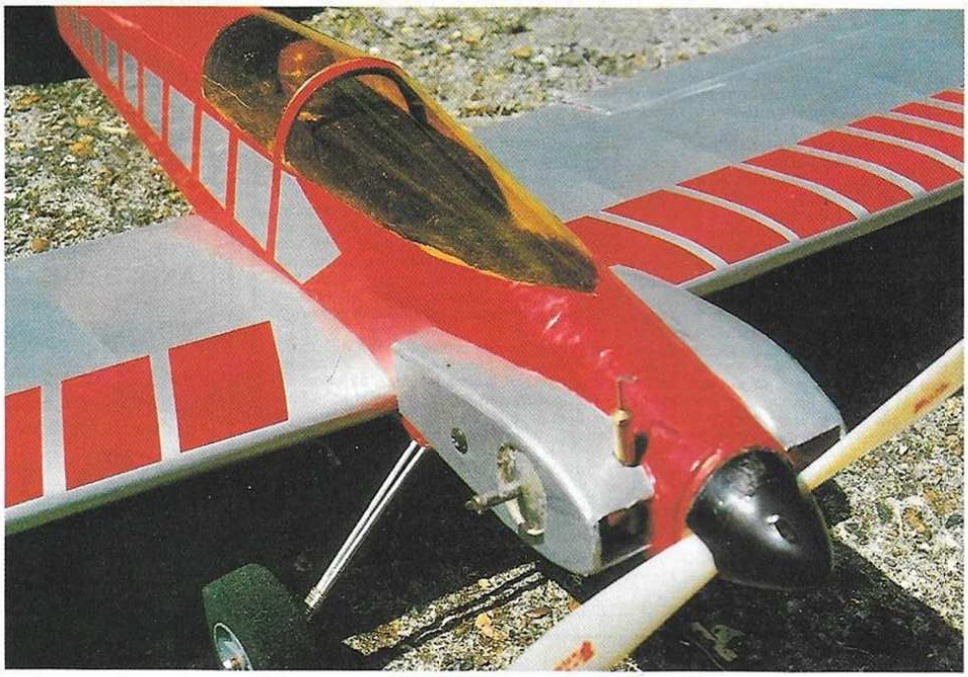
MOONDAN

Peter Miller's been at it again! Here's his 32" span aerobat for 1.5 to 2cc engines and 4-channel R/C



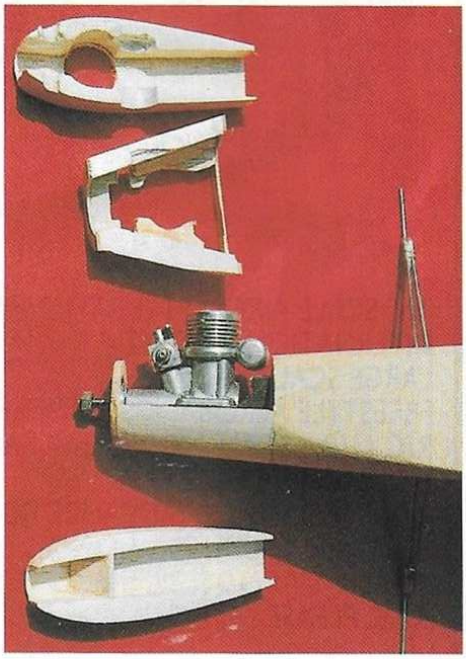
Moondancer was designed as a result of the styling doodles done for "Yuppy Love" (**RM** August '92). One of the drawings that did not fit that name looked so good that I developed it a little more, added some aerodynamic features that had worked well on another design and came up with the plan that you will find in the centre of this issue.

The model was designed to take four Fleet mini servos and a standard size Rx. The rudder is only needed if you can take off and so one servo could be eliminated. Inset ailerons are used so the aileron servo can lie flat in the wing – the upright servos for strip ailerons take up far too much room.

The wing is quite thick – NACA 0015 for those who take an interest in such details. This wing section gives plenty of room for the servo and the blunt L.E. makes the model much more forgiving in the stall.

For once I did not design for minimum weight. I designed for strength and looks first, the finished weight was 1lb 14 ounces which gives a wing loading of 17.1/2 ounces per square foot. This loading gives a reasonable performance on a standard P.A.W. 1.49 R/C, one of the .12 cu. in. engines available now might make it sparkle even more.

