BLACKBURN BEVERLEY
by Ivan Pettigrew
Construction Notes

Forty seven production Beverleys were built in England in the mid fifties and were in service with the RAF until the late sixties. It was a large aircraft for its day, with a wing span of 162 feet and length of 99 feet 5 inches. It could load objects up to 10 feet wide and 10 feet high through the rear opening doors. The main cargo hold was over 15 feet high. It could carry up to 15 jeeps, and troops could be carried in the upper deck, or tail boom. Maximum gross weight was 135,000 pounds. The Beverley had a very good short field performance and could take off and climb over a 50 foot barrier in 2,400 feet.

The Beverley was developed from a design by General Aircraft Ltd, the company that built the 110 foot span Hamilcar tank carrying gliders that were used during WWII. In 1950 General Aircraft first flew the prototype of the four engine Universal Freighter fitted with 1,950 h.p. Bristol Hercules engines. It was the forerunner of the Beverley, but had a different style of rear opening cargo door, and the first prototype used huge single wheels on the main undercarriage instead of the double bogies used on the Beverley. About the same time as the Universal Freighter was launched, General Aircraft Ltd merged with the Blackburn Company. The design of the Universal Freighter was refined, the engines were upgraded to the Bristol Centaurus of 2,850 h.p. and the result was the Blackburn Beverley.

For ease of transportation, the wing of the model is built in three sections. The tailplane, undercarriage and nose section of the fuselage can also be removed for transportation. Only two screws are used to assemble the model, a nylon wing bolt, and a #8 screw that holds the tailplane in place in similar fashion to the wing attachment. All other parts are held together with wire clips, nylon snap fasteners or magnets. Assembly at the field only takes a few minutes. The wing is assembled upside down so that the snap links and aileron clevises are easily accessible. A hatch over the centre section of the stabilizer, kept in place with a small magnet, gives access to the screw that holds the tail in place as well as the clevis that is connected to the rudder bell crank. Don’t forget to take the tail and the undercarriage along to the flying field if they have been removed! The optional slotted flaps are very effective, but should be limited to 25 degrees. Take offs can be done without flap, but half flap is good for an impressive short field take off. The model is very easy to fly. The Beverley has an excellent undercarriage design for a model of this size. It can handle rough airstrips quite safely. However, it has been noticed that multiple small wheels like this do not roll as easily in long grass as single large wheels. The models of the Lancaster and Freighter built in earlier years could operate from fields with long grass quite easily, but the ten smaller wheels of the Beverley add quite a bit of drag when operating from long grass. Builders who fly regularly from fields with long grass might want to consider building the GAL Universal Freighter. The single axle main gear with two large wheels would be much easier to make than the double bogies of the Beverley with eight wheels, and the rear cargo doors could be changed quite easily. The cargo doors of the Universal Freighter were not like the streamlined clamshell doors of the Beverley, but had a large flat section which dropped down to form a loading ramp. Pictures of the GAL Universal Freighter and Blackburn Beverley can be found on the internet. Some pictures show the second prototype of the Universal Freighter fitted with the double bogie wheels, but it still had the original rear cargo door. Three pictures of the GAL Universal Freighter are available from Ivan on request. These are low quality black and white photos, but they do show the different style of cargo door used on the Freighter, and one of the pictures shows the "single wheel" version.

A small three view drawing is shown on sheet #3 of the plans of the model. This is the most detailed drawing of the Beverley that has been found, but it was not on hand until after the plans for the model had been drawn and the model was built. Two other drawings were used as a basis for the plans for this model, and in true form, there were many discrepancies found between the two. Those of you who are purists will likely find more discrepancies in this model from the three view drawing that is shown on Sheet 3, but such discrepancies are part of the challenge when trying to reproduce any scale model. Propeller size is one of those question marks. I have seen it published in two references that the propellers on the Beverley had a diameter of 16 feet 6 inches, but according to the scale of the three view drawings, it looked to be closer to 13 feet. The four blade propellers used on the model are strictly for appearance. They do not enhance performance. The model would fly better with regular APC-E props, but there is so much reserve performance that the four blade props still fly the model in style. The prototype model used very old Mabuchi 550 (Speed 600) can motors that started life in electric gliders about 15 years ago. They were then used in the Lancaster until it was upgraded to racing car motors, and likewise were used in the Mars flying boat until the motors in it were changed to Speed 480s. Having this set of four motors lying unused in a box was part of the motivation for building this model. It has such a light wing loading that it does not need excessive power and would likely fly very will with Speed 480 motors. The motors on the prototype are wired series parallel and performance is quite adequate on 6S Li-Pos. The model has also been flown with a 7S pack and the power was well within the limits of the motors, but more than necessary for scale performance. .

