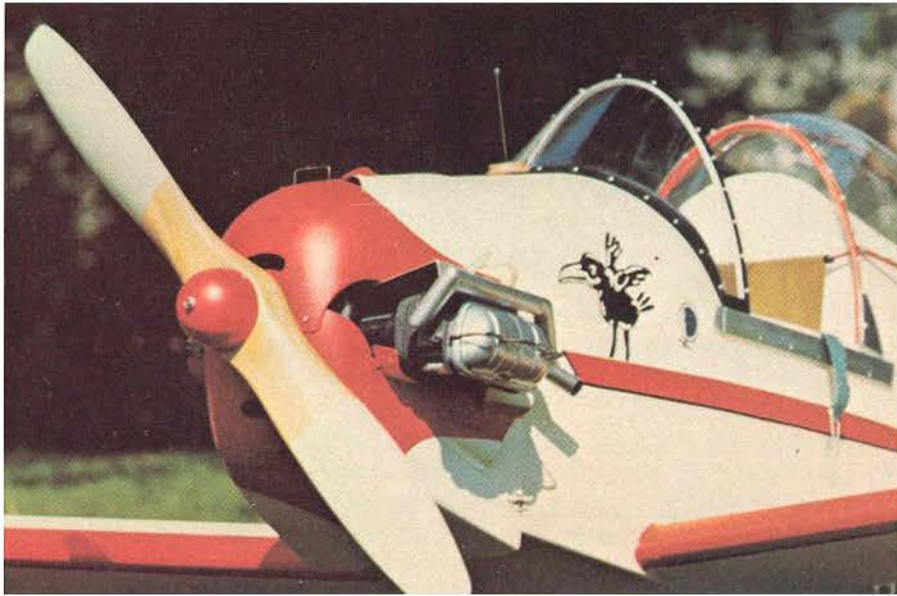


DRUINE D-31 LIBELLE

BY FRANZ MEIER
TRANSLATION BY B. HUBER

TRUBBUBBA



R/C Modeler Magazine is proud to present one of the finest scale aircraft ever published. An exact reduction from the plans of the full size 'Turbulent,' this R/C aircraft is totally scale in every detail.

