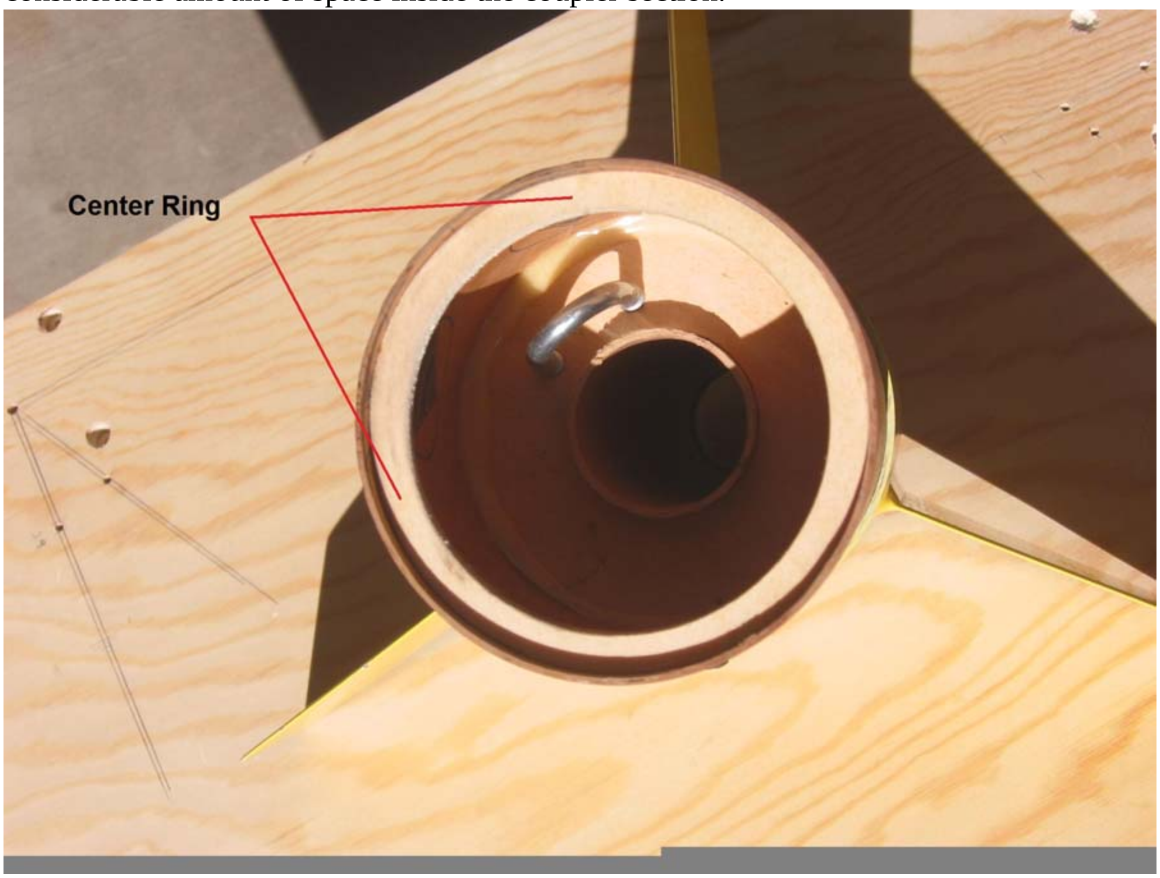
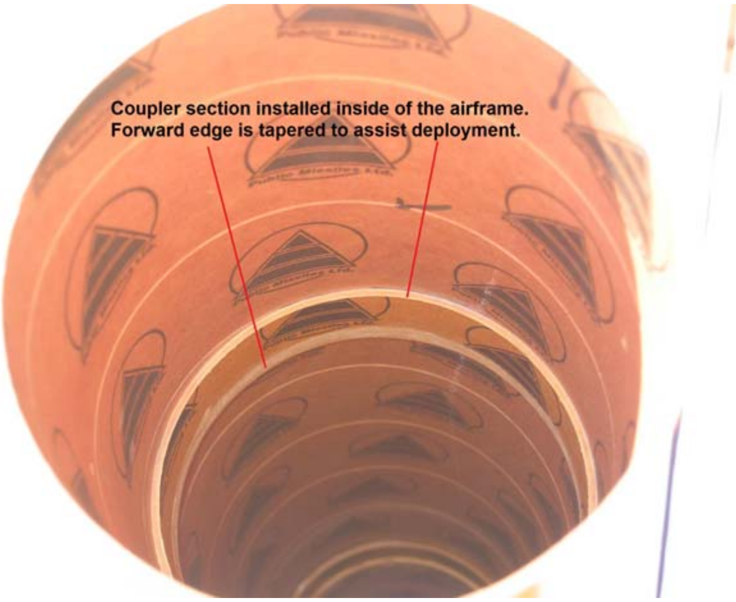
I am assuming the only end goal is to deploy the recovery gear for a high powered rocket. To me that means; separate the airframe sections, eject or pull out all of the shock cord and parachute. Additionally the parachute has to be able to inflate in a timely manner. For this thread, I do not want to confuse the issues with deployment bags, thermal barriers, Kevlar®, Nomex®, pistons, baffles and such. Additionally, I did not eliminate the use of black powder of e-matches, these two products reliably provide a lot of energy for size and weight without adding complexity.

