DE HAVILLAND DH98 MOSQUITO 600
by Ivan Pettigrew
Construction Notes

This is a model of the T-III which was a trainer version of the Mosquito fitted with dual controls for training purposes. This 1/9 scale model was designed in Aug 2000, to be powered by inexpensive brushed electric motors. The prototype uses 16 turn Trinity "Ruby" motors, driving 14" x 12" APC electric props through a 6:1 reduction gearbox. The MEC superbox is a good choice for this application. Running the motors in series from eighteen cells turns the props at 4,800 RPM while drawing 31 amps, providing 67 ozs static thrust. The wing span is 74 inches, wing area 825 sq ins, and the airfoil is an Eppler 374. Because of the high taper ratio of the Mosquito wing, and NASA type leading edge cuff is used on the outboard wing section. 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 is a very smooth flyer, and the model is extremely aerobatic. It is possible to do spins of up to about two turns, but beyond that the model wants to come out of its own accord. The weight of 114 ounces, and wing loading specified at 20 oz/sq.foot, is based on the older RC-1700 nicads, and the use of a 2 ounce 270mAH receiver battery. It has been found that the lighter CP-1700 SCR cells result in considerable weight saving, and also give more power. The climb rate with the lighter cells is spectacular because of the lower weight. Other noticeable improvements are the increased sizes of the loops and Cuban eights. Performance should be still better with 4/5FAUP 1950 NiMH cells which are even lighter than the CP-1950 nicads and have a very high discharge rate. With lighter cells it may be necessary to move the battery pack further forward than shown on the plan. The use of heavier batteries in not encouraged because of the nature of the retracts.

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 a much larger and more impressive loop than is possible from level flight. It is much more "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.
Most of the top surfaces of the T-III trainer were white, with red on the outer wing panels, elevator and rudder. Easy visibility was the reason for choice of this configuration. The writer had previously built a smaller Mosquito which was done in military colours. Because of the grey colour, and the higher scale speed of the smaller model, visibility was a problem. This T-III version is an attempt to make the Mosquito more user friendly, and has been very successful.

It is expected that the builder of this model will have previous experience in constructing build up models, so these instructions will not dwell on the obvious, but deal with the items of special interest.

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 in removable, along in one piece with the upper section of the fuselage that covers the centre section of the wing. This makes for easy access to the batteries, which slide in from the front. With this upper/nose section removed, wing removal, and access to the radio and servos is also simplified. When the lower/rear section of the fuselage is framed up, the curved section 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 front/upper section of the fuselage is built as a separate unit, but may be best left until the wing has been completed. Doing it this way makes it easier to get the correct fit where it covers the wing centre section.

TAIL SURFACES
These are of conventional construction. In making these, it is recommended that the spars for each of the surfaces is 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. The result is that the tail surfaces can be built very light, and are also less prone to warping.

WING CONSTRUCTION
The wing construction is outlined on the plan. 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 engine nacelles are started by building a bulkhead at the position of N-2. Note that N-2 is made of hardwood because it accepts the wood screws that hold the cowlings in place. A balsa doubler is glued to the rear face of N-2. When sheeting the nacelle, the forward edge of the 1/16" sheet should just come to the join line of the hardwood N-2 and balsa doubler. This allows for flush fitting of the cowling which is screwed to N-2.

COWLINGS
These are made with the motors in place. First the nose block is made, but the hole for the propeller shaft should, at this point, be made just large enough for the nose block to be a snug fit over the propeller adaptor back plate. This will hold the nose block in place while the cowling is built. Later the hole for the propeller shaft can be enlarged. With the MEC

type of gearbox, it is best to slide the motor a little to the rear of its final position so that the propeller adaptor is in the middle of the nose block, thus supporting it while the cowling is assembled. Start making the cowls by cutting out the side panels. These are attached at the rear to the hardwood N-2 bulkhead, using #2 screws. To reinforce the balsa where these screws are located, a small square (washer) of 1/64" ply should be placed under the heads of the screws. The front edges of the side panels are glued to the sides of the nose block. Next apply the top and bottom parts of the cowling, gluing these to the nose block and adjacent side panel sections, but not of course to the bulkheads adjoining N-2. When the glue is dry, take out the screws, and remove the cowling. Now the hole in the nose block for the propeller shaft can be enlarged to give adequate clearance, and the motor moved forward to its correct location.

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.

BATTERY LOCATION
The battery packs that are shown in the plan are two nine-cell packs of standard RC 1700 nicads. Each pack is made from a flat seven cell pack , with two additional cells added on top of each pack. This is a matter of convenience for this builder, since these packs are used in several other single motor models. Another way of arranging the batteries is to use three "six cell" packs taped together sitting on edge. There is ample length available for the battery pack, so this provides plenty of space for moving the packs forward or backwards to achieve the correct C of G location. If using the lighter cells, the battery packs will likely have to be quite a bit forward of the location shown on the plans. The packs are secured to the platform with Velcro strips, but a back stop should be made so that they do not move backward under acceleration on a rough strip.

ELECTRICAL INTERFERENCE
In multi motor electric models, there is an increased risk of problems with radio interference from motor brush noise and also the increased length of wiring used for the motors. Schotky diodes should be placed across the terminals of each motor when they are wired in series such as in this model. This is in addition to the normal capacitors, which should of course be used across the motor terminals. The wires carrying current to the motor should be kept touching each other, and twisted at least one turn to the inch. The radio and servos should be kept as far as possible from the motors and motor wiring, but this is taken care of with the layout shown in the plans. Servo leads must be kept short. Do not use outboard servos for the ailerons. These would require long leads running along the wing, and they would be very prone to picking up interference from the parallel wiring that carries power to the motors. At the low airspeed of this model, one standard servo is ample to operate the ailerons. Weight can be saved by using micro

servos for the rudder and elevator, but it is recommended that a standard servo be used for the aileron. The ailerons require more force than the elevator and rudder, and apart from being stronger, a standard servo draws less current under high load conditions.

