# EZ-DD Rocket Assembly Guide

# Introduction

The EZ-DD Rocket is a 3" diameter dual-deploy rocket including all of the hardware, electronics, and wiring that you need to make it operational. Rather than making you hunt around for all of the little bits that you need to complete the rocket, we have included everything you need in one package. All you need is a motor, 9V battery for the altimeter, and some recovery wadding (or Nomex blanket if you want to go that route). It's designed for 29mm G through I motors… ideal for those just starting out in electronic deployments.

The EZ-DD Rocket is based on the Balsa Machining Services' 3" School Rocket kit. This is a 3" diameter rocket with a 29mm motor mount, with a traditional paper/wood construction and a plastic nose cone. Its relatively large size and ease of construction makes it the ideal starting point for a first dual-deployment project, which is why we chose it. We have carefully selected the additional pieces to add the payload bay and AV bay, and everything comes pre-cut and pre-drilled so you don't have to worry about messing any of that up.

Construction of the rocket starts out with the same instructions as the BMS 3" School Rocket, with a few changes. For example, the 3" School Rocket comes with ¼" launch lugs; we've added 1010 rail buttons, because most NAR/Tripoli clubs which you could launch a dual-deploy rocket with have club-owned rail launchers, and they're a more stable platform for launching from anyway. We'll have you start out using the excellent BMS instructions, and have you stop where necessary when you need to deviate from their instructions. When you're basically done with the booster side of the rocket, we'll have you go to "our" instructions for building the AV bay, payload bay, and connecting the rocket together.

## Choosing the Right Glue…

You can build the rocket using either a good quality wood glue (Titebond is preferred) or a hardware-quality epoxy such as Bob Smith or Devcon. You do not need to buy the extremely high-strength (and expensive) epoxies such as RocketPoxy or West Systems… you can build the entire rocket with just a few ounces of 5-minute epoxy. Which glue you choose doesn't really matter all that much… we've seen great results with either Titebond wood glue or Bob Smith epoxy, it basically comes down to your personal preference. What DOES matter is that you take your time and follow the instructions exactly, so you end up with a good strong airframe.

## Some Hints and Tips

There's always a tendency to jump right into building something like the EZ-DD, especially if you've built a bunch of rockets like this before. While there isn't really anything remarkable about this build, there are a couple of "gotchas" that if you're not paying attention could cause you problems later on.

**PRINT** out the instructions, so you can view the pictures and read the text. If you view it on your computer as you go (or even worse, on your phone), chances are very good that you're going to miss something. Things look different in print.

**READ** these instructions FIRST, before starting to build the rocket. That may save you from missing a critical step… such as not installing the rear rail button before gluing on the rear centering ring.

**CHECK OFF** every step as you go, so you don't miss anything.

# Building the BMS 3” School Rocket… with a Few Changes

Most of the bottom half of the rocket is the basic BMS 3” School Rocket kit. There are a few minor exceptions, mainly because we added rail buttons to their kit which normally comes with a ¼” launch lug. The holes for the rail buttons are laser pre-drilled.

BMS’ instructions are excellent, they have step-by-step check-offs, so rather than duplicating them we’re going to have you use their instructions. You will need to stop at the right point in the instructions, however, in order to install the rail buttons.

___ **Complete Steps 1 through 14 of the 3” School Rocket build.**

Going from the BMS 3” School Rocket assembly instructions, start with Step 1 and continue through Step 14 exactly as per their instructions. However, **STOP** when you get to **Step 15…**

## DO NOT GLUE THE REAR CENTERING RING ONTO THE ROCKET AFTER THE FINS HAVE BEEN INTERNALLY FILLETED! STOP at STEP 15!

___ **Mounting the rear rail button**

You will find the parts for the rail buttons in the package marked RAIL BUTTON KIT.

Screw a #8 x ½” screw into the hole of the rail button backing plate, just enough to “cut” the threads. Remove the screw.

Stack one Nylon washer, one spacer, and another washer on top of one of the #8 x ½” screws to build a rail button. With a #2 screwdriver, screw it into the REAR rail button hole until the threads just begin to “catch”. You don’t need to press hard… just enough so it “catches”.

Hold the mounting plate against the inside of the body tube, then screw the rail button in so that it bottoms out. Do not overtighten it… the screw should completely bottom out and be fairly snug. Place the mounting plate inside the tube so that its hole lines up with the screw. Tighten the screw until the backing plate is nearly flat against the long axis of the tube.

