DL50 Discus Launch Glider

**DL50 Specifications**

**Length:** 39 in. (99 cm.)

**Wingspan:** 50in. (127 cm.)

**Wing Area:** 275in² (1774 cm²)

**Weight:** 8oz. (227 g.)

**Revision History**

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision Notes/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/12/2004</td>
<td>Document initial creation.</td>
</tr>
<tr>
<td>8/18/2004</td>
<td>Changes to instructions</td>
</tr>
<tr>
<td>9/9/2004</td>
<td>Update to version 2</td>
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</tbody>
</table>

Thank you for purchasing the DL50. This plane is an elevator/rudder discus launch glider, designed for the intermediate pilot who wants a strong, easy to build and fly glider. The DL50 was a joint design effort between Doug and Matthew Binder.

Sincerely,
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Before You Begin

Before you begin building your DL50 make sure you read and understand all of the instructions thoroughly.

Additionally, you will need to have the following items. Check to make sure that all of your parts are there and in good shape, and review a couple quick building tips to make this whole process go quicker and easier.

What You Will Need

- Smooth and flat work surface
- Wax paper
- Thin Cyanoacrylate (CA) glue
- Foam Safe Glue – 5 minute epoxy or foam safe medium CA
- Minwax water based Polycrylic
- Hobby knife with #11 blades
- Needle nose pliers
- Wire cutters
- Sanding block with 200 grit sandpaper
- 2 channel radio
- 2 channel receiver
- 2 micro servos
- 4 cell 350 mAH NiMH battery pack

Parts List

<table>
<thead>
<tr>
<th>Number in Kit</th>
<th>Description of Part</th>
</tr>
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<tbody>
<tr>
<td>Wire and Carbon Rods</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>26.5” tapered carbon boom</td>
</tr>
<tr>
<td>4</td>
<td>.060” carbon spars</td>
</tr>
<tr>
<td>2</td>
<td>.025” music wire pushrods</td>
</tr>
<tr>
<td>2</td>
<td>Pushrod tubes</td>
</tr>
<tr>
<td>Foam, etc</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Foam wing sections</td>
</tr>
<tr>
<td>2</td>
<td>.7 oz Fiberglass</td>
</tr>
<tr>
<td>1</td>
<td>1.4 oz Fiberglass</td>
</tr>
<tr>
<td>Bagged Parts</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>6” heat shrink tubing</td>
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<tr>
<td>1</td>
<td>6” Velcro strip for mounting the battery and receiver</td>
</tr>
<tr>
<td>1</td>
<td>1/16” x 3/8” x 2” Launch Peg</td>
</tr>
<tr>
<td>1</td>
<td>12” Kevlar tow</td>
</tr>
<tr>
<td>1</td>
<td>1/2” x 64” carbon tape</td>
</tr>
<tr>
<td>4</td>
<td>8-32 wing hold down screw</td>
</tr>
<tr>
<td>1</td>
<td>8-32 self tapping screw</td>
</tr>
</tbody>
</table>
General Building Tips

- Balsa is a lightweight and fragile wood, so you do need to be careful with it; however, you will also need to use a little bit of force to make everything fit properly, so don’t be too timid.
- Join all of your wood pieces using thin CA (Cyanoacrylate) glue, unless we tell you otherwise. In general, only a small amount of CA is necessary to glue parts together.
- Use only foam safe glue to attach the wing sections. Regular CA will dissolve the foam.
- Don’t remove any pieces from the balsa sheets until they’re ready to be used. That way, parts won’t get mixed up or disappear.
- After you remove pieces from the balsa sheets, carefully remove any of the extra material from where the piece was attached.
- Don’t over force your pieces together. If they aren’t going together properly, make sure you have the right pieces and that they are oriented correctly.
- If you want to remove the charred edges caused by the laser cutting process, dampen a cloth with bleach and gently rub the affected areas. Removing the char will not increase the strength but will make it look better.

Assembly Instructions

Okay, so now you are ready to actually build the DL50. If you follow these simple instructions, we can have you flying in no time!

The Entire Process A to Z

Step 1: Prepare your workspace for assembly.
Step 2: Assemble the wings.
Step 3: Assemble the fuselage.
Step 4: Assemble and install the stabilizers, rudder, and elevator.
Step 5: Install the elevator and rudder servos.
Step 6: Finish the kit up with the battery, throws, and center of gravity.
Final Step: Go fly.

