CRESCENDO
designed by
C MAIKIS
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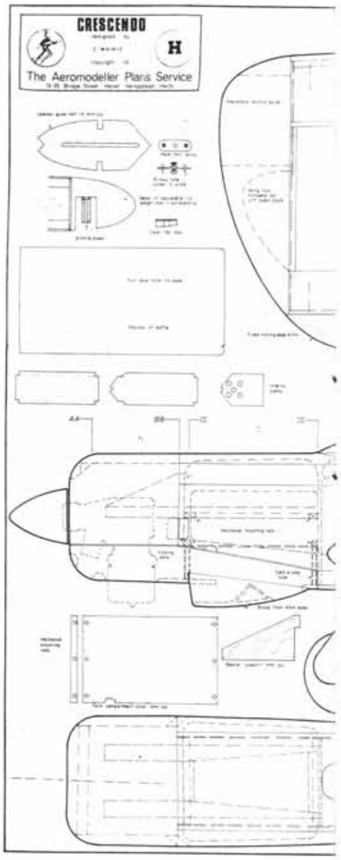
The Aeromodeller Plans Service
13-35 Bridge Street, Hemel Hempstead, Herts.
H
Leadout guide half rib 1mm ply
Plate 1mm brass
16 swg tube solder to plate
Detail of adjustable tip weight box in out board tip
8mm Ø dowel
Cover for box
Fuel tank from tin plate
Position of baffle
Internal baffle
Leading edge 8 x 8 mm
Leading edge sheeting 1.5mm
U/C bearer
Adjustable leadout guide
Main spars 5 x 10mm
7 strand heavyweight laystrate leadouts
Vertical spar webs 1.5mm
Bellcrank gussets 3mm
Bellcrank support and platform 3mm ply
All wing ribs 1.5mm
Cap strips 1.5 x 7mm
Wing tips hollowed out soft balsa block
Trailing edge sheeting 1.5mm
Trailing edge stiffener 5 x 5mm
Trailing edge 3 x 3 mm
R/C type Mylar hinges with 1.5mm dowel pegs
14swg flap horn and tube bearings
Fixed trailing edge 6mm
Flaps 6mm
Top blocks 10mm
Mylar hinges
Leading edge 10mm
Spars 10mm
All ribs 1.5mm
AA
BB
CC
DD
EE
Commercial or home made acetate cockpit canopy
Fuselage top 10mm
Fuselage deck 20mm
F1
F2
F3
Hardwood mounting rails
Access hatch
Fuselage sides 4mm
Cooling slots
Position of undercarriage support plate
14 swg fittings Epoxied with dowel plug
Access hatch
Fibreglass tube pushrod
Card or alloy tube
Scoop from 4mm balsa
Fuselage bottom 3mm
Bottom blocks 10mm
16 swg tail leg
Tail wheel bearer 2mm ply
Solder cup washer
Tail wheel 30mm Ø
Wheel doors 1mm ply
Wheels 75mm Ø
Hardwood mounting rails
Bearer support 1mm ply
Tank compartment cover 1mm ply
Fuselage doublers 1mm ply
Cover plates 1mm ply or 3mm balsa
6mm fairings
Fuselage shaping blocks 15mm
Former 3mm balsa
16 swg steel bellcrank and flap horn
16 swg link to elevator rudder horn
F1 5mm ply
Centre half rib 10mm
Main spar 5 x 10mm
Leading edge stiffener 6 x 15mm
Bellcrank support and platform 3mm ply
Trailing edge stiffener 5x5mm
Trailing edge 3 x 3 mm
Leading edge 8 x 8 mm
Rear spars 3 x 3mm
Mainspars 5 x 10mm
Centre rib
1 centre half rib 10mm
2 centre ribs 5mm
2 support ribs 3mm
All other ribs 1.5mm
Tip rib
Leadout slots
Radial cowl planked with 10mm strips
3mm cowl shaping former
Fix formers on 10mm dowel 100mm apart
Remove formers after shaping
Top
Deck
Bearer support 1mm ply
Doubler
Side
Shaping block
Engine bearers 10 x 15mm beech
Exhaust Duct
Cowl frame 1mm ply
F3 - 3mm
Access hatch
Fuselage top 10mm
Fuselage deck 20mm
Doublers 1mm ply
Hollow for lightness
Shaping blocks 15mm
Engine bearers 10 x 15mm beech
Tank compartment
Tank mounting rail
Fuselage sides 4mm
Tank compartment cover 1mm ply
Card or alloy tube
Cowl frame 1mm ply
Cover mounting rail
Air scoop
Scoop from 4mm balsa
Shaping blocks 10mm
Fuselage bottom
F2 - 3mm ply
Undercarriage bearers 2mm ply
10swg undercarriage legs
18swg steel rudder horn
1mm ply horn mount
Tip blocks 10mm
All ribs 1.5mm
Trailing edge 4 x 15mm
Leading edge 10 x 10mm
Spar 10 x 13mm
Spar 10 x 16mm
R/C type Mylar hinges with 1.5mm pegs
1mm ply rudder horn mount
14 swg elevator horns and tube bearings
Centre blocks 10mm
CL 1388