Mix up a small amount of epoxy and apply it around and underneath the backing plate on the INSIDE of the body tube. Lay the rocket so that the rail button is facing down, and allow the glue to dry.

___ **Mounting the forward rail button**

Screw a #8 x ½” screw into the hole of the rail button backing plate, just enough to “cut” the threads. Remove the screw.

Stack one Nylon washer, one spacer, and another washer on top of one of the #8 x ½" screws to build a rail button. With a #2 screwdriver, screw it into the FORWARD rail button hole until the threads just begin to "catch". You don't need to press hard… just enough so it "catches".

Hold the mounting plate against the inside of the body tube, then screw the rail button in so that it bottoms out. Do not overtighten it… the screw should completely bottom out and be fairly snug. Place the mounting plate inside the tube so that its hole lines up with the screw, you will probably need to use some needle-nose pliers to hold the mounting plate since it's about 6" from the end of the tube. Tighten the screw until the backing plate is nearly flat against the long axis of the tube.

Mix up a small amount of epoxy and apply it around and underneath the backing plate on the INSIDE of the body tube. Be careful not to get any epoxy on the Kevlar shock cord; you may want to use some low-tack masking tape to keep it out of the way. Lay the rocket so that the rail button is facing down, and allow the glue to dry.

__ **Mount the rear centering ring**

Per **Step 15** of the BMS 3" School Rocket instructions, glue the rear centering ring onto the end of the fin tabs, and fillet the outside joint. Note that it is VERY important that you line up the T-Nut with the center of the fin with the cutout; the end of that fin butts up against the T-Nut, and prevents the T-nut from pushing out when you insert the screw. Don't forget to remove the screw after you've positioned the centering ring and applied the glue… we recommend that you do so after the glue has just started to "set".

When the glue for the rear centering ring has dried, mount the "Z-mount" motor retainer in the T-nut at the back of centering ring, using the screw provided.

___ **Fillet the fins**

Per **Step 16** of the BMS 3" School Rocket instructions, fillet the fins where they meet the body tube. We like to use low-tack masking tape to keep the glue fillets looking nice and to keep it away from places we don't want it to be.

___ **SKIP Steps 17 and 18…**

We recommend that you DO NOT use the ¼" launch lug (included in the base School Rocket kit) for this rocket. It's really a little too heavy for a ¼" rod, flying a too-heavy rocket from a rod can result in "rod whip", which causes the rocket to wobble severely as it leaves the rod. Also, you're not going to tie the nose cone to the shock cord on the body… it's going to attach to the payload bay shock cord, near the end of the build.

You are now done building the bottom half of the rocket. Now you're going to be building the AV Bay, and then final assembly….

# Building the EZ-DD AV Bay

The EZ-DD AV Bay was designed to be as simple as possible, its construction is pretty typical of dual-deployment rockets with a mid-mounted AV bay. Basically, it's a coupler tube with bulkplates on each end, the electronics are in a "sled" mounted inside, and the assembly is held together with two steel threaded rods. There are a lot of little steps to build it, but it's actually pretty simple… and once you build this one, any other AV bay that you build is going to be a piece of cake.

Note that the holes are laser-cut, sometimes this process leaves a "slug" of material in the hole. You can pop out the slugs very easily with a small screwdriver. It should take almost no force to do that, since they are cut completely through.

You may want to paint the outside of the two bulkplates FIRST, before you assemble the AV bay, we recommend using flat black. They are going to get soiled and grimy from the pyro powder discharge, this keeps them looking a bit nicer and makes them easier to clean. It doesn't hurt anything if you do not paint them… but the first time that you fly your EZ-DD rocket you'll see what we mean.

## Prepare the Coupler

___ Measure ¼" inside from each end of the 5 ½" coupler, and make several marks around the inside of the coupler, all ¼" from the edge of the coupler.

___ Draw parallel lines ¼” apart in each of the ½” coupler rings. With scissors or a hobby knife, cut out the ¼” strip from two ½” coupler rings.

___ Test-fit the coupler rings inside the coupler, making sure that the rings just fit inside the coupler with the cut ends of the rings just touching. If the ends overlap a bit, trim to fit. It’s OK if there is a slight gap, but you do not want the cut ends to overlap.

