DE HAVILLAND DH98 MOSQUITO 480
by Ivan Pettigrew
Construction Notes

This is a model of the T-III which was a trainer version of the DH98 Mosquito fitted with dual controls. An earlier model at 1/9 scale model was designed in Aug 2000, powered by geared brush motors, and is referred to as the Mosquito 600. It used nicad batteries, had a wing span is 74 inches and the plan showed scratch built retracts. The plan of the Mosquito 480 is basically a 78% copy of the original 600 plan, but modified to show the installation of brushless motors, li-po batteries and servoless electric retracts that are now readily available. Because this plan has been reduced, the thickness of the wood shown on the plan is slightly on the thin side. The model spans 58 inches and the scale 1:11.2.

Because of the high taper ratio of the Mosquito wing, and NASA type leading edge cuff is used on the outboard wing sections. This combined with some washout results in a model that is not prone to accidental tip stall. The long moment arm of the Mosquito makes it a very smooth flyer, and the model is extremely aerobatic. It is possible to do spins if the C of G is not forward of the indicated position, and the model will recover of its own accord. If the steering proves too sensitive, in particular on take off, the rudder throw can be reduced a little. This will make the model reluctant to spin. It is a very safe flyer.

The weight of 55 ounces, and wing loading specified at 15.8 oz/ sq.foot, is based on the use of Park 450 size outrunner brushless motors and a single 4S, 2,200 mAH or 3S 3,000 mAh li-po battery. The climb rate is spectacular with a static thrust of 52 ounces.

The Mosquito is very clean and picks up a lot of speed in a dive. Use this to build up speed before a loop and it is possible to do huge impressive loops that are “scale like” for planes of the Mosquito era. The roll rate is excellent, and eight point rolls are easily achieved. Outside loops are not a true scale manoeuvre for a Mosquito, but the model is capable of doing them.

Some T-III Mosquitoes were white, with red on the outer wing panels, elevator and rudder. Easy visibility was the reason for choice of this configuration in the earlier “600” model. The 480 model is in the colours of the T-III Trainers used by the Royal Navy, R.N.A.S, Brawdy, in Wales. For the discerning, the letters on the fin of the model should have been BY, and VT626 was actually **422**. The numbers on the model were the best available in the scrap box.

It is expected that the builder of this model will have previous experience in scratch building stick models, so these instructions will not dwell on the obvious, but deal with the items of special interest. Carpenter glue is recommended for stick construction. It is much stronger then CA for end grain joints.

FUSELAGE
The fuselage is a simple framed up box with bulkheads added to the top, sides and bottom. First build the two sides of the fuselage over the plan, and join together. Note the sketch on the plan that shows how the nose section is removable, along in one piece with the upper section of the fuselage that covers the

centre section of the wing. With this upper-nose section removed, wing removal is easy, and access to the radio and servos is simplified. It also makes for easy access to the battery, which slides in from the front. When the lower/rear section of the fuselage is framed up, the curved surfaces on the top and bottom can be sheeted with 1/16” balsa. If contest balsa is used for this sheeting, it will result in some weight saving, and will also be easier to work with. The sheeting on the sides should be left until the control rods are installed, and the linkage for the steering tail wheel is completed. The nose-upper section of the fuselage is built as a separate unit, but is best left until the wing has been completed, then built in place. Doing it this way makes it easier to get the correct fit where it covers the wing centre section. Notice that a snap link is used to attach the removable section to the rear fuselage. This is functional for the strength of the airframe. A magnetic attachment is not recommended for this location since the fuselage may flex if there is not a positive snap link or similar attachment. Insert hardwood or plywood blocks for locating the wood screws in place.

TAIL SURFACES

These are of conventional construction. In making these, it is recommended that the spars for each of the surfaces are made, shaped, and hinged, before starting assembly of the rest of the tail surfaces. There are aerodynamic advantages to having a symmetrical section in the tail surfaces, besides which, the resulting deeper spar gives added strength over a flat surface, and is more resistant to warping. The result is that the tail surfaces can be built very light. It is important to block up the leading and trailing edges of the surfaces when building over the plan so as to prevent warps being built in. Notice that the spar of the fin extends into the fuselage and is locked firmly in place by attachment to cross pieces. If using nyrods to operate the tail surfaces, but sure to brace them at several locations in the fuselage so they do not flex.

WING CONSTRUCTION

The wing construction outlined on the plan is the same as was written for the Mosquito 600. An added note is that the leading edge is extended forward in the inboard section between the fuselage and engine nacelle. The wing is first built without this extension. Next, the nose ribs, 2N, 3N and 4N are added to the existing leading edge, and then the new extended leading edge is attached. The centre section of the wing is sheeted with 1/16” balsa, and also the bays where the engine nacelles are attached. This sheeting should extend a little beyond the ribs so as to make covering easier.

The details written on the plan applying the wing construction were written for the 600 and are similar for the 480 except for step #11. The undercarriage pedestal is different in the 480, so follow the details listed here.