Step 1: Preparing Your Workspace for Assembly

Before you begin assembling the DL50, you must prepare your workspace.

Making space in what is probably the most crowded place in your home

1. Insure that your worktable is clean and flat.
2. Keep wax paper handy to prevent gluing the plane to the table.

Step 2: Assembling the Wing

The first thing you are going to assemble is the wing of your airplane. This involves shaping the wingtips, gluing the spars, attaching the wing halves, covering, applying the reinforcement, adding the launch peg support.
**Shaping the wing**

Carefully remove the two wing cores from the foam block. With a straight edge and a sharp xacto, trim the trailing edge. The root chord is 6.25” and the tip chord is 4.75”.

We will now shape the wingtips. Using 220 grit sandpaper, shape the tips as shown. Take care to get both tips the same.

![Wing Tip](image)

**Installing the Spars**

The spar is created by gluing in four .060” carbon fiber rods into the grooves in the wing cores.

- **Putting together the spar**

  1. Verify the spar rods fit properly in the grooves and that there are no foam beads in the grooves left over from the foam cutting process.

  2. Cut the rods to length and lightly sand the rods with fine sandpaper to remove any surface coating. Note that the top spars are a different length than the bottom spars.

  3. Glue the spars in place, one at a time. Don’t try to do more than one as you will be too rushed. Mix up a small amount of 5 minute epoxy and lay it into a groove. Press a spar into the groove and scrape off the excess epoxy. If you want to play it safe, use 30 minute epoxy. The wing core is on a flat surface, right? Lay wax paper over the epoxied spar and gently press for a smooth finish.

![Spar](image)
Gluing the wing halves

4. Lay the two wing cores next to each other, bottom side up and centers touching. Run three strips of tape across the center joint to hold the two halves together.

5. Flip the wing cores over, mix up a small amount of epoxy and flow the epoxy into the center joint. Lift one wing to close the joint and force the epoxy out. The tip should be approximately nine inches off the table. Wipe off the excess epoxy. Place something under the raised wing to hold the wing up and let the glue dry. You may want to place a weight on the wing against the table to keep it from lifting.

6. Cut two strips of ½” carbon fiber tape 12” long but cut at a sharp angle so that the ends come to a point. This is to distribute the load over a larger area and not create a stress riser. See the photo. Cut both ends this way.

7. Epoxy the strips to the top and bottom of the center joint. The easiest way to do this is to lay the tape on a piece of wax paper and apply the epoxy to the tape. Lift off the tape and place it on the wing joint. I like to line up the points with the spar rods.
8. Cut two 1.4 oz fiberglass darts 16" long and 6" wide as shown.

9. Apply the darts to the center wing joint, top and bottom. There are three ways to glue the fiberglass. You can lay the glass in place and paint Minwax Polycrylic over the glass, you can glue the glass down with foam safe CA, constantly spreading the CA around with a sheet of wax paper or a baggie, or you can mix up some epoxy and spread the epoxy over the glass with an old credit card or something similar. Another hint is to spray the fiberglass with 3M77 to hold the glass in place while gluing.

10. Next you will cover the wing. (If you are experience at working with epoxy feel free to use that, otherwise, proceed as follows). Lay plastic or wax paper over your work area, this process can get a little messy. Carefully lay one piece of ¾ oz fiberglass over the top of the wing insuring that there is at least 1/2” of overlap all the way around. Starting from the center of the wing, brush Minwax water based Polycrylic into the glass with a foam brush, working from the spar out and towards the LE and TE in a herringbone design. Use as little Polycrylic as possible, just enough to saturate the cloth but not enough for it to appear shiny. Go beyond the TE but only to 1/4” shy of the LE. Always brush with the grain of the cloth, if you brush at an angle it will stretch the cloth and cause wrinkles.

11. Once the Polycrylic dries, cut the glass ½” outside the LE and tips. Do not cut the TE. Cut slices in towards the tip to make wrapping it over easier. Starting from the center, wrap the glass over the LE and adhere with Polycrylic.
12. Cover the bottom of the wing in the same manner, overlapping the top. Once everything is dry, trim the TE 1/16th beyond the foam. You may wish to reapply Polycrylic to any thin areas. They will appear whitish.