FUSELAGE

Fairly hard balsa should be used for the stick construction of the fuselage. Ready cut balsa sticks are often cut from soft balsa, so it is risky to buy unseen. It has been found that it is better, and much more economical, to cut strips from sheet balsa. A balsa stripper such as the one made by Master Airscrew is the best $7 investment any scratch builder can make. Looking at a typical sheet of balsa, it can usually be noticed that the wood towards one edge is harder than at the other side. Test by pressing into it with a fingernail. Strips should be cut from the side that is hard, and the softer side can be used for bulkheads and fittings. Most of the sticks used in the construction of the fuselage for the Beverley can be cut from 3/16" sheet balsa. The fuselage is of the basic box construction.

All wood is balsa, except where indicated otherwise. The term “hardwood” can refer to either spruce or basswood. These may not be “hardwoods” in the true sense of the word, but they are certainly harder and stronger than balsa. The sides of the fuselage are built over the plan using the shaded parts which indicate the sides of the primary structure. When picked up from the plan, the sides may appear very weak, and need careful handling. Do not use thicker sticks. When additional longerons and stringers have been attached, the fuselage will have adequate strength. Someone described airframes like this as being “Ivan’s spaghetti” in the early part of the construction, but they firm up as details are added.

In building the sides of the fuselage for the Beverley, it is good to look ahead to what is going to happen in the area of the cargo doors. Until the upper longerons of the clamshell doors are fixed to the belly of the tailboom, there is a weak point in the fuselage structure at the location of bulkhead 11T. The upper longerons of the cargo doors are not going to be glued to the tail boom until they are pulled together to form the clamshell doors. Until that is done, at station #11, just the lower longerons of the tail boom are supporting the whole tailboom assembly. To overcome this problem, the upper longerons of the clam shell doors should be temporarily pinned to the lower longerons of the tail boom. These pins are removed later on in the construction when the clamshell doors are pulled together and glued to the lower cross pieces of the tail boom.

Before joining the sides together, notice that there are some doublers on the inside surface in the areas of the cut out sections for the wing and undercarriage. Join the two sides together using sticks at top and bottom. Anyone who has built a Lazy Bee knows that the recommended method for putting the cross pieces in is not to butt-glue them to the inner surface of the corner longerons, but to cut them to the total width of the fuselage, and glue them to the inner face of the top and bottom longerons, against the vertical stick at that location. By gluing the cross pieces in the corners like this, it makes for greater strength, since they act like gussets. It is also easier to glue the sticks this way in the early stages of joining the two sides of the fuselage together. Finish joining the sides of the tail boom together before bringing the sides of the cargo doors together.
The longerons of the cargo door come together with a sharper taper than the main tail boom. It may be necessary to soak the balsa in the area of the sharpest bends where the taper begins, especially at the bottom where the taper is sharper. Bulkheads and sheeting are then added to the sticks across the top and bottom of the fuselage. When sheeting is curved such as on the top of the fuselage, it will always bend easier if it is dampened on the outside. But there is a down size to this. As the sheet balsa dries out, it shrinks and leaves the sheeting with what is known as the “starved horse appearance.” All the bulkheads show. For sheeting curved surfaces, choose softer sheets of balsa, and only dampen the wood if it is too hard to curve while dry. Notice that a section of the belly is removable to gain access to the snap links that hold the undercarriage in place.

The sides of the nose section can also be built over the plan. When completed, these should be pinned in place on the fuselage, using thin plastic “Cling wrap” to prevent the nose section being glued to the main fuselage while the rest of the structure of the nose section is added. A “cut out” is necessary in the bottom of the nose section to provide clearance for the nose wheel wire.