UNDERCARRIAGE / MOTOR MOUNT PEDASTAL

(Step #11) An alternative for basswood used for the beams is spruce, or any other wood that is strong and holds screws well. Where epoxy glue was specified for the heavier Mosquito 600, regular carpenter glue is adequate for gluing the beams in the Mosquito 480 if the joins are clamped during set up. Beams B2 and B3 in the pedestal are made from ¼” x 1/8” strips of spruce which are readily available in most areas. If ¼” x ¼” is not available for the motor mounting beams, (B-1), glue two pieces of the ¼” x 1/8” spruce together. Gusset G-1 that the retract unit is screwed to should be cut from ¼ inch spruce or bass. Gussets G-2, 3 and 4 are cut from 1/8” hard balsa or softwood.

The prototype used light commercial mechanical retracts operated through a bell crank from a central retract servo. The alternate method to use servoless electric retracts, and that is what is shown on the plan. The mounting system for each is really identical so either method can be used. The pedestal is started by gluing the motor beams, B-1, to the wing with strong joints to the main spar and secondary spar. Since the undersurface of the wing is angled up slightly to give dihedral, a 1/16" shim may be placed under the wing at the bearing point of the outer pedestal assembly to keep it perpendicular to the ground. This is one place where it might pay to use epoxy. When the motor beams are in place, a strip of 1/8" x ½" spruce is attached to the rear of the leading edge between ribs 4 and 5 and glued so as to attach the leading edge to the motor beams. Next beams B-2 are glued in place using gussets G-2 as a guide to getting the right angle. If the gussets G-1 are now glued to the lower ends of beams B-2, the beams B-3 can be glued in place. Gusset G-3 is cut carefully to give the down thrust shown, and glued in place. Gusset G-4 is then added and the motor mounting plywood plate glued in place, with gussets added to the rear to reinforce the joint. Some builders may prefer to frame up the sides of the pedestals before gluing in place.

At this point it is best to install the retracts and get them operating. The wire should be bent as shown to give clearance when the gear is retracted. Some builders may wonder why the retracts are angled as shown in the plan and the bends in the wire made the way they are. It is important that the angle and position shown is maintained so as to give good absorption of bumps in the runway. The important thing in undercarriage location of the this type is to have the imaginary straight line from the hinge point of the retracts, to the point where the wheel touches the ground, swept back in relation to the ground line when the model is taxi-ing in the three point attitude. To achieve this, the hinge point of the retract unit should be well forward and kept as low as possible. It means that the undercarriage leg will flex backwards **AND** the axle arcs upwards as it hits a bump, thus absorbing the shock without the need for oleos. If the hinge point is directly above the undercarriage leg, it will be raked forward in relation to the ground when the model is taxi-ing. This means that when if flexes backwards on hitting a bump, its effective vertical length is increased instead of decreased. Models with this set up have to be equipped with oleos or they do a series of "bunny hops" when taxi-ing on grass. The landing gear leg could be left lined up from the hinge point of the retract unit to the point of the wheel axle. The sweep back of the leg would be obvious, but would not look right for a Mosquito. If appearance is important, a dummy secondary leg of thinner wire can be attached to the primary one near the exit from the retract unit, and the leg dressed up with a fairing as shown for the primary leg.

The engine nacelles are started by building a bulkhead at the position of N-1, 2 and 3. Note that spruce blocks are glued to N-2 which serve to hold the wood screws that keep the cowlings in place. Build the nacelles by adding N-4 through N-7. When sheeting the nacelle, the forward edge of the 1/16" sheet should just come to the centre line of bulkheads N-1, 2 and 3. This leaves a 1/8" inch wide shoulder which holds the cowling in place.

COWLINGS

These are made with the motors in place. First the nose block is made, but the hole for the motor should at this point be made just large enough for the nose block to be a snug fit over it. This will hold the nose block in place while the cowling is built. Later the hole for the motor can be enlarged. Start making the cowls by cutting out the side panels. These are attached at the rear to the hardwood blocks attached to the N-2 bulkheads, using #2 wood screws. To reinforce the balsa where these screws are located, a small piece (washer) of 1/64" ply should be placed under the heads of the screws and glued to the cowling before covering is applied. The front edges of the side panels are glued to the sides of the nose block. Next apply the top and bottom sections of the cowling, gluing these to the nose block and adjacent side panels, but not of course to the bulkheads adjoining N-2. Use strips of scrap balsa for doublers where the side panels joint the upper and lower sections of the cowling. When the glue is dry, take out the screws, and remove the cowling. Now the hole in the nose block for the motor can be enlarged to give adequate clearance and airflow for cooling.

CONTROL THROWS

The control throws are shown on the plan. Aileron differential will really help with flight at slower speeds, especially as on approach to landing. In order to provide for this, the aileron servo arm should be made so that it is a 60 degree "V" as shown in the plan. This can be cut from the circular disk that comes with most servos. Some builders may prefer to use outboard ailerons for each servo, but angle the servo arm well forward so as to achieve adequate aileron differential.

BATTERY LOCATION

There is ample length available for the battery pack, so this provides plenty of space for moving the pack forward or backwards to achieve the correct C of G location. If using a lighter pack, or if the tail is too heavy, the battery will likely have to extent to the forward location shown on the plan. It could even extend further into the removable nose section if the platform is made longer. The pack is secured to the platform with Velcro strips, but a back stop should be made so that it does not move backward if it breaks loose under acceleration while taking off on a rough strip.

