PEAK OF FLIGHT NEWSLETTER

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Repairing Broken Parachute Loops on Nose Cones

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Repairing Broken Parachute Loops on Nose Cones

By Tim Van Milligan

We've all had situations where the parachute loop on the back of the nose cone got broken off after a flight. It seems to happen more frequently to smaller rockets with injection molded polystyrene nose cones. This article will cover some of the different fixes that I've used in the past to repair the nose cones in order to get the rocket flying again.

The reason smaller nose cones are more prone to breaking off the parachute loop is that the polystyrene plastic is a bit more brittle than those larger blow-molded nose cones used on high power rockets. That is a trade-off that comes with using polystyrene plastic for nose cones. Since it is brittle, you can crack it if you over stress it. In this case, the weakest point is the thin plastic on the parachute loop, as shown in **Figures 1 and 2.**

Figure 1: The thin wall of the parachute loop is typically where the nose cone will break.

But polystyrene has some really nice characteristics too. It can be painted with almost any paint, and you can glue it using a variety of glues like super glue, plastic model cement, or epoxy. It can also be sanded smooth and shaped with a variety of tools.

Figure 2: The typical appearance of a nose cone after the loop breaks.

The nice thing about plastic nose cones is that if you get them back after the loop has broken off, they are typically repairable.

What I like to do is start by removing the broken plastic and opening up the hole in the base of the shoulder, as shown in **Figure 3**.

Figure 3: The repair starts by cutting off the remaining parachute loop, and enlarging the hole in the base of the shoulder.

I open up the hole large enough, as shown in **Figure 4 (Page 3)**, to be able to slip a stiff wooden dowel into the nose.

The shock cord is reattached to the nose cone by securing it in place with epoxy. It doesn't really matter what type of epoxy you are using, as they will all work. If you're in a hurry, a five-minute epoxy like

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Figure 4: Open up the base of the nose cone large enough to be able to pass a dowel through it.

the Double Bubble (https://www.apogeerockets.com/Building_Supplies/Adhesives/Double_Bubble_Extra_Fast_Epoxy_Packet) will be adequate.

Just give it longer than 5 minutes before you fly the model. It really isn't fully cured in 5 minutes, it is more like 20 before I'd trust it to hold up to the forces of flight.

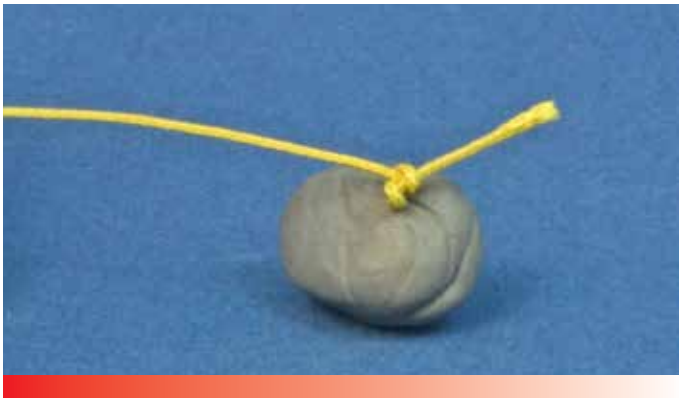

Figure 5: Tie a knot in the end of the shock cord, and press it into the mixed clay.

If you choose to use the Fix-It Epoxy Clay (https://www.apogeerockets.com/Building_Supplies/Epoxy_Clay/FIXIT_Epoxy_Clay), what I suggest is that you do is to tie a knot in the end of the shock cord (**Figure 5**) and press it into the mixed clay.

Figure 6: Roll the epoxy clay, and insert it into the hole in the back end of the nose cone.

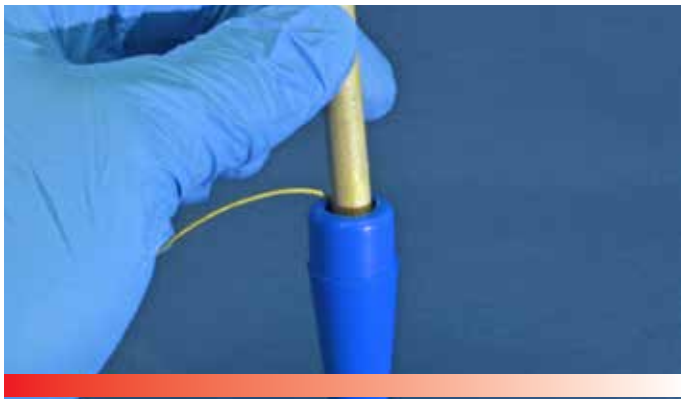

Figure 7: Using a wood dowel, press the epoxy clay firmly into the tip of the nose cone.

