PEAK OF FLIGHT

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IN THIS ISSUE

Building Your First Ebay: Part 2

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APOGEE COMPONENTS

Building Your First Ebay: Part 2

By Jerome Vida

In *Building your First Ebay: Part 2* we will start by securing all the wires into place to help keep them organized. For this, we will need four of the self-adhesive cable tie mounts and four small zip ties.

1. Take two of the self-adhesive cable tie mounts and stick them to the sled between the altimeters, refer to **Figure 1**.
2. Using a small zip tie, secure the red and black wires attached to the battery cradles to the self-adhesive cable time mount closest to the battery cradles as pictured (**Figure 1**).

Figure 1: Secure the red and black wires into place with zip ties.

3. Next carefully and neatly bunch the rotary switch connections wires and secure them in place with a small zip tie to the self-adhesive cable mount near the edge of the sled. Make sure that the female locking connector has a few inches of loose wire hanging past the edge of the sled. This will allow easy connection when assembling and disassembling the AV-Bay.
4. Once the rotary switch connection wires are secured to the top of the sled, flip over the sled.
5. Take two of the self-adhesive cable tie mounts and stick them to the bottom of the sled as shown. Make sure they will not interfere with the threaded rod (**Figure 2**).
6. Take the ejection charge relay connection wires that are attached to the main ejection charge relays on both altimeters and secure them to one of the self-adhesive cable tie mounts using a small zip tie.
7. Take the ejection charge relay connect wires that are attached to the drogue ejection charge relays on both altimeters and secure them to one of the self-adhesive cable tie mounts using a small zip tie.

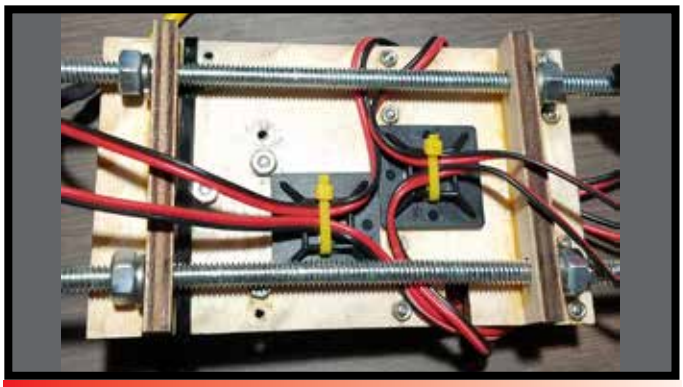

Figure 2: Attach the self adhesive cable mounts to the bottom of the sled.

8. Verify that the two mains are together and that the two drogues are together. This is of the utmost importance. If these connections are not grouped correctly, your ejection charges will not fire in the correct sequence.
9. Using some colored electrical tape, mark the main connections in one color and mark the drogue in another color.
10. Insert your two 9 volt batteries into the battery cradles and use a heavy-duty zip tie around the entire sled to help secure them in place.
11. Finally, slide the all thread rod through the holes in the brackets you glued to the plywood sled. Make sure the sled in centered on each of the thread rods. Secure the all thread rods into place using a flat washer, a lock washer and a nut on each side of the sled.

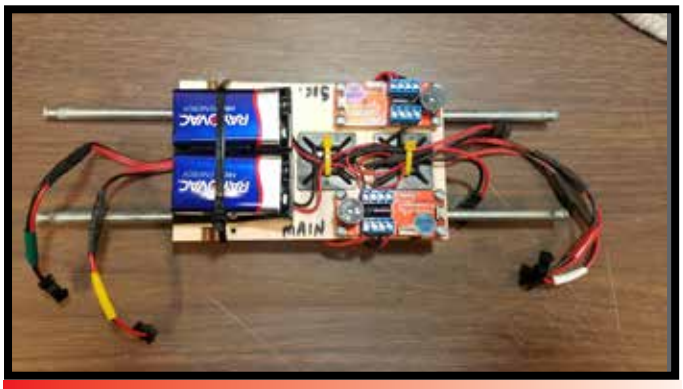

Figure 3: Here is a photo of the completed AV-Bay sled.

Continued on page 3

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Building Your First Ebay: Part 2

Continued from page 2

Now we move on to make the make the AV-Bulk bulkheads. The bulkheads are the end caps that close the sled into the AV-Bay body and have the eyebolts that your shock cords attach too. The bulkheads also have the ejection canisters and ejection terminal blocks mounted to them.

