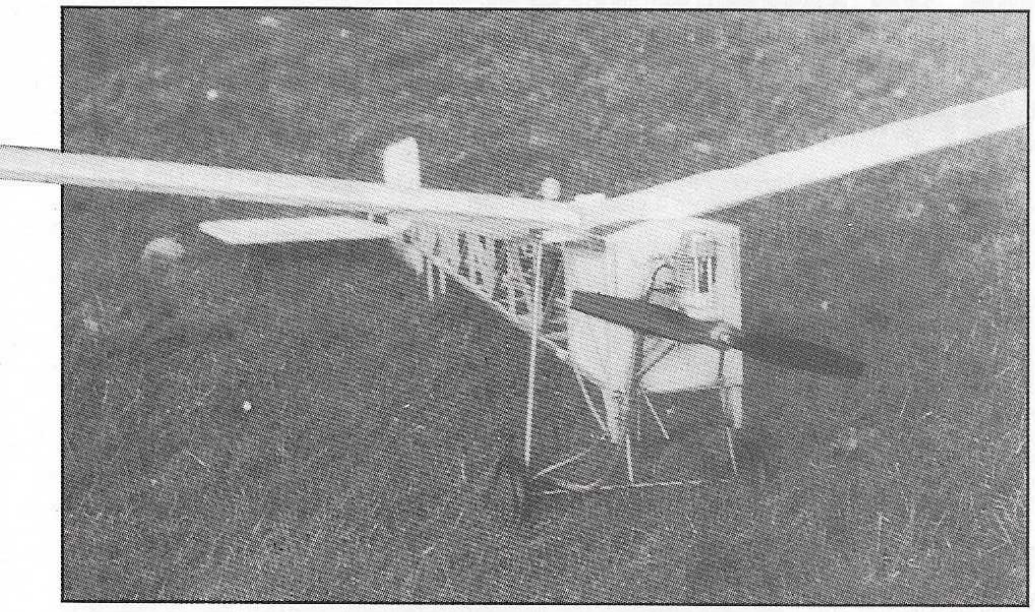
BERNHARDT B2



This scalish, Bleriot-like early bird by Alex Weiss is a super flier. Build one and enter our competition!

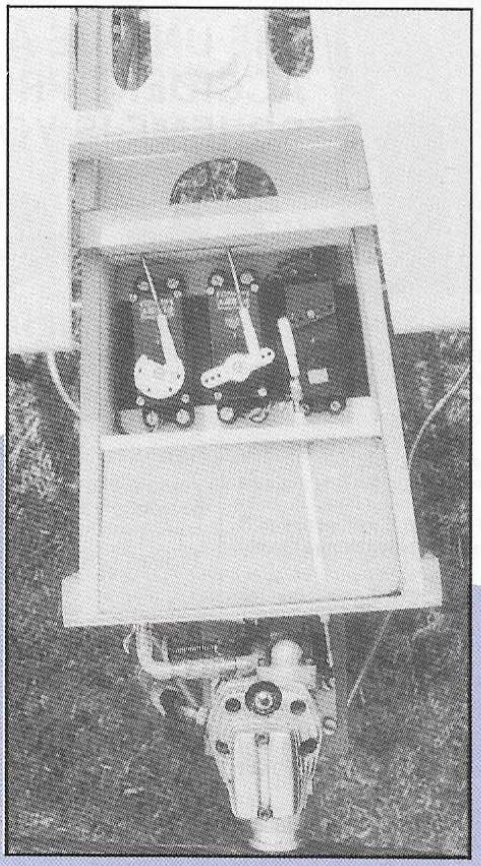
The Bernhardt B2 dates back to the pre First World War era in Germany, when Kaiser Wilhelm II ruled supreme. In what is now the prosperous town of Dusseldorf, the call of aviation came to young Ludwig Bernhardt. Enthused by reports of the successes of the famous Louis Bleriot, Ludwig became determined not only to emulate the Frenchman's achievements, but, in true Germanic style, to better them.

