Two views of Porters, with wheels and skis, in their natural environment

AIR TEST No. 48

Pilatus Porter

by the Manager

THE PORTER is a product of the Pilatus Aircraft Works Ltd. of Stans, Switzerland, which takes its name from nearby Mount Pilatus. Mountains, rugged terrain and small landing strips are conditions in which the Porter is designed to work, and which have governed the design. Its principal features are good control at low speeds, very short take-off and landing, and a spacious cabin with big double doors to accept a wide variety of awkward loads.

The aircraft used for this air test (HB-FAG) weighs 2,360 lb. empty, and can lift a useful load of 1,960 lb. A later variant, the Turbo-Porter, powered by a Turboméca Astazou, weighs 2,340 lb. empty, and can lift 1,980 lb., without exceeding its normal maximum all-up weight of 4,320 lb. Certification tests are currently in progress to increase useful load and max. a.u.w. by another 500 lb.

Construction

HB-FAG is a type PC-6/350, fitted with a 350-h.p. Lycoming engine. Apart from the engine, and its installation, the two types are structurally identical. The high monoplane wing, constructed in two halves, each attached to a centre-section integral with the fuselage, has a single main spar of I - section, and an auxiliary rear spar to carry ailerons and flaps. The duralumin sheet wing covering combines with the main spar to form a torsion box, and loads from the auxiliary spar are transferred to it through the wing ribs which join the auxiliary to the main spar. Fuel tanks are constructed within the wing structure, one on each side; there is a lift strut on either side of the aircraft.

A special feature of the Porter is its slotted flaps. These are constructed with a narrow fixed slat attached to the leading edge of each aerofoil-shaped flap in exactly the same way as a fixed slat is sometimes attached to the leading edge of a mainplane. When the flaps on the Porter are lowered, they also rotate about the hinge point which is a few inches below their lower surface, and in doing so, move away from the shroud formed by the rearward extension of the upper surface of the mainplane. Thus in the down position, there is a slot between the mainplane and the upper surface of the slat fixed to the flap, and another slot between the slat and the flap. This double-slotted effect contributes to the special low speed and STOL qualities of the Porter.

The flaps are mechanically operated by a handle in the cockpit roof and can be set in any position desired between up and full down, which is 45 deg. and requires eleven full turns of the handle. Flap position is indicated by a small rod, resembling a static pitot head which extends from the leading edge as flaps are raised; coloured bands on the rod indicate 15 deg., 30 deg., and full down. Flaps and ailerons are each constructed in two sections, and like the elevators and rudder, are covered with a corrugated skin. Ailerons, elevator and rudder are all mass balanced.

The tail unit is distinctive, though not pretty; like some other parts of the aircraft, its appearance is reminiscent of certain pre-war Rohrbach aircraft. An unusual feature is the directional trim-tab which is attached to the trailing edge of the rudder by rubberised fabric. It is operated by a small rotatable handle mounted conveniently for the pilot's left hand on the side of the cockpit. Fore-and-aft trim is provided by the adjustable tail-plane, which is moved through its range of 10 deg. by a screw-jack which raises or lowers the rear attachment; it is operated mechanically by a handle in the roof of the cockpit, mounted concentrically with the similar handle that operates the flaps.

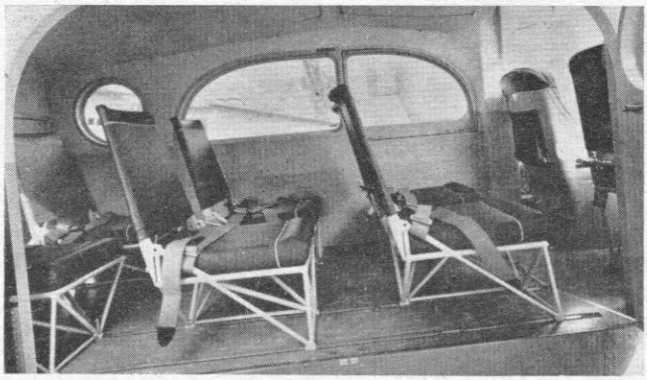
The fuselage is an all-metal semi-monocoque duralumin box, stiffened with frames and stringers. The forward part is rectangular in section and of the same width and depth throughout. The rear portion, also rectangular, is tapered down to the end bulkhead, to which the tailwheel assembly is bolted.