By
Claus Maikis

Special features: Moving Rudder, Adjustable Leadouts, Tipweight, Flaps and Elevator controls on this 64in span Aerobatic model for 10cc motors.



CRESCENDO

WHEN COMPETING at international level, you will notice a trend in model and engine size, a slight but steady *Crescendo.* The reasons may be different. In my case it often happens that I carry around an idea for a long time, I consider different possibilities, look for information, talk to other flyers. One day I met the American, Al Rabe when he was on a short holiday in Germany. Our conversation provided the impetus to start designing my *Crescendo* and the biggest credit for the layout of this aircraft must go to Al.

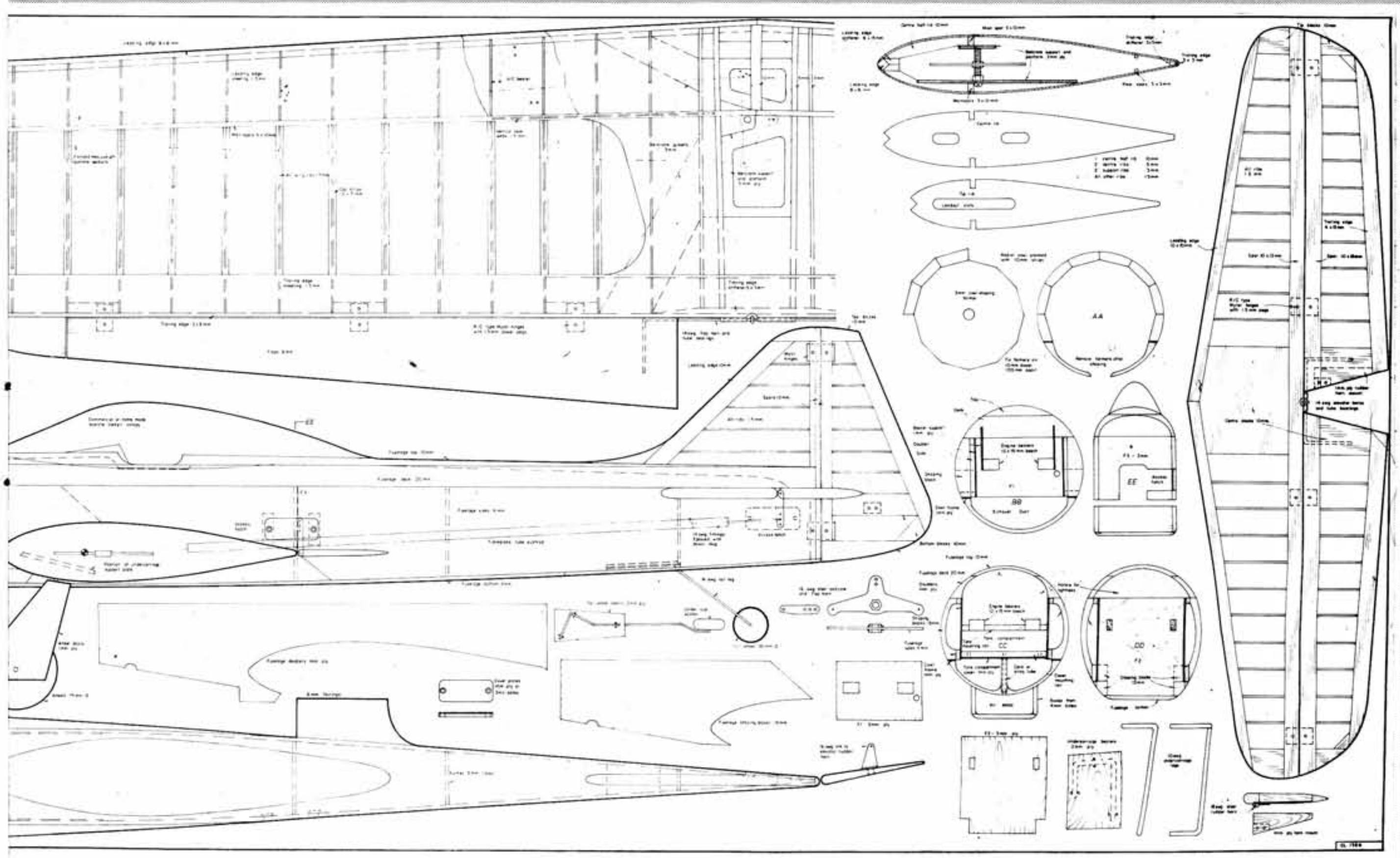
At that time I had lost my regular flying field due to a judicial flying prohibition because of a noise complaint. This caused me to look for a really silent solution. I think that a considerable part of the noise is created by radiation of sound waves by the muffler itself, it was therefore clear that it should be enclosed in the cowl. In order not to reduce engine performance too much, the muffler should not have too small a volume which also helps keep the engine temperature within reasonable limits. The resulting dimensions required quite some space within the fuselage to allow reasonable clearances – after all, I didn't want my aircraft to catch fire in mid-air!