___ Glue one of the ½” coupler rings inside the 5 ½” coupler on the side with the laser-cut holes, just **below** the ¼” marks that you made in the coupler earlier. There should be a ¼” gap between the end of the coupler and the top of the coupler ring. The cut edges of the coupler rings need to be positioned half-way between the holes that are laser-cut in the coupler, and the coupler rings’ ends should be just pinched together if you cut them properly. Make sure that the coupler rings are even with the ¼” marks in the coupler, you don’t want them to be tilted. Wipe away any excess glue that may be in the coupler on top of the ring… that might interfere with the bulkplate fitting into the coupler later on.

___ Allow the glue to dry before continuing.

___ After the first coupler ring is glued, similarly glue the second coupler ring into the coupler, on the end that does not have the laser-cut holes. Again, the ring needs to be even with the ¼" marks that you made, and the ring needs to be even.

**Build the Sled Base**

Prepare the bottom (Apogee) Bulkplate…

___ Retrieve a charge well from the AV Bay Wiring Package. Mount the charge well using the hardware from the Charge Wells Hardware package.

___ Retrieve a terminal block from the AV Bay Wiring Package. Mount the terminal block to the bulkplate using the hardware from the Terminal Blocks Hardware package (order is screw, charge well, bulkplate, washer, nut).

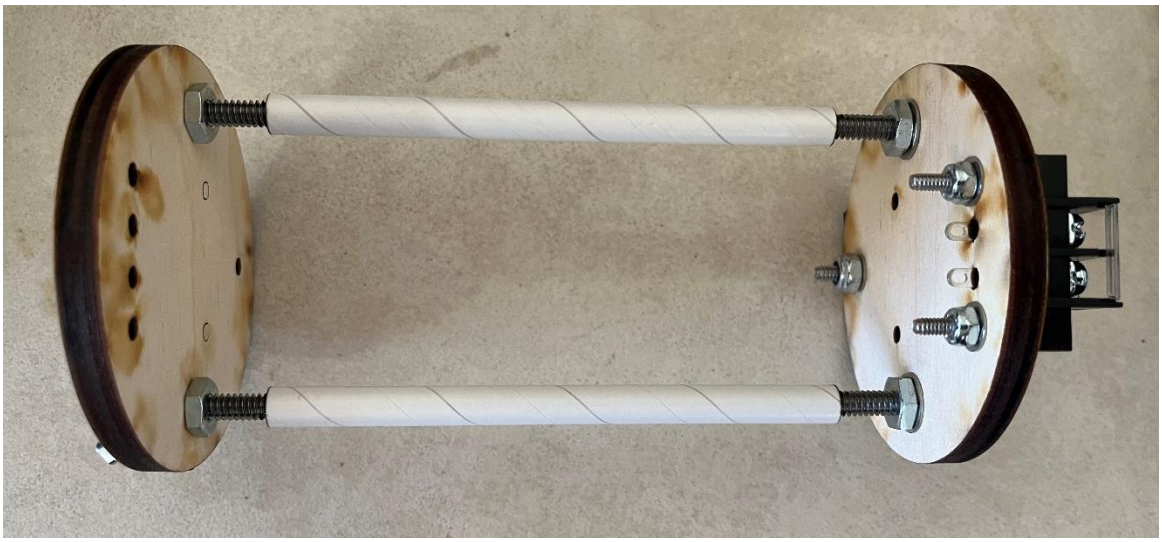
___ From the AV Bay Coupler Hardware package, retrieve the two 6" 10-24 allthreads, four washers, and four #10 nuts. Screw 10-24 nuts ½" into one end of each allthread. Slide #10 washers onto the ends.

___ Attach the bulkplate to the allthreads with the terminal block "up". Slide #10 washers onto the ends, then fasten with 10-24 nuts. Tighten the nuts securely.

___ Slide the 4” T2 tubes onto the allthreads,

___ Screw nuts onto the open side, leaving about ½” of space

___ Attach the second bulkplate to the assembly, using two washers and the two wingnuts.



___ Check the fit of the sled… it needs to fit between the screws/bulkplates. Adjust the nuts on the MAIN side if necessary.

___ Tack-glue the sled to the T2 tubes, with the two extra holes to the LEFT. We recommend using 5-minute epoxy for this. Make sure that the sled is centered between the two allthreads.

