PEAK OF FLIGHT NEWSLETTER

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APOGEE COMPONENTS

Building Your First E-bay: Part 1

By Jerome Vida

I cannot remember how many times I launched a high-power rocket that went so high I could barely see it. I also remember that feeling I would get when I knew how long of a walk was coming to retrieve that rocket. I think we have all been there, right? Using motor ejection is easy but there is a price to pay. However, there is an answer! I was at a club launch one sunny afternoon and watched a fellow club member launch a dual deploy rocket. My rocket landed nearly ¾ of a mile away and his landed like 300 feet from the pad, and they both went about the same height. I thought to myself "WOW, now that's the way to do it" and so began my journey into the world of dual deploy high power rocketry.

I was new to the world of high power rocketry. I did have my level 1 cert, but up until then everything I had flown was motor ejection. I really had no clue where to begin. All I did know was that I wanted to build and fly a dual deploy rocket. Therefore, the first thing I did was walk up to my fellow club member who had just flown that dual deploy rocket and started asking questions. My fellow member suggested that at our next club meeting he bring with him a dual deploy AV-Bay and go over the entire thing with me.

Walking into the next club meeting I was anxious to get the rundown that I was promised. After some chit-chat, we finally sat down to go over the AV-Bay that he brought. We started with parts and simple functions of the AV-Bay components. Here is a list.

The Bits and Pieces

What is nice here is that the bulk of the parts can be purchased at Apogee Rockets, which will save time and money. Here is the link to the site. https://www.apogeerockets.com/

- **Dual Deploy Altimeter** – For this build, I used the Perfect Flight StrattoLoggerCF. This is a solid altimeter and is easy to program for the beginner. https://www.apogeerockets.com/Electronics-Payloads/Altimeters/PerfectFlite-StratoLogger-Altimeter-CF

- **Rotary Switch** – I like to use the dual pole rotary switches. They are easy to mount in thru the wall applications, which make them easy to access since the switch face is on the outside of the rocket. https://www.apogeerockets.com/Electronics-Payloads/Electronics-Accessories/Electronics-Rotary-Switch

- **4" x 8" Fiberglass Coupler** – This is the actual AV-Bay Body. In this build I used fiberglass, however, if you use cardboard the build process is the same. https://www.apogeerockets.com/Building_Supplies/Body_Tube_Couplers/Fiberglass_Couplers/4inx8in_G12_FW_Fiberglass_Coupler

- **4" Fiberglass Bulkheads** – The bulkhead is used to cap off the ends of the AB-Bay using the thread rods. The bulkhead is also used to mount the ejection canisters, the ejection charge terminal blocks and the eyebolt used to attach your shock cord. https://www.apogeerockets.com/Building_Supplies/Bulkheads/Coupler_Bulkheads/Fiberglass_Coupler_Bulkhead_Disk_4in

- **Switch Band** – This is the part that holds the AV-Bay in place between the forward and aft sections of your rocket. It is also the part that houses the on/off switches for the altimeters.

- **AV-Bay Kit** – In this example, I am using an AV-Bay for a 4" rocket. Please note that this AV-Bay kit comes with the plywood sled, ¼" plywood bulkheads, all thread rod, nuts, washers, lock washers and eye bolts. Everything you need to assemble the AV-Bay sled. https://www.apogeerockets.com/Electronics_Payloads/Electronic_Bays/4-0_Madcow_Ebay

- **Terminal Block** – These are used to connect the altimeter to the ejection charge igniters. https://www.apogeerockets.com/Electronics-Payloads/Electronics-Accessories/Terminal-Block

- **Stand Offs** – These are used to mount the altimeter to the AV-Bay sled. This link is the nylon variety, but the metal variety will work just as well. I used the metal variety for this AV-Bay. https://www.apogeerockets.com/Electronics-Payloads/Electronics-Accessories/Altimeter-Mounting-Posts

