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NEWSLETTER

In This Issue

Build Your Own Parachute Release Mechanism

Cover Photo: Red River Rocketry's Red Shift model rocket kit. Get one at:

www.ApogeeRockets.com/RedRiver_Red_Shift.asp

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Build A Parachute Release Device For Your Short/Stubby High-Power Rockets

By Braden Carlson

I have seen quite a few stubby rockets that barely have room for a nosecone to sit above the motor tube, use a dual deploy set up.When I watched them fly, the drogue parachute deployed as usual, and it began to float down to earth. As it was coming down I wondered how they had fit an altimeter bay inside with such little room to begin with.

As I watched the rocket descend and get closer to the altitude where the main should pop, I wondered what would happen next. When I heard the pop of the ejection charge, and saw the main parachute come out, there was no extra shock cord with the main chute on it, and the rocket had not separated anywhere besides the original point the drogue was deployed from. At this point I wondered if I missed something, because I had never seen anything like it before.

I found out there are various ways of doing so, like using the upper part of the motor tube as a cannon of sorts, and all types of methods involving shear pins and complicated designs. However, there are several devices on the market that allow you to build a rocket with a dual deploy set up without cutting your body tube into separate lengths and pieces, or even using shear pins. One such device is the Tender Descender (www.ApogeeRockets.com/Tender_Descender.asp)

This article is a how to for the do it yourself rocketeer, teaching how to make a similar release device out of nothing more than some masking tape, wire ties, a bit of a wood dowel or peg of some sort, and a spent .38 special or .357 magnum bullet case, and costing no more than a few bucks. The best part of this device is the fact that it is reusable, allowing a small investment for many uses. This device also allows the drogue and main parachute to be on the same shock cord, therefore eliminating the cost of another shock cord. It will also keep your beautiful rockets one solid piece, instead of having to cut up the body tube and breaking it into multiple parts.

This device is also much simpler than building an entire electronics bay, since you can run the igniter directly from the altimeter to the ejection charge depending on how you set it up. The device is also very small, so it can be used in farily small rockets too. A similar home made device was recently used in a minimum diameter rocket to over mach 4. Similar designs have been built and have all worked perfectly, but I could never find a good how-to on making one, so I built a couple with a few changes here and there, and thought I would finally get a how-to out there.

First a parts overview:

- A proper work place. Also don't forget safety gear, as drilling through the bottom of the case can get frustrating, and the case could slip and you could hit your hand with the drill bit.
- A bullet case (.357 magnum or .38 special. Other sized shells may be used as well, but these are just the sizes I have used so far).
- Nylon wire ties. I used eight inch long ones for this specific project, however, for larger chutes something longer may be in order.
- A dowel or wooden peg that will be a little small for the case (if a perfect sized dowel is found use it) I used a section of a rose art colored pencil.
- A drill and bits in sizes 1/8th, 7/64ths and 1/16th and one in a size slightly larger than your igniter head.
- A set of pliers, no particular kind, I used your standard pair.
- Masking tape. I used half an inch wide tape.
- Some kind of anchoring "thread." I used a guitar string (.010 inch wire), but 100lb-Kelvar® works too (www.ApogeeRockets.com/shock_cord.asp).

The first step is to obtain your bullet case. Once that is achieved, determine the igniters you would like to use. A few things you need to take into account are the lengths of the leads, how much power is needed to ignite them, and the cost. I like the Quest Q2G2's {www.ApogeeRockets.com/igniters.asp}, however, these are probably only best used in small rockets and for ground testing. Find a drill bit that is slightly larger than the tip of the igniter with the pyrogen. Begin to drill a hole into the back end of the bullet

Continued on page 3

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Continued from page 2

Build a Parachute Release Device

Figure 1: Drill a hole in the base of the bullet case.

case, tryinf to make it as central as possible. Use your pliers at this stage would be a good idea, as the case will begin to spin and can slip away. Once the bit is in the primer,

Figure 2: The hole through the base of the case.

grab the case with the pair of pliers and pull hard. The primer, the cylindrical piece of metal the hammer hits to fire the bullet, should pull out fairly easily. If it won't come out, you can try a different case, or just drill all the way through the bottom. If you were successful in removing the primer, there should already be a hole there, so drill it out with your bit to make sure the head of our igniter will fit.

Step two is to get a peg of a size close to, but smaller than the case. In my case I used a section of a colored pencil. If you can find a dowel that fits perfectly in the case, go with that, as it will be much easier. Cut it down to about an inch and three quarters. Then, simply wrap masking tape around the peg until you have a satisfactory fit.

The masking tape I used is half and inch wide, which

Figure 3: Wrap tape around the dowel so it has a snug fit into the bullet case.

