hummer

Sport Canard For Geared Speed 600 Electric Motor

Design by Bill Winter with John Hunton

Photography By Bernie Stuecker and Tom Schmitt
(Construction Photos By Authors)

Winter and Hunton holding Winter's latest designs. Bill holds classic cabin model, John holds advanced canard design. Both are powered by Speed 600 electric motors.

Introduction

The Hummer is an idealized, contemporary design for optimum enjoyment of wide-open spaces and infinite skies. It is not a wee-hours doodle. Let's cut to the chase ...

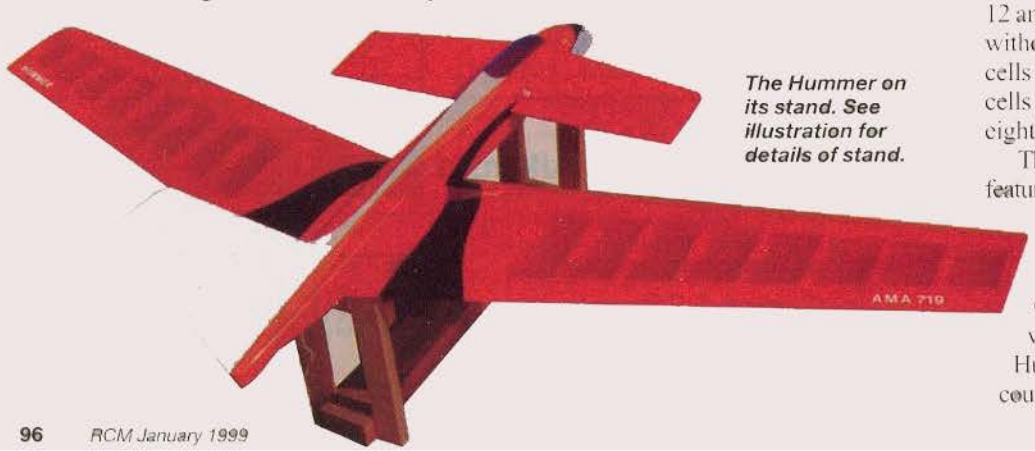
To the designer of both wet and dry models, the former has one correct engine, tank, and prop, and that's that. Electric has a multiple split personality in that there can be many correct motors, combinations of batteries, and a wide variety of correct props, both tiny and huge. All are justified by various combinations of drives with gear ratios, volts, amperes, watts, smoke, and mirrors!

Nikola Tesla (alternating current mastermind) demonstrated an R/C model submarine in Grand Central Palace (NY) at the turn of the century; he'd love this wild stuff!

The facts: Speed 600 motor, seven 1400 mAh cells, 2:1 gearing (ours is a Hobby Lobby 1.8 Titanium belt-on gearbox), Graupner 11 x 7-1/2 folder, an Airtronics MA-6 controller (BEC type), and the current draw is 10-12 amps. Airframe: 62 in. span, 558 sq. in. wing area, 138 sq. in. canard area, total lifting area is 696 sq. in., gross weight is 53 ounces, wing loading 13.677 oz. per sq. ft., total lift area loading 10.97 oz. psf.

Since the motor run is 7 min. at 12 amps, 8 cells would boost power without a short-run penalty. 800 mAh cells at 12 amp yield 4 min., 1700 mAh cells 8.5 min. Ratios of 2-1/2:1 and 3:1 on eight sub-C's will go well.

The Hummer's configuration combines features of previously published "X" ships, notably the Q.E.D. canard (March 1996 *Model Aviation*), Javelin delta-canard (September 1997 *RCM*), and Goblin (July 1997 *Model Aviation*) with its forward sweep and V-tail. Hummer is a forward-swept, short-coupled canard. Forward sweep, in this



The Hummer on its stand. See illustration for details of stand.

Bill Evans (Similar designer) launches Hummer. Model has no landing gear (permanently retracted?) for best efficiency. Hand-launches easily.

configuration, requires wingtip wash-in, not the familiar wash-out.

