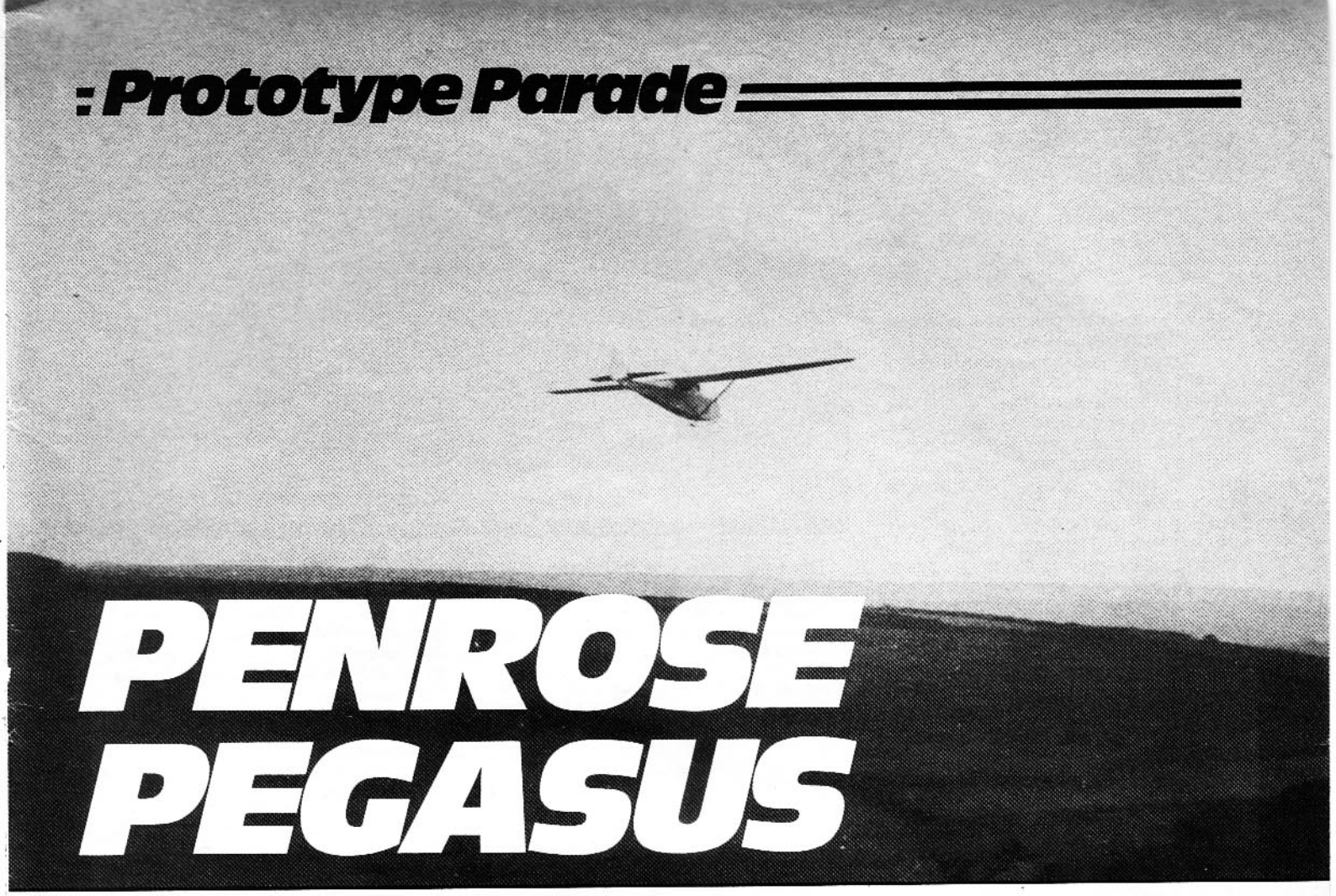


PENROSE PEGASUS

Barrie Shore researches a unique sailplane by an original designer – Harald Penrose

AN ARTICLE in the 17th October 1935 edition of 'FLIGHT' is headed 'MULTUM IN PARVO SAILPLANE'. 'Multum in Parvo' loosely translates from the Latin as 'A lot in a little'. This could equally apply to the subject reviewed, or to its Designer/Constructor and sole Pilot, Harald J. Penrose, OBE, C.Eng, FRAeS, MRINA.

