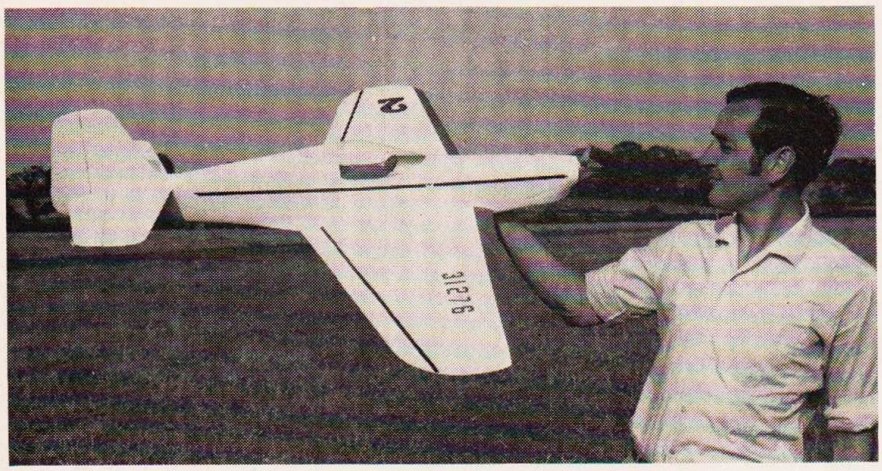

## *Fastest at the Nats! Frank Van den Bergh's*

# PHAETON

## F.A.I. PYLON RACER

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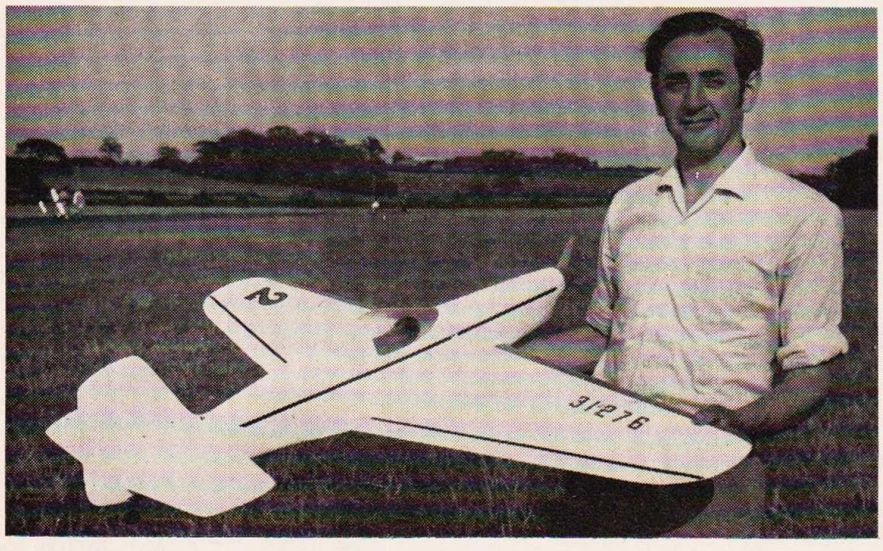
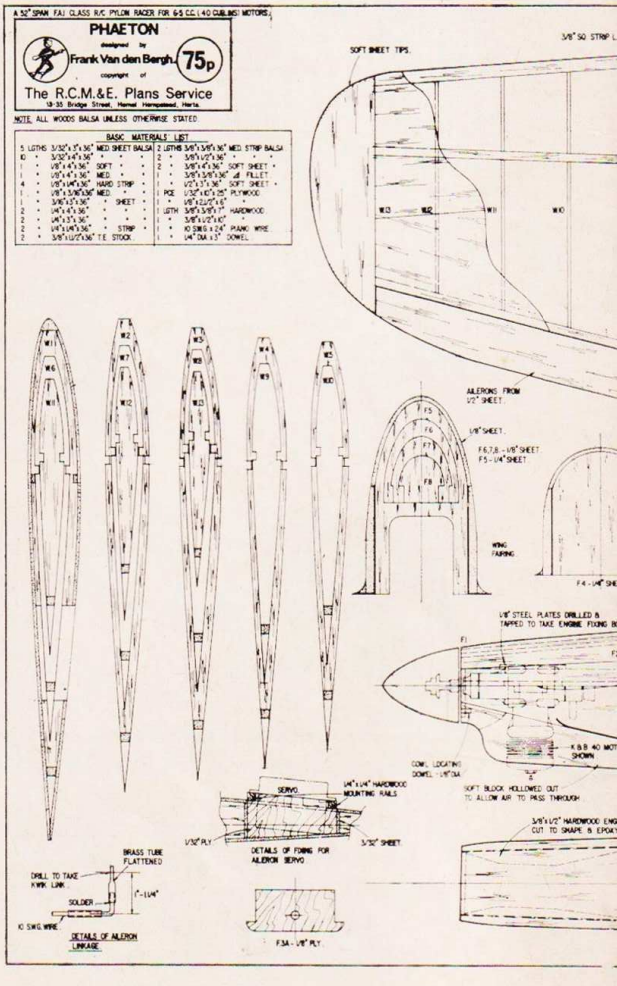
Please quote plan RC/1088 when ordering.