With the aid of a modest loan from his father, Ludwig set up a company and started designing and building monoplanes. His first, the B1, was based on the Bleriot layout. It managed a few short hops in 1910, but was soon abandoned, to be followed by the eminently practical B2. This was a large aeroplane by the standards of the day, with a wingspan of 19 metres. It was powered by a Schultz-Lorenz vertical twin which produced 39HP.

The Bernhardts could well have supplanted the Fokkers in the war which followed, had not Ludwig falled in love with the daughter of a steel tycoon, Max von Schlum, who was only prepared to agree to the match on condition that Ludwig gave up his crazy aviation endeavours. Ludwig was put in charge of a new division of his father-in-law to be's company, which had recently been established to build the submarines required by the Kriegsmarine. History has shown that aviation's loss was the U boat's gain.

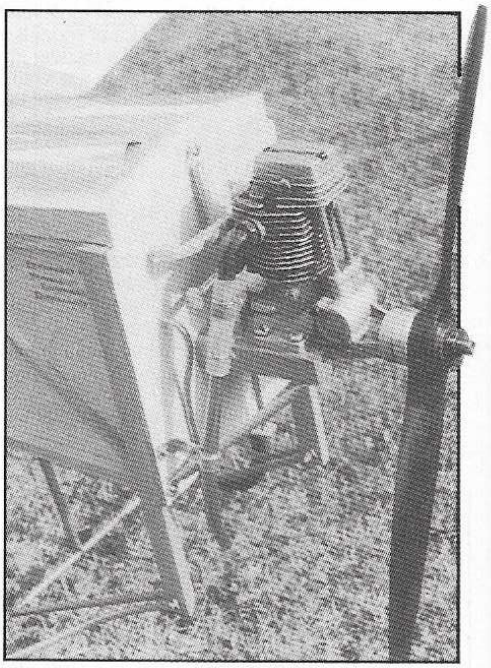
At least that is the way it might have been if the model I built had been a scale one. In fact the Bernhardt B2 is a figment of my imagination, so let's take a look at the requirements I set myself when I started the design of the model!

The four-stroke engine (an O.S. 40) is shown off to best advantage in this cowl-less installation; typical of the era and easy to get at. Below, three servos sit in line-abreast with Rx and nicad beneath; tank is athwartships behind engine and is covered with foam rubber here.



Design criteria

There were a number of ideas I wanted to test, that I had never tried before. The first was the use of dowels for the wing leading and trailing edges as these seemed to offer the benefits of high strength combined with a scale-looking profile. The second was the use of an open uncovered structure between the two halves of the wing. Both these features would also act as a testbed for a true scale model of this vintage, over which I have been ruminating for some time. The third was an open structure spruce fuselage. What a time saver! No covering or painting is required; just a couple of coats of fuel proofer. Fourth was an operating



suspension for the alighting gear, constructed from brass tube.

I had read with great interest Richard Hawke's article in the third *RCM&E* Special "Radio Control Scale Aircraft" (the one with a Ruskin Air Services Dakota on the front, if you want to refer to it). I was convinced of the benefits, but concerned that I might be forever replacing bent brass tubes. Time has told, and I have had trouble-free operation from this apparently frail part of the aeroplane.

Lastly, I wanted to try all-moving tail surfaces. Here was an ideal chance to test them on a slow flying model. I also decided that the tail surfaces should be readily removeable, as it is much easier to cover them before they are attached to the fuselage. All these five aims are incorporated in the aircraft, and none has given any problem in service.

The Bernhardt B2 was to be a simple design of pre-1914 vintage for three channel radio and my by then well worn OS 40 four-stroke motor. The former defined a large dihedral angle for rudder-only operation, whilst the latter demanded a modest all-up weight allied to a low wing loading. Having just written off my Albertine (Plan RM 273) due to a loose crystal in the transmitter, speed of construction also became a major consideration. The open structure fuselage, and the use of Solartex on all the flying

surfaces, certainly speeded up the completion of the model. In addition, the omission of ailerons, and therefore the need for only three radio channels, considerably simplified the installation of the servos and the control runs.