Born a few months after the Wright Brothers' first successful powered flight, Harald Penrose took three months unpaid leave from his employment as aerodynamicist with Westland Aircraft at Yeovil, trained under the RAFO's Ab Initio Flying Training Scheme, and a few months later, in 1926, gained his private Pilot 'A' Licence. He then flew for the next twenty seven years as Westland's Test Pilot, the latter twenty two years as Chief, sampling all their output from Widgeon to Wyvern.

With over 390 types in his book, including hang gliders, sailplanes, jet and piston engined fighters, multi-engined aircraft, jet airliners, autogyros and helicopters, he has amassed a total of 5500 flying hours, much of them in short flights. Since retirement from his flying career, he has become a renowned Aviation Historian.

In 1930, being a co-founder of the Dorset Gliding Club with a Zögling Primary Glider, he was offered a flight in the Airspeed 'Tern', a relatively high performance sailplane for its day, which had captured all of the available British records for height and distance. Interest was further stimulated when Austrian Robert Kronfeld and Carli Magersuppe gave masterly demonstrations of thermal soaring at his local Gliding Club, in the 'Wien' and 'Professor'.

Duration versus distance

In Britain, until 1929, there was little interest in Gliding, but Kronfeld's exploitation of thermals, and Alexander Lippisch's development that year of the Variometer, brought a new dimension to the Sport. Nevertheless, at the beginning of the 'Thirties, Slope Soaring, with duration the primary goal, was the norm, and the design of British sailplanes reflected this approach. With high lift aerofoil sections, airspeeds were low, and relatively draggy airframes were deemed acceptable.

On a long sea voyage to South America in 1931, to demonstrate 'Wapitis' to the Argentinian and Uruguayan Air Forces, Harald Penrose began to sketch out the design parameters of his own personal home-built sailplane. He decided that there was too much 'lugging', and too little flying with contemporary sailplanes. Assessing various types, he considered that a higher Aspect Ratio, coupled with higher wing loading should produce a satisfactory performance. Factors of simplicity and low initial cost, controllability due to low inertia and portability were also paramount.

Design and construction of 'Pegasus' commenced towards the end of 1932, and it was hoped to complete the project within twelve months, but despite the usual optimism, valuable help from his wife Norma and friends at Westlands, Harald's limited spare time from flying duties prevented completion until 1935.

'Pegasus' was designed purely as a 'fun machine' rather than for serious competition, and took advantage of the small stature and barely ten stones weight of its pilot.