**If you fly F.A.I. pylon, you either build a Phaeton now or chase 'em around the pylons from now on!**



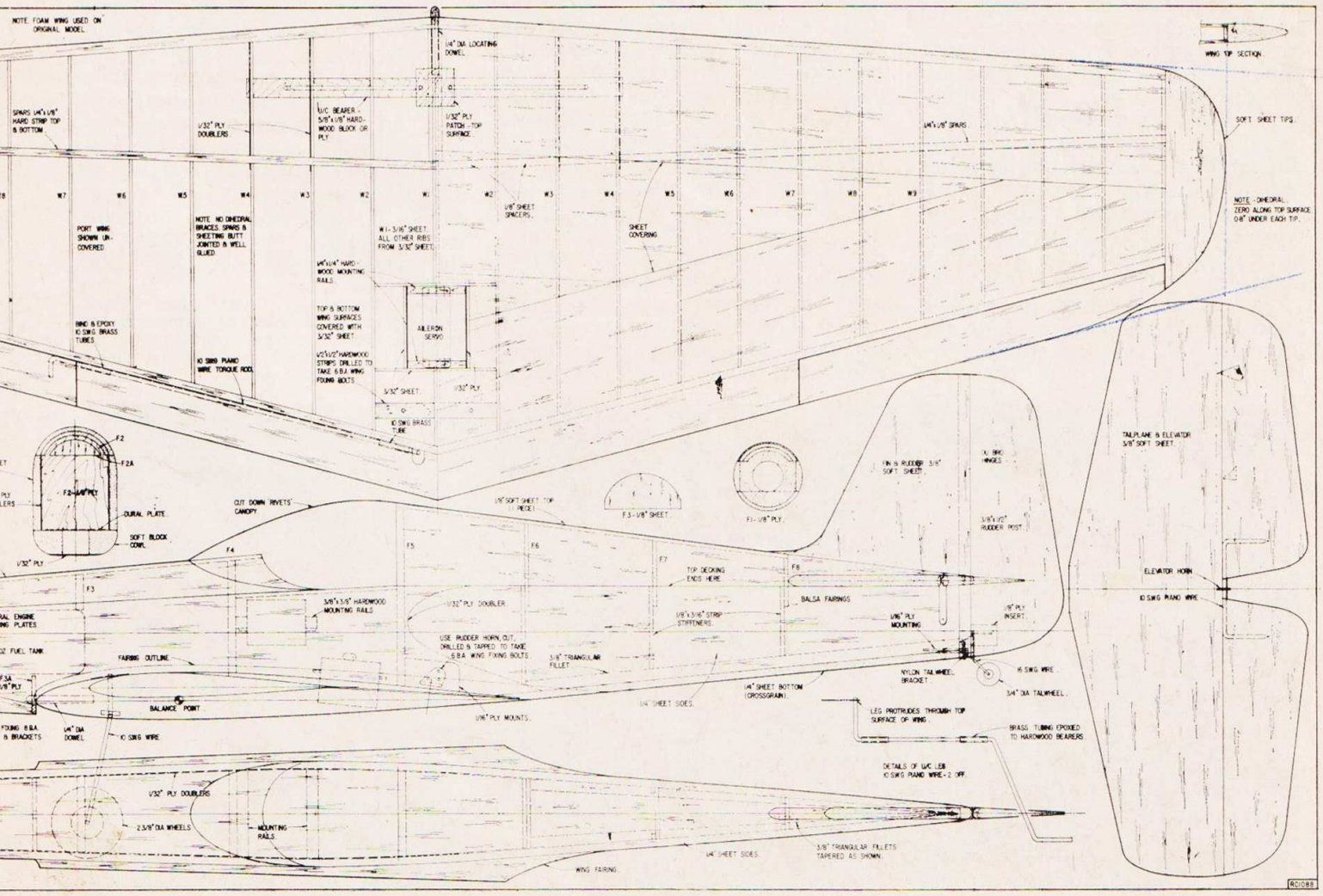


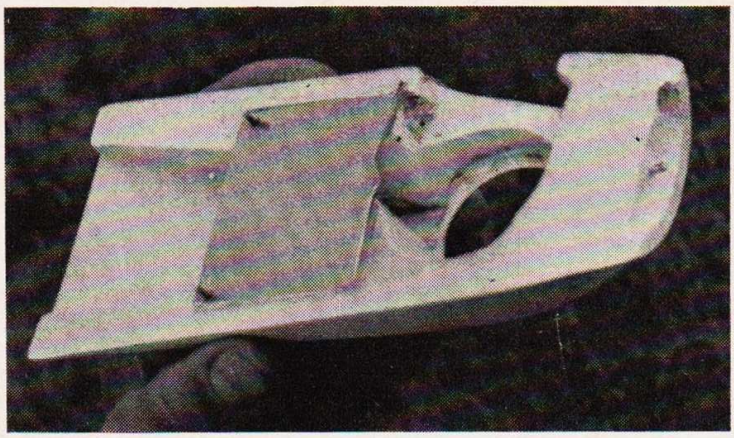
ACCORDING to the legends of the Ancient Greeks the sun was driven across the heavens every day by the Sun God, Helios, in his chariot. Helios had a son named Phaeton (pronounced 'Fay-etton' with accent on the 'Fay') and, perhaps finding his daily drive rather monotonous year in – year out, one day the Old Man incautiously agreed to let Phaeton have a go with the chariot. Now Phaeton was only a very junior God and in his youthful exuberance he went in for some low flying that could be called the Great Original Burn-up in every sense of the term and thereby achieved everlasting fame! A couple of centuries ago Phaeton gave his name to a light, two-horse carriage much-fancied by the young bucks of the time, and now, although he may not know it, he has given it, with the help of a rather horrible phonetic association, to an F.A.I. pylon racer.