1. Start by drawing a line across the center of the top of the bulkhead (**Figure 4**).

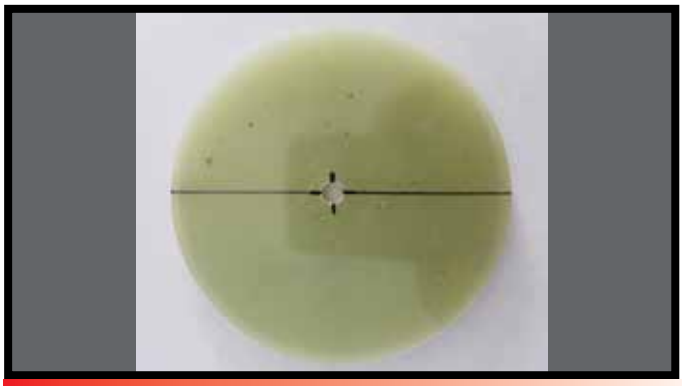

Figure 4: Draw a line across the center of the bulkhead.

2. In this build, the sled used has a 2" span on the thread rods that are used for mounting the completed AV-Bay Sled into the AV-Bay. Using a ruler mark the thru hole location for the all thread rod 1" to the left and right of center on the line you drew (**Figure 5**).

Figure 5: Mark the 1" locations for the thread rod holes from the center of the bulkhead.

3. Next, make marks 1.25" on the center of the thru-hole perpendicular to the line you drew across the bulkhead. These will be the thru-holes to mount the ejection canisters (**Figure 6**).

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Figure 6: Mark 1.25" for the ejection canister holes from the center of the bulkhead.

4. Now place the ruler's edge on the mark for the ejection canister and the end of the line you drew across the bulkhead as seen in the photo (**Figure 7**). Make a mark 1" from the ejection canister mark, this will be the terminal block thru hole. Next, make a mark ¾" from the terminal block mark. This will be a thru hole for the connection wire.

Figure 7: Create marks for the terminal block thru hole and the thru hole for the connection wire.

Continued on page 4

Building Your First Ebay: Part 2

Continued from page 3

5. Repeat this process on the opposite side of the bulkhead. Once complete the bulkhead markings should look like **Figure 8**.

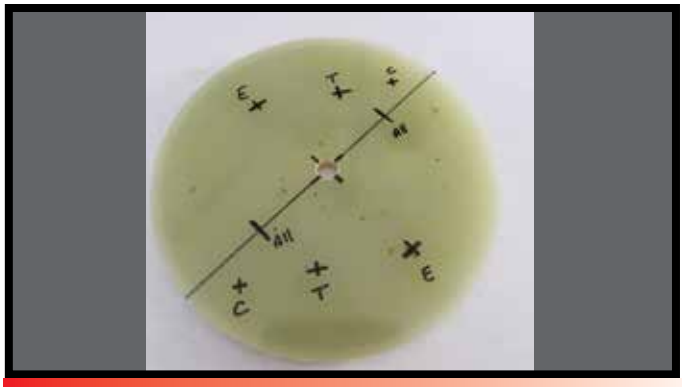

Figure 8: Completed markings for comparison.

6. Repeat this process to mark the second bulkhead.
7. Once all the thru hole locations are marked drill the thru-holes. The all thread mark is drilled with a ¼" bit; the other marks are drilled with a 1/8" bit.
8. Optional step: once I drilled all my thru-holes, I painted the bulkheads with a light coat of flat black spray paint. I just like the look better.

Now it is time to mount the parts to the bulkhead. For this we will need the 1" O.D. PVC pipe plugs, the plastic terminal blocks, four 18" pieces of the red/black connection wire, four of the male side of the male / female locking wire connectors and the eyebolts and 4-40 hardware. When everything is mounted to the bulkhead it should look like **Figure 9**.

1. Using a 1/8" drill bit drill a thru hole in the center of the 1" PVC pipe plug. Slide a 4-40 screw thru the drill hole from the inside of the cap.
2. Now slide the screw thru the ejection canister thru hole in the bulkhead. Secure the PVC cap in place using a flat washer, a lock washer and a nut. Blue Loctite can also be used.