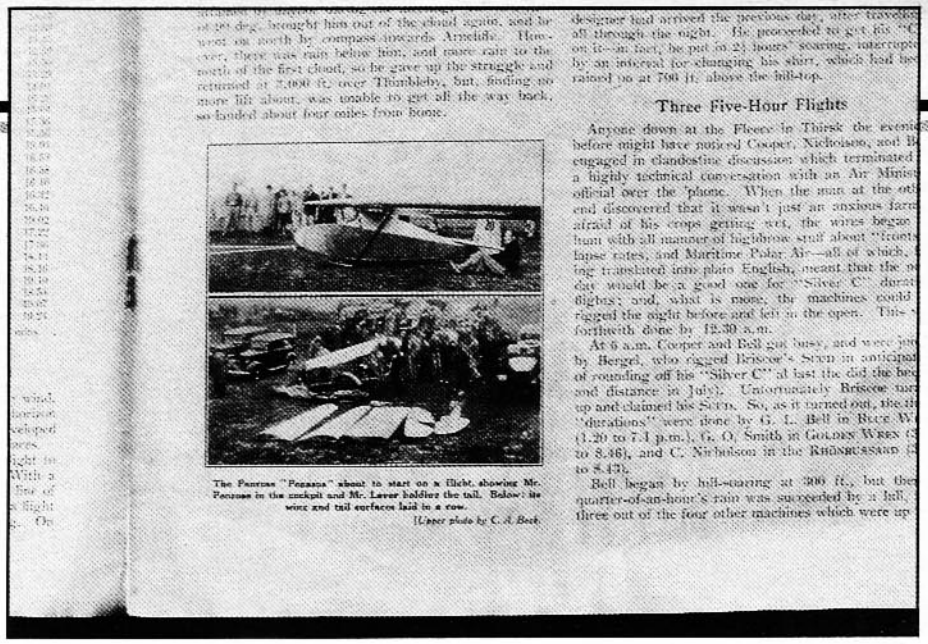
Home-build limitations

Being a Home-built, in a cottage Workshop/Bedroom at North Coker, with stairs which limited the component length to 12ft 6in, 'Pegasus' evolved as a 34 ft span sailplane with an Aspect Ratio of 13:1, a mere 92 sq.ft Wing Area and Unladen Weight of 133lbs. For ease of construction and from the aspect of cost (despite the whole of the airframe materials amounting to £30), and to keep the Wing Loading within the designed limits, each component had to be of the simplest possible construction, compatible with lightness.

The fuselage was 12ft 6in long from nose former to rudder post. A simple rectangular section torsion box form of construction was employed, with 7/8 X 5/8in spruce longerons, 5/8in square spacers,

lightweight sandwich built-up formers and skinned with 1mm mahogany ply. Intermediate diagonal 'D' section stiffeners of 5/8 X 1/2in spruce were applied to the inside of the ply cladding. A 1/16in birch ply, fabric covered Vee fairing raised the wings to enable the pilot to be positioned just forward of the wing mainspar position, with barely sufficient headroom under the wing leading edge. The Vee fairing was continued towards the tail, made up of triangular formers and intermediate struts to support the spine, and was fabric covered. The 1mm ply on the fuselage torsion box was not covered and was finished in clear varnish.

To absorb landing loads, a steam bent curved ash skid was attached under the nose by a hinge and shoe, and by redundant Westland 'Widgeon' sprung tailskid units in the form of a Vee under the wing strut attachment points. The fixing lugs for these were divorced from the strut anchorages to avoid 'knock-on' damage. This sprung skid enabled the aircraft to withstand drift landings.



Three Five-Hour Flights

The Penrose "Pegasus" about to start on a flight, showing Mr. Penrose in the cockpit and Mr. Lever holding the tail. Below: its wing and tail surfaces laid in a row.