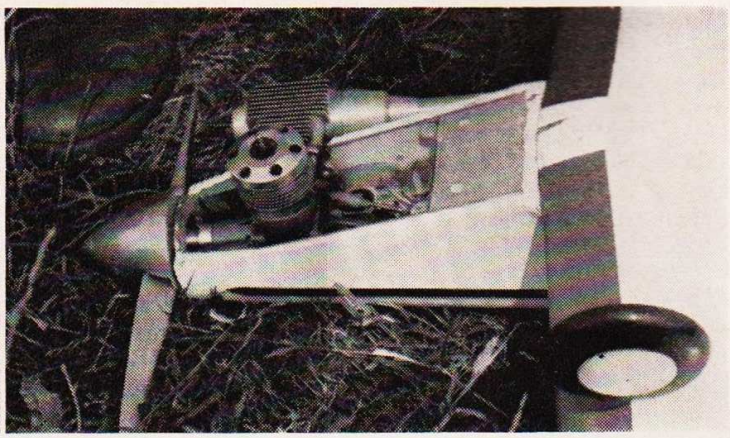
The F.A.I. first decided to recognise R/C Pylon Racing for international competition by adopting a set of rules in November 1969. These rules required a new class of model based closely on the U.S. Formula II Class which was, I believe, intended for less ambitious flyers than the well-established Formula I in case further development should raise flying speeds to a dangerous level. Thus the F.A.I. rule calls for a bigger wing area (close on 700 square inches including tail surfaces) and a minimum wing thickness of $1\frac{1}{2}$ inches measured at the root but outside the fuselage. Height and width measurement of the fuselage can be fractionally under the 7 x $3\frac{1}{2}$ inches of Formula I, but as a further speed reducer only 'straight' methanol/castor oil fuel is permitted. Silencers are compulsory but tuned pipe exhaust systems are excluded. A basic requirement is for a 'semi-scale' model, which is understood to mean that it must follow the general lines and layout of full-size aircraft but need not be a replica of any one type.

This new class was open to criticism on the grounds that it was too close to Formula I to be worthwhile making a change, and, from an aesthetic point of view, the large wing area in relation to fuselage makes for a less attractive looking model. But these were minor points compared with the main question – was it likely to produce some good racing sport? Believing that it would, I decided to design and build a model for the 1970 season. The design had to be reasonably simple to construct, of pleasing appearance and avoid any extreme features which might be outlawed by future amendments to the provisional rules. It also had to be fast as I reckon I am getting too old to take on younger men *and* faster models.

