



SUPERMARINE SPITFIRE F22/F24

Supermarine's Spitfire was the only Allied fighter to remain in continuous production throughout the whole of WW II; some 20,351 were manufactured. During the period, from 1936 to 1946, its power increased

by 100%, its weight by 40%, its maximum speed by 35%, and its rate of climb by 80%; quite a remarkable history of development. Even at the end of its long career, it remained one of the fastest piston engined fighters with a top speed of 454 mph at 20,000

ft. This achievement was made possible by the introduction in the Mk XII Spitfire of the 2,000+ H.P. Rolls Royce Griffon engine to supersede the 1500 H.P. Merlin.

It wouldn't be too far from the truth to say that the later Spits were in fact different aeroplanes from their forebears. For instance, the F22/24 variants had a redesigned wing from the one which had continued with only superficial visual changes for 8 years previously, and a larger tail assembly. With their prominent rocker covers and bubble canopy, these late Mark Spitfires certainly looked formidable, whilst retaining that sleek elegant (as opposed to functional) attraction for which the entire Spitfire series is remembered.

My model depicts an F24 from the only Squadron to fly the type in battle, No. 80 Sqn. RAF, which fought in the

Build this 1/8 scale model of the post WW II version of Britain's wonderful Spitfire.

By Gordon E. Whitehead



Korean war. The F22 and F24 Spits, though not as well known as the earlier Marks, were flown by 13 different RAF squadrons, and some were sold to the Rhodesian and Egyptian air forces.

I've shown pretty comprehensive details of the 80 Sqn. markings on the plan, to help those who might not have huge reference libraries of colour schemes.

However, let's start building now. The sooner we do that, the sooner we fly!

CONSTRUCTION

Fuselage:

The fuselage is made by making two half shells and joining them along the horizontal centre line. Start with the upper half shell, which runs from F3 to F11. Pin the two 1/4" x 1/8" balsa crutch strips to the plan; on these, erect all the upper half formers, and then add the cockpit floor. Begin planking with the two lower side strips, which are 1" wide strips of 3/32" sheet. The remaining planks are 3/8" x 3/32", tapering from F6 to F11.

The fuselage lower shell runs from F2 to the sternpost, and is built inverted over the plan as per the sketch. Ensure that the ply webs P1 are well glued to F4 and F5 by employing temporary internal spacers. Planking starts with two 1 1/2" wide strips which begin to taper to about 3/8" wide from F6 rearwards. At this stage, leave most of the planking between F11 and S1 open so that you will be able to experiment with the retractable tailwheel installation.

Before joining the upper and lower half shells, install the snakes for the rudder, elevator, and retractable tailwheel. If you're going to use pneumatic main gear, make a paper tube to hold the air tank between F6 and F7.

Glue the upper and lower fuselage halves together. Then add the upper half of F2, the engine bearers, followed by F1 and the two ply webs P2. Fit the engine bolts, soldered to tinplate strips. Then add the 1/2" sheet cowl sides and top sheeting, using 1/2" triangular stock in the corners. The access hatch is only tack glued in place whilst shaping is performed. Eventually, the hatch will be held by two front pegs, and a long machine screw threaded into the bottom of F1/F2.

The tailwheel retracting mechanism uses the over-centre locking principle when down, but is light enough not to need an up lock. The parts are drawn full size on the plan, and should not need further explanation here. Needless to say, check the operation many times to ensure that the wheel fully retracts inside the fuselage, and fully locks

when down. A Robart retract tailwheel may fit. When you're satisfied with the operation of this crude but effective device, glue the ply plate in position, add the 1/2" sheet tail end, hollowed slightly for clearance, and plank the remainder of the lower tail end. I did this with the wheel locked down, so that I could

Tail Surfaces:

The elevators and rudder are assembled flat on the plan. The fin and stab can be built in two half-shells by splitting the ribs longitudinally, and joining afterwards. Hinges are Robart metal pinned hinge point. The tail feathers are not glued to the fuselage until later.

Wings:

The wings are built away from the plan as follows. Using the join lines shown on the plan, cut out the 1/16" sheet parts for the upper and lower wing skins. Tape the pieces edge to edge using masking tape or magic mending tape, and glue the edges using balsa cement. When dry, sand the outer sides. You should note that the top skins are full width over the flaps, whereas the lower skins stop at the flap L.E. Also note the slight overlap of both upper and lower skins beyond the aileron gap.