I was not too afraid of the drag resulting from the fuselage cross section, as at least that bulky muffler was not hanging out in the breeze. Finally, I was impressed by those magnificent flights by the Frenchmen Billon and Lavalette with their huge stunters. So I had enough reasons to look for a suitable 60 engine, the Super Tigre ST60 being by far the lightest of this family. The big engine was able to: handle the (expected) weight; ignore the power loss caused by the muffler; overcome the drag of the thick fuselage; swing the required large diameter propeller; take the necessary pump desired for fuel flow (forced upon by tank location); run at low RPM (reducing noise and heat); last but not least, produce a wonderful sonorous sound.

While waiting for the engine I realized that I was running into problems concerning tank location. Not wanting to make the fuselage still more 'roomy', the tank had to be placed right onto the engine bearers. As I knew that I had to produce my own carburettor venturi, it was impossible to bring spray bar and tank centrelines to the same level. I was nearly giving up the whole project when I remembered the American Perry Pump. The maker claims that tank location can be forgotten when using this pump and the pump action would probably help fuel flow, which is so important in control line stunt. The American expert Clarence Lee anticipated one drawback which I read in his monthly column: if there was the slightest air bubble in the fuel pick up line (which would only cause a tiny hiccup with normal operation) the pump would run 'dry' for a sort period of time before delivering fuel again, or the engine might even stop. So some extra thoughts were given to the tank design to provide safe and steady fuel flow. Fortunately a Perry Pump is available for the ST60.

While brooding on details of the design, I felt it was time to try some trimming devices to allow fine tuning adjustments on the finished model. As I did not intend to make the wing removable, fearing increased weight, some access to the horns is desirable, also the ability to change rudder offset, tip weight, and line rake.

To me drawing up a completely new design is a challenge, which I overcome by studying new technology and old wine – a very exciting time indeed. Since the approach was now completely different I could not use much from my earlier aeroplanes. The wing airfoil was all I took from my earlier *Palatin* design. The span is 64in, if I have calculated right the overall wing area is about 950sq in. The airfoil tapers from 15% thickness at the root (including flaps) to about 18% at the tip. The fuselage nose was drawn rather short to compensate for the increased weight of the engine. Since there had to be enough room for a long tank – it had to be flat! The nose still looked relatively long, so the tail



moment was lengthened considerably. To ensure good line tension, the fin and rudder are of generous size. The cylinder head should protrude from the fuselage as I expected increased temperature from the type of muffler. This engine installation dictated the nose cross section. A 5mm clearance is kept between muffler and cowl with the resulting diameter of a scant 120mm and a well rounded nose, which is not too much area to keep the prop from working. While the cylinder head is well cooled, the rest of the engine should get enough fresh air from the front gap. The airscoop was felt necessary to cool the muffler. The hot air disappears through the rear of the scoop and two additional slots at the fuselage sides. The tank cover keeps the muffler from heating the tank. Special attention was given to the bellcrank bearing, platform and supports. I have never pulled a bellcrank out of any of my airplanes and I won't do so with this one either.