In quest of speed the Phaeton design does not resort to any way out subtleties of aerodynamic theory (I don't know any). The required measurements are just tucked away tidily to minimise the frontal area, the wing taper concentrates the rather large wing area towards the root where the thickness is specified, and care is taken to keep the whole shape clean and free from excresances. As required by the rules, the motor is fully cowled except for the cylinder head. The inlet and outlet apertures for engine cooling air are smaller than normally seen on R/C models, but have not led







Left: aircooling of engine is most important. Note here the internal contours of the nose hatch, shaped to channel air through engine fins and out at rear of engine cowling. Above: engine bay installation.

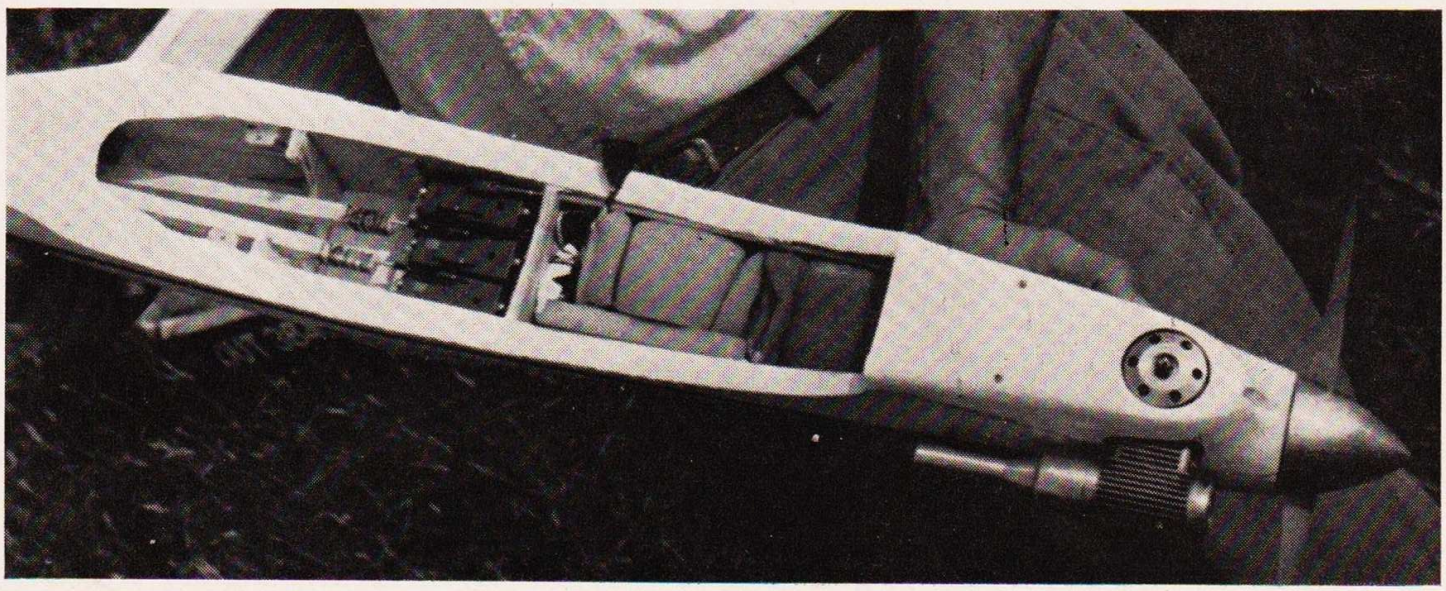
to any overheating. To achieve this I have taken care in shaping the airflow passage *inside* the cowl so that the airflow is ducted closely round the cylinder and I hope that this feature will be apparent in the accompanying photos. Actually, the initial flights of Phaeton were made without the detachable cowl in order to make sure that the motor was adequately run-in and to eliminate the risk of damaging the cowl by nose-over landings on rough ground before I had some experience of the landing characteristics.