TAIL SECTION

Notice that the spars for the stabilizer and elevators are tapered, being quite wide at the root in order to give added strength. Having a relatively thick cross section like this means that the construction can be lighter, and it is easier to control warps in the flying surfaces. Start construction by making these spars first, and fitting the hinges. The stabilizer spar is assembled over the plan so that the correct dihedral angle is incorporated. Then build the surfaces over the plan in the conventional manner. There is one thing to watch however. Because the stab and elevators are tapered, if they are built with the lower surface pinned right down to the building board, they will end up with a warp in them. Check this during assembly because it may be necessary to slide some of the parts up the pins slightly. Tailplanes with twin fins and rudders are quite a bit more work that conventional tails. The weak link is the attachment of the fin to the rudder. Notice the important large gussets that reinforce the last rib of the stab. When it comes to gluing the fins to the stabilizer, care must be taken to get the alignment correct. It has been found easiest with these large fins to attach them first with two small screws. After a trial fit, the fins are glued in place with the screws keeping them in the correct position. If desired, the screws can be removed after the glue is set. There is no question about the fin attachment being strong enough for normal flight loads. Where they will suffer damage is with hangar rash. These fins are so large; they seem to catch on everything in sight when handling the model in the workshop and transporting it. One of the stories told of the Beverley is about the control tower operator who on seeing the Beverley for the first time said, “We have you in sight but you appear to be followed by two unidentified objects.” The captain calmly replied, “Don’t worry! Those are our rudders.”

WING CONSTRUCTION

The wing is built in three sections. The basic airfoil is a Selig 7055, but the removable outboard sections use a NASA leading edge cuff to reduce tip stall tendencies. The full depth spar is continuous throughout the wing The ribs are cut and butt glued to the front and rear surfaces of the spar. The slotted flaps enhance the slow speed performance, but are in no way essential. They do add weight and take a considerable amount of time to build. The flaps are built like miniature wings, but the fit to the secondary spar of the wing is critical. Construction of the flaps should only be attempted by experienced builders.

MAIN WING SECTION

Cut the main spar of the wing from 1/8 inch sheet balsa and join together over the plan so that the dihedral angle is correct. Notice that the spar also sweeps back at the centre point.

This joint is important both for accuracy and strength. The doublers should be well glued. Glue hardwood strips to the top and bottom edges of the wing spar as shown in the plan. At each end of this section of the main spar, build the boxes that will receive the tongues of the “plug in” outer wing sections. Before closing in these boxes, make the hardwood tongues that will be attached to the outer wing panels, and ensure that they will be a snug fit into the wing boxes. There is a slight taper on the tongues so that they fit quite tightly when fully inserted. Before continuing with the construction of the main wing section, it is best to make the spars for the outer wing sections. These are made from 3/32 inch balsa. The hardwood tongues should be glued to these outer spars, ensuring that the dihedral angle of the outer sections is correct. It is easier to get this correct at this point, rather than later in the construction. The areas of greatest stress in the wing are the join in the spar at the centre of the wing, and the wing boxes. It is recommended that a good quality carpenter glue be used for these joins. CA glue is fast for tacking things together, but sometimes the quality of the join is compromised. Carpenter glue gives a more dependable join, and was used in most of the construction of this model.

Before cutting out the ribs, notice that they are of different thicknesses, depending on the stress they are subject to. Some ribs support the flap brackets, while the ones that hold the flap bell crank have a lot of side thrust on them when full flap is deployed. It is good to cut ribs first to the outside line shown on the plan, then nest them together to check accuracy and sand off high spots. Cut all the ribs into two pieces at the point where they join the spar. There is quite a bit of inset sheet covering on the wing, in particular on the front section from the spar to leading edge. Trim 1/16” off the nose ribs to allow for this. A balsa stripper set to 1/16” makes this very easy to do. If making flaps, the rear part of the ribs can be cut off at this point and kept for using in the construction of the flap. If flaps are not being built just leave the rib full length. The rear part of the ribs of the wing extension should be cut off and kept for building the ailerons. Notches need to be cut in the ribs where the secondary spars are attached.

Assemble half of the wing section (e.g. left half) flat on the workbench with the other half of the spar raised a little to the dihedral angle. Start by pinning the spar and lower secondary spar in place on the plan. Attach the centre part of the ribs to the rear face of the main spar and the lower secondary spar. Next glue the upper secondary spar in place. Now attach the nose ribs and the first leading edge strip. Notice that the leading edge consists of two strips of balsa. Only the first (inner) strip should be applied at this time. When this half of the wing panel is completed, raise the outer rib so that the spar of the other half is flat on the workbench and assemble the second half of the wing. Sheeting is now applied from the leading edge to the main spar, but ONLY to the lower surface of the wing. At this point the wiring should be installed for the motors just ahead of the main spar. This wire should be #13 gauge. To reduce the danger of electrical interference to the radio, the wires should be kept close to each other, and twisted about one turn to the inch.

