



FOKKER E.V / D.VIII



# THE FOKKER E.V. / D.VIII

## - THE FLYING RAZOR

Dubbed the "Flying Razor" by Entente pilots, due to the single flat parasol wing resembling a razor blade, the Fokker E.V. was the last Fokker designed aircraft to enter service with the German Army Air Force, the Luftstreitkräfte, during World War 1.

Most aircraft at that time were biplanes or triplanes with relatively thin section wings, as this offered low weight, structural simplicity, strength and low wing loading. However, the struts, bracing wires and aerodynamic interference between the two wings added significant drag. These factors, alongside the obvious cost of another set or two of wings, begged for a more effective solution. Following Fokker's brief work alongside Hugo Junkers, Reinhold Platz designed an innovative thick section cantilevered wing for the new Fokker type. When tested it fared well, both aerodynamically and structurally.

The first aircraft were delivered in late July 1918, but by mid-August two pilots had died after wing failures. All aircraft of the type were grounded and an investigation started. It was alleged that the wings had been poorly constructed at Fokker's subcontractor who produced

them for the production versions. However, Fokker contended that during the aircraft's acceptance tests the authorities – who were cautious of the innovative design – had insisted on adding another rearward spar. This had the effect of actually weakening the wing by causing it to twist during flight due to the aerodynamic loads. It is quite likely that the truth was somewhere in between, as when properly built to the original design, the wings were proven sound.

By this time the aircraft had developed a poor reputation, so it was re-introduced and re-named the D.VIII in an attempt to distance it from the E.V. However, this proved to be too late, and the aircraft did not score another German kill before the armistice some two months later.

Following the terms of the armistice most aircraft, either in service or partially built, were scrapped, but the Polish air force obtained a number and proved their credentials in the Polish – Soviet war. Such was the pace of aircraft development in the early 1920's they were already obsolete, and they ended their days as training aircraft.

## YOUR KIT

This kit is designed for you to build a traditionally constructed, rubber powered, free flight model of a Fokker E.V flown from Lawica Airfield between 1921 to 1926 as a trainer. This is a simple but striking scheme – you can decide to do your own favourite or more complicated scheme if you wish – as there are many to choose from.

Power is provided by a rubber strip motor that is wound up before flight. Free flight means just that – once the model is launched, it is on its own. It must follow a predetermined flight path established when the model is initially adjusted for flight or ‘trimmed’. This type of traditional building technique and flying requires a degree of patience and skill, but is extremely rewarding.

The Fokker E.V / DVII is just one of a series of kits designed and manufactured by the Vintage Model Company. Aeromodelling was very popular from the 1950s until the 1980s and following a decline and the loss of UK manufacturers such as FROG, KeilKraft and Veron, a revival is now underway. The advent of modern technology such as laser cutting of parts and

the growth of the internet giving access to information on the skills and techniques required to successfully build and fly these models, means new enthusiasts are discovering the joys of aeromodelling every day.

Typically for a small model and in the spirit of the traditional kits, profiles are simplified and adjusted from the original and a relatively large propeller is used. This is done so that the model is light and stable enough to fly on its own, is simple in construction and can work with the rubber motor. These adjustments have been done with care and sensitivity so that the shape and spirit of the original aircraft is preserved as much as possible. Also in the spirit of the traditional kits, additional items required to build the model are things that can be found in the kitchen drawer or are easily available on the high street.

Construction of the model from this kit uses the traditional method of ‘stick and tissue’, that consists of a built up balsa wood skeleton (framework), covered with a tissue skin. The balsa frameworks are built over a plan that is printed at the exact scale of the model, which is in essence a real engineering drawing.

## KIT CONTENTS

- Four balsa sheets with precise laser cut parts and strip wood.
- One set of plywood precise laser cut wing struts
- PVA glue for building the wooden frames.
- One 150mm diameter plastic propeller.
- One pre-bent motor hook and shaft.
- A 225mm long piece of 8mm diameter balsa dowel for the engine cylinders.
- A 100mm long piece of 4.8mm diameter balsa dowel for the construction of the machine guns.
- Four low friction plastic 'nose' bushings - two for the propeller and two for the undercarriage wheels.
- Piano wire for the main undercarriage legs.
- A 225mm long piece of 2mm diameter ABS Filament for the engine induction pipes.
- Three cocktail sticks or toothpicks, one for the motor peg and the others for use in various details.
- Rubber motor strip.
- Tissue to cover the model.
- A Piece of clear acetate for the screen and "trim tabs".
- A precisely moulded plastic cowling
- Parts reference sheets W, full size summary plan sheets X, scheme diagram sheet Y (the last page of this booklet) and scheme markings Z printed on lightweight paper.

## OTHER THINGS THAT YOU WILL NEED

### CONSUMABLES

- Glue, 'cyano' (sometimes called 'superglue'), quick setting epoxy and a 'glue stick'.
- Cling film or waxed paper to cover your plan or a wax candle to rub over it.
- One sheet of standard printer paper (80gsm).
- Tissue sealant – if you want to fly your model outdoors (see 'Covering' for details).
- Paints (Humbrol-style enamels) if you want to give your model an authentic scheme.

### TOOLS

- A "building board" – A flat piece of wood or cork that is large enough for the largest part of the model and soft enough for pins to be pushed into.
- Some modelling pins. If these aren't available, dress making pins or drawing pins with tall heads will suffice.
- A sharp craft knife or scalpel.
- Pliers and wire cutters.
- 180 and 600 grit sandpaper and a small sanding block, or a disposable nail file with rough and smooth sides.
- A small engineers square or a plastic set square from a school geometry set.
- 30cm rule (preferably steel).
- 'Blu-Tack' or plasticeine.
- A fine marker pen.
- Brushes – one thin and fine, one flat and soft 10-12mm wide.
- An old perfume bottle or similar that can deliver a fine mist of tap water.
- Some sprung wooden clothes pegs to use as clamps.