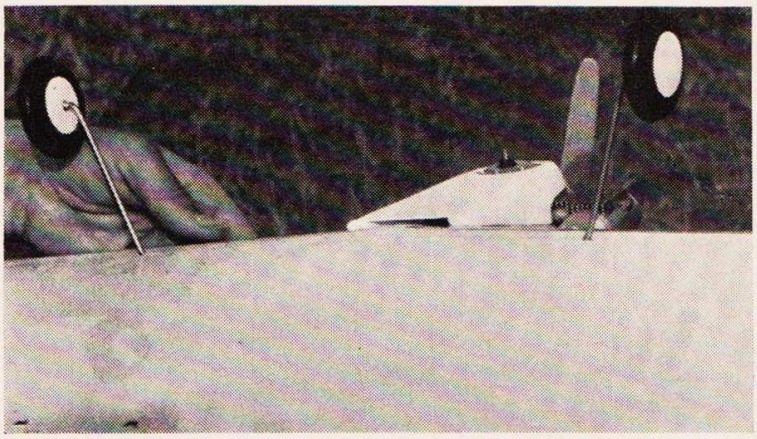
Phaeton is of basically quite simple construction which is just as well because some time and care is required on the important points for a racer of motor mount, cowling shape and wing seating and fairing for a smooth joint between wing and fuselage. Taking the wing first, the original Phaeton uses a foam wing, veneer covered, and the ailerons are of the 'strip' type except that only the outer halves move and these are operated by long torque rods of 10 s.w.g. wire faired in with a fixed balsa trailing edge along the inboard half of the wing. The landing gear is also of 10 s.w.g. wire which is adequate with the fairly short leg length, and the inboard torsional anchorage is provided by making the wire long enough to protrude through the top surface of the wing near the centre-line where a small ply patch is glued on the outer surface.