It's probably worth mentioning that the real Mk 22 and 24 Spits employed piano-style hinges on the bottom surfaces of the wings, with a fairly complicated flexible cover strip arrangement over the resultant upper hinge gap. I judged it easier to go for the shrouded type of hinge which, whilst being simpler to install, still looks about right. Frise-type hinges are completely out of place on this wing.

Take a lower wing skin, mark the rib and spar positions on its internal surface. Also mark the retract door positions with pin holes through to the exterior. Glue the lower mainspars, WA and WB, and the ribs in position, pinning them to the skin until dry. The thickness taper of the wing takes place only on the upper surface, the lower spar being straight. So, before adding the top spars, pin the bottom skin to the workbench. Then add the U/C plate, the spar webs, and the inner L.E. strip.

Next fit the retract mechanism. The prototype model uses Powermax pneumatic mains, which are a standard "sport" 90° retracts, i.e., no fancy leg angles here — and the U/C plate has been oriented to accommodate this retract angle. The 1/8" ply shims used between retract mechanism and plate may be omitted if you use Rhom-Airs.

Cut the hole in the lower surface for the leg and wheel, and jiggle the whole lot about until retraction and extension of the U/C leg can be accomplished with no hang-ups. Then drill the bolt holes, and secure the retract mechanism to its mount.

Then make up the wheel outer door and its associated ironmongery, and get that to work. The "striker" pin starts the upward motion of the door, whilst the "closer" pin holds the door

SUPERMARINE SPITFIRE F22/F24

Designed By:

Gordon E. Whitehead

TYPE AIRCRAFT

Scale

WINGSPAN

55 1/2 Inches

WING CHORD

12 1/2 Inches (Root)

TOTAL WING AREA

550 Sq. In.

WING LOCATION

Low Wing

AIRFOIL

Semi-Symmetrical

WING PLATFORM

Elliptical

DIHEDRAL EACH TIP

2.4 Inches

OVERALL FUSELAGE LENGTH

49 1/2 Inches

RADIO COMPARTMENT SIZE

(L) 7 1/2" x (W) 2 1/4" x (H) 4"

STABILIZER SPAN

19 1/2 Inches

STABILIZER CHORD (inc. elev.)

6 1/4 Inches (Max.)

STABILIZER AREA

105 Sq. In.

STAB AIRFOIL SECTION

Symmetrical

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

10 1/2 Inches

VERTICAL FIN WIDTH (inc. rud.)

8 3/4 Inches (Max.)

REC. ENGINE SIZE

.45-.61 2-Stroke

FUEL TANK SIZE

10 Oz.

LANDING GEAR

Conventional

REC. NO. OF CHANNELS

6

CONTROL FUNCTIONS

Rud., Elev., All., Throt., Flaps & L/G

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage Balsa, Ply

Wing Balsa, Ply, Spruce

Empennage Balsa

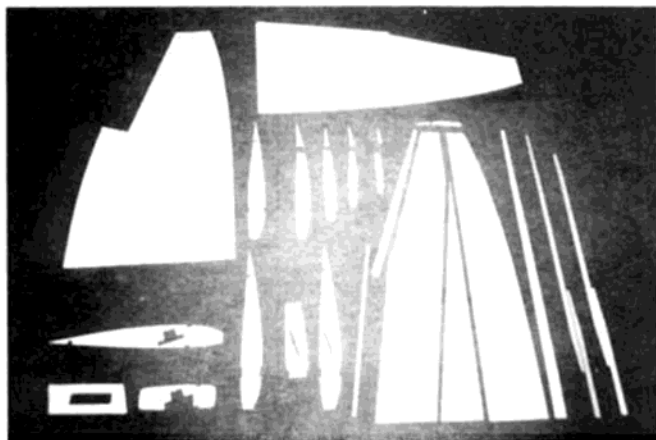
Weight, Ready To Fly 120 Ozs. (7 Lb. 8 Oz.)

Wing Loading 31.5 Oz./Sq. Ft.