Before construction began, there was quite some work to be done. Running-In of the engine took place with throttle to be able to change speeds quickly and easily. Later an 8mm diameter venturi was turned with a spray bar of 3.5mm o.d. As the engine would not run rich with this carburettor the diameter was reduced to 6.5mm i.d. Fuel consumption was tested to give an idea of the final tank volume. At last the Perry Pump was added to check operation with this device. To my surprise, a change of tank location height of two feet (1ft up, 1ft down) did not produce any difference in engine speed. A noticeable RPM drop or increase was found beyond these limits only. Change of the pump setting changed speed naturally. But after correcting the needle setting, running characteristics were the same again. So the pump was set at medium stage.

During my 'speed phase' many years ago, I had some experience in aluminium welding. So I tried to make the muffler and adaptor from this light material. I won't tell you how many mufflers I threw out. I asked my friend Arno Wamper, a well known engine man, for help. All he told me was "use steel!" Now the muffler is constructed of 0.3mm tin and the 'elbow' is of steel. Weight is almost double that of aluminium but – at last – it keeps together. I used a Camping Gaz blow torch and silver solder, it works quite well. If you are an impatient character forget about it! Asbestos sheet and cloth of different type were also used. The muffler is completely wrapped with cloth while thin sheet is glued to the tank cover and cowl inside. The 'elbow' and muffler are connected with silicone tube. This arrangement won't let vibrations run from the engine directly to the muffler, so it can be built lighter and together with the tank cover, it

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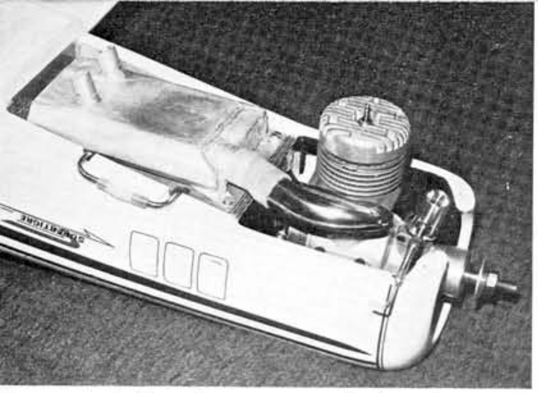
is bolted to the fuselage. The elbow is tapped for muffler pressure operation.

Construction begins by acquiring one year's production of balsa in advance. Select each piece of wood so that it seems much too light for its purpose – that's the way I build my overweight airplanes. With those new 'zapping' glues I have done jobs which until now needed pins, for example glueing the leading edge or main spars to the wing ribs. The spar is put into place and fixed with the cyanoacrylate glue – to assemble the wing. White glue is then added sparingly to the joints. This seems double the effort but as the wing is instantly fixed, work can continue at once. Parts which have to take big loads – the complete centre section with bellcrank platform and all supports – are glued solely with white glue. The main spars are webbed up to the rib bay of the undercarriage. Hollow the inboard wing tip block as much as possible. The outboard block takes the tip weight box. The cover is held by a bolt which screws through a hardwood dowel into a fixed nut. The inboard tip rib takes the plate for the leadout guide which by now I feel absolutely necessary.

Don't forget the control system before



Far left: ***Very neat engine and silencer installation shown with lower cowl removed.*** Left: ***removable parts ready for installation, fuel tank, tank bay cover plate, silencer and connections and lower cowl.*** Below: ***details of silencer, note mounting lugs. Exhaust elbow and silicone tube connector shown inset.***

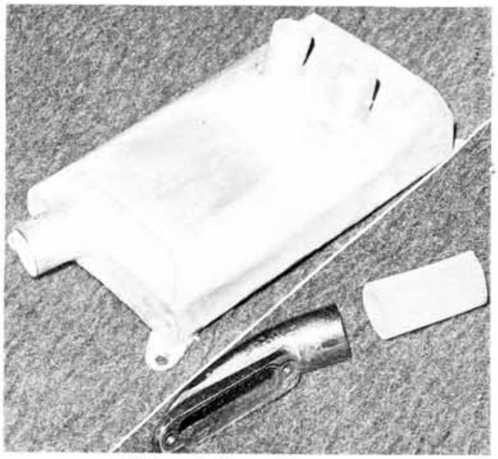
Below left: ***cowl is fabricated from strips of balsa assembled onto formers fixed to dowl, which can then be turned in electric drill and sanded to shape.***