# THE PLAN, GENERAL BUILDING TECHNIQUES, TERMS, HINTS AND TIPS

The plan provides most instructions for the construction of the major components. Major components are all built over the outlines on the plan provided. *Cover your plan with cling film or waxed paper or rub it all over with a wax candle to stop the parts sticking to it.*

There are some terms used on the plan that you may not be familiar with:

- **Laminate:** This means to make a glued sandwich of various parts, often with the grain of the parts crossed to make a single thicker and stronger part. When laminating, ensure that the parts are held together or weighted down and are aligned according to the plan instructions. Make sure that you remove excess glue that squishes out, as not doing so can make the parts harder to sand and in internal corners, may leave an undesirable glue 'fillet'.

- **Cut through section:** This is simply a way of showing parts on the plan in more detail – as if you had cut through the parts on the line shown. The parts that are 'cut' are shown 'cross hatched'.
- **Bevel:** This means to angle the edges of a part, usually by sanding.

## SAFETY

This kit is not a toy and as such is not suitable for children below the age of 14. Read and follow any instructions and warnings given on the various glues, adhesives and paints, etc. When flying your model, follow the guidelines in the section 'Trimming and flying your model'.

## TIPS TO MAKE A GOOD JOB OF YOUR MODEL

Read and follow the instructions and the plan carefully.

- A light model will fly much better than a heavy one, so use glues and adhesives sparingly. Work neatly and remove excess adhesive that squishes out from joints – glue weighs far more than the balsa wood! A piece of stiff 1.6mm square scrap wood with the end cut at an angle makes an ideal scraper to remove excess glue from corners or slots.
- To avoid losing the parts, remove them from the laser cut sheets only when you need them. Use the parts reference sheet to identify the required part(s). Keep what remains of the balsa sheets once the parts have been removed. This 'scrap' can be useful later to replace a broken part, or make other detailed parts of your choosing.
- Balsa wood is very delicate – a light touch is required and this is especially true when sanding. If you have not sanded balsa before, practice on the scrap edges of the balsa sheets. You will be surprised by how quickly the material is removed!
- When using glue (especially cyano), don't use it from the tube directly. Instead, drop some onto a non-porous disposable surface such as clean foil from a yoghurt pot lid. Alternatively, save pistachio nut shells – one held upright and firm on a piece of Blu-Tack or plasticine makes an ideal disposable glue container. You can then pick up precise amounts of glue on the end of a pin or piece of wire to apply to the parts. This saves overuse of the glue and the potential embarrassment of sticking yourself or other items to your model!
- All of the contact surfaces of the parts to be joined should be covered in glue.
- To remove the balsa parts, cut through the tabs that join them to the sheets with a sharp craft knife or scalpel – do not try to snap them from the sheets as they may split. Remove the remains of the tab with a light sanding.
- Some parts have a laser engraved letter 'T' on them
  - this means that the part should be orientated with the letter T to the top when it is correctly assembled.

- If you decide to paint your model, then use paint sparingly. It is very easy to add weight with paint and your model will not fly well if it is too heavy.
- The balsa sheets are graded. Sheet 1 and 2 are hard and strong but heavy – they are used for parts where strength is in preference to weight. Sheets 3 and 4 are weaker and softer but light and are used for parts where lightness is key, obviously at the expense of strength. There are long lengths of cut balsa (known as strip) on both the 'light' and 'heavy' sheets, so use strip wisely and as suggested by the instructions to make things as strong and light as possible.
- Never push pins through the balsa parts or strip (unless specifically told to do so) – it will weaken them or cause the wood to split. Use pins each side of the parts either angling them or using the head to hold the parts down.
- Never force a part to fit – check and adjust it until it fits snugly but without force.
- Pin parts together tightly but be careful not to crush or damage the wood – a tight joint is a strong one.

- Trial fit the parts before gluing and carefully adjust them if required. They are cut accurately, but small errors can occur between the parts and the printed plan. Wood is a natural material and its thickness may vary – it will contract and/or expand after the parts are laser cut.
- You can work on several parts at one time. For instance, you can make up the wheels and undercarriage at the same time as something else is setting. Just make sure you read through the instructions first and follow a logical sequence.
- If you have never bent wire parts before, then grab a few paper clips and practice on those with your pliers, before committing to bend the (expensive) piano wire in the kit. Use a fine Sharpie marker to mark the position of each bend as you go along.
- The internet contains a huge amount of information to help you build your model. Searching for terms such as 'free flight scale' and 'stick and tissue' will yield example builds and a lot of useful information to help you with your build.
- **Above all... take your time!**

# MAIN PARTS AND FRAMES BUILDING SCHEDULE

## THE WING CENTRE SECTION

N.B. The Fokker E.V/ DVIII has a very obvious "flat top" wing. However, for more stable flights and easier trimming the standard build includes a small amount of dihedral. For a more scale appearance to your model - but potentially harder one to trim, substitute the part CS6A, and the dihedral gauge DGA for their counterparts CS6B and DGB and raise the tips of the wing sufficiently to make the top spar entirely horizontal instead of the standard dihedral on the plan.

- 1) Identify and remove all of the parts on the laser cut sheets: CS1, CS2, CS5, CS6A plus 2 off each CS3, CS4, R1, R2, R3, DGA and 4 off corner gussets.
- 2) Pin down CS1 and CS2 over the outlines on the plan; check the fit each end using the ribs R1 as a guide.