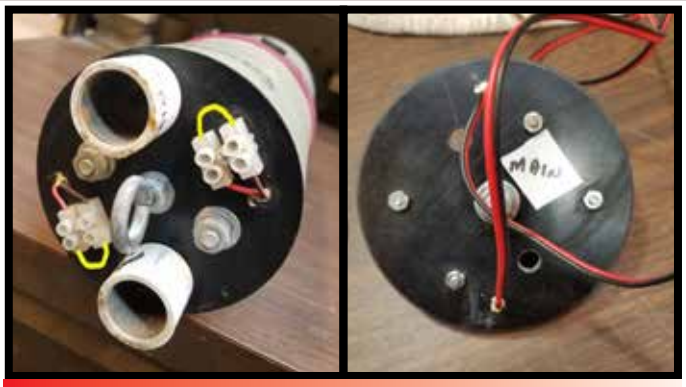

Figure 9: Completed bulkhead

3. Next, using a 4-40 screw secure a 2x2 plastic terminal strip to the bulkhead. Slide the screw thru the mounting hole in the terminal strip and then slide the screw thru the terminal strip mounting hole in the bulkhead. Secure in place using a flat washer, lock washer and nut. Blue Loctite can also be used. Make sure the end of the terminal block is pointing at the connection wire thru hole that you drilled in the terminal block.
4. Repeat this process for the opposite side of the bulkhead.
5. Slide the eyebolt thru the center hole of the bulkhead. Secure in place using a flat washer, lock washer and a nut. Blue Loctite can be used as well.
6. Using wire strippers, strip ¼" of the end of you 18" piece of connection wire.
7. Slide the connection wire thru the connection wire thru hole in the bulkhead.
8. Use a small Phillips head screwdriver to loosen the terminal block screws closest to the connection wire.
9. Slide the stripped ends of the connection wire into the terminal block and tighten the terminal block screws. Make sure the connection is secure.
10. Repeat for the other side.
11. Secure each connection wire by using a small ball of epoxy putty in the thru hole. This is very important because you want to plug this hole. You do not want ejection gases coming into contact with your electronics inside the AV-Bay.

Continued on page 5

Building Your First Ebay: Part 2

Continued from page 4

12. Using wire strippers, strip ½" off the loose end of the ejection terminal connection wire.
13. Using wire strippers, strip ½" off the red and black wire on the male side of the male/female locking connector.
14. Slip a 1" piece of small shrink tubing over the red and black wire on the male connector.
15. Using your fingers twist the red connection wire and the red wire from the male connector together.
16. Using your fingers twist the black connection wire and the black wire from the male connector together. Should look like Figure 7, Page 7, in Peak of Flight Newsletter #464 *Building Your First Ebay: Part 1* when finished.
17. Using solder and your soldering iron, solder the red twisted ends and then solder the black twisted ends.
18. Once the solder connections are cool to the touch, slide the shrink tubing over the solder connections and use a lighter or heat gun to shrink the tubing over the solder connections.
19. Repeat this process for the opposite ejection connection wire.
20. Once the first bulkhead is complete, repeat all these steps to complete the second bulkhead. Once you are completed the finished bulkhead should look like **Figure 9** on Page 4.

With the completed AV-Bay Sled and the two bulkheads, we come to the assembly of the AV-Bay Body. For this, we will need the 4" x 8" Av-Bay Fiberglass coupler, the fiberglass switch band, two rotary switches, two male sides of the male/female locking wire connectors and two 18" pieces of the red / black connection wire.

1. Using a tape measure mark the center of the 4" x 8" fiberglass coupler. It should be 4 inches from either end of the tube.
2. Using a tape measure mark the center of the fiberglass switch band. The mark should be about ½" from either side of the switch band.
3. Using some 60 or 80 grit and sandpaper rough up the inside of the switch band making sure that once done you remove all the fiberglass dust. Removing all the fiberglass dust will help ensure you have solid epoxy adhesion.
4. Using some 60 or 80 grit sandpaper rough up a 1" band around the outside center of the 4" x 8" fiberglass coupler making sure when done that you remove all the fiberglass dust. The roughed-up areas will be where you epoxy the switch band to the coupler tube.
5. Prepare a small amount of RocketPoxy fiberglass epoxy.
6. Carefully run a small bead of the RocketPoxy all the way around the coupler tube. Make sure you run the bead at the edge of the sanded area.
7. Now slowly slide the switch band onto the tube coupler starting at the side closest to the bead of RocketPoxy. You want the switch band to spread out the epoxy over the roughed-up area of the tube as you slide the switch band into position.
8. Make sure your two centering marks line up to ensure the switch band is positioned directly in the middle of the coupler tube.
9. Visually inspect the edge of the switch band and clean up any epoxy that may have collected. This is very important to ensure a good fit when your rocket is assembled (**Figure 10**).