Recently I was thinking about an alternative to the typical construction techniques and deployment methods. For the last two years, I have built zipper-less fin cans with an open top. This provides additional internal space. I reinforce the coupler section with a center ring to spread the side load of a shock cord across the coupler and prevent a zipper of the coupler. Pictured below is a 4" fin can with a 38mm motor mount. The added center ring is 1/4" plywood and approximately 3/8" wide. As you can see, there is a considerable amount of space inside the coupler section.

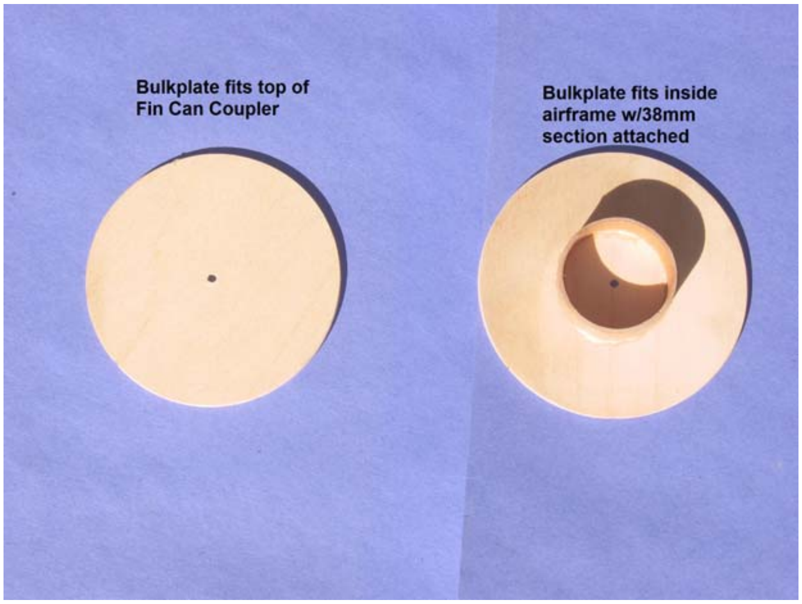


Deployment charges have to be sized to provide sufficient pressure within the recovery bay space. Large airframes can require a fairly sizable BP charge to reliably severe shear pins, overcome friction and separate the sections. If the volume of the space is reduced then, smaller charges will develop the same pressure as a big charge in a big space. However you need a method to contain the space and the expanding deployment charge gases.

In the following picture, the airframe has an additional short section of coupler tubing added to provide a base for the forward airframe bulk plate to push against during deployment. The coupler is permanently bonded to the airframe with epoxy or other appropriate adhesive. The forward end of the coupler has been tapered to prevent the shock cord or parachute from getting hung up during deployment