- 3) Lay out parts CS3 and CS4 each side that form the trailing edge. Trial fit ribs R2 and R3, making any small adjustments as required.  
When you are satisfied, pin down and glue all the trailing edge parts in position making sure that you have nice neat butt joints. Allow this outline to set.
- 4) Once the outline is set, glue the ribs R1 in position along with CS5 ensuring the parts are upright.
- 5) Glue the R2 ribs in position both sides making sure that they are securely glued to all of the other parts and they are upright.
- 6) Fit part CS6A along with root ribs R3 – tilting them inwards using the gauge DGA to meet the ends of CS6A as shown on the plan. This sets the dihedral angle later on. Make sure the slots in R3 where the wing top spars will fit later on are free from glue.

- 7) Glue pieces of 3.2mm wide strip to the inside faces of both R3 ribs. Make sure that no glue goes into the slots otherwise the wings struts may not fit properly later on.
- 8) Glue the corner gussets where shown.
- 9) Allow the whole assembly to dry then lift it from the board.

## THE WING PANELS

- 1) Identify and remove **one set of parts** in the following quantities from the laser cut sheets:  
**1 off each R4-R8, W1-W6, and special corner gussets L and T.**

- 2) On the left hand upper wing outline, pin down the leading and trailing edges W1 and W2, along with the tip piece W3 and a stiff 1.6mm Square strip that forms the lower wing spar, noting that the spar starts flush to the outer face of R4 and finishes inside the notch of W3.
- 3) Trial fit the inner and outer ribs R4 and R8 and make any minor adjustments to the positions of the previously pinned down parts as necessary. Once you are satisfied glue W3 in place along with the gusset pieces W5 and W6 ensuring neat and strong butt joints.

- 4) Fit and glue all of the other ribs making sure that they are upright and properly located to the leading and trailing edges.
- 5) Glue W4 in position, ensuring that it butts up to the outer rib.
- 6) Fit a stiff 1.6mm square strip as the upper spar, noting that it runs from the notch of the outer rib and extends out from the inner rib as shown on the plan.
- 7) Glue the special corner gussets L and T in position.
- 8) Glue pieces of 3.2mm wide strip to the outside faces of both R4 ribs. Make sure that no glue goes into the slots otherwise the wing struts may not fit properly later on.
- 9) Repeat for the right hand wing panel. Leave both panels to set before removing them from the building board.

## COMPLETING THE WINGS

- 1) Pin the wing centre section back over the profile on the plan. Ensure it is nice and flat and that it is accurately positioned.
  - 2) Take the left hand top wing panel and apply glue to the end face of rib R4 and the mating face of the top spar extension, then glue to the face of R3 on the centre section. Ensure it is aligned correctly to both the centre section and the profile on the plan, and no excess glue goes into the slot that locates the wing struts later.
  - 3) Prop up the wing tip 13mm using a matchbox or similar. The two pieces can be clamped together using a sprung clothes peg or gentle modellers
- clamp; Just make sure that the wood is not crushed as it is clamped.
- 4) Repeat steps 2 and 3 for the right wing panel. Leave entire assembly to set before removing it from the building board.
  - 5) Round off the leading edge of the wing assembly and taper the trailing edge as shown on the plan.
  - 6) Bevel the top of part CS5 Carefully give the entire structure a light sanding to smooth the joints, remove lumps and bumps and the burnt edges of the laser parts.

## THE WING ALIGNMENT JIGS

Parasol winged model aircraft are somewhat more complicated to construct than high winged cabin or mid winged monoplanes as the wings are held solely by struts rather than being joined directly to the fuselage. Therefore, the struts need to aligned carefully and the wings positioned accurately on them.

To help align all of the struts and wings properly, VMC have designed jigs to hold them in the correct position during the positioning of the struts and later on when the wings are finally assembled. Although these jigs will not form part of the model and take to the air, their careful construction will mean that

the important parts that do fly (the wings!) will be properly aligned. ***It is very important that the jigs are built accurately, so take your time.***

- 1) Identify and remove all of the parts on the laser cut sheets: 1 off each **JF1-JF4 plus 2 off JF5.**
- 2) Referring to the plan cut a piece of 4.8mm wide strip to the length shown
- 3) Laminate the two parts JF2 and JF4, aligning the top edge of JF2 to the Engraved mark on JF4, also aligning the central slots in both, remove any glue that may have gone into the slots in the parts. Pin or weigh down to keep flat until dry.
- 4) Glue in plate JF3 making sure it goes all the way into its slot in the JF2/JF4 lamination. Be careful to ensure that the side face of JF3 is at right angles to the face of JF3. Allow the glue to set.
- 5) Simultaneously, glue parts JF5 each side and JF1 on top of them, location all of the slots and tabs. The top edge of JF1 should be parallel to the top edge of the JF2/JF4 lamination and the faces of the two parts also parallel.

the important parts that do fly (the wings!) will be properly aligned. ***It is very important that the jigs are built accurately, so take your time.***

- 6) Glue the piece of 4.8mm strip to the side of JF3 where shown on the plan, using the engraved lines as a guide.
- 7) Check that all looks square and true before allowing the glue to set fully, noting that the top edge of JF3 has a 3° angle that sets the wing incidence.
- 8) Identify and remove all of the parts on the laser cut sheets: **1 off each JR1 -JR6.**
- 9) Laminate the three parts JR2, JR3 and JR4. Ensure that the top edges of JR3 and JR2 are aligned, along with the lengthwise positions of the central slots in both. Also ensure that the bottom edge and tabs of JR2 and JR4 are aligned. Remove any glue that may have gone into the slots in the parts. Pin or weigh down to keep flat until dry.
- 10) Simultaneously, glue the JR2/JR3/JR4 lamination and parts JR5 and JR6 to part JR1, locating all of the slots and tabs. Check that all looks square and true before allowing the glue to set fully.