It will be noted that the wing at this point is still not torsionally strong, meaning that it can easily be twisted. After the sheeting is applied to the upper surface of the area already sheeted, the wing will be very rigid and difficult to twist. Hence it is very important to weight each wing panel down on a surface that is perfectly flat while applying the sheeting to the top surface. The remaining leading edge strips are cut from sheet balsa and glued to the one in place. It is then contoured to shape. Notice that this outer strip is not continuous throughout the length of the wing. It does not pass through the area where the engine nacelles are built, or where the centre section of the wing passes through the fuselage.

To get a good fit with the flaps, it is best to build them in place with the adjacent wing panel flat on the workbench. Flap brackets are glued to the corresponding ribs. The hinge pins for the flaps can be 2-56 screws as used in nylon control horns. Pins of this type should not have a nut that is tightened up, but rather a lock nut that allows a loose fit, but at the same time does not come loose. A suitable lock nut can be cut from the back plate of a nylon control horn, using one of the holes already drilled for a 2-56 screw. A box has to be built near the mid point of rib #4 to accommodate the tongue at the top of the removable vertical landing gear strut. To support the covering material used on the lower surface of the wing, there needs to be some 1/16" inch sheeting around this box, and likewise the flap brackets.

After fitting the wing to the fuselage, the missing part of the fuselage above the centre section of the wing is filled in. This is built on to the wing as a fixture. While building this part, with the wing in place, use thin plastic "cling wrap" between the bulkheads of the fuselage and wing so that they are not glued together.

OUTER WING PANELS
The outer wing panels are built in a similar manner to the main wing. When applying the sheeting to the upper surface of these panels, the trailing edge at the tip should be propped up ¼" to provide the correct washout. A dowel is glued to the inner rib just ahead of the secondary spars to provide anti-rotation of the outer wing panel. To get a good fit with the ailerons, it is best to make the spar at the front of the aileron first and hinge it to the wing. Then build the ailerons in place, with the wing panel pinned to the building board over the plan. Try to duplicate the design of the Frise ailerons with top hinging. It makes for good control balance at slow speed and helps avoid the adverse drag that is often a problem in slow flying models with a long wingspan. If the wood is on the flimsy side where the aileron hinges are inserted, add a small double. Be sure to pin the aileron hinges with toothpicks. After the tongue of the hinge is inserted in the balsa slot, drill a 1/16" hole in the middle of the tongue area, and push a toothpick through. Apply a drop of glue and cut off the ends of the tooth pick. Pinning the hinges this way will ensure that they don't come lose. "Hinge gap" covering on the top surface of the wing will further ensure that hinges do not come out.

Aileron differential is the other thing that helps to counter adverse drag, so it is important to make the arm of the aileron servo as shown on the plan. It can be cut out from one of the disks that usually come with new servos. The distance the aileron horn is back from the leading edge of the aileron is another factor in aileron differential, so watch that the aileron horns are mounted where shown on the plan. When electric motors are wired in series, or even series parallel as in this model, there is an added risk of interference to the radio. For this reason, outboard servos for the ailerons are not recommended because of the long run of wire parallel to the heavy wires carrying power to the motors. If radio interference is experienced, it can often be reduced by placing a schotky diode across the terminals of each motor in addition to the usual filtering capacitors.

It is extremely important that the wing has the correct washout before covering. With some model planes, the wing is not torsionally strong, and if the covering on a twisted wing is shrunk while holding the wing in the correct position, it will hold the new set.. With the type of construction used in the Beverley this does not work very well, since the "D" section from the spar to the leading edge is too strong for the covering to hold it in place. The way to correct a twisted wing before it is covered is to dampen the sheeting forward of the leading edge, and weight the wing down overnight while it is drying. There is often a little 'spring back' when the weights are removed, so it may be necessary to do this twice. To check the accuracy of the wing, turn it upside down and prop it up so that a builders level can be put from the spar to the trailing edge. This should be level at the wing root and stay the same to the wing join. At the wing join and the tip it should be the same if a ¼ inch spacer is put between the level and the tip trailing edge to provide for the washout.