Introduction

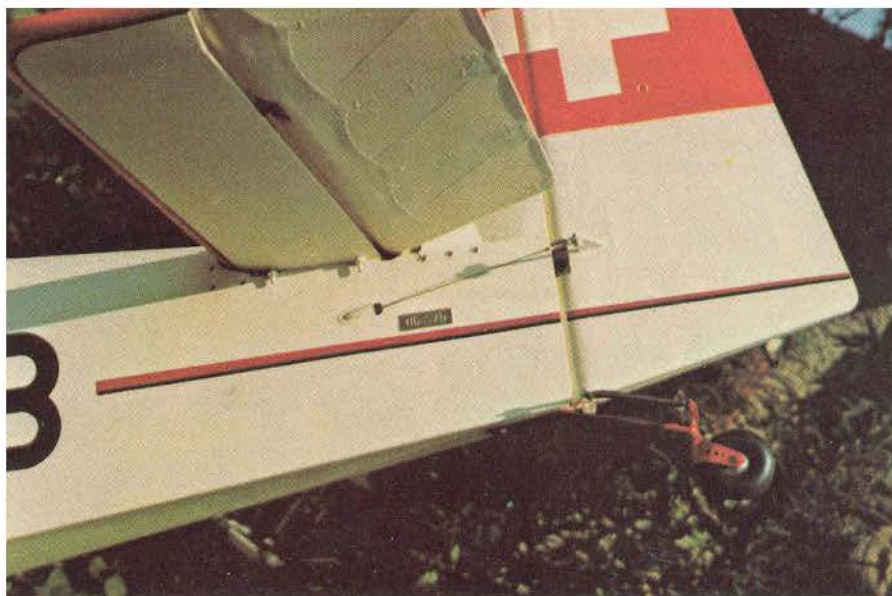
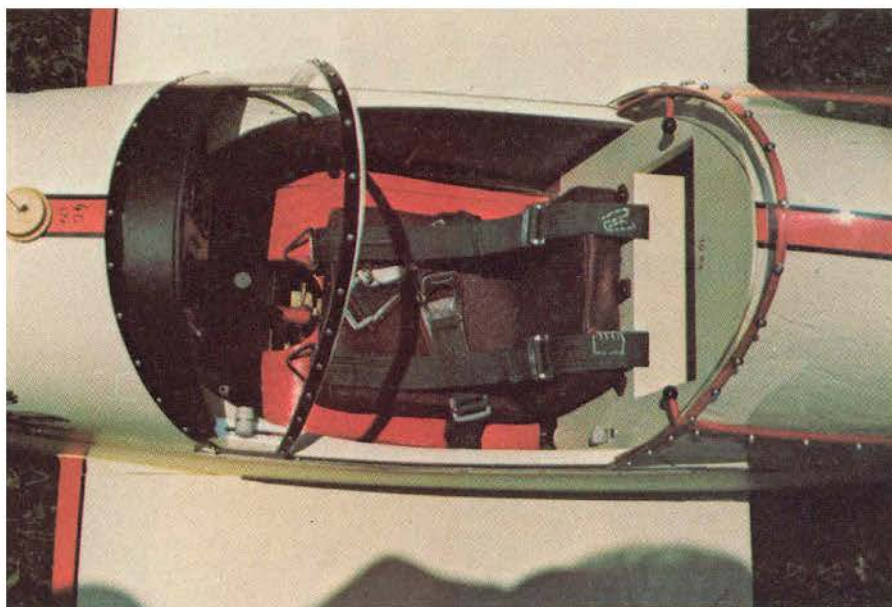
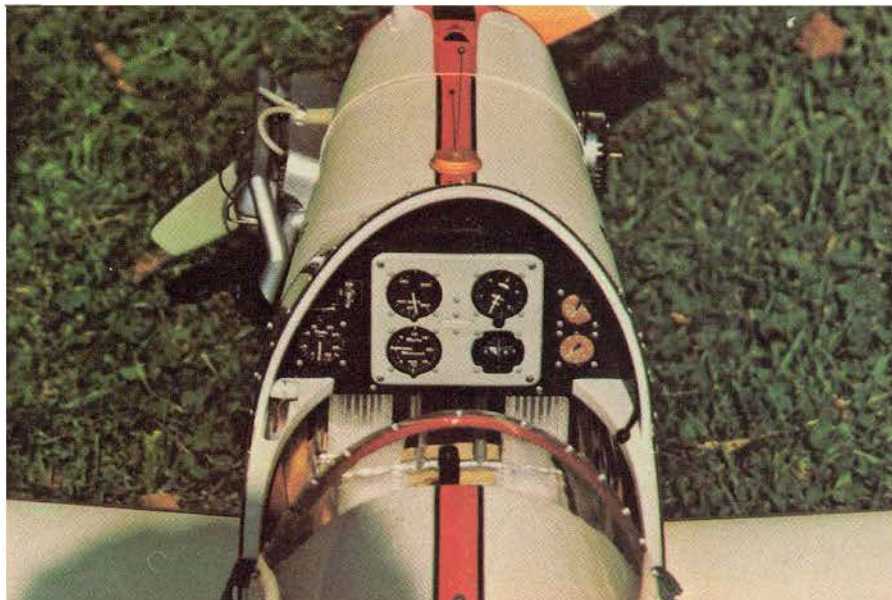
During a big meeting of "home-built" full size aircraft on the airport of Wangen/Lachen at the shore of Lake Zurich, I was anxious to see the simultaneous flight demonstrations of a "Topsy Nipper" and a "Turbulent." I only had heard of the "Turbulent" but never had seen the full size aircraft, so I looked forward to the show. The first fly-by made me completely change my mind and put this plane into the first priority of models I wanted to build. Later, I talked to the pilot and obtained the address of the owner of the aircraft. After sending him a letter it did not take long to get the full set of building plans and parts lists as well as the authorization to completely check and take pictures of the original plane at its home airport.

