Avro York

Now when someone made a suggestion in passing that I should design an Avro York because he couldn't find a plan, kit or anything to build a model from, I thought he just wasn't looking hard enough. There must be at the very least, a plan of some sort, available from somewhere I thought! so I decided to have a look for myself.

Now for such a well known and iconic aircraft to go un-modelled I found very surprising. Needless to say I failed to find any modelling plans or kits but I did find a nice selection of plastic kits which had a popular following on various build forums throughout the world. One very popular livery which came up time and time again was the DAN AIR colour scheme and since constructing my prototype in the same livery, it has provoked a large number of modellers emailing me with their particular fond memories of flying in the real thing during the late 1940s and 1950s. Well it seems I under estimated the strength of feeling the York holds for a lot of modellers so deciding to produce a plan, was I guess the right thing to do, if only to fill a gap in the market.

Now producing any new design from scratch needs something more than just an emotive desire to do it. Fortunately the York shares a lot similarities with its military brother, the Avro Lancaster. Now those of you out there with a keen eye will see the similarities between the Avro York and my 72" Lancaster. In essences the same wings are used, the same nacelles and undercarriage, the same tailplane and the same fins. Effectively the only difference is the fuselage and an extra mid tail fin.

For anyone who has seen pictures of the York or in the flesh at Duxford, will notice the fuselage is a very simple square box structure. So with a new fuselage, gobbled together with my proven 72" Lancaster, it would seem silly to pass up a great opportunity to add a new design to my range with the minimum of fuss! Well the challenge was set and my Lancaster drawings were dug out and the modification process started.

When the original 72" Lancaster model was launched in December 2001, we had at our disposal the Sanyo SCR NiCad's and the ubiquitous 'Speed' 400 series of 'brushed' motors. Although Nickel metal Hydrides were around, these were struggling to match the performance of the NiCad's and brushless motors were still incredibly expensive. As a result the marginal power available gave the model a challenging weight target of around 5.5 to 6lbs. In 2006, the 72" Lancaster was given a facelift which saw the motors updated with gearboxes and other design changes such as a two piece wing, redesigned wing section and other subtle changes.

So here we all almost 6 years on again and it seemed a useful opportunity to yet again, 'tweak' the Lancaster design and incorporating these into the York. These tweaks predominately revolved around the up-grade of the power system, in particular, the motors to outrunner brushless and the batteries to LiPo's. I also found a supply of 3-bladed props which look pretty good and should satisfy the scale buffs out there. The retracts, undercarriage legs and wheels can also now be sourced directly from Tony Nijhuis Designs.

As with the Lancaster, all of the VAC forms are available in the form of a nose cone and a set of 4 engine cowls plus a set of scale spinners.

Building the York

The model has a traditional 'built up' construction (no foam), the fuselage being a box type structure with slab sides and sheeted top and bottom; pretty basic really!

The wing is one piece and built in three sections and fully sheeted with balsa. The nacelles are constructed on the wing and removable cowls allow access to the motors. The tailplane is fully sheeted over rib construction as are the elevators. The fins are sheet balsa, planed and sanded to shape.

Fuselage

Start by cutting out the fuselage sides from 4.5mm (3/16") balsa sheet and mark the positions of the formers. You will need to splice sheets of 900mm (36") balsa to make the fuselage sides. Now glue 12mm (1/2") triangle stock along the top and bottom inside edges of the fuselage.

Make up the fuselage formers and glue F3 and F4 into position on one side of the fuselage only. Glue the other fuselage side into position and fit the remaining formers. A small gap between F4A and F4B and F3A and F3 will be required to fit a hacksaw blade between in order to remove the top fuselage section above the wing.

Now add the wing and tail seat doublers WS1 and WS2. Now begin to cross sheet the top and bottom of the fuselage using 'medium' 3mm (1/8") sheet balsa Using a razor plane, begin to radius the corner edges along the complete length of the fuselage.

Now assuming you have ordered the VAC set, you should have a VAC formed nose cone to hand. Trim the rear edge of the nose cone and fit NR1. Position the nose cone centrally on to the front of the fuselage and finish off by blending the fuselage smoothly into the nose cone.

Finish by cutting away the wing section piece between F3 and F4 and trim the sheeting around the tailplane area.