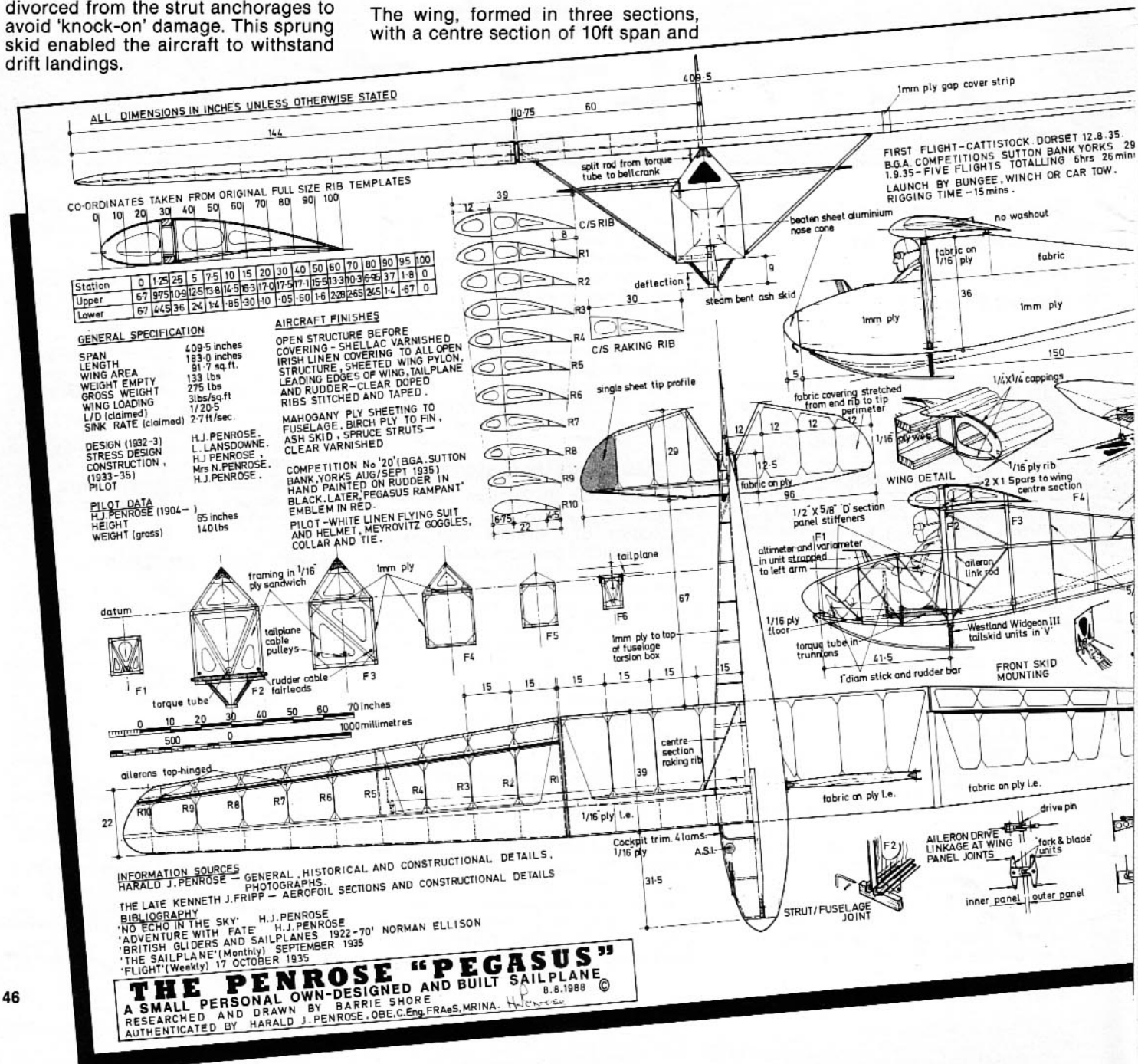
[Upper photo by C. A. Beck.

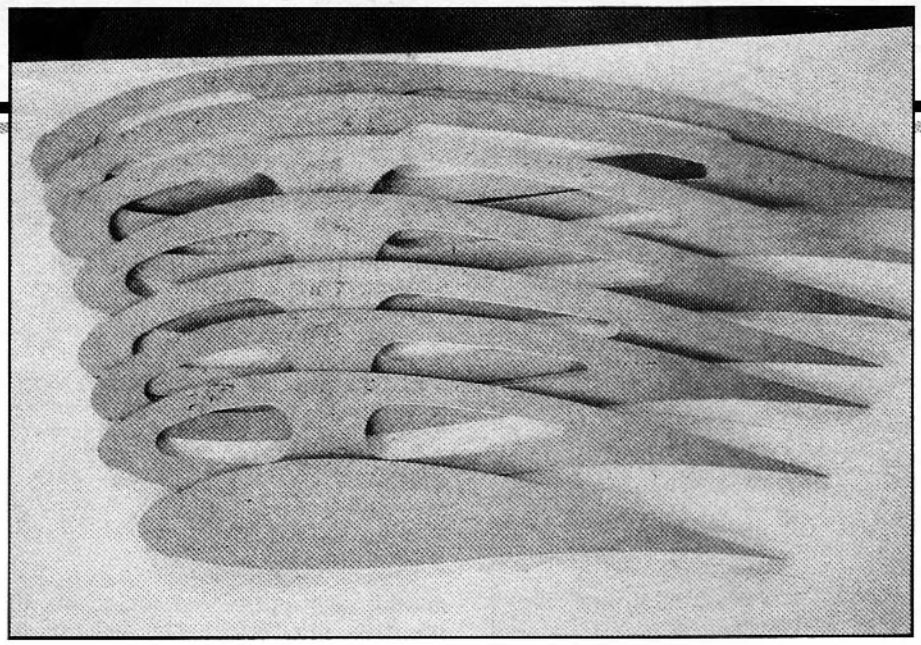
The nose cone was of beaten sheet aluminium, and was polished. The vestigal fin was in the form of an extended rudder post, with a short ply covered fairing.