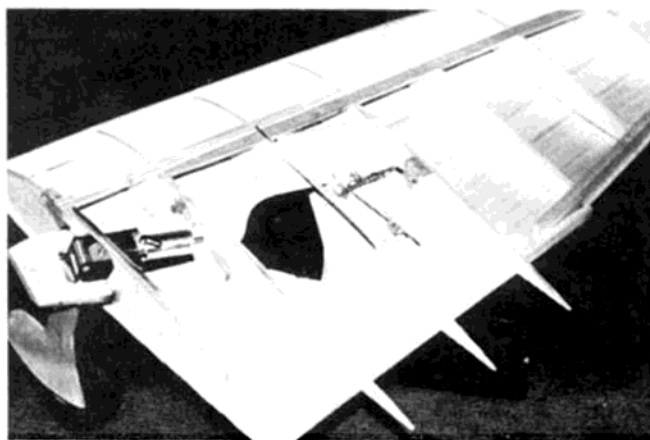
judge where to cut out the wheel doors.

The fuselage is now sanded smooth, and the cowl blocks profiled. The rocker fairings are added next. Then you cut out and hinge the tailwheel doors, and play around with the door linkage until you get the doors to close neatly.

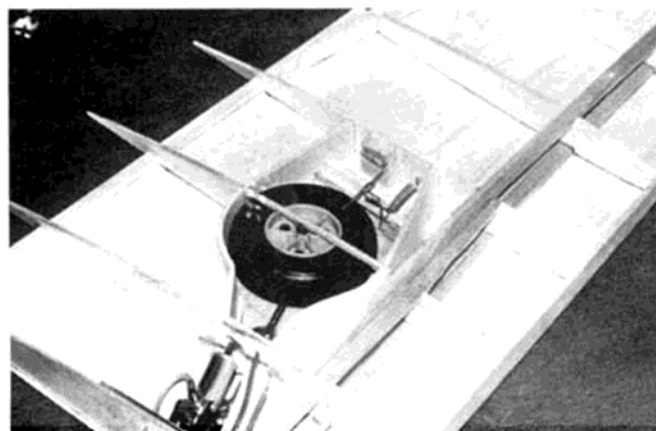
The wing root fillets are not fitted until after making the wings.



Complete parts layout for a wing panel.



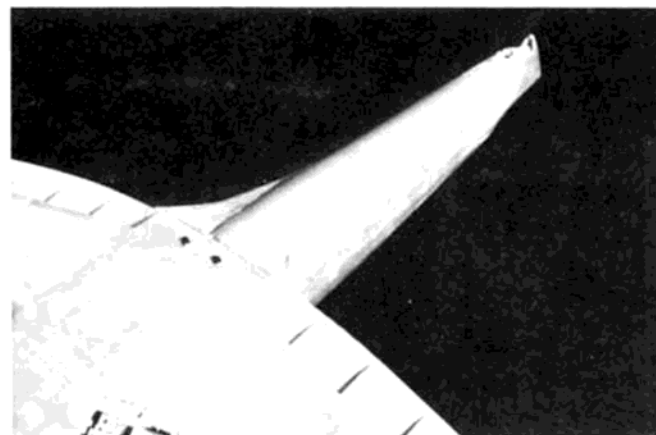
Retract installation viewed from top.



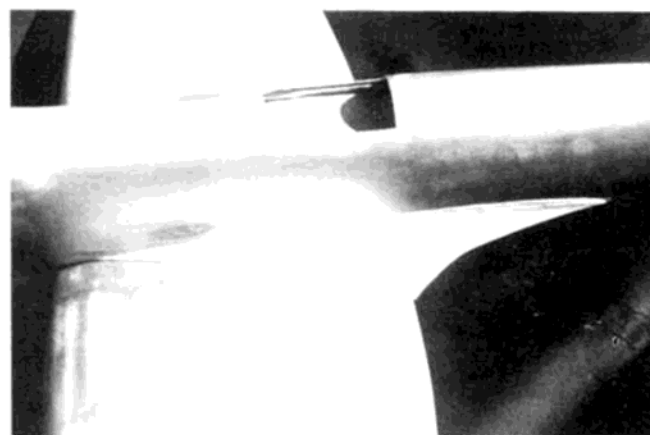
Checking retract operation before wing is completed.



Making the wing fillet. Note that gussets need hollowing more.



Fitting lower rear fillet skin.



