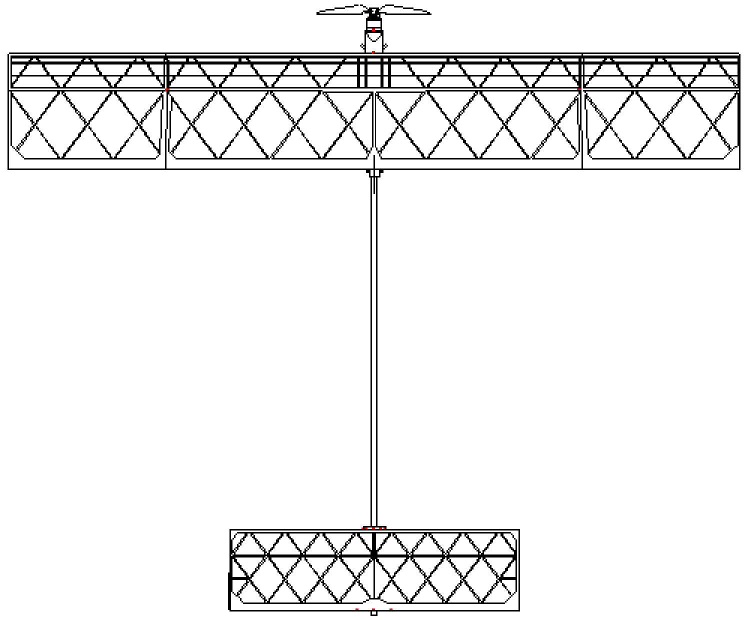

Apache II

Construction Manual

Kit No. CBMD-007

CB Model Designs

www.cbmodeldesigns.com

Thank you for purchasing an *Apache II* E-36, and welcome to a world of enhanced performance. This model is the next generation of a series of Apache free flight models, starting with Ralph Ray's 1960 Nationals winning 1/2A model that was produced as the *Veco Apache* kit in the early 1960's. There is very little in the *Apache II* that appears close to that era Apache aside from the distinctive 20 degree down thrust and shoulder wing configuration that Ralph pioneered for free flight. In late 2014 Ralph approached me about building a kit of the *Apach-E* model he was currently flying. I agreed, but was challenged with the boxy design and its rudimentary elements that were just enough to house the electronics and mount the Hyperion outrunner motor. It was hard to fall in love with and feel good about spending what would certainly become a significant amount of design time and flight testing to develop something worthy of kitting. But I took up the call and headed down the road on a kit version of the Apache, with my own vision of how this should look for a modern E-36 model.

Ralph supplied plenty of input on the design-encouraging me every step of the way to refine it and make it lighter and better. I went through five major design iterations on the design, evolving to what you have before you, all of it based on learning what makes the model fly best and weigh the least given the general arrangement we are working within. What I offer the free flight community today is something I did fall in love with and stand behind as an able performing model with flight characteristics the average flier can handle. It's not a beginner model for E-36, but if you want to step up a notch in performance and get that five second serious contender model, you have made a wise choice with this kit and design.

General assembly process recommendations

Please read these instructions thoroughly in conjunction with study of the kit drawing and supplement sheets before starting construction. These written instructions assume the builder has the knowledge and skills to construct a model of this type, and the instructions will be brief and cover highlights of the process only. A construction photo documentation PDF file is available as a free download from our website www.cbmodeldesigns.com within the *Apache II* product page; please refer to the photo documentation for more detailed insight into a prescribed building sequence if the written instructions are not sufficient for you. As always, you may refer any questions to me (Clint Brooks) at cbmodeldesigns@yahoo.com as needed.

Wing Assembly

Review the laser part number sheets before starting to understand the part arrangements and numbers. Mark any items that look like they would be confusing to sort due to similar size and shape.

Start wing construction by splicing the WS-1A and WS-1B spar segments, using the plan to hold the pieces relevant to the notching features. Add the firm 1/16 x 3/32 balsa spar caps top and bottom on the FWD SIDE of this assembly and also the outboard WS-2 spar sections using the plan to ensure alignment.
When done, turn the center spar over (aft side up) and align and install the WS-1C center doubler on the AFT SIDE.

Align the wing trailing edge pieces over the plan to fit the notching for the features accepting the truss rib ends, etc; glue the scarf joint at the center section when all notching is in line with the drawing. Sanding the trailing edges to the nearly finished section is recommended prior to installing them into the wing. Leave some material thickness to allow final sizing when sanding the finished wing assembly.

Build the two wing tip washout jigs from the parts supplied in the laser sheet. Retain these for use after the model is complete in the event of wing damage to the tips and replacement of broken parts is required you will want to re-establish the washout condition in either panel if affected.

Wing framing begins by building the front wing D section first. Once this is complete, the aft truss ribs are installed to allow the exact chord of the wing to be maintained and absorbing all assembly tolerance accumulations from the D section build.

You can build the wing in three sections. Starting with the center panel, locate the spar assembly over the plan and block into position. Also block the 1/8 x ¼ leading edge stock to match the plan. Cut a firm 1/16 x 1/32 cap for the leading edge-leave slightly long at the dihedral breaks to allow matching the angle with the joints after assembly. From the 3/32 thick laser sheet scrap margin cut a strip that is 3/8 wide to use at the wing center for fillers. These are where the wing locating keys are attached and serve a very useful purpose. Run the filler all the way to the aft surface of the leading edge stock. Set the 1/16 x 3/32 leading edge cap on top of them and position the four SR-1 ribs per plan, engaging the cap strip in the slot of each rib. I suggest dry fitting everything over the plan before applying any adhesive. Now start dry fitting the remaining diagonal nose ribs W-1. These are designed to match one vertical corner edge touching the aft side of the trailing edge stock, and one vertical corner edge the forward surface of the wing spar. You only need to bevel the leading edge of the rib slightly to get a good fit, leave the end common to the spar alone. Slip them into position from the side, engaging the leading edge cap in each rib slot as you get them snugged into place against the spar and leading edge. Pay attention to which side gets the bevel as you go as it alternates for each rib installation. Install all the ribs except the ones common to the dihedral break-these are installed after the tip panels are rigged in angle to the center. Make sure everything is seated against the building board and positioned accurately for gluing.