- **Connection Wire** – I used the black and red wire to connect the altimeter to the terminal block and the rotary switch to the altimeter. https://www.apogeerockets.com/Electronics_Payloads/Electronics_Accessories

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About this Newsletter

You can subscribe to receive this e-zine FREE at the Apogee Components website **www.ApogeeComponents.com**, or by clicking the link here Newsletter Sign-Up

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- **RocketPoxy** – https://www.apogeerockets.com/Building_Supplies/Adhesives/G5000_RocketPoxy_8_oz_Package

- **Additional Parts** – available at your local hardware store or on Amazon.
  - 9-volt battery
  - 9-volt battery cradle
  - 1" O.D. PVC pipe plugs (Ejection Canister to hold FFFF black powder)
  - 1" 2/56 pan head screws, washers, lock washers and nuts
  - 1" 4/40 pan head screws, washers, lock washers and nuts
  - Male / female Locking wire connectors: Locking wire connector
  - Self-Adhesive Cable Tie Mounts: Cable Tie Mounts

Tools that will be needed

- Pencil
- Ruler and measuring tape
- Small flat head screwdriver
- Small Phillips head screwdriver
- Needle Nose Pliers
- Small Adjustable wrench
- Wire cutters
- Wire Strippers
- Soldering iron & Solder
- Shrink tubing
- Drill Bits, #43 (2/56), 1/8" (4/40), ½"
- Small and heavy duty zip ties

So, this was the basic list of parts and components that I made from my fellow club member. I took a few photos of his AV-Bay, and we talked a bit about each of the items on the list. When I left the meeting, I was confident in what I was going to do and how I was going to go about it. In the next day or so I decided on a kit that I was going to build. I chose a Madcow Rocketry Warehouse X-Celerator! It is a 4" Fiberglass Kit with a 54mm motor mount. Perfect kit for dual deploy and being it is a mid-cost kit I decided to go with dual deploy with secondary back up (Using 2 separate altimeters) a main and a backup. And with that, I started to buy my parts and components. Once I had received everything I needed to build my AV-Bay I got to work.

Figure 1: Finished glued section of the sled.

In speaking with my club member friend, I found there are the three main parts of the AV-Bay. First is the sled, second is the bulkheads and third is the AV-Bay body. I will give a detailed step by step for the build of each of these three main AV-Bay parts.

The Sled

The main parts for the sled are the altimeters, battery cradles, batteries, and standoffs.

The first thing I did was assemble the plywood AV-Bay sled. I used TiteBond wood glue. The sled is laser cut so the parts fit perfectly together. I simply laid a bead of glue for each of the sled brace pieces and put them in place. I then ran a fillet bead of glue on both sides of each brace and set aside to dry (**Figure 1**).

Once the sled was dry, I laid out the main parts on the sled to make sure that everything was going to fit on the plywood sled from the Madcow AV-Bay. I laid out the two perfect flight altimeters that I ordered from Apogee and the two 9-volt battery cradles. Every-

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Quick-Change Motor Adapters

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- Works with all single-use and re-loadable motors
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thing seemed to fit well and still gave me a bit of room for wiring things up. However, keep in mind that the layout of the parts on the AV-Bay is critical because you need to be able to fit the sled into the AV-Bay once everything is mounted onto the sled. I found out the hard way that just because everything fits nicely on the sled the way you lay it out on your workbench, does not mean that it will always fit neatly into the AV-Bay body itself when the parts are mounted to the sled. There was a little bit of trial and error for how I had to arrange the parts on the sled so it would fit nicely into the AV-Bay body. Here is a quick layout chart (**Figure 2**) for the guideline positioning I settled on for the altimeters and battery cradles to ensure everything fit neatly into the AV-Bay Body once the sled was fully assembled.

