V1 Flying Bomb, 1/9 Sport Scale

Introduction

In the late stages of World War II, the Germans invented a new and terrible weapon, the V1 flying bomb. Though not nearly as accurate as today's cruise missiles, it could hit a target such as a city from several hundred kilometers away.

They were a 4000 lb, 350 -400 MPH pilot-less drone, catapulted from a ramp set in the direction of the city that they were aimed at, stabilized by gyroscopes during flight. It was powered by a simple pulse jet that shot flame out the back, and made a very loud low frequency buzzing sound. This led to the bombs being called "buzz-bombs" by the intended victims. A simple wind-milling propeller mechanism on the front measured the distance of flight, and kicked in down elevator when the pre-set number of propeller turns had been reached. The engine then cut out, and the bomb glided down to impact, in relative silence. The people on the ground quickly learned to take cover when the engines cut.

Though only accurate enough to hit a general area, several thousand people were killed, and a very large amount of property damage was caused in the target cities

Large numbers of AA guns were set aside for shooting them down, and squadrons of Spitfire Mk X IV's, and Tempest Mk V's, were assigned to patrol for them. As soon as they became coordinated well, the fighters were the most effective method of stopping the bombs. Although other airplanes, such as the P47 and P51 accounted for some V1's, the great low-altitude speed, and 20 mm cannon of these two British aircraft made them the most effective against the fast, steel-skinned, low-flying bombs. The Tempests were the most successful, with over 600 destroyed, with one pilot single-handedly destroying more than 60. This was hazardous work, as the bombs could blow-up if the warhead was pierced by a shell. This could, and too often did, take out the attacking fighter along with the V1. You had to get in fairly close, as 50 cal machine gun bullets would bounce off of the V1, and the 20 mm cannon did not have a great range as the machine guns. Pilots learned that flying with the wing-tip close to the V1's wing tip would upset the stability of the V1 and cause it to crash.

As the proximity fuse, and predictive radars (that used analogue computers to calculate where the target would be when the shell reached it) became available to the AA guns, they became far more effective against the V1's, and the fighters were reassigned to other tasks.

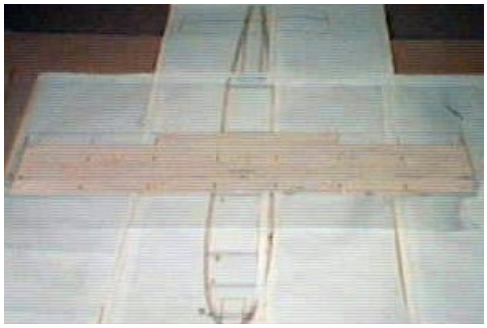
This model is a sport-scale version of this famous cruise missile. It is intended as an accessory for a 1/7-1/12 WWII allied fighter, for flying intercept missions, and re-enacting this period of history. To make it easier to launch, fly and land, it includes ailerons, and a slightly over-sized wing. It has a flight envelope that includes steep turns, rolls and loops, but not spins, snaps and other advanced aerobatics. Because of its shape, it is forgiving of imperfect landings. The jet-tube is attached strongly, and could be used for rocket launching the V1, if desired.

This kit requires intermediate building and flying skills.

(This manual was revised and updated 5/5/2017 by Tom Jacoby, Manzano Laser Works.)