If you must know more, a detailed explanation of canard layouts appeared on page 11 in the March 1996 *Model Aviation*. That reference shows how to find the MAC (mean aerodynamic center) of the whole airplane, not just the wing, a calculation necessary for any model with a "lifting tail" wherein both surfaces lift and share the weight load. On the Hummer, we found that locating the C.G. on the MAC resulted in an "iffy" rearmost C.G. location. The final C.G. location is 1/2" forward of the MAC to provide an adequate margin of stability with the amount of lift generated by the large canard which is set at a necessarily high angle of incidence ... *(Bill Winter)*

A few cautions are warranted for this advanced design. While the model is exceptionally simple to build and fly, you should be aware of the following differences: The Hummer has a high lift to drag (L/D) ratio with a very shallow glide angle. You will usually have to "fly" the model onto the ground to land it, not just let it float across the field, for it will not stall. Also, with the super-stall stable characteristics inherent in the canard, it is easily possible, on the other hand, to get "behind the curve" in landing and not have enough velocity to flare. So, when landing, keep your speed up and fly the Hummer onto the ground.

In the air, the Hummer presents a completely different aspect, being a "tail first" model. Just keep it high and close-in until you get accustomed to its visual feedback. It has a very low frontal area and it is easy to lose sight of it during a high climb-out; you just see the "razor's edge." Keep your colors bright and always climb into the wind so it will tend to drift toward you if you lose it momentarily.

The Hummer is a very stable soaring platform and frequently reaches the clouds. Often, you can set up neutral trim (by adjusting one or two clicks of trim at a time) and it will turn by itself either way into lift. After you have climbed to a comfortable altitude and have powered down, establish a neutral trim and the model will start turning on its own; don't over-react and change anything, it is trying to tell you something. Just let it be and it will climb if there is lift.

CONSTRUCTION

Keep your wood light. This model is not designed for aerobatics (although it will loop nicely) or to be subject to high stresses. When buying wood, get plenty so you will have a stock to make specific selections from. Use medium/light wood (but not mushy) throughout except for the wing spars and any other areas called out on the plan. Use film covering because it has a good strength-to-weight ratio. We used red transparent film.

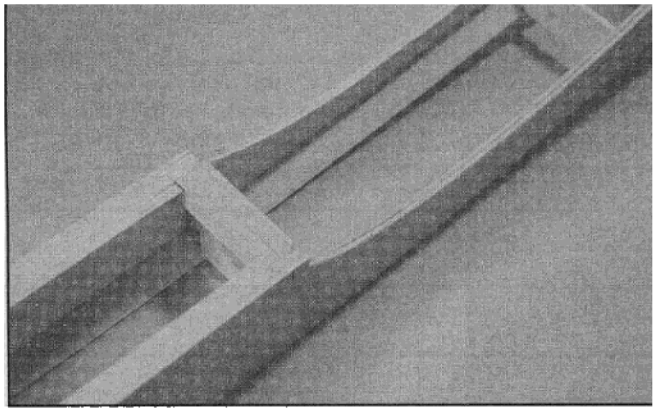
Bill Winter holding the Hummer.