You can finish the aft section of the center panel if you want at this point. I typically continue building outboard with the forward D section for each tip panel, then go back and finish all three aft box sections after. I like to keep things coincident wherever possible and ensure accurate plan form alignment which I feel my build sequence offers.

Repeat the process for the most part to build the tip panel D section. Leave the leading edge stock long to allow flush finish with the canted wing tip rib after assembly. The 1/16 x 3/32 leading edge cap needs to be set to the tip rib canted plane, so this means you need to set the tip rib location at this point in the process.

The tip ribs are intentionally oversize in height to allow final contour blending after assembly. For now, you need to sand the lower edge to a bevel that will allow the rib to sit flat on the plan with the cant angle it is set to. The end of the spar serves as a gauge to set the tip rib cant angle. Use some blocking on the inboard edge of the rib against the plan to maintain the station alignment-this is important to flight trim characteristics so don't ignore the need to maintain alignment of the tip rib to the plan.

On the outboard side, between the board top and underside of the rib, place some additional blocking, with one edge beveled roughly to match the cant angle; this is to stabilize the rib location against the spar end for assembly.

Locate the wing washout gauge to the plan using the pinning strips. Note-the tip rib is placed hard against the plan, the washout jig ramps the trailing edge and gusset up by 1/8 inch at the tip of the wing. It also cants the trailing edge down slightly toward the front edge which is why the short angled portion of the shim is included. The trailing edge is blocked to match the plan, and then pinned to the board through the washout jig to orient this piece for assembly. Do this now so you can pre-fit the tip rib complete before bonding it to the leading edge and outboard end of the spar. Once the tip rib location is established, you can fit the outboard end of the 1/16 x 3/32 cap to match, using a 3/32 thick shim under it to locate the right height above the plan for the joint. The inboard end can be left slight long to the dihedral joint for final size when this area is prepped for assembly. Dry install the remaining W-1 ribs as done for the rest-when satisfied for position and firm against the building board and bond together.

Block the center section trailing edge to match the plan and align with all the notch features as closely as possible. Pre-fit the center rib W-2 to the aft side of the spar and notch in the trailing edge. Bond in place, and add the two WG-1 gussets. Add the 1/16 x 1/8 lower caps on either side of W-2. On top of WG-1 and the caps, install short 1/16 x 1/8 filler pieces to span the joint under them-these get sanded flush to the top of W-2 later. See the airplane assembly side view showing this area in more detail.

Install the lower 1/16 x 1/8 truss ribs, starting from the center and working outboard. Use firm but light balsa for these ribs-if the material feels fairly strong when flexed it's adequate. Add all the top truss ribs next. The upper and lower ribs common to the dihedral break cannot be added until the panels are assembled together.

Install the small shear ties WST-1 at the locations where the truss ribs cross. These provide a lot of benefit for torsional stiffness and should not be omitted. The easiest way to install is by pinning at the top with a modeling pin serving as a temporary handle. Then use cellulose glue (DUCO, etc.) on the bottom saddle notch and one side near the laser slot at the top. Position the tie against the upper truss rib side and against the top of the lower truss rib, and then carefully remove the pin once you are sure contact is firm against both parts. Allow to sit undisturbed-it's important to allow the shear ties to be installed with no vertical pre-load, something CA glue use can unintentionally lead to. Any force that bends a truss rib up or down will result in both ribs equalizing for deflection once removed from the building board, not just one side. If you want, go back and hit these joints lightly with CA after the wing assembly is removed from the building board.

Continue installing truss ribs on the tip panels. As the trailing edge is tapering up for washout, the lower truss ribs will not be in contact with the building board except at the spar joint locations. Shim under the truss ribs to maintain correct flushness with the trailing edge underside. Install the wing trailing edge gusset, noting the orientation of the partially cut slot accepting the end of the truss rib. Cut the notch through at the trailing edge-leave the front edge of the gusset intact. Bevel the edge common to the tip rib and install to match the same plane as the lower surface of the trailing edge. The upper truss rib fits into the slot and mates into the small one matching it in the trailing edge to complete.

Install the WST-1 ties between the outboard truss ribs. Make a wedge shaped shim to position under a lower truss rib at the WST-1 location. Carefully slide the shim into contact with the rib; lightly tapping against it until you feel it stop moving, indicating it is being supported against downward pressure. Install the tie with DUCO or similar to allow no stress preload in the glue joints and let dry undisturbed.

At this point the basic structural panels are complete and you can remove them from the board for joint prep at the dihedral locations. Install the 1/16 square key into one of the spar ends and dry fit together. Use blocking at the leading and trailing edge plan form locations to maintain span wise alignment. Best fit the dihedral joints and bond with thin CA when all alignment is achieved. Install DG-1 on the aft side of the spar joint when complete.