Real F24 has this paneling arrangement.

closed. The light spring keeps the door open with the gear extended. Make the door hinge pins removable, so that you can take the door off when necessary.

The U/C leg covers are made from thin ply and balsa, and clamp to the leg as shown on the plan, so as to be flush with the wing undersurface, except for the bulged cover over the wheel. Dummy oleos can be made to camouflage the leg.

The wheel well webs are fitted next, followed by the aileron and flap snakes. Lay the wing panel on the bench and insert the washout shims.

Note that the outer shim is thinner at the tip. Using aliphatic glue, add the top wing skin, pinning it to the various internal members and weighting the whole lot down to ensure that the correct twist is built in.

Now make the opposite panel.

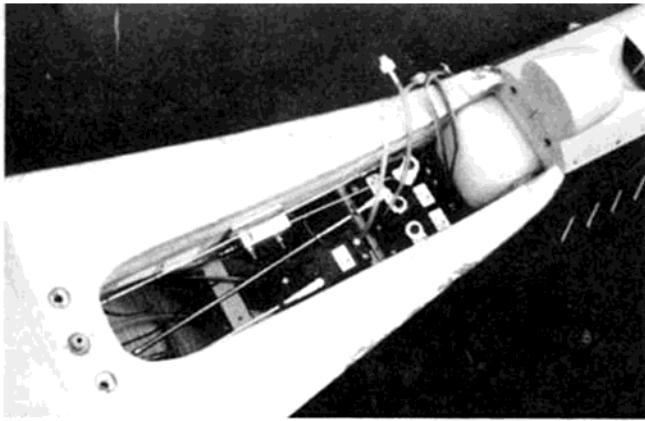
Make up the centre section less top sheet. Join all three wing panels together at the correct dihedral, and then add the centre section top skin. The T.E. shim will keep the centre section warp-free during this operation.

Add the outer leading edge strips. Make the flaps and ailerons flat on the

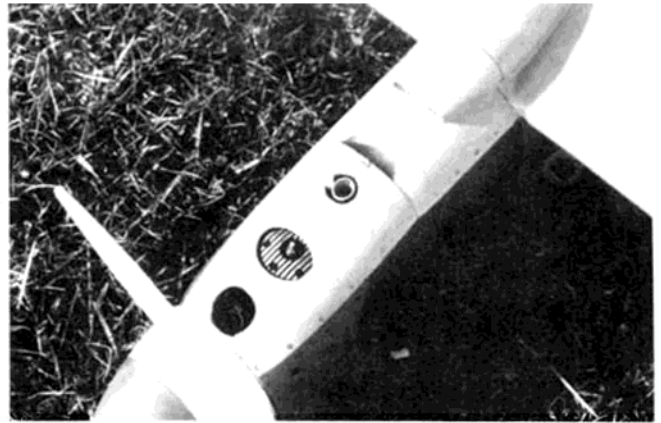
workbench, and hinge these to the wing. Check for full and free movement, but don't secure them until covering has been done. Fit the upper wheel blisters and shape externally, and hollow out internally to clear the wheel.

Covering:

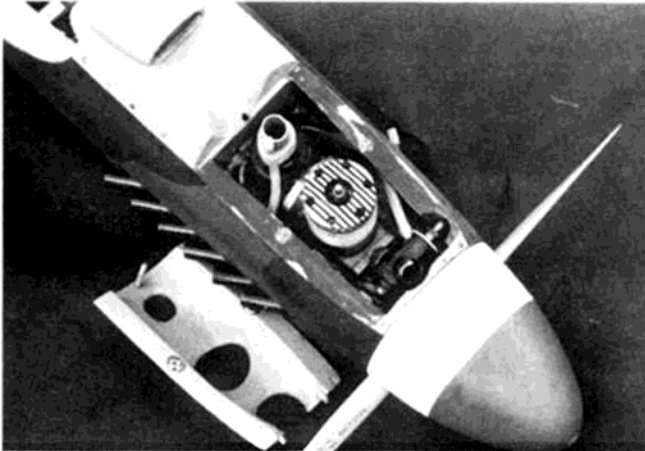
I covered all the separate components of my model (including all wheel doors) with .55 oz./sq. yd. glass cloth and epoxy resin thinned 25% with Isopropyl Alcohol. To prevent excessive build-up of resin, I used the toilet roll technique when applying the first coat. When the first coat had