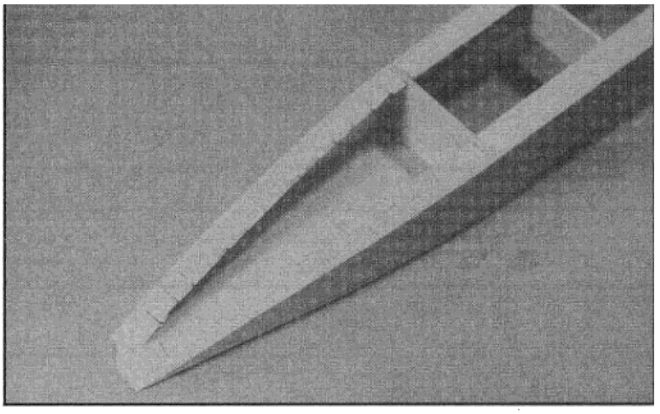
HUMMER

Designed by:
Bill Winter
TYPE AIRCRAFT
Sport Canard
WINGSPAN
62 Inches
WING CHORD
9 Inches (Avg.)
TOTAL WING AREA
558 Sq. In.
WING LOADING
13.67 Oz./Sq. Ft.
WING LOCATION
Low Wing
AIRFOIL
Flat Bottom
WING PLANFORM
Swept Forward, Double Taper
DIHEDRAL, EACH TIP
2-13/16 Inches
OVERALL FUSELAGE LENGTH
36-3/4 Inches
RADIO COMPARTMENT SIZE
(L) 12-1/2" x (W) 2-1/2" x (H) 2-1/2"
FOREPLANE SPAN
23 Inches
FOREPLANE CHORD (inc. elev.)
6 Inches
FOREPLANE AREA
138 Sq. In.
FOREPLANE AIRFOIL SECTION
Flat Plate
FOREPLANE LOCATION
Shoulder-Front
VERTICAL FIN HEIGHT
11 Inches
VERTICAL FIN WIDTH (inc. rud.)
6-1/2 Inches (Avg.)
REC. MOTOR SIZE
Speed 600
GEAR RATIO
1.81:1 (2:1)
PROPELLER
Graupner 11 x 7-1/2
LANDING GEAR
None
REC. NO. OF CHANNELS
3
CONTROL FUNCTIONS
Elev., Ail., Motor Controller
C.G. (from L.E.)
2-9/16 Inches (At Fuselage)
ELEVATOR THROWS
1/2" Up — 3/4" Down
AILERON THROWS
3/8" Up — 3/8" Down
DOWNTHRUST/SIDETHRUST
0°

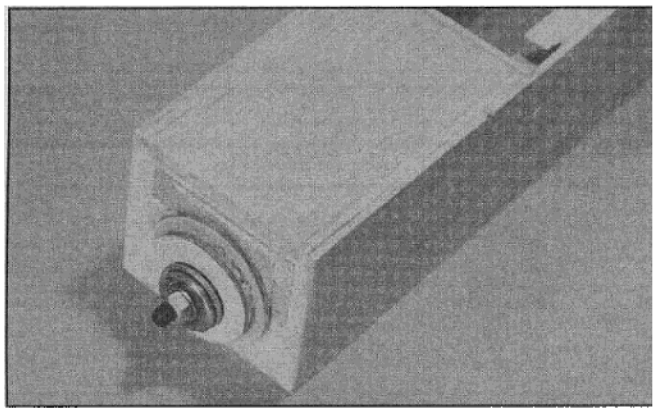
BASIC MATERIALS USED IN CONSTRUCTION

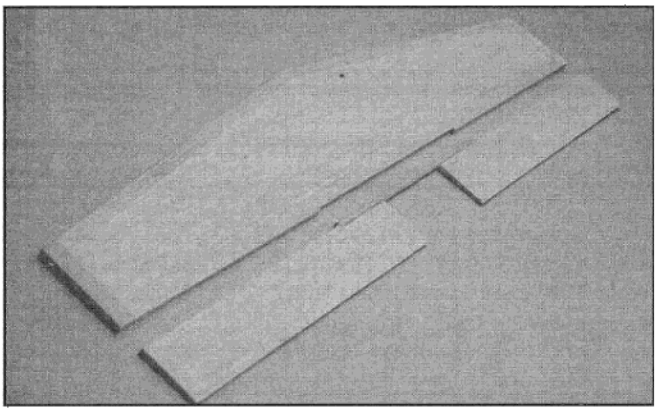
Fuselage	Balsa & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready To Fly	53 Oz. (3 Lbs. 5 Oz.)
Wing Loading	11.0 Oz./Sq. Ft.





(L): View of fuselage under construction shows "triangulock" system. Longerons are triangles notched for formers. Wing saddle shown here at 1/8" thick was later changed to 1/4" thick. (R): Longerons at tail are notched to allow for bending.





(L): Nose of Hummer before shaping. Nose ring is shown larger than required, to be sanded to final shape. Gear box configures with offset from motor shaft underslung (see plan). (R): Foreplane is built-up then sheeted. Elevator joiner must be epoxied for highest strength.