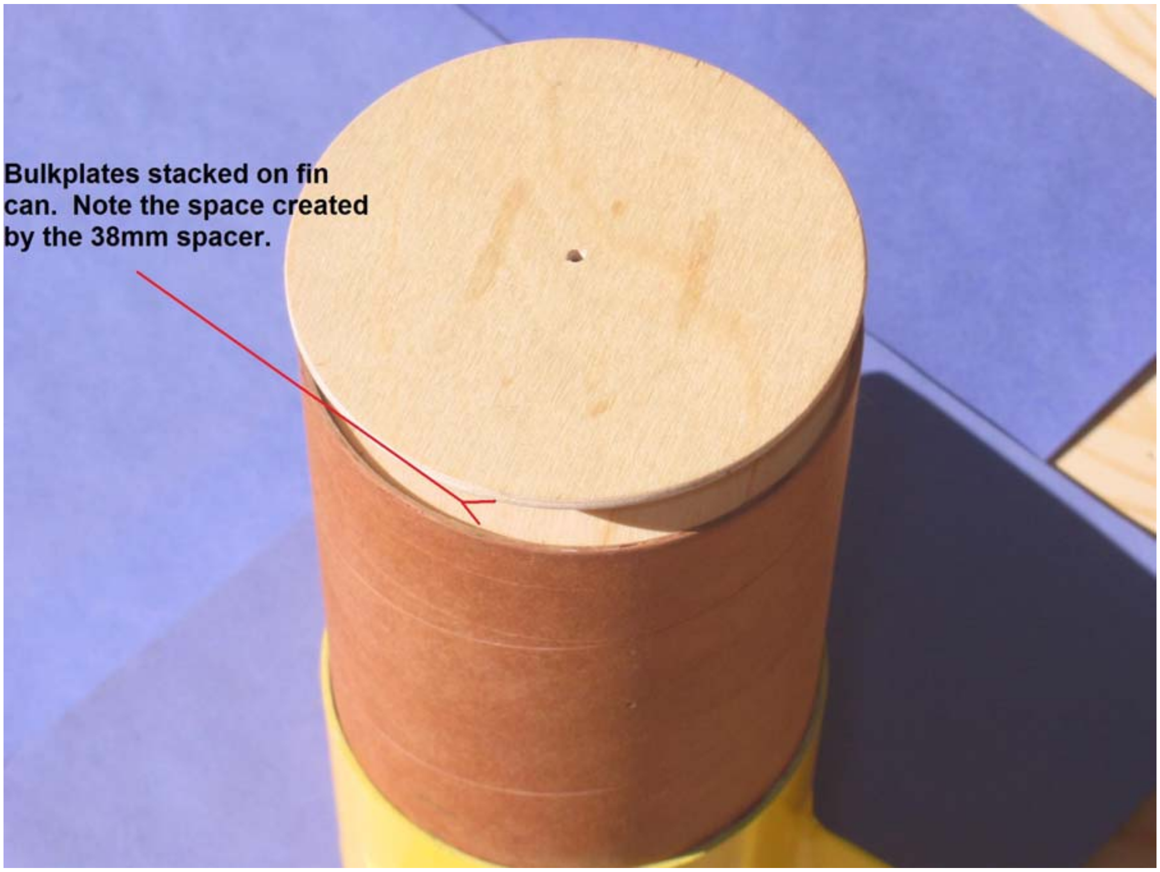


I made two ¼" bulk plates for this project, one bulk plate is cut to fit the inside the fin can coupler section and rest on the center ring, the second bulk plate fits inside the airframe and has a short (about ¾") section of 38mm airframe tube added as a spacer. Both of the bulk plates are a "very loose fit" to avoid binding as the bulk plates need to also exit the airframe during deployment. In order to prevent the bulk plates from free falling they are attached to the shock cord.



Below you can see the forward bulk plate resting on the forward coupler during a test fit.

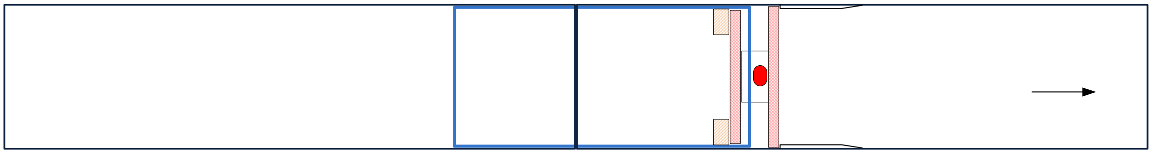
Next, here are both bulk plates are resting on the fin can, note the space created by the spacer section. The BP charge will be installed in the spacer section and about 18” to 24” of Kevlar® shock cord will be stowed outside the spacer and in between the bulk plates. The aft end of this shock cord is connected to a longer length of shock cord (TN or Kevlar®) stowed inside the fin can space. The forward end of the shock cord is attached to the remaining shock cord, drogue or main chute and the forward attachment point.