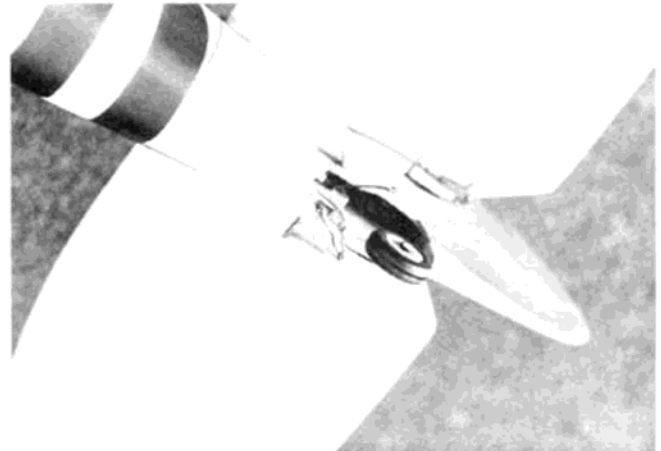
View from bottom showing servo installation.



Neat cowling arrangement. Top side is clean and smooth.



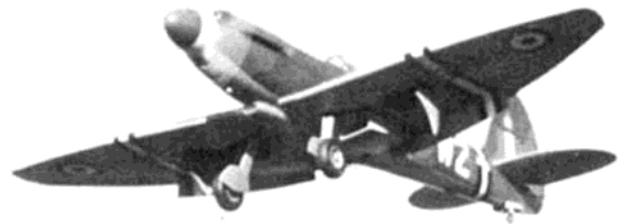
K & B 6.5 with earlier muffler (which fell apart).



Retract tailwheel showing doors.



Could very well be the real thing.



Everything down for landing approach.

set, I brushed on a second coat, which was left for 48 hours before sanding down to a smooth finish using 80 grade "Production Paper." This relatively coarse paper left a sufficiently smooth finish on the epoxy without requiring following up with finer paper. Furthermore, wet and dry paper hardly touched the epoxy. Thanks are due to Dan Parsons for this tip. See Dan's ad for the epoxy and glass materials in RCM.

Wing Fillets:

Adding the wing fillets after glassing the wings ensures an accurate fit. Clamp the ply bottom plate between wing and fuselage and add the fillet gussets. Then fit the rear fillet bottom skin. This goes flush with the wing lower surface. The slight upward curve of its outer edge is achieved using Scotch Tape while the glue sets. See photos. Glue 1/16" x 1/8" balsa edging strips in place before

fitting the fillet upper panels. Five-minute epoxy is used to assemble the fillet. After sanding the fillet to blend with the fuselage and wing, epoxy/glass the fillet.

Final Assembly:

Epoxy the tail feathers in place, and fair the fin root L.E. with epoxy and microballoons. Add the cannon bulges and any detailing you like. I simulated panel lines with 1/64" drafting tape. Even though raised panel lines are

The air cooling holes shown on the plan allow a good throughput of air, and my engines have suffered no overheating to date.

If you own only side exhaust engines, don't let the lack of internal silencer space deter you from building the model. Hang a dustbin or torpedo silencer on the side and enjoy yourself!

Radio:

Position the avionics as far forward as possible. The RX fits above the elevator servo, and is wrapped in foam. The rudder, engine, and retract servos are three abreast just behind the tank, with the battery pack above them between F3 and F4. The elevator servo is taped to the LH web P1, and the pneumatic air distribution valve is screwed to the RH one. The retract filler valve is located on the wing bolt plate, and projects through a hole in the wing centre section T.E. The RX antenna passes through its own snake tube, run internally through the rear fuselage.

I made a slight but significant modification to my JR 8 TX to accompany this plane. Previous experience had shown that it is a poor idea to have the retract switch on the same side of the box (RHS) as the main aileron/elevator stick.

I relocated the switch to the left side of the transmitter, interchanging it with the less frequently used rudder rate switch. This change makes it easier to operate the retract switch in those situations when distraction from the main controls is least wanted, like just after take-off, or when you've had an engine flameout and wish to delay extending the landing gear until just before touchdown. This mod is such an improvement that I have similarly altered my 7 channel and 5 channel JR equipment as well.