Next, roll up the epoxy clay into a snake that is small enough to pass through the hole in the back end of the nose cone as shown in **Figure 6**.

Now press the epoxy clay into the tip of the nose cone using a wood dowel (**Figure 7**). You want to make sure there are no air bubbles trapped in the epoxy that would allow the shock cord to slip through and come free.

If you use a liquid epoxy, you'll have to make sure the nose cone stays

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inverted so that the epoxy doesn't flow out through the hole in the back end. This is one reason I like the epoxy clay, because it stays put.

Adding the epoxy to the nose has the additional benefit of making the rocket more stable. I don't worry about adding extra weight, since the advantage of extra stability is worth it.

Once the epoxy hardens, you still have to provide a way of attaching the parachute to the rocket. I simply tie a loop in the shock cord near the nose cone, as shown in **Figure 8**. You can then attach the parachute to that loop.

Figure 8: Tie a knot in the shock cord so you have a place to attach the parachute.

If I'm flying a competition rocket where there is a penalty for having the nose cone fly off the rocket, I'll just skip tying the shock cord to the loop during the construction of the model. Instead, I'll tie it to a disk that is inserted into the base of the nose cone. The disk (**Figure 9**) can

Figure 9: A disk to reinforce the base of the nose cone.

be made from thick cardstock or from plywood. I prefer plywood, but it is heavier and in competition a lower weight is more desirable.

The disk needs to fit into the base of the shoulder, so you may have to make a couple of disks to determine the right size so that it fits flat on the base. There is usually a rounded corner along the outer edge of the shoulder, so you have to take this into account as you make the disk. Just remember, it will be strongest if it lays flat inside the shoulder as shown in **Figure 10**.

Figure 10: Glue the disk inside the shoulder piece of the nose.

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You'll notice the little notch on the edge of the disk. I add this notch because it saves a little when drilling the hole into the base of the shoulder. A hole needs to be added so the shock cord can be tied on to the nose cone. It needs to be positioned as close to the edge of the shoulder as possible in order to maximize the strength of the attachment.

When you glue it into the shoulder, remember to put a good fillet of glue around the perimeter so that it is strong and can't shift around.

Figure 11: Drill a hole through the base of the nose cone from the inside of the shoulder.

If you do have a little notch in the disk, like shown in **Figure 10 (Page 4)**, you should drill a hole from the inside of the shoulder right at the notch (**Figure 11**). If you don't have a notch, you can drill from the outside of the shoulder, because it doesn't really matter where the hole goes, other than it needs to be close to the edge.

Tie the shock cord through the holes in the

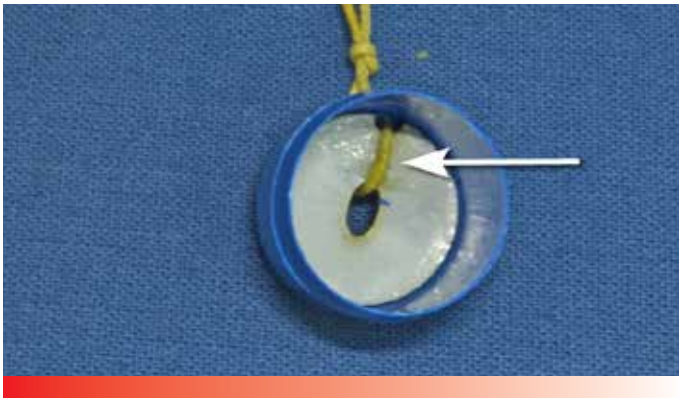

Figure 12: Put glue over the shock cord to hold it in place.

shoulder, as shown in **Figure 12**. I recommend putting a thick bead of glue over the top of the shock cord on the inside of the shoulder as shown by the arrow in **Figure 12**. The reason is that you don't want the shock cord to be able to slide back and forth through the shoulder. This is especially true if you use a Kevlar® cord like what is shown here. Kevlar is very abrasive, and it will act like a saw and cut through both the disk and the plastic base of the shoulder. So by locking it down with some glue, you prevent it from becoming a saw.

