49" VULCAN

So here we are, one year on from the 2013 RCM&E Special and another war bird to whet your appetite. Now as many of you may remember, we always tried to keep the subject matter for the free plan, a reflection of the people's voice. We do this by having an on-line vote on the RCM&E's Modelflying web site, for yours truly to design the subject with the most votes.
This year, we didn't do the voting process on the basis I had gathered quite a list of runners up, so I'm now having a 'dip' through the runners up and picking out the one that I have always wanted to do. Now this may seem a little selfish, but this model was in the top 5 of the 2012 online vote and as 2015 is likely to see the last flying subject being finally grounded, I thought it was only fitting to pay my own small tribute to what is a personal favourite of mine.

So for this year's subject, we decided to do the Avro Vulcan

I have no doubt the Vulcan will be very well received by all aero-modellers both young and old alike, judging by the vast numbers who had previously voted for the subject to be modelled.

Now, as part of the design process, I decided to ask a few question on the 'Modelflying' forum as to what modellers would like to see incorporated into the design. As usual, you didn't disappoint. However, the trouble with asking questions is the amount of 'wants' you get, so you really have to sort them into the practical and the 'not so' practical. The only problem was I really wanted to do this model and even the not so practical were all doable…..so here is the top 5:-

- Around the 50" span and be made in one piece.
- To be powered by ducted fan, or twin pusher prop or a single tractor prop installation.
- Designed for both hand launch and ROG.
- Retracts to be fitted if possible.
- To be simple in construction and scale in appearance.

Now if I wanted to make life easier, I should have picked only a couple on the wish list, namely a 50" span and a pusher configuration.

Trying to marry all of them together was clearly not going to be an easy. Initially I thought that building one Vulcan and converting it to the alternative forms of propulsion was the way to go but I soon realised it wasn't that simple. All the configurations needed testing as it wouldn't be fair to build one version and then leave it to the builder to work out how to build the others! It did transpire that all three power version did require a major re-design.

I needed to design a base structure capable of housing all three variants. This wasn't too difficult and the plans quickly took shape. The thought of building three variant didn't fill me with excitement, due mainly to having a very short span of attention. So building one after the other wasn't an option….so I decided to build all three variants at the same time so three sets of fuselages, three sets of wings, three sets of fins and not to mention,

three sets of radio gear, retracts and electric flight packages!...this was going to be a long and expensive process!

I won't bore you with the finer details of the build yet but if you are a regular contributor to the Modelflying forum, and in particular the Vulcan thread will know the trials and tribulation the three Vulcan have caused. Needless to say that of the three that were built, only two have made it to the publishing stage! The tractor version was for some reason an absolute disaster. I had thought this version would be the test bed for the pusher and DF versions, but I couldn't have been more wrong. On test flying the tractor version, the model twice screwed its way into the ground from what were two very good hand launches. The third and final launch proved fatal but ultimately the same sequence of events happened. I could only put this down to the torque effect of the motor and the C of G position which is over 500mm back from the motor.

So somewhat taken aback and resigned to fact that I could be on the brink of total and utter failure….I prepared the pusher version for flight. So with full power applied and a gentle hand launch, I expected the worst! However, I couldn't have been more wrong…..the model climbed away beautifully and was a real peach to fly. Moving on the DF version, if ever I had a concern, it was with this variant. Being a little heavier and less well powered I thought we may need a bungee to launch this one. However with nothing seemingly to lose, the DF version was hand launched….she gently sunk a couple of feet, levelled off and climbed away smoothly!. The DF version turned out to be a real smoothy and is my favourite out of the two remaining.

So all these years of designing and you think you know what your doing, only to be put in your place!....

So there's a potted history of the highs and lows.

The only thing that you'll have to decide is which version to build. Fortunately, the plan shows both variants so you can look at the pros and cons of each and then decide.

To assist the builder, I have once again made available a Vac form set and CNC pack for those who wish to make the build a little easier. For this years model, the CNC pack and VAC set will ONLY be available though Tony Nijhuis Designs Ltd (TND) and not Myhobbystore. The plan itself will only be available in the RCM&E Special edition with future copies of the plan only being available through TND Ltd.

A few other points to note, the retracts unit and oleo legs have been source and available through TND and a bespoke electric flight package for the pusher version, can be sourced from 4-Max.co.uk.
The 50mm fan units and controllers were sourced from hobbyking

Lastly and possibly the most important, a photographic build log is available as a free download to print out from www.tonynijhuisdesigns.co.uk. These photos will be invaluable and I would suggest downloading both version; yes there are two…one for the DF version and one for the pusher version, so you can familiarise yourself with the build.

