MONARCH

Construction Manual

Kit No. CBMD-005

CB Model Designs

www.cbmodeldesigns.com

Thank you for purchasing a Monarch P-30 kit. We hope you will enjoy building and flying the Monarch and derive many hours of joy from it.

Please read these instructions thoroughly in conjunction with study of the kit drawing and supplement sheets before starting construction. Comprehensive construction photo documentation PDF files are available as a free download from our website www.cbmodeldesigns.com within the Monarch product page.

Adhesive and general assembly process recommendations

Cyanoacrylate adhesive (CA in this instruction) should be used with discretion and caution. Assembly of the basic structures is best achieved with white glue (Elmer's or similar) or cellulose cement (Duco, Testors, Ambroid, etc.). Use of these types of adhesive offer the best chance for any minor adjustment during assembly, and minimizes the chance of adhering the structure to the plan or building board by thin glue wicking through pin holes in the wax paper covering the plan. This in turn reduces the chance of part damage when removing a structure assembly from the plan when complete. All parts should be preassembled dry before any gluing occurs to check for proper location and fit. Proceed carefully and take your time with the assembly process. A Monarch can easily be built and made ready to fly in one week of evening work sessions.

Before you do anything-find the laser part identification sheets 1 & 2. Inventory the laser part package carefully and orient the sheets on your work surface to match the part identification sheets. A strong caution at this point concerning the four fuselage motor tube sides A,B,C &D. Each side skin consists of two sections and spliced. It is easy to get confused about which part edge matches the other, and the notching at the intersecting joints in not the same on all seams. Apply masking tape onto the skin parts while still held in the laser sheet, noting the part number as well as indicating the edges it assembles to as shown on the identification sheet. You would be wise to mark the part outline edge in the sheet (scrap portion) to have as a puzzle clue in case you need to refer back in the event the tape number falls off, etc. and you lose orientation.

Other parts can be identified when called for in the assembly sequence or will be obvious for fit and location. Another word of caution is with regard to the wing and stab nose ribs. On the stab, the ribs are all the same airfoil contour. The only differences are in the tabs common to the spar which has matching notches to accept these. Some ribs have two tabs, others only one. Wing ribs are similar in this regard. Study the assembly drawing and parts to see why this is and gain an understanding of the rib installations to the spars. As the truss ribs tie into some of these tabs it is important they be assembled in the right place to achieve the greatest strength in both the wing and stab.

One more thing before we start the build process. This model has gone through several design refinements to reduce weight. The Monarch, if built to the design intent should result in a model that weighs in the range of 42-45 grams without rubber. Your construction goal is to keep your Monarch as LIGHT as possible. If you think about making changes, make them to add LIGHTNESS, not additional weight. I have tried to engineer this design to be as light as practical and still be durable as far as things like this go. Trying to remove 2 or 3 grams of weight is challenging, but very easy to add if you are not careful.

Fuselage construction

The fuselage box is probably the most challenging assembly to make. It interlocks nicely and makes a strong light structure, but you have to be patient and methodical to get a light and accurate result. It's a bit of a puzzle at first but it gets easy and goes fast once you grasp it. 1/32 balsa is very thin to handle without damage so that is going to be your greatest challenge for both the fuselage box and pylon assembly. Control of the assembly process is essential and I will tell you what I discovered to make it work well with no damage to the parts.

Start the fuselage box by making the splice joints between the front and rear sections of all four sides. Control of the assembly process begins at this step by making sure the joined sides are straight. Achieve this by using a straight edge to set a piece balsa strip (pinned-at least 30" long-I use 1/8 square) flush against this to achieve straightness. At the splice location, use a piece of wax paper against the building board under the strip to prevent bonding the side skins against the building board. I use Duco cement to make the splice bonds-apply to edges common to the joint and place against the building board and the straight strip stock to provide reference for straightness and seat the splice joint together. Use another piece of strip stock pinned against the opposite edge of the skin to provide restraint against the primary straight edge control. Repeat this for the next skin splice, and keep adding additional strips between each skin to provide edge and straightness reference. You should have all four skin assemblies constrained against each other on your building board at the end of this step.

<u>A word of advice at this point</u>: seal the inside surface of the fuselage with 50% thinned dope to help prevent motor lube from soaking into the balsa and extending the service life of your fuselage. I have found that it is best to apply the dope to both sides of the skins prior to assembly. This step will help prevent curling of the sheet sides along the grain by balancing the shrink tension from the dope on either side and keep the part flat. If you do this one surface at a time during the assembly steps you may find the curling a problem in making an accurate assembly of the box and have a wavy result in the finished fuselage skins. Minor waviness does not affect performance but your pride might suffer….

Pre-fit the skins based on the markings for mating edges you did initially. On the tail cone transition area the drawing shows a scored line on the outside skin surface where you crack the skin slightly to bend the tail end for the tapered tail cone section. Make sure you bend the tail cone sections the right direction-that's why you need to study the interlock sequence before making the scores and cracking the skins!

Install the 1/16th square reinforcement at the tail cone transition area in skins 'C' & 'D'. These little pieces stiffen up the stab platform area considerably and are worth adding. (look at drawing section C-C).

