

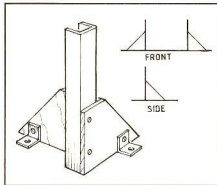


MINI-JAVELIN

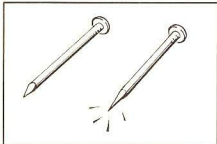
Follow Chris Golds' 57 steps to twin Cox .020 ducted fan fun!

Conventions

- 1. HWC - Hot Wire Cut** (Mine is 10 year old MFA 39 inch and still on the original wire!)
- 2. Foam Block** - Blue foam approx 4 inches thick for loft insulation from builders merchants. White foam, usually 2 inches thick, very much softer and lighter than blue. Ask for damaged panels - they are usually much cheaper than sound ones.
- 3. Cut Block** - foam marked out and HWC (or sawn and sanded) to exact size ready for pattern cut-work.
- 4. Epoxy** - 5 min. variety and used very thinly; keep the bottles hot on radiators and they will mix easier, spread thinner & cure quicker.
- 5. PVA** - ordinary Evo-stick Resin-W type, water based wood glue.
- 6. Paste** - 65% PVA, 35% tap water plus some red food dye (to show you where you have covered and how thickly.)
- 7. Balsa** - that strange, soft light wood from South America - someone gave me some once! KEEP IT SOFT - whatever thickness.
- 8. For Block Cutting** - make yourself two vertical posts from some aluminium channeling (like used for removable shelf brackets) and ply, with metal brackets to allow you to screw onto worktop.



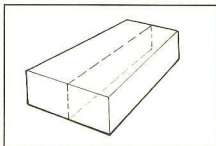
9. To pin/nail patterns to cut blocks use 2 inch nails filed clean. Drill each pattern to accept pattern nails (PN).



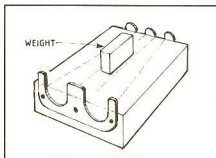
- 10. BP** - Brown Paper, medium light for wrapping parcels: shiny side and matt side. *not* shiny both sides! Paste only matt side.
- 11. To BP** - to apply Brown Paper, cut to panel size and paste matt side; allow at least 30 seconds for paper to expand. Then paste foam and stick paper on. NB: Keep your fingers dry and clean or you will 'pick-up' the paper. When all of a panel is done, paste all over. BEWARE shrinking and ability to warp. Hang up to dry so that all sides dry together.

Fuselage

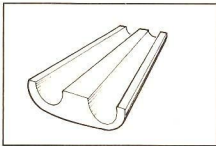
1. Cut block to WXYZ in 4 inch thickness, mark C/L all round.



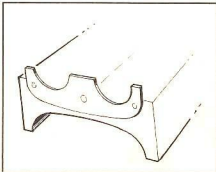
2. Make patterns C&D from scrap 1/16 (or thereabouts) ply. Pattern nail to block and HWC out the duct halves. NB: *blue foam*. Use a heavy narrow weight to keep block from moving. (W).



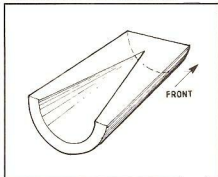
3. Next, HWC the outside cut and you have a *bottom half*. Mark it!



4. Turn block over and repeat to achieve a *top half*. Mark it!

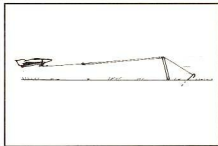


5. Make patterns A and B and cut a suitable piece of *Blue Foam* 4in x 4in x 7in long. Mount patterns on block ends. Cut notch in A down to 1/4in from foam surface.



6. HWC out the conical centre of half nose block by resting wire in notch and cutting inside of B.

7. HWC outside of A and B, you now have:

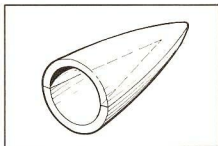


8. Repeat for other half of nose.

9. Lightly epoxy halves together.

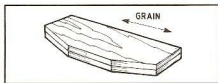
10. Sandpaper (medium, then fine) to the correct symmetrical section as per plan.

11. You now have:



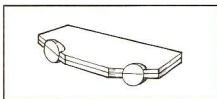
Use three or four coats of paste to seal rear of Cox tank, also from 1/8 lite ply.

12. Make Engine Plate from two laminations of 1/8 lite ply.



13. Make two engine bulkheads to match rear of Cox tank, also from 1/8 lite ply.

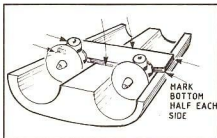
14. Notch the leading edge of engine plate in duct centre positions and epoxy or PVA bulkheads in position - *True & Square* to duct line.