Install the aft dihedral rib W-3B after installing the 1/16 x 32 cap on the lower inboard side, sanding a small bevel in the bottom edge to match the tilt angle of the rib for installation. Install the WG-2 gusset after beveling one edge to match the W-3B rib angle. Install the lower truss rib common to this gusset. Then install the upper truss rib common to the dihedral rib. Install the WST-1 after these items are in place. There is a soft 3/32 x 1/8 filler that is installed on the upper inboard edge of W-3B at this time-the ends chamfered to fit the truss ribs terminations at the trailing edge and spar. Install to allow a bit of material remaining above the profile of W-3B to provide clean-up to match the plane of the wing upper surface during final shaping. I found the shock load on the covering during D/T landings caused it to detach from W-3B, and have provided a large enough attach land with the filler to help prevent this. If the covering does detach it is not a problem provided it detaches the same amount on the opposite wing panel. With film covering this can result in a large fillet transition on the wing in this area, and if these are not symmetrical it creates a washout effect that can impact your trim pattern. It is entirely possible to omit trying to provide a covering joint along the top edge of W-3B and attach to the nearest upper truss ribs instead, creating a triangular gusset of covering that can then be shrunken to offer this blend radius transition between the two panels, which aerodynamically speaking does not appear to hurt anything. Just make sure they are fairly symmetrical in their formation on the left and right hand side of the wing or flight trimming could be frustrating.

Install the forward dihedral rib W-3A after sanding a similar bevel as done on W-3B on the lower edge. Trim one of the remaining W-1 ribs to the modification view on the drawing and install as done for the rest of the W-1 ribs, except the aft end will be against the canted W-3A rib side. A small bit of bevel on the modified edge of W-1 gets a quality fit against the canted rib; Modified W-1 should be installed square to the building board as done for the rest of the W-1 ribs, on both the inboard and outboard side of W-3A.

Now lay the tip panel against the building board with the center supported from gravity deflection. Make sure the wing washout jig is back in place under the trailing edge. Re-establish plan form alignment to the drawing and secure. Install the remaining WG-2 gusset, truss ribs, outboard W-3B upper filler, the modified W-1 outboard rib and the WST-1.

Repeat the process on the opposite panel to complete the basic framing. With the last tip panel against the building board, fit and install the two turbulator spars, leaving some excess length bridging the dihedral rib joint locations. Glue into place except at the dihedral rib joints. Re-position the center panel against the board surface and install the two turbulator spars, leaving excess across both dihedral joints. On the joints that have the tip panel spars installed, perform the scarf joint slice with both spars at these joints, and then bond together and to the rib. Re-position the wing again to put the remaining tip panel against the building board with washout jig in place and install the last two turbulator spars, fitting against the tip rib and letting the difference go to the scarf splices at the dihedral break. This completes the assembly of the wing structure.

Shaping the wing is best achieved using a sandpaper sheet size flat board with 150 grit sandpaper contact cemented to it. Use this tool clamped in a vise or otherwise secured with the sandpaper side up. Start with sanding the bottom of the wing flat against the board. You have a lot of control and light touch by simply polishing the wing structure on top of this flat abrasive surface if you do it like this. Use gentle strokes to work the irregularities out of the structure on the bottom of each wing plane. On the tip panels, remember the forward D section is flat and a separate plane from the portion aft of the spar, which can also be sanded flat and flush.

Do the same sort of sanding on the upper portion of the wing aft of the spar. Focus on sanding the W-3B fillers flush to the top of W-3B and on the same plane as the rest of the upper wing surface adjacent to them. Work the upper surfaces and finish shape the trailing edges flush to the upper truss rib surfaces, leaving about .050 thick at the trailing edge.

With each wing panel flat against a building surface, shape the upper leading edge to match the flat planar entry of the stanfoil section presented by the rib sections. Carefully sand this upper surface area to the back edge of the first turbulator spar. Then do some light sanding on the contoured ribs to get all the edges flush with minimal cleanup. Finally you can sand in the lower entry contour at the wing leading edge, or just leave alone and sand in a blend radius to the edge of the stanfoil entry. This intersection should be left fairly crisp on the framework with the understanding it may get softened a bit with the covering process. If you want a bit less drag on the wing and some more speed, the lower entry is a recommended feature.

Finally I recommend a 3K carbon tow or similar local reinforcement bridging the dihedral joint on the upper side of the spar. If you omit this now it is my recommended repair should the spar develop a crack at the dihedral joint from D/T landings. DG-1 is designed to mitigate this possibility, so make sure when you install them there are no gaps the entire bonded surface between DG-1 and the spar ends to eliminate cracking along the grain of the spar web starting from the dihedral joint.

I make this from 3K carbon tow, a 5-6 inch length stretched across a small bit of parchment paper. I use a tab of masking tape on either end, then you can pin through this into your building board for maintaining a light tension in the tow. Flow some thin CA onto the tow and use another bit of parchment over the top of the layup and work it flat with your fingertip to distribute the glue. When this is cured, abrade the cured ribbon with some 220 grit sandpaper to give some tooth to the surface, on both sides. Now you can clip off several pieces about 1.5 inches and CA bond it to the spar, allowing a small transition radius between the wing panels. Your pet technique may be better-use it.

Fine sand the wing to get it ready for covering. I like to use and recommend Esaki tissue for the wing covering. It is by far the fastest to apply and easiest to repair, but it is sensitive to humidity and yields to all sharp objects in the field. It also adds structural rigidity to the wing and stabilizer when taut. Heat shrink polyester films (Microlite, etc.) work well but in my opinion only offer the benefit of being waterproof. I've used Polyspan but this is heavy and in my opinion no better than plastic film for structural integrity. It's probably the most puncture resistant of them all but you need to accept the weight penalty for using it. For me, I'll sacrifice covering durability for light weight and structural stiffness and tolerate tissue repairs after flying sessions. I seal the framework with clear nitrate dope and attach the tissue using the same. For finish, I apply two 50% thinned coats of clear nitrate, applied in interrupted sections to prevent the wing from warping under the stress of the shrinking dope.