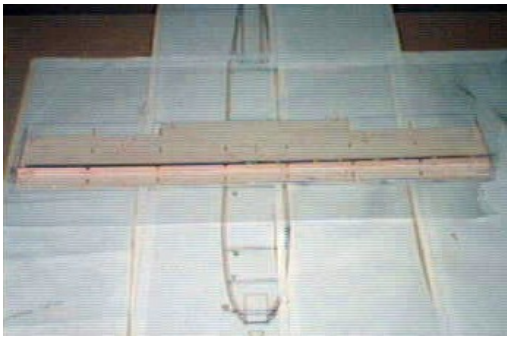
Construction

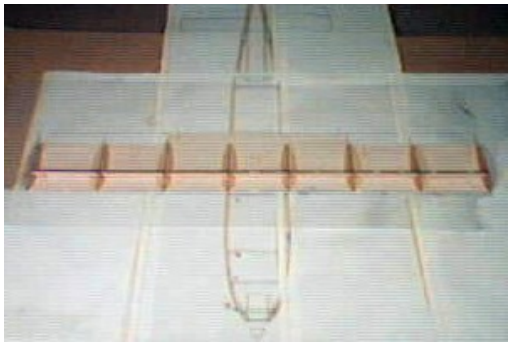
Wing



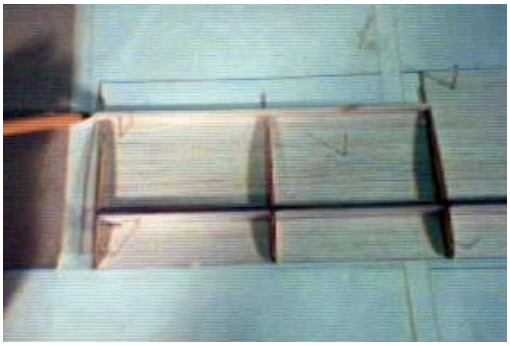
Wing construction begins with pinning the **BOTTOM WING SHEETING** to the building board. Protect the plan and the building board with waxed paper.

The **SPAR** is then fitted to the sheeting,, with slots facing up, using the pre-cut tabs and slots to align it properly. Fit the **DIHEDRAL BRACE** to the back of the spar, at this point. Glue it with thin CYA, after the ribs are all in place



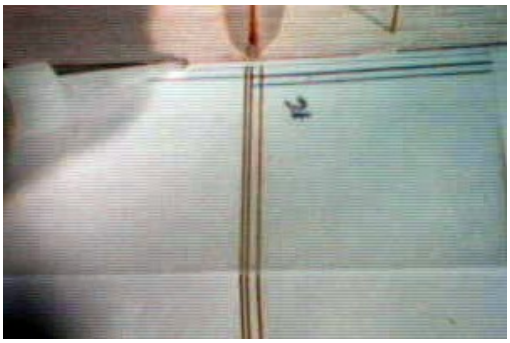


The ribs are then fitted to both the **SPAR** and the sheeting, again using the provided slots and tabs to ensure alignment. Note that there are now more ribs. **W1**'s go in the two most inboard positions, and **W2**'s go in the outboard positions. When all parts are in place, and the front of the ribs line up exactly with the front of the **BOTTOM WING SHEETING**, glue everything together using thin CYA, followed by medium CYA to form a fillet.

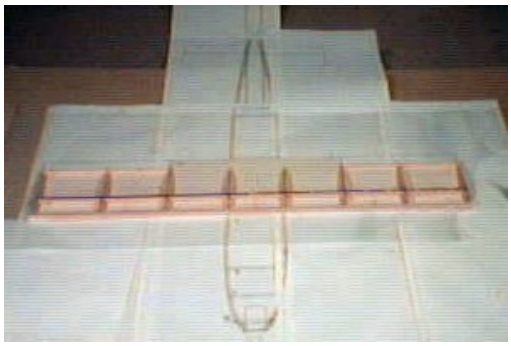


Glue 1/8 x 1/4 balsa stock to rear of outboard ribs, and flush with end of sheeting to form front of aileron bay. Butt glue the inboard end to **W1**. Repeat for other side.

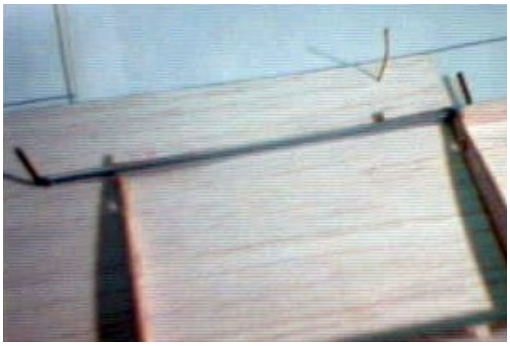
Check that 1/4 x 1/2 stock for leading edge is straight. If it has developed a warp along the 1/2” axis, used a straight edge to cut one edge completely straight. Ensure that the piece is not less than 3/8 high at any point.



Apply medium CYA to the front edge of the **BOTTOM WING SHEETING**, and the front of the ribs.



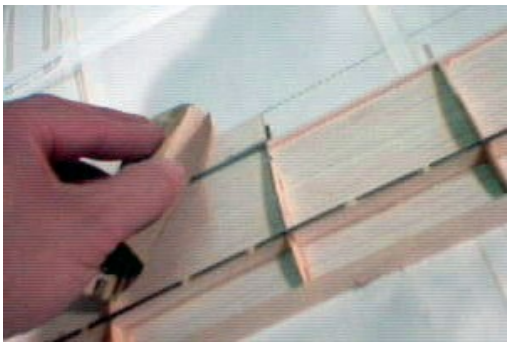
Glue leading edge in place, with straight side down on the building board. Go over each joint again to form fillets.