___ Let the tacked glue joint cure completely before continuing.

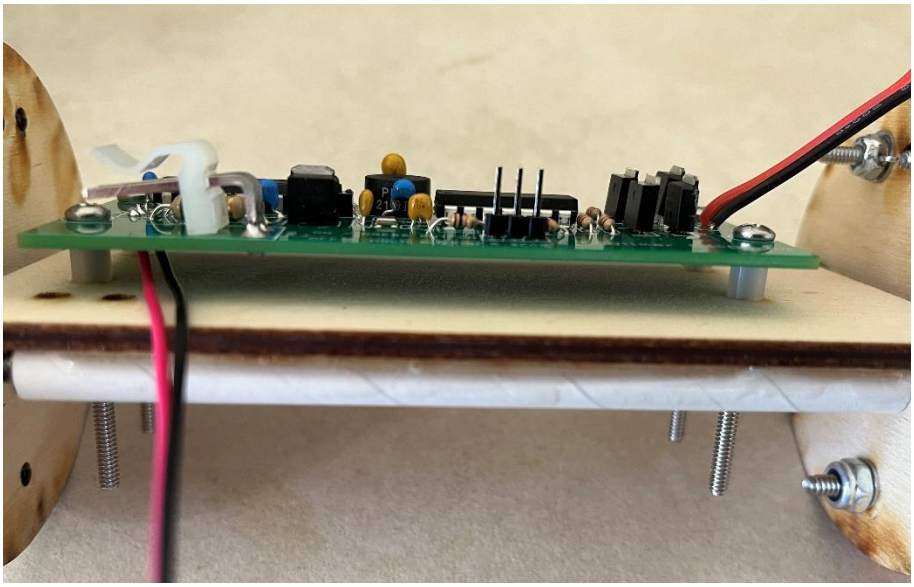
___ Turn the AV Bay assembly over, and fillet the T2-sled joint using 5-minute epoxy. Allow the glue to cure complete before continuing.

**Mount the Altimeter**

___ If you have Christmas tree lights soldered to the pigtails of the altimeter, unsolder them.

___ Remove the MAIN output 2-pin plug/pigtail if it's plugged into the altimeter.

___ Using the hardware from the Altimeter Mounting Hardware bag, mount the altimeter to the top of the sled. The order should be screw, altimeter, spacer, sled, washer, nut. The two extra holes should be on the bottom edge of the altimeter, right next to the 2-pin header.

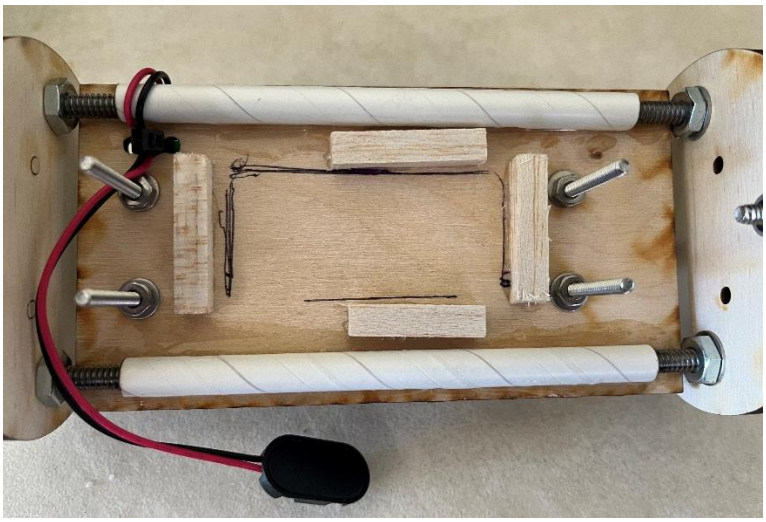


___ Zip tie 9V battery clip to the sled, using the two holes on the sled next to the MAIN connector. You'll have to insert the zip-tie through the bottom of the sled.

___ Temporarily connect a 9V battery to the clip. Turn the sled over and place the 9V battery so that it's centered between the four screw posts, on both the top-bottom and left-right sides. Draw an outline around the battery and clip.

