BD5 Build Instructions

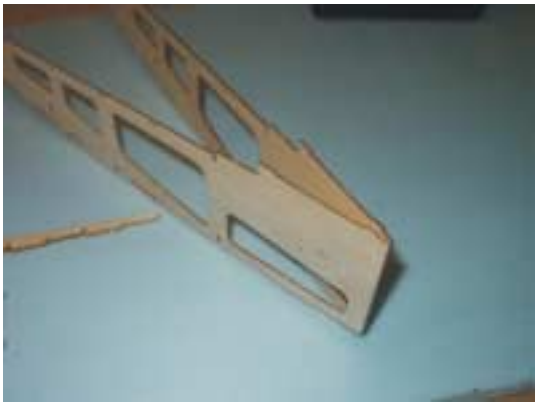
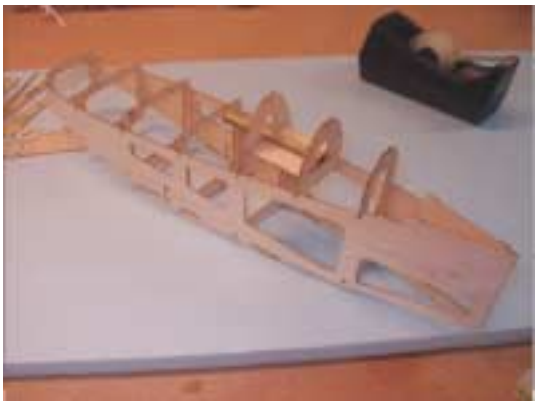
By Dave Blum

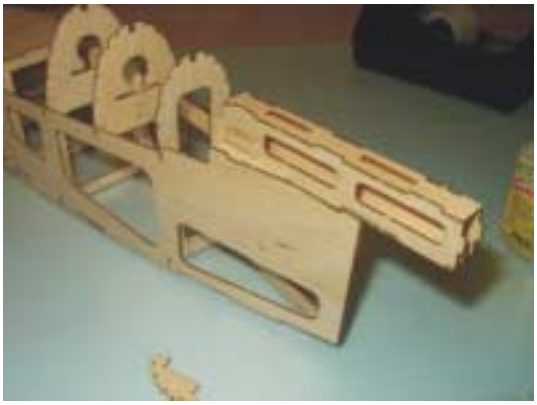
Since I've sent out so many copies of my BD5 plan I figured it would be a good idea to do a build thread on it. It would appear that some of the folks who got short kits from Aerolock got parts cut from an older file, but fear not the differences are minor. If F5 and F6 do not have holes for the driveshaft you have the older parts. This build is using parts cut from the current file which are the parts shown on the plans, I will note any changes that need to be made to the older parts.

Fuselage

Here goes, lets start with the fuselage.

	Lay out and familiarize yourself with all the parts.
	Start by gluing the doublers to F2, F3, and F4. Those with the earlier parts will need to make some doublers and cut some slots for the lower fuselage stringers. Size is not critical, they're just there to keep you from crushing the fuselage until the lower sheeting is added. Also laminate the two FS rear fuselage spine parts.

 	Place the two fuselage sides on top of each other lining them up EXACTLY. Now take some slow CA and smear it across the rear of the fuselage taking care not to get any glue in between the two sides. When dry this will form a "hinge" allowing you to now open the sides up in perfect alignment.
	Place former F1 in place and put a piece of tape across both sides to hold it in place. Run the tape at least an inch down each side as it will be under some tension when the other formers are in place. Do not glue F1 at this time. Place all formers except F4B in place and when you are happy with the alignment glue them all including F1. Those with parts from the old files will need to cut some holes for the driveshaft in formers F5 and F6. Refer to sheet 2 of the plans for their size and location.
	Now is also the time to decide if you will be using a GWS IPS drive. If you are, assemble the motor stick and make sure it fits in the gearbox. It will require some squishing for a snug fit and may even require a little trimming. It is important to do this now otherwise you'll destroy the fuse tryng to get the gearbox in later. Install the motor stick as well as part MM3 being sure to glue the stick to both the formers and MM3. I will not be using this drive so all subsequent photos will not show these parts installed.

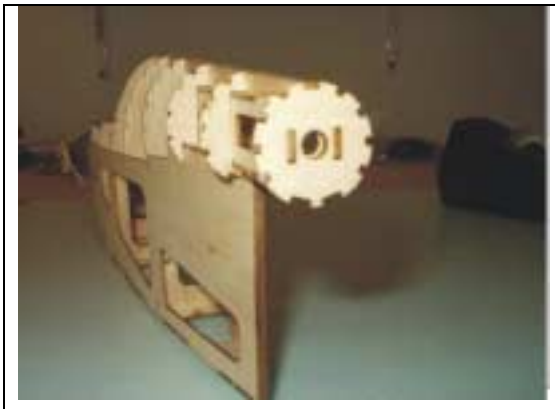
	Glue on the fuselage top. You will notice that the center is perforated, do not remove it at this time.
	Now build the bearing box using parts BB1, BB2, and BB3.
 	Now add the rear spine and formers F8 and F9. Next glue former F4B in place as well as the upper fuselage sides. Make sure the sides are oriented correctly with the bigger end at the rear.