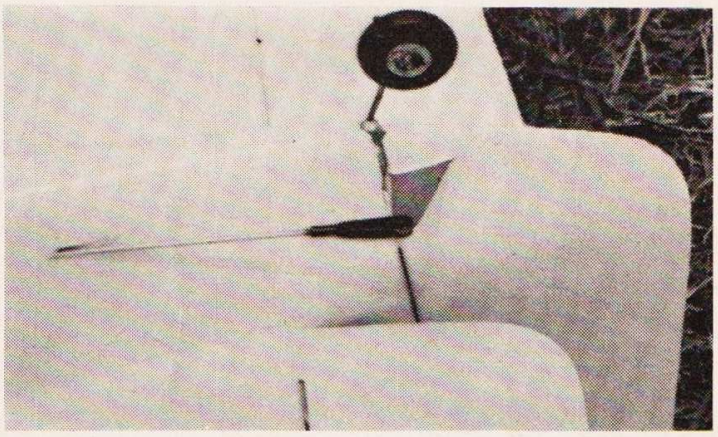
At the editors request I have also sketched a structure for those who prefer to make a built-up balsa wing. It will be noted that no dihedral braces are specified as the stresses are spread evenly over the exterior sheeting along the large root chord, and plywood braces would tend to set up undesirable local stress concentrations. I would suggest cementing the sheeting to make up the shape required for covering each wing panel surface in one, and using either P.V.A. or contact adhesive applied to both ribs and sheet for attaching this sheeting.

Turning to the fuselage and tail unit, this uses quite a large volume of very light balsa which can easily be sanded to a curvy shape. You must therefore make a nuisance of yourself at your local model shop by feeling every sheet of balsa and when your finger nails meet in the middle you have found the right grade! Seriously, balsa selection is extremely important and if you cannot obtain really light material you would be wise to figure an alternative structure or you will end up with a grossly overweight model. For example, the plan shows tail surfaces sanded from $\frac{3}{8}$ in. sheet but it would not be difficult to make a light built-up structure instead. At this point I must confess to a misjudgment in the design as my model turned out tail heavy and requires about 5 oz. of lead in the engine bay to correct this. Fortunately this was no disadvantage as the prototype model required ballast anyway to bring it up to the minimum weight of 4.85 lb. required by the F.A.I. rules. To minimise this problem the design has been modified in the accompanying plan by 1 in.

Below: the radio installation. Nose wing retainers at rear of compartment and contour of engine cowl with its front slot intake, slightly exposed motor head.







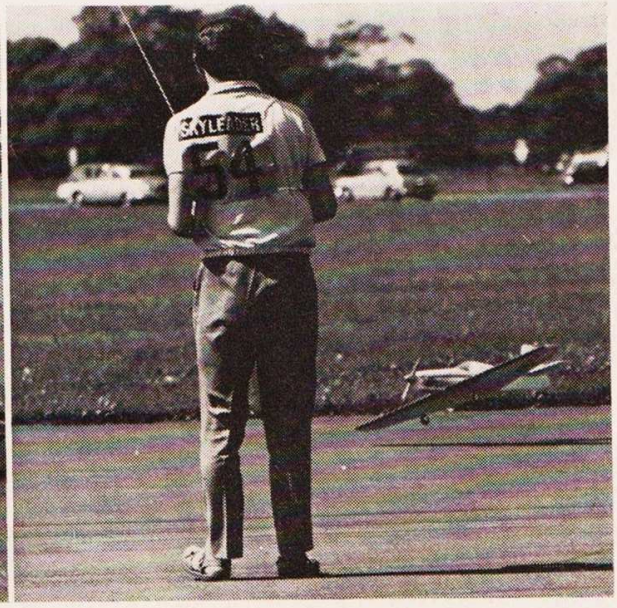
Above: Note the widely spaced undercarriage which aids ground handling at take-off. See also the air outlet at rear of cowl. Above right: tail detail showing steerable tailwheel assembly.

increase in fuselage nose length. I still recommend building as light as possible and the use of *Solarfilm* covering which is a valuable weight-saver compared with a paint job. Extra weight always tends to shift the C.G. backwards and Phaeton is tricky to fly with the C.G. any further back than indicated on the plan.