Make and install aileron torque rods, using scrap 1/8 sq behind them to block them into place. Use a semi-flexible glue on the antenna tubing, such as RC 560. 1/2” arm goes into aileron, 3/4” arm goes up to aileron servo.

Sand 1/8 x 1/4 stock at front of aileron bays until it is flush with, and matches the angle of the ribs.

Sand the inboard trailing edges so that the last 1/2” of them tapers from 1 mm to a sharp edge.



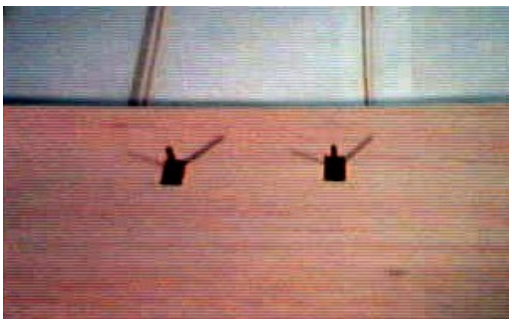
Run medium CYA along the straight edge of this sheeting, and glue it to the back of the leading edge, so that it is touching all of the ribs. Use a straight pin over each rib to ensure positioning. Fill any gaps with a gap filling glue that can be sanded, such as PICA Gluit.

Do not glue the sheeting to the ribs yet.

Using a straight edge and a single-edged razor, ensure that one edge of the 1/16” x 6” balsa sheeting is completely straight.

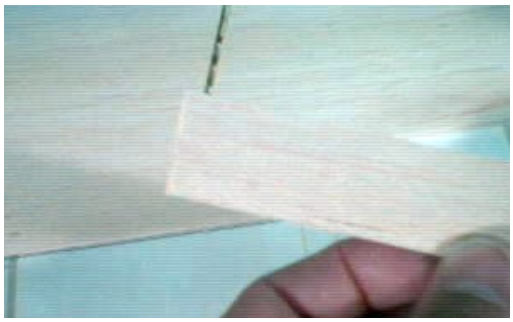
When glue is dry, carefully roll sheeting down on ribs, until aileron torque rods poke up through sheeting. Lift it back up, and cut 1/4 wide by 1/2 long slots around the holes made by the torque rods.

Completed slots for aileron torque rods.



Without rolling down the top sheeting, place the wing bottom side down on a flat surface. Carefully roll the sheeting down onto the glued ribs, **SPAR** and trailing edge, making sure that you work from front to back. Use a gentle, palming motion to ensure that all “frame” members have joined to the sheeting.

Fit 1 x 1/4 aileron stock into place, and cut to size, using plans as a guide. Leave a 1/32 to 1/16 gap at the inboard end.



Place wing with leading edge on table and trailing edge in the air. Run medium CYA forward along the top of the ribs, so that the entire top of the rib is covered with glue. Also run medium CYA along the top of the **SPAR**, on the top of the front of the aileron bay (1/8 x 1/4 piece sanded earlier), and the taper sanded on the inboard trailing edge.

Fill gap between sheeting behind aileron torque rod, at inboard end of aileron bay with scrap balsa.

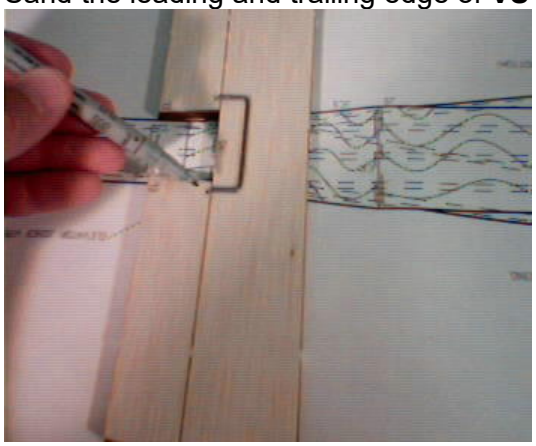
Drill a 1/16 hole chord-wise, 5/8” deep, into the inboard end of the aileron, 3/16” in from end. Trial-fit hinges, then bevel leading edge of ailerons. Cut a groove inboard of drilled hole, to allow room for the torque rod.

Remove ailerons, and lay wing flat on waxed paper. Glue WT (wing tip pieces) to ends of wing. Trim excess that extends into aileron area.