Now using the templates provided on sheet 2, cut out the two upper sheeting parts. Trial fit these and trim off the top so that each half will meet in the middle of the rear spine. When you are satisfied with the fit glue into place. When the sheeting is dry trim off the front and sand flush with F4B. Sand the rear flush with F5. Now make note of the marks on F5 that look like unfinished stringer notches. These give you the location of 1/16 square stringer notches you will now cut into the top sheeting, the marks being the center of the notch.

Cut some 3/32 square sticks and glue along the fuselage bottom being sure that they fit into the notches in the bottom of the formers. Now glue the bottom in place.

Now add the 1/16x1/4 lower nose stringers.

	To prepare the fuselage for the lower nose sheeting, you will now need to sand a bevel into the fuselage sides continuing the curve of each of the nose formers. You will have quite a large bevel at F1, and none at F4. Using the templates, cut, fit, and glue the lower sheeting in place. To minimize the chance of building a twist into the fuse, try to glue each piece of sheeting from the center out. When you're done, sand every thing nice and smooth, blending the sides into the bottom. Be carefull not to go crazy sanding because the balsa will get very thin here.
	Now you can remove the perforated section in the fuselage top, F4B, and the tops of formers F2, F3, and F4. You can discard these parts. All those flimsy pieces of balsa will be quite strong at this point.
	Assemble the rear bearing carrier from BC1 and BC2 making sure to align them carefully before gluing them together. Place, but do not glue this assembly NOTCHES UP into the bearing box making sure that the larger of the two holes faces OUT. Place F10 into place and move the BC1/BC2 combo until it will sit against the back of F10. Now remove F10 and wick some thin CA around the BC combo gluing it in place. Glue F10 in place making sure that the two large notches face DOWN. Wick some thin CA into the bearing hole to harden it, and after making sure the glue has dried push the bearing into place. It should be a nice snug fit. Those with the older parts will have to trim the BC1/BC2 combo slightly because I don't believe the holes line up with F10. If memory serves you'll have to take a little off the top. You'll also need to trim a little off the ends of BB1 and BB3 so that F10 will fit.

	
 	Glue the lower rear stringers into place after trimming the bearing box slightly so that they will fit into the notches in F10. Now add the 1/16 square rear stringers. Those with the older parts will have to trim some stringer notches here and there so that they run straight. You may also need to add a little scrap of balsa around the lower stringer notch in F7. When they are all in place, take a piece of sandpaper wraped around an x-acto handle or something similar and scallop the formers between the stringers. This will make the formers disappear after it's covered. The fuselage is done at this point with the exception of the nose block.
	Next up is the nose block. Trace the nose top and side views on a 3x3x3 balsa block and cut on a band saw. Cut the top profile first, and without letting it fall away from the rest of the block turn it and cut the side view. Next hold the rough block against the fuselage and trace around it and CB1. Now using a razor plane (I use a cheap one made by Master Airscrew but it works great) rough out the shape of the block. When you are satisfied with basic shape, TACK glue it to the fuselage and finish sanding. When you are done, cut it off the fuse and hollow it out. I use a

sanding drum on a Dremel tool for this but you could also cut it in half and hog it out with a knife or some woodcarving tools. Glue the hollowed block back on and this pretty much finishes the nose.

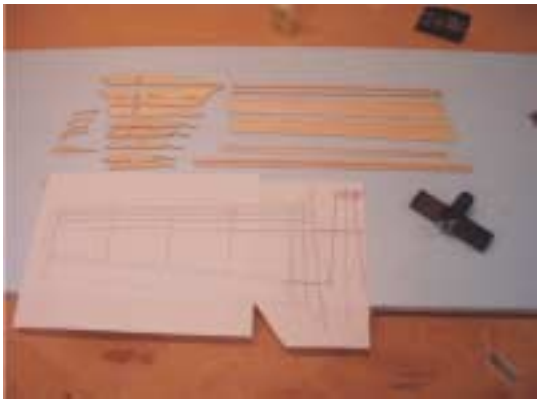
The construction of the canopy base begins by trimming CB2 to fit flat against the cockpit opening. Then sand a bevel on CB1 and CB3 and glue them to to CB2, being careful to glue them only to the base and not the fuselage. Now sand everything flush with the fuselage. I like to sand the base about .010 smaller than the cockpit opening all the way around to compensate for the thickness of the canopy plastic. This way when the canopy is installed it is nice and flush. Glue a small piece of scrap balsa block