ENGINE NACELLES AND COWLINGS

Start building the nacelles by attaching the beam motor mounts to the wing. Do plenty of "eye balling" to see that they are all lined up with each other. It is quite a job to get four motors perfectly aligned in a model like this, and the secret is to double check the accuracy at every step of the way. Before starting to add bulkheads for the nacelles, assemble each pair of bulkheads, "C-2" and "N-1". After gluing the small plywood plates to these bulkheads, screw them together and check that they are a good fit. They form the attach points for the cowlings. The construction of the nacelles is rather basic. When it comes to making the lower nacelles, hopefully the builder knows what is meant by "planking". To provide for cooling air to pass through the motor, air outlets are cut on the inside wall of the lower part of the nacelles under the wing. In this location they are not noticeable to anyone except the troops in the lower deck.

The nose rings of the cowling are cut out like doughnuts, and can be of one piece of thick balsa, or laminations. They are then shaped to the correct cross section, and the cowlings are assembled. Do this by taking the sheet covering that forms the cowling and curling it around to form a sleeve Join the edges with CA glue. If the sheet balsa used for the cowling is on the hard side, it will help to dampen it on the outside. Don't dampen the sheeting anymore than necessary, so as to avoid the “starved horse” look. Check the fit of the nose bulkhead C1, and also C2. Since the cowl is slightly tapered, these should be slid in from the rear. If the cowl is too small or too large, a small sliver can be added or subtracted to the sheet cowling. When the fit is correct, apply regular carpenter glue to the bulkheads and slide into place. After completing the cowls, do a trial fit of the motors. It is often necessary to put shims under the motor to get the propeller shaft centered in the cowling. Mount the propellers and “eye ball” them from one end of the wing to see that they are all in the same plane. If you didn’t get the motor beams parallel in the earlier stage, the shims you put under the motors will need to be wedges.

If making four blade props from regular two blade props, the hubs are notched where they cross each other. It is not necessary to glue the props together. They will be held in place when the propeller nut is tightened. In making the notches, it is important to get the matching surfaces parallel to the plane of the propeller. If this is not true lengthwise, the propeller will not track correctly. If it is not correct sideways, one blade will have more pitch than the other. In extreme cases this could flex one blade and make for another tracking problem. Both of these errors could lead to vibration. A good pair of eyes is all that is necessary to get the props correctly aligned. The main thing is to be aware of the pitfalls of not getting the matching faces fairly close to parallel. If the individual props are balanced first, it is not necessary to balance them after assembly. It has always been found that four blade props made in this manner run very smoothly.

UNDERCARRIAGE

The main landing gear is made up of three wires. Most of the weight is taken by the centre and rear wires which are 5/32” in diameter. The forward wire is thinner with 1/8” wire, since its main function is more that of a “drag” strut. A vertical strut is also attached to the wing just outboard of the inner engine nacelle. This strut is built like a “pogo stick” and acts more as an overload spring. Start the gear assembly by making the centre wire. It should be bent slightly where is leaves the fuselage so that there is allowance for ½ inch squat. When the model is at rest sitting on its wheels, loaded with batteries, the horizontal undercarriage legs should be parallel to the ground. To allow for the ½ inch deflection under load, the wire must be bent so that it is angled down slightly when not loaded. At the outer end, the wire is bent to go down two inches vertically. It is best to assemble the remaining two wires with the gear held in place on the fuselage. Notice that the end of the rear wire is also bent down two inches at the end and will be attached to the end of the centre wire. The end of the front wire is doubled back and attached to the centre wire as shown in the plan. Some patience and perseverance is needed in getting the bends correct but it is good preparation for what is to come. A one inch length of brass tubing is fixed to the vertical legs at the upper part of the centre and rear wires where they join. This serves to hold the wire at the bottom of the “Pogo Sticks.” Although the wire used at the bottom of the pogo sticks is 3/32” diameter, the brass tubing can be 1/8 inch inside diameter to allow for the changes in alignment during gear deflection. The brass tubing should be attached to the upper part of the ends of the gear legs by binding in place with thin wire and soldering. Also bind and solder the point where the front leg joins the centre wire. The four radial arms that support the axles are now bent from 3/32 inch wire. They are bound and “attached” to the lower section of the wires that were turned down at the end of the main gear legs. The word “attached” suggests that they could be just be tack soldered at this point, since it may be necessary to re-set this solder joint later on in order to align the gear. The axles are now bound in place with thin wire and soldered. Check alignment of the gear from the front, side and top. Getting eight wheels to look right from all angles is another exercise in patience and perseverance. At this stage you may wish you had opted for the Universal Freighter.