## THE TAIL PLANE (STABILIZER)

- 1) Identify and remove all of the parts on the laser cut sheets: **1 off T1 and T6, plus 2 off T2-T5, and 2 off corner gussets.**
- 2) From the stiff 1.6mm square strip, cut the central rib that runs between T1 and T6 using the plan to get the right length, set it aside.
- 3) From the light 1.6mm square strip, cut all of the remaining ribs using the plan to get the right length, set these aside.
- 4) Pin down the tail plane central spar T1.
- 5) Lay out the parts starting at T6 and the two parts T5, then work round in each direction, making any small adjustments. When you are satisfied, glue all the parts in position making sure that you have nice neat butt joints. Allow this outline to set.
- 6) Once the outline is set glue all of the ribs in place adjusting the length if necessary, then Glue the two corner gussets in place.
- 7) Leave to set then remove from the board and give both sides as well as the outside edges a light sand. Be careful to not make the structure too thin or cause unevenness in the surface by over sanding.

## THE FIN AND RUDDER

- 1) Identify and remove all of the parts on the laser cut sheets: **FR1-FR7**.
- 2) From the stiff 1.6mm square cut a length for the base rib (which eventually sits on top of the tail plane) and set it aside.
- 3) From the light 1.6mm square strip cut all of the ribs using the plan to get the right length, set these aside.
- 4) Pin down the fin and rudder central spar FR1.
- 5) Lay out the parts starting at FR2 and work round in each direction including the stiff base rib, making any small adjustments as required.

When you are satisfied, glue all the parts in position making sure that you have nice neat butt joints. Allow this outline to set.

- 6) Once the outline is set glue all of the remaining ribs in place adjusting the length if necessary.
- 7) Leave to set then remove from the board and give both sides as well as the outside edges a light sand. Be careful so as not to make the structure too thin or cause unevenness in the surface by over sanding.

# THE FUSELAGE

At this stage the major side pieces of the fuselage should be handled very carefully before the various stiffeners and other structural parts are added, as they are quite delicate.

Preparing all of the parts:

- 1) Identify and remove all of the parts on the laser cut sheets: **2 off K1 and K3 plus 1 off each F1, F2, F3, F4 and F6.**
- 2) Pin the two fuselage sides K1 down onto the board so they are "mirrored" (see sketch on the plan) although it is not strictly necessary to pin them down, it does help to ensure that you end up with two mirrored parts i.e. a left hand and a right hand.
- 3) Glue parts K3 in position on each fuselage side.
- 4) Referring to the plan, add light 1.6mm square strips to bridge the notch in the slot just ahead of the F6 position.
- 5) Referring to the plan, add light 1.6mm square strips as backing pieces over the slot just behind the F2 position, this gives the wing struts a face to sit against later.
- 6) Referring to the plan glue a piece of 4.8mm strip to F2, making sure that it is flush to the bottom edge, and the ends start and finish where shown.
- 7) Referring to the plan, glue light 1.6mm square strip "strengtheners" on F3, F4 and F6 where shown, ensuring that they do not overhang the edges of the parts, note the top strip on F3 is on the reverse side to the bottom one.
- 8) Laminate parts F1 and F2 together with the engraved line on F1 and the 4.8mm wide strip on F2 facing outward. Use the square cut outs and the notches in both to ensure that they are properly aligned. Pin the parts down to keep them flat and ensure that any glue that squishes out from the parts is removed from the edges, notches, and slots, otherwise the parts may not fit together well later.
- 9) Remove all of the parts from the board once set and put them aside for the next stage of construction.

## FUSELAGE ASSEMBLY

- 1) In addition to the parts prepared in the previous steps, identify and remove all of the parts on the laser cut sheets: **2 off K2, plus F5L, F5U, F7L, F7U, F8L, F8U, and F9.**
- 2) Bevel the ends of both parts K1 as shown on the plan.
- 3) Pin down one K1 so that the strip on it faces upwards then fit and glue F3, F4 and F6 in position ensuring the strengtheners are facing in the direction as indicated on the plan. Make sure that all of the formers are at right angles to the fuselage side using a square. Now leave to set.
- 4) Glue the second fuselage side to the opposite end of the formers again making sure that all is located square and true. Leave to set before removing from the board.
- 5) Fit and glue the F1 and F2 assembly to the nose of the fuselage sides. Take care to make sure that the tabs on the fuselage locate neatly into the slots in F2. Allow to set.

- 6) Using stiff 1.6mm square strip, cut and glue into position the two stringers each side that run from F2 to F4, and then the top stringer that runs from the front face of F1 to F4. Allow to set.
- 7) On the outside of each part K1 score about half the depth (**not cut through**) the part along a line immediately behind F6 – noted “score line” on the plan. Each side should then be “cracked” inwards forming a sharp kink in the side rather than a gentle bow.
- 8) Bring the ends of the fuselage together and fit F9 (with its slot towards the top) holding until set.
- 9) Pinch rear of fuselage together and glue it together ensuring that the ends meet uniformly and the fuselage remains straight and true, use the gauge lines on the plan to help. Hold the ends together with a clothes peg or similar until the glue is set.
- 10) Fit all other formers and cross pieces top and bottom working from F5L backward ensuring that the fuselage remains square and true in all directions.

- 11) Using stiff 1.6mm square strip fit and glue the "backbone" stringer in position from F5U to F8U at the rear. Fit and glue the remaining rear stringers making them from light 1.6mm square strip.
- 12) Carefully cut two pieces of 4.8mm strip that will go from side to side and form the slot for the undercarriage to fit later. When gluing them in place leave a gap of around 1mm (the thickness of a credit card) between them and the strengtheners on F2 and F3, this gap will accommodate the wire later.
- 13) On the left hand side, fit part K2 locating all of the notches and slots, bridging the forward slot in the fuselage side. Repeat for the right hand side.
- 14) Sand the fuselage all over to remove the burnt edges. Be careful not to over sand and ruin the profile of the parts.