to the inside of the nose block, put the canopy base in place, and drill a small hole the size of a round toothpick through both. Now glue a short piece of toothpick rounded on the end into the hole in the base to serve as the front canopy hold down. After you've done whatever detailing or painting you want on the canopy base you can glue the canopy on. Make sure that the base is not twisted when you do this to insure that the whole assembly fits properly. The rear of the canopy is held down with small rare earth magnets, the placement of which will depend on your power system. If you have an outrunner in the cockpit area you will also need to cut out the back of the canopy base to clear the motor. This is also a good time to think about cooling air through the fuselage. If you run the GWS setup, a small NACA type hole can be cut in one side of the upper fuselage sheeting for airflow and a heatsink is a must. If you have your motor in the cockpit area you may want to make a hole in the front of the canopy. I didn't have one on mine and never felt like the motor got too hot. Whatever you choose to do, leave the last lightening hole in the bottom sheeting open for cooling air exit.

Horizontal & Vertical Stabilizer

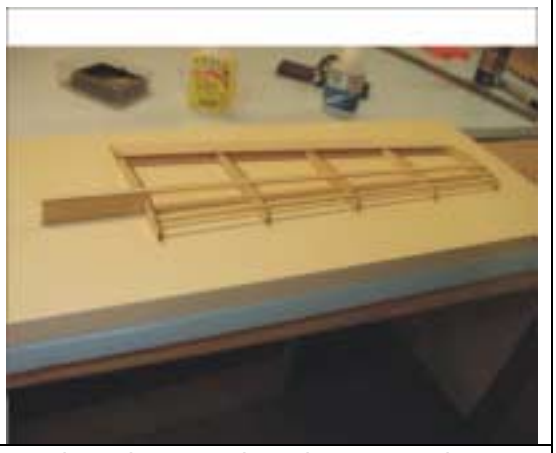
The horizontal vertical stabilzer are pretty straightforward. Those with the older parts will need to build the horizontal stabilzer shown on the plans, otherwise the diagonal bracing in the original parts will cause it to warp up like a propeller and no amount of heat will fix it. You can still use the odd shaped center pieces but will need to trim them a bit. You will notice there is a slot in one of the center pieces for the control horn, and there should also be a hole in F7 for the elevator pushrod. When planning your covering make sure that the control arm is on the same side as the hole in F7. The latest file has a control arm slot in both sides so this should not be an issue if you have the new parts.

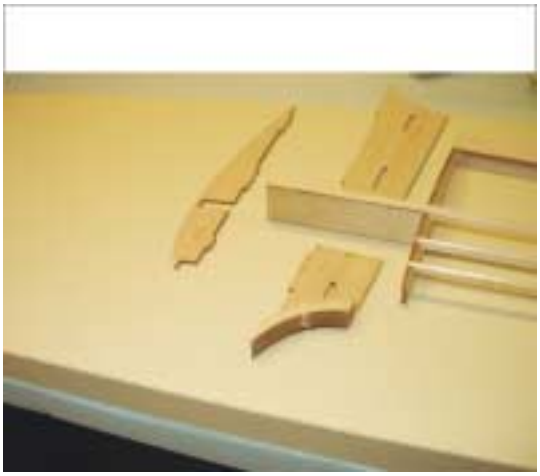
Wings



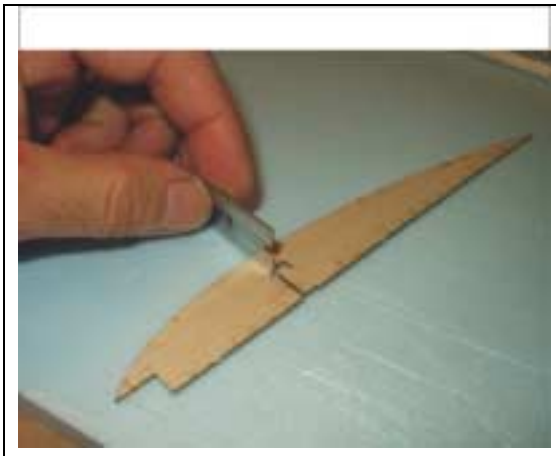
On to the wings. Start by laying out the plans and getting all the parts ready. When you're cutting your strip wood for the 1/16 x 1/8 sub spars, try to get them as close to the exact height as the notches in the ribs as possible. This will minimize the sanding you'll have to do on these. If you think "Oh I'll just sand them down later", they end up the right height at the ribs when you sand them, but they flex between the ribs and will end up all wavy. Next, pin the bottom spar and the bottom trailing edge/aileron in place. Use a couple of ribs to determine the spacing between them as the plans can shrink or expand slightly with humidity. It is very important that you make note that the bottom of the aileron is the one with TWO cuts in it. The top aileron sheet has only one. Now glue ribs W3-W7 in place. When you are satisfied with the rib placement, make sure the wing panel is perfectly flat and glue the top spar and upper aileron sheeting in

place. At this point you will also glue the ply wing joiner pieces to the inner FRONT portion of the spars. Those with parts from the earlier file will need to trim the ears off the wing joiner and cut it in half.