The flaps can be operated by the small proportional auxiliary lever, so that you can select any angle of flap between up and fully down. This feature is more useful than a straight "up" or "down" flap choice, as will be

seen in the later section on flying. A useful feature of the 7 channel and 8 channel JRs, however, is the coupled flap/spoiler feature. First zero the elevator flap coupling for safety. Then, by cross-coupling spoiler and flap, you can drive the flap channel with the 3-position spoiler switch and achieve a very useful 3-position flap function, i.e., up; slight droop for takeoff; and full droop for landing.

Painting:

I found that the best paint to use was Humbrol matt enamel brushed on; the Humbrol range of colours provides everything you want for this ship. The roundels and squadron codes were applied using a drawing pen either mounted in a compass, or used with a flexible straightedge to define the outlines, filling in with a brush. I used matt Aerokote fuelproof. (*Editor's Note: There are many excellent paints available for this aircraft. The Humbrol line, to our knowledge, is not available in the U.S.*)

Preflight Checks:

Epoxy sufficient lead inside the cowl so that the model balances where shown on the plan. My ship started life with 6 ozs., but all of this ballast was eventually removed.

Run a couple of tanks full of juice through the engine to check throttling. I always secure the tail of the model with a length of nylon cord to a stake in the ground for this operation.

Check that the flaps operate freely and together. Those on my model have warped slightly with age, and they do not close perfectly now. However, flying behaviour appears to be unaffected. So if you can't get them to close up fully, don't worry. I've already tried out poorly fitted flaps for you!

Squirt plenty of the recommended lubricating oil into your retract pneumatic cylinders to ensure smooth operation, and cycle them at least 100 times to verify their reliable operation. Using the Sonic Systems pump, I equate five pump strokes to one retract cycle. I pump back up after every flight. But after five flights, I cycle the system down to low pressure, and then pump up the full 35 pumps.

When you first run your engine up in this ship, you'll find that the revs will be at least 500 rpms down on what you might have been used to, and this is because of the drag created by the relatively large diameter spinner. I have recently been considering replacing the now well used X45 with my much older, but more torque O.S. .61 FSR, in an effort to simulate the Rolls Royce Griffon a bit more convincingly.

Don't forget that a beauty like this ship is going to attract a crowd at the flying field. I've seen 'em stand shoulder to shoulder and two deep at

Sepulveda Basin, in California, all admiring a particularly attractive scale model of the Grumman F7F Tigercat. So, make sure that you've done all your preparation before you get to the flying field, so that you can give the guys something worth waiting for. In the above instance, the crowd slowly melted away, disappointed, because it was obvious that disorganization was going to prevent the first flight that day of the F7F.

So aim to get to the field with a model that needs the minimum of preparation before flight.

Take-off:

At take-off I droop the flaps around 1/4" to 3/8" to generate a little extra lift. This is because I fly from a fairly bumpy grass strip, and I like to get the model airborne fairly quickly. Used as just described, the flaps are satisfyingly effective, and you should leave them drooped until the gear is retracted and the model is quite high. The pilots of full size Seafire carrier aircraft used the same technique for their takeoffs from carrier flight decks. Because their flaps were compressed-air operated, and were either fully up or down, they could not select a partly extended flap from the cockpit. So they had the flaps held ajar about 15° using blocks of wood supplied specially for the purpose. Once safely airborne, a quick push-pull on the flap lever would jettison the blocks, and return the flaps fully up.

Use high rate throws for all take-offs and landings. On take-off, you need to open the throttle fairly slowly, and hold full up elevator for the first few feet, otherwise she'll nose over. When you're trying to start the take-off roll on grass, many models will not start moving until the engine is almost at full bore. If you have this problem, try see-sawing the rudder fully from side to side. This trick often starts the model moving one wheel at a time, and once rolling, you're in business. You will need to hold full right rudder until she leaves the ground to prevent a sharp tail swing. As the speed rises, let the tail rise, and she'll fly herself off.

In Flight:

Once safely airborne, select wheels up first, followed by flaps up after the climbout. The initial rate of climb at 7½ lb. weight on the engines I've used so far is not spectacular, but it's safe. Once she's at a good height, you'll be able to have yourself an air display.