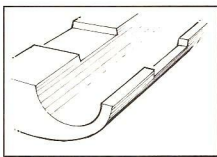
15. Try-mount engines to bulkheads using long (3/4in) thin self-tappers into bulkheads and engine plates. (Later, after an engine removal, cyano into self-tap screw holes - allow to set thoroughly.)

16. Make two dummy fan discs from 1/8 ply to 2.5/16in diameter. Drill for prop shaft and mount onto engine.

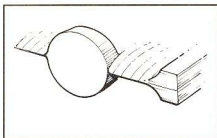
17. Offer engine assembly up to bottom fuselage half and move forwards or backwards to centre the dummy discs in the ducts.



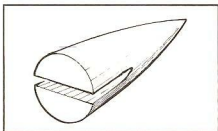
18. Rebate bottom half by 1/8in in way of engine plate, right across the fuselage. Put on top half and transfer the edge rebate marks and apply engine assembly upside-down to top half and mark and rebate top half.



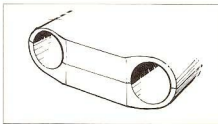
19. Chamfer leading and trailing edge of plate in way of ducts and paste all over to seal wood and sand.



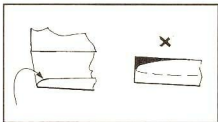
20. Make engine bulkhead fairings from blue foam or soft balsa and epoxy to plate and bulkhead. Paste all over to seal then sand.



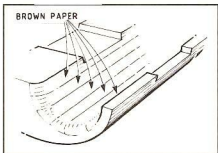
21. Cut or sand the intake lip angle away from the fuselage.



22. Sand the inside of intake lips to a bellmouth section, but not at fuselage side.

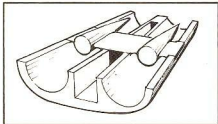


23. Brown paper the duct halves and allow to dry. Use strips of BP approximately 3/4in wide. Overlap by 1/8in. Clamp or weight down to dry - *beware warps*.

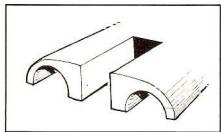


24. Fit the engine assembly to bottom half of fuselage - epoxy in place.

25. Hollow out in front and behind the plate for subsequent radio fit.



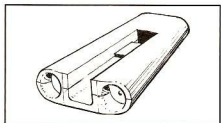
26. Hollow top half far enough rearwards to clear elevator servo.



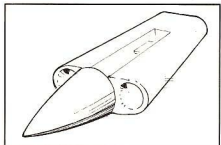
27. Top and bottom halves: paint inside ducts black enamel (fuel proof preferably) and all of engine plate and fairings (inside ducts).

28. Fuel proof duct halves, they are too small to get into when assembled.

29. Now epoxy top to bottom half; you can leave engines and dummy discs in situ. Weight or clamp to prevent movement.



30. Epoxy nose cone to fuselage.



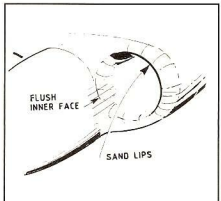
31. Hot wire cut the fin from foam or make from soft 3/16 balsa.

32. Make tailplane (1/8in soft balsa) and fit elevator in one piece using mini hinges.

33. Epoxy tail to fin top square.

34. Epoxy fin to fuselage using 1/16in ply vertical brace.

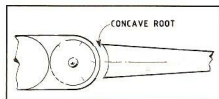
35. Sand outer lips of intakes to conform to fuselage nose cone.



36. Make wings: Hot wire cut block and, using wing sections, HWC both panels.

37. Epoxy on the aileron hinge spar (1/2 x 1/4in soft) and soft 1/2in tip.

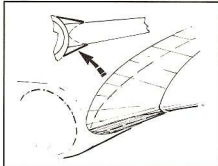
38. Sand to conform and sand a concave section to wing panel root to fit outside curve of fuselage.



39. Epoxy wings to fuselage, check no dihedral, and along fuselage centre line.



40. Make four wing/fuselage fairings from Armm ply (or file type card) cross grain. PVA to wing/fus join - to act as 'dihedral braces'.