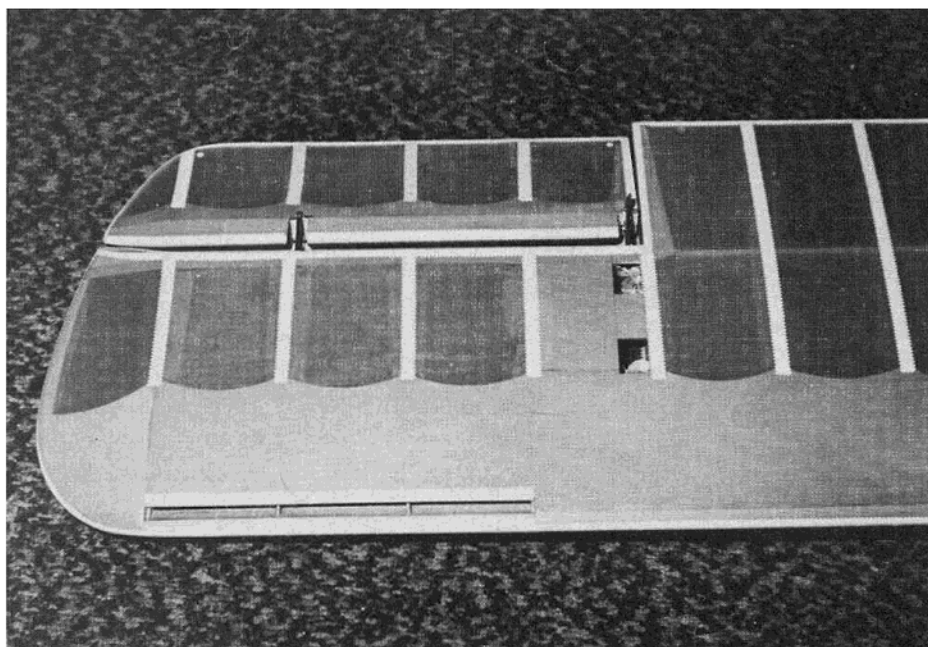
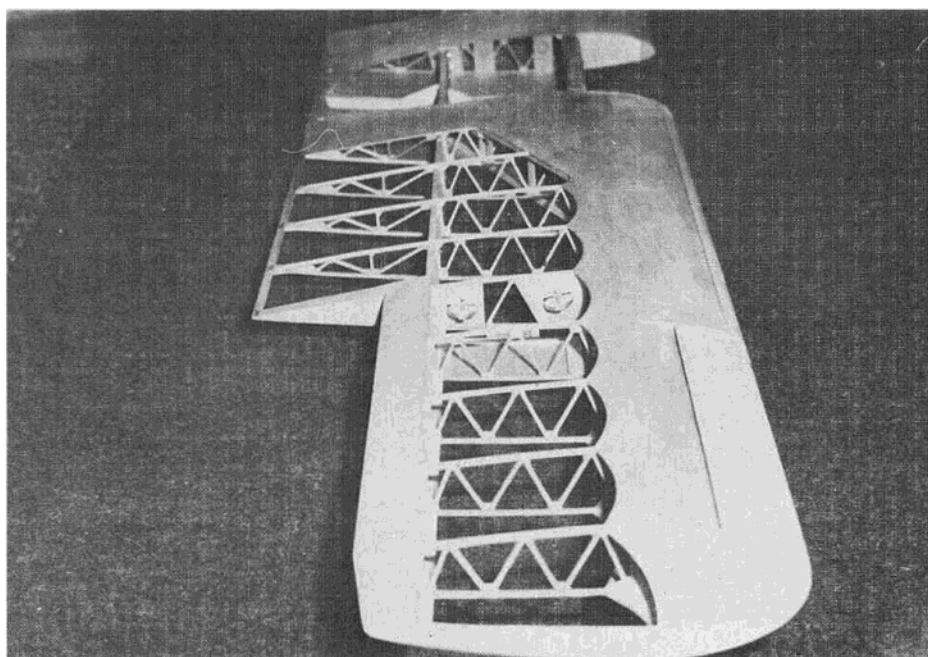
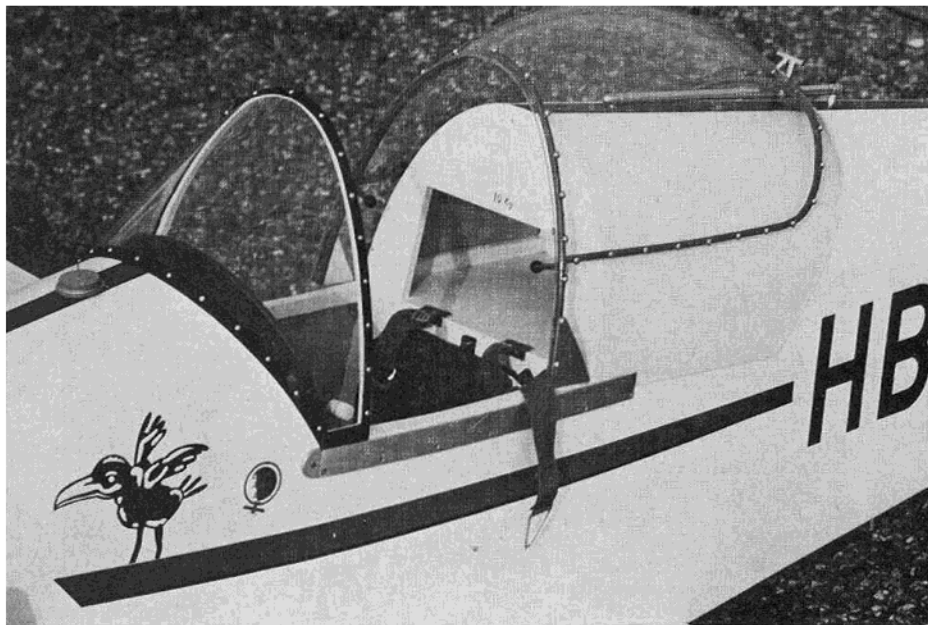
I don't know too much about the history of the "Turbulent." It was developed in the early 50's by a Frenchman by the name of Druine. It soon became very famous as a "home-built" aircraft. In Germany the slightly modified "Stark Turbulent" was built in a lesser quantity. The original of our model was built by its owner entirely by himself in a time span of about 7 years. It is powered by an original 30 H.P. 1953 VW engine. A lot of cross country trips, especially to the northern countries like Denmark and Sweden, prove that more than fun-flights in the neighborhood of the airport are possible.