Wing construction

It is important to choose straight grained unwarped 1/4in (6mm) square spruce for the wing spars. The same applies to the dowel leading and trailing edges. The wing ribs are medium crossgrained balsa, and are all identical in shape. I wrapped a piece of sandpaper around a thin piece of dowel to sand out the semi-circular leading edge and trailing edge, after pinning a wing's worth of ribs together. The tips are laminated from two thicknesses of 1.5mm ply glued together around a suitable former (a large tin waste paper basket). After they have been fixed in place, a strip of soft 1/8in (3mm) balsa is added to give extra thickness.

The two wings are joined by substantial ply dihedral braces attached to the two pairs of wing spars, whilst the leading and trailing edge dowels are cut off at the inboard ends of W1. A piece of 3mm ply set between the two dihedral braces forms the plate for the two wing bolts. Be in no doubt: the bolts are quite strong enough to take the positive 'G' loads and still have an adequate safety margin. The dihedral angle is ten degrees per wing.

Fuselage

The fuselage side panels are built over the plan, remembering to make a port and starboard side. It is important that the spruce longerons are warp-free and that the verticals and diagonals are a good fit, so take a little time and care at this point. The inside of the fuselage between F1 and F3 (there are only three formers) is sheeted with 0.8mm ply giving a strong box for the radio. The engine bearer spacing may need to be adjusted to suit your particular motor.

The wing mounting plate is cut from 3mm ply and glued to the top of the fuselage behind F3, with lengths of spruce on top to cope with the dihedral. The hatch is a simple balsa affair, which has a dowel at the rear to locate into the beech beam above F3. This beam also takes the suspension loads. The fuselage is sanded and then given two coats of Tufcote; the lettering on the front fuselage sides being freehand pencil applied to the bare ply before the fuel proofer.

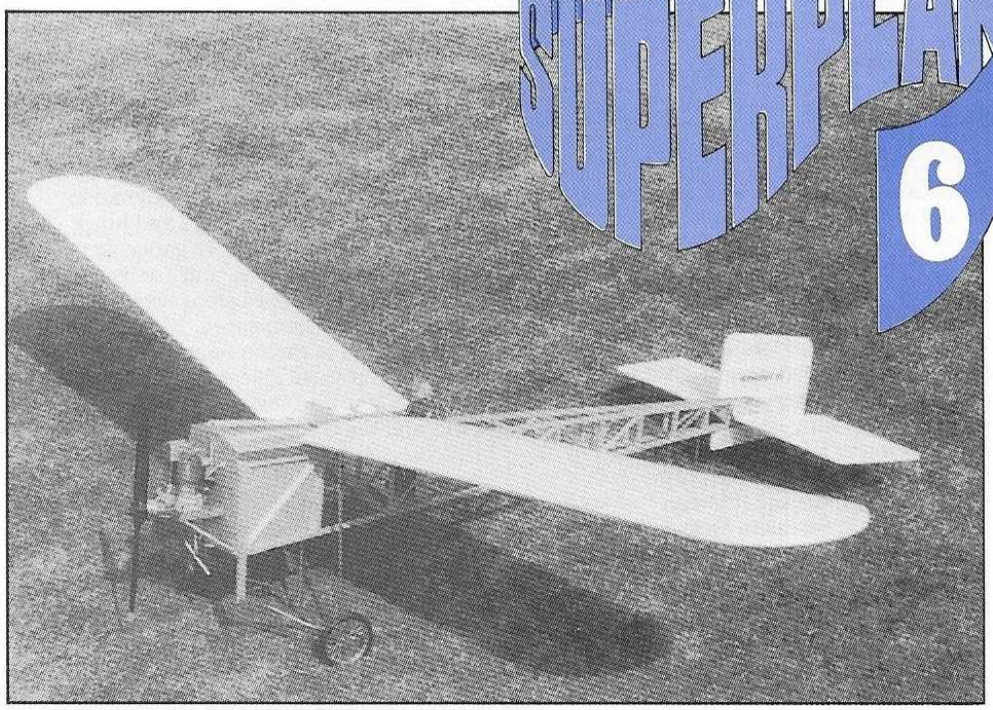
I feel it is well worthwhile on a model like this to include a pilot, seat and instrumentation as well as a control column. My pilot is converted from a Tamiya 1/12th scale motorcycle jumping rider, cut in half at the waist, reglued together in a normal sitting position and built up using hot glue.

