Braden didn't mention was the importance of rocket motor selection, and angling the launch rod correctly when flying rockets. This is as important as how you construct your rocket.

Branden's first article appeared in *Peak-of-Flight* Issue #277 (www.ApogeeRockets.com/Education/Downloads/Newsletter277.pdf), and described how to make a parachute tether release device to allow dual-deployment out of a single tube.