If you are planning to fit a tail wheel, make this up as detailed on the plan.

Wings

The wing will be a one-piece affair and is constructed over the plan in three sections; the middle section and two outer wing panels. To aid the build process, jig tabs have been added to the ribs to help keep the wing twist free while building.

Begin by making the outer panel first. Pin the 6mm sq hard balsa front and main spars to the plan noting that balsa packing should be applied under the spar in the position shown on the plan. Now fit the ribs W4 through to W15, remember ribs W6 and W7 are angled to offset the nacelle against the wing dihedral and the spar at W13 to W15 is notched to allow the ribs to 'sink' in to. Fit the three remaining top spars and then fit the inner leading edge and the trailing edge at the aileron. At this point the wing assembly can be removed from the plan and the remain lower rear spar fitted. Now build the opposite outer wing panel to same standard.

Now build the middle wing section.

Trim to the correct length and pin down the front main spar over the plan only; note that the top and bottom front spars are made from 6mm sq obechi. Now fit the 9 off W1 ribs. The wing braces B1 can now be glued into position and the split rib W2 fitted.
The front top spar and the middle top spar can now be fitted. Fit B2 into position. Now fit W3 noting that W3 is angled slightly.

The inner leading edge, from 4.5mm balsa sheet, can be cut and glued into position.

The wing assembly can be removed from the plan and the remaining top and bottom spars can be fitted.

As directed on the plan apply the shear webbing between the top and bottom main and front spars, to all wing panels. The centre and outer panels can now be joined together at W3 and the top surface skinned with 1.5mm sheet balsa. The best way of sheeting large open framed wings and avoiding the ridges or steps you always seem to get when butting together sheets of balsa wood, is to gluing each planks together on a flat work bench which was been well waxed. This avoids any chance of the balsa sheets sticking to the work bench. Glue together enough planks to cover the whole wing. Then use a large sanding block (300mm long and 75mm wide) and sand the entire surface flat, removing any ridges caused by the joining of sheets. What you will be left with is a smooth seamless sheet of balsa ready to be glued, in one piece, across the wings.

At this point, all the power and servo wiring should be run through the wing to their respective positions and make up the aileron servo mounts on the underside of the wing. Make up the wing bolt support blocks and glue these between the first and second W1 as detailed on the plan.

The bottom skin can now be applied once the jig tab have been removed. There in no requirements for washout so make sure as you enclose the wing with the sheeting, that the structure remains straight. On the under side either leave out (or remove later) the bottom sheeting between W1 & W2 and W6 & W7 forward of the 'main' spar, for the nacelles to fix into.

Now trim any overhang or excess wing sheeting and fit the outer leading edge made from 6mm balsa sheet. Finally shape the leading edge to the profile as shown on the plan.

Next, make up the ailerons. This done by cutting the bottom sheet to size, then trimming and fitting the aileron leading edge, which is made from 6mm sheet balsa.
Now mark out and fit the ribblets on to the bottom sheet. When this is done trim the top of the aileron leading edge flush with the ribs. Finally enclose the structure with the top sheeting and then trim. To finish, angle the aileron leading edge as shown on the plan.

Nacelles

The nacelles are fairly time consuming but at least the cowls are made for you (that's assuming you've bought the VAV formed pack of course!).

The main nacelle structure lock together fairly quickly so it shouldn't take too long to see each nacelle structure appear ready for skinning. The motor bulk head

is set back slightly to allow for different types of Motor. For the prototype, I used the 4-Max setup as recommended by George Worley. This set up also allowed me to use some scale-ish 3-bladed props too.

Now glue the nacelle structure into the wings. Next cut and fit the retract mounts in the position shown on the plan. You will need you preferred retract mechanism to hand to set out the mounts correctly.

The inner nacelle sides are constructed in three parts and the outter nacelle sides, in two parts. On the plan you will notice the parts are numbered and direct you to cut along the lines shown. So firstly cut out all the parts and glue part 1 into position. You may need to wet the wood surface slightly, towards the rear of part 1 to aid the bending against the rear formers. When dry, parts 2 & 3 can be added. Notice that part 2 on the inner nacelle splays out slightly between NI2 & NI3 to give the undercarriage leg sufficient clearance. The rolled top planking can now be added between the fire walls NI1 & NO1 and the second formers NI2 & NO2 respectively.