Three section wing

The wing, formed in three sections, with a centre section of 10ft span and

'Sailplane and Glider' (Sept 35) cutting, above and the original wing rib blanks, for outer wing panel (R3-R10) above right (photo. Ken Fripp) Copies of the 1/12th original drawing (Drg 3089) are available from our Plans Service, price £2.50 plus 60p postage.





39 inch chord was braced by tapered low-drag section struts anchored to the wing outer panel junction plates, and to the bottom of the main fuselage bulkhead. The wing outer panels, each 11ft span tapered in plan from 39 inches to 22 inches at the last rib position and had rounded ply covered tips. Aerofoil section was of 17.5% thickness/chord and had co-ordinates constant throughout the span. There was no washout.

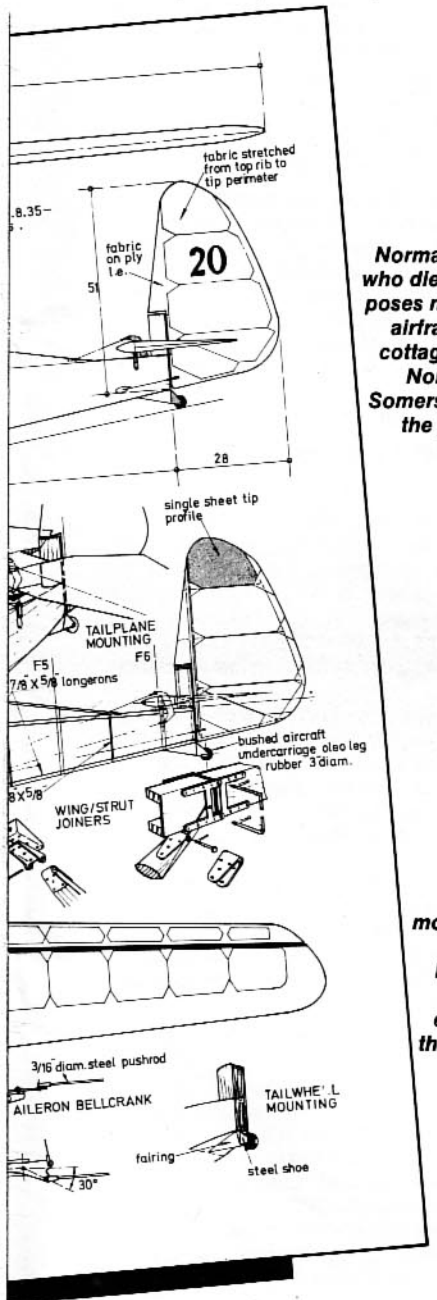
The structure was stressed such that even in the event of a wing strut failure, the remainder of the airframe would stay integral. Top-hinged strip ailerons of 20% chord, and the whole length of the outer wing panels employed a heavy differential movement, with very little 'down'. Aileron cable linkages at the wing panel junctions were connected by a 'fork and blade' system which automatically interlocked when the outer panels were offered up during rigging.