installing the top centre planking. For the pushrod I use a fibreglass tube (such as an arrow shaft) which is much lighter and stiffer than anything I have used before. Both ends take a beech dowel, the piano wire ends run through the dowel, the inner end is bent and locks into a small hole in the tube. Everything is carefully glued together with a two part epoxy resin of high strength. After completion the rod is trimmed to exact dimension by making the rear bend. The tailplane is built as light as possible. A plywood stiffener and fixed nuts at the outboard elevator will take the small horn for the moveable rudder.

Construction of the fuselage front is very much the same as with my FW190 (August '76 *Aeromodeller*).Two formers are glued together crosswise to form the nose shape. A third former of the same section is cut, then both pieces are glued to a hardwood dowel. Then tapered strips are attached to the formers with a glue which at least in Germany, I can only get from old carpenters – it is a powder which is mixed with water. As it doesn't fill well, parts must fit very tightly but it sands like balsa. Work extremely carefully when making the former cut-outs for the engine bearers. Two hardwood pieces with blind mounting nuts between the bearers will hold the tank.Two more hardwood strips with three nuts each are used to hold the tank cover, muffler, and cowl in place. The front end of the engine bearers are supported by plywood stiffeners. The removable part of the cowl is completed with the ply frame and carboard tubes. Cover the ply with masking tape. Put a thick layer of filler (preferably micro balloons mixed with epoxy resin) to the matching area of the fuselage. Instal cowl and remove the filler which is squeezed out. After drying, remove tape and – with the cowl fixed tightly – sand the fuselage shape. You'll never get such a tight fit and clean edges. Completion of the fuselage is quite conventional except for the hatches which allow access for changing the control ratio. Be sure you have built in the variable control horns before!

The drawing shows development of the tank. With this method – making the bends as shown – it is quite easy to produce a tank which is slightly wider at the rear. I have included a baffle to ensure steady fuel flow – so essential with pump operation. The uniflo vent should end right in front of the baffle. Short, wide lugs are soldered to the tank for removable installation. Tank cover and cowl inside are protected with thin asbestos sheet, then covered with a lacquer which is heat and fuel proof (try those car muffler brands). After you have completed the finish – I'm not going that fast, am I? – set the rudder as shown, using RC type links. I prefer to mount the muffler with rubber grommets to reduce vibration. Try first with the lead-out guide in medium position. Choose a calm day, use your best lines, and take a sedative or a beer.

Except for some minor naughtiness, this ship flies better than anything I ever had. As ever, it came out too heavy: 64oz, fortunately it has enough wing area. But if I imagine a few ounces less – this could be a real precision aerobatic aircraft. At first I had to move the line guide as far forward as possible and reduce the rudder offset. The tail horn is linked by the medium hole, while the flaps horn is linked by the lowest hole (shortest moment arm). So flap movement is almost as large as elevator



movement. With a lighter ship, you could manage with less flap travel, but with my weight, I just need that lift. With the rudder set up as shown, you have more offset on 'down' elevator and a little less with 'up'. This is as it should be but you'll have to find out your own appropriate horn shape; that means, hole location and moment arm, Make a sample as I did, and check on your work bench to see direction and amount of movement.

Holding the airplane inverted for starting is not necessary. This engine starts extremely well. The pump pushes fuel into the carburettor with every flick when upright so if the engine won't start instantly, it will soon be drowned. Flick a few times by 'choking' and intake until the engine feels wet, then light the plug and start. I must admit that I still have to sort out some bugs. At the first flights, the engine turned lean (it changed from four cycle to two cycle) when inverted or in outside manoeuvres. This might result from the height difference of the pump and the spray bar. I changed from 65ft to 62ft lines and run the engine quite rich now. The tank shown has about $5^1/_2$ ounces. The schedule is finished in about 5 minutes, the engine stops at around 6 minutes. I use a 5% nitro fuel and a 12 x 6 Top Flite wood prop with carefully trimmed airfoil, pitch (a little less at the tip), and balance.

With this aircraft I hope to reach the limits of my talent. And with a better pilot than myself, this aircraft should prove a winner, my only worry is of competing against another *Crescendo.*