Build the box by making two subassemblies-one consisting of side skins 'C' & 'D' (upper) and another consisting of sides 'A' & 'B' (lower). These two 'L' shaped assemblies are then joined in the last step.

I strongly suggest you build the subassemblies by using the edge of your building board or make a tool from two pieces of ¾" thick pine board (high quality stock available from building supply stores) I simply stack two pieces together with one board edge offset ¾" to create a 'vee'shaped pocket-use 'C' clamps to hold the two boards together for the assembly duration or assemble if you wish to keep for future use. Select the straightest and cleanest boards you can find for your jig. (see tool drawing for details-included in the documentation)

Start assembly by using small tabs (about ¼" wide) of masking tape to hold the two skin sides together. Hold the two skins against the corner of your building board or tool to support the application of the tape. Doing this any other way will result in severe frustration and probably damage to the parts as the 1/32 material is very flimsy. With this method you can apply quite a bit of pressure without damage and install the tape tightly. I start by taping the interlock tabs that are edge up when on the assembly. Check the pieces for best fit, then start working from the center toward either end and bring the edges together. Leave the tail cone area alone for now-just assemble the basic 'L' shape. After taping all the upward facing tab edges reverse the assembly on the jig to tape the remaining tabs by putting them in the 'up' position. Things become more and more stable as you go on this so be patient and work carefully. Use the edge of the board to keep things straight-do not allow forced fits or bow to occur in the skin joints.

Once you have enough tape tabs to secure the assembly position begin joining using thin CA adhesive-applied VERY SPARINGLY to avoid gluing fingers to a part, etc. Apply a strip of creased wax paper to the edge of the board under the corner joint to prevent glue bonding the parts to this surface.

Hold the two skins locally against the jig edge in a tab area and apply a drop of CA to either side of the tape tab holding it, then remove that tape tab to prevent it getting bonded to the wood, and give an indication of what you have tack glued as you progress down the edge. Continue working down the edge-tack gluing all the tabs with edges up and removing the tapes. Then reverse the assembly to get the remaining tabs in the 'up' position and carefully add drops of thin CA to adhere these joint areas, removing all the remaining tape as you go. Lift off the tack glued assembly and remove the wax paper that has now adhered to the inside surface corner. Crease another strip of wax paper and line the vee pocket in the assembly tool or equivalent arrangement and position the assembly into the tool against the two sides and tape down with some tabs to hold firmly into the corner (see step 2 on the tool drawing). Run a small amount of thin CA down the inside corner of the assembly to complete the seam gluing for that corner of the fuselage.

The tail cone area will start to come together as you assemble the sides-you can go ahead and glue the seam of the tail cone once you understand the overlap on the joint. Do some dry pre-fitting with the opposite taped assembly to be sure of the joint overlap before gluing the tail cone seams-use the vee of the tool to aid in keeping the tail cone surfaces flat and square to each other while gluing.
Repeat the taping and gluing steps for the opposing assembly. Build the tail cone insert from TC-1 & -2; 1/4” triangle stock filler is added after the insert is bonded into the tail cone. Install the ¼” triangular corner gussets into the front end of each skin subassembly where the nose block installs.

Final box assembly is best achieved using the assembly tool to control for squareness and twist. Start by bringing the two subassemblies together with some tape tabs to generally hold them in position. Then place the assembly into the ‘vee’ area of the jig to support installation of the remaining tape tabs along either unfinished joint. Note the 3/16” square applied to one edge of the tool-this helps when a clamping strip to be applied down the length of the fuselage to keep the assembly locked against the jig surface and held straight and true (see step 3 on the tool drawing).

Perform the interlock tab taping and tack bonding as you did when you made the upper and lower subassemblies. You can’t press the corners as hard as before but having the support of the tool makes things rigid and allows quick and accurate work. Remove the tape tabs and final bond all remaining areas of the main motor tube. Install the remaining two pieces of ¼” triangular stock gussets in the front end.

Pre-fit the tail cone insert into the tail cone area before you finish gluing this section together. Fit it into the four index slots in the ends of the tail cone skins. Use some small tape tabs to hold the tail cone skins near the end to stabilize the insert position, then a few more tabs further up the two remaining seams to hold together for gluing. Check for final best fit and apply thin CA to glue everything together. Now you can install the ¼” triangular stock fillers to fill in the tip of the tail cone for shaping.

There are two options to use when installing the fin mounting platform F-3 into the open area in the fuselage tube. First, sand a 45 degree chamfer along the edges of F-3 that will make contact with the side skins C & D. Dry pre-fit to confirm a good joint seam. You can install F-3 by itself at this point or create a subassembly of it with the vertical fin and stab platform SP-1 and install as a unit. If you install F-3 by itself pin some scrap sheet on the upper surface of it to control depth of F-3 to be flush to the edge of the cutout in side skins C & D. Then install the fin into the tab slots in F-3 and then install the stab platform SP-1. Caution: glue fillets around the base of the fin joint to F-3 will prevent the forks of the stab platform from seating flush to the top of F-3. Do not glue the aft end of the fin to the top of F-3 until the stab platform SP-1 is installed. Using soft 1/8 square balsa, make some fillers to fit into the gap between the top of F-3 and the fin-sand to match the sides of the fuselage.