Fuselage:

The fuselage is built using our own "triangulock" system which helps accuracy of assembly. Trace templates off the plans for all fuselage parts. From the templates, cut the sides, top, and bottom sheets out, leaving a little excess on the sides of the top and bottom sheets. The side sheets run forward even with the nose ring, but do not curve in to it. Cut out the triangular longerons and notch them accurately for the formers. Test-fit all of the notches with a piece of scrap before assembling anything. Slit the triangles for rear fuselage curvature using a band saw (or a hacksaw against a backstop). Cut out all formers (drill wing dowel hole in former E) and the wing seat doublers. Glue the triangles to the side sheets (except at the top rear), being careful to make a left and a right side. Install the wing seat doublers. Cut through the side sheets for the foreplane while they are still on the board.

Install formers B and E into one side, also install the wing hold-down plate into the slots in the wing seat doubler. Use a yellow glue like Titebond. Install the other side to the formers, being sure that they bottom out completely. Check alignment over the plan top view and let dry. Install all other formers and crosspieces which are of similar length. Let this subassembly dry before pulling the tail together. Next, pull the tail together, checking alignment over the plan, making sure that the sides are vertical at the tail-post. Install the double-slotted rear upper triangles.

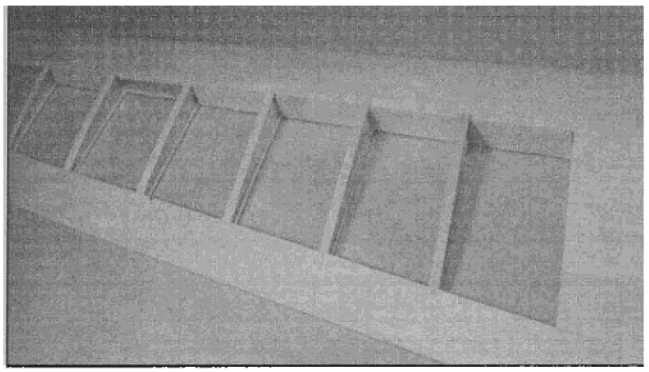
Block-sand the bottom of the fuselage sub-assembly to ensure that it is perfectly flat. Glue the bottom sheet on. Install the bottom nose fairing blocks, then the side blocks. Install the pine block motor mounts. Using masking tape, temporarily block off any ports or holes on the motor. Test-install the motor using the stock clamp as shown. Center the plywood nose ring over the motor shaft noting that there will be a cooling air gap (or inlet) behind the spinner. Also, note that the gearbox is offset from the motor shaft. Rig the gearbox so that the offset is underhung (see plan). Install all motor wiring per the diagram (make any solder joints solid and shiny). Install the servos and linkages, then remove all equipment from the fuselage. Install the top sheeting and complete the nose assembly.

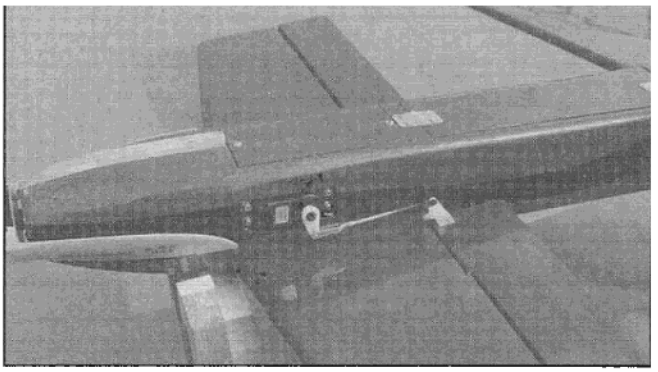
Shape the fuselage using coarse paper at first, then finer paper. Contour smoothly to the nose ring. Leave flats at the wing leading edge/fuselage juncture. You can do considerable rounding of the fuselage corners which will also make the model lighter by removing this material. Cut out the two hatches and the motor access hatch. Use a Zona-saw or hack saw for the cross cutting of the motor access hatch. Install hatch hold-downs. Sand the ends of all mating access and hatch surfaces slightly short to allow for covering material overlap. Cut out the cooling air exit holes, where shown, in the bottom rear of the fuselage.

Be sure to install the motor buffers as shown. These buffers transfer the load of the battery to the fuselage sides in case of a sudden stop!