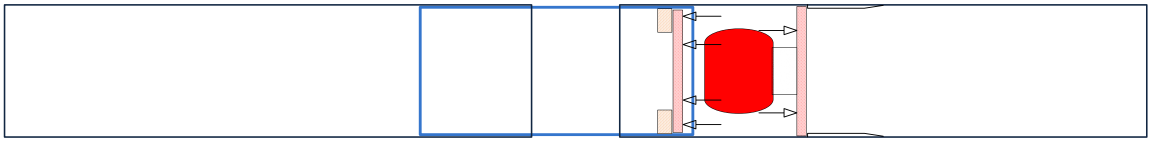
Operation:

When the BP is ignited and the pressure builds between the two bulk plates, the force will drive the fin can and airframe sections apart. As the two sections separate, the connecting shock cord will draw out the bulk plates and the remaining recover harness.

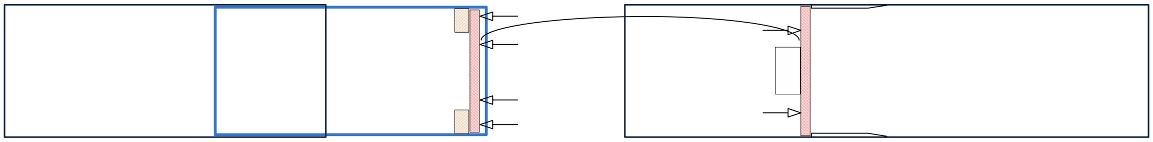
Rocket Configured for Launch:



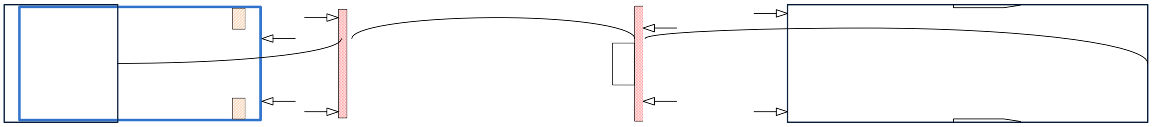
Stage One of Deployment:
BP Gases have sheared retention pins, airframe sections are moving apart.



Stage Two of Deployment:
Both airframe section are free and the bulk-plates have not separated from their perspective positions.



Stage Three:
The bulk-plates are free of the airframe and shock cord is deploying.



Zipper-less Fin Car

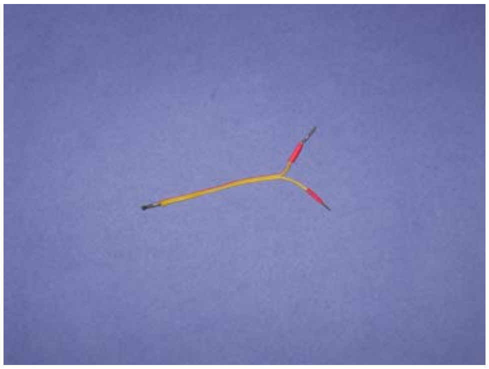
First System Test (ground):
I ran the first test without any shock cord, two 1/16" styrene shear pins and 0.6grams of BP. The fin can and airframe separated easily and each section traveled about one foot. I cleaned all of the parts with a wipe of a wet cloth.

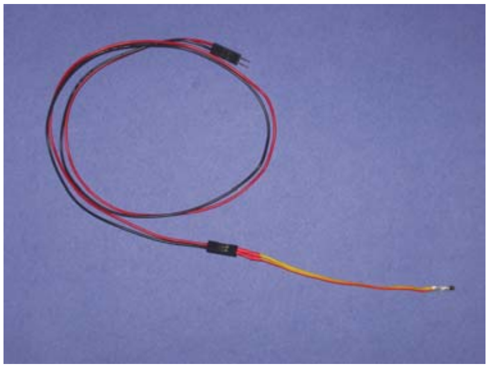
Second Systems Test (Ground):

For the second ground test I and added 10' of 11mm Kevlar shock cord to the fin can, ejection charge bulk plates and then connected to a 20' length of 9/16" TN. The goal was to ensure that the recovery harness and bulk plates would exit the airframe. I also increased the BP to 1.2 grams. The resulting ground test was very successful with the majority of the shock cord fully deployed. One exception was the fin can shock cord could not extend due to the routing of the ematch wire and I did not use a quick disconnect on the ematch lead for the ground test. (I also overshot my padding☹)

Possible Tips, tricks and Gotcha's:

1. The E-match wire will need to have some sort of quick disconnect that will release when the sections deploy, otherwise the wire could possibly cause the forward bulk plate to hang and not release the deployment gear.