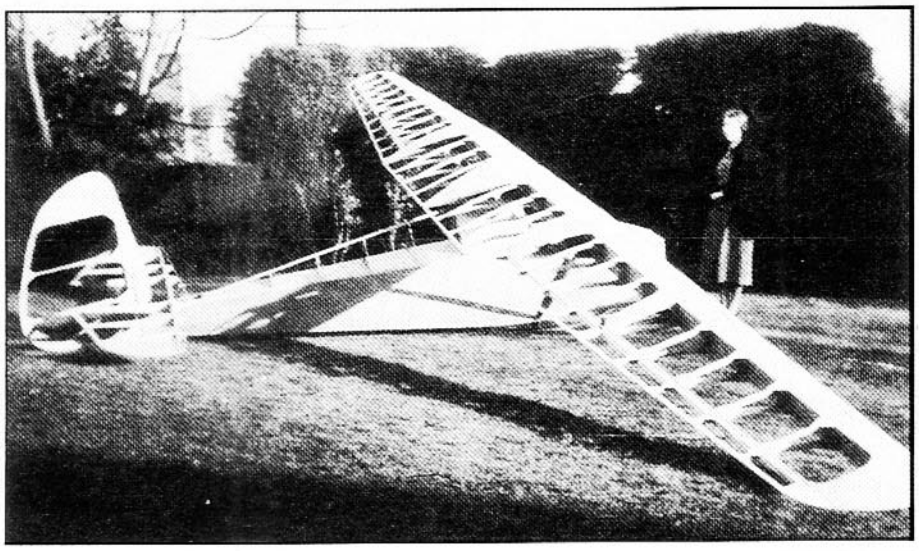
Wing joining points were at the top and bottom of the mainspar, and at the leading edge, and were formed by the usual interlocking steel plates, secured by steel 'L' shaped pins. The gap of 3/4in was covered by a wrap-round strip of 1mm ply.

The built-up main spar, with top and bottom flanges of spruce, and located at 30% chord, tapered towards the tips in the outer wing panels, and had a continuous web of 1/16in ply, stiffened between the spar at each rib position, but glued to the rear of the spar flanges only. Ribs were formed from 1/16in ply band sawn together, with generous lightening holes, and stiffened top and bottom by 1/4in.sq. spruce cappings, grooved to accept the ribs. The ribs were then cut at the mainspar web junction, glued to the spar at 15inch centres, and reinforced by chocks and triangular ply 'biscuits'.

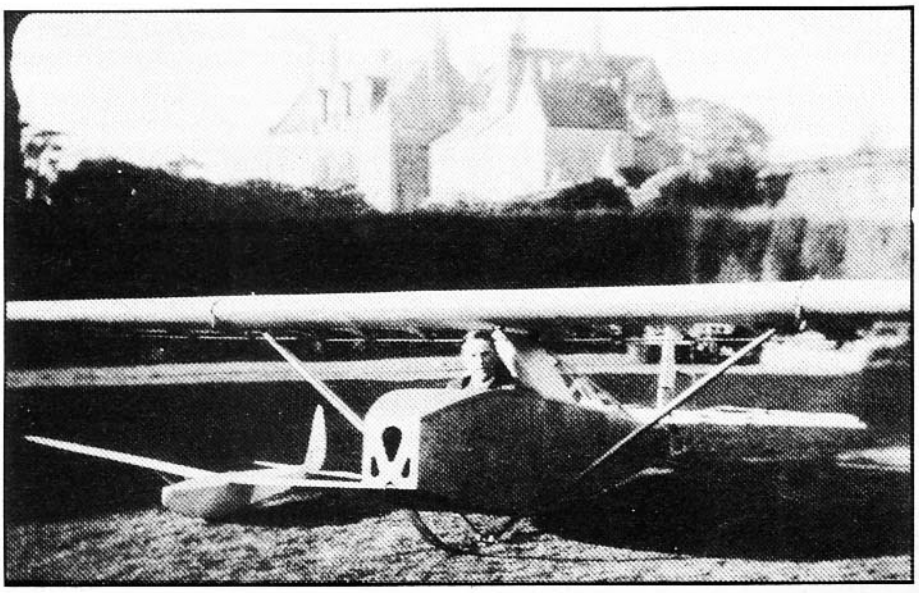
The whole of the leading edge of the wing from the mainspar forward was clad in 1/16in ply to form a 'D' torsion-box.