The Model

I decided to build a model that was truly scale in every detail directly from the full size plans. Not only the dimensions, but I also wanted the materials to be true to the original. To avoid excessive transportation problems I decided to build it to a scale that would result in a wing span of less than 2m (79"). With a scale of 1:3.33 the wing span resulted in 195cm (77"). The plans did not specify an airfoil, so I photographically reduced the full size profile. The ribs are built up from spruce strips in a jig, taking about 1 hour per rib, and using 25m of 2 x 4mm spruce strips. The main spar is fabricated, as on the original, from spruce, but on this important sub-assembly I committed the worst error with regard to the weight. When I finally weighed the model it was 180 gr. (6.35 ounces) too heavy and this meant for me; another 20 ribs and another wing! I was able to save 324 gr. (11.43 ounces) with this new wing, but with a balsa main spar!

The wing sheeting is .6mm (.024") ply. The only difference from the original is the leading edge, because it was no longer





possible on the model to pull the ply sheeting around the tight radius. Therefore, a balsa leading edge had to be used. The attachment of the ailerons is absolutely true-to-scale. The pulleys are specially made from aluminum, the control cables are 19 x 0.1mm C/L lines. Of course the control stick moves with the controls and the tension of the control cables can be varied by scale tension blocks. The wings are covered by Graupner artificial silk. An absolutely scale effect on wings, vertical and horizontal tail is achieved by the simulation of the rib lacing cords and the pinked-edge finishing tapes. With regard to the latter, I made an immense number of tests until I solved the problem with a saw-blade. I bought one in a department store with the correct tooth height. Since the teeth are not symmetrical, the first operation was to file them into the right shape and a uniform tooth height of 2mm (.08"). After that I started a research program on the adequate paper quality. However, I could not obtain the proper result, since either the teeth were not properly formed or the remaining fibers were too long. I was just about to give up, when I saw my 7 year old boy, Renato, producing perfect pinked-edge tapes from some of my blueprints. At first I was angry, but then I realized that this was the paper quality I needed. The technique is simple, all you need is a flat surface, pulling slowly and along the grain structure of the paper. The covered wing is doped twice, then the finishing tapes are applied with glue. Be careful, because bubbles could occur under the tapes due to the fact that the paper expands when it gets wet. The lacing cords are simulated by applying little "worms" of glue with a hypodermic syringe. This operation has to be practiced, because the needle has to move all the time. After these operations, the wing is covered with dope in the conventional fashion.