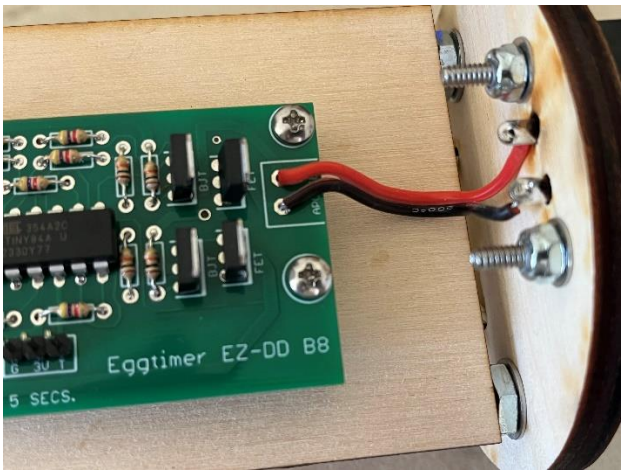
___ Remove the battery and tuck the battery connector away from the center of the sled.

___ Glue the four ¼" square stringers around the battery, on at each edge. We recommend that you leave a little bit of room to account for the slight difference in size between different makes of batteries (maybe 1/32" or so on each edge, about the width of a credit card). We've found that medium-viscosity CA glue works really well for this. Allow the glue to dry.



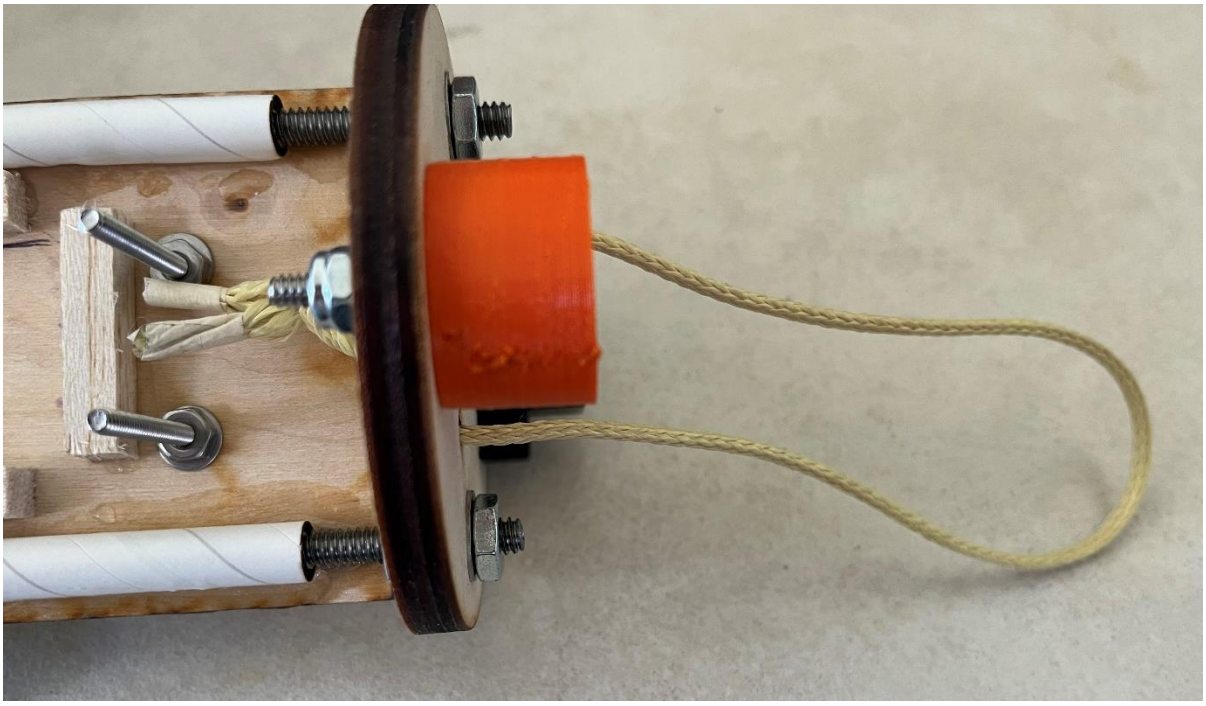
___ Trim the two APOGEE wires so that they reach the Apogee terminal block, with about 3/8" of slack. Strip about 1/8" from each of the wires, then twist and tin the ends with solder.

___ Solder the two APOGEE wires to the terminal block on the Apogee bulkplate.




___ Get one of the 1' Kevlar shock cord loops, and wrap the ends with a piece of masking tape about ¼" wide. This will help you get them through the holes in the bulkplate.