Undercarriage

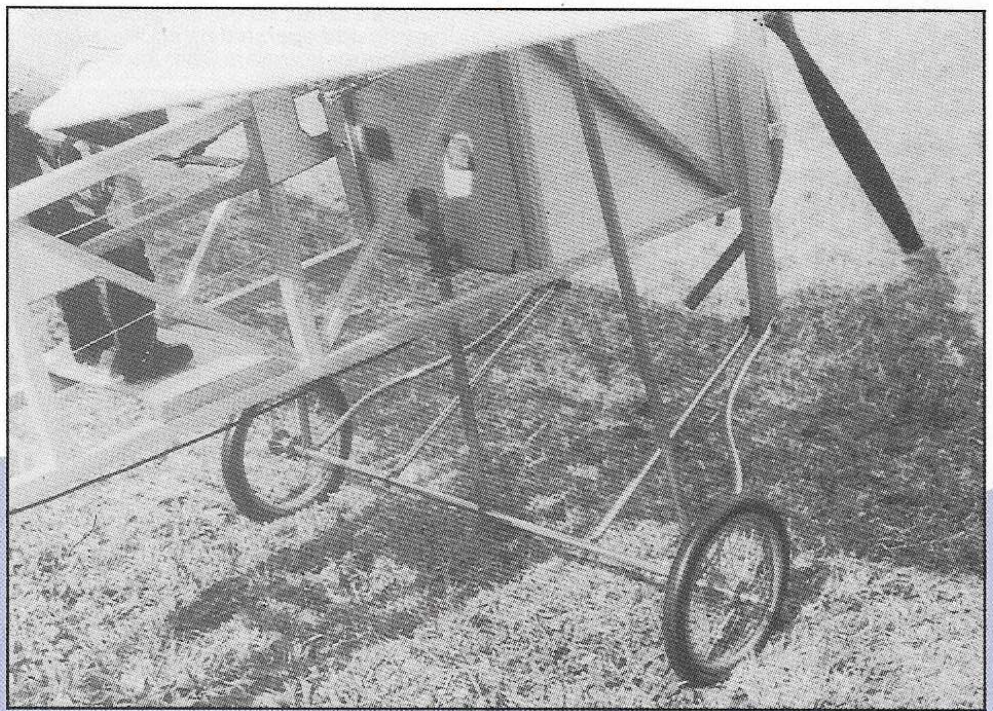
I don't know what it is about a working suspension, but it fascinates me, and was certainly the part that I most enjoyed building. I had been horrified to discover that the weight of the main undercarriage of my 'JH2 Stringbox' (Plan RM259) was 14 ounces (395gm). Its suspension was built almost entirely from piano wire. I was, therefore, particularly interested to see how much weight I could save using brass tube. In the event, the results were staggering. The Bernhardt B2 fuselage, complete less engine, fuel tank, fin and tailplane weighs only 8 ounces (225gm) What a weight reduction, even allowing for the smaller wheels!

Construction is quite straightforward too. First of all decide what sort of wheels you are going to use. I had a pair of 3in (75mm) spoked wheels which I had made whilst on holiday (well it isn't a holiday if I'm not modelling) using the Arthur Searle technique, but solid Palmer Cord wheels don't look out of place, and Flair produce a nice pair.