Here is an e-match with two pins soldered to the ends. These are similar to the headers used on computer mother boards. I then found a cable that will act as the female end and routed to the altimeter pyro channel.

I have used similar custom made quick disconnects on my 38mm J – I two stage rocket successfully. However you may chose to use any other quick disconnect that meets your needs. One suggestion is Deans Connectors commonly used in remote control airplanes.

2. I expect the two bulk-plates to char/burn from the BP charges; the plates should be replaced when necessary. A layer of masking tape will probably add a longer life.

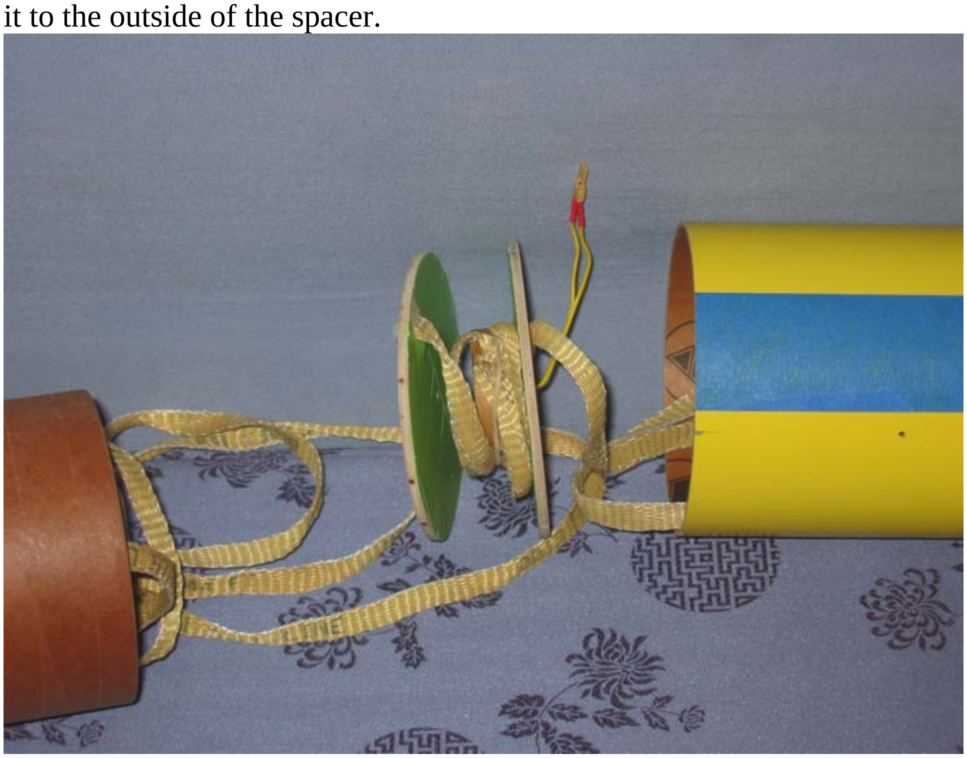
I covered the bulk plates with a layer of green masking tape. The bulk plates show very little residue after a single BP charge, you can see some residue on the shock cord. This is not a new section of shock cord; it has been used several times in a different rocket, however the residue that you see if from a single test.

3. The center holes, shock cord passages and e-match wire in the bulk plates should be plugged/sealed, I used masking tape.


The bulk plates are not airtight, BP gases leakage will occur, however it is minimal. Here you can see the amount on the fin can and inside the airframe section. The recovery shock cord and other areas did not appear to be exposed to the hot gases.

4. Shock Cord Management.

One area that needs improvement is managing the shock cord to prevent it from being inadvertently blocking the correct position of the bulk plates. I finally used a couple of rubber bands to hold the shock cord in place. This procedure could easily be improved with practice and alternate methods of shock cord management (breakable tape, rubber bands etc).
Note: I did not wrap the shock cord the spacer, but rather folded it and rubber banded it to the outside of the spacer.



You may be wondering name “DragonFart” for this technique.
Steve Shannon helped to review the idea and provided the name, a small fart of a BP charge is able to separate the rocket and drag out the recovery gear. ☺

I’m more than willing to entertain any other name.