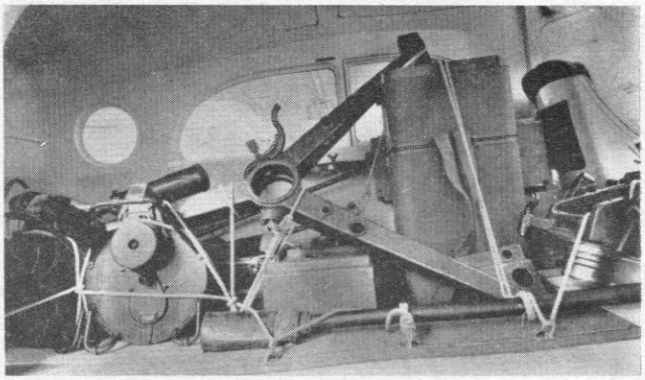
Power plant

The power plant of the model PC-6/350 is a six-cylinder Lycoming IGO-540-AIA engine, giving 350 h.p. at take-off at sea-level, and driving a three-bladed constant-speed Hartzell propeller. The engine has an electric starter and is fitted as standard with a Bendix 24-volt generator. Fuel required is 100/130 octane rating, and is contained in two tanks, each of 200 litres (44 Imp. gall.) capacity. Fuel is drawn simultaneously from both tanks, and is controlled by a single on/off cock, located adjacent to the rudder trim by the pilot's left hand. In addition to the normal engine-driven pump, there is a booster pump in the fuel line, which should be "on" for landings and take-offs, but "off" in normal flight. The engine is also the source of hot air for the cabin heating and windshield demisting system; the latter is notably thorough and effective, and supplies a good blast of hot air across the full width of the windshield.

This model of the Lycoming engine uses fuel injection, and there is no carburetter; it is interesting, however, to find that an alternative hot-air intake source is provided, under the pilot's control.

The engine is equipped with an interesting exhaust system which not only results in very quiet running, but is also used to augment thrust, as well as to suck cooling air through the hot parts of the engine. An adjustable flap in the system permits adjustment to cope with outside tempera-





The Porter cabin with: (LEFT) *eight seats; and* (RIGHT) *a 1,145-lb. load of 20-mm. Oerlikons and ammunition*

Pilatus Porter . . .

tures ranging from arctic to tropical; there is also a pilot-controlled oil cooler capable of dealing with a wide range of temperatures.

The normal wheeled undercarriage of the Porter has a steerable tailwheel, linked to the pilot's rudder pedals. The tailwheel can be locked central for take-off and landing. The mainwheels are normally 24 in. in diameter, but 32-in. diameter wheels can be fitted if desired. Both types incorporate Goodyear hydraulically operated disc brakes, controlled by toe pedals on the rudder bar. The brakes may also be locked "on" for parking. The main undercarriage strut incorporates long-stroke steel coil springs with oil damping.

Accommodation

The cabin of the Porter is designed to accommodate a wide variety of loads. Apart from sound-proofing, there is little concession to prettying-up the interior of the aircraft, which is as "utility" as its box-like exterior suggests. Entrance to the cabin is by double doors on the starboard side. When both doors are open, the width for loading is 62¼ in. and the height is 41 in. at the centre; if desired, two similar doors may be fitted on the port side. In addition the cabin floor contains a rectangular hatch 22¾ in. wide by 35½ in. long through which things or people may be dropped, or which may be used for survey cameras. Furthermore, the Porter can be flown with the starboard cabin doors removed so as to parachute things that are too big for the bottom hatch.