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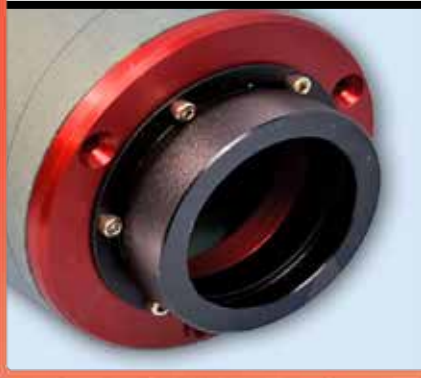

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Figure 13: Attach the tip of the nose cone to the shoulder with glue.

After you attach the tip of the nose cone to the shoulder with glue, you're pretty much done. You can see in **Figure 13** that there is a small gap between the base of the nose cone and the knot in the shock cord. This is a good place to attach the recovery device of the rocket.

Figure 14: A blow molded nose cone with a small-ish parachute loop.

Sometimes, you'll get a rocket that has one of the older style blow-molded nose cones, like the one shown in **Figure 14**. The loop on the base is small. Even though it is molded from durable polypropylene plastic, it can still be a little bit weak. If you don't trust it's strength, you can attach your shock cord using this method.

Start by drilling a hole on the base of the nose cone near the perimeter edge of the shoulder as shown in **Figure 15**. It is important that the hole not be on the seam line, which is indicated by the arrow in the figure.

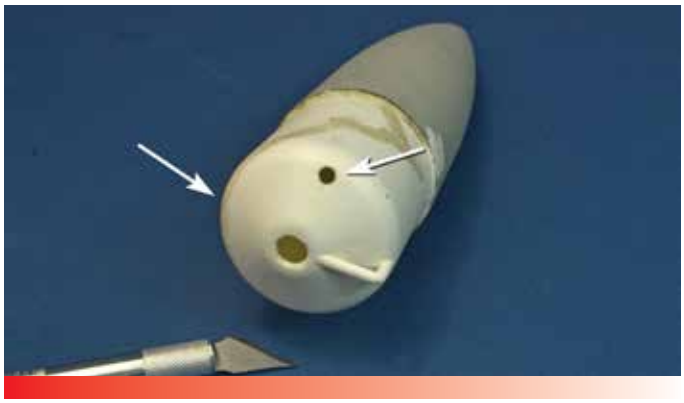

Figure 15: Drill a hole in the base of the shoulder close to the perimeter edge.

The reason you don't want it on the seam line is that it is the weakest point of the nose cone. It is where the edges of the plastic are joined together during the blow-mold process. The plastic has to fuse itself together at this location as the plastic cools. And usually it isn't as strong as other areas of the nose cone. If you've ever had a nose cone split in half on you, then you'll know exactly what I mean.

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Next, thread the shock cord through the hole and out through the larger hole in the middle of the base of the nose cone. This is the tricky step, because it can be hard to find the shock cord and pull it through. I find using a needle-nose tweezers helps a lot (**Figure 16**).

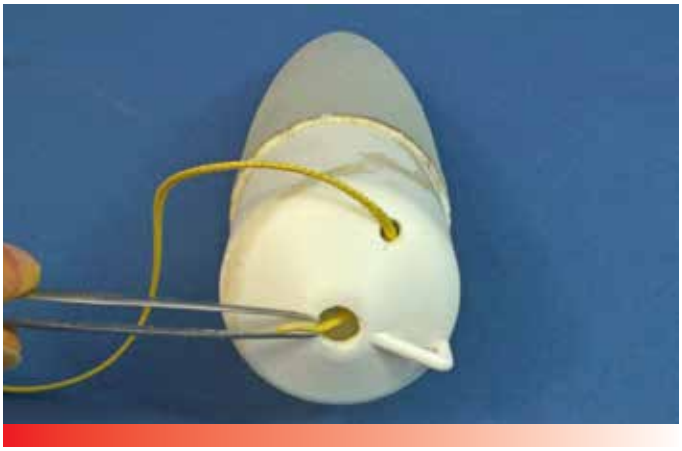

Figure 16: Thread the shock cord through the holes in the base of the nose cone.