Now the fuselage assembly can be cleaned up with sandpaper to smooth all the corners along the length. Just sand enough to smooth-do not sand anything more than a very small blend radius to maintain strength in the joints. Finish sanding the tail cone to final shape-install the basswood incidence screw insert and drill a 1/16” diameter pilot hole for the screw which self taps into the basswood and balsa assembly. Install the curved D/T line aluminum guide tube on the end of the tail cone-check that the D/T lanyard thread will pass through before installation and remove any burrs or clogging that prevents this. Hint-harden about 1 ½” of the end of the D/T line with thin CA to provide a wire-like stiffness that will still bend when pushed into the aluminum tube.

On the front end of the motor tube durability is enhanced by wrapping this area with the silkspan strip supplied using thin CA to attach and laminating against each surface. This can be tricky and if not confident use cellulose cement to saturate the paper and laminate it to the fuselage smoothly with no wrinkles or bubbles I also allow thin CA to fill the end grain of the nose area by applying lightly to the front edges of the skins. Lightly sand these areas to remove any roughness. Similarly, install the silkspan circle reinforcements included over the motor peg hole locations to improve durability. Remove the hole slugs prior to gluing on the reinforcements. Use a sharpened 1/8” diameter wire or a reamer to clean up the hole after the reinforcements have hardened. No twist drills please-you will very likely ruin the hole-use a reaming tool for best results. After a hole is cleaned up, apply thin CA to the edges of the hole to harden it for wear, and again ream to remove any roughness when the glue has dried. Test fit the motor peg aluminum tube for a nice slip fit in each location.

Build up the nose block assembly and create the clocking notch in the fuselage to accept the nose block index key. Note-assemble the nose block such that the three adjustment screw clearance notches for the Gizmo prop unit are aligned as shown on the drawing of the nose block. It makes it easier to keep track of thrust angle adjustments during flight trimming if the alignment is as shown. Sand and blend the nose block to shape and then finish with dope. Some minor cleanup of the hole for the prop unit is probably necessary-make it so the thrust bearing is a light press fit into the nose block. On the aft edge of the nose block common to the clearance hole for the Gizmo adjustment, provide a chamfered or blended edge to provide additional clearance to the locking collar and rivet that may catch this edge during thrust adjustment steps and prevent propeller freewheeling on motor run down.

Install the dental band tensioning barbs for the nose block and stab D/T. Nose block retention bands are optional as the prop unit retains itself in place due to motor tension in the free wheel mode. I use them simply to ensure consistency in how the nose block is held against the end of the motor tube and to keep any tendency to vibrate or move minimized in the case of the motor unloading roughly during flight or if there is any loose fit of the nose block.

Fine sand the overall fuselage with 320 grit sandpaper (you already have a coat of dope on the outside from the first step, right?) and apply another 50% thinned coat of nitrate dope to seal mainly the corners and give an overall finishing coat. When dry, sand this with 600 grit paper and then wipe the fuselage down with soft tissue soaked with some nitrate dope thinner to provide a smooth seal. That’s the end of the finishing process on the fuselage. I provide a color fade on the fuselage aft end area using Design Master floral spray which is a very fast drying lacquer based spray paint available at art supply stores. Just dust on the color to give some contrast to the finished model and help make it stand out in the grass at the flying field.

Build the pylon using the two separate pylon assembly drawings provided. On sheet 2, assemble the side skins directly over the drawing. I use Duco for the splice joints. Once the basic skins are assembled use strips of wood pinned over them to control the locations of the 1/32 X 3/32 longerons. Cut the longeron strips from the scrap margins of the 1/32 part sheets. It is important to maintain the angularity between the upper edges of the skin to the pylon floor (PC-1) as this controls the wing incidence angle. The longerons provide this reference to the pylon floor and also the pylon cap skin (PC-2A & -2B). Add the 1/32 X 3/32 strip to reinforce the pylon formers (PF-1 & -2). Install them into the slots in the pylon floor via the tabs on the bottom of the formers. Center them on PC-1 for a fit to both side skins. Assemble PC-1 and formers to one of the side skin assemblies, still against the building board. Make sure the tab in PC-1 engages in the slot in the side skin and that it seats neatly against the longeron lower edge. Confirm clearance notches to the longerons on PF-1& -2, then tack bond with thin CA to join the straight sides of PC-1 to the side skin. Install the opposite side skin by lifting the subassembly off the building surface and applying it against the remaining side skin, pre-fitting as done before. Confirm fit of everything and tack bond, making the basic pylon assembly complete except for the installation of PC-2A & -2B and the conformance to a point on the aft end.

Carefully pinch the aft ends of the pylon skins to conform around the aft end of PC-1 and bond to the longerons. Now prefit the subassembly of PC-2A &-2B into the top of the pylon-this should install flush to the top edge in the straight areas and then fit down into the notch for the curved closeout areas. Add some Duco cement to the top edges of the pylon formers and re-install the pylon cap skin using thin CA.