About the tip plates on the wing-these are intended to counteract the effect of the wing pitching moment as it accelerates during the climb phase. This tends to twist the wing and cause problems if the wing can't react against it. You can build a very stiff wing for twist and you can also try to provide a counterforce to the twist by adding drag in a discrete manner. How much is required is somewhat an argument, but what I have provided seems to work in flight testing. I've also installed them with the leading edge canted aft for a more pleasing look, but did not find it as effective as the vertical leading edge installation. These do not provide a real dramatic change in performance. I suggest you fly the model initially without them and try to get it trimmed as close as you can to what you think is good enough. If you are happy with that, you need go no further. If you want to see if things can be improved, add the tip plates to see what is different in the climb. In theory you should get a little higher if the model stays at a high angle and does not start to go over the top as the speed builds, something that concerns all five second competitors. I glue them on with DUCO cement in case they need to come off later. And if they are subject to handling or landing abuse, I would rather have them come off easily instead of tearing up the tip rib and damaging the wing. In practice they don't come off under normal handling glued on with DUCO. Just make sure you have good wood exposure between the rib and tip plate if using film covering.

Also, make these from very light density balsa-they will be on the denser side as provided in the laser sheet-use these for a template. Leave all edges square and 3/32 thick. We want localized drag to build on these surfaces as airspeed goes up. At minimum sink speed (glide) they don't seem to offer any penalty at all for drag.

Horizontal stabilizer assembly

This starts with the built up spar construction. Select a section or two of hard 1/16 x 3/32 strip to use for the spar elements. I strongly suggest a blocking strip to build this against to ensure the assembly process yields a flat and straight spar when complete.

Basically, cut three pieces to excess length and assemble such that the center spar is on edge with respect to the upper and lower, forming a 'T' cross section. Place any bowed material in opposition to cancel out forces influencing warpage for the upper and lower caps. Make sure all pieces are hard against the building board and then carefully bond with thin CA. When cured cleanup any glue flash and trim to net length required per the drawing. At this point, the stab framing sequence follows the same process used for the wing, starting with the forward D section. Glue the truss ribs where they cross-they contact each other in this case, using gap filling CA.

I strongly suggest you build this framework to closely match the drawing at the tips and the SF-1 feature to keep the stab keying and fin positions in close relationship to each other. I have engineered the stab platform to closely match the keying features related to it, and also the slotted index at the stab trailing edge. Care taken in construction allows these critical features to work together and ensure success in easily flight trimming the model.

With basic framing and all sanding, shaping completed I suggest installing the SK-1 & 2 details to the trailing edge before covering. Make sure you use the 1/64 ply SK-1 detail to prevent the incidence adjustment screw from penetrating the balsa trailing edge. Carefully assemble these as a stack-the sides will be used to index and center the slot for the screw so take some care to get this even.

Using scrap 1/32 balsa or similar, make a three sided trap for this assembly using the plan for the two sides and across the front to control the forward location of the SK-1/2 assembly. Place pins to hold the trap material and clear the framework of the stab. Dry fit the stab frame to the drawing with the SK subassembly in position within the trap you made. Add blocking at the tip rib sides to maintain an alignment to these sides, and also some blocking control the trailing edge location so the stab is completely controlled from location variation in all directions.

Remove the stab frame, and use DUCO or similar on the back of SK-1 to join. Replace the stab frame again, making sure it is in position to the blocking and that the SK subassembly is also registered into the trap correctly. Pin or weigh down and allow to dry undisturbed. When finished, you have captured all the key relationships of the stabilizer.

Proceed with covering-I leave the D/T post DTP-1 off until the stab is covered, then slit the upper covering for it and install with a bit of thin CA.

Add the tip fin plates after covering the stab. I attach these with DUCO as well-it gives you a chance to get it right before securing the joint. Pin prick the covering after lightly abrading it if in place in the joint area for improved adhesion.

The rudder tab shown has a big effect on the climb pattern. I suggest starting with this size and thickness dimension shown on the drawing. You can attach with glue stick if you want to remove easily later. I stick them on with DUCO. You fine tune during trimming by shaving off the upper and lower aft corners, or sand the wedge down until the trim pattern is acceptable.

Fuselage assembly
Build the fuselage pod by making the series subassemblies that are detailed on the drawing. Note-if you want to build this model for a left handed flier, you can easily do so by reversing the assembly stack-up of all the pod sections, and by reversing (flip over) the crutch floor F-1 to put the keel bias on the right side of the model instead of the left as shown. Spend some time studying how to reverse all the pod features if you want to set up for a lefty.

The main thing to consider for accurate alignment on the lower pod build-up are the front edges common to the firewall plate, and the upper edges common to the crutch floor F-1. It is important for the firewall mounting plate to install 90 degrees to the pod sides. This model needs no adjustment in down thrust, but is very sensitive to side thrust settings. Having the firewall installed in a neutral position will help you start off with success with little or no side thrust adjustment required. You need to control this end of the pod assembly as you build up, so blocking these edges to maintain a uniform stack up is important to do. Use blocking material that is 90 degrees to your building board surface, and thick enough it can be used from beginning to end and control this feature on the model. Do the same for the edges common to the crutch floor, just to have good structural integrity when assembled with the crutch portion after. The rest of it is just best fit to design intent of the drawing.

Start with pod subassembly number 1. Note that F-11 has a bridging tab that is intended to be removed after bonding the margins to F-10, so don’t glue this tab to the side of F-10; it’s just there temporarily for part stability and handling. Also, I use DUCO for assembly of the pod laminations, as it gives some adjustability during assembly and is lightweight, sands easily and dries quickly. It seemed like pods built using CA tended to weigh more, and I think this is somewhat due to the glue mass-it’s easy to flood CA without realizing it.