## ADDING THE WING STRUTS TO THE FUSELAGE

- 1) Identify and remove **all** of the parts from the laser cut sheets: **2 off each WS1-WS5.**
- 2) Bevel the edges of main wing strut parts WS1 and WS2 as shown on the plan.
- 3) Using the plan make two off front upper wing struts assemblies. Once dry bevel the edges as shown
- 4) Following the instructions on the plan, fit the wing alignment jigs and strut parts as shown adjusting them as required.

Note that at this stage:

- The front main and upper struts should only be glued to each other and the fuselage **but not to the wing**
  - The rear main struts should **not be glued in place at all**, once trial fitted they should be set aside until final assembly
- 5) Allow the glue to set and remove the wings along with both jigs.

## THE NOSE BLOCK AND DUMMY ENGINE

- 1) Remove parts in the following quantities from the laser cut sheets: **1 off each NB1-NB3 and NP1, 2 off each E1, E2 and NP2, plus 3 off E3.**
  - 2) Make up the nose block following the comprehensive instructions on the plan, noting the following points and tips carefully:
    - When preparing the plastic cowling the paper template can be temporarily glued to its face using a glue stick, and then after, peeled off and cleaned up using warm soapy water. Also leave a small amount of excess material on the cut edges and remove it later on as required when it is trial fitted.
    - The pieces of dowel that are cut to make the cylinders do not have to be entirely accurate, but cutting them as accurately as you can to the desired shaped helps to ensure that they are evenly spaced and look neat. Reserve the neatest ones for the three cylinders that will be entirely on show.
- The plastic rod that makes up the engine induction pipes should bend easily without cracking, however, if it does then warm it with a hair drier to soften it slightly.
  - If you intend to paint your model, paint the engine and nose block sub-assemblies before fitting and gluing them. It is much easier whilst they are separate than later as a complete assembly.
  - When gluing the NB and NP laminations together, trial fit them to the fuselage to ensure they are properly aligned, but do not glue the nose plug/nose block into the fuselage
  - When gluing the nose buttons/bushes in place.  
**DO NOT ALLOW THE ADHESIVE TO GO INSIDE THE BUSHESS.**

# THE WHEELS

- 1) Identify and remove parts in the following quantities from the laser cut sheets: **2 off WH1, 2 off WH2, 2 off WH3, 2 off WH4 and 8 off WH5.**
- 2) Sand the internal diameter of the WH1 and WH3 parts to remove the "tags" and burnt edges using a piece of sandpaper wrapped round a pencil or similar.
- 3) Sand the external diameter of WH4 to remove the "tags"
- 4) Laminate the parts cross-grained as shown on the plan to make 2 wheels, make sure all of the parts stay concentric. Once they are set round the edges off as shown on the plan.

- 5) Fit a plastic nose bush to each wheel using cyano adhesive. **DON'T ALLOW THE ADHESIVE TO GO INSIDE THE BUSH.**
- 6) Fit four of the parts WH5 to each wheel, evenly spacing them as shown on the plan. If you want to paint the wheels do so now.
- 7) Make up the wheel covers using paper pattern on the plan. The wheel covers can be painted or covered in coloured tissue, try them in place. **BUT DO NOT GLUE THEM IN POSITION AT THIS STAGE.**
- 8) Set the wheels and covers aside until the final assembly stage.

## THE UNDERCARRIAGE LEGS, WING AND TAILSKID

- 1) Identify and remove parts in the following quantities from the laser cut sheets: **1 off each LG1R, LG2R, LG1L and LG2L.**
- 2) Follow the instructions on the plan to make up the two main undercarriage leg assemblies. Be very careful to make sure that you make a left hand and right hand assembly as shown.
- 3) Identify and remove parts in the following quantities from the laser cut sheets: **1 off each LW1 and LW2, 2 off each LW4 and LW5, 4 off each LW3 and LW6.**
- 4) Follow the instructions on the plan to make up the undercarriage wing, the construction being similar to that of the main wing. Whilst it is still pinned flat to the board fit the axle wire securing it to all of the balsa parts it passes through with a small drop of cyano. When set round off the leading edge and taper the trailing edge as shown on the plan.
- 5) Identify and remove parts in the following quantities from the laser cut sheets **1 off each TS1 and TS2.**
- 6) Make up the tailskid as shown on the fuselage side view, but do not fit it at this stage. In order to make the tailskid more robust the bottom (exposed) section may be coated in cyano to harden the balsa. NB. leave the top part uncoated to avoid adding too much weight at the rear of the model.
- 7) Set all of the undercarriage parts and tailskid aside, ready for assembly onto the model later.

## MACHINE GUNS AND STEP

- 1) Identify and remove parts in the following quantities from the laser cut sheets: **2 off G1 and 4 off parts G2.**
- 2) Make up two identical machine guns as shown on the plan using the laser cut parts, a piece of 4.8mm dowel and a piece of cocktail stick/toothpick.
- 3) Referring to the "pilot's eye" view of the rear of the guns on sheet 2 of the plan, bevel the lower edges of the rear part of each gun to fit the front deck of the fuselage where they will later added. N.B. as the guns are not 'handed' when assembled, each gun will need to be shaped slightly differently to correctly fit onto the fuselage deck.
- 4) Make up the step as shown on the plan, you can either use leftover wire or sewing pins cut to length.

## COVERING

The tissue in the kit is used to provide a 'skin' over the balsa wood framework. The basic idea is that the tissue is attached to the framework and then sprayed with water and then left to dry. As the tissue dries, it shrinks and tightens. For flying indoors this can be left 'as is', however, sealing the tissue is advisable if you intend to fly your model outside, as it makes the tissue more durable and stops it going 'saggy' if it is damp or humid. Traditionally, cellulose dope was used for sealing the tissue (thus the process is often called 'doping'). Cellulose dope is pretty smelly and is now frowned upon for shipping by post making it hard to obtain unless you have an old fashioned model shop in your locality. Two alternatives are available:

**Clear lacquer** This is available at many DIY stores in spray cans. The model can be given a single coat of it once it is built, but before the paper decals are applied. If you use this method then make sure that you only apply a light coat. It is very easy to get carried away with it and add a lot of weight!