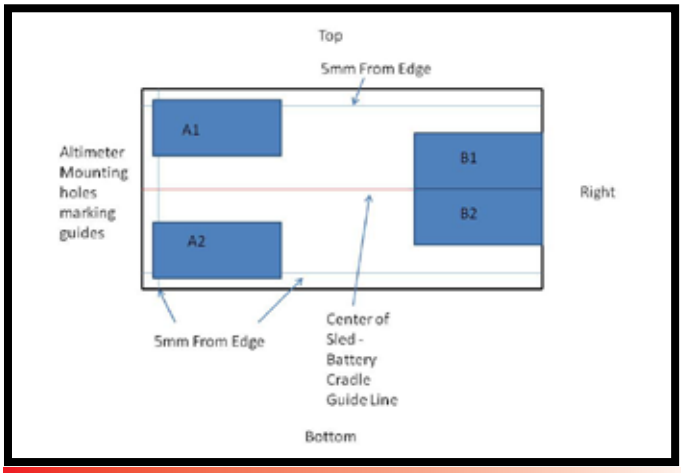

Figure 2: Layout chart for part placement on the E-bay

Once my basic layout was set these are the steps I used to layout and drill the mounting holes for the battery cradles and altimeters. In this build, the sled is 3” x 6”.

1. Using a ruler and a pencil, measure and mark the guidelines on the sled. First, draw a line down the exact center of the sled’s 6” length. This line is used to position the battery cradles.
2. Next, I marked the altimeter guidelines. These lines are approximately 5mm from the left side edge and 5mm from the top and bottom edge of the sled.
3. To mark the mounting holes for the battery cradles, place the battery cradles into position aligned to the center guideline. One battery cradle will nicely fit on each side of the line. Then align the bottom of the battery cradle to the right side of the sled making sure that the wires attached to the battery cradle are facing the altimeter side of the sled.
4. Once the cradles are in position use a pencil to mark the three holes in each of the battery cradles. These three holes are used to bolt the battery cradles to the sled. Keep in mind that the batteries are going to be just about the heaviest parts that are attached to your sled so making sure they are secure is very important. Because of the size of the mounting holes in the battery cradles, I used 1” 2/56 pan head screws.
5. With the hole locations clearly marked on the sled, use a #43 drill bit to drill the mounting holes into the sled. Once all the holes are drilled, verify that the locations of the holes are correct by doing a test mount of both battery cradles. After the test, fit remove the battery cradles and set aside.
6. Next, using the Perfect Flight StrattoLoggerCF as a mounting template, align the mounting holes in the altimeter to the guideline marks that you made on the sled.
7. Make sure that the altimeters are positioned per the graphic above. Also, verify that the center of the mounting holes in the altimeter line up with the guidelines.
8. Once the altimeter is correctly aligned, use a pencil to mark the altimeter’s mounting holes’ locations.
9. Using a 1/8” drill bit, drill the mounting holes for both altimeters. After you drill the mounting holes verify the holes are in the correct locations by lining up the holes in the altimeter with the mounting holes you just drilled in the sled.
10. If all the thru-holes are correctly positioned it is time to start mounting the two battery cradles and the two altimeters.

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Mounting the two battery cradles and the two altimeters.

1. Align the three holes in the first battery cradle to the battery cradle mounting holes in the sled.
2. Slide a 1” 2/56 pan head screw into the first of the three mounting holes.
3. On the backside of the sled while holding the first screw in place, slip a flat washer and then a lock washer over the screw.
4. Place a small drop of blue Loctite on the screw and secure everything in place with a nut. Use a small adjustable wrench and a small screwdriver to tighten down the screw and nut. Repeat this process for the remaining screws to secure the battery cradles to the plywood sled.
5. To have a bit of a cleaner look on the bottom of the sled use a cutoff wheel in a Dremel tool and remove any access screw.
6. Next, insert a metal standoff into the first mounting hole for the altimeter. Because of the thickness of the sled and the length of the threaded part of the standoff, only a small portion of thread will extend thru the mounting hole.
7. Place a small drop of blue Loctite on the threaded part of the standoff that is extending thru the sled.
8. Secure the standoff in place with a nut. Tighten down the nut using a small adjustable wrench while using a pair of pliers to hold the standoff in place.
9. Repeat this process for the seven remaining standoffs.
10. Using 3/16” 4-40 pan head screws, attach the altimeters to the standoffs. Makes sure that the power terminals on the altimeter are facing towards the middle of the sled and that the ejection charge relay terminal is facing out (**Figure 3**).