Assemble the front fillers PLE-1 and rough trim the ends to match the angle of the pylon edges. Sand the front end of the pylon lightly to allow the filler to seat with no gap and bond in place. If you did a neat job forming the point of the skins on the aft end you may not need to install a filler to finish off the pointed end of the pylon. If not, sand away a portion of this area and install a soft balsa scrap filler. Install the wing T.E. stop as shown on the fuselage plan view.

Carefully sand and blend everything at this point, working with 120 & 220 grit sandpaper. Drill the hole for the wing D/T system swivel fairlead. If the wood is soft, a 3/32" diameter hole will allow a fairly snug press fit of the swivel. If the material is harder and pressing the swivel will cause damage, open the hole up slightly until it can press in or use some Duco cement to install-make sure the swivel ends can still freely move however. Install the plywood backup plate for the Badge viscous timer. It is helpful to pilot the screw holes for the timer and pre-thread them prior to installing as the pressure imposed on the pylon assembly during screw installation after is a risk for pylon damage. A mounting plate is also included for a Badge timer option if you prefer to substitute.

Add the silkspan circle reinforcements at the 1/16" diameter aluminum D/T line turn post location, as done for other reinforced areas. Use a sharpened 1/16" diameter wire to auger the holes for the aluminum tube in the pylon skins. Install the aluminum tube. Auger the wing dowel hole with the sharpened wire as well. Use a tiny rat tail file to open the holes up for the dowel or use a slightly bigger sharpened wire to auger the holes until the dowel slips through, and install the dowel. Install the 3/32" diameter aluminum bung tube and fillers on the right side of the pylon. Install the trip wire and fillers as shown on the left side. Fair these fillers in to remove weight and provide some streamlining. Now coat the pylon with two coats of nitrate dope as done for the fuselage.

Prepare the lower pylon flanges for mounting to the fuselage. On your tool edge, apply a creased piece of 220 grit sandpaper the sheet length long, held in place with tape. Place the pylon onto the edge as it would be in position on the fuselage and very lightly and slowly draw the pylon back and forth along the edge of the sandpaper lined tool. This will chamfer the pylon skin edges for a clean fit with the fuselage. Carefully chamfer until the corner of the jig begins to scratch the bottom of the pylon floor. When you see this mark the entire length of the pylon floor it means you have set the skin edges to meet the fuselage joint and maintained the reference for the wing incidence. Stop sanding and check fit on the fuselage. Everything should fit fairly snug and that's good enough. Mark a point on the fuselage upper joint about 6 1/8" pack from the front edge of the fuselage for setting the forward and aft location of the pylon. Install the pylon using cellulose cement on the skin edges only, setting the forward location at the mark you made.

Using cellulose cement allows you to break the bond with acetone should you want to remove the pylon for some reason later.

Wing and Stabilizer construction

Start flying surface construction with the horizontal stab before the wing to work through a simpler structure first.

Build the forward section with nose ribs then add the truss ribs and T.E. after. I start by placing a piece of straight balsa stock on the wax paper covered plan to set the leading edge position. I also pin straight stock at the outside edge of the tip ribs (ST-1) to control the boundary of the assembly plan form shape to the drawing.

Mark the stab nose ribs per the laser part legend. Note the ribs have variations in the tabs associated to the notches in the stab spar (SS-1). Dry install the ribs per the drawing onto SS-1 (held in the hand) to observe the fit and orientation. Then position this assembly over the plan and adjust it to meet the locations shown on the drawing, with the leading edge part SLE-1 positioned against the boundary stock to work against. Dry install the ST-1 tip ribs at this time. You can use another piece of straight stock to push against the back surface of the spar to hold everything in place but a word of caution about using CA while in this situation. It will tend to bond the backup stock to the spar along with the ribs, so my method is to use a short piece of stock (about 3" long) to locally apply pressure but not be directly behind the rib station you are bonding. As you bond the rib to the spar and leading edge, move the backup stock down to the next station to be bonded (but to the side a bit), apply light pressure to hold everything in place and apply the CA again to the leading edge and spar joints. Keep repeating until the entire front assembly is complete, and ST-1 ribs are bonded to the spar ends and to the leading edge stock via the ST-2 gussets.

Now position the stab trailing edge (STE-1) to the plan. Again, use straight stock to provide the boundary control for this part during assembly and avoid any waviness due to the rib ends being pushed into a notch, etc. When best fit to the plan, bond the ST-1 ribs to the trailing edge. Note: you can pre-taper the trailing edge to near net shape prior to assembly if you wish. I generally do this after the assembly is completed so I have the opportunity to sand the tops of ribs, etc. into a faired condition with the trailing edge.

Find the hardest pieces of 1/16" square stock in the bundle provided to use for the stab truss ribs. I like to take 220 grit sandpaper and fold a small square to clean up strip stock a bit before using it. Do this by pulling the strip stock through the folded paper held in your fingertips, keeping the wood in tension always. You clean up two sides by drawing it through the paper fold a few times, and then rotate to clean up the remaining two sides. This will re-size the wood cross section slightly and in the process yields lightness in what comes next, so it's a minor step that yields good results.