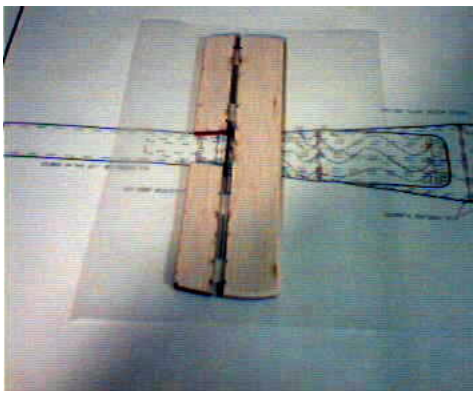
Sand leading edge to airfoil profile seen on plans. Wing is now complete. Pin back down to building board, aligned with plans.

Empennage

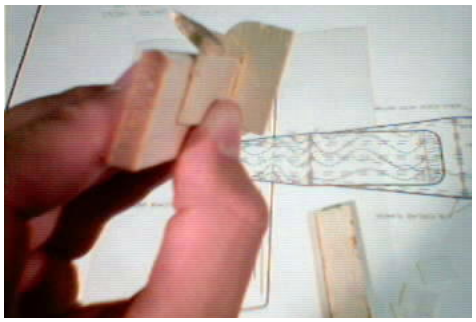
Sand the leading and trailing edge of **VS** and **ES** to a rounded profile.



Lay **HS** and **EL**s in place the plan, and mark the locations for the joiner wire holes to be drilled in the elevators. Also mark the positions for the hinges at this point. 2 CYA hinges per side are recommended.

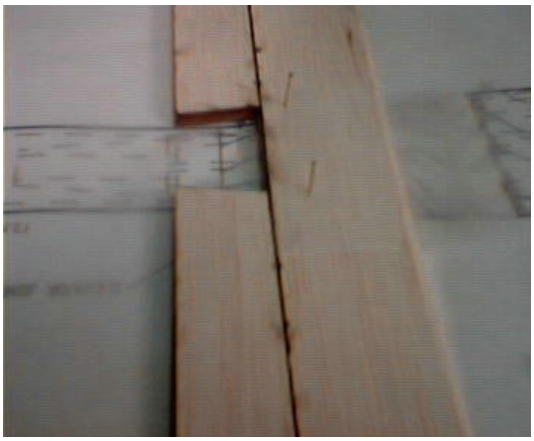


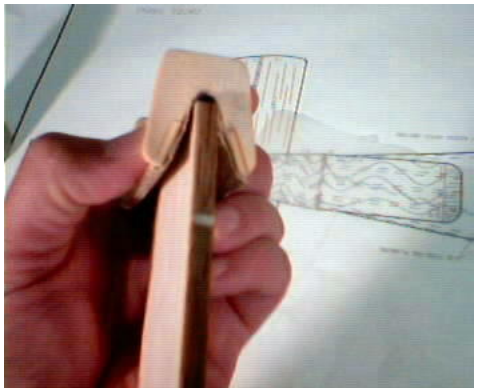
Test-fit the hinges and the elevator joiner wire. Do not glue, at this time.



Sand bevel on leading edge of **EL**s, using a suitable sanding block. Cut small groove from joiner wire hole to inside end of **EL** to allow joiner wire to sit flush with leading edge.

Protecting plans with waxed paper, wrap a bit of waxed paper around the mid trailing edge of **HS**. Pin stabilizer to plans. Fill elevator joiner wire holes and grooves with 5 minute epoxy. Assemble **EL**'s to **HS**, installing hinges without glue. Make sure that all parts are held flat to the board, as the epoxy cures.

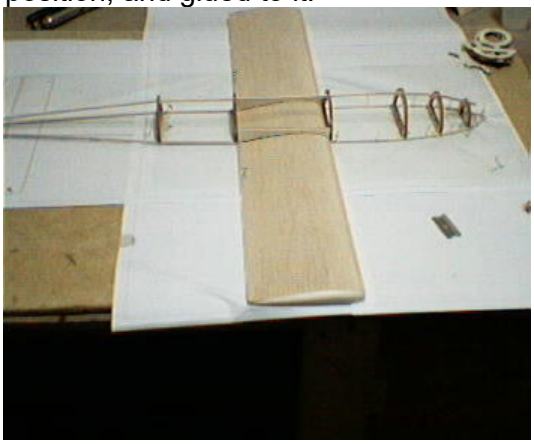




Using a suitable sanding block, round all leading and trailing edge, as well as the tips of the assembly.