When it comes to making the pogo stick and nose gear springing, it helps to understand that a good suspension unit has “progressive” springing. This is accomplished by having a weak spring that absorbs the first part of the load softly, then a firmer spring that stops the load “bottoming out.” These springs are put in series. In both the pogo stick and the nose gear there are weak springs that are like the ones used in ball point pens. The stronger springs are usually available in a hardware store. If only short springs are available, use three or four in series to make up the desired length. With the pogo stick, the weak springs are almost fully compressed when the leg is in place, and keeps the leg is compression. This puts a light pressure on the top of the pogo stick where it fits into the wing so that it does not fall out when the weight is off the landing gear. The only time a leg has become dislodged in the prototype was pulling out of a loop which was done as part of Ivan’s “testing” program for the Beverley. It seems that with the G force on the wheels and U/C leg,, it stretched far enough for the top of the pogo stick to come out of the wing. It was back to the drawing board to increase the length of the tongue at the top of the pogo stick. Now the Beverley is approved for loops. When fitting the wing to the model it is necessary to place the pogo sticks in the brass tubes on the lower undercarriage first, start the wing leading edge dowel into the fuselage hole, then guide the tongues at the top of the pogo sticks into the wing slots while the wing is lowered to the fuselage. A third hand is helpful the first few times this is done.

The CG location and control throws are indicated on the plan. If checking the CG by the traditional method of supporting the model at the main spar, remember that the wing has sweep back. This means that the model should be supported at the MAC (mean aerodynamic chord) which for the Beverley is at rib #8 just outboard of the outer motors. This point is one inch to the rear of the position of the main spar at the wing root. In full scale aircraft it is always necessary to check the CG fore and aft, just as we do with models, to ensure that it is within limits. With the Blackburn Beverley it was also necessary to check the CG vertically. It is reported that the plane was noticeably more stable when the CG was towards the bottom of the box, as well as kept forward. Reading about this after making the initial test flights with the model helped to improve stability. When the model was first flown, the motor battery location was near the top of the fuselage so as to give easy access, but it was noticed that in turns, there was a tendency for the model to increase the angle of bank to the point where opposite aileron and up elevator were needed to keep it from going into a spiral dive. When the battery was lowered to the floor at the bottom of the fuselage, the stability in turns was greatly improved. With a deep fuselage such as on the Beverley, there is quite a build up of air pressure on the side of the fuselage if it starts a sideslip during a turn. Revisiting what was learned in Physics 101 about "couples" will help to understand the benefit of the pendulum effect that is gained by keeping the battery low. When they stacked those 15 jeeps into the Beverley, they no doubt had to keep the heavy ones at the bottom of the pile

NOSE WHEEL

After building the pogo sticks, the nose wheel will not be any challenge. The other thing done here to soften the limit of full extension, as well as add to the progressive springing, is put one spring above the upper nose wheel bracket. The length of the steering arm should be double the length of the arm on the rudder servo. Note the angle of the steering arm. If it is not kept at right angles to the adjacent line of the push rod, the nose wheel will not turn the same amount in each direction. Because there is quite a bow in the pushrod, it needs to be well supported at fuselage stations along the way. Note that the push rods that go to the tail surfaces should be kept as straight as possible in order to prevent bowing. This is of special importance with flight controls. In order to keep the pushrods to the tail surfaces straight, please support them at every fuselage station along the way.

COVERING AND FINISHING

The airframe on the prototype is covered with Monokote and low temperature film. "Dove Gray" Monokote was used for the lower fuselage and the lower surfaces of the wing and tail. The white on the upper surfaces is Towerkote which is similar to low temp Solar Film. The transparent windows and windshield of the flight deck are "Clear Transparent Monokote." In choosing a covering material for the Beverley, avoid the use of fabric type (….tex) coverings. They are heavy, and the strong shrinkage could warp the lightweight structure. They also stretch a certain amount, and lightly built tail surfaces and ailerons can flex and cause flutter at high speed. With film covering it has been found that flying surfaces are much more rigid and there has never been any problem with flutter. Many colour schemes for the Beverley can be seen by doing an on line search for "Bristol Beverley." .