**Eze Dope** This is a modern replacement for cellulose dope, and being water based it is fine to be shipped by post. This is thinned (30% Eze-Dope to 70% water) and then brushed on the tissue after it has been shrunk. If you choose to use the Eze-Dope, then you should shrink the tissue with a 5% solution of it (rather than plain water) and pin the model parts down each time you apply a coat, as you do when you shrink them following the instructions overleaf:

## THE FIN, RUDDER AND TAIL PLANE

- 1) For the covering you will need a glue stick, PVA, fine brush, scissors, an old perfume bottle or fine mist sprayer and a sharp knife. It is also worthwhile to get a sponge and a dry cloth so that you can
- keep your fingers clean and dry as you work.  
Thin the PVA around 50% with water (err on the strong side if unsure) in an old jar lid or similar.

- 2) Cut out some spacers (about a dozen or so) about 20mm long and 5mm wide from the edges of the left over sheet and apply one layer of sticky tape to one surface. These spacers are used when shrinking the tissue - the sticky tape simply prevents the spacers sticking to the parts.
- 3) Starting with the fin and rudder, cut out two pieces of tissue that are about 10mm bigger than the outline of the part. Lightly apply the glue stick only to the face of the parts of the structure that form the outer profile, keep the covering smooth and avoid it gathering in blobs on the surface and in corners. With the tissue flat on the work surface, put the glued side down onto it. Turn the tissue covered side towards you and gently tug and tease the tissue until there are no wrinkles and the tissue is nice and smooth. You do not have to make the tissue tight, the water shrinking will do that later. Give the glue stick a few minutes to do its job.
- 4) Once the glue has set a little, cut the tissue carefully leaving an edge about 1mm wider than the part all the way around, apart from where it fits to the tail plane and fuselage stern post. Here you should cut it flush to the structure.

- 5) Working in stretches of a couple of inches at a time, apply the thinned PVA to the tissue edge that is sticking out and carefully roll the tissue up so that it sticks to the edge of the part. Rub all-round the edge with a dampened finger to ensure that the edge is fully stuck down and is nice and smooth. Do not get the PVA on the tissue any other place other than the edges - or the tissue will not shrink properly later.
- 6) Repeat for the other side, once again overlapping the tissue at the edges. Let the glue dry for a few hours or preferably overnight.
- 7) Spray the part with a fine mist of water on both sides, then use the spacers that you 'sticky taped' to hold the edge of the part off the board. Use pins set at an angle to hold it flat until it dries. Holding the part down in this way helps prevent warps. Note that the tissue is very delicate when it is wet, so handle the part at the edges (and with care) so that you don't damage it.
- 8) The method for the tail plane is the same.

## WINGS

- 1) Cover the underside of the upper wings with three pieces of tissue, one for each wing and one for the centre section, overlapping the joints at the R3/R4 position. Cover each wing panel first and the centre section last. As with the fin/rudder and tail plane use a glue stick to attach the tissue at the outlines only, then seal the edges and joints with 50/50 thinned PVA to ensure that it is well attached. At tissue to tissue joints, brush the thinned PVA through the top layer of tissue, and then gently rub the joint with a damp finger to ensure a good joint.

- 2) Cover the top of the wings in a similar manner, but with 5 pieces of tissue. This time the wing panels themselves are covered with two pieces, one that runs from the R3/R4 position to the tip rib, and then one from the tip rib to the wing tip itself. Cover the centre section last.
- 3) Allow the glue to go off for a few hours or preferably overnight, and then shrink each panel (top and bottom) one at a time doing the wing panels first, then the centre section. Pin or weigh down the outline of each panel with spacers underneath as you did for the fin, rudder and tail plane.

# THE FUSELAGE

1) Cover the fuselage in a similar way to the flying surfaces using a glue stick and thinned PVA on overlapping joints or where the glue stick cannot reach. The following is a suggested order for covering the fuselage:

On each side:

One piece running from F6 to the sternpost at the rear, along the top and bottom edges of K1.

The bottom:

One piece running from F1 to the sternpost at the rear.

The top:

Cover the top rear with a triangle shape between the top edges of K1 each side from F5U to F8U – over all of the stringers.

2) Allow the glue to go off for a few hours or preferably overnight, then shrink the tissue. You need not constrain the fuselage in any way as the tissue shrinkage should be equal on both sides and no warps should occur.

- 3) Trace paper patterns X, Y (2 off), and Z onto standard printer paper (80gsm) following the solid lines.
- 4) Using a glue stick, glue the paper parts to an area of tissue, leaving a gap between them. **Note for parts Y you need to make a left hand and right hand version by gluing them the opposite way round on the tissue.**
- 5) Once the glue has dried, cut them from the tissue sheet, leaving extra all the way round as indicated by the dotted lines on the plan.
- 6) For paper part X leave the main edges all of the way round sticking out, but nick the edges where the slots are (that will go around the wing struts, and fold the tissue back and glue it to the reverse side of the part so that it covers the edge of the paper).
- 7) For both paper parts Y, fold the tissue back and glue to the reverse side of the parts at the rear edge and around the slots as previously. Leave the other edges to stick out.