___ Insert the ends of the Kevlar loop into the two holes in the top of the Apogee bulkplate. Pull the ends through, then tie the ends together with a knot. Pull the loop through the end tight… it should feel secure.



**Finish the TOP (MAIN) Bulkplate**

___ Remove the MAIN bulkplate from the sled assembly, set the washers/wingnuts aside.

___ Retrieve a charge well from the AV Bay Wiring Package. Mount the charge well using the hardware from the Charge Wells Hardware package.

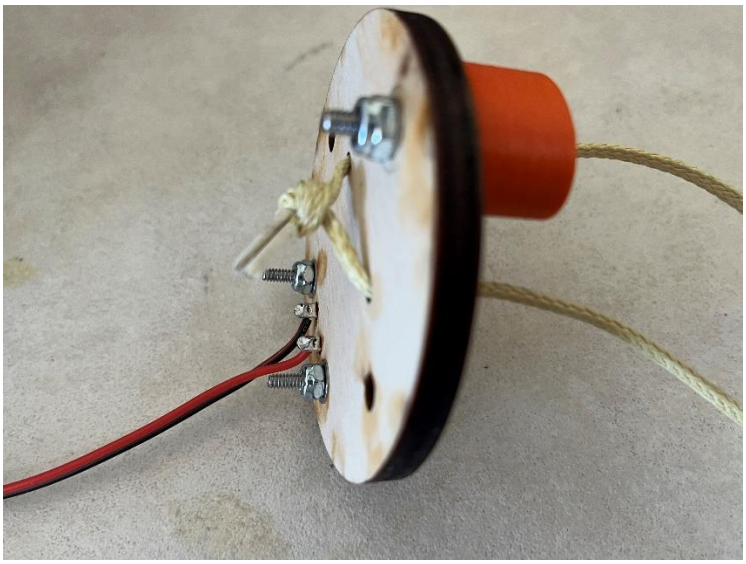
___ Retrieve a terminal block from the AV Bay Wiring Package. Mount the terminal block to the bulkplate using the hardware from the Terminal Blocks Hardware package (order is screw, charge well, bulkplate, washer, nut).

___ Cut the MAIN header/pigtail so the pigtail is about 7" long. Strip about 1/8" from each end of the pigtail, then tin the ends with solder.

___ Solder the MAIN pigtail to the terminal block.

___ Get one of the 1' Kevlar shock cord loops, and wrap the ends with a piece of masking tape about ¼" wide. This will help you get them through the holes in the bulkplate.

___ Insert the ends of the Kevlar loop into the two holes in the top of the MAIN bulkplate. Pull the ends through, then tie the ends together with a knot. Pull the loop through the end tight and give it a good tug… it should feel secure.