So assuming you have decided which variant to build, let's crack on.
Unfortunately we don't have enough space in this article to do a separate write up for both the pusher and DF version, so I'll concentrate on the pusher version but will make reference to the DF version where appropriate.

Fuselage section

Begin cutting out all the wing rib from W1 through to W11.
W1 & W2 are used in the fuselage section.

Now make up a pair of FS1 & 2. Glue these square into the slots on W1. For the ducted fan version, line the top & bottom edging of FS1 & 2 with 3mm sq hard wood as shown on the plan.

Cut out the rear bottom sheeting (denoted on the plan by the arrow edging) and pin this over the plan. Glue W1 on to the centre of the bottom sheet.

Now fit W2 to each side. You may want to use a wing spar and clamp this to W2 to keep itstraight and true. Use also a set square against W2.

Now fit the 6mm x 3mm front swept & rear top spars.

Now sheet the top of the fuselage from the rear edge to the front swept spar. The first 200mm or so of the sheeting from the rear edge can be made in one piece. As you move forward, the sheeting will have to be cut along W1 so it cranks over W1.

Now construct the nose section using F1 to F6 and S1 to S3 pieces. These pieces should interlock together and thin cyano applied to secure.

Now slot the nose section into the main fuselage section and fit the nose retract framing pieces F20 to F22.

Now fit the bottom spars which mirror the top spars fitted earlier.

For the pusher version, sheet the underside of the fuselage leaving a small section out where the wing spars need to join. This is so you can easily apply glue to the mating edges.

For the DF version the thrust tubes need to be made up. Fit ER1 and RF1. Mark the position of where the tubes go on the bottom rear sheet and remove these sections of wood. You will also need to scalloped out through the top sheeting too.

Now fit the fan units and tubes. Its best to run any power & control cabling as things can get a bit cramped from here on.

Fit ER2 and now you can sheet between ER1 & ER2 (template for these sheeting pieces are shown on the plan).

Secure the fans and tube into position and now sheet the bottom between FS2 and the front swept bottom spar. Note; the sheeting at FS2 should not extend over the 3mm sq edging.

The next sequence applies to both versions.

Fit the air intake top & bottom leading edges between W2 and F6. If you are going to fit retracts, install the nose retract support bearers.

Now cut some pieces of 6mm sq balsa and glue these between the intake leading edge and S2. Align another piece of 6mm sq balsa to fit between the top and bottom swept spars. These pieces will support the edge of intake duct.

Now continue to sheet up to the duct leading edge, noting the cut / curved edge on the bottom piece.

Begin to sheet the nose section. There are template shown on the plan for the pieces that fit between F5 & F6.
From F5 to F1, you can either sheet in 'hooped' fashion between the formers or plank longitudinally between F1 & F5.

Now build up the top turtle decking. Working from the rear, mark the positions of the half round formers F14 to F7. Begin by gluing F14 & F13
into position, using the angle templates to set the correct angle against the fuselage.

Glue the remaining formers into position making sure they run straight and true along the centre line of the model, then fit the top stringer.
Using the template shown on the plan, cut out left and right sheeting pieces. Offer these up and trim where necessary. Glue one sheeting piece into position and mark the position of where T6 goes against F14

Now enclose the turtle decking with the remaining piece.

Make up from 12mm laminated balsa, the nose block and glue this into position. Roughly shape ready to sand later on.

Moving on to the air intake ducts, begin by using the template dimensions shown on the plan and using soft 1.5mm balsa, make up a piece to the sizes shown. Now wet one side and begin to roll the sheet (with the grain) with the wet face on the outside. Glue the edge to enclose and make a cylinder.

Now squash the cylinder to a flat oval shape and add some packing (about 35mm thick) so the tube is made firm to aid cutting into two pieces. First mark the cut line on both sides, then using hacksaw blade, cut the cylinder diagonally into two pieces.

Making sure the pieces remain wet and plyable, squash and insert them into the fuselage intake openings. Adjust the position of the duct tube so the diagonal cut edge overhangs the front edge of the opening by a couple of millimetres.

When happy, glue into position and trim the edges flush.

Test fit the intake fairings (made from 3mm lite ply) and trim so these fit flush against the air intakes. At the opposite corner of the intake, insert a piece of 12mm triangle. With a sanding tube, shape the piece to the profile of the curve duct.