Now that the main components are mounted to the sled, we are going to start the wiring process. We will need wire cutters, a wire stripper, solder, a soldering iron, shrink tubing and a lighter or heat gun. We will also need our male/female locking wire connectors.

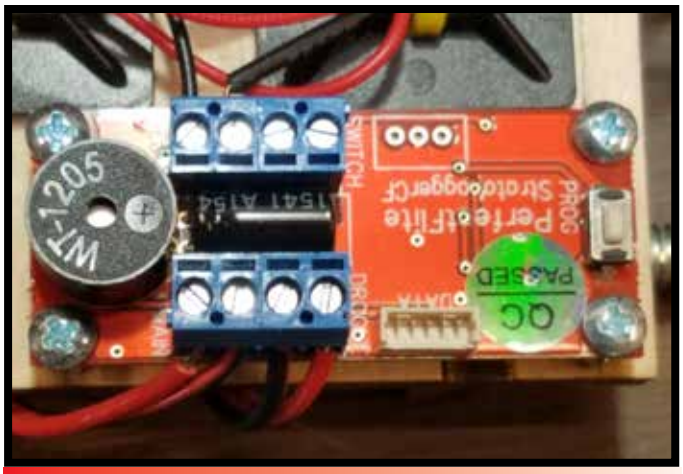

Figure 3: Attaching the altimeter to the sled.

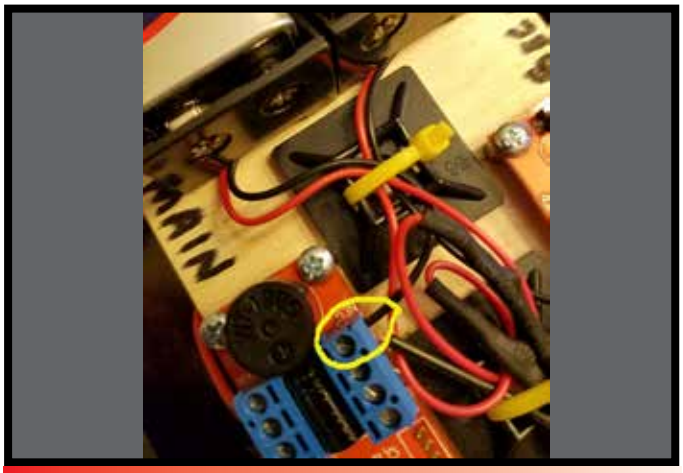

Figure 4: Test fit for length the black lead wire.

1. Test fit for length the black lead wire coming off the battery cradle to the negative terminal on the altimeter (**Figure 4**).
2. Once you roughly have the correct length, which should be around 3 inches or so, using the wire cutters snip the black wire to length. Using the wire strippers, strip about 1/4” of the plastic off the end of the black wire.

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3. Using a small flat head screwdriver loosen the first terminal block screw labeled “NEG” on the altimeter.
4. Gently slide the stripped end of the black wire from the battery cradle into the side of the terminal block.
5. Use the small flat head screwdriver to tighten the terminal block screw and secure the black wire in place.
6. Repeat this process for the second altimeter with the second battery cradle.

Now we will make the rotary switch connector.

1. Get the female side of the male/female locking wire connectors. The female side is on the right in the photo (**Figure 5**).

Figure 5: Connect the locking wire connectors.