Apple-cheek cowls on prototype are pretty and simple enouh to do; motor is a grand old PAW 149 with throttle.



The undercarriage is a little different from most, it is a system that works incredibly well. I have used it on a seven pound biplane powered by a Saito 90 twin and other models, the great advantage is that it will never bend backwards. How many times have you had to heave on the U/C leg of a model to get the wheels back in their correct place? Well you won't with this model.

The end plates on the wing are really for styling but they do seem to make the ailerons more effective. I set the model up with a very small aileron travel on low rate, mainly because my co-pilot who flies the models when I am trying to get flight pictures does not like twitchy models. The small travel proved so good that I knew that if I went to high rate I could be in trouble.

Flying

The model is stable in flight and quite fast but the P.A.W. 1.49 must be right on song and turning a good prop – an 8" X 4" Master airscrew seems the best. It pays to let the engine warm up fully before launching or you can finish up with an over-compressed engine in the air.

The model will do loops, rolls and inverted flight and any combination of these but vertical performance is a bit lacking and inverted needs quite a lot of 'down' elevator held in. Low speed passes are nice and easy to do. All in all, a very pleasant model to fly.

Construction

Most of the construction is pretty conventional but there are some areas that will call for a little more care than the usual box and plank, these slight complexities are there to allow for the styling or to improve

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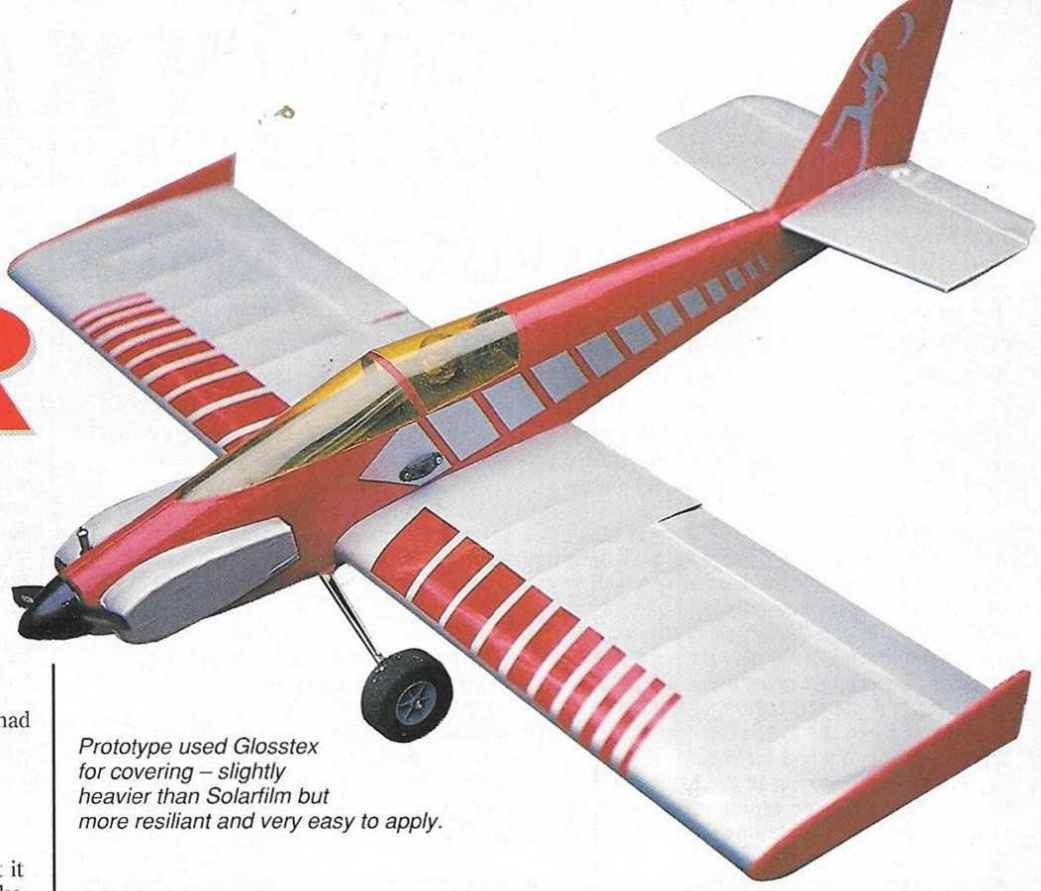


Prototype used Glosstex for covering – slightly heavier than Solarfilm but more resiliant and very easy to apply.

the aerodynamic design or functional qualities of the model.