Now make up the rear fuselage section using parts S4 to S6 and F16 to F19. Do not glue F16 to the structure yet.
Cut a slot in rear fuselage parallel and against F15. Insert F16 and glue this centrally to F15. Now glue the rear fuselage section into position.

Now sheet the structure. You can either sheet in a 'hooped' fashion between the formers or plank longitudinally between F16 to f19

WINGS

The wings are a traditional 'built up' construction and are made over the plan. The sequence detailed below should be followed closely to avoid construction difficulties.

Begin by taking the 6mm sq rear lower spar and notching for ribs W9 & W10. Then chamfer the top notched face between W9 and W11 as detailed on the plan

Now pin the rear lower wing spar on to plan. Glue UC1 to W4 & W3 remembering to make a pair of left and right hand sides. Now fit all of the wing ribs remembering to use a set square against W3. Now fit & glue the trailing edge making sure this is pinned firmly to the plan. This is important as the wing shapes is 'lock in' from this point on.
Add the top rear spar remembering to notch and chamfer as done with the bottom spar.

Now add the top forward spar and again, check W3 is square using a set square.

Cut to length the centre inner leading edge and glue this into position. Then add the two remaining inner leading edge pieces. Once again use a set square against W3 when fitting the leading edge. Any twist in W3 will mean the wing wont fit snugly against W2 when the final join is made.
Use 12mm triangle to secure the leading and trailing edges to W3.

The wing can now be removed from the plan and the retract mounts fitted

Build the other wing to the same level of finish.

Now test fit the wing structure onto the fuselage and make any adjustments to the spar joints. Take note that W3 should be centralised against W2 to take account of the wing sheeting that needs to butt against the fuselage sheeting.

Use a white glue or epoxy to secure the wings to the fuselage to allow final adjustment and use plenty of glue where the wing spars join the fuselage spars.

Now the top of the wings can be sheeted with 1.5mm balsa

At this point, fit the servo mounts and the wiring. For the DF version, make up the wing battery compartments

Now sheet the bottom of the wing and make good the slots left open on the fuselage section (pusher version)

Using a sanding block, blend the wing sheeting into the fuselage sheeting.

Trim any overhanging material and make up the three section outer leading edges. When happy, fit these and profile to the shape shown on the plan.

If retracts are being fitted, trim the bottom sheeting (as shown on the plan) to reveal the retracts mounts and oleo leg / wheel wells. Also cut to reveal the elevon servo mounts and DF version battery compartments.

Using 12mm sheet balsa, make up the wing tip and glue these into position

Now make up each individual ailerons and elevators as shown on the plan. Start by cutting to shape the bottom skins. Now trim and fit the leading edges which is made from 6mm sheet balsa. Now make up and fit the riblets and the control horn support block. Finally enclose with the top skin and trim to shape as shown on the plan.

The elevator and aileron is joined to form a single elevon. A pin and tube arrangement is detailed on the plan to provide this 'link'.

Dry fit the elevons and making sure the root sits flush with the fuselage. Mark the tip aileron position and profile the wing tip around this. There is very little reflex required with this model but it is important the elevon position reflects the wing rib W11 profile shown on the plan.

FIN

The fin is constructed over the plan. Firstly, make up the fin post to the shape detailed on the plan. Now add the fin ribs T1 to T5.

Fit the 4.5mm x 3mm spar on to one side then remove the fin from over the plan.

Add the remaining 4.5mm x 3mm spar.

Position and fit T6 and fit (from 3mm sheet balsa), the fin inner leading edge.

Now sheet the fin both sides with 1.5mm balsa and trim any overhang. Note that the sheeting at the base of the fin should match the profile shown on the plan.

Make up the fin tip from 12mm balsa and the fairing pieces from scrap balsa.

The rudder is made in a similar fashion to the elevons.

FINISHING OFF

As there is still a far bit to do, I would suggest the fin is fitted later to avoid damage.

With the pusher version, glue into position PF1 & PF2. A small section of the sheeting behind the motor opening in PF1 will need to be removed to allow the short length of 32mm Phenolic tubing to be inserted through. Once done, cut two lengths of tube (available from SLEC Ltd) and epoxy glue these to both the recess and PF1.

Finally glue into the end of the phenolic tube, the motor support ring PF3.

At this point, fit the motors and hardware. Cut all the necessary access hatches and trial the radio and power systems. Also fit the retracts and test these work, making sure they do not foul the structure.

Finally make up from 12mm sheet balsa, the tail block and shape to the profile shown on the plan.