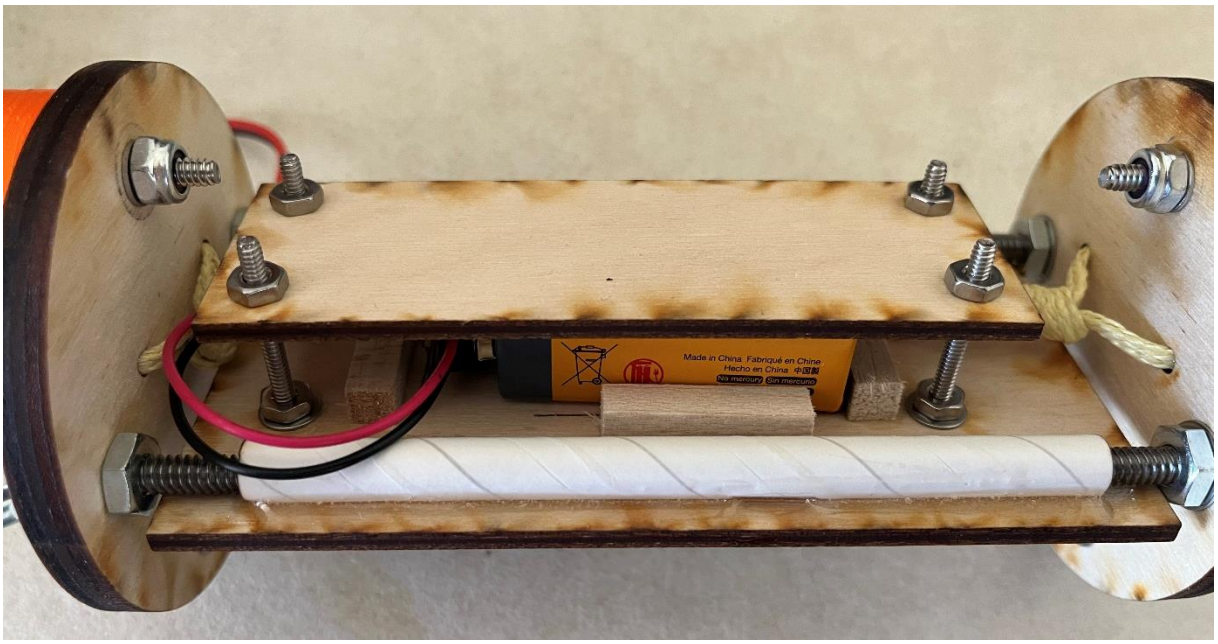
**Final Assembly & Testing**

___ Plug the locking plug into altimeter locking header

___ Screw the top bulkplate onto allthreads using the two washers and wingnuts that you removed earlier.

___ Connect your 9V battery to the clip, insert the battery into the well. The clip should face the opposite side of the zip-tie, so that there's not a lot of slack.

___ Insert the battery cover through the four screws, then secure with the four #4 nuts from the Altimeter Mounting Hardware package. They should be snugly finger-tight… you don't need to use tools to secure them.




Now you're ready to make sure that everything is working…

___ Press the button on the altimeter… it should go through the self test then give you the 1 beep 2 beep no-continuity error codes because you don't have anything connected to the terminal blocks.

___ Hold the button for at least 5 seconds to turn off the altimeter.

___ Loosen the screws on the terminal blocks, and attach the test loads (Christmas tree lights) on the terminal blocks. The leads should go underneath the "plate" of the terminal blocks, NOT directly underneath the screws.

___ Press the button to turn on the altimeter… the beeps should go all the way to the "I'm Ready" chirp.

___ Hold button > 5 seconds to turn off.

The AV Bay is now complete. Time to put it all together…

# Final Assembly

## Finishing the EZ-DD AV Bay

___ Remove the MAIN bulkplate, and set the wingnuts and washers aside.

___ Unplug the MAIN connector from the altimeter board.

___ Slide the AV Bay sled into the AV Bay coupler from the bottom, the side that does NOT have the holes, so that the large hole in the coupler aligns with the altimeter's power button.

___ Plug the MAIN connector back into the altimeter board.

___ Put the MAIN bulkplate on the allthreads, you may have to wiggle them a bit to get them on. While you are doing this, tuck the extra MAIN wiring pigtail into the battery side of the coupler.

___ Put the washers and wingnuts on, just enough so they set.

___ Check the alignment of the altimeter's power button and the large hole in the coupler… the button should be dead-center. If it is not, rotate the sled assembly until it is.

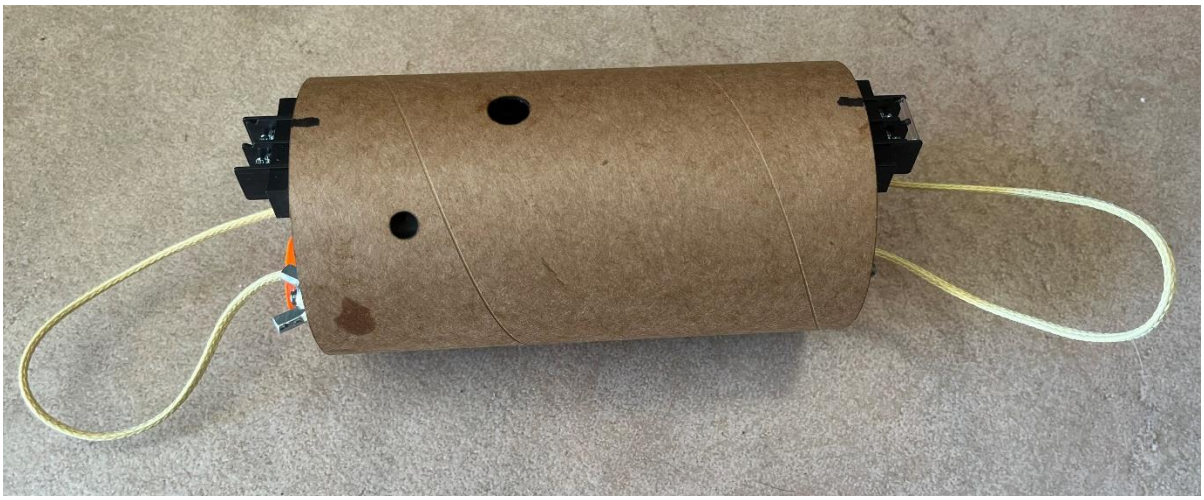
___ Once the button and hole are aligned, tighten the wingnuts.