Fuselage

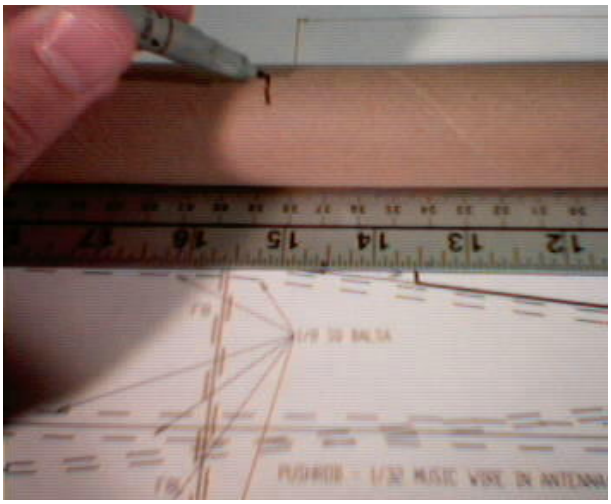
Note: By the builder's choice, the horizontal tail surfaces can be attached to the building board and "built around", like the wing, or the fuselage top half can be built, and then cut to accommodate this assembly. If the latter is chosen, the horizontal tail surfaces must be assembled, covered (if using film, not painting over balsa as on the prototype), and permanently hinged prior to attaching to the fuselage top half. The fuselage top half is then completed, removed from the board, and notched to accommodate the horizontal tail surfaces, and elevator joiner wire. The horizontal tail surface assembly is pinned to the plans, and the fuselage is lowered back into position, and glued to it.



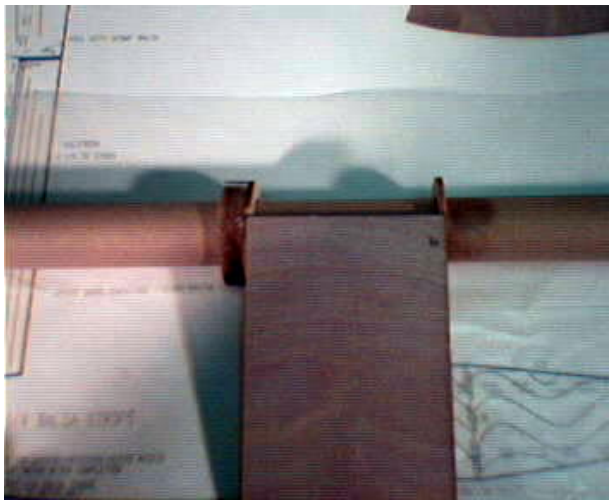
Pin the wing in place on the plans, and pin the 1/8 sq. side stringers in the places shown on the plans. Glue formers **F3** to **F9** to the stringers. **F6** and **F7** also glue to the wing. Glue left **WS** to **F6**, **F7** and the wing. Repeat for right side. Add top 1/8 sq stringers.

Sand both **WS**s to match the profile of **F6** and **F7**.

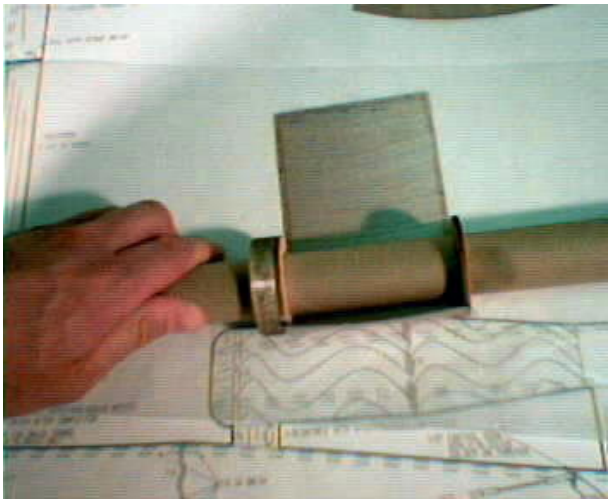
"Jet Engine"



Measure 15" from one end of tube. This will be the rear of the rear former. Using plans, mark the position of the rear of the front former, as well.