Continued on page 4

Continued from page 3

Build a Parachute Release Device

I find is just about the perfect depth for the pencil/dowel/peg to be inside the case. The fit inside the case should be fairly snug, however, you don't want it to be hard to get out the the case. You should be able to hold the case and shake it really hard and fast, and still not have the dowel fall out. I don't really have a great way to explain the fit, so go with your best gut feeling based on the description I previously stated.

Step three is the most important part. Begin by inserting the peg with the tape wrapped around it into the bullet case. Then affix the assembly to a suitable jig, such as a piece of wood, so that you will be able to keep it steady and in place while you drill into the side of it. Grab one of your wire ties, and find a bit that is slightly larger than it. I used a 3/16th inch bit for mine.

Begin to SLOWLY drill into the case where the dowel and tape are below it. Once you are through the brass, you can then proceed to speed up the drill. and push it straight through the case, dowel and tape. Make sure you are all the way through before beginning to pull back as this hole needs to be straight as possible.

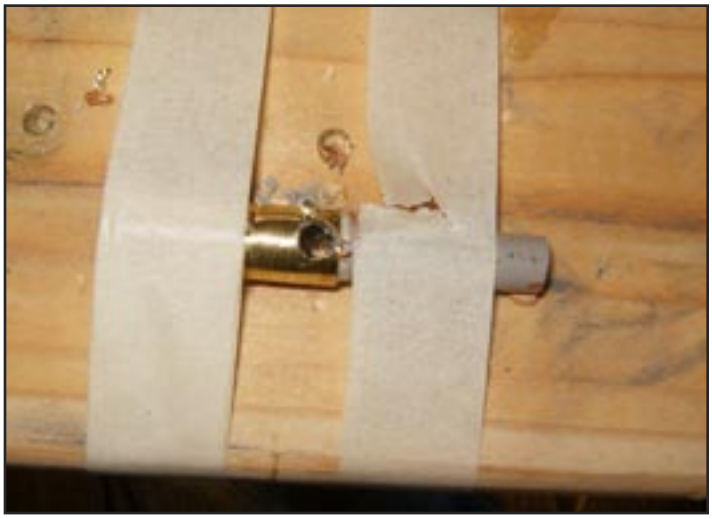

Figure 4: Drill a hole through the side of the case and the wood dowel.

Once you are through, proceed to pull the bit out of the case, and now you have the hole for your tie wrap to go through. If it doesn't fit, step up the bit slightly and widen the hole.

As long as the device is taped down, drill a smaller hole (I used 1/16th inch drill bit) through the top of the dowel hanging out of the case. This will be the point of anchor that will keep the dowel or peg from being shot into the sky. The thin wire mentioned above will be run through it, and it will be anchored to your shock cord.

Figure 5: Drill a hole through the side of the dowel near the end for a tether attachment point.

The assembly process is now complete. Now it's time to begin the set up process. First, begin by inserting the wood peg or dowel into the bullet case. Make sure the holes are lined up as shown in Figure 5. Slip your wire tie wrap through it as shown in Figure 6 and set it aside.

For this device, the preferred method of chute packing is "burrito style;" this way it will open quickly after the

Continued on page 5

Continued from page 4

Build a Parachute Release Device

Figure 6: Insert the tie wrap, and the assembly is done.

wire tie is broken from the ejection charge. After folding your parachute "burrito style," fold up your shock cord "zig zag" style. You want to fold up enough shock cord for the parachute to be close to the top of your rocket without the nosecone on.You want the parachute to be out of the airframe while on drogue, just not too far out. After you have folded it to your satisfaction,carefully press the bullet case

Figure 7: The burrito style parachute roll.

against the parachute, and hold the "zig zag" style folded shock cord behind the parachute, and wrap the wire tie around both the parachute and the shock cord. Make sure the wire tie is very tight around the parachute and shock

Figure 8: The tie wrap sinched down against the parachute and the shock cord.

cord as shown in Figure 8. You don't want that shock cord to slip away from the parachute when you're on the drogue parachute.

After you have secured the parachute and shock cord tight enough to the bullet case, be sure that there is nowhere that your black powder could escape from the forward end of the bullet case. Flip it over, and put between .2 and .6 grams of FFFFg black powder in through the hole you drilled in the bottom, tapping the side of the bullet case until the black powder falls all the way into the case. After doing so, insert your igniter, and make sure it is sitting all the way in the black powder.

Keep the case flipped over and put a small piece of tis-

Continued on page 6

Continued from page 5

Build a Parachute Release Device

sue or toilet paper inside it. After the tissue is in, pour CA in the hole on top of the igniter and allow it to dry.

