Pterobat Jnr.

A 48" span low-wing sports design for .25 size engines and 4 function R/C designed by Alan Wooster...

This is the third in this trilogy of the 'Pterobat' range of sport aerobatic models that have been subject of ongoing development since 1998. At 48" span it is the smallest of the three. It's easy to fly, extremely agile, predictable and grooves nicely, yet will slow up well for landing without a fast tip-stall. I did expect it be a little twitchy due to its size, but it was not to be. Pterobatat Jnr. is certainly a lot faster than I expected and may therefore not really be the ideal second model for the novice. And the name? The first of these was produced as my counter reaction to the fun-fly models with their wild antics. I prefer my models to perform smooth aerobatics reminiscent of the patternships of old, hence the rather jurassic-like label.

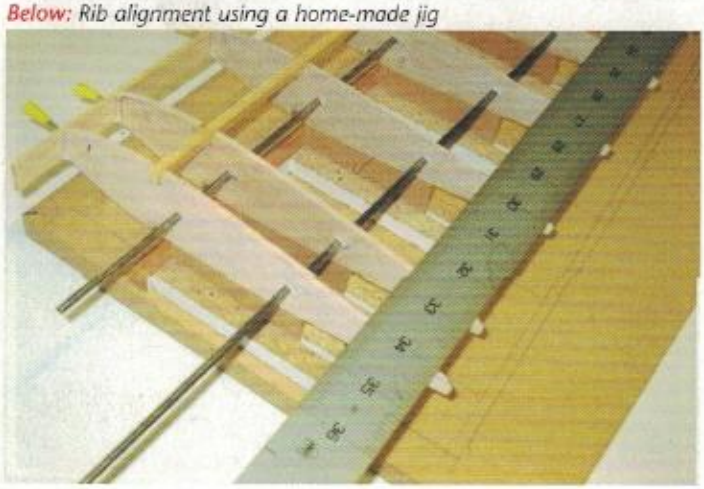
Because this one really is just a reduced version of its big brothers, it does involve all the same building processes and sequences and so really is a busy little project. If you are old enough to still enjoy building with balsa sticks the old fashioned way, and young enough to enjoy lots of agile aerobatics, then this one might be right for you.

About the Construction

I consciously strive to keep the weight down as I build and generally use light grade balsa where possible. The fuselage sides and tailplane were framed ex medium/hard strips I cut from one sheet, the balance being cut from medium or soft balsa unless otherwise specified. The prototype was covered entirely with 'Easycoat' film. I used 'Sig-Bond' aliphatic resin for general construction and both thin cyano and some 30-minute epoxy where necessary. Finishe dry weight of the prototype was just short of 3 lb.

Because this was one more in a long development line, I did opt build the wing on a basic jig I have developed over some time. Th jig does work extremely well and produces a nice straight wing ever time.