As indicated before, tie a knot on the shock cord to hold the nose cone on (Figure 17). Again, you can attach the parachute to the loop between the base of the nose and the knot on the shock cord.

Figure 17: Tie the shock cord to itself to complete the nose installation.

The unfortunate drawback of this installation is that the shock cord can slide somewhat through the holes. You'll have to inspect the plastic between the holes between flights to make sure that the shock cord isn't cutting through the plastic in a saw-like fashion. I've never had this happen to me, but you should always keep an eye on it, especially if you fly the rocket often.

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Using a Tube Coupler as a Shoulder

Occasionally you may lose the shoulder of the nose cone before the rocket is assembled. If you have a tube coupler that fits the rocket, you may be able to salvage the situation. In essence, the tube coupler can become the shoulder for the nose cone.

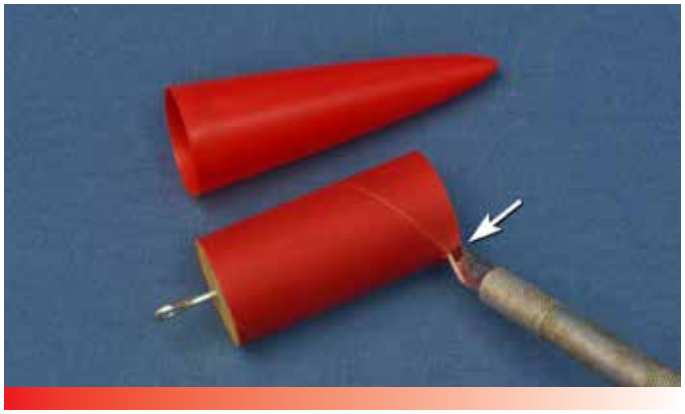

Figure 18: Cut slots in the tube coupler and bend the tabs inward so that is slides into the nose cone.

Start by cutting a number of slits in the end of the coupler as shown in **Figure 18**. This will make a series of small tabs that can be bent inward. By doing this, you can insert the coupler into the rear of the nose cone (**Figure 19**).

Use the nose cone as a forming tool to bend over the tabs. Try to get as much of the coupler to go into the nose cone as possible so that you'll have a lot of surface area of the coupler inside the nose cone.

Smear a liberal amount of super glue or epoxy into the nose cone, and then insert the coupler.

Figure 19: Insert the coupler into the nose cone.

The important part is to make sure that the coupler is straight inside the nose cone. I like to then insert the coupler into a body tube and roll it along a flat surface to make sure the nose is perfectly straight on the coupler **(Figure 20)**. Once you know it is straight, allow the glue some time to dry.

Figure 20: Keep the coupler straight by rolling it back and forth on an even surface.

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Figure 21: Attaching the shock cord to the inside of the tube coupler with an Estes-style shock cord mount.

You can attach the shock cord to the shoulder using an Estes-style shock cord anchor (**Figure 21**), or you can put a bulkhead disk inside the coupler and use a screw eye to attach the cord.

Conclusion

One final word of advice on shock cords. To reduce the stress on the parachute loop, I suggest making the shock cord longer. As I've mentioned in my tutorial videos on our web site, a long shock cord is not a bad thing. It allows the nose cone time to slow down as it exits the rocket. And the slower it is when it fully stretches the shock cord, the less of a tug there will be on the parachute loop.

But if you do happen to have a broken parachute loop, don't worry. It is salvageable. Just use the techniques in this article to reattach it to the rocket.

About The Author:

Tim Van Milligan (a.k.a. "Mr. Rocket") is a real rocket scientist who likes helping out other rocketeers. He is an avid rocketry competitor and is Level 3 high power certified. He is often asked what is the biggest rocket he's ever launched. His answer is that before he started writing articles and books about rocketry, he worked on the Delta II rocket that launched satellites into orbit. He has a B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University in Daytona Beach, Florida, and has worked toward an M.S. in Space Technology from the Florida Institute of Technology in Melbourne, Florida. Currently, he is the owner of Apogee Components (http://www.apogeerockets.com) and also the author of the books: "Model Rocket Design and Construction," "69 Simple Science Fair Projects with Model Rockets: Aeronautics" and publisher of the "Peak-of-Flight" newsletter, a FREE e-zine newsletter about model rockets. You can email him by using the contact form at ApogeeRockets.com/Contact.

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