I worked out the system of fuselage construction to give rounded cross-sections without resorting to planking or to carving large blocks of balsa. If you will look at the top view in the plan you will see that the fuselage sides are straight except for a pronounced curve amidships in the region of the cockpit. This enables the top decking fore and aft of the cockpit to be a simple curvature than can be formed with sheet balsa. The compound curvature is in the cockpit canopy itself, and this, incidentally, is a 'Rivets' canopy cut down slightly. The fuselage sides and rear underside are in $\frac{1}{4}$ in. balsa, of which a good deal is sanded away, after completing the structure, to give a rounded appearance and the sudden curve amidships is then no longer noticeable. The centre curve is easily set in the $\frac{1}{4}$ in. sides by steaming. Apply steam mainly to the outer surface of the curve and set up a little more bend than required, as it may tend to straighten out slightly before you have completed the assembly. The 1/32 in. ply doublers are fixed to the sides with Evostick after setting the curve. Then mark the positions of the formers on each side and take special care to mark the position of the hardwood engine bearers accurately before epoxying these in place. I used Araldite to assemble sides and formers, as this gives plenty of time to line up the whole caboodle and you can then leave it overnight to set. In applying the top sheeting, steaming helps again and also some sticky tape across the sheet to put it into position. The plan shows the top sheeting doubled and trebled over the engine bay, but this part, I now know, could more easily be shaped from block balsa.

Reverting to the subject of engine bearers, I use $\frac{1}{8}$ in. hard aluminium facings over the wood, and these are epoxied in place using the engine itself to press them down, thereby, one hopes, ensuring that they are lined up true with the mounting lugs of the engine. Similar size plates of steel are fitted to the reverse side of the hardwood bearers, and these are tapped with screw threads for the hold-down bolts, for which 6 B.A. seems adequate. The engine bay provides plenty of room for a rear-induction carb and for the plumbing of a pressure fuel system. It will be noticed that a piece of thin aluminium sheet is glued to the cowl to separate the carb. compartment from the outlet passage for the cooling air from the cylinder. The mixture control needle protrudes through the hole in the top of the fuselage, and by

Below: Frank never indulges in the 'cook the other fella' start up tactic. Starts motor right away and runs it rich until just before end of 2 min. start-up time. Then turns down the tap. Below right: Phaeton lands quite slowly and has no vicious landing characteristics.



making an external lead-in groove to this hole it also acts as a cold air inlet for the carb compartment.

I think that I have now described all the distinctive features of Phaeton, but for the benefit of anyone with previous experience of a fast Pylon racer I would mention that only very small control-surface deflections are required, as this makes all the difference between a racer that is easy to fly and one that jumps all over the sky. The elevator horn should, therefore, be about $1\frac{1}{2}$ inches long, which is longer than any commercial one that I know.

My model was completed only a week before the Nats this year and as I had to be abroad on business during most of that week I arrived at the contest with very little air time on Phaeton. Fortunately, my first heat in the racing was also my first really good motor run, and Phaeton proved to be appreciably faster than any other model in the F.A.I. class – a nice comfortable situation that enabled me to win in two heats and the final! But I nearly missed placing altogether through being late to get my motor started in the semi-final, so there are plenty of pitfalls in this game. I am very pleased with my *K&B 40* motor (with 'F.A.I.' head by Ron Irvine), although I do not think it is exceptional, as they are all good, and we are fortunate to have such powerful, smooth-running and trouble-free motors available.

Although I have still not had a great many flights with Phaeton, I would say that the model flies clean and handles pretty well. There is perhaps some lateral unsteadiness when slowed down for landing, and this might be improved by building the wing with one degree washout (only $\frac{1}{8}$ in. under trailing edge at the tip), but you have to be pretty good to build that accurately anyway, and the stalling speed is already very low.

I am sure that many more designs to the F.A.I. rules will soon be appearing, and I shall be most interested to see how these fare in competition. But I am sure that Phaeton will be to the fore for some time to come as improvements in airframe design are not likely to have a big influence on speed, the really important factors for success in pylon racing being: 1) Get your motor running right, at the right moment, and 2) fly a steady close course round the circuit.

If you have not yet tried pylon racing, let me tell you that it is the greatest sport yet invented. I would love to see a few Phaetons racing against each other, and wish good luck and much enjoyment to all who fly them.