COVERING AND FINISHING

The prototype is covered with low temperature Sig Aerokote lite / Lightex from World Models. This is excellent for a model like this. Heavier films like Monokote tend to shrink the lightweight sheeting of the fuselage and give an undesirable starved race horse look, especially on the upper surface. All the windows of the prototype are covered with transparent monokote. Since this is a high temp film, it should be applied first, then the low temp covering applied on top of it.

WIRING

Again, it is expected that builders of this model have experience with electric models and as such have their preferred way of doing things. It is basic knowledge that brushless motors should have an independent speed control for each motor, but the motors may be wired in parallel from one battery, and each speed control linked via a "Y" harness from the radio. When doing this, it is important to disconnect the battery wire from one of the speed controls if using the BEC feature to power the radio. In this model the speed controls are located in the space behind the motors. Some modellers prefer to use the BEC from one of the speed controls to power the radio and flight servos, and power from the other BEC to operate the retracts, but with this model being so light, no problem has been encountered by using one BEC to power all the servos including the retracts.

FLYING

There is nothing unusual about flying this model. It is a delight to fly. But there is one word of warning regarding the take off. With those large propellers, there is enormous thrust and a certain amount of torque. High speed taxiing prior to the first test flight is NOT recommended. The model is likely to take off unexpectedly at low speed and catch the pilot unawares. Previous flyers have been caught by this. By all means practice some taxiing, but keep it fairly slow. On take off, apply power VERY slowly. If the grass is long, keep back pressure on the stick until the model is rolling. Otherwise a small amount of back pressure is all that is needed throughout the take off. Just apply about 25% power at first until the model is rolling straight, remembering that rudder control is very positive and sensitive. Then slowly apply more power. The model is usually in the air by the time the throttle is a little more than half open. Once airborne, more power can be applied and the gear retracted. So the bottom line is, "DON'T APPLY POWER QUICKLY."

Landings can be done with no power, but are a little safer under windy conditions if a little power is carried. The approach speed for this model is much slower than most modelers are used to, and some who have flown it have had trouble with it floating too far on landing. Hold off touching down until the model is in the three point attitude and try the first landings that way with the stick right back by the time them model touches down. If the model balloons in the flare, or floats too far, the approach speed has been too fast. An overshoot should be started and the next approach made at a lower speed. The attitude of the model gives a clue to the right approach speed. If the model has a "nose down" attitude when gliding in to land, it is going too fast. Hold a little back pressure on the stick during the approach so the attitude of the model is nose level and the speed should be right. First landings should be three point at minimum speed. Do not force the model on the ground if going too fast. Go around! The repetition is intentional. With the landing gear located well forward, it makes it a little more difficult to do smooth wheel landings, but there is little risk of the model going on its nose in grass. Wheel landing can be done by those with experience, but don't say that you were not warned if there are some surprises.

There is no fear of tip stall if the wing has the correct washout. If there is any indication of tip stall just prior to a full stall landing, a little more washout should be added to the wing that drops.

Once comfortable with the Mosquito, a good introduction to the flight routine is to do a half loop on take off with roll off the top. After lift off, just keep the climb on the shallow side to retract the gear and gain some extra speed before entering the loop. By the time the end of the runway is reached, there is enough speed for this manoeuvre. Then, as the model comes back over mid field it will have enough speed to do a repeat. Good luck in showing off your Mosquito 480.

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MOSQUITO 480

(August 2011) 1/11.2 scale. Span 58 inches. Wing area 501 sq inches. Length 43¼ inches. Airfoil, Eppler 374 with NACA leading edge cuff outboard. . Weight with 4S 2,200 mAH Li-Po is 55 ounces for a wing loading of 15.8 ounces/square foot. The prototype uses Ram Tech 28/30/16 motors, 700 KV turning 10 x 7 APC electric props turn at 7,200 RPM. Total static current draw is 22 amps giving 52 ounces thrust. Servo less electric retracts are Hobby King HKD-312.

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Motor selection. The motors selected could be run from either a three cell or four cell li-po battery. For a three cell operation it would be best to have a KV rating close to 1,000, and with four cells a KV rating in the area of 750. This would result in using a suitably sized prop such as 9x6 or 10 x 7. For 3 cell li-pos,the model could be flown on E-Flite Park 400 outrunners, but slightly more power will give a more sparkling performance. Turnigy or E-Flite Park 450 motors with 9x6 props would be very adequate, or any outrunner of about 170 watts input. Some may opt for the Park 480 motors which are larger than the motor used in the prototype and would really be overkill. Avoid high KV motors that would turn smaller props at very high RPM. Larger scale-size props turning slower are more efficient than small ones turning very fast, and give more thrust for a better climb rate. They also look better and are quieter.

Another option for flying on 3S LiPo batteries, could be the A-2217-8 motor available in the USA from BP Hobbies. It has the same 28mm diameter as the Ram Tech motor but 4 mm longer. It will run continuous at 16 amps which is 177 watts input.