Prior to adding truss ribs, install center rib S-1. Start truss rib assembly by installing the lower truss ribs first. Lay the stick on the plan approximately parallel with the rib location and cut one end of the stock approximately parallel to the rib station. Slide the stock under the spar in the notch to seat the beveled end against the rib tab. Now cut the end common to the trailing edge vee notch to fit and push into place. Don't glue until the opposing rib end is in place. Keep repeating until all the lower truss ribs are in place and bonded to the rib/spar intersections and into the trailing edge vee notches and against ST-1.

Now repeat the process for the upper truss ribs. It's basically the same procedure-just pre-fit to each location and cut to length as you go. Once the truss ribs are in place take some soft 1/16" square and pass between the upper and lower truss ribs, sliding aft until the stock cross section contacts both ribs at the approximate location they cross each other. Use thin CA and bond each of these intersections of the ribs and filler. Use a very sharp razor to nick off the stock to either side of the intersection joints, leaving a small amount of material acting as a filler between the ribs. This adds a great amount of stiffness in the resulting assembly by reducing the ability of the truss ribs to bend.

Remove the stab assembly from the drawing and clean up with sandpaper. At this point I like to use a rough carbide sanding file to shape the trailing edge down (avoid contact with the ribs) and generally rough profile everything in the plan form shape. Then I go back using a sanding block with 120 grit paper finish and sand the trailing edge to shape while at the same time finishing the upper surface of the truss ribs to fair them in with the spar top and trailing edge. I also profile the tops of the contoured ribs a bit to bring everything flush to the spar. Having a flat top airfoil makes block sanding easy to do. I also clean up the bottom of the stab to a flat condition with the sanding block to remove any irregularities, glue bumps, etc and generally provide a nice flat finished surface when covered.

Now go back and add the 1/32 sheet filler that bridges between the S-2 ribs and plywood D/T band hooks SH-1. I cut from scrap to fit the area needed, then with the stab upside down on the building board with wax paper between with the filler held against the board surface. Roll the stab slightly along the contour of the ribs to allow flush fit of the filler to the rib profile as you glue in place. Then using a new sharp razor, create slots in the filler adjacent to the ribs to allow the top of the plywood hooks to protrude up through the filler. Once everything fits, bond the hooks to the sides of ribs S-2. Make sure the bottom of the stab is still flat-if any of the plywood hook edge protrudes beyond the profile of ribs S-2, sand flush as this area is in contact with the fuselage stab platform. Next, add the lower 1/32 filler that is common to the leading edge, between ribs S-2 in a similar fashion. This completes the basic assembly-fine sand everything to shape and seal with two thinned coats of nitrate dope, sanded with 220 grit paper between coats the areas to be attached to the covering material.

Wing assembly follows the same basic procedure as the stabilizer except you are building three separate panels. Build the spar/nose rib assemblies first. Note again the differences in the rib tabs common the spar notches. What deviates from the stab assembly is the process to build washout into the outboard panels.

After the forward assembly of the wing panels is complete add the trailing edges and truss ribs. The center panel construction is identical to the stabilizer for procedure. On the tip panels, install just the lower truss ribs as shown in the wing drawing, left tip panel (right side follows the same procedure-it's just shown one place on the drawing to avoid redundancy). Review drawing note 'C' applied to the upper truss ribs-these will be installed with the wing panel rigged using a tapered shim to provide the washout angle. Make the washout shim from the scrap margin of one of the 3/32 " thick laser part sheets-mark where 1/8" height is and use the same shim for both sides of the wing.

Break the tip panel frame loose from the wax paper. The leading edge should be pinned or restrained against the board surface with the tapered washout shim in position under the trailing edge. Install the four upper truss ribs to lock the twist in the wing panel.

This step makes a big difference in flight performance of the model and should not be ignored. Repeat the steps for the opposite tip panel.

Next, set the dihedral in each tip panel. Check the fit of the tip panel to the center panel spar end and leading and trailing edge with the panel blocked up 3” at the tip. Maintain plan form alignment using the leading or trailing edge outline on the drawing. Very little prep is necessary to complete the joint-I ignore the bevel on the leading edge joint-just make sure it touches with plan form alignment. If not, add a small scrap sheet shim filler and hold the plan form alignment as the primary requirement. On the trailing edge, a few light swipes with the sanding block to bevel the joint edge slightly makes it good enough. The main spar to spar joint is not flat when viewed from above. There is a small slot to allow you to install a 1/32” balsa sheet key to align the spar ends. Cut a piece of scrap 1/32 sheet with the grain direction ½” long, and width about 3/16 “ wide. Slip this key into the center spar slot, equalizing the 3/16” width. Now slip the tip panel onto the key with its mating slot and push the assemblies together and against the building board. Use blocking to maintain the 3” dimension at the wing tip while you set the joints. Use a small amount of thin CA to bond the trailing edges at the dihedral joint first. Then apply thin CA to the spar to spar joint, then the leading edge joint. Repeat the steps for the opposite tip panel.

Remove the wing from the building board and clean off the excess key material from the main spar joints-lightly sand flush to the spar using an emery board. Relocate the wing to the drawing (center panel) and install dihedral break ribs W-1D & W-1E. Install the remaining upper and lower truss ribs at the W-1D joint for the center panel.