The pod assemblies build onto each other, the main reason to allow some support for installing small segments that would otherwise be difficult to assemble and handle, and provide accuracy in the result. I suggest you follow the logic for the best build process. So with that in mind, assemble F-8 elements onto subassembly 1. And continue building up to the subassembly 3 configuration.

Construct subassembly 4 by building up the keel members F-6 on the back of F-5 as the carrier to start off. This will involve inverting the stack from what is shown on the drawing to assemble. Flip subassembly 4 over and build subassembly 5 by adding F-4 to this and installing the plywood timer mounting frame TMF-1 into the cutout in F-4 that receives it. If you plan to use the eMAX timer you must leave the balsa spacer frame in place for the timer fit offset, and the TMF-1 frame installs on top of this.

You now have two shell halves of the pod assembly. Make sure you install the small bridge filler at the top of subassembly 3 before the next steps-see section D-D on the drawing for this area.

Sand a local ramp into the forward edge of F-5 common to the timer frame to clear for the timer connector in this area –see section A-A on the drawing for this detail. Go around the timer bay cavities with a sanding stick or similar to sand all the edges flush and remove excess weight before joining the shells together.

Dry fit subassembly 5 with the crutch floor F-1. Don't remove the wing dowel knock-outs in F-1 until both pod shell subassemblies are glued on. Position the dry fit assembly upside down on the building board and square up subassembly 5 with F-1 and bond together with dabs of thin CA. Now you can position the opposite shell subassembly 3 against the mating side of subassembly 5 and the bottom of F-1 for installation using thin CA. Make sure the firewall mounting plane you are trying to control is flush with subassembly 5 before applying the glue.
Now go back and chip out the wing dowel slot knockouts before adding the upper crutch assembly details.

The upper crutch assembly sequence begins by laminating the F-2/F-3 longeron subassembly and the F-2/F-3/F-4 subassembly; reference section D-D on the drawing for this detail. Care should be taken to keep the forward edges coincident in the stackup as they form part of the firewall mounting plane so carefully controlled in the lower pod assembly. F-4 is a reduced profile above the bottom edge to provide a slot configuration for the battery wiring, so make sure this is maintained in the assembly.

When assembled, these are located in F-1 slots via the tabs in F-2 and glued in place. I suggest using the tail boom tube as a temporary spacer gauge between the F-2 installations to make sure there is a good fit to the side of the tube as the F-2 elements are glued in. Also, you will have to clear the right hand F-2 for the ESC wire harness pass through in F-1; easier if done prior to bonding in the subassembly.

Sand the front end of F-1 to match the upper and lower firewall mounting plane formation. Carefully sand this whole area carefully to get as even as possible for installation of the plywood firewall FW-1. When satisfied, pre-fit FW-1 equalized to the sides of the pod for centering. Any mismatch with the edges of FW-1 and the pod sides needs to be made flush with light block sanding before adding the plywood doublers FD-1 & FD-2.

Install the 1/64 ply doublers FD-1 first. I sand the plywood with 220 grit and wipe off with acetone or similar solvent before bonding as this improves adhesion quite a bit. Best fit this piece to the top edge of the fuselage longeron and the overlap onto the side if FW-1. Also check for alignment with the wing dowel slot in F-1. When satisfied, bond to the pod with thin CA. Install the FW-1 using the notching to match the FD-1 tabs.

Sand the 1/32 ply doubler FD-2 and clean for bonding; best fit and attach with CA to complete. Do the same on the opposite side and you have completed the ESC bay and basic pod assembly. One more detail-I cut off the upper corner of the F-2 subassemblies where they butt against the FW-1. Simply split the material along the grain from the top edge to the bottom to form a large chamfer. This has no impact to strength and removes a bit of mass that isn't doing anything structurally. It also provides a bit more clearance for the wiring associated with the ESC and motor.

I use a razor saw to cut off the pod laminates on either side of the keel to the rough taper shown on the drawing plan view of the pod. Block sand everything smooth and square to the basic profiles of the shape, and then knock off the corners as much as possible to fair the shape and remove excess weight. On mine, I glue a skid plate to the bottom of the pod made from the scrap margins of the

1/64 plywood laser sheet-it's not shown on the kit drawing but you can see it in the photos of the model. This is 5/8 inch wide centered on the bottom and glued on after the side profile of the pod has been sanded and before the blend radius shaping begins. I wrap the ply skid up the front of the pod and terminate just below the edge of FW-1, and as far aft as the constant section side profile goes. This skid gets reshaped to whatever feather edge emerges when you sand in the blend radius and finish up shaping the pod contours. It adds a tiny bit of weight, and is part of the noted RTF weight of the T-3 model used as the baseline weight for this kit. It also keeps the bottom of the pod from looking wood peckered from landing on rough field surfaces. You could also fashion a skid leg arrangement of some sort but so far I find the skid plate very simple and highly effective for preserving the bottom of the model.

Add the FC cover assembly over the ESC bay behind the firewall. This is used to trap the ESC under it. You can leave this off if you want-on some of my prototypes I just used electrical tape stretched over the bay and down the sides to retain the ESC. It works but looks unfinished and tends to come loose with time and use. The FC elements make the front end very finished looking and functional.

To finish things off add the aft wing dowel lugs WL-1 and dowel. I suggest leaving the end common to the battery wire longer to allow some capability to turn the battery lead around the wing dowel then forward to keep it pulled back and against the side of the pod for flight. I also suggest the scrap 1/64 ply wear plates installed above these locations to keep the wing keys from eroding the balsa sides with use. Add the front wing dowels by installing into the clearance slots in the ply doublers and the slots inside of F-1 cleared out earlier. I just press these into place in case they break or need to be removed at some point and replaced.