The fuselage of the original is built primarily from 2.5mm ply. For the model this would mean .75 (.03"), which is not a standard thickness in Europe, so I chose .8 (.031") ply. There are spruce reinforcements on the fuselage and, where they are visible, I made them absolutely to scale dimensions. I used an additional nylon cover over the fuselage with finishing stripes at all fabric connections. An HB-61 engine from Graupner was used with a 400ccm (13.5 oz.) tank. It would have been possible to lead the exhausts through the exhaust pipe of the dummy engine, however, I decided not to do so because of the problems with smearing over the canopy. By installing a Minivox muffler type "Q" by E. Jung, Modell-Technik, Iserlohn, Germany, I not only reduced the noise, but also the exhaust residue on the plane. The engine cowl is of hand laminated fiberglass construction and is not bolted to the plane but slipped over four pins and secured with little clamps.

One of the most exciting details of the "Turbulent" is the dummy engine. I first made a lime-tree model of the valve cover of

the VW engine. The actual model valve covers are thermoplastic moldings over the model. A carefully selected silver dope, together with a high gloss transparent final dope, produce the "metallic" appearance of this part. The cylinder heads are built-up from ply and lime-tree as well as plastics, while the exhaust pipes are brass tubes, brazed together.

The biggest problem on the plane was the canopy, which only a specialized firm with special equipment could produce, at enormous cost! Now commercially available, the canopy is bolted with 1.4 x 5mm round head screws to the 4mm diameter aluminum tubing frame.

The instrument panel is not really complicated, but requires a lot of labor. All instruments were drawn full scale and reduced photographically to 15 resp. 21mm diameter. The convex glass over the compass was made from an easter-egg packing. To improve the appearance of the instruments, a 0.6mm diameter brass wire was applied as a frame. These rings are so delicate, that they had to be applied with dope only as an adhesive. The panel is attached with four bolts, so that it can easily be removed for access to the tank.

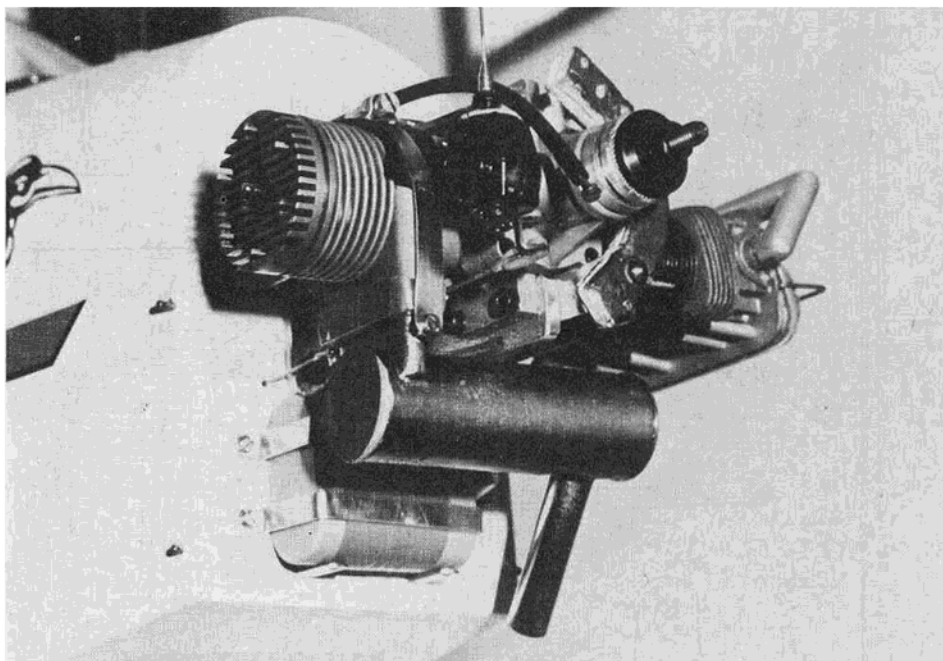
The seats are made up from .6mm ply, while the cushions are sewed together from little red vinyl sheets (I used the ribbons of an old gardeners apron). I used a mixture of hydrogen peroxide and sal-ammoniac to bleach them to the original color. All the metallic parts of the belts are made up from .8mm aluminum sheet.