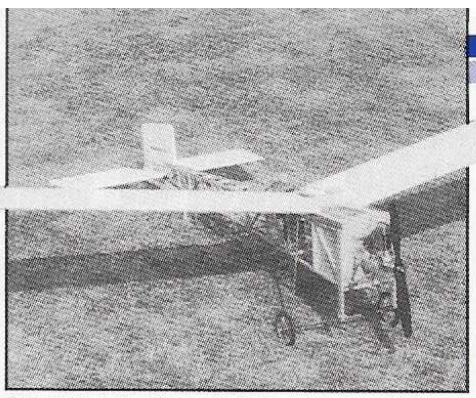
You will need three different sizes of brass tube to construct the suspension, as well as a short length of 10 gauge piano wire for the axle, and some compression springs of a suitable diameter to fit into the largest of the tubes. The two outer locating struts need to be bent to shape and length, and then have their ends flattened with a pair of pliers, prior to having the holes drilled. It sounds more difficult than it is in practice,



Although it makes no serious claims to being a true scale mode, the Bernhardt looks the part and is a beautiful flier; build one for unhurried circuits and super slow, low passes.



Working suspension and wire wheels give atmosphere to the Bernhardt; keen-eyed will notice a few subtle differences between pics and plan, which represents the Mk2 fuselage currently flying.



Model is simple to build and has added advantage of open framework fuselage - no need for covering!

and I didn't end up with any reject parts. The main telescopic units may need the length of the inner strut altered to suit your particular springs. Note also the small centre strut which prevents the telescopic struts from coming apart in flight. I used a small spring at the top of it to absorb any rebound shock. The springs came from a Proops pack, while the tube can be found in the HSL Metal Products rack. When purchasing the tube, use the same source to obtain the brass strips used for the tail skid, and attaching the tail to the fuselage.

Tail-skid

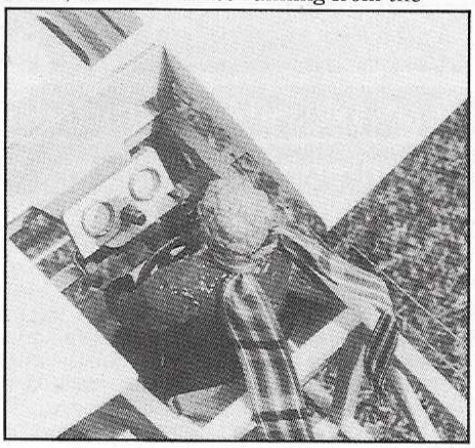
The skid itself is constructed from two thicknesses of 0.8mm ply which are glued together and left to dry curved round a suitably diametered tin. I used PVA white glue for this task, and almost every other gluing job. A strip of 0.016in brass strip is then fixed to the outside of the ply using five minute epoxy. This makes a strong yet lightweight skid which will stand up to the rigours of the flying field. Don't omit the brass strip, since the ply will fracture at the fuselage attachment point.