___ Try to rotate the sled, it should be firm in the coupler. If it rotates fairly easily, you probably have a loose nut between the ends of the sled. Take it apart and check the fit, then

reassemble it. In extreme cases (i.e. you mounted the two ½" coupler pieces a little too far in from the edge of the coupler) you may have to remove the two nuts from the MAIN end of the allthreads to get the sled assembly to tighten in the coupler… it's OK if you do, that won't affect anything.

___ Once the sled is tight in the coupler and the button is properly aligned with the access hole, create alignment marks in the bulkplates and coupler, to make it easy to re-align them when you take it apart later.

Your AV Bay assembly is now complete…



## Final EZ-DD Rocket Assembly

___ With a bowline know, tie the body tube's shock cord to the APOGEE Kevlar loop (the side of the coupler WITHOUT the holes). Leave at least 2" of the cord remaining when you tie the knot. After you have tightened the knot, tie at least two more knots at the end of the cord… you do not want it to come loose!

___ Using a bowline know, tie one end of the 10' Kevlar shock cord to the MAIN Kevlar loop (the side WITH the holes). Leave at least 2" of the cord remaining when you tie the knot. After you have tightened the knot, tie at least two more knots at the end of the cord… you do not want it to come loose!

___ Feed the Kevlar shock cord through the payload bay tube, with the laser-drilled holes facing the AV Bay. When you put it together, the holes in the AV Bay coupler and the payload tube will align so you have access to the altimeter's power button.

___ Make a loop in the Kevlar shock cord about 1' from the end, tie a knot there. This will be used to connect the MAIN parachute.

___ Using a bowline know, tie the Kevlar shock cord through the loop in the nose cone. Tie at least two extra knots… you don't want it coming undone!

___ For the 24” parachute: gather up the lines so that the are even, and tie knot about 2” from the end, leaving loops about 2” in diameter. Loop them through the loop in the Kevlar shock cord, then feed the parachute through the loops in the parachute lines. Pull taut until the parachute lines knot around the shock cord loop.

___ Carefully attach the payload bay tube to the AV Bay coupler, aligning the holes in the payload bay tube with the holes in the AV Bay coupler. (Note: The base 3" School Rocket kit comes with a snap-swivel for attaching the parachute. We DO NOT recommend that you use it for this rocket… it's not strong enough to handle the extra load!)

___ Push the four body fasteners into the four 6mm holes in the payload bay tube and the AV Bay coupler.

___ Feed the MAIN shock cord into the payload bay tube, and fold the 24" parachute and insert it into the payload bay tube.

To fold the parachute:

- Lay the parachute out flat with the shroud lines facing out.
- Fold it top-to-bottomso it's in a semi-circle.
- Fold each outer third towards the middle.
- Lay the shroud lines inside the middle, so that there's only a little sticking out.
- Fold the parachute in half again, covering the shroud lines.
- Fold the parachute from tip to the base.
- Roll the parachute into a "burrito".
- Wrap the shock cord ONCE around the "burrito". DO NOT wrap it a bunch of times… the shock cord wrap is meant only to keep the parachute from coming undone while in the payload tube. It has to be easily unwrapped when the parachute is ejected from the payload tube.

___ Check the fit of the nose cone in the payload bay tube. It will probably be a little loose. The nose cone should fit snugly, so that it won't fall off if you shake it or hold it upside down, but it shouldn't be difficult to remove. Wrap a little masking tape around the base, and check the fit. Add a little bit of tape at a time, until you get the right fit.

___ Feed the MAIN shock cord into the main body tube, then carefully attach the AV Bay coupler to the main body tube. The hole for the switch should be centered between two fins, but NOT aligned with the rail buttons (since you're going to need to access it on the pad).

At this point, your rocket is done! You will need to do the usual prep work for flying… but that's all covered in the Flying Your EZ-DD Rocket manual.