There was a saying among pilots of the Bristol Freighters that flying one of their monsters was like flying a two-story house from the upstairs bathroom. You go now, and enjoy flying your three-story barn from the attic. It's a blast!

Ivan Pettigrew

SUMMARY: BLACKBURN BEVERLEY

August 2007. Scale 1/15.5 Span 125 inches. Wing Area 1,700 sq.in. Length 77 inches. Airfoil Selig 7055 with NACA leading edge cuff on outboard sections. Slotted flaps. Wing built in three sections. The nose section of the fuselage is removable to give access to the battery and make adjustments to the nose wheel mounting, as well as reducing the size of the fuselage for transportation. The tail plane and main landing gear are all removable for transportation. Weight with a 6S Li-Po 2800 mAH battery is 164 ounces giving wing loading of 13.9 oz/sq.ft. Four "Speed 600" (Mabuchi 550) can motors wired series-parallel, with 3.5:1 Master Airscrew reduction gearboxes, turn 10x6 four blade props at 6,500 RPM. Static thrust is 110 ounces at 32 amps (16 amps to each motor). Each airscrew is made from two regular 10 x 6 Master Airscrew GF nylon props, notched at centre and crossed. These are held in place by bolting together on the propeller shaft. It is not necessary to glue them. The four motors used in the prototype are the same ones that were used in earlier years in the Lancaster and Mars before those models were upgraded to other motors. The Beverley has a lower wing loading than the other models these motors were used in, so it has a better climb rate on similar power. Because the 6S Li-Po battery being used in this model has a slightly higher voltage than the 18 nicads being used in the older models using these motors, the pitch of the propellers was decreased. The previous four-motor models used 10x7 props. The Beverley is flying on 10x6 props. The four blade props are mainly for appearance. The performance would be better with regular two blade APC electric props. \In selecting a speed control, use one that does not have a brake engaged permanently. It makes for smoother landings if a little power is left on, and this is not always possible with a brake on the ESC. The Castle Creation 35 amp Pegasus is one possibility, and another is the JETI 45 amp ESC. Both of these are of course for brush motors. The JETI ESC does not have BEC, but in any case,a separate radio battery is recommended for a model this size.

May 2008 This model would fly well on Speed 480 motors. The wing loading would be lighter than with the Speed 600 motors and the endurance would be increased .These Speed 480 motors are sometimes referred to as "long can speed 400" motors, and are not to be confused with the Graupner series of Speed 480 motors which have a different configuration and thicker shaft, apart from being quite a bit more expensive

Because the diameter of the motor can and the shaft thickness of the Jamara 480 and Permax 480 motors are the same as for Speed 400 motors, they use a Speed 400 gearbox. It is claimed by some that these Speed 480 motors can be run up to 170 watts input. In the applications given for the Sealand 480 and Albatross, the input is closer to 125 watts which is a conservative figure that results in better efficiency and longer motor life. The Permax motor has more turns than the Jamara, but of thinner wire. Hence if maximizing the performance, the Permax could be run at a higher voltage on more cells than the Jamara, but the Jamara with its winding of thicker wire can take more amps, and the voltage should not be too high. The efficiency of the Jamara motor may be a little higher than that of the Permax.

There is a large variance in propellers, but as a starting point it would be good to go with a 4.1:1 ratio MP-Jet gearbox on the Jamara motors with the original props, and a 3.5:1 or 3:1 ratio gearbox on the Permax 480. Tests should be done to see that the props are loading the motors for the desired amperage. For Jamara motors it could be 14 amps a motor which is 28 amps to the battery with series parallel wiring, and for the Permax the loading of each motor should be kept to 12 amps which is 24 amps to the battery. When using four Jamara motors wired series parallel, the recommended battery would be a 6S Li-Po. With the Permax motors wired series parallel it would be quite safe to run a 7S Li-Po, but at less amperage than the Jamara as mentioned above. The Jamara motors are available from John Swain of www.fanfare.f9.co.uk at Eight Pound each. He sends overseas orders by airmail at a reasonable cost, and can supply the MP-Jet gearboxes and 3mm “long shaft” prop adaptors that are necessary with these gearboxes.