Tail surfaces

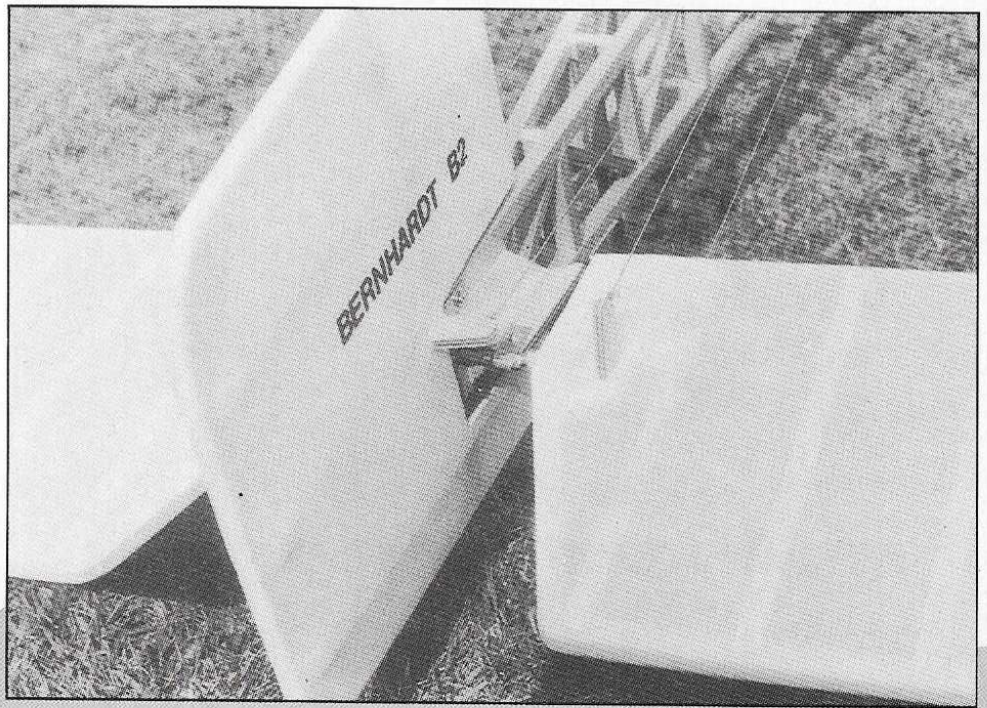
Both the tailplane and fin are all-moving and operated by closed-loop controls. I had some initial concern about the vulnerability of all-moving surfaces, but this has been completely dispelled in practice. The fact that the surfaces are removeable aids covering, and means that any slight damage can easily be repaired. Both surfaces are built from 1/4in (6mm) balsa strip, with main spars from similarly dimensioned spruce. The finished outlines are fitted with gussets and then have 3/32in by 1/4in (2.5mm by 6mm) balsa capping strips added. This allows the completed items to be sanded to something of an aerodynamic section. The tailplane joiners and hinge tubes are fashioned from 12 gauge piano wire and matching tube, and are bound and glued to the mainspar before construction of the tailplane is commenced. 12 gauge brass tube is bound to the fin main spar in the same way. A vertical length of the brass tube is bound and soldered to tailplane brass tube, and the whole assembly attached to the fuselage by four U shaped pieces of brass strip and 10 BA nuts and bolts. The 12 gauge fin pivot pin then holds the fin in place. The horns are cut from 3mm ply and glued in place before the capping strips are fitted.

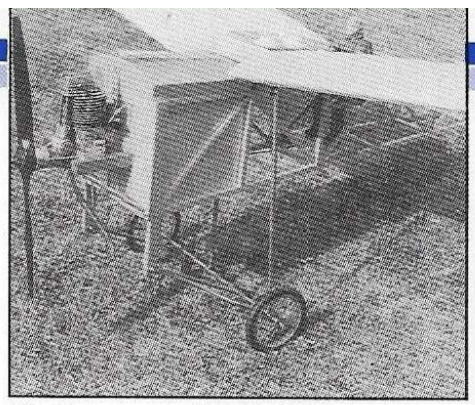
Engine

The motor installation could not be easier; the brass tubes running from the



This sort of model demands a pilot figure and cockpit detail. Below, tail surfaces are all-moving and operated by closed-loop wires. Control horns are from 3mm ply.





Working suspension is worth the extra effort; it's very satisfying to watch it work on touch-and-gos.

engine bearers to the firewall being for looks rather than strength. The fuel tank is a square SLEC four ounce (120cc) one which is installed across the fuselage rather than along it. Pressurisation is not used, but no trouble with fuel feed has been experienced in some 100 flights. The exhaust pipe is a length of 1/4in (6mm) brass tube bent to shape and attached to the engine's exhaust stub with a short piece of silicon tube. The bottom end of the exhaust pipe runs over the undercarriage axle, which keeps any oil well clear of the fuselage.