The all-moving tailplane of 20% wing area, and large rudder with minimal fin area employed small areas of aerody-

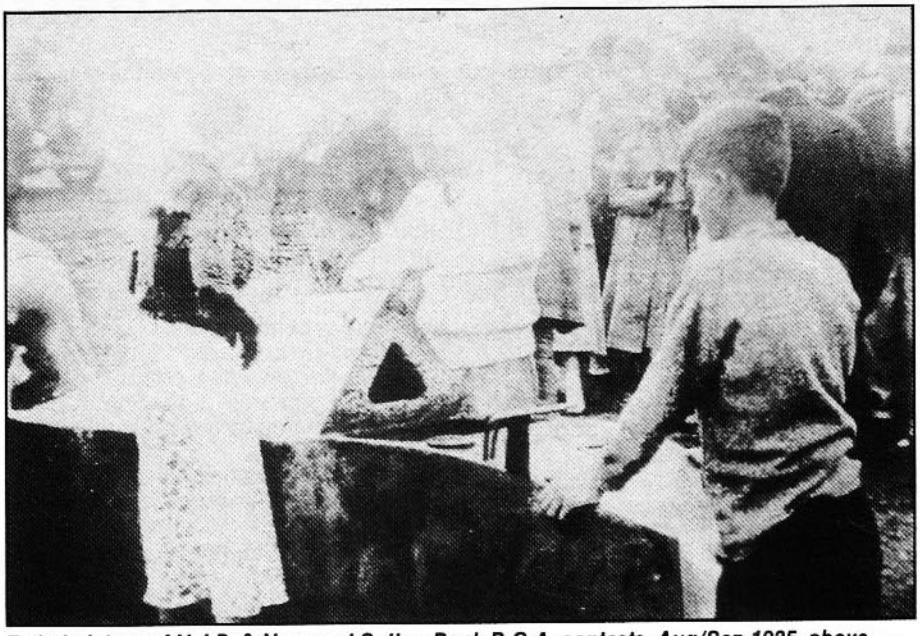




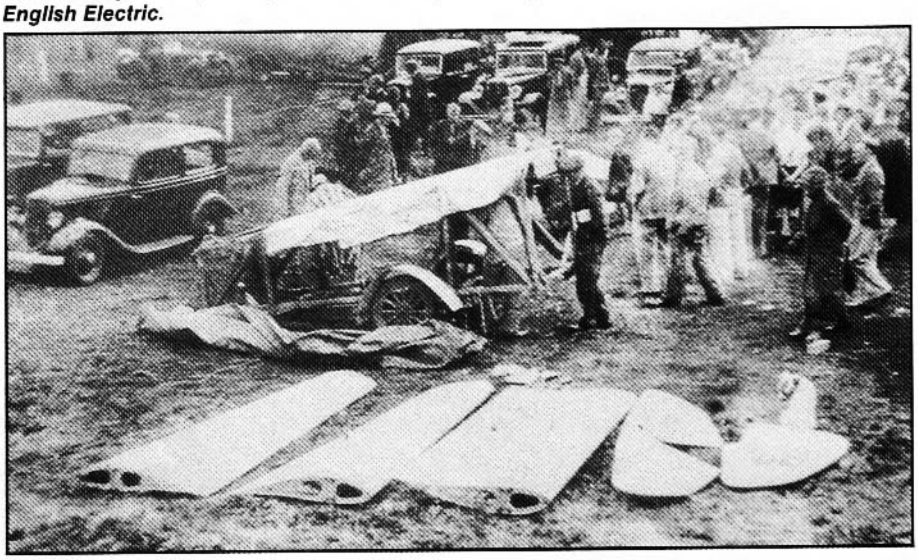
Norma Penrose, who died in 1986, poses next to the airframe in the cottage garden, North Coker, Somerset, where the prototype was built.