Below: Rib alignment using a home-made jig

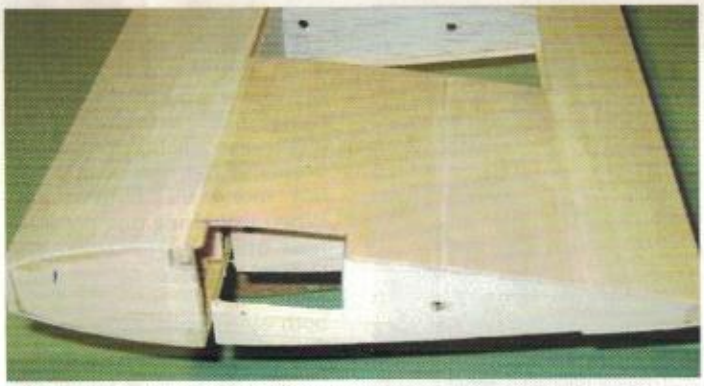


Wing Construction

Twenty ribs are cut sandwich-style in two similar operations, or for each wing. I cut the rib patterns from scrap Formica. Accurate mark and drill the two holes on the rib centre-line. These hol locate the ribs on jigging wires as well as hold each stack of ten ri together for shaping. Note that the slots for the spars are exclude from the rib patterns. Stack the roughly cut rib blanks together. Lo one rib template on the stack and carefully drill through the who stack ensuring the drill hole is square in both planes. I find it help to tape the stack all together with masking tape for this operatio Bolt the stack together with two suitable bolts, remove the tape an accurately plane and sand the stack to shape. Repeat for the secon stack. With both stacks still bolted together (templates removed) pl and mark the spar positions with a pen across the top and botto of each stack. Make the slot cuts with a razor saw and clean the out with a hacksaw blade or file. Carefully number each rib as th stack is dissembled, also colour coding for left and right wing Carefully thread the ribs onto the wires. By backing the rib with th biscuit and gently twirling the jig wire, you will minimise the chances of splitting any ribs during this operation.

Eyeball the assembly from one end and when suitably adjusted for alignment, glue the top mainspar in place followed by the vertical 1/8" sub-LE section. The rib trailing edge points are now adjusted and the 1/4" square balsa TE applied. To align the TE, sit a straightedge over the rear edge of the full line of ribs, and adjust each rib to the common line. It is not critical how much is removed from each rib as long as this done as a common operation for both wings to ensure the wings remain as a similar size pair!

Below: Front and rear sheeting added. Note piano wire alignment



Above: Cut the slots for aileron servo in each root rib. Note slot for spar brace

The top LE and TE 1/16" soft balsa sheeting is now applied. When dry invert the wing panel and fit the lower spar. Don't forget to epoxy the pine wing retaining blocks in place at the wing roots before gluing the lower LE and TE sheeting in place. DO NOT fit the lower centre-section sheeting at this time. The lower cap strips can now be installed. Invert the wing again and install the vertical-grain shear webs followed by the top cap-strips. The top centre-section sheeting is now fitted.

The wing halves are now ready to be joined. Before doing this the slot for the aileron servo can now be cut in each root-rib. It is easier to do a neat job now rather than when the wings are joined. The wing halves are now butt-joined and glued with 30-minute epoxy with one panel flat on the bench and the other raised at the tip to provide 2" total dihedral. Withdraw the jig wires when dry. Now cut full depth slots in the first two root ribs hard up against the spars from underneath to accommodate the 1/8" spar doubler. First make a cardboard pattern and then cut the finished article from birchply and epoxy in place. The lower centre-section sheeting is then glued in place to finish the basic job.

The 3/8" soft balsa LE strips are fitted after the wing is offered up to the fuselage to allow neat fitting at the fuselage end. I find it easy to apply these strips in rectangular form as cut from the sheet and shape them in-situ using a razor plane and sandpaper. Now make and fit the aileron from stock strip. The prototype ailerons were fitted with a Du-Bro torque rod kit and the ailerons retained with Sig polypropylene 'Easy Hinges'. These were pinned in place with toothpicks inserted from the underside.

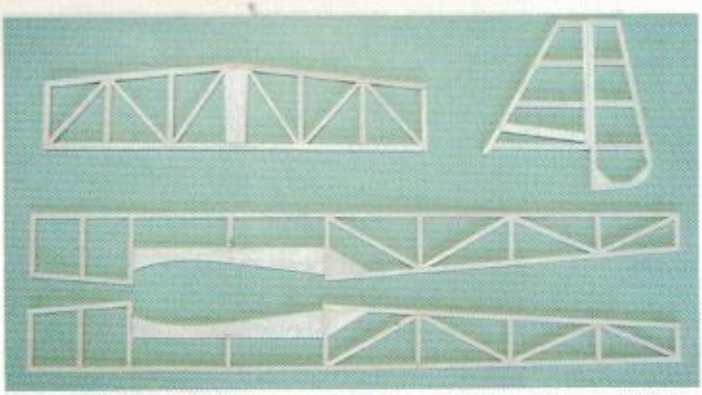
The soft balsa wingtips are fitted after that. Thoroughly sand the wings before covering.

Tailplane

No secrets here. These items are framed up over the plan using medium - medium/hard 3/16" sq. balsa. The elevators are cut from soft 3/16" balsa sheet and joined with a piece of hardwood dowel using 30-minute epoxy. I pre-covered the stabiliser, elevators, and rudder prior to assembly, but covered the fixed fin after it was glued into the fuselage. (See 'Assembly Sequence'.) All tailplane control surfaces were again hinged using 'Easy Hinges'. In this instance they were all cut in half before use, and also pinned with toothpicks.