Radio

The radio receiver and battery are located in the separate compartment below the fuel tank, whilst the three servos are installed in line abreast between F2 and F3. Unless you decide to fit a hatch in the bottom of the fuselage, you will have to remove the servos to access the receiver and nicad. The servos connect by pushrod to remote operating levers made from 1.5mm thick brass strip, which pivot on 8 BA bolts, and are connected to the all-moving tail surfaces by 20 pound (9 kg) breaking strain nylon covered fishing trace.

Covering

Both wings are covered with Solartex; I chose opaque white, but antique or red would be equally appropriate. My fear of lack of adhesion to the dowel leading and trailing edges proved unfounded. I covered the undersurfaces first, ironing the edges of the material round the dowels and then overlapped the top surface covering by some 1/2in (12.5mm). I had no problems whatsoever with this excellent covering material, and, as is my wont, left it bare: no dope, no fuel proofer. When it gets a bit dirty, which is not often with a four stroke, I clean it with neat fuel. It works! The tail surfaces are similarly covered, the lettering on the fin being self-adhesive black vinyl letters. Again, no fuel proofing has been necessary.

Controls

Control movements should be as follows:

Tailplane: 1.25in (30mm) each way, a total of 2.5in (60mm)

Fin: 2in (50mm) each way, a total of 4in (100mm)

The measurements should be made at the trailing edges of the surfaces. Yes, I know the amount of movement seems to be ridiculously large, but the figures are correct. Make sure that there is no slop in the controls, and that the neutrals are correctly set.

Flying

Flying the Bernhardt B2 presents few surprises once you have come to terms with the fact that she uses rudder to turn. Despite the large areas of the all-moving tail surfaces, and the relatively large movements, control response is positive, but not over-sensitive. For the first flight it is most important to check the tailplane is in line with the small fillet by which it is attached to the fuselage. Also ensure that the centre of gravity is in the right position. The all-up weight of the prototype was four pounds four ounces (two kilogrammes).

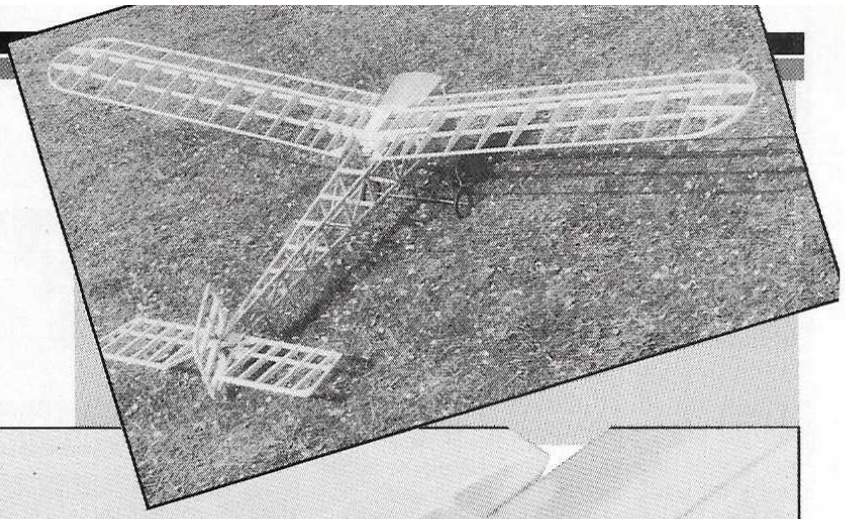
Check that your engine is throttling satisfactorily, and open up to full power, holding on full up elevator and a bit of left rudder. Keep the aircaft straight with rudder, and as she picks up speed, release the elevator letting the tail come up. A slight back pressure on the stick and she will break ground and climb gently away. The rate of climb using an 0S 40FS and an 11 by 5 (28 by 13) prop is just right for a model of this character. Excessively steep climbs with very high nose up attitudes should be avoided.