Set up the tail boom assembly next. Assemble the stab platform parts using the small plywood gauges SP-2 which fit into the notches at either end of SP-1. These are small and frustrating to handle, but they do provide an accurate saddle assembly if you install and utilize them to sand the radius in the two filler blocks SP-3 that go between them. The easiest way to install is glue them onto some scrap balsa that is big enough to easily handle, with the upper edge of the SP-2 against the one edge of the scrap so it can be pinned to the building board and hold the part against the building board top and vertically aligned. Push the SP-1 against it along the building board top until it seats the SP-2 into the notch for it. Tack with some thin CA, then repeat for the other end. Finally position the two fillers SP-3 and glue to the platform and SP-2's, then remove the temporary scrap handling tools from the SP-2's. You can use the tail boom tube or the little remnant I give you in the kit as a sanding tool and wrap some thin sandpaper around it to sand away the balsa filler until you match the SP-2 contours. You want the radius to be level and aligned parallel with the sides of SP-1 which is calibrated to your stab key features, remember? So the SP-2 is my design aid to help maintain accurate alignment of the tail installation and minimal problems in trimming the model.

I have provided the balsa filled and stepped notch in the aft end of the tail boom tube for you. The only thing you need to do is establish a clearance hole for the incidence adjustment screw head, which in use will end up flush or slightly inside the OD of the carbon tube. To do this, you need to assemble the SP-4 details, which again are aligned by their sides for installation so take care in the assembly of these two pieces for maintaining this characteristic. Use the #1-72 screw and thread it completely through the SP-4 with the small pilot hole at the screw location. Screw it all the way down against the bottom of the screw head so it aligns itself perpendicular to SP-4. Now install the #1-72 hex nut on the opposite side, all the way down to the plywood surface. Then assemble the second SP-4 on top of this using DUCO and keeping it away from the threaded features.

When dry, remove the screw and nut. Push a small amount of modeling clay into the nut to protect the threads from glue. Reposition the nut into the receiving hole in the top SP-4 and apply DUCO to cement it into place. When dry, run the screw back up through the nut to clear out the clay. Now use the assembly to establish where the screw center is for the clearance hole through the carbon tube. Once the center point is established, I suggest step drilling up to a near final size using a pin vise, starting with a 1/16 dia drill all the way through the balsa and carbon tube wall, then increasing drill sizes to open the hole to just clear the screw head diameter. Be very careful in using twist drills as these can easily de-laminate the carbon as they break through the wall of the tube. I generally final size using a small fine rat tail file to obtain the finished clearance hole. Once done, soak this bore with thin CA to solidify things.

Set the tail boom tube up for assembly with the stab platform details. I provide a small jig SPJ-1 that is sized to match the tube dia which is the same as the SP-4 width to keep these items aligned for installation. Pin SPJ-1 to the plan view on the drawing where shown in phantom line for controlling the aft end position for the tube. Also provide blocking to keep the tube aligned to the drawing further forward so nothing gets skewed in the platform installation.

Check the fit of SP-4 into this, along with the tube on top of it to get a feel for the setup. You want SP-4 and the tube to sit flat against the building board, trapped together by the SPJ-1. Add masking tape shim the top surface of SP-4 until it is flush to the tube side against the building board.

Locate the stab platform to match the drawing position as seated against it for exact alignment to the tube and spacing to the incidence screw center. Apply cement onto the underside of SP-4 and place against the notch in the tube and locate the tube into position using the SPJ-1 jig for alignment, also setting the tube into the platform saddle, but no glue yet in this area. The flat on SP-4 is utilized to clock the tube radially and set this surface parallel to the stab platform for a horizontal set to the stab. Make sure SP-4 is flat against the board top and apply CA to the stab saddle to attach it to the tube. If done correctly these items are parallel surfaces when viewed from the aft end. Don’t forget to drill the .047 diameter D/T lanyard hole located per the other pilot hole in SP-4. It’s best to countersink the entry and exit edges of this hole a bit to reduce the abrasion on the lanyard passing through it in operation.

The next assembly step is to mate the tail boom tube assembly with the pod, making sure the wing saddle area is parallel with the stab platform. Assemble these items directly on top of the plan, upside down as done to set the stab platform. The wing saddle edges of the pod have incidence compared to the tube and stab platform, so it is not possible to place the pod flat against the drawing. Set up controls for overall length of the assembly; use the aft tube end as a hard stop, the forward end is a hard stop set to the upper edge of FW-1 as shown on the drawing plan view of the fuselage.

Dry fit the tube assembly into the slot in pod and push to the contact the top of F-1 so the tube is in three lines of tangent contact with the pod. (F-1, and the two inner sides of F-2). The easiest way to align for parallel condition between the wing saddle area and stab platform is to use two rounds (drill blank, aluminum or brass tubing, etc.) at least 1/8 inch diameter; one placed between the building board and top of the pod, the other between the board and top of the stab platform, aligned span wise on both. This gives you two parallel contact lines to clock the rotation of both assemblies . The only thing to be careful of is keeping the carbon tube fully seated in the pod slot while making the alignments.

Confirm all alignments are good and apply a light tack of thin CA at the end of the pod at F-1. Pull the assembly off the board and visually confirm the tube is seated, then apply more thin CA to adhere the tube into the slot. If done correctly the stab platform and wing saddle are parallel when sighted from the front or rear of the fuselage. Install the scrap balsa filler over the tube near the rear wing dowel to provide seating for the wing trailing edge contact. Install the 1/16 OD aluminum tube fair leads for the D/T lanyard to complete the tail boom detailing.