The model is tough, it is a little heavier than my normal designs, especially in the wing, so under no circumstances add any more wood or use heavier or thicker material.

Anyone building this model will have had some experience and so I intend to concentrate on the unusual features and trickier points.

Fuselage

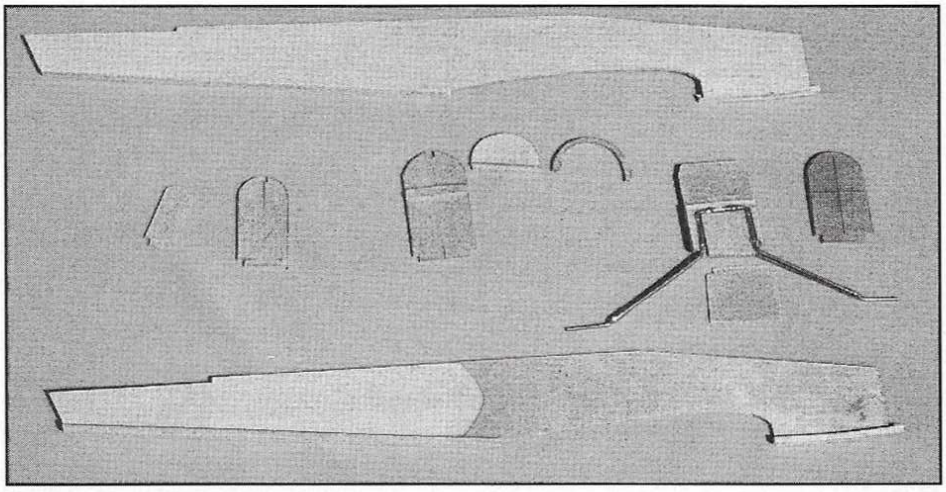
The fuselage is a conventional box but it is assembled in an unusual sequence. Make up the sides with 1/64th ply doublers and cut out all the formers.

Assemble the undercarriage to F-2. The undercarriage is made up from two pieces of wire bent to the same pattern but the rear unit does not have the axles. The two parts are bound, one on each side of F-2, with copper wire and soldered, and then the bottoms of the legs are bound and soldered together just above the axles.

This method produces one of the best undercarriages that I know; it will not bend backwards but will give sideways. I have used it on a heavy aerobatic biplane powered by a Saito 90 twin and landed it at speed in a ploughed field without any distortion. It is not much heavier than a single leg because the wires can be thinner.

Once all the formers have been made join the fuselage with F-5 and at the tail. Fit F-7 and F-8 and leave to dry. The reason for this is that when the fuselage sides are pulled in to meet F-2 they will take up a smooth curve through the cockpit area which allows a little more room for the servos and looks better.

It helps if you have a building jig when fitting F-2 and F-1 but it can be done without if great care is taken. Make very sure that F-1 is vertical and not offset – you want the thrust line to be true to the fuselage centre line.



'Kit' of parts for the fuselage; undercarriage fixing is one of the best methods, says Miller...

Using bendable 3/32nd sheet fit the two pieces of sheet that wrap round F-1. Leave them oversize and once the glue is dry trim and sand them so that the top of the basic side and curved deck form a straight line when viewed from the side.

The rear turtle deck is made from 1/16th sheet. The cockpit floor is also 1/16th sheet with grain across the fuselage. This completes the top of the fuselage.

The small hatch under the nose is essential – the battery and tank are fitted through this. Glue 3/16th sq. hardwood to the 3/16th sq. balsa strip and sand to match the curve. Cut a 1/16th ply hatch with the grain across the narrow dimension; the hatch should be no wider than the hardwood strips. Screw it down with small self-tappers and then glue scrap 1/16th balsa each side of the hatch but not to it. Sand the radius on to the corners of the fuselage.