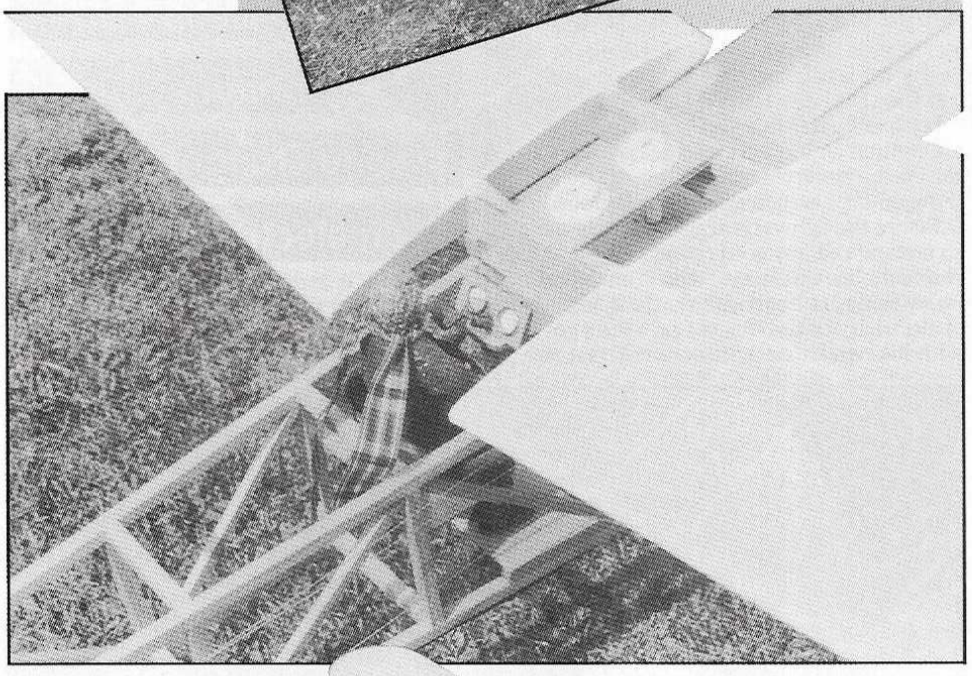
As soon as you are at a safe height, try a turn. These are naturally not as smooth as aileron turns, but, of course, this is true of the flight handling of most pre World War 1 aircraft. You will need to hold on a little rudder during the turn to maintain the angle of bank. The top speed of the Bernhardt B2 is restricted by the large fuselage frontal area, and this also means that, for a shallow angle of approach on finals, it is better to keep some power on. As you flare, close the throttle, and the speed will reduce rapidly. Due to the light wing loading, the stalling speed is low, and the aircraft should touch down slowly, the working of the undercarriage suspension being clearly visible. You will need to use full up elevator during the landing run to prevent a nose over, and possibly just a little throttle to get some slipstream over the tail. There is no tendency for the aircraft to ground loop.

The Bernhardt B2 has a modest aerobatic capability. Loops require a diving entry, as do barrel rolls. Rolls off the top are feasible but rather chancy affairs, the rollout being very barrelled. Stall turns are a real treat and can be performed with precision if you are lucky. The stall is very gentle and mushy, whilst spins are slow and cumbersome with almost immediate recovery as soon as the controls are centralised. Spins are best entered from a gentle climb at half throttle.

Conclusion

So there it is. A vintage looking aeroplane that should satisfy you sports fliers. What could be better than to spend a windless summer evening flying low passes to the gentle purr of a throttled back four-stroke? Ludwig's scarf flutters in the breeze; the open structure of the fuselage and the wire wheels are shown off to perfection against an azure sky. Can you resist such temptation? No! Then get out your building board.





This group of pics will help you work out the construction methods employed and should be studied in conjunction with this month's 'Superplan'. And don't forget to send us some photographs.