After the ejection, most of the CA should be gone. However, if any CA is left inside it after recovery, just use your drill bit to open the hole back up. After the CA dries, attach the igniter leads to the main parachute port on your altimeter. This is where you will need an igniter with longer leads, so you may have to make a jumper to complete this hook-up.

Make sure the leads in the altimeter are snug, and make sure the head of the igniter will not fall out of the case. Use more CA if necessary to keep the head of the igniter inside the case. Run the thin wire through the hole you drilled in the top of the pencil, and use that to attach it to the shock cord above the bundle, so you will be able to recover the piece and use it again. Another suggestion is to place a nomex shield against the chute below.

Once you have everything secured and ready to be fired, you are ready for flight.

Electronics Installation

Altimeter location is completely up to you. However, there are some methods and ideas that are helpful in your placement decision. If your motor mount tube is close to the top of the airframe, you can simply mount a small piece of tubing on the top of the centering ring, against the side of the main airframe tube, and house the altimeter inside it. This method is very useful, and is much simpler than installing an entire electronics bay.

Figure 9: One location for your altimeter near the bottom of the main tube.

However, if you simply want to use a device like this because you don't want to cut up the body tube on your scale rocket, another great way to secure the altimeter close to the top of the airframe is to add a bulkhead as close to the top as you would like, and, again mount a tube against the main airframe tube on top of it. With the altimeter tube sitting against the main tube, all you need to do is drill a vent hole through the wall of the main airframe tube and the altimeter tube.

Another (more risky) way to do this is to mount the altimeter in a small tube, and affix it to the shock cord below the parachute. This way you won't have to bundle up the

Continued on page 7

Continued from page 6

Build a Parachute Release Device

shock cord with the chute, but it is a less desirable method, as this would make it harder to set up your apogee charge.

Perhaps the best suggested method is to simply mount the altimeter inside the nosecone. Create a bulkhead that fits inside the nosecone, and attach a sled to it that will hold the altimeter. Then place the apogee charge on the bulkhead, and run an igniter from the nosecone to the device attached to the main parachute. This again eliminates the need to bundle up the shock cord with parachute, because you can simply use a long enough igniter to reach the main parachute from the nosecone.

You could also build a normal altimeter bay out of a coupler and various hardware parts, or get one from Apogee Components (www.ApogeeRockets.com/Electronics_Bays.asp). But instead of using a three part ejection set up, simply place it in the top of the rocket, and use it as the anchor point for the shock cord.

There are endless ways to set it up, just use your imagination, something brilliant will come to mind and you can show off to all the others who suggested the above methods!

What to Expect During Flight

After take off, the drogue will deploy via the motors ejection charge (at apogee) as it normally would. However, your bundle of shock cord and parachute will be fluttering around above the airframe tube. This is why a long igniter is necessary, you don't want the leads of the igniter to pull out of the altimeter while it is fluttering about.

When the rocket reaches the altitude you set for the main to be deployed, the charge should go off, which will shear the nylon wire tie, releasing the shock cord bundle and letting the parachute open. This is why you need to make sure both the bullet case and dowel/peg are well secured to the shock cord. This way you will be able to recover both of them, reload it, and use it again.

Amount of Black Powder:

The above recommended black powder range was created from various ground tests. Less than two tenth's (.2) of a gram doesn't work too well, and more than three fifths (.6) tends to blow apart the whole device, which will still release the shock cord and parachute, but you won't be able to use it again if it's in a million pieces. I just put that range there because they came out of ground testing as the best amounts. I've found that using two fifths (.4) of a gram is just about perfect, but that's with my eight inch fifty pound test wire ties. The longer ones tend to have a higher breaking strength, which may also require more black powder in the charge. For the one in the picture, I used half a gram.

Figure 10: With the proper amount of BP, the plastic tie-wrap should shear cleanly in two.

Troubleshooting

Sometimes the device may not work. This is why I say ground test, ground test, ground test. A few common problems I have had that have been solved:

Charge went off, wire tie didn't break: One of the

Continued on page 8

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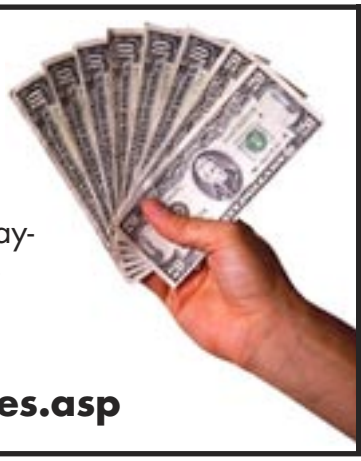

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Continued from page 7

Build a Parachute Release Device

most common causes for this problem is that the back end of the bullet case was not filled with enough CA to plug it, and the charge escaped out the back. Another common cause is the dowel having too little tape on it, which allows the gasses to fly right by it without moving it. In this case, cut your wire tie, and pull out the dowel, apply a little more tape around it to make the fit a little snugger. If all else fails, try using a little bit more black powder.