Assemble the lipo tray as shown. The intent of this device is to allow installation and removal to one location in the fuselage, yet allow you to position the lipo forward or aft to adjust the center of gravity of the model, and retain the lipo in a similar manner as if Velcro attached on the fuselage side as typically done. It allows a flush installation of the lipo with the ease of access of one mounted on the side of the fuselage in the open. The receiving cavity for the lipo in the pod is sized for the Thunderpower R/C 2S lipo configuration. When installed with thin Velcro, the fit should be a smooth slip into place with just a bit of friction pressure to install. The basswood strip installed at an angle acts as a taper to grip the tray and retain it. Combined with the light pressure of the cavity fit and this taper the battery is secure enough for all phases of flight, and slides out to the side when needed. You can adjust the cavity fit by sanding the top (balsa) side of the tray to reduce thickness until you get the fit you want. Consider the Velcro thickness when pre-fitting the tray and lipo. You could probably get by without this if you want-I swap batteries between different models so I don't have to run the Velcro differently on the lipo to fly either model which is why I designed this system. You might be able to get a good fit and retention using foam tape or similar instead of Velcro and maybe save a gram or so.

Finish sanding all the wood components and seal with wipe on polyurethane or clear dope. I like a natural wood finish as it's easiest to repair with use.

Electronic timers

The design shows both the Starlink- Flitetech and eMAX electronic timers installed. I strongly suggest you set up your model with the RDT system and the Starlink or eMAX timer equipped for RDT. The timer mounting frame (TMF-1) hole pattern matches the eMax timer and allows direct installation. Note-only the straight pin version of this timer will fit in the model. The Starlink timer utilizes TMP-1 to adapt mounting into the model. A 1/64 plywood cover plate TMP-2 is supplied for the eMax timer installation to protect the circuit board from moisture and handling wear. Both timers use #0 x 1/8 sheet metal screws or similar to install.

Install all the electronics and motor for bench testing. I utilize the Hobby Wing Flyfun 12A ESC as an inexpensive and durable product. The ESC bay on the model has been designed around this ESC configuration. Keep the wire lengths to the minimum that will allow all connections. The splice for the ESC battery leads are bulkier than the wire and will not fit neatly into the slot for them at that area. Slice away as much of F-2 on that side as needed to clear the area for the wire splicing. I cut down to the top of the carbon tube to clear material for the splicing.

Set up the D/T lanyard and stops per the drawing. I have not used dental bands any stronger than what is shown on the design. I use (2) 5/8 diameter medium pull on the stab hold down, and two at the servo arm attach point. The servo does not appear to be overloaded when used in this manner with the bands noted, but keep them near the hub of the servo arm to minimize drain.
Anything stronger may cause an overload on the servo and battery drain.

Put everything together and weigh in. I use #19 rubber bands to hold the wing on-one each side and one extra for redundancy should one break in flight. Check CG location-it should be about where shown on the drawing if you built per plan. I have no ballast added on any of my *Apache II* models. My best weight to date (T-3) is 153 grams ready to fly, including RDT and using the Starlink timer.

Flight trimming
There could be a book written on this, at least comic book size. Seriously, the model is not that hard to trim in spite of the non-standard look it has. If you built it straight and true you will quickly be successful, especially if you use RDT to control mistakes in the launch during trimming sessions.

Decide if you are going to set up for a left-left or right-right pattern in the model. This dictates which fin to apply the rudder tab wedge. The model can be trimmed to fly in either direction without problem generally speaking. It depends on where your comfort zone is on launching; being ergonomically comfortable is an important factor for flying this model as it helps with launch consistency.

With the model assembled, make some reference marks on the wing underside adjacent to the sides of the fuselage, front and rear after centering the wing. If wing skew is used you need to understand how much change is being deployed relative to these reference marks. Don't plan on keying the wing until a good flight pattern is established in the model.

Next, I suggest you adjust the stab incidence adjustment screw until the trailing edge is at the suggested starting dimension-approximate is acceptable as you will probably be adjusting this in or out a bit to adjust the climb pattern.

If you are not planning to use RDT, you need to be very conservative about adjustments and testing. Always start with a 3 to 5 second motor run with quick D/T after motor braking. If the model will climb safely for five seconds you can open the time up and start working the transition and glide. Any trim change adjustments should start over on the reduced D/T time to safely review the effect of these adjustments.

Even with RDT, you should take measures to manage the RDT transmitter to be easily accessible for emergency shutdown and not interfere with your handling of the model at launch. I modified a sports holder for small electronic devices (iPod, etc.) that allows the transmitter to be retained hands-off. I strap this to my upper left arm, and after following through with my right arm at the launch, position my right hand automatically to my other arm over the kill button should it be needed. The same conservative approach should be observed for trim changes as low altitude problems are still challenging even with the RDT backup.

Before heading to the field for initial flight tests review the free download **Launch Techniques and Power Trimming Patterns** document from the Apache II product page on the CB Model Designs website. This illustrates two launch styles that work well with this model, and also the power trim pattern variations and corrective action suggestions authored by Stan Buddenbohm . A lot of flight testing and technique development has gone into all the Apache E-36 designs and are represented as current best practice for you to get a jump start on learning to fly this airplane.

Start with some power off hand glides to see the basic glide pattern. With the stab set at the starting dimension shown on the kit drawing it should be a fairly flat and even glide (note-this dimension is inclusive with the stab tilt shim applied). Install a 1/32 thick stab tilt shim to start, on the side you wish the model to turn toward in the glide. Observe that the model is stable and tending to turn in that direction. With RDT I don't usually test glide much more than this. Without it you may wish to be more aggressive in the test glide by throwing the model very hard with left or right bank depending on your pattern choice, and observe that it will transition into a glide turn.