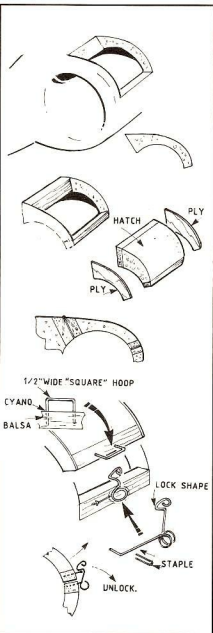
41. Make and fit ailerons using mini hinges: 1/4in up and down at root trailing edge is plenty(!) of movement. Use rates to reduce to 1/8in either way, but fly first launch un-rated to give you plenty of control.

42. You now have a complete airframe with just a few fiddly bits to do!

43. First of these are the engine hatches.

Important! They must be easy to open and self-locking shut with a well sealed fit to prevent loss of duct pressure.

a. Use a sharp knife to cut out hatches just behind fan blade tips, 7/8in ahead of plug and lin behind plug. NB: sloping inner face and outer edge.



b. Line inside of hatch 'hole' with 1/4in balsa inner and outer - thin ply front & back.

c. Reduce size of cutout by 1/4in balsa inside and out, thin ply front & back.

d. Sand and fit, allow thickness of postcard freedom all round (for paint thickness): hinge hatch into place into inner 1/4 linings. Hatches both open inwards.

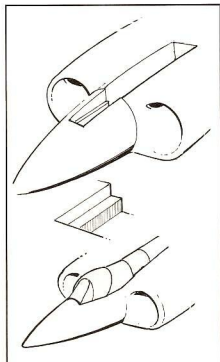
e. Fit hatch locks: make two sets from 22/24 swg piano wire.

f. Relieve inside of hatch for head or plug and paint black gloss inside all hatch.

44. Cockpit. Carve to shape from blue foam or soft balsa with 1/2in deep 'skirt'. Mark

Fuelling the .020s is easy through the hinged hatches.



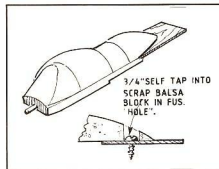


shape on top of fuselage and cut through into cone leaving about 1/2in all round sides and align with previous cut out in fuselage top half. (see note 26). Cut down about 1/2in to leave ledge for cockpit skirt to sit in and on.

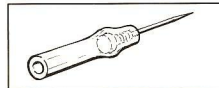
45. Epoxy in a scrap ply plate at forward edge of cockpit hole to take dowel.

46. Fit thin (1/8) dowel into cockpit and mark and drill the location in scrap plate (above). Cockpit is held by dowel in same way as trainer wings are dowelled into fuselage.

47. For rear fixing, epoxy to underside of rear of cockpit, a ply plate sufficient to cover any hole hollowed in fuselage top.

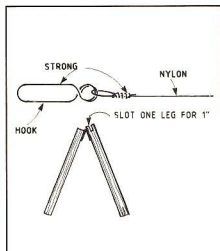


50. Engine needles. turn the right (No.2) engine carburettor round so that the needle is to right side. Pierce hole through foam duct wall to accommodate a fuel tube extension of needle: you can adjust mixture from outside of duct. Ensure carb. returned down tight but don't strip thread!



51. Skid/hook. Make from 1/8in lite ply long grain. Armour the hook using 16/18swg wire and epoxy into place in skid. Epoxy skid to fuselage bottom centre line.

52. Bungee/'A' frame. Bungee is 10 yards of 1/4in flat rubber (as for rubber powered models - ah! forty years ago!) made into a



single loop. Model end is three yards of strong thin nylon cord bound strongly to bungee. Hook is 16/18swg wire. 'Peg' end of bungee is five yards of same nylon firmly bound to bungee and with a loop at 'front' end, and a loop to take 'A' frame.

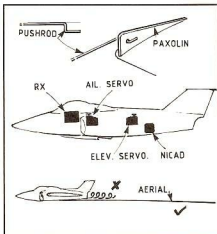
'A' frame: two pieces 1in x 1in timber scrap, hinged at top (allows collapse to fit easily in car). Any stout metal peg will do - well buried into ground - not a lightweight tent peg. NB: Stand 'A' frame leaning slightly towards a/c; it will collapse forward on take-off.

Length of bungee stretched: Approx 30 yards. Warn other members of location of bungee.

53. Radio fit. Santa has been remiss these last few years, so I have to use an 8 function Rx - if possible get a mini Rx. Use a mini battery (mine is 270mah), and mini servos. Do not use a switch harness - simply plug battery into Rx and screw down cockpit before start-up. (Tx ON - of course!).