For the DF version there is a large VAC formed hatch to fit which accesses the fans and tubes plus the avionics. To make more of a defined edge line against W2 and for something to screw the hatch to, cut two lengths of 6mm sq hard balsa and line the bottom inside edge of W2. Trim the VAC formed hatch so the return edges on the front and sides protrude down by approximately 3mm. The back edge return should be cut away so this sits flush over ER2. The hatch is secured with 4x 2mm self-tapping screws.

Finally fit the fin. The top turtle decking will need to be cut between F14 & F15 and approximately 15mm beyond F16. Leave the top stringer in position but remove any of the sheeting left attached to it.

Test fit the fin and keep trimming until the slots in T6 and the fin post fit snugly against the turtle deck stringer.

When happy, glue the fin into position.

Now make up the fin strike (fillet). Mark the positions of T7 & T8 and glue these into position. Add the top edging made from 3mm balsa and butt glue this against T6.

Sheet the fillet sides using 1.5mm balsa.

Cut and fit the fin outer leading edge and make up (from 12mm balsa) a solid fillet piece linking the fin to the strike.
Finally, shape and sand to a smooth flowing profile as shown on the plan.

Now do a final sand of the whole model.

To add a little more strength to the wing joint, cut a 50mm strip of wing tape and apply this to the joint, securing with either PVA or epoxy. Bucks Composites should be able to assist with the fibreglass cloth

COVERING

Both prototypes were covered using silver iron-on Easycoat from J Perkins and using 900 carbide paper, the shiny surface was removed ready for painting.

Hinges all the moving surfaces and secured with glue and pins. Fit all the servos and the all the control horns.

For the pusher version, the bottom VAC formed turtle decks can now be trimmed and fitted. The Vac formed engine blisters and the canopy can now be fitted. Note that the engine blisters for the DF version will need a little more trimming as they foul the turtle decking.

FINISHING

The prototype mark and type was based on the XH558 which I guess was the easy choice. The paints used were the small tins of Humbrol Enamels. The main colours are Dark sea grey and Dark Green for the top camouflage and Light Grey for the under surface (just to be different!)
.
The squadron markings and decal are available from Pyramid Models

For both, version, the C of G position should be achieved without any ballast

FLYING

So having given you an early taster at the beginning of the article, I'll go into a little more depth about the quirkiness of a Delta.

The first thing to note is the wing loading is very low so the Vulcan will be a bit of a floater and can be slowed greatly.

Delta wing forms will perform similar to a conventional wing aircraft during normal flight. They can be quite 'slippery' through the air and have quite a turn of speed when full power is applied. If you haven't flown a delta before, you will enjoy the experience. They really are the ultimate bank & yank model.

This slipperiness dose mean the landing approach can be quite fast if you don't apply some sort of braking. On the full-size Vulcan, there are no flaps, just fuselage mounted air brakes but as we don't have these there is a little trick which dose help to slow the model.

When a delta wing pitches up, it very quickly air-brakes. Fortunately, deltas are stall tolerant and will 'mush' and hold high alpha's before even considering tip stalling. So to slow the model up, a 'blip' of elevator can be used to air brake the model. Once slowed, the decent can be check with elevator and throttle.

If you opt to use retracts, the suggestion is to slow the model as much as possible to avoid 'bouncing'. If you are not using retracts, you shouldn't have this problem.

Both the ducted fan and pusher versions were tested with and without retract operation. The ground will need to be firm and grass cut very short to allow ROG. The ground clearance for the props on the pusher version is not great and during rotation from ROG, you will no-doubt hear the props clipping the ground. The ducted fan However will have no such problems.

Both models are a joy to fly. If I had to choose one over the other, the DF version possibly has the edge. It doesn't have the performance of the pusher, nor the duration or the scale appearance, but it is much smoother through the air (as ducted fan models usually are). Whichever one you choose to build, take pride in the fact you're keeping alive a piece of aviation history. Enjoy

Words 3833

Specification

Wing Span- 49" (1238mm)
Length- 48.5" (1212mm)
Weight- 3.5lbs (1.6kg)
Wing loading- 10oz/sq' (3.2kg/m2)
Motor- 2 x in-runner pusher
4 x 50mm ducted fan

Prices

Two sheet plan- £20-00
VAC form set- £30-00 (please state which version required)
CNC pack of cut parts- £72-00
Additional wood to complete the model- £65-00

Complete pack (incl all the above)- £177.00

Sales Enquiries- sales@tonynijhuisdesigns.co.uk or 07563 518159
Online ordering- www.tonynijhuisdesigns.co.uk