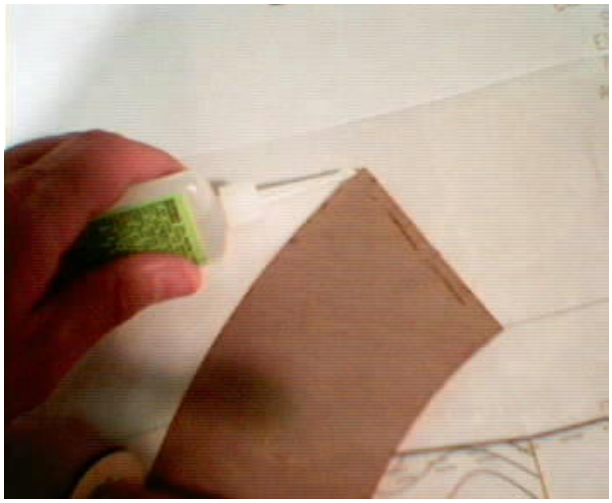


Install two 1/8" formers , **ER**, as well as the 1/2" former, **JR**. Glue the 1/64 ply sheeting, **JS**, into place as shown.

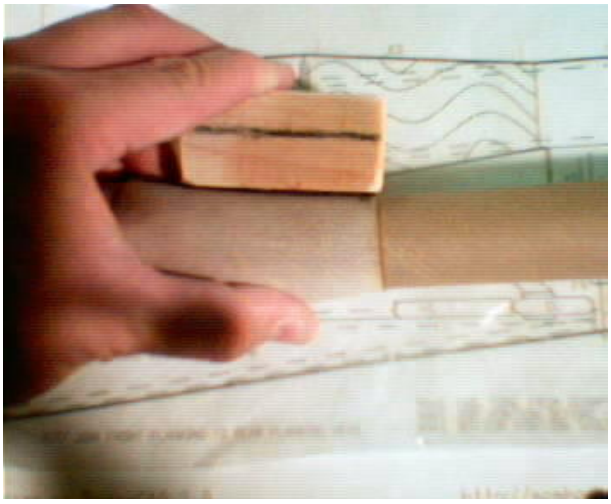


Place a bead of glue along the edges of **JS**, and then roll it down on to the formers. Make sure that there is a bead of glue on the edge that will overlap when it is fully rolled down.

Repeat this procedure for **JCS**.

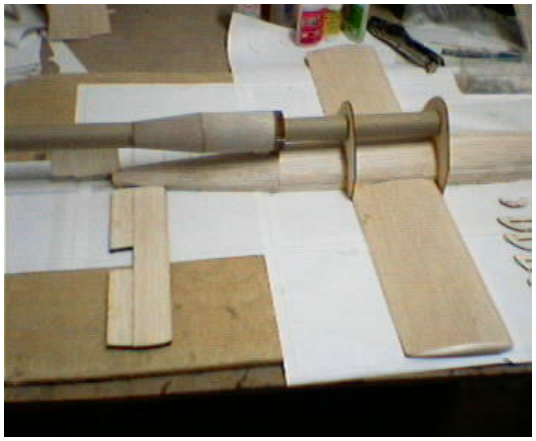


Placing the bead of glue on **JCS**.



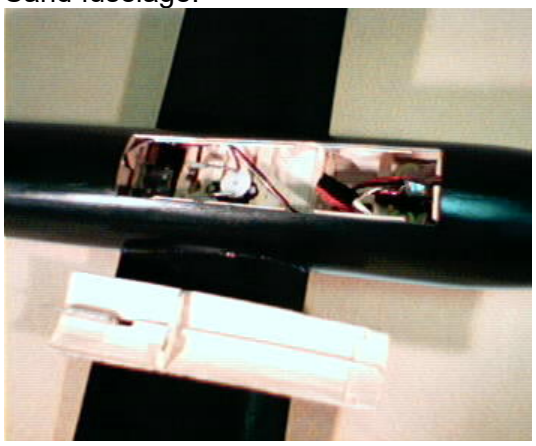
Use a straight wooden block to hold down the overlap joint while the glue dries.

Sand all edges smooth, and add filler, as necessary.



Plank entire fuselage with 1/16 x 1/4 balsa strips. Confident builders can sheet the tail cone, instead, if they wish. Make top portion of tail block from balsa blocks, attach to back of **F9**, and carve/sand to continue shape of tail cone. Slide **FAJ** from front of fuselage to wing. Repeat with **RAJ** from rear. Ensure that both are sitting flat on the building table. Slide jet assembly into holes in **FAJ**/**RAJ**, and slide forward until front of jet is in position shown on plans. Ensuring that they are vertical and straight, glue **ES** and **VS** in place. Reinforce joints with epoxy/micro-balloon fillets.