At this point make sure you feed the power wiring through to all nacelles. Now trim the bottom edges of the nacelles and cross sheet with 6mm and 3mm sheet balsa as shown on the plan. Make up and cut to shape the tail blocks and glue into position.
To finish the sheeting, infill the gaps between pieces 1 and the underside of the wing with scrap balsa.

The nacelles are almost finished now but do not profile until the cowls have been made and fitted.

Cowls

With the CNC pack you will have four cowl edge support rings. These give the cowls rigidly when fitted to the nacelle.
Firstly, trim the cowls and open up the front for the motor shaft and the air intake.
Now fit the support rings to the cowls. Trim any excess plastic overhanging, flush with the support ring. Position the cowl on to the nacelle making sure it sits centrally.
Once happy either tack glue or use small screws to secure the cowls into position. The nacelle can now be sanded flush with the cowl. To protect the cowl against sandpaper scratches, it is worth masking the cowl edge with tape.

Tail & Fin

The tailplane is a built up affairs and constructed over the plan. The ribs are fully symmetrical so it doesn't matter which is top or bottom. However you will need a small amount of dihedral built in, so when you build the tailplane over the plan, it is effectively upside down! The dihedral is produced as a consequence of the ribs tapering. When you remove and turned over the tailplane, you will get the picture so to speak!

Firstly, cut and pin the trailing edge and the 'top' spar to the plan. Now fit the ribs to the spar and the trailing edge. Now trim and fit the inner leading edge made from 4.5mm sheet balsa. Note this is made in three sections. Now fit the bottom spar. Twin rudder servos are shown controlling each rudder and now is the time to install the servo mounts and wiring to each of these.

Trim the trailing and leading edges flush with the ribs and sheet the underside with 1.5mm soft balsa. The tailplane can now be removed from the board. The positive dihedral should be just noticeable to you now! The top sheeting to enclose the tailplane can now be applied. Note that the sheeting will stop and start again at T1 to allow the centre fin to be positioned.

The outer leading edge can now be applied and the rear tips blocks cut to size and fitted. Finally the shape the leading edge and rear tips to a smooth flowing curve.

The elevator is made from a 3mm balsa centre core cut to the size of the elevator. The leading edge is cut from 6mm sheet balsa to match the depth of the tailplane trailing edge. The leading edge is glued centrally to the core. 2.4mm riblets are then applied to the top and bottom of the centre core as detailed on the plan. This effect gives an 'open framework' appearance for the elevator.

The fin and rudders are part of the CNC pack and are made from 6mm balsa sheeting. They only need shaping to the profile as shown on the plan. Only glue these into position just prior to covering the model.

Back to the Fuselage

The wing bolt retaining plate can now be fitted into the fuselage and the securing dowels fitted into the wing leading. Make the corresponding dowel locating holes through F3 and fit the wing. Make any adjustment at this stage and when happy, mark out the wing bolt positions, then drill both though the wing and the wing plate together. Finally fit the captive wing nuts and secure the wing to the fuselage.

Now trim and fit the fuselage wing piece (top piece between F3 and F4) and glue this to the top of the wing to effectively make a fairing. Remember to make holes in the fairing so the wing bolts can be accessed.

Moving back to the fuselage, cut from balsa, the tail block and shape to a smooth finish. Now glue the tailplane on to the fuselage checking that the tailplane is parallel with the wings.

Some scrap balsa is used to blend the fuselage top edge smoothly into the tailplane

Covering

For covering on the prototype I use red and white Easycoat solarfilm and grey Profilm. This base colour scheme matched the Dan Air colour scheme nicely without having to dip into the paint pots (too much any way). The darker grey nacelles and stripes over the wing were indeed painted using a matt Humbrol enamel (No27) and the spinner were painted a matt red.

Finishing

The main decals and the art work, were all supplied courtesy of Pyramid Models. These are now available as a set through their website.

Fitting out with radio is quite straight forward and is generally all contained under the wing section of the fuselage. To access the flight packs you will need to remove the wing as these fit just forward of the C of G.