- 8) For paper part Z, fold and glue back the edges of the tissue at the front and back. The tissue at the sides should be left sticking out. Nick the edges of the tissue where the cockpit hole is, and fold the tissue back on itself and glue to the rear of the part.
- 9) Fit part X to the fuselage using a glue stick and PVA at the edges. It should wrap around F1/F2 and run to F4. Now use thinned PVA to smooth and glue the wide tissue lip over the nose. Use the excess tissue "tabs" at the sides to make a neat joint to the fuselage side (K1) each side and F4 at the rear.
- 10) Fit paper parts Y each side, the slot at the front should fit around the lower front wing strut, wrap and fix the wide tissue lip at the F1/F2 position as before. Use the excess tissue at the sides to make a neat joint at the fuselage and to paper part X.
- 11) The paper part Z is not fitted until the wings are in place so set it aside for now.

## **UNDERCARRIAGE WING**

- 1) The undercarriage wing may be tissue covered using a similar method to that outlined for the other flying surfaces. Alternatively, it can be covered using paper pattern W covered in tissue following step 2 onward. NB The basic tissue covering is lighter, but the tissue covered paper part is more robust and makes for a stronger wing.
- 2) Trace paper pattern W onto standard printer paper (80gsm) following the solid lines.
- 3) Using a glue stick, glue the paper part to an area of tissue, ensuring that there is a tissue border all round.

- 4) Once the glue has dried, cut the part from the tissue sheet, leaving extra all the way round as indicated by the dotted lines on the plan.
- 5) Fit around the wing as illustrated on the plan, using a glue stick and PVA at the edges folding over and fixing the tissue at the ends with thinned PVA. Ensure the two slots in the paper part align with the slots in the wing where the legs will fit later.
- 6) Cut two pieces of tissue the same shape as the wing section and glue one on each end covering the remaining exposed wooden parts.

## FINAL ASSEMBLY

- 1) If you want to draw on the control surfaces, do so now using a fine marker or strips of black paper referring to the chain dashed lines on the plan.
- 2) If you want to cover or paint bare wooden parts such as the wheels/struts, etc. do so now. This is much easier when the parts are not fitted to the model.
- 3) Assemble the propeller to the nose block using the wire hook as shown on the plan, making the shaft as short as possible.
- 4) On the wings, cut away the tissue around the points where the wing struts will fit.
- 5) Refit the wing alignment jigs. Glue the wings in position along with the rear main struts ensuring that the wings locate properly and look square and true to the fuselage. NB you may need to carefully break or cut away the jigs to make space when removing them so as not to damage the wings or fuselage, they are no longer required after this step.
- 6) Cut away a small piece of tissue at the very rear end of the fuselage to allow fitment of the tail skid. When fitting it ensure the end locates into the slot in F9 and it is firmly glued in place.
- 7) Glue the tail plane in position, making sure it is square, true and in line with the wings.
- 8) Make up two tail plane struts from light 1.6mm square strip, and glue them in position noting from the plan where their ends fit.
- 9) Glue the fin and rudder in place, ensuring it is properly located on the tail plane and at right angles to it, adjusting it if required.
- 10) Make slits in the tissue at the positions where the F2 and F3 stiffeners are – where the undercarriage wire will fit. Trial fit all of the undercarriage parts. Once a satisfactory fit is achieved glue all the parts together and to the fuselage using epoxy. Ensure good joints but do not use too much epoxy as it is quite heavy. Hold all the parts in position, square and true until the epoxy has set.

- 11) The wheels can then be added to the axles of the legs and retained, either by simply bending up the wire or using the insulation from some thin electrical flex held with a blob of glue. N.B. make sure that the glue does not enter the wheel centre bushing and the wheel can rotate freely. Add the wheel covers, checking to make sure that they do not foul on the ends of the axle.
- 12) Fit the guns and step in position as shown on the plan.
- 13) Fit paper part Z. Use the excess tissue "tabs" at the sides to make a neat joint to the fuselage side.
- 14) Stick the acetate sheet provided at the edges over the screen pattern on the plan using masking tape. Carefully cut through the acetate the way round. You can simulate the frame with paint or a marker pen if desired. Fit to the fuselage where shown.  
NB The screen can be attached to the fuselage with cyano, but don't use too much or it will 'fog' the plastic.

- 15) Markings are provided on lightweight paper. They should be cut out and glued in position with a glue stick using the colour scheme diagram (Y) included at the back of this booklet.
- 16) Fit the motor peg made from the cocktail stick/toothpick provided, cutting it to length leaving about 5mm sticking out each side. Use the scrap ends dipped in cyano and rolled round the peg hole to harden it, trying the stick for a good 'squeaky' fit each time you add more cyano.  
**BE CAREFUL!** Wait for the cyano to dry at each stage before trial fitting the stick to avoid it being permanently bonded!

## TRIMMING AND FLYING YOUR MODEL

**When flying your model, choose a large area free from any obstructions. Do not fly it towards people or property.**

To fly successfully, your model must be correctly trimmed. Trimming is a normal procedure for any aircraft, but for a free flight model it is especially significant as once the model is released, you have no control over it. Trimming takes some time and skill and the basics are outlined here. More detailed information and help is available from the many

experienced free flight modellers who have websites dedicated to the subject or post information on numerous on-line forums.

The first step involves fitting the motor and checking the balance. Short test flights should then be carried out during which the behaviour of the model can be observed. Following initial flight tests, the number of winds on the motor and thus the duration of the flights can be slowly increased.

## TO MAKE UP AND FIT THE MOTOR

The motor consists of the rubber strip provided. This strip is more refined than that used in rubber bands and is very stretchy, allowing it to hold lots of energy. A single loop should have enough power for the model if it is built lightly as per the instructions. Contrary to popular belief, the rubber motor is not designed to hold in the nose plug, and motors that are much longer than the distance from the propeller hook to the rear peg are used by experienced modellers. This requires a geared winder to 'stretch wind' the rubber motor. If this is your first model and you do not have a stretch winder, tie a knot in the rubber to make a loop that is roughly the distance between the peg and the hole in the nose. Wetting

the rubber makes it easier to tie a knot, however, do not pull the knot too tight otherwise it can tear. Once knotted, apply a tiny drop of cyano to the end 'ears' of the knot, taking care to avoid putting cyano on the actual working part of the rubber. To make your rubber motor more efficient it can be lubricated with castor oil or spray silicone trim polish that can be bought from motor factors.