Fuselage

The fuselage is simply a box framed up with 3/16" balsa sticks and some sheet and a turtledeck applied on top. Frame one side over the plan - over a non-stick protective clear sheet of course (I still use Monocote film backing for this). When dry shift the non-stick film up one level and build the second side over the first. When this is dry lift and sand both halves inside and out and apply the horizontal exterior 1/16" balsa sheeting to the front area bounded within the black triangles. Do make a pair and not two of the same side! Note that this sheeting projects 3/16" forward of the front vertical fuselage member. Apply the 1/16" vertical-grain doublers into the four interior sheeted bays and lightly chamfer both stern-posts for later neat joining.



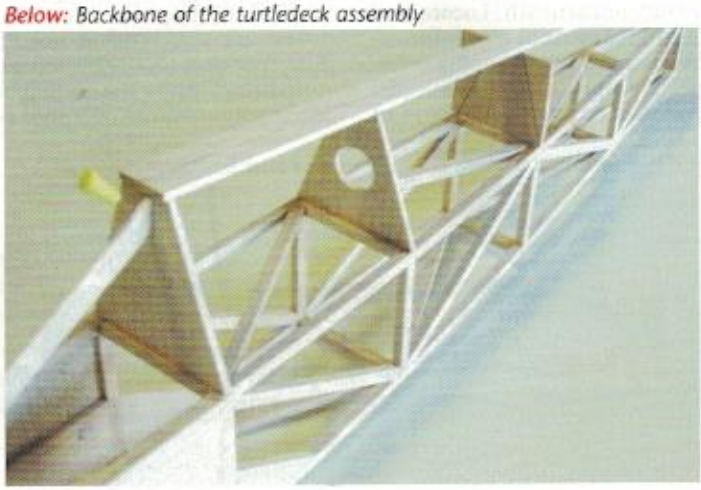
Above: Fuselage sides and tail surfaces prepared from mainly 3/16" square balsa

Above: Fuselage side frames are jigged and joined with cross members

The sides are now joined to form the basic box. My trusty old fuselage jig is invaluable for this. If you don't have one, you will have to sit these sides vertically on your flat building board and hold them in place with a stack of books or bricks. The fuselage is joined at former F2 at this stage and also all the similar length sticks to ensure the sides are square and parallel from F4 position forward. I pre-cut all the similar length cross-members and sand them to the same length before starting with the glue. Cyano. can be used here for an instant fix. Draw the fuselage halves together at the rear, adjust to a true alignment, apply the glue and hold the assembly with a suitable clip until dry. Fit and fix the three cross-members at positions F5, F6 and F7. The top and bottom diagonal bracing at the rear fuselage can be fitted now.

Former F1 is now epoxied in place. Ensure it is fitted square in both planes as it will dictate the motor thrust-line. Former F4 is now glued in. Cut the Turtle deck top rail from a piece of medium hard 1/8" sheet and glue it to top of F4 at the front. The rear end is chocked up to a height of 3/4" above the box top-rail. Use a piece of the material removed from the fin slot to temporarily support it in place using a couple of drops of cyano. This short post is cut out later. Formers F5, F6 and F7 are not shown on the plan, and why now becomes apparent. We measure and cut them to suit as we go. These are similar in shape to F4 with plain sides; side stringers are cut in later. Measure, cut, and glue these three formers in place now.

Below: Backbone of the turtledeck assembly



Next logical sequence is to fit the fin, however, we should properly locate and fit the wing first, and then install the tailplane square to that. Fit the two locator dowels into the wing LE in position shown and epoxy in place. Offer the wing up to the fuselage, carefully mark the dowel hole positions on F2 and make a pilot hole with a drill approx 1/8" dia.