Fit the snake outers to the rear fuselage (a length of sharpened tube will cut the holes nicely), cover the bottom with 1/16th balsa and again carve and sand the radius to the corners; it is amazing just how large a radius can be shaped without weakening the model and how much nicer the model looks when it is done.

And off she goes. Trick photo is a Miller speciality – see his feature on model photography in the June issue of sister magazine Aeromodeller for more ideas.

Add the 3/32nd sheet treblers in the radio bay and the hardwood block for the rear wing fixing bolt.

Fit the engine mount to F-1. This item may have to be cut down to fit inside the cowl sides – you may even have to drill new bolt holes. Alternatively a pair of Micro Mold Tee mounts can be trimmed to fit. The basic fuselage is now complete.

Wings

The wing structure is pretty conventional with one or two small exceptions. Lay down the bottom spar, packing it up 1/16th" from the board and glue the ribs in place. Glue in the top spar and leave to dry.

Pre-chamfer the T.E. sheet and pin this down to the board. Rock the wing back and glue the ribs to it. Fit the aileron spar and then the aileron leading edge and aileron ribs. When the glue has dried fit the top T.E. sheet which should also have the chamfer formed; this gives a beautifully sharp T.E. Fit the L.E. strip and then sheet the L.E. and add the 1/8th capstrip along the L.E.; use soft wood for this.

Build the other wing in the same way; because the wings are symmetrical the right wing can be built upside down over the plan but remember that it is upside down or you will have two left wings. When it is complete sand the angle on the thick root ribs using a sanding block. If the wing is propped up to the correct angle on the edge of the bench it is quite easy to get the correct angle. It is vital that the mating surfaces are a good fit, even if the dihedral angle is not exact.

Cut away each centre rib to take the servo and sheet each centre section and then epoxy the two wings together taking great care to get them aligned exactly. Wlhen combined with the covering this joint is more than strong enough and no braces are needed. The model has cartwheeled across a cow pasture with no damage!

Fit the aileron control run and bellcranks and push rods. When the wing is complete it is a simple matter to run a knife down the aileron gap and then cut up the end rib to separate the ailerons from the wing and you will have the most perfectly matched control surfaces ready for top hinging. If you forgot my warning about building the right wing supside down you will find out at this stage when you have one top hinged and one bottom hinged aileron and you will never live it down in the club!

Do not fit the end plates to the wing until it has been covered.

Tail surfaces

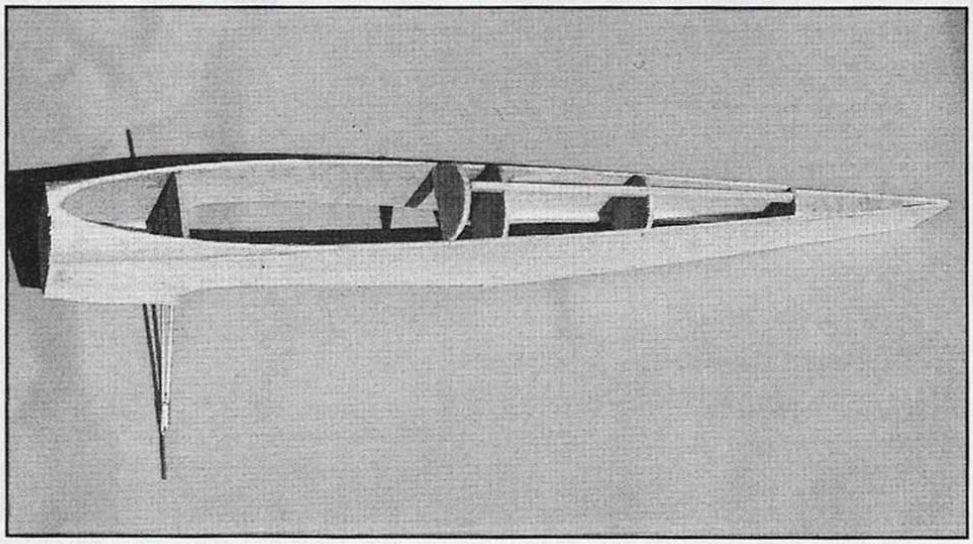
There is little to say about these as they are all sheet. The tailplane is very soft 3/16 sheet while the fin is harder 1/8th with hard 1/8th sq. edges.