Figure 10: Visually inspect the switch band edge to ensure that it is is clean of epoxy.

Continued on page 6

Building Your First Ebay: Part 2

Continued from page 5

10. Set the coupler, switch band aside, and allow the RocketPoxy to completely cure. While the RocketPoxy is curing, we will make the rotary switch connection wires.
11. Using wire strippers, strip ½" off the end of one of your 18" long red / black connection wire pieces. (18" wires are a good length because they are long enough to allow you to make all of your wire connections outside of the AV-Bay, then once you have made all the connections you can put the wires into the AV-Bay during assembly.)
12. Carefully slide a ½" piece of small shrink tubing on to both the red and black side of the connection wire.
13. Take the nylon nut that comes with the rotary switch off. Set the nut aside.
14. Take note that the rotary switch has four terminal posts on the backside of the switch. For this build, we will be using the two center terminal poles. Take the stripped end of the red connection wire and feed it thru the hole on the left center terminal pole. Twist the wire to hold it in place.
15. Slide the stripped end of the black wire thru the hole in the right-center terminal pole and twist into place.
16. Using solder and a soldering iron, solder the red and black wire to the terminal poles.
17. Once cool to the touch, slide the shrink tubing over the solder connections and use a lighter or heat gun to shrink the tubing (**Figure 11**).

Figure 11: Place shrink tubing over the solder connections and seal into place.

18. Using wire strippers, strip ½" of both the red and black side of the connection wire on the loose end of the rotary switch connection wire.
19. Slide a 1" piece of small shrink tubing over each end of the wire.
20. Using the male end of a male / female locking wire connector, twist the red side of the connection wire to the red wire on the male locking connector.
21. Twist the black side of the connection wire to the black wire on the male locking connector. It should look like the example on Figure 7, Page 7, in Peak of Flight Newsletter #464 Building Your First Ebay: Part 1.
22. Using solder and a soldering iron, solder the red twisted wires together and then solder the black twisted wires together.
23. Once the solder is cool to the touch, slide the shrink tubing over the solder connection. Use a lighter or a heat gun to shrink the tubing over the solder connection.
24. Repeat these steps to make second rotary switch connection wire.

With the rotary switches wired up, it is time to drill the rotary switch mounting holes in the switch band. The rotary switch mounting holes need to be ½" holes. In addition to the mounting holes, we also need to drill four ¼" vent holes in the switch band so the altimeters can operate properly. Perfect Flight will recommend how many and how large the vent holes will need to be based on the size of the AV-Bay to ensure proper altimeter function.

1. First, on the switch band, mark a straight line from the bottom to the top of the band. This will be the starting point for all the marking point for your mounting and vent holes. This line will also mark one of the four vent holes' positions on the switch band.
2. Next measure and mark a guideline in the middle of the switch band all the way around the band. This line will be used to help center all your mounting holes and vent holes in the switch band. See **Figure 12** (left) below.

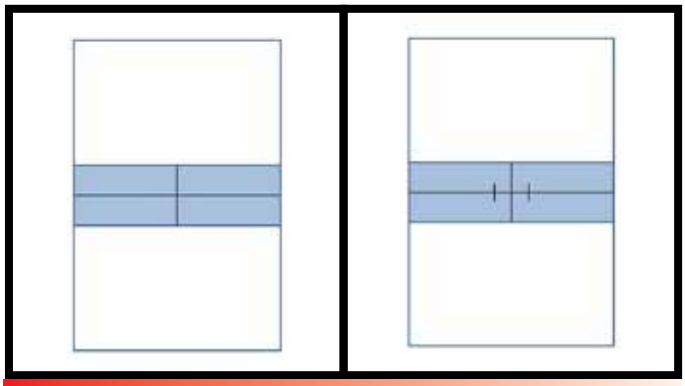

Figure 12: Marking the switch band

Continued on page 7

Building Your First Ebay: Part 2

Continued from page 6

3. Next measure and mark 1” to the left and the right of the main center line on the switch band. These will be where you drill the ½” rotary switch mounting holes. See **Figure 12**, Page 6 (right).
4. Next, we are going to mark the locations of the four – ¼” vent holes. To space them evenly around the switch band you will need to get a piece of printer paper. Cut two 1” strips of the paper down the entire width of the paper. You should end up with two – 8” strips of paper. Using some masking tape, tape the two paper strips together to make a 16” long strip of paper (**Figure 13**).