Now position one tip panel against the plan as done for the panel assembly. Replace the washout shim under the trailing edge and duplicate the settings you had when building the tip panel with washout. Support the remainder of the wing using a block, etc. to prevent twisting or movement. Install the four upper truss ribs and the one lower truss rib common to rib W-1D. Install the two 1/16” square turbulator spars in the notches in the nose ribs. At the spar splice joint locations over rib W-1D, leave about ½” extra projecting beyond this point to allow scarf splicing to the center panel spars. Repeat this sequence for the opposite tip panel.

Position the wing assembly flat on the center panel and install the two turbulator spars in the nose rib notches. Allow ½” overlap at ribs W-1D for the scarf splicing with the tip panels. Create the scarf splice by placing one turbulator spar over the other at rib W-1D. With a very sharp razor, slice through both spars at the approximate angle shown, whatever direction suits your comfort range-orientation is not critical. Place the beveled ends together within the notch in W-1D and bond together with CA. Repeat this at the remaining splice locations.

Shape and finish the wing structure for plan form shape and leading, trailing edge contour, etc. Install the forward wing plywood D/T hook WH-2 against the back side of the leading edge and against center rib W-1. Install scrap fillers on either side of the hook area to provide a place to anchor the covering material, sand the fillers flush to the leading edge and rib.
Measure along the top edge of rib W-1 from the trailing edge to set the location of the plywood wing D/T hook WH-1 and glue in place. Add 1/16 scrap fillers to either side as shown and sand flush if needed to the adjacent wing structure. Finish the wing structure with two coats of nitrate dope everywhere the covering is to be attached.

Cover the wing with Esaki provided or material of your choice. My finished wings covered with Esaki and location keys shown weigh in the range of 13-15 grams. Wood density makes a difference, as does the amount of glue used. As a general observation, higher density wood can be sanded to a thinner section and still be strong enough to perform-consider this for the truss ribs. Tapering of the truss ribs during assembly is tedious but can also save some weight if you care to make the effort. You can also sand taper in the thickness of the main spar in the tip panels for additional weight savings-.04-.05 thick range at the outboard ends.

For tissue covering, I use nitrate dope to adhere the Esaki to the structure. Some use glue sticks with success. You can also use cellulose glue applied with your fingertip to adhere the tissue but be wary of this becoming softened if using thin dope to seal the tissue. Shrink the tissue with denatured alcohol or water using a fine misting applicator (one used for cleaning eyeglasses works well and is readily available). I use taughtening nitrate dope, thinned 50% to seal the tissue. Apply two coats and that's it-anymore is just extra weight. I apply dope in sections of the covering at a time. Apply dope to the covering in one rib bay area, upper and lower, then skip a bay and do the next. Then go back after the first bays have dried and dope the remainder. Repeat the process for the second coat. Applying dope in an interrupted manner helps prevent warping the structure.

Other suitable covering materials are ½ mil Mylar and some of the ultra light heat shrink films. My preference on plastic films is the use of ½ mil Mylar as it offers the least risk of warping. None of the plastics offer any benefit in strength whereas Esaki tissue covering does and is my recommended covering choice for the Monarch.

Final assembly and Dethermalizer (D/T) rigging

Mount the viscous timer to the pylon. Cut a length of D/T line stock-about 12" long and tie one end to the D/T tension spring. Secure the knot on the spring tie with a tiny drop of thin CA and then cut-off the remaining tail of thread. Make another loop of D/T thread stock about 3" long. Attach this to the opposite end of the spring by passing one end through the loop, the opposing end through this loop to cinch onto the spring loop. Do not bond this piece to the spring until all timer calibrations are complete as it may be necessary to adjust the size and replace. Feed the long end of the spring lanyard through the two swivel eyes on the pylon, and aft through the aluminum bung tube. With the wing on top of the pylon and the lanyard captured by the forward wing D/T hook, adjust the length of the lanyard to where it turns around the aluminum D/T turn post with about ¼" of thread feeding forward to the aft end of the spring. Install the tapered bung plug in the aft end of the aluminum bung tube to pinch the lanyard tail in place for testing.

Install the wing with a dental band on the aft end through the D/T hook and peg ends on the pylon. The forward D/T hook should have the wing D/T lanyard installed to represent the flight condition for setting the timer speed. You can adjust the pull tension on the spring by pulling the tail of the lanyard to shorten the length or pull it forward to add length. For those uninitiated to a viscous timer-they simply turn while providing a drag on the rotation via a thick grease of which the viscosity controls the amount of energy it takes for the movement speed. You apply turning force with the spring by placing the lanyard over the arm on the timer barrel and with this tension the timer rotation occurs. The rotation is fast or slow depending on the tension in the spring and how powerful the spring is. These are custom made springs that are designed to work in the force range these timers operate. Never pull the lanyard for tensioning by the spring-always grasp just at ahead of the end loop of the spring, allowing this loop to take the tension force as you wrap around the turn post and engage the timer. It's a light pull with one hand while holding the wing against the pylon with the other, then release the wing and pinch the lanyard lightly against the side of the pylon with your fingertip while leading the other end forward with the opposite hand to engage the timer arm. A few practice trials will make it seem easy. I always secure the wing during motor winding by tensioning the lanyard around the turn post and then placing the lanyard end around the barrel of the timer, not the arm. When ready to fly, slip the loop off the barrel and engage the arm, then set the tripwire catch under the lanyard to prevent this from releasing until the timer releases. Then attach the stab D/T line to the tripwire arm as described below.