COVERING AND FINISHING

The prototype is covered mostly with low temperature film. It is slightly lighter than high temp film, and less likely to shrink the balsa covering of the fuselage into undesirable hollow panels. Some of the new lite films now available would be even better than the low temp film available when this model was built. In the prototype, mica film was used for the lower surface of the wing and horizontal tail surfaces. It is lighter (especially the transparent) and stronger than film. Its appearance is not as good, but that is not so important underneath. The windows of the prototype are covered with clear monokote. This should be applied before the regular film covering.

UNDERCARRIAGE

Instructions are written separately for the retracts that are used in this model. A very simple adaptation can be made it a fixed gear is preferred. The same undercarriage mounting pedestal is built from hardwood strips. The gear leg is made up similar to the one used for retracts, but the “U” shaped slot at the top end should not be formed. Rather than this, leave the wire straight and run it up the full length of the #2 hardwood rail. This wire should be bound and glued to the #2 rail. Making the gear in this manner gives the same torsion bar springing that is provided for with 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 builders have warned about 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, and rudder control is positive. Then slowly apply more power. The model is usually in the air by the time the throttle is little more than half open. Once airborne, full power can be applied and the gear retracted. Landings can be done with no power, but are more realistic, and safer under windy conditions, if a little power is carried. A powered approach should be somewhat flatter, and power kept on through the flare. All landings should be three point at minimum speed. 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 stalled.

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. By the time the end of the runway is reached, there is enough speed for this manoeuvre. Then by the time the model comes back over mid field it will have enough speed to do a repeat. Good luck in showing off your Mosquito.

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Summary: DH Mosquito T III. (2000) 1/9 scale. Span 74ins. Wing area 825 sq ins, airfoil, Eppler 374 with NACA leading edge cuff outboard. Length 55.4 ins. Weight with eighteen RC-1700 cells is 114 ozs for wing loading of 20.0 oz/sq.ft. Trinity Ruby 16T motors with 6.2:1 ratio superbox drive 14 x 12 APC electric props at 4,800 RPM. Current draw 31amps giving static thrust 67 ozs. Retracts.

LIGHTWEIGHT RETRACTS

The retracts described here were designed for electric powered models of multi engine aircraft, and have been used in several the have weighed from seven to twelve pound. The only item needed for the construction is a good vice, and the strength does not depend on any solder joints.

Absorption of bumps in the runway is important. In this design, when a wheel hits a bump, the landing gear leg is allowed to flex backwards. This is due to the ‘torsion bar’ effect of section A to B of the landing gear leg where it passes through the nylon landing gear straps that form the pivot point. Because of having the axle behind the pivot point, as the landing gear leg flexes backwards, the axle also moves upwards, thus reducing effective vertical length of the gear and absorbing the bumps very effectively. The bend in the landing gear leg between the pivot point and axle is for cosmetic reasons only. The only part visible below the nacelle is the vertical part, and looks better than if it were raked backwards directly from the pivot point to the axle.

The landing gear leg is actuated by the end of the operating crank. It slides in a slot which is formed by a long “U” shaped bend at the top end of the gear leg. Forming this “U” shaped slot is perhaps the most challenging part of the construction, so this end of the gear leg should be made first, the rest being quite straight forward. The wire is bent cold with the use of a vice. When the gear leg is in the down position, the end of the crank is “over centre” in relation to the slot, so the rearward force on the gear leg forces the crank into the dead end of the slot, thus preventing a gear collapse. The positioning of the operating crank is quite critical in order to get this effect, along with the correct amount of travel for the gear leg.

A long 3/32” wire shaft is used from the retract servo out to the engine nacelles to operate the retracts. When building the wing, the nose ribs have to be threaded onto this wire shaft before they are glued in place. The motor mounts and pedestal are made of hardwood. My preference is basswood. The glue joints need to be of good quality, using epoxy, and gussets may be used where thought necessary. The sequence for construction is shown on the plans using numbers, starting with 1. (On some of the older plans such as the Lancaster, the sequence is with letters "A,B,C,D" etc.)

The spring from point S1 to S2 compensates for the weight of the landing gear leg and wheel. With the correct tension, it is possible to raise and lower the gear with very little force, but this only applies when the wing is held in a horizontal position, and the wheels are in place. Before connecting up the retract servo, operate the gear manually. Adjust the tension of the compensating spring so that approximately the same force is required to lower the gear as raise it. When this has been done, connect the retract servo. The engine nacelles are built after the gear is completed and is operating satisfactorily. Next the cowlings are made.

If the gear legs get bent back due to a heavy landing etc, it is possible to remove them by taking off the two nylon straps that hold them in place at the pivot point. Access to these straps is possible through the wheel well opening. The legs may then be set to their original position in a vice. It is not advisable to try and bend them back to their original position while in the plane.

Good luck with your retracts.

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September 2005. The Trinity Gem series motors now have a different name. The updated Ruby motor is the Trinity Speed Gem Chromium 16 turn double wind motor available from Tower Hobbies and other sources. This is an 05 racing car motor (speed 550), often referred to overseas as a "buggy motor." The MEC superbox is available from Pete Peterson are MEC in Seattle at a ratio of 6:1 which would be suitable. Check www.modelelectronicscorp.com Other options are brushless motors of course, but try to use a large 12 to 14 inch prop with course pitch. Anything less in prop diameter or pitch will be less efficient. The used of li-poly batteries will reduce the flying weight considerably and enhance the performance of the model.