Black Powder is leaking: Find the source and try to plug it up. It that doesn't work, you may have to make a new one with a different bullet case. If you need to plug a leak spot, CA should suffice.

Figure 11: Ground testing the system by hanging up the parachute burrito from a basketball hoop.

Charge was really loud, blew shell apart: You either used too much black powder, or you had too much tape and overpressurized it. Try using less black powder first, if it doesn't blow the case apart, but the dowel doesn't come out and the wire tie doesn't break, try taking a little tape off the dowel.

Conclusion

I hope you have found this article useful, and very easy to follow. The device works really great, but can always stand for improvement. Nothing is perfect,so if you have the time and will to experiment with it, that would be great! Find what works best for you. Also, remember that you are using loose black powder, and should take sufficient precautions. Black powder can be dangerous if not used properly, and should not be played with. Be sure to be smart, and be safe. Always do your ground test behind some kind of barricade, because if the shell case fragments, you want to stay safe.

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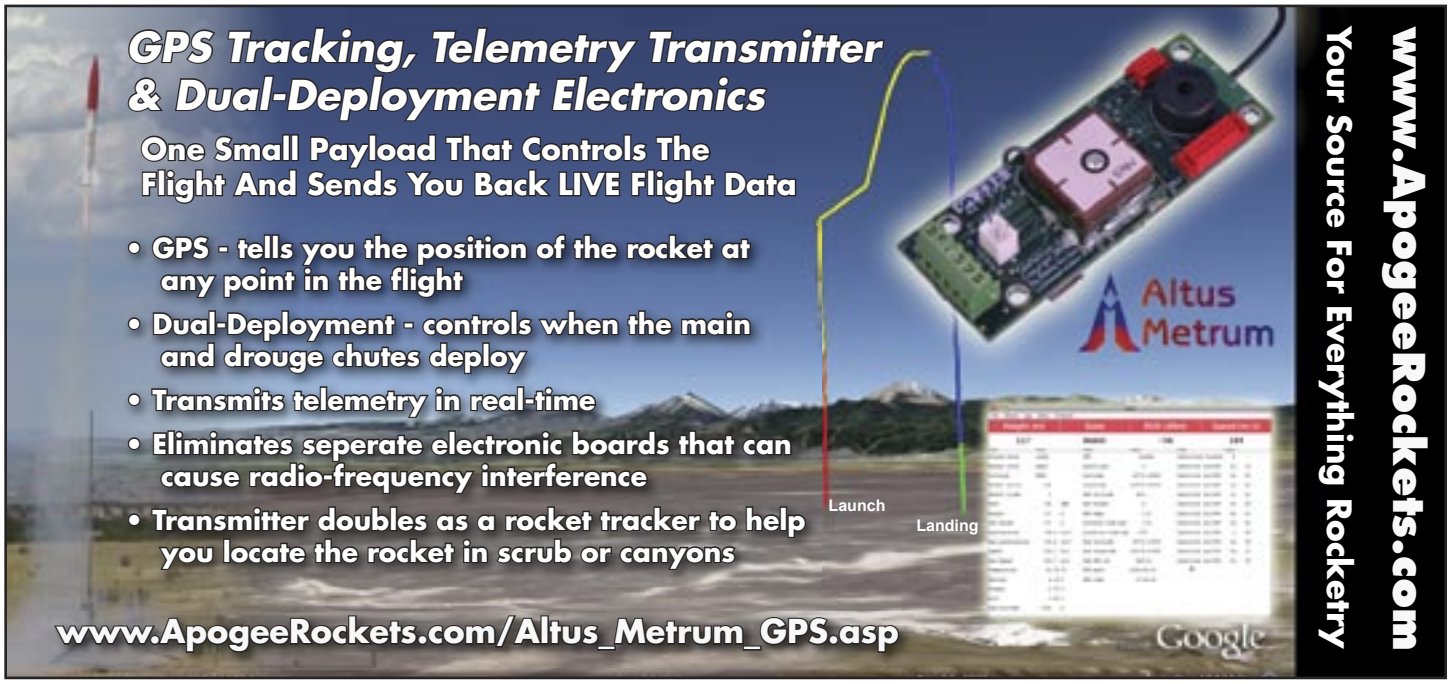
15-Year-old Braden Carlson lives in Boise, Idaho, and flies rockets with Tripoli Idaho. He and his dad have been flying rockets for years. Since his dad took him to his first high power launch, he was instantly hooked. He now has a nice collection of low, mid and high power rockets that he flies quite often. Since he is under-age, Braden lets his dad handle the black-powder for the high power rockets that they fly together.