The timer should be set such that the moment of release under tension occurs with very slight rotation movement. Adjust the spring tension until the timer barely moves at the end of its rotation and the lanyard releases from the timer arm. This should yield five minute time with the timer at the 180 position to start, and up to 10 minutes at a full 360 degree rotation to start. If you are not overly concerned with obtaining maximum duration from the timer you can speed it up a bit to have a run length of two minutes or so such as when flying in a small field area. The bung setup allows you to reset it for a contest, etc. later.

Once you have the timer run set to your satisfaction, cut-off most of the lanyard tail aft of the bung plug-leave about 1 ½” to allow future adjustment potential-secure the end of the lanyard tail to the side of the pylon with a small dot of cellulose glue. Also apply a small amount of cellulose glue to the bung plug where inserted into the tube along with the thread being pinched to keep this from slipping or falling out in flight. Some acetone on a small paintbrush will allow instant removal later should you need it.

Make the stab D/T line from a length of the thread stock by first creating a loop around a piece of 1/8” diameter wire or other object. Slip the formed loop off the wire and apply a small amount of thin CA to it and the knot. This will harden it into a formed loop that will not collapse in use, making it easy to take on and off, etc. On the other end, harden about 1” of the length with thin CA to ease the installation through the curved guide tube on the tail cone. Install the stab using two of the dental bands looped together in a figure 8. Hook on one side, wrap under the fuselage and to the opposing hook as a yoke. Attach the formed loop of the D/T line to the stab connector eye. Slip the small piece of 1/16” aluminum tubing onto the D/T line and slide up to the tail cone area. Allow the stab to rotate up to the 45 degree D/T position and hold it there using line tension. Slip the tube up against the guide tube end and crimp it carefully to pinch the D/T line and maintain a stop for the pop-up position. Pull the stop tube and line away from the guide tube and apply a small dot of thin CA to the forward end of the crimped tube to further secure from slippage in use. Do not let the line stop retract back to the guide tube until you are certain the CA has dried!

Now form another hardened loop at the front end of the D/T line, terminating approximately where shown on the drawing, with the stab in flying position. Install another dental band into this loop and pull the band forward to engage the tripwire lever while the tripwire catch is held under the D/T spring lanyard (shown in loaded position on the drawing). The trip wire provides enough leverage to hold the stab down while the timer operates independently. When the timer releases, the whole mousetrap snaps open and simultaneously releases the wing and stab which assume their respective deployed position and the model ceases forward flight. Check your system out on the bench completely for reliability before attempting flights. Also, put your name and phone number somewhere on the model in the event it wanders off from you!

Flight trimming-glide phase

Install a 10 gram rubber motor using the second motor peg location (just below the forward end of the fin). Establish glide trim using this position as the baseline for trim flights. Adjust the incidence screw until the stabilizer is neutral incidence-compare the bottom of the stab to the corner of the fuselage when viewed from the side-you can see relative angular changes between these two reference features. Neutral would be the bottom of the stab parallel with the fuselage side joint line.

Check for stab tilt relative to the wing. The right stab tip needs to be raised above the left stab tip to influence a right hand glide, when viewed from the back end of the airplane. Before adding any stab tilt shim, try test gliding to see if the model naturally turns this direction as is. If not, shimming will probably be required to gain this characteristic. Use cellulose cement to attach a 1/16" thick balsa shim to the right side of the stab platform top surface such that when the stab is pulled down to flight position it is tilted with the right tip up about 1/8" higher than the left, as viewed from the rear of the model. Taper the shim to make sure the contact with the bottom of the stab is at the edge of the stab platform. If possible, find a shallow hill from which you can launch the model for test glides. The objective is to observe the glide path for stalling or diving, and also to obtain a right hand glide circle. Hand wind some turns in the motor to give the prop some revs as the glide starts and get the prop up to free wheel speed. Launch the model gently-wings level into any slight breeze (always test glide in calm conditions) that is apparent. Observe for the glide angle-too steep and fast, or pitching repeatedly in a series of shallow stalls. If the model glides fast, turn the incidence screw out about ½ turn to remove incidence to the stab (raises the nose of the airplane) and glide again in the same manner. If the model is stalling slightly turn the screw in to add incidence to the stab (lowers the nose of the airplane). Adjust the incidence screw until the glide is just under a stall, steady and turning to the right as it settles to the ground. Observe the right hand turn during the glide; this should be roughly 30 feet in diameter. If it is a tight spiral, remove some of the stab tilt by shaving or sanding off some of the shim. If there is little or no turn, add more shim to increase the stab tilt. Make sure the stab will still pop-up completely with the stab tilt in effect. Make sure the glide is safe and consistent before moving on to power flight trimming.