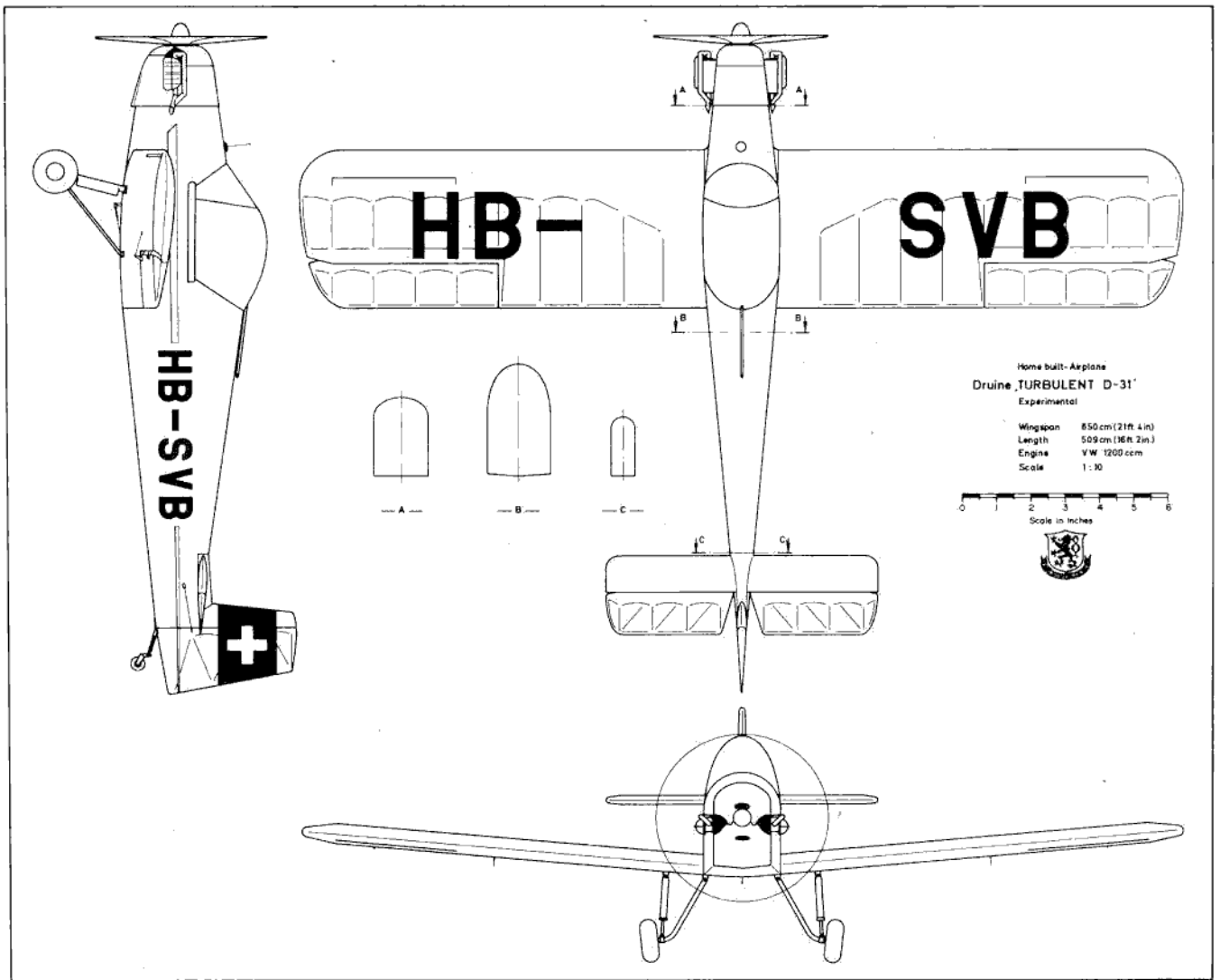
The installation of the R/C gear was absolutely no problem. Two servos and the receiver are placed under the seats. Two more servos are installed in the fuselage, while the power pack is attached to the front former. In addition to the required functions, the control stick, the pedals, and the throttle lever are moved by the servos.

The landing gear is built-up from thin-walled steel tubing with brazed connections. The landing shocks are absorbed by the telescoping struts. The brakes are only indicated and are not functional.

It required a couple of visits to the original aircraft to come up with the identical color tones on the model. The white base of nitrate color is followed by the red trim stripes also using dope. Since the black stripes are only 2mm wide, I used black MonoKote. The bird, Hans Hückebein, was photographically reduced and also cut out from MonoKote. Finally, a flat-finish two component dope is used as a protection against damage by fuel.