With everything retracted, the handling of this ship is very pleasant throughout the entire speed range. Lowering the flaps a little adds buoyancy, whilst lowering them a full 80° produces lots of drag, as well as lift, but doesn't disturb stability; there is a

slight pitch-up tendency at all flap settings. Lowering the landing gear by itself introduces a certain amount of buffeting, and causes the model to rock and slip slightly from side to side, making it feel a little unstable. Lowering the flaps to the take-off position smooths the ride considerably, and with full flap and gear down she flies smoothly again.

So if you wish to make a fixed gear version of this ship, I would recommend that you do not cut the wheel wells out. You should omit the leg fairings and not fit the inner doors. These stratagems should serve the dual purpose of causing minimum disturbance to the stability of the ship, whilst keeping the gear fairly unobtrusive.

At a good height, explore steep turns, stalls and spins. When the model is in a slow and fairly well-banked turn, it tends to overbalance into the turn, and you can find yourself having to back off and perhaps hold a little opposite aileron. At intermediate and high speeds, no such effect is apparent.

The stall is innocuous, and there is slight left wing drop. Spins are safe to perform, and the exit is rapid with centralized elevator and opposite rudder.

The F24 rolls beautifully; any type of roll from a large barrel to a 16-pointer is delightfully satisfying to perform or observe. When I'm on form, I can manage sequential 2, 3, 4, 5, etc., up to 16-point rolls alternately up and down the field, with a half reverse Cuban in-between each leg.

Loops from level flight are possible, but not large enough to match the muscle that this ship should display. All climbing manoeuvres are best preceded by a long gentle dive for speed. That 500+ rpm loss mentioned earlier makes itself felt in any upward-going manoeuvre, but even so a complete upward roll, with a push over to level flight at the top, is just possible.

If you pull the ship into a vertical climb, and keep it going until it's prop-hanging, the scale downthrust will always pull the ship nose-down. This is a characteristic that can spoil an attempt at a Hammerhead.

When entering loops and Hammerheads, you need to add a large amount of right rudder to prevent the model from screwing out to the left. This left going tendency makes it easier to go left at the top of the Hammerhead, and makes use of all that right-to-left rudder travel you'll have available.

At the top of a loop, you need to centralize the rudder, or she'll skid sideways.

In blustery conditions she'll fishtail, in common with many other WW II

fighters; I mention this characteristic so that the first time it happens, you don't blame a glitch.

Landings:

I've mentioned that the stability characteristics of this ship with flaps and LG lowered are good. What I didn't mention earlier is just how darned effective those flaps are as air brakes. Full flap creates masses of drag, and for straight and level flight with full flap deployed you will need at least 3/4 throttle. At lower throttle settings, necessary of course when landing, you must keep the nose **pointing down**. Otherwise, those big barn doors will stop her in mid air and she'll stall. This amount of drag is a fantastic bonus in fact, and enables a quick steep descent to a smoothly controlled touchdown to be performed much more easily than without using flap. Here is how I land the model.

First, at a good height, I select high aileron and elevator rates. During the downwind leg, flown at about twice the height that you'd expect, I droop the flaps to take-off position, lower the gear, and reduce revs to about 1/2 power. In a gentle descent, I curve the model into its glide slope, and deploy full flap and put forward pressure on the stick to push the nose down. I keep my thumb on the throttle stick in case more oomph is needed. I aim the model, in a steep descent, at the threshold, and level off and throttle back just before touchdown.

There is little fear of overshooting the landing area using this technique, as the ship comes down like a parafoil, taking bystanders quite by surprise. In an undershoot situation, be ready to open up to full throttle until the model is in a better position. In an overshoot and go-around, open the full throttle, reduce flap to the take-off setting, and go and enter the downwind leg again.

If you're landing the model dead stick, bring her onto the landing leg with flaps and wheels up, at a fair speed, in a fairly steep glide. Lower the wheels and part flap. Only deploy full flap — and you'll **need** to deploy it if the model isn't to keep on floating for miles — when the model is safely over the threshold. Don't let the nose rise above horizontal, but let the ship settle onto the ground in a wheely.

The flying shots say it all, really. My thanks to clubmates Chris Salmon and Tom Jackson for their perseverance with their cameras.

Happy landings!

References

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- Spitfire — Story of a Famous Fighter. Harleyford.
- Supermarine Aircraft — Putnams. □

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