Harald J. Penrose in cockpit, model built by Les Lansdowne, stress engineer for the 'Pegasus'.



Faded picture of H.J.P. & Norma at Sutton Bank B.G.A. contests, Aug/Sep 1935, above. Trailer components, below, were donated by the designer N.E.W. Petter of Westlands and English Electric.



namic balance. The tailplane was simply top mounted onto the fuselage by eye-bolts at the spar position, pivotting on plates fixed either side of the rear fuselage to a substantial bulkhead.

The rudder was hinged by eye-bolts to the rudder post. Trimming the tailplane in flight, to avoid undue loads on the stick, was effected by a short length of men's trousers suspender elastic stretched from the stick to the nose former.

Access to tailplane control horn was through permanent apertures at the rear of the fuselage top decking.

Initially, a small tail skid was fitted to give ground clearance to the rudder, but proved prone to damage, and was replaced by a solid rubber wheel running in a steel shoe.

After the whole of the open structure had been shellac varnished, the fabric covering of Irish Linen was clear doped to the whole of the flying surfaces, including the leading edges, and to the fuselage wing-mount and spine. The fabric was stitched to the ribs and taped.

Promising performance

After completion, in the summer of 1935, test flights locally at Cattistock in Dorset proved that the little sailplane was most responsive and pleasant to handle, with a promising performance. Turns were possible on aileron and elevator alone, there being little adverse yaw.

Although it exceeded the recommended BGA Wing Loading Factor at 3lbs/sq.ft, 'Pegasus' was allocated C of A No. BGA232, and it was decided to obtain a performance comparison by competing in the August BGA Annual Gliding Competitions held at Sutton Bank in Yorkshire.

After loading 'Pegasus' onto its spartan canvas covered trailer, made up from the wheels and axle of a Hanomag light car, Harald Penrose, his wife Norma and the crew drove through the night, reaching Sutton Bank by breakfast on 29th August.

After a couple of hours of snatched sleep underneath the trailer, 'Pegasus' was rigged, watched by a crowd of sceptical onlookers, who were no doubt hoping that this little glider, bearing competition No. 20 on its rudder, would provide the fun of the meeting. They were only just disappointed as the 'anchor man' released before sufficient tension had been achieved in the Vee Bungee.

'Pegasus' barely cleared the stone wall at the edge of the drop as Harald had to lean on the stick to trade height for speed. Catching a powerful updraught, the crowd's jeers changed to cheers as 'Pegasus' joined the stack of other sailplanes, including the Buxton 'Hjordis', a 'Rhönbussard', a couple of Manuel 'Wrens' and the Airspeed 'Tern'.

Day one – two and a half hours

On his first flight, Harald Penrose was aloft for over an hour, until a brief rainstorm prompted him to land to change his wet shirt. A second flight in the afternoon brought his daily total to two and a half hours, gaining him the 'C' award at his first serious attempt at soaring.

Flying on the Friday was virtually washed out by the bad weather, but on the Saturday and Sunday before leaving for Dorset, Harald put in a further three flights, bringing his total times for the Meeting to 6hours 26minutes.

Up to the outbreak of War, 'Pegasus' was flown on most weekends, usually at Kimmeridge near Poole Harbour, when the weather was not compatible with sailing, another activity dear to Harald Penrose's heart.

Sad end

After the War, Les Lansdowne, who did the original stresswork calculations for 'Pegasus', cut off the fuselage in front of the main bulkhead, intending to convert her so that a pilot of average build could be accommodated.

Sadly he never completed the work, and 'Pegasus', now suffering from the ravages of time, was eventually burnt.

Few ground to air shots of the '~~Penrose~~' PEGASUS exist, this one was also taken at the Yorks Gliding Club site at Sutton Bank in 1935.