Moving along to the wing root, glue WF1, and WF2 in place. Stack up the WL parts and glue flush with the front of WF1. Those with parts from the early file will have to trim and juggle the parts here as I recall they didn't fit quite right. Now glue W2 into the slots in WF1 and WF2. I believe you'll have to make the notch a little taller to fit against the stack of WLs. Next score rib W1 in about four places and "crack" it to make it curve. Pin W1 to the fuselage side with a piece of wax paper between them, lining the rib up with the spar notches. Wick some thin CA into the cracks to make W1 take on the exact contour of the fuselage side. Pin the fuselage to the table and slide the wing panel into the fuselage slots. Now prop up the panel 1 3/8 inches at W7, and when everything looks good, glue W1 to WF1 and WF2 as well as the spars. Now remove the wing panel.



You can now cut the aileron free and fill between the 1/32 wing trailing edge pieces with a vertical strip of 1/16 balsa. Cut away the bottom piece of the aileron using the second perforation, leaving the front with an angled face. Do not fill the leading edge of the aileron yet as you will need to shorten it about 1/8 inch so there will be a gap at each end when you attach it to the wing. Cut it at the root end because you will need to fill about 1/4 inch with a tapered block from scrap so that the aileron torque rod has something to go into. When this is done you can cap off the front of the aileron. At this time glue W3A in place and add the 1/32 VERTICAL grain shear webs. Carve the wingtip from soft balsa and add the little filler pieces in the wing root.

Before covering the wing you will want to take a piece of .032 wire and cut it with a pair of side cutters so it's got a nice sharp edge on it. You will use this to drill the holes for the aileron torque rods, which you will make from the same size wire and install AFTER the wing is covered and glued to the fuselage. Place the wire flush against the wing trailing edge about 1/32 from the top of the aileron opening.You are drilling at the top because the ailerons will be top hinged. Drill through W3A, W2, and W1 keeping the wire flush with the trailing edge and parallel to the top. Now fit the wing to the fuselage and continue the hole through the side of that as well. If you align everything carefully your holes in both the fuselage sides will be more or less in the same location. Now make a block from scrap that you can glue against the side of the fuselage to support the inner end of the torque rod and drill through that also.

Covering

	Start by covering the rear area with the stringers, then the nose. Do the upper sides, then the lower sides, then the bottom. Cut the covering from both the lightening holes in the rear bottom. The rear hole will be a cooling air exit, the larger front hole will allow you access to bend up the aileron torque rods after the wings are glued on. Place each wing half in the fuselage and find a discreet way to mark around the wing root so you'll know where to cut the covering. Remove the wing and cut and remove the fuselage covering about 1/16 in inside the mark you just made around the wing root. Now lets cover the wings. OK, here's where it starts to get tricky. Cover the wing panels from W3 outboard first. DO NOT COVER THE ROOT AREA YET. When the outer wings are covered, go ahead and shrink the covering and make sure your panels are true and flat. I don't put washout in any of my planes and this one doesn't need it either. However, if you are one of those pilots that finds a way to tip-stall anything feel free to put a little in. When you are satisfied go ahead and cover the root area, BUT DO NOT SHRINK IT YET. This is tricky because since this area is convex you will want to iron the covering to all the ribs and filler pieces without actually shrinking it. This is so that W1 does not get pulled and distorted by the covering. Remember how much trouble we went to to make the root match the fuselage? This part is going to make some of you crazy and I appologize but it had to be done for those trademark wing fillets. You can now glue the wing panels to the fuselage. Don't worry about dihedral angle since the panels are not joined in the middle yet. Those of you with parts from the old files did cut the wing joiner in half didn't you? After the panels are glued to the fuselage, pin the fuse down securely to the building surface making sure it's nice and flat.

	A good way to square it up is to place your carbon rod through the holes for the stabilator mount and eyeball the rod to make sure it's parallel with the work surface. Prop up the wing tips 1 3/8 like you did when you were gluing rib W1. Eyball everything one more time. When you're satisfied with the alignment of everything glue the wing joiner doubler to the joiner pieces already glued to the spars. Those with parts from the old files will have to make a joiner from a piece of 1/32 ply. The wings will now be nice and solid and you can go ahead and shrink the covering on the wing roots. Cover the stabilator, ailerons, and rudder and you're ready for final assembly.