Above: Rear fuselage showing fin fitting and control rod exits

Carefully work the hole size up through trial and error until you get a neat fit - you only get one shot at this. Ensure the wing fit is square by constantly checking the dimension between each wing tip and the fuselage rudder-post. When satisfied that the dimensions indicate the wing is square, securely tape the wing trailing edge at the fuselage and drill the wing bolt holes through the wing and through each fuselage mounted hold-down block in one operation. Again, start with a small pilot drill and work up to the correct size. Each fuselage mounting block hole can now be tapped to size and the corresponding hole in the wing can be opened out a little with a round file to provide clearance for the hold-down bolt. Alternatively use T-nuts and bolts, or your preferred method.

Now the fin. Temporarily locate the stabiliser and fit the fin down on top of that ensuring the fin remains square to the wing. The bottom rail of the fin forms the top of the stabiliser slot in the fuselage. Glue the fin into the slot, but not to the stabiliser at this time; the stabiliser is not glued in place yet. Remove the stabiliser and fit a 3/16" horizontal balsa wedge each side of the fin bottom rail to provide a finish line for the aft fuselage and form a full width slot for the stabiliser. Now fit the two 3/16" sq. balsa stringers to each side of the fuselage. Pin all stringers in place to provide a balanced application, mark each former and cut the slot with a razor saw. Note that the upper stringers run full length to the rudder post, and the lower stringers finish at F7.

The upper nose sheeting is now applied using a similar approach as for the turtle deck. Install the 1/8" balsa cockpit floor, cross-grain, and then glue F3 in place. Now temporarily tack the top horizontal sheet which should be cut well over-width. Cut and fix F2A to the fuselage - not the top sheet at this time. When all is dry, remove the top sheet and fit both canted side sheets. These will require to have the bottom edges bevelled to provide a neat fit. Glue both side sheets in place and then plane and sand the top edge in situ to provide a neat fit for the top sheet which may now be permanently glued in place.

Nose & Engine Bay

The nose area is basically built around the selected engine. The engine is installed via a standard engine mount. I used a glass reinforced nylon one here. It is important that the engine mount is tapped for the engine bolts as these are screwed down from the top and there is no access to apply nuts underneath. Locate and permanently bolt the engine mount to F1. The final motor thrustline is not critical; I arrived at this by aligning the top of the cylinderhead with the top of the fuselage. Fit a propeller and selected spinner to the motor. I used a 2" spinner on the prototype. Cut both nose-cheeks from soft 3/8" sheet balsa, chamfer the rear vertical edge and tack these temporarily in place. Cut a nose-ring to same size as the spinner back-plate from 1/16" plywood and juggle this and the side-cheeks to provide a neat finish behind the spinner. Glue these items in place with 30-minute epoxy. Maintain approx 1/16" clearance between the spinner backplate and the nose ring. The nose-ring can be wedged fro spinner back plate whil glue dries. When dry, re the motor and fit the b nose sheet using alip glue; also install trian balsa fillets inside the e bay along this bottom When dry plane and san nose area to a neat fini Dremel handtool with sa drum will help carve the both sidecheeks to fit a the motor exhaust stack needle valve.

Above: Front end sheeted with 1/8" balsa and upright engine installation

Undercarriage

The wire undercarriage the torsion bar variety a into pine channel loc which are epoxied acros fuselage bottom to each fuselage side. Reinforce this install with triangular balsa reinforcing as indicated on the plan fuselage legs are retained with a pair of thin aluminiu Formica straps screwed into the transverse pine channel. The ends of these straps protrude forward of the pine rail and se retain the back edge of the hatch cover under the tank bay.

That completes the major construction work.

Assembly Sequence

Cut and fit the lower hatch cover from scrap 1/8" sheet w 1/4" x 3/32" applied around the edges to build it up to 3/16" The hatch is fixed with a pair of servo screws at the front retained above the over-length U/C straps at the rear.

The servo tray is cut from 1/8" liteply. I used three old Fu S120 servos in the fuselage. Depending on servos used, you need to pack the throttle servo down to avoid fouling on the i of the top sheeting.

The stabiliser can be permanently glued in place now. I film ered this item before installing it. Ensure it too is installed sc and true to the wing and fin.

Sig 'Easy Hinges' were used on all control surfaces. I used ful hinges at the ailerons and cut these in half for the elevator rudder. Cut all the slots before covering.

A fixed tailwheel was used on this model for simplicity a save weight. Fit a hard balsa wedge at the lower fuselage groove this to accept the wire which is epoxied in place after ering.