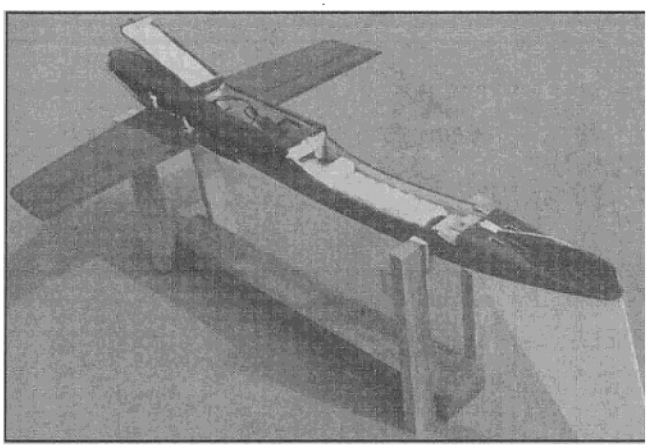
Dorsal fin:

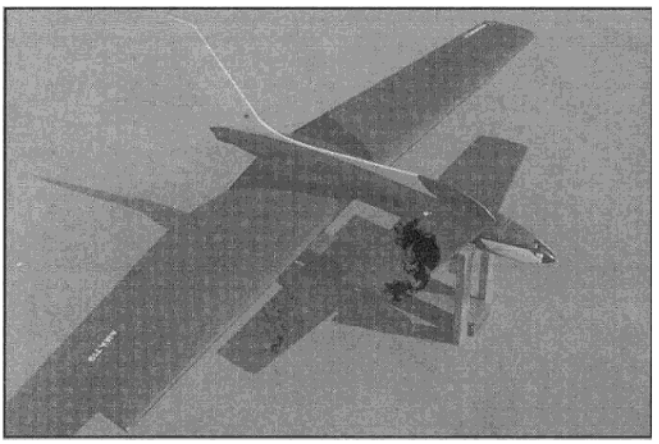
Trace off the fin and dorsal fin in duplicate from light sheets of 1/8" balsa. Lightly spray one side of each sheet with 3M 77 (or equivalent) spray adhesive and put the parts together flat on the board after the adhesive becomes tacky. Cut to final shape, then unite these parts over wax paper. Sand the sub-assembly smooth and round off the top (leave square where it mates with the fuselage). Taper the fin to 1/8" thick at the tip to save weight. Test-fit dorsal and fin to the fuselage; trim and sand as required to get a tight fit. Cut notches for the stubs, then mark and cut the fuselage correspondingly and install the stubs in the dorsal as shown. Build the sub-fin similarly. Do not attach the fins/dorsal fin to the fuselage until after covering is complete.





(L): Wing construction is typical "D" tube and capped ribs. Simple to build, strong. (R): Underside of "tail first" Hummer shows simple external elevator linkage. Note that downward deflected elevator is up control, just the opposite of "tail last" conventional planform.





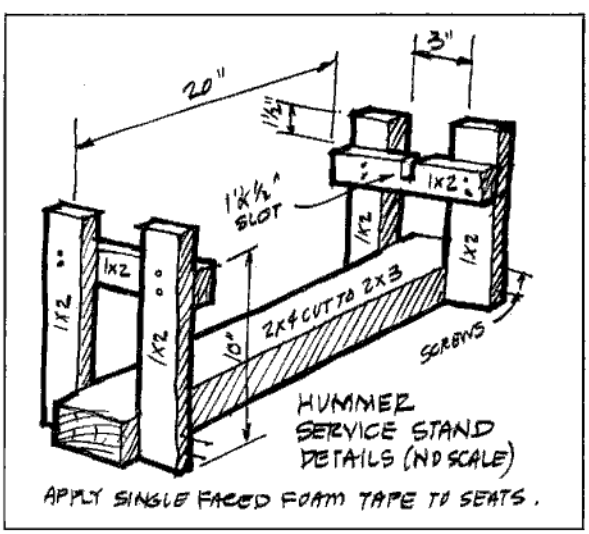
(L & R): Stand for Hummer is almost a necessity. Stand allows for bottom access as well as a place to stow Hummer safely while charging batteries (we use three packs, one flying, one cooling, and one charging).