- Servos: are screwed down onto scrap wood beams epoxied into place.
- Snakes: are thin piano wire inside the smallest possible snake inner. They curve easily across fuselage and down to wing root and up fin to tailplane and are epoxied into place.
- Horns: from thin paxolin or similar - but not metal.
- Snakes: are simply bent at horn hole: no clivises needed.
- Radio Loading sequence: is from under front of cockpit to rear. Positions from the nose aft are: receiver, aileron servo, elevator servo and battery rearmost in belly. I cannot balance your model for you, so decide the exact locations yourself.
- The Rx aerial is passed down through bottom of fuselage and sticky taped to fuselage beside skid. Any concrete landings - check aerial is not 'sandpapered'. It trails about 18 inches behind model, so smooth it straight prior

to flight. Never wind it up neatly as it will tend to stay thus and in flight you could



suffer range loss.

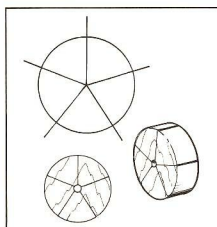
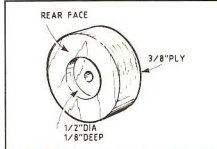
54. Paint job. Silver underneath and normal grey/green Humbrol matt above and fin. Green - Matt 30.

Grey - Matt 27.

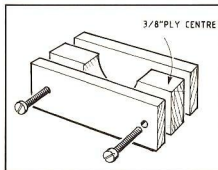
Silver No 11.

Make your own roundels etc. by painting glass colours onto white Fablon sticky back sheet. Fin 'Flag' is St. Andrews - ie: white cross on blue ground. I flew 43 (F) Sqdn. Hunters with this squadron (151) at Leuchars in Scotland ages ago when they had the Javelin/Jabberwock/flat iron/dragmaster and any other rude epithets we could dream up. Boy! Did it slow down in a tight turn! The registration for Y was XA710 on the side of the intake ahead of the wing. No need for fuel proof.

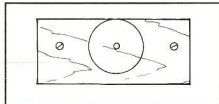
55. The fan. This is made quite simply from a 3/8in thick multi-ply disc with a 2.1/2mm centre hole and an 1/8in deep relief at rear face. Dia: 1.1/8in. Get a friend to turn you some - much better than trying to saw cut



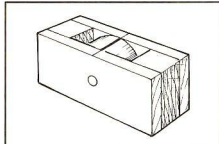
then out (as were the originals, and they worked!). Blades are from nylon sheet, the thickness of a post-card. Cut out and clamp together to sand together, as in sanding for multiple ribs. Do them in sets of five, ie: one fans worth at a time. Draw on paper a 2.1/4in dia. Circle and plot it for five radials at 72° spacing. Extend these lines. Lay disc on circle, centre it and mark five blade slots. Draw right angles at rim. Make a slot



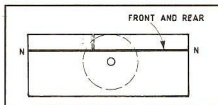
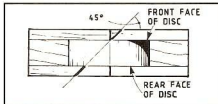
cutting jig using scrap 1/4 multi ply for outer panels. Clamp together and bolt through. Plot and drill 2.1/2mm hole through jig so that disc just shows flush with



top. Mark line across top of jig to align with disc edge marks. Mark a 45° line across top



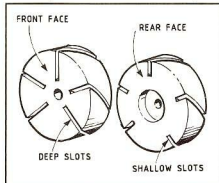
of jig. Fit a disc into the jig (NB: forward face of disc) and secure with 2.1/2mm rod or drill through centre. Draw a line across front and back of jig 1/8in above centre



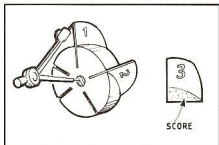
hole. Mount jig in vice and saw cut along 45° line down to line N-N to cut first blade slot.

Notes: Ensure disc is rotated until the first cross line is aligned with cross line on jig top.

Ensure jig is clamped hard in vice to stop disc rotating under saw cut. Remove saw, ease vice, rotate disc to next line and repeat.



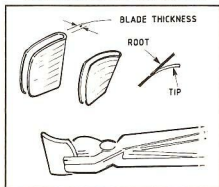
You should end up with a five cut 45° root disc. Tight push fit blades into slots and use a compass to check blade tips are of equal diameter. Fill centre hole with small dowel to centre compass. Mark blades in sequence and mark each blade where it meets the disc.



Remove blades and sand/score lightly inside marked area front and back to key for cyano. Replace in disc, thoroughly check with compass for equal diameter at each tip and cyano each blade *carefully* into hub. You can improve performance by giving each blade a tip curve. Use thin aluminium to make a bending jig.