Figure 13: Tape 2 strips of paper together to make a long strip for wrapping around the tube.

5. Take the long strip of paper and starting at the main centering line on the switch ban, wrap the paper strip around the band until the paper strip is back at the main centering line. (This is the same basic practice as a fin marking guide.) Mark the paper strip where the end meets and cut the excess of the strip off at that mark. You have now made a paper strip that will perfectly fit around the circumference of the switch band.
6. Next, fold the strip in half and fold in half again. Making four equal sections as seen in **Figure 14**.
7. Unfold the strip and use a pencil to mark lines on the folds. This is what you will use to mark the evenly spaced vent holes on the switch band (**Figure 15**).
8. Using a piece of masking tape, tape the end of the paper strip to the switch band starting at the main centering line just like you would when using a paper fin location template. Wrap the paper strip around the switch band and secure the other end of the paper strip with a piece of masking tape. Make sure the ends of the paper strip butt up against each other and are aligned with the main centering line.

Figure 14: Fold the strip of paper in half two times to make four sections.

Figure 15: Unfold the trip of paper and mark the fold lines with a pencil.

9. Mark the switch band where each line on the paper strip is. Including the main centering line there should be a total of four marks for vent hole locations.
10. Remove the paper strip and masking tape from the switch band.
11. You should now have two rotary switch mounting holes evenly marked and centered on the switch band and you should have four vent holes evenly marked and centered on the switch band. Note, the main centering line is being used as a vent hole mark as stated before.
12. Using a ¼” drill bit, drill the four vent holes into the switch band. Making sure they are centered from top to bottom in the switch band.
13. Using a ½” drill bit, drill the two rotary switch mounting holes. Making sure, they are also centered from top to bottom in the switch band.

Continued on page 8

Building Your First Ebay: Part 2

Continued from page 7

Now it is time to mount the rotary switches into the switch band.

1. From the outside of the switch band, feed the rotary switch connection wire thru the switch mounting hole.
2. Once the wire is all the way thru, slip the end of the wire thru one of the rotary switch nylon nuts and secure the rotary switch in place by tightening the nut onto the threads of the rotary switch.
3. Repeat with the second rotary switch. Your rotary switches should look like **Figure 10,** Page 5 and **Figure 11**, Page 6 when mounted into the switch band.

Now that all the components are complete is it time to test the completed AV-Bay.

1. Connect the male end of the rotary switches to the female ends of the battery cradles attached to the altimeter.
2. Turn on the switch. You should hear the altimeter start to beep. This means you have power. Test both switches and altimeters. Once done testing, power off the altimeters.
3. Connect the four male ends of the ejection charge connection wires to the female ends of the ejection charge relay wires on the altimeters.
4. Using a small piece of stripped wire, bridge the open ends of the ejection charge terminals on the bulkhead. This will simulate your e-match (**Figure 9,** Page 4).
5. Once all four ejections charge terminals have been bridged, switch the altimeters back on. The Perfect Flight StrattoLoggerCF will report a sequence of beeps. After the sequence of beeps, you will begin to hear a rapid series of three beeps. The rapid three beeps indicate that there is continuity "power" going to both the main and drogue ejection charge e-match. If you hear the rapid series of three beeps for both altimeters then everything is working correctly.
6. Once you are done verifying the operation of the altimeters and the ejection charge terminals, power off the altimeters and remove the four bridge wires from the ejection charge terminal blocks.

AV-Bay Final Assembly

1. To Assemble the AV-Bay, start by making all your connections. You will want to make sure that the ejection connection wires from one of the bulkheads have been put thru the AV-Bay Body. Now make all your connections.
2. Once all your connections are made slide the sled into the AB-Bay body making sure to avoid the rotary switches.
3. Slide the thread rods thru the mounting holes in the first bulkhead. Use a flat washer; lock washer and nut on each of the thread rods.
4. Next slide the second bulkhead over the all thread rod. Use flat washers, lock washers and nuts on the all thread rod to secure the sled into the AV-Bay.

The finished AV-Bay should look like **Figure 16**.

You are now ready to make your life a whole lot easier by not having to walk a mile one way to retrieve your rocket. Good luck, and happy flying!

Jerome Vida
NAR 99674 – L3, TSO

Figure 16: Completed Ebay assembly.

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