13. Install the 1/64” ply center reinforcements. Very carefully line up the 1/64th top ply sheet so that it is centered on the center wing joint and ½” back from the leading edge of the wing. The top 1/64th ply sheet is wide sheet. The end with the split faces forward. Epoxy in place. You can also use foam safe CA. Sand the 1/32” ply reinforcement plate so that the edges are beveled to improve airflow. Using the holes in the 1/64” plate as a guide, glue the 1/32” plate over the 1/64” plate.

14. Drill out the wing bolt holes using the hole in the plate as a guide. Be sure to drill straight down, taking into consideration the wings dihedral. You will use these holes to line up the bottom reinforcement plate.

15. Glue the 1/64” bottom reinforcement plate. Use the holes you drilled through the wing as a guide. The plate should be centered to the wing and ½” behind the leading edge.
16. You will now make the throwing peg. Find the 1/16” x 3/8” x 2” plywood in the parts bag. Cut a strip of carbon 8” long. Mix up some epoxy and spread the epoxy on the carbon tape. An easy way to do this is to lay the tape on a sheet of wax paper. Wrap the carbon tape lengthwise around the plywood peg. Lengthwise means the tape will go around the peg 4 times. Lay the peg on a sheet plastic and lay another sheet of plastic on top. Weigh down the plastic till the epoxy hardens.

17. Sand a flat on the tip of the wing where you want the peg to go. The peg will be positioned so that the front of the peg is even with the carbon fiber spar.

18. Mix some 5 minute epoxy and glue the peg to the tip of the wing. Ensure the tip is perpendicular with the wing and centered vertically. The epoxy should form a small fillet between the wing and the peg.

19. You will now cut 8 strips of ½” carbon fiber tape. Two strips are cut 5” long, two are cut to 4”, two are cut 3”, and two are cut 2”. One end of the tape is cut square and the other end is cut to a point. See the photo below.

20. Take one set of 5”, 4”, 3”, and 2” tape and epoxy one side. Lay the longest strip from the top of the peg, down along the peg, and then along the wing. The square end of the tape is at the top of the peg and the point lines up with the spar. Repeat with the other three strips. Remember, longest first, shortest last. Press the tape down with a sheet of plastic.

NOTE: The point needs to be towards the front of the wing. This means you need to be careful what side of the carbon tape you apply the epoxy.

21. Repeat the previous step on the bottom of the peg.

22. Sand the peg to round the carbon tape at the edges.

23. Work some epoxy into the Kevlar tow then tightly wrap the peg with the Kevlar tow equally top and bottom. The Kevlar is wrapped at the junction of the wing and peg. In other words, where the carbon tape makes the turn from going down the peg to going along the wing.
**Step 3: Assembling the Fuselage**

You will assemble the fuselage by first assembling the wing hold down plates to their respective formers then attaching them and the rest of the formers to the fuselage sides. After that, you’ll attach the fuselage bottom then top. The fuselage wood is glued with thin CA.

**Putting together the fuselage**

24. Glue the 1/64 ply fuselage doublers to the fuselage sides. Make sure they are carefully aligned with the top of the fuselage sides. Glue with thin CA. You did make a right and a left side and not two of one side, right?

25. Glue the wing hold down plates to their respective formers. These parts only go together one way so it isn’t too difficult to figure out how to assemble them.

**Note: The rear former is delicate, handle with care.**

26. Place the just competed parts in one fuselage side and add the rest of the fuselage formers except the front most one.

27. Attach the other fuselage side.

28. Attach the fuselage bottom. It is easiest to start at the middle and work back. Don’t glue the front yet.

29. Attach the fuselage top.

30. This is a fun step. Position and glue the front most former into place while holding everything into position. Extra points if you don’t glue your fingers to the fuselage.

31. Glue the three 1/4” blocks to the nose of the fuselage then sand the fuselage to shape.
Fiberglassing the fuselage

You will fiberglass the outside of the fuselage to give it strength. As discussed in the wing section, you have various options for gluing the fiberglass into place.

1. Cut a piece of 1.4oz fiberglass about an inch longer than the fuselage and wide enough to wrap completely around the fuselage.

2. Spray the fuselage with 3M77 and position the fiberglass on the bottom of the fuselage. The glass should be off center because one side will cover the side of the fuselage and the other side will cover the other side and the top of the fuselage. Wrap the glass around the fuselage and press it into place. You will need to cut small slits around the nose to make the glass conform to the shape of the nose.

3. There are three ways to glue the fiberglass. You can paint Minwax Polycrylic over the glass, you can glue the glass down with CA, constantly spreading the CA around with a sheet of wax paper or a baggie, or you can mix up some epoxy and spread the epoxy over the glass with an old credit card or something similar. Whatever method you chose, try to keep the glue to a minimum while still being sure to completely wet out the glass.