Allow to cure/dry thoroughly, and then remove from board. Add 1/8 sq lower side stringers to bottom of top side stringers, continuing them under the wing and **HS**. Add bottom formers, directly below their top counterparts. Add bottom 1/8 sq stringer. If you are going to add a bungee hook, reinforce the area at this time. Plank the bottom of the fuselage, and make the bottom section of the tail cone. Cut all planks flush with the front of **F3**. Bolt motor to **F1**, wrap in waxed paper, slide back into **F2**, and epoxy **F1** to **F2**. When epoxy cures, remove motor. Knock out cross-members in **F3**, and epoxy **F2** to **F3**. Sand fuselage.



Cut hatches on top and bottom of fuselage, as shown on plans. Use scrap 1/16 balsa to form a flange on the inside of all sides of the bottom one, and the front and sides of the top one.

Make simple latch for the top hatch as shown on the plans. Use some 1/32 music wire, some antenna tube, and a piece of scrap elastic (replace regularly). Attach the tube to the hatch with a bit of glass cloth. Hook the elastic over the wire at the front, and R/C 560 the back to the wire, just above the bend.

Note 1/16 balsa “tongues” on rear end of hatch.

Bottom hatch does not have a latch. It merely rests on 1/16 balsa flanges, and is held in place by the covering, or clear tape. Fill any gaps at the front of the fuselage, and reinforce joint between planking and **F2/F1** with glass cloth.

Finishing

Knock-out the cross-members on **F4** and **F5**. Fit and install your radio equipment, and power system. Several 1/8 lite-ply rails are provided, as well as ample scrap lite-ply. Use hook and loop material to help secure removable items, such as the power pack. Also secure the battery with either a strap, or rails in front of and behind the pack.

Set up control throws, as per recommendations. A bit more throw can be safely used, if you use exponential. Make sure that, when neutral, both ailerons are up about 3/32”. This is the only wash-out in this wing, and the V1 will tip stall much more readily without it.

Prototype uses Wattage Super Cobalt 400 motor (item No 131480), 8 Sanyo AR 500 cells, a 25 A BEC speed control, and an APC 6 X 4 E prop. No right or down thrust is used. KAN 1150’s are also excellent cells for this airplane.

Remove your equipment. Cover, or paint your V1. Simple dark green upper, light blue lower is fairly scale, and easily done. There are very few, if any markings needed, and weathering is not really needed on an airplane that only ever flew once. A more visible and fun, though not scale scheme would be all Fokker red, with WW1-type markings. If

you are using dope, make sure that the wing is supported very well, or the shrinking of the dope will cause it to warp.

Check to make sure that the control surfaces are securely glued to the hinges, and that everything moves smoothly and easily.

Reinstall equipment, and verify that C/G is correct.

Flying

Have an assistant hand-launch the V1 for you. It requires a couple of quick steps, followed by a quick, level toss. If it climbs, immediately level the nose to allow speed to build. If it wallows, allow it to sink with wings level until speed builds. Gently climb to circuit height allow speed to build, and then turn into your circuit. Back off to 2/3 throttle and trim for straight/level flight. Unless using more robust cells than 500 AR's, continuous full throttle will result in short flights, and short battery life.

Properly trimmed, when flown hands-off, the V1 will be stable in pitch and quite neutral in roll. Turns take a bit of getting used to, as the very long nose tends to exaggerate the rate of climb or sink in a turn.

Do not deliberately stall your V1! If it spins, due to its unusual tail, it is very unlikely to recover. Stalls generally slide off to one side or the other. Except when landing, if you find yourself holding more than 1/4 up elevator to maintain level flight, you need to increase the speed. The V1 will give some warning of cornering to slowly/steeply, by seeming unresponsive to elevator, and trying to drop its nose to the inside of the turn. Increase your throttle, decrease your bank angle, and reduce climb, if climbing.

The V1 can move pretty quickly, and it is small, and oddly shaped. Keep it in close, until you are accustomed to its shape and handling. Once you are used to it, you can extent your flight times by using 1/3 -1/2 throttle for level flight, and throttling up to 1/2-2/3 for turns, and 2/3-full only for climbs.

The prototype V1 is capable of rolls and loops. For your first few attempts, keep it conservative, as described here. A roll is achieved from 2/3 or higher throttle level flight. Pull up a few degrees, roll. Don't bother with down-elevator while inverted, as it will not sink too badly. Begin your first loop from a shallow dive at high altitude and full throttle. Chose the diameter so that you go over the top at about the normal cruise speed of your V1.