Flight trimming-power phase

The Gizmo prop assembly comes factory preset at the centered (neutral) position. You will need to adjust in some down and right thrust in this model even though the drawing does not show this. It takes more down thrust than right thrust, so adjust the upper two screws out to cant the bearing down about three degrees. Tighten the right side upper screw a bit to cant the bearing to the right in addition to the down thrust. The bottom screw position can be tightened to add more down thrust, or extended to remove it. These are rough settings to start and intended to prevent damage on the first power flight by having the model climb steeply and then stall into the ground. You will be fine tuning the thrust angle as you proceed to raise the power level in the subsequent steps.

Hand wind the motor to about 300 turns. Set the D/T timer for short duration (20 seconds or so) and gently launch the model, wings level. Observe for a right hand shallow climbing turn. If there is no turn, you need to increase the right thrust. If the model pitches up into a stall, more down thrust is needed. Make these adjustments until the model climbs evenly (no stalling) and to the right. Again the turn needs to be roughly 30 feet in diameter at low power. Adjust thrust angle until the model becomes predictable and safe under low power. Now begin lower power flight

using a torque meter to make observations about power in the motor and the effect on climb trim. Stretch wind to 3-3.5 in/oz torque and launch. The model should still be fairly shallow in climb, but with much more duration. Again observe the climb characteristics for turn and stall-adjust thrust angles slightly if necessary. Also watch for the glide transition and glide pattern that follows. The model should transition to a slow floating glide with a right hand turn pattern. It may be necessary to adjust the stab incidence slightly to obtain a good glide after the power runs down.
Continue to add more torque on subsequent test flights. Fine adjust the thrust angle to control the climb characteristics. The target is to obtain the maximum climb performance profile for the model. Too steep and the power is wasted on overcoming the drag of the high angle of attack. Too shallow and fast is obviously not going to offer duration gains from altitude. The model should be climbing slightly faster than glide speed to be on a good climb performance profile. At higher power the turn may tighten somewhat, but this can help on a steep climb during the power burst to prevent stalling and is desirable. If the model banks heavily to the right under high power and does not climb, you need to remove right thrust until the model flattens out and climbs in the turn. This model has been flown in torque ranges of 3 to 12 in/oz with no problems within the trim setting once established.

Now try some powered flights using the forward motor peg location. This position is to facilitate a 10 gram motor that is looped into a thicker cross section for higher torque.
The center of gravity will shift forward significantly when changing motor peg locations.
As the model is already trimmed for power and glide, the easiest way to deal with the Cof G shift is to add a ballast weight at the end of the tail cone. Use a small ball of clay applied to the top of the tail cone, under the stab and in front of the incidence screw.
Check the balance point and perform some test glides to verify the trim settings are still correct to what was demonstrated earlier. Add or remove ballast to fine tune the glide angle.
Power flights can then be undertaken-use lower power and short D/T on the first one to make sure nothing is upset by the new motor location. Then start power trials using the maximum torque level you tested on the longer motor. Watch for excessive right turn as the power increases-some of the right thrust may need to come out, and down thrust increased to handle the additional energy. These will be very small changes-make them carefully.

After adjusting the model with clay ballast, remove and save after the flying session. In a contest, you will need to re-install if you decide to change motor strategy to suit conditions.
Learn all you can about the performance potential of your model by experimenting with various motor sizes using 10 grams in each case. Long power cruise (2:00 min has been demonstrated consistently) can be had on a 4 X 1/8 SuperSport motor. This motor can only take about 3.5-4 in/oz. of torque and does not offer a robust climb. It will allow a long hunt for lift and in light conditions will often yield max time easily without the model getting very far off the ground. If any lift is contacted the model will climb for quite some time and towering height can often be achieved in this manner.

Similarly, a 6 x 3/32 SuperSport motor will offer a long cruise (1:30 min consistently) and better climb performance. This motor can take up to 6 in/oz. of torque consistently.
Use the forward motor peg location for 6 X 1/8 or 8 X 3/32 motors and high torque ranges. You don’t have the motor run duration (35-40 seconds typically), but you will gain altitude rapidly. This type of motor is probably best suited to turbulent conditions when you need to get high above the ground quickly into smoother air or flying from a smaller field size. Make sure the motor is well lubricated to prevent binding in the motor tube. The use of an oversize tube on the

tail end of the motor is suggested to allow the motor end to pivot on the motor peg and reduce binding potential. Use 5/16" OD X .014 wall aluminum tubing, 3/8" long for this purpose.

Care should be taken to store the model out of light and in a reasonably constant temperature location with low humidity. The tissue covering can eventually ruin the framework with continued exposure to heat and humidity, and light will deteriorate tissue colors and strength quickly. At contests, always test fly first to be sure new warps haven't crept into the model and impacted your trim settings.

Dental bands provided will eventually need to be replaced, especially the ones used to drive the Dethermalizer system. Obtain new dental bands from FAI Model Supply, PO Box 181, Avon Lake OH 44012 USA. www.faimodelsupply.com
Please contact me at cbmodeldesigns@yahoo.com if you need additional information about building and flying the Monarch.

Thanks again for purchasing a kit from CB Model Designs!
Clint Brooks January 2013