4. Once the glue is dry, trim the fiberglass flush with the openings in the fuselage.

5. Position the fuselage cover on the fuselage and sand to match the fuselage. It would be a good idea to also glass the cover.

6. As I use a switch jack to charge my receiver battery, I don’t need to get into the fuselage much. As a result I just tape the cover to the fuselage. Another option would be to tape the front of the cover to the fuselage to form a hinge and hold the back in place with a rubber band. You can also hinge the back and hold the front in place with a piece of large heat shrink tube that has been shrunk to shape.

7. You need to tap the holes for the wing bolts. The kit comes with a self tapping screw for this purpose. Make sure the screw is perpendicular to the hold down plate when you thread the screw in. You may wish to flow just a bit of thin CA into the threads after they have been cut to harden the wood.

Step 4: Assembling and Installing the Stabilizers, Rudder, and Elevator

You will assemble and glue the horizontal and vertical stabilizers, sand a bevel into the leading edge of the elevator and the rudder, and then sand the parts smooth. Once the parts are ready, they will be attached to the boom. The control horn will be positioned on
the right if you are right handed and on the left if you are left handed. The following pictures are of a right handed plane.

- **Putting together the stabilizers, rudder and elevator**
  1. On a flat surface with waxed paper over it, assemble the vertical stabilizer, rudder, and elevator and flow thin CA into the joints.

![Stabilizers, rudder, and elevator assembly](image)

2. Sand a 45° bevel into the leading edge of the rudder and elevator.

3. Take a piece of ½” wide carbon fiber tape and slit it lengthwise to form two ¼” strips. One strip will be glued to the bottom of the horizontal stabilizer and the other strip is glued to the left side of the vertical stabilizer. The strips are positioned 1/16” from the trailing edge of the stabilizers and can be glued with thin CA.

4. Sand the vertical stabilizer so that the leading edge of the stabilizer is rounded and the trailing edge of the rudder comes to a point.

5. Lay the rudder next to the vertical stabilizer and hinge the two with a ¾” strip of 1.4oz fiberglass with epoxy or polycrylic. Do not use CA as it’s too brittle. There should be just enough gap between the parts to ensure free movement of the rudder, maybe .005”. The hinge is on the right side of the rudder if you are right handed, left if you are left handed.

6. Glue the rudder control horn to the right hand side if you are right handed, left if left handed. The rudder control horn is the one with the longer base.

7. Hinge the elevator to the horizontal stabilizer as you did with the rudder. The control horn must be on the opposite side of the rudder control horn. The hinge will be on the top.
8. On the bottom of the horizontal stabilizer you will glue the standoff. The standoff is positioned so that the grain is vertical. Sand the standoff so that the front and back come to a point. Glue the standoff to the horizontal stabilizer ensuring that it is centered and perpendicular with the back of the horizontal stabilizer. Note that the photo does not show the carbon fiber tape.

9. Wrap some sandpaper around the rear of the boom and run the boom along the standoff to sand the booms shape into the standoff.

10. Lightly sand the last 4” of the boom to remove any coating on the carbon.

11. Glue the vertical stabilizer to the boom, ensuring it is flat and centered on the boom. Glue with thin CA.

12. Cut a triangle of 1.4oz fiberglass 2” by 5” that will be used to reinforce the vertical stabilizer. The 5” length will go next to the hinge line and the 2” length will go along the boom. Glue with epoxy or CA.

13. Position the horizontal stabilizer/elevator so that the elevator clears the vertical stabilizer by 1/8”. Be very careful to ensure the stabilizers are perpendicular to each other. Glue with thin CA.

14. Cut a triangle of fiberglass 1.5” x 6” to go around the boom and reinforce the horizontal stabilizer. Glue with epoxy or CA.
15. Lightly sand the front 7” of the boom and position the boom in the fuselage. Don’t glue yet. The boom will slide through the back four fuselage formers and extend just past the fourth former.

16. Lay the wing on the fuselage and position the boom so that the tail is aligned with the wing. Remove the wing and glue the boom to the fuselage with thin CA. The tail section needs to be waterproofed, I recommend a light coating of lacquer.