A standard size servo operates the ailerons via a set of stan Du-Bro torque-rods and fittings. The servo is mounted in a li tray epoxied on the wing top surface.

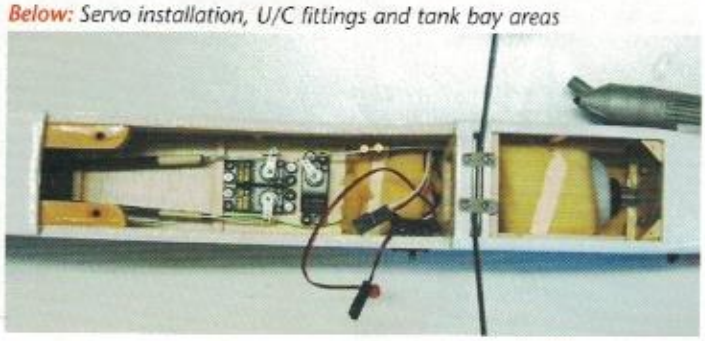
Pre-fit elevator and rudder pushrods before covering, also throttle line. Du-Bro 1/2A nylon horns were used on the proto I fit slotted 'patches' from scrap 1/16" balsa flush with the fuselage to provide a neat exit for the pushrods.

Cut and fit the cockpit canopy before the model is covered. the cockpit interior and fit a pilot if you wish. I did fix a square balsa trim approx 1 mm in from the edge of F4 to pro a rebate to glue the canopy cover into. I used Pacer 'Formula to hold this in place.

Give all woodwork a good sanding prior to covering. I Easycoat film on the prototype.

I painted inside the engine bay with black paint and then clear polyurethane over that and also inside the tank bay to proof these areas. Fit ailerons, elevator and fi rudder, not forgetting to pi the hinges.

Below: Servo installation, U/C fittings and tank bay areas



Flying

Prototype control th were set thus: Ailerons: plus up and down. Elev 3/8" up and down. Ruc 1¼" each way

I had to wait before the test-flight and the grass was not mowed as short

Above: Covered in Easycoat the little model is easily transported in a car without dismantling

would have liked for the small wheels, but that proved to be no problem. I carried out the range check, and the new OS25FX motor started easily. I had put three tanks of gas through it on the bench so it was ready to go. I placed the model in the centre of the strip headed into the light breeze, checked all controls again and opened the throttle...

The model slithered through the grass for about ten feet and then leapt into the air and pulled strongly away with a hint of a roll to the right. Two clicks on the aileron trim and one on the rudder fixed that, and a couple of clicks up trim, I was aware it was a trifle nose heavy, and the model was away straight and level at a mighty clip. The control throws were spot-on; I was quite comfortable with them and have not changed them for subsequent flights. I was expecting the model to be rather twitchy because of its small size, but apart from the mighty turn of speed it grooved nicely and offered no untoward surprises. I eased back to a little over half throttle and flew it back and forth in straight lines for a while with a combination of Immelmann turns and half reverse cuban-eights at the ends.

I never did close the throttle and hold it off for a stall, but rather launched into an exuberant series of basic aerobatics starting with consecutive loops and then a few rolls. Avalanches, 4-point rolls, square loops, it was like its larger brother. Even the spins were crisp and fast once they got started. I was conscious of its slightly nose-heavy set-up through most of it but I've got room to move the NiCad pack more aft yet.

The approach and landing produced no surprises. The model slowed up nicely on final and greased in like its big brothers just as the next shower started - pity there was no audience.