This model is designed to be launched in a VTO (Vertical Take Off) attitude. It will require full power from the initial attempt. The model needs to be given energy to launch properly-don't just let go of it under power. At first make sure you are giving a firm but non-aggressive push to launch. With practice the model can stand quite a bit of launch energy but until you have trained yourself it will only make it harder to observe the effects of trim adjustments early on. A firm controlled push is more important than a large force application at launch for most people to be consistent which often trumps high energy and inconsistency in a contest setting. Don't forget the air picking skills!

Before you attempt power runs I refer you back to study the trimming document concerning cylindrical climb pattern standards and configurations, and trimming remedies to achieve the best one. This was written in the context of the Apache design, and this Apache version will trim to the same standards and is a very useful instruction. I suggest you bring it as reference when you fly so you can compare observations of your model and what is depicted for the type of pattern and remedies to improve as you work through launch sets for trimming.

You can launch VTO style in a few different ways. All launch methods are at shoulder or waist height, no kneeling to launch is needed.

I started with the underhand VTO method when first learning to fly the Apache. You stand with the wind at your back, and hold the model with the underside facing you so the model will be launching into the wind. Tilt the model toward you, roughly 80 degrees to the ground. Also tilt to the side your climb circle is targeting, so left wing about 10 degrees low for a L-L pattern. This will look tilted to the right from the underside, pay attention as this is often a root cause with bad launches if you reverse the turn.

Start the motor, confirm launch attitude and push the model up and release. It should start up in a very slight turn and maintain a steep climb angle. For five seconds the model should just start to turn at the top which should result in a nice roll out into the glide.

The other technique is an overhand launch with the model pushed up in the same steep angle with the model banked slightly to the direction of the desired turn pattern you are trimming for. An accurate launch upward should result in the same steady vertical climb with a slight turn.

If the model is pulling hard to one side or the other right at launch, you probably need to adjust side thrust to reduce this to an acceptable level. The design is very sensitive to this adjustment. Shims the thickness of one sheet of bond paper will completely change the turn characteristic under power. Start with a paper thickness shim to see if that gets rid of any hard pull into a turn right out of your hand. I have had good luck with tapering a small strip of 1/64 plywood down to a feather edge and installing as the shim. You can keep sliding it further under the motor mount until the problem is corrected. Attach with some DUCO to maintain the position and break off any excess that is projecting out excessively. You want the model to track straight and allow the rudder tab to influence turn as the speed builds.

The other factor to help obtain a good climb pattern is increasing or decreasing decalage (changing the angle between the wing and horizontal stabilizer). Adding decalage (raising the stab TE or shimming the wing LE) will make the model loopier and tighten in turns. A loopy pattern also means a condition in the climb where the model appears to start into a turn and continues to track in the turn without climbing, appearing to flatten off. Removing decalage will reduce the tendency for the model to pitch up and behave in a more neutral manner (goes where pointed so to speak).
As you observe the climb pattern, you are trying to get the model to climb uniformly. A five

second climb may look perfect but when you go to a ten second attempt the model may start to roll into a turn and flatten off. Is it rudder tab or decalage causing this? This can be a confusing set of circumstances to work through. Try reducing decalage first to see if you can keep the model climbing on a vertical track. If it starts into a tighter turn, that's acceptable provided it stays vertical in orientation. Keep removing decalage until the climb pattern stabilizes into a consistent climb. I'm talking about ¼ turns on the incidence screw for each adjustment-not gross changes. Everything about this model needs to be done in small increments to obtain a good trim pattern.

One other trick to help with a troublesome turn issue is to add some wing skew. If the model insists on going left in spite of the decalage adjustments, adjust the wing to have the right wing tip aft just slightly which increases washout in the right wing. Look at your reference marks and at the front try shifting off the marks to one side or the other-maybe 1/64 of an inch or so, nothing dramatic. A little more drag on the right wing may help with compensating some of the roll that is causing the model to flatten off in a turn to the left, etc.

If the model is still trying to flatten out after these tweaks, try sanding down the rudder tab shim or cut off some of the upper and lower corners a bit to reduce the area and force this little surface is adding. Again, little bits at a time until you get the problem solved.

My observations are this for a well trimmed Apache II:

Five seconds-the model climbs in a steep and fairly straight pattern with a slow turn bias to the wing angle you launched at. As the speed picks up the climb goes a bit more vertical and starts to turn to heading about 90 degrees from where it launched. The motor shutoff allows the model to roll out based on the turn starting due to the rudder tab.

Ten seconds-the model follows the same trajectory at launch as a five second, but the turn continues to happen as the model passes the five second point. At shutoff, the turn has progressed to about 180-200 degree heading and the model rolls out into the glide, heading downwind.

Fifteen seconds-everything repeats, and you will probably have at least two full turns to altitude before the motor shuts off.

For all these patterns the model is heading mostly up with very little flattening off in the turns. The longer motor runs reveal tendency to flatten as the speed can really build up during this phase and offer you the best sense of how well the model is trimmed for climb. Sometimes a model will be good for any of the run attempts; other times you may have one best suited for five seconds because anything more results in instability in the climb. Pick your battles wisely-most of my models have been decent for all phases of the E-36 profile and the Apache II should be a good tool for you.

Fly like the wind! With many thanks to Ralph Ray and Stan Buddenbohm for their support and encouragement in developing this design variant and kit. And welcome the Apache fraternity of builders and flyers.

T-3 Build Weights

Stab frame with fins:	6.6 grams
Wing Frame with tip plates:	26.4 grams
Fuselage assembly:	22.8 grams
Stab assembly covered (Esaki):	9.3 grams
Wing assembly covered (Esaki):	34.8 grams
RTF gross weight:	152.4 grams