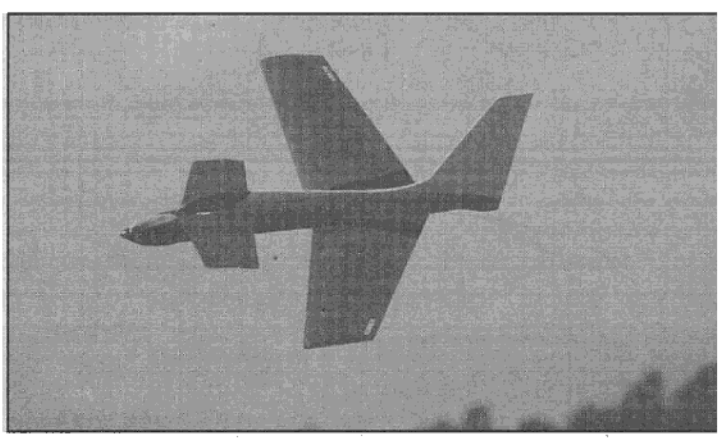
Foreplane:

Select medium wood for the leading edge and hard balsa for the rear spar. Elevators can be light balsa. Cut out the bottom sheet and butt join as required. Mark locations of all foreplane members on this sheet. Lay wax paper over the plan and pin the sheet down. Cut and fit the edge pieces, then glue into place. Install the center block and all diagonals. When glue is cured, remove all pins and block-sand the top surface level and even. Mount the top sheet using slow cure CA. Sand the top and bottom of the foreplane smooth. Round the leading edges and tips. Pin the foreplane back down over the wax paper. Fold the wax paper up and over the rear spar. Build the elevator right up against the foreplane. When cured, remove the elevator assembly and sand to proper outline. The foreplane and elevator are covered before hinges and horn are installed.

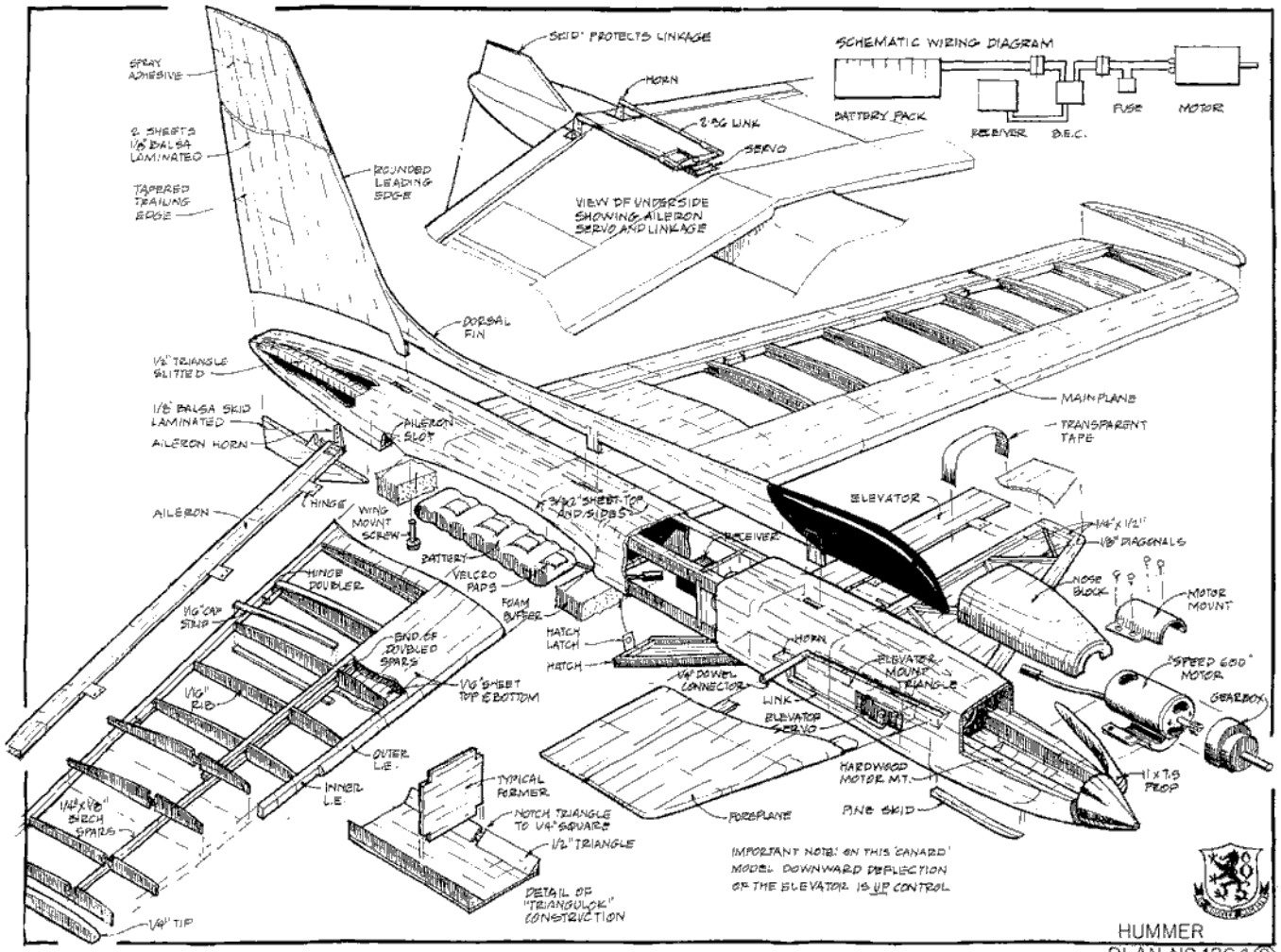
Wing:

Build the wing complete to the center section and cut out the front center as required after basic assembly is complete. Trace over each rib outline and transfer to medium balsa. Cut out each rib, being certain to hold the knife vertical at all times. Cut the spar slots accurately with a sharp blade. Select firm, straight-grained wood for the spar and aileron spar stock. Cut the spars and doublers to length, leaving a little excess in the center section. When gluing the spar doublers in place, pin the assembly to the bench and align with a metal straightedge. Cut to length, then notch the aileron spar. Cut a piece of wood for the bottom leading edge sheeting and true the edges with a sanding block. Pin the sheeting down over wax paper covered plan. Pin the bottom spar in place over the sheet and glue it in place,





Sleek Hummer gliding with prop folded. Model has excellent lift to drag ratio. When making approach to landing, keep speed up. It is very easy to get flying too slow for good control or to flare. Fly model onto ground, do not wait for it to stall.



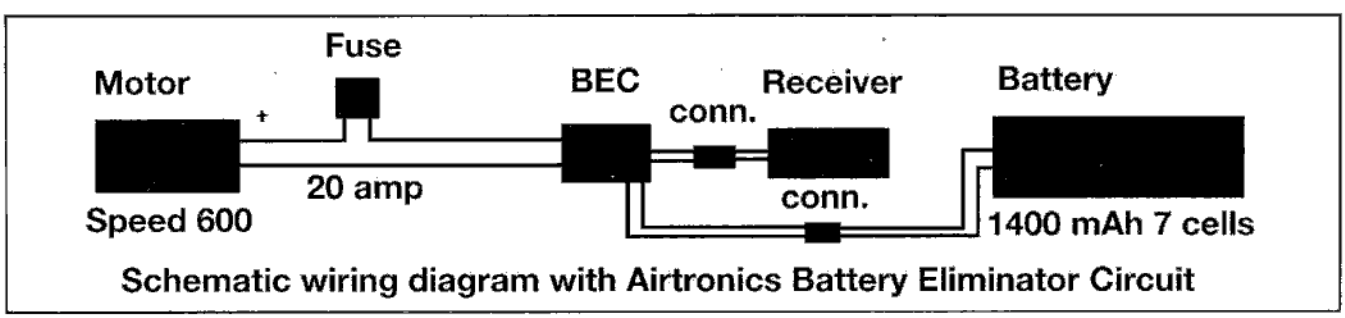
noting that the sheet only extends halfway across the spar (so a good seat is provided for rib cap strips). Pin the trailing edge over the plan. Install the leading edge onto the bottom sheeting. Install small shims under the leading edge to raise it 1/16" at the center section and zero at the tip (with proportional shimming in-between). Dry-fit each rib (trim ends with a sanding block as necessary), then glue ribs in place with a 1/16" shim at the aileron spar, using a small triangle to ensure vertical position. Pre-fit the top spar assembly (trim ribs as required), then install spar. Lightly block-sand the top of the wing assembly to true the ribs.