I find that the best way of joining the elevators is as follows: cut them out in one piece and sand to shape. Make the wire joiner and fit it into the elevators using epoxy, then, and only then, cut the 'V' out of the elevators and you will have two perfectly aligned surfaces which are still easy to cover.

Cowl

The cowl is quite complex but the drawing shows the exploded view. Use soft material throughout this part. The applecheeks are not essential but they do make the model look much better and are designed to give good cooling. The left applecheek is fixed; it has a baffle inside and there are two holes cut in the cowl to direct air onto the crankcase and then get rid of the hot air, important on a fully cowled engine.

The right hand cheek is shaped to force air through the fins on the engine; the layout is based on team racer and speed model cowls and it works well.



The fuselage comes together; a building jig is always useful for this phase of construction but not essential if great care is taken to keep everything perfectly square.

Fuel tank

The fuel tank shown is designed to allow unlimited inverted flight, it is a nice little exercise in soldering but really needs a little silver soldering as well as soft soldering.

The tank is constructed like the old control line tanks. Take a strip of 0.005 K&S brass sheet the width of which is the same as the length of the tank and bend it up to make a square tube to the dimensions shown on the plan. Cut it to length after bending and then solder along the overlap. Cut a pair of plates to fit over the ends of the tank and solder one of these in place.

Take two pieces of K&S brass tube which are a sliding fit – 3/32 and 1/8th bore would be the best sizes. File a 90° notch in each tube about 3/4" from one end and bend the tube at this point. Silver solder this joint if possible, it will avoid problems later.

Punch a hole near the front of the tank about half way up the side and slide the smaller tube through this; it should be a firm fit. Check that when it is slid into the other tube the larger tube is free to flop up and down. Trim lengths until it is. Now cut the free tube to length so that the free end is about 1/4" inside the tank.

When everything is working smoothly, solder the feed tube to the side of the tank making sure that the hole is sealed, and that the free tube is still free. Take another piece of tube and fit it through the bottom of the tank and up to the top – this is the vent. Check that it does not foul the 'clank' tube.

Solder on the rear plate of the tank. Check for leaks by sealing both pipes and immersing the tank in a bowl of hot water. Solder up any leaks. NOTE: do not put any oil into the tank until it is complete and all leaks have been sealed. Oil and solder do not mix and the oil always wins.

One could use a fixed fuel pick-up tube but then inverted flight would be very limited. Another option would be the old balloon tank but you would have to put up with the risk of this bursting and dumping fuel all over your battery. Both tanks are drawn on the plan.

Covering and finishing

The canopy has to be fitted before covering can begin. Take some clear plastic sheet and find a tube about the same radius as the cabin former – an old mailing tube or length of plastic pipe. Heat the plastic gently until it just starts to go floppy and place it over the mold and hold until cool.

Fit the curved plastic over the fuselage and trim to fit. Glue down with R/C Modellers glue and then repeat for the rear portion of the canopy. The idea is that the windscreen forms a straight line from spinner to apex and the rear portion is straight from apex to tail. A small rebate to take the plastic sheet makes a neater and stronger job.

I used Glosstex for covering; this material is a little heavier than film and a useful saving in weight could be made by using Solarfilm but the Glosstex is so easy to apply. The engine bay and inside of the applecheeks can be coated with Clearcote before covering and this will fuel proof the stucture. Trim was cut from Solartrim including the logo on the fin.

The tip plates are glued onto the wing after covering. The covering was used to hinge the ailerons while the elevator and rudder where hinged with the old clothes horse system, again using Glosstex.

Installation

There is plenty of room for the radio. All my radios are Fleet these days and I used a standard Rx with four Mini servos and a 270 Mah nicad.

The servos sit across the fuselage, the bearers are made from 1/4 square spruce with 3/16th balsa sheet which is carved and sanded to match the curvature of the sides in the radio bay. These are fitted towards the rear of the bay with the Rx in front and the battery over the tank.

The aileron servo bay has two strips of 3/16th square glued to each side so that the servo lugs with grommets slide down between the strips. A ball connector allows for easy disconnection if needed.

Conclusion

Moondancer is slightly more complex than many small plans but it is very sleek, extremely tough and flies very well. Enjoy!