Put the rubber loop down into the nose of the model, lower it down to the peg position and trap the loop with the peg, then connect the other end to the motor hook, and fit the nose plug.

## TO BALANCE THE MODEL

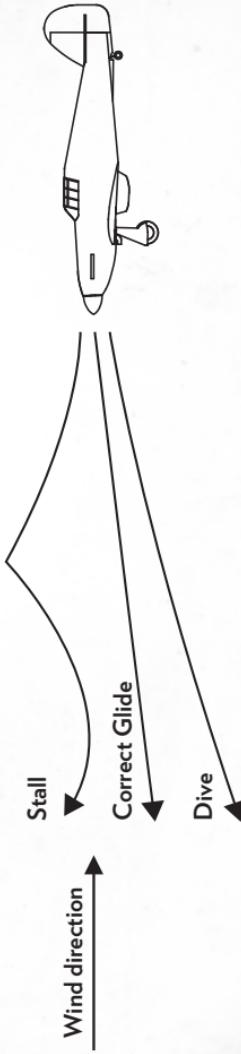
Referring to the arrow on the plan labelled 'balance', hold the model with your fingertips under the centre section at that position. It is likely that the model will want to tip backwards. If it does, add Blu-Tack

or plasticine to the nose of the model, adjusting the amount until the model balances at the correct position with the tail plane approximately level.

## TEST GLIDES

Choose a calm, dry day if you are trimming your model outdoors. This is a small model and slight gusts and disturbances will make it hard to judge how your model is behaving. It is useful to find a field with nice long grass to act as a gentle landing spot during these early flights.

Gently throw your model towards an imaginary point on the floor about 7-8 metres in front of you into any wind. If the model nose rises then falls then there is insufficient nose weight. If the model heads nose first downwards, then there is too much nose weight. Carry on test gliding and adjusting the nose weight until the glide is smooth, and the model lands about halfway towards the imaginary point.



## POWERED FLIGHTS

Wind up the motor with approximately 50 turns (wind clockwise looking at the front of the model) and launch it into the direction of the wind (if present). This should achieve a gentle powered glide. Aim for a gentle left turn by adding a tab made from clear acetate (the clear film that you might find on a chocolate box 'window') to the trailing edge of the rudder. Adjust it towards the left to make the plane turn left and to the right if the left turn is too sharp.

If the left wing 'dips' and the model spirals in, then add an acetate tab to the left hand wing and bend it down a little. Gradually increase the turns on the motor in steps of 50 turns up to approximately 250 for the short simple loop. At each step make adjustments to the tabs to control the flight pattern. If you struggle to get your model to fly well, then check for warps in the flying surfaces of the model. These can be removed by twisting them over a bowl of steaming water.

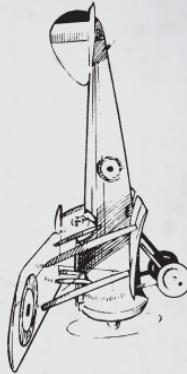
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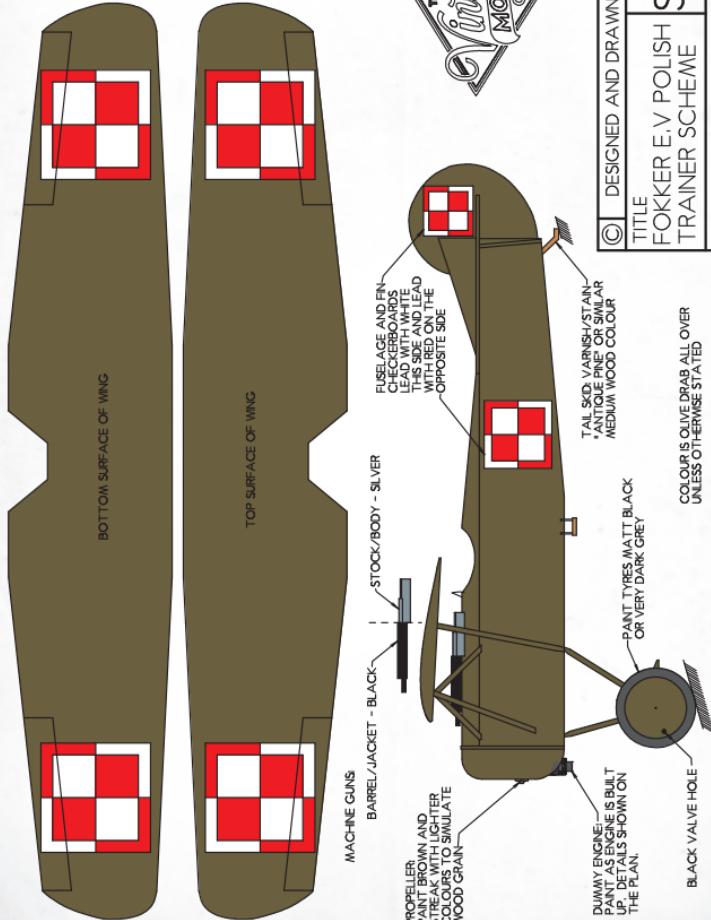
# BUILDING NOTES

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Use this sheet for notes during your build

FLIGHT LOG

Keep a log of your flight durations here



(C) DESIGNED AND DRAWN BY A.J. DARBY	SHEET Y
TITLE	FOKKER E.V POLISH TRAINER SCHEME
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