The high moment of the "Turbulent" was on the 19th of May 1973, almost exactly 11 months after beginning construction. It was an ideal day for the test flights — clear with a very light west wind. The control stick was, as with most test flights of my models, in the hands of Heini Steiner. We first made some engine run-ups and taxi-tests. Then we filled it up again, started the engine, made a final check of the controls, taxied on the runway, then applied





PLAN NO 608 (C)

**DRUINE TURBULENT
D-31 'LIBELLE'**
Designed By: Franz Meier
Translated By: B. Huber

TYPE AIRCRAFT
Scale French Homebuilt
WINGSPAN
76.77 Inches
WING CHORD
14.18 Inches
TOTAL WING AREA
1064 Square Inches
WING LOCATION
Low Wing
AIRFOIL
Reduced from orig. drawings
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
3.12 Inches
O.A. FUSELAGE LENGTH
60.11 Inches
RADIO COMPARTMENT AREA
Various Locations
STABILIZER SPAN
23.62 Inches

full speed, and we were airborne. Heini had to push the stick considerably, trimmed the plane out and went to a safe height. The model seemed to fly poorly due to being tailheavy! The landing, however, was pretty good, and the landing gear did a great job. We decided to add some lead to the nose and the second flight was tremendous. All combinations of stunt figures, low passes and touch-an-go's followed without an interruption.

Building Instructions

After giving you a couple of construction details in the description of the model, these instructions have been condensed to the absolute minimum. It should be understood, that this is a model for a scale builder with a certain expertise. As a general comment, I have to tell you to build the model as light as possible rear of the C.G., as shown on the plans.

Fuselage

The ply sides are reinforced with the balsa stringers according to detail "V", then glue the doublers after that. Assemble the formers and glue them to the sides. The rear fuselage bottom is inserted and the fuselage top covered with the sheeting.

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STABILIZER CHORD (incl. elev.)
7.09 Inches
STABILIZER AREA
157.5 Sq. In.
STAB. AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
8.59 Inches
VERTICAL FIN WIDTH (incl. rudder)
6.75" (Average)
REC. ENGINE SIZE
.61 Cu. In.
FUEL TANK SIZE
12-14 Ounces
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
Four
CONTROL FUNCTIONS
Rudder, Ailerons, Elevator, Throttle
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage Balsa, Ply & Spruce
Wing Balsa, Ply & Spruce
Empennage Balsa & Ply
Weight Ready-To-Fly up to 176 oz.
Wing Loading 23.8 Oz./Sq. Ft.



DRUINE TURBULENT

Glue the front fuselage bottom and finish the fuselage front portion according to sheet 1. The rudder and brake pedals have to be installed before sheeting the front fuselage top. The cockpit is then completed. Sand the fuselage at this point and cover it with a thin nylon fabric.

Canopy

Make the canopy to fit as a unit. Be careful, because the material cracks easy. Use very fine saw-blades and tape the cutting areas. If the canopy fits, the cutting line is marked on a tape and cut. Make Part No. 10 then, fit it, and glue it to the fuselage. The canopy front portion is temporarily fixed. Parts No. 18 & 19 of the sliding mechanism are made and screwed to the canopy with little countersunk screws, then it is mounted to the fuselage. Detail "W" shows a cut in the canopy on both sides. This cut is used to lock the canopy in flight. If everything fits, remove the guide rails, close the canopy, and mark the cuts on the fuselage. A small wood-screw is screwed at this location, the head is filed off, and the guide rail mounted again. This screw and the brass gusset at Part No. 19 lock the canopy in flight at 3 points. I used another little screw as a safety feature to prevent opening of the canopy. Build the aluminum tube canopy frame now and assemble it to the canopy. The screws in the front are used without washers; and are used in the rear with washers. I used tape as a canopy edge at the front portion.

Wing

The ribs are built in a template. The spruce strips are softened in hot water if required. Make the necessary changes to the template to make Rib 51. The main and auxiliary spar are built now, making certain to drill the holes for the landing gear before assembly of the wing. The brackets also have to be mounted before sheeting. Also, the pulleys for the aileron control are mounted before final assembly.

The horizontal and vertical tail are of conventional construction, but remember it is very important to keep the weight as low as possible. Make sure to mount the aluminum guide tube into the horizontal tail.