Above: Author shows off the airframe and just how compact it is

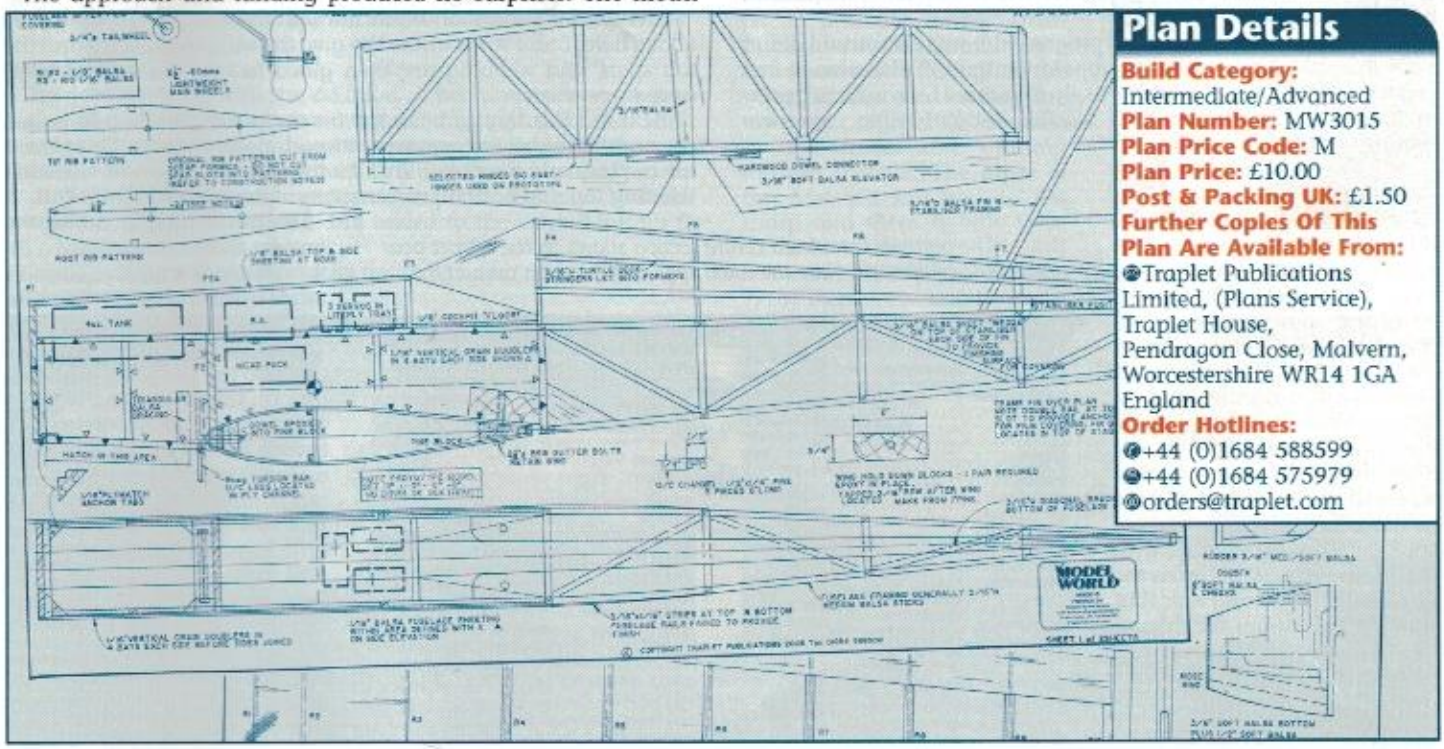
The prototype uses three old miniature Futaba S120 servos in the fuselage so if you use standard size S148s or similar, retain the existing servos position shown and you shouldn't get into a balance problem. Just don't balance aft of the C of G position shown (on spar) or you will be looking for a new project in short order.

Conclusion

All in all, I was extremely pleased with the overall performance of this little machine. Apart from my sojourn with small electric models, I generally favour the larger IC models for organised weekend flying and IMAA rally flying, but like the small electrics, this one can be tossed in the back of the car and carted off to the strip at short notice to provide instant fun with the minimum of fuss and a small cash investment. **RCMW**

Editor's Footnote

The similarity of this model to the Precedent Fun Fly is purely by accident and development. SLEC Ltd has seen and approved this plan design for publication.



Plan Details

Build Category: Intermediate/Advanced
Plan Number: MW3015
Plan Price Code: M
Plan Price: £10.00
Post & Packing UK: £1.50
Further Copies Of This Plan Are Available From:
Traplet Publications Limited, (Plans Service), Traplet House, Pendragon Close, Malvern, Worcestershire WR14 1GA England
Order Hotlines:
+44 (0)1684 588599
+44 (0)1684 575979
orders@traplet.com