For landing, complete a circuit at a slow cruise, so that you are lined up with the runway about 100 m (110 yd) out, and about 12 m (40 feet) up. Reduce to a 1/4 throttle powered glide, aiming for 2m (7feet) up at the threshold. Kill motor at threshold, and continue glide. Try to hold at 30 cm (1 foot), and it will sink in when it is ready. If you are running out of runway, just reduce elevator and allow it to settle in. The shape of the fuselage will help to keep it from bouncing with the nose up, and allow it to slide without much likelihood of damage. For a cross-wind landing, keep the speed higher.

As you get more time on your V1, you will get comfortable with the appearance and handling. You will find that it can maneuver fairly well, and can occasionally out-fox the

fighters pursuing it. When you are ready for a “scale” interception, I find that the following works well:

Fly in formation with fighter on the set-up leg, at normal circuit height. The V1 and fighter should fly the same speed, with the V1 about 5-10 lengths ahead. When almost at the end of circuit, turn the V1 in a moderate, gently diving arc, so that it gets to the field at ½ throttle, and about 8 m (25 feet). The fighter turns later, maintaining height. As the two pass along the runway, the fighter dives in, and throttles up to about 1 1/4 times the sped of the V1. It can then fly in behind it and pretend to shoot, arrive beside it, and pretend to tip it, or drop down right in front of it, pretending to use wake turbulence to upset the V1. The V1 can then roll, dropping moderately towards the ground, pulling gently level again at very low altitude, and a higher throttle setting (preparing to climb again). The V1 then cuts inside of the fighter to get in front to repeat the process.

For a scale “bombing”, simply fly up to end of field at a high circuit height, cut throttle at threshold, and dive at about 45º towards the center of the runway. Gently throttle up and pull level at a low height (don’t yank it – remember, this thing does not have much wing).

Have fun!

Completed V1 prototype

V1 prototype along with 1/10.9 Tempest Mk V from intercept squadron.

LASER CUT PARTS FOR V1 FLYING BOMB

NAME	EXPLANATION	LOCATION
F1	MOTOR MOUNT PLATE	1/16 A/C PLY
F2	½ BALSA MOTOR MOUNT RING	1/4 BALSA
F3	UPPER FUSELAGE FORMER	1/8 BALSA
F4	UPPER FUSELAGE FORMER	1/8 BALSA
F5	UPPER FUSELAGE FORMER	1/8 BALSA
F6	UPPER FUSELAGE FORMER	1/8 BALSA
F7	UPPER FUSELAGE FORMER	1/8 BALSA
F8	UPPER FUSELAGE FORMER	1/8 BALSA
F9	UPPER FUSELAGE FORMER	1/8 BALSA
F3L	LOWER FUSELAGE FORMER	1/8 BALSA
F4L	LOWER FUSELAGE FORMER	1/8 BALSA
F5L	LOWER FUSELAGE FORMER	1/8 BALSA
F6L	LOWER FUSELAGE FORMER	1/8 BALSA
F7L	LOWER FUSELAGE FORMER	1/8 BALSA
F8L	LOWER FUSELAGE FORMER	1/8 BALSA
F9L	LOWER FUSELAGE FORMER	1/8 BALSA
WS	WING SADDLE	1/8 BALSA
HS	HORIZONTAL STABILIZER	1/4 BALSA
EL	ELEVATORS	1/4 BALSA
VS	VERTICAL STABILIZER	1/4 BALSA
ES	ENGINE SUPPORT	1/4 BALSA
WT	WING TIP	1/4 BALSA
JR	JET RING	1/4 BALSA
ER	ENGINE RING	1/8 BALSA
JS	JET SHEETING	1/64 PLY
JCS	JET CONE SHEETING	1/64 PLY
DIHEDRAL BRACE	DIHEDRAL BRACE	1/16 AC PLY
SPAR	WING SPAR	1/8 BALSA
W1	INBOARD WING RIBS	1/16 BALSA
W2	OUTBOARD WING RIBS	1/16 BALSA
BOTTOM WING SHEETING	PRE-CUT AND NOTCHED SHEETING FOR BOTTOM OF WING	1/16 BALSA
FAJ	FRONT ALIGNMENT JIG	1/8 LITE-PLY
RAJ	REAR ALIGNMENT JIG	1/8 LITE PLY