Powering Up

As I mentioned earlier, electric power has moved on quite a bit since 2006 and the release of the 72" Lancaster. The power available back then for this type of model was always a little marginal but we now have no excuses with a plethora of great value brushless motors and controller to choose from and high performance Lipos also.

As mentioned earlier, I used the power selection as recommended by 4-Max. In short I used four 210watt 1300kv motors, each with their own 25amp speed controller and connected to a single 3S 5000mah Lipo. All the speed controllers were 'Y' leaded together into the throttle output of the receiver.

Flying

I have to say, my expectation were high for the first test flight as the model was effectively a modified Lancaster so C of G position, aileron and elevator movements could be matched to the York without too much concern.
The first test flight took place as always with the model uncovered. With 800watts of power at my disposal, I had no worries regarding whether the power would be sufficient. In fact I was pretty confident all round. So only thing I could do to upset this confidence was to pick a foul wet and windy day to test fly it. Although I didn't set out with a day like this in mind, as I arrived at the Hastings MFC flying field, the weather closed in and the wind began to gust up to 30 mph. Now I should have called it a day or maybe waited for the weather to clear but I decided to temp fate and have a go.
Without further a do the York was lined up into wind and the throttle opened progressively. The tail rose almost instantly and there was no swing as speed was quickly achieved.

After some 15 feet elevator was progressively applied and she was away. Gaining height in the blustery conditions wasn't too difficult and by the end of the first circuit she was cruising at around 100m. With a few click of up trim and she was flying hand free, straight and level at around two thirds throttle.

Although the York was same weight and had more power than the Lancaster, the model wasn't as sprightly but did feel much more stable…not surprising with the high wing set-up really. The York is just as 'draggy' as the Lancaster so cruising speed is consequently slow. Certainly on a windy day as this was, the model into wind was producing a perfect scale 'lumbering' speed. Applying more power did little to increase the speed but if you put the nose up, she will climb with gusto. After some two minutes of 'weather bashed' flying, enough was enough and the model was throttled back to quarter power on final approach. Because of that draggy airframe and head wind, she did take her time to get to the landed strip. You could almost consider York a STOL model in these conditions! Needless to say at the point she touched down, she was almost hovering! Somewhat of an anticlimax but the model passed the test with flying colours.

Next Outing

For the next out, it was altogether a better and calmer day. The throttle was open progressives, the tail lifted and she gently rolled forward. At this point you will have to apply a little up elevator to keep the nose from tipping. No appreciable swing was noted manly due to the props selected being a pair of tractor type and a pair of pusher type. In short this meant I could balance the motor torque across

the model by fitting the pusher propos on the right hand motors (remembering the reverse the two motors of course) and fit the tractor props to the left hand motors. Once the model has picked up speed, she will track straight without rudder and the elevator can be neutralized. After some 30 to 50 feet small progressive increments of up elevator were applied and she gently rose off the ground in a very scale manner.
As you retract the undercarriage, you will notice the York's climb rate increase slightly and the nose rise, as the drag from the undercarriage disappears and the C of G changes slightly.

So having reached a comfortable height, the model was re-trimmed and was flying once again, straight and level at around two thirds throttle..

The model is very easy to fly on just ailerons and elevator but to do the model justice, use the rudder to help it through the turns. A slow flat lumbering turn will require rudder to be held in while the ailerons are used to stabilise the angle of bank. This means you may end up putting opposite aileron in if the wing drops too sharply in the turn. One good reason why mixing rudder with aileron is not always a good idea.

The advice here is learn to use rudder on you sport model and apply this to the York.

Flying the York is a real enjoyment, not for the manoeuvres it can do, but more the slight of a heavy four engined air liner which captures that overwhelming sense of history and aviation sprit.

Landing the model is very easy. The airframe and those large 3-bladed props, when cut to idle proved quite some drag, so approaches can be made with good height if required. If you come in low and slow, you may find you'll need to keep the power on and 'drive' the model onto the strip.
When within a couple of feet of the ground, just check and flair out using elevator and she should just 'grease' in. Superb

Spec

Wing Span - 72" (1800mm)
Length - 54" (1345mm)
Weight - 5.5lb-6lb (2.7kg max)
Wing loading - 26oz/sq' (8.17kg/m2)
Radio - 5 Channel