Landing Gear

The assembly of the landing gear is a little bit more complicated. Make the spring-strut 41 first, and bend tube 42 according to the plan afterwards. Braze bushing 35 and bracket 39 to the tube. All completed parts are mounted to the wing, checked for alignment, and then tube 43 is made to fit. Make a brazing jig for tubes No. 43. A rib is cut out of 6mm thick plywood. Temporary fittings are made to give the same condition as on the wing and mounted to the jig. Assemble all parts on the jig and braze the complete landing gear as a unit. Mount the landing gear to the wing, assemble the axles, then align and braze them. The balsa streamliners are mounted after that.

Make all the detail parts for the tailwheel first. Epoxy Parts 12 and 15, and bolt and epoxy Parts 13 & 14. Assemble the tailwheel now and paint it red with the exception of the spring. The two tension springs couple the tailwheel to the rudder.

Final Assembly

The control is made by cables. The connection

to the servo is via a Kwik Link, and the cables are attached according to detail "T" and connected to the rudder according to detail "S". The elevator is driven by a pushrod instead of the cables. The following method is used to drive the control stick with the elevator movement: A pulley is mounted to the wing with a control cable around it. An electrical terminal with a soldered-on brass tube is fixed to the cable. A piano wire is, in turn, soldered to the pushrod. When mounting the wing, the wire is engaged into the brass tube, establishing the connection of the control stick.

At this stage the wing is covered with fabric, Graupner No. 615, while the horizontal tail is covered with thin paper. After 2 coats of thin dope, the finishing tapes are glued on. The lacing cords are simulated with white glue and a hypodermic syringe. Apply 11 "worms" over the full length of a rib on the wing; 3 of them on vertical and horizontal tail. After that apply the last coat of dope and start painting the model according to the color scheme. I used a dull transparent final coat, which gives the model a yellowish appearance exactly like the full size airplane.

The dummy engine is a job as such. First you have to get two "Williams Whirlwind 2" cylinders. Only the lower part, 30mm long, is used. The plan shows how it is put together. Paint the whole thing with silver paint, to which a little portion of black has been added. Solder the parts of the exhaust now and fix it with the two epoxy-brackets to the dummy engine.

The engine cowl consists of two parts. Make the lower part fit first. The front bearing pins are M2 bolts, epoxied from the rear side. The fan sheets are made from 0.2mm aluminum sheet. If the proposed muffler is used, the cowl has to be cut out to fit. The cowl is attached with 3 aluminum brackets and small bolts, the rivets are imitated with brass nail heads. The upper cowl is attached with 4 wood screws (without heads) and wire clamps (I replace the scale clamps with safety pins for flying!).

Build up the seat from 0.6mm ply and balsa formers. The cushions are made from red vinyl with foam rubber upholstery. The seat is squeezed at Former 3 and bolted at Former 2 with an aluminum bracket.

Instrument Panel

First make a 0.8mm ply sheet fit according to Former 2A. Cut out the openings for the instruments and cover the panel with a black self adhesive sheet. Cut out the rectangular frame and the covering sheet. Solder 0.6mm diameter brass wire to the rings according to the size of the instrument openings. Dump them into black paint and apply them to the panel. The frame of instruments No. 4 & 5 consists of 0.6mm plywood. Put a plexiglass sheet to the rear side of the panel and fix the instrument photos with adhesive tape. Finally, the panel assembly is bolted to Former No. 2A.

Test Flights

Use a 12/5 propeller. The C.G. location should be as indicated on the plan without fuel. Apply ballast, if the C.G. is not right. Taxi around before the first flights to get accustomed to the response of the tail wheel. The model will lift the tail shortly after applying full power, however, make sure that you have enough speed before you take-off. The model has excellent flying characteristics and good response to the controls. Practically all stunt maneuvers have been flown with it. The final landing approach should be made with some power, going to full throttle shortly before landing. The plane should touch the ground with the elevator fully up, preventing a turnover.

Since it is not possible to fix all details on a plan, I have prepared the following sets of information material:

15 color photos (9 x 13cm) of the original — \$10.00

Set of instruments — \$6.00

I will be glad to send you this material. Write to Franz Meier, Moosstr. 31, 8630 Ruti, Switzerland.

Also, since the plans are in millimeters, you can obtain an RCM Circle Scale for \$1.50 from RCM Products Division, P.O. Box 487, Sierra Madre, California 91024, which has both a metric and inch scale.

And now: Happy Landings! □

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