Put a blade into jig and, using round nose pliers, give the tip some aerofoil shape. Slightly more than you need, as the blade 'memory' gradually loses shape. Mole clamp the bottom trailing edge of blade and boil all for two mins; then 1 min in cold water and remove blade. Repeat for all blades.

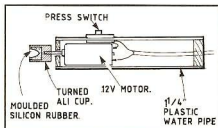
Then fit them and follow the procedure



for establishing equal diameter explained above before cyanoing into the slots in the disc.

I have made a number of fans of this type and not one has shed a blade but take care and use safety goggles when running them, at least for the first few runs.

56. **Starter motor.** You will need a baby starter for this engine type. The thumb



button is a door-bell pushbutton: Fill aluminium cup with silicone sealer, press in spinner suitably watered to prevent sticking, remove and let sealer set.

Let's go flying

57.

a. Safety: warn others of bungee operations and location of 'A' frame.

b. Choose a calm-ish day: the a/c will fly in a wind but it is quite difficult, initially.

c. Range check your radio gear and ensure the Rx aerial trails sufficiently straight. See note 53.

d. Follow Cox instructions for starting and get engine No.1 running about 1/2 turn rich. Beware over-volting the heads (1.1/2 volts). e. Close No.1 hatch and lean out as normal. I have not been able to measure r.p.m. as the fan is so small, but I guess it at about 20-24,000. Also, I have not measured the thrust, but it is noticeable even two feet aft of exhaust.

f. Warm No.1 engine, then stop it using needle nose pliers on fuel tube.

g. Same for No.2 engine and stop.

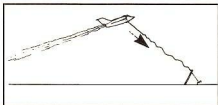
h. Refuel.

i. You should be able to start No.1 and within five seconds No.2. They should be set up (needle-wise) and you simply close the hatches.

j. Your no.1 helper is ready with bungee stretched and your No.2 man simply hooks onto the bungee.

k. At your nod, your No.2 man simply releases the aircraft - cleanly.

l. You do not need 'up' elevator until you reach the far end of the bungee (about two seconds) then you need some elevator to counter the down action of the bungee.

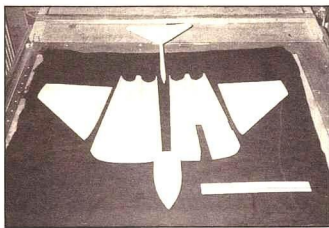
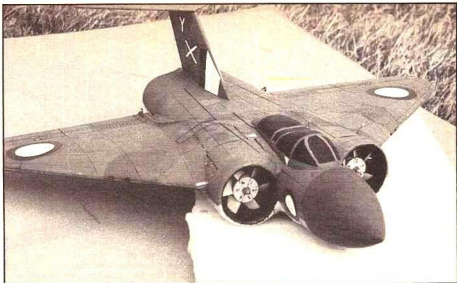


m. Once you are away (and I have *never* had a bungee hang-up, with lots of different models of various sizes), the Javelin will climb quite well on two engines *but* do not

climb at too steep an angle as the delta wing will slow the model right down (just as in real life with any delta). She is capable of looping and rolling and will provide you with about 90 seconds of thrilling flying.

Keep your eye on her as she is small and very easy to lose visually - I did on the first flight and went into tarmac at full speed. BOOM! Subsequently re-built and now flown with more care! Don't let her get too far away from you and if possible have your helper warn you of 60, 70, 80, 90 seconds. When one engine cuts, begin a gentle curving descent towards a position from which to glide in. She will not fly level on one. When both have cut, *keep coming down* and keep some airspeed to flare into the grass. NOT CONCRETE. Beware: the fans, when stopped, form very effective air brakes and the glide angle is quite steep.

The inspiration for the Javelin stems from seeing Shane Harding's small F16 at Wroughton '91, which I thought was superb. My Jav is not in his class as I find it very difficult to build light. However, I did get this one down to 16.3/4oz fuelled, ready for first flight. Even with considerable repairs, the Javelin now weigh only 18oz ready to fly. I have plans for the future which include a central tank with a longer engine run - say three mins - allowing a higher climb and more aerobatics. Santa Claus has been asked for two more Cox 020 TDs. Happy flying and FLY SAFE!



Fully fuelled and ready for another 90 second sortie! Tiny fan units are all home-made and the feature tells you how. Now that you know they work, we wonder what other jet subjects the more inventive amongst our readers will come up with...

All-foam airframe; darker areas are paste dyed red with food dye which shows you where you've pasted and how thickly.

CLOSED THURSDAY
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