Step 5: Installing the Elevator and Rudder Servos

- **Installing the servos**
  1. The servos are glued to the sides of the fuselage. To make the servos removable and to be sure glue doesn’t get into the servos, Stick a piece of packing tape to the servos as shown. You will need to scuff the other side of the packing tape to get the CA to stick to it.
  2. Install the rudder and elevator servos into the fuselage. Place the front (elevator) servo slightly higher than the rudder servo so that the elevator pushrod clears the rudder horn.
  3. Glue the yellow pushrod tubes so that they are lined up with the pushrod exits in the fuselage, rotate down to the sides of the fuselage, then line up with their respective control horns.
4. Feed the .025 wire pushrods through the rear of the pushrod tubing, through the holes in the fuselage, then into the servo area. Make a Z bend at the front end of the pushrod. You will need to remove the servo horn from the servo to install the Z bent onto the servo horn.

5. Cut a piece of .025 music wire 1.5” long and make a 90 degree bend in one end ¼” in. The short end will fit into the rudder control horn and will attach to the pushrod with a short piece of heatshrink tubing. You will need to take a small block of wood to angle the end of the yellow pushrod tubing out so that it lines up with the rudder control horn.

6. To prevent the L bend from falling out of the rudder, insure that pushrod extends past the control horn on the opposite side of the L bend wire. See the picture of the elevator below.

7. Make a similar L bend for the elevator.
8. After making sure the servo horns and control surfaces are in a neutral position go back and carefully place a drop of thin CA on all the heat shrink tubes on the pushrods to secure them.

You should center your servos before you hook them up to the pushrods. To do this: Connect your servo to your receiver, turn on your transmitter, and then connect your batteries to your receiver. Your servos will move to a neutral position, assuming all of your radio trims are set to zero (0).

Step 6: Finishing the Kit
Well, you’re almost there...the end is in sight; just a few more steps and you can go flying, assuming the weather is cooperating.

Attaching the Battery
No matter what battery pack you use, its attachment to the battery mount will be the same. You will need:

- 6” Velcro strip for mounting the battery and receiver (Bagged Parts)

  Getting the battery to stay where it belongs
  1. Cut the rough side of the Velcro strip down to 2” in length, and then attach it to the bottom of the front of the fuselage.
  2. Attach the soft side of the Velcro strip to the bottom of your battery pack.
  3. Adjust your CG by moving the battery pack around the fuselage till the glider balances ~2.75” behind the LE.
  4. I recommend placing a block of foam in front of the battery in case you have a less then desirable landing. This will keep your battery from flying forward and jamming in the front of the fuselage.

Setting the Throws
You need to adjust your radio trim so that the elevator and rudder are all level. The throws are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Low Rates</th>
<th>High Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator</td>
<td>+- .5” (1.0” total travel)</td>
<td>+-.75” (1.5” total travel)</td>
</tr>
<tr>
<td>Rudder</td>
<td>+1.0” (2.0” total travel)</td>
<td>+1.25” (2.5” total travel)</td>
</tr>
</tbody>
</table>

Setting the Center of Gravity
The Center of Gravity (CG) will affect how the airplane recovers from a nose up or nose down condition (pitch stability). With the CG too far forward, the plane will be quite stable, but require a lot of up elevator to fly level. This will result in an increased low end speed. On the other hand, too far back and the plane will be hard to control, requiring constant input to keep the plane flying straight and level. The CG should be 2.75” behind the leading edge. At this CG, the DL50 will be fairly neutral in pitch and will not correct itself in a dive. You may wish to start with the CG slightly forward of this point till you get comfortable flying the DL50.
Flying

Discus launching takes some practice. After you tried a toss to verify you are trimmed right, grab the launch peg with the pads on your fingertips. Face into the wind with your launching arm behind you and the outer wingtip resting on the ground. Swing around 360 degrees, keeping your arm behind you. As you get to the end of your spin, rotate your arm forward and release the glider slightly earlier than seems right. You should throw the glider up about 30 degrees and about 10 degrees to the right of the wind (assuming you are right handed). After about 100 throws or so, you’ll get the hang of it. Hopefully, you will find this way of flying very addictive.

Wing Repair

In the event that you ding the wing, Dr. Mark Drela has a method for restoring the shape of the foam. Take a paper towel and dampen it with cold water. Place the towel over the damaged area. Turn a sealing iron to maximum and heat the towel to create steam. Don’t let the towel dry out as that would ruin the foam. Once the foam has returned to the proper shape, apply a thin coat of Polycrylic over the repaired area and go fly!