Cut out the spar joiner, crack it slightly to accommodate the required bend (check over plan), CA the resulting joint, then install it to the wing panel under construction.

Install the top leading edge sheeting thus: pre-fit it and trim as required, apply yellow (Titebond) glue sparingly to the ribs. Pin the leading edge of the sheet down and glue it in place with CA. Pull the sheet over the ribs, pin and then CA the spar/sheet joint. Check that the sheet is tight to all ribs, pinning as necessary. Install the top cap strips. Pull the wing up and block-sand to true, then install bottom cap strips. Install tips, then block-sand the entire wing panel to true it up.

Begin building the second wing panel by pinning the first panel down over the plan with the tip blocked up the required amount for dihedral. Build to the exposed spar joiner. After the basic wing has been assembled, pull it up and add the fixed trailing edge parts. Make the leading edge center section cutout by doing the required cutting. Install 1/8" balsa buffers at the open ends, then install the plywood sheet. Do not drill the hole for the hold-down dowel in the wing yet. Sand the entire wing assembly with a block and fine paper. Cut out and shape the ailerons as shown. Install the 1/16" ply hold-down bolt reinforcement by cracking it to conform to the wing. Wing is covered before hinges are installed.

Pre-final assembly: Slip the foreplane (without elevator) into its slot, checking that it is square to the fuselage and level. Shave and shim as required to make the foreplane dead-level with the fuselage and not tilted to either side (it does have 5-1/2°



Schematic wiring diagram with Airtronics Battery Eliminator Circuit

of positive incidence). Trial-mount the wing and trim the seat until the wing is perfectly level with the foreplane.

Covering:

After fine-sanding all parts, vacuum thoroughly to remove dust. Clean your bench also. We use Coverite's films and BalsaRite, thinned, to ensure good adhesion of the film. Follow manufacturer's instructions for film application. Check the wing surfaces for trueness after covering. Take out any warps or twists. Pin each wing panel to the board, shim up the leading edge of each tip 1/8", re-heat the top surface to provide one degree of wash-in.

Final Assembly:

Slit for all hinges and install them along with the control horns. To install the front wing hold-down dowel accurately, push a small dab of modeling clay onto former E over the pre-drilled dowel hole. Slip the wing into place and the clay should come off onto the wing (attached to the film covering) and give you perfect indication of where to drill for it. Install the dowel with epoxy, slip a piece of wax paper over the dowel, then re-install the wing while the epoxy is setting. Drill and tap for the hold-down bolt at the rear of the wing. Install all R/C equipment and control linkages as shown. For the canard configuration, be sure to remember that up control is when the elevator deflects downward. Differential elevator control is indicated on the plans (this is to provide more up than down). This can be obtained by tilting the elevator servo arm toward the elevator by about 10°-15°. Check the balance point and add ballast front or rear if you cannot attain balance by shifting the power pack far enough.

It is very important to buffer the battery front and back with rigid foam once it has been properly positioned. On an early test flight, I did not buffer the battery and the following harrowing scenario resulted: The hand-launch was made harder than necessary. Because of this, the battery pack slid back in its compartment and became unplugged from the BEC. With no control now, the model nosed over into the ground and stopped suddenly. The battery pack slid forward, wiping out several fuselage formers. Buffer your batteries!

Electrical System:

The Hummer has been designed around Hobby Lobby's Speed 600 motor with a Titanium gearbox. We use a 1400 mAh 7-cell pack and an Airtronics electronic speed control unit with BEC (Battery Eliminator Circuit). With the BEC system, no rx battery is necessary. The BEC will shut the motor down, leaving ample power for extended soaring. Be sure to include a 20-amp fuse in the circuit for safety. The Airtronics BEC includes an arming switch which is recommended for additional safety.

Test Flying:

Range check your radio. Make sure that receiver and transmitter antennas are fully extended. Check all controls for proper throw and freedom of motion. Fully charge the flight battery pack. It is very important to keep your flying speed high during the initial phase of flight, so plan to climb out at a shallow angle using minimal control inputs. While the Hummer can be safely operated by one person, it may be prudent to have a helper