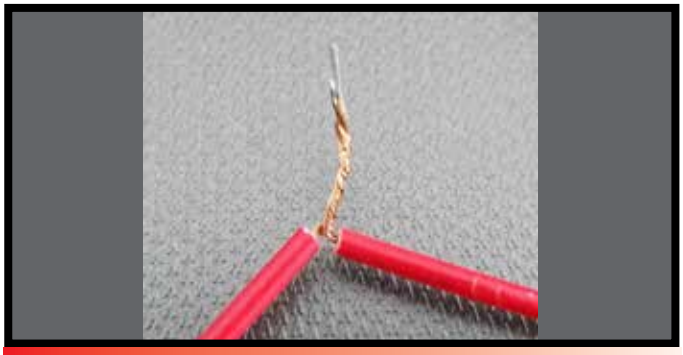

Figure 6: Twist the red striped wires together.

2. Using the wire strippers, strip about ½” of the end of the red wire side of the wire connector. If the strands separate just use, your fingers to twist them back together.
3. Using the wire strippers, strip about ½” of the end of the red wire attached to the battery cradle. If the strands separate use, your fingers to twist them back together.
4. Slide a 1” piece of small shrink tubing over the end of the red wire on the female wire connector.
5. Twist the two ½” striped red wires together with your fingers. It should look like **Figure 6** when done.
6. Solder the twisted ends together with your soldering iron.
7. Once the solder connection is cool to the touch, slide the piece of shrink tubing over the soldered twisted wires and use a lighter or heat gun to shrink the tubing around the solder connection.
8. Next, strip about ¼” of the black wire attached to the female side of the male/female locking wire connector.
9. Using a small screwdriver, loosen the screw in the altimeter power terminal directly next to the terminal labeled “NEG”. Slide the stripped end of the black wire on the female locking wire connector into the terminal.
10. Tighten the screw on the terminal and ensure a tight fit.
11. Repeat this process for the other battery cradle and altimeter.

Next, we will make the connection wires for the ejections terminals. Making the wire connectors for the ejection charge terminals is like the rotary switch connector.

1. Get a female side of the male / female locking wire connector.
2. Using wire strippers, strip ½” of both the red and black wires on the female connector. Twist the ends of the wire if they separate.
3. Using wire cutters, cut off a piece of the red/black connection wire about 8” long.

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4. Using the wire strippers, strip ½" off the ends of both the red and black side of the connection wire. Twist the ends if they become separated.
5. Slide a 1" piece of small shrink tubing over both the black and red side of the connection wire.
6. Using your fingers twist the red wire on the female connector to the red wire of the connection wire and twist the black wire of the female connector to the black wire of the connection wire. Should look like **Figure 7** when finished.

Figure 7: Twist the black wires together matching the red.

7. Using your solder and soldering iron, solder the twisted red wires together and then solder the twisted black wires together.
8. Once the solder connections are cool to the touch, slide the shrink tubing over each of the solder connections.
9. Use a lighter or a heat gun to shrink the tubing around the solder connection.
10. Using your wire strippers, strip about ¼" of the other side of the red/black connection wire. This will be the ends that go into the ejection charge relay terminal block on the altimeter.
11. Repeat this process to create a total of four ejection relay wire connectors.

Once the four ejection charge connector wires are complete, we will attach them to the ejection charge relay terminal block on the altimeters.

1. Using a small flat head screwdriver loosen the four screws on the ejection charge relay terminal block. They will be marked "MAIN" and "DROGUE".
2. Take the first of your ejection relay connection wires and slide the stripped ends into the two slots marked for the main ejection charge.
3. Use the small flat head screwdriver to tighten the screws to secure the connection wire in place. Ensure they are secure.
4. Take your second ejection relay connection wire and repeat the process for the drogue side of the terminal block making sure the wires are secure.
5. Repeat the process for the other altimeter. Use the photo of the wire connected to the ejection charge relay terminal block for reference (**Figure 3**, **Page 5**).

In the next issue I will show you how to finish your E-bay build in "*Building Your First E-bay: Part 2*"

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