The cabin floor is fitted with four rows of T-shaped rails which can be used for fixing seats, cargo, stretcher racks, survey cameras, etc. The position of seats or cargo can be varied to suit each other by means of a simple pip-pin engagement in the floor rail. When not required, seats can be stowed in the rear compartment, and conversion from passenger to cargo or *vice versa* can easily be made in a few minutes. A maximum of eight people can be seated (including the pilot). Finally, an opening in the rear bulkhead of the cabin permits stowage of items which are too long to be contained in the cabin itself. The space normally available is 7 ft. 6 in., measured from the back of the pilot's seat to rear cabin bulkhead, and this is more than enough for the carriage of two stretcher patients, with attendants.

The cockpit, like the cabin, has an internal width of a fraction under 50 in., and so is quite spacious. The wide instrument panel has plenty of room for almost any number of instruments, and radio; and access to the front seats is made even easier because the back of the starboard front seat can hinge out of the way. The seats are not adjustable; but the rather upright position will fit most pilots, and an adjustment of 2½ in. on the rudder pedals will be enough for all but extremes.

When normally seated, the pilot has his eyes about 28 in. (the ideal distance) from the nearest instrument, and a trifle aft of and 3 in. below the wing leading edge. By leaning forward a little, one can easily see in front of the leading edge, and the high wing position then only interferes with the view more than 90 deg. from ahead. The view ahead is excellent, and the engine cowling obscures the ground only over a relatively narrow arc straight ahead. The quality of the windshield is good, and it is free from distortions and reflections. There is a small clear-view panel to port.

There are three criticisms of the cockpit layout. The first is that the handles which control the flaps and tail trim are too near the pilot's head; in fact when first using them one is conscious of having to dodge about to avoid hitting oneself on the head. The second is the location of a shelf, some 5 in. wide, which runs across the full width of the cockpit at the lower edge of the instrument panel; its unpadded angular edge is close to the knees of the occupants of the front seats, and would be an unpleasant additional hazard in any crash landing. The third point of criticism is the insignificant wire toggle which is pulled to lock the wheel brakes "on" for parking. It does its job certainly, but it is unpleasant to use and looks makeshift.

Handling

Apart from remembering to lock the steerable tailwheel before take-off, there is nothing unusual about the Porter. The fuel-injection Lycoming is started like a car, by turning the ignition key past the position of both magnetos "on"; it started each time easily and ran quietly and smoothly throughout.

Aided by the steerable tailwheel and wheel brakes taxi-ing presents no problems, and the wheel brakes are adequate for running up the engine. With the rudder trimmed slightly to starboard, there is no noticeable tendency to deviate from a straight course on take-off, and with flaps set to 15 deg. down, the Porter left the ground against a 12-knot wind and at a weight of approximately 3,100 lb. in about 90 yards.

Recommended climbing speed is 75 m.p.h. (65 knots) which is well within the limiting speed for lowered flaps, which is 84 m.p.h. (73 knots). If a steep angle is desired, climb may be continued with flaps lowered; a similar rate of climb, but at a smaller gradient, is obtainable with flaps raised. During type-approval tests by the Swiss Government the take-off distance to 50 ft. at full load was recorded as 765 ft. at sea-level, and the climb thereafter (on skis) as 825 ft./min. after raising flaps.

Flap problem

Raising flaps by turning the handle resulted first in hitting one's own head and secondly in lowering more flaps instead of raising them. The first is a question of becoming used to the position of the flap handle. The second was due to the flap indicator which protrudes further from the wing as flaps are raised. One expects excrescences to disappear as the aircraft is cleaned up, and it would be more natural if the amount of rod protruding indicated the amount of flap lowered, instead of the reverse.

Normal cruise at 60 per cent power at 6,500 ft. is given as 116 m.p.h. (100 knots), giving a flight duration of over six hours. Higher speeds can be used if desired, and are well within the capacity of the Lycoming engine, whose maximum continuous output is 325 h.p. at 3,000 r.p.m. and 29.4 in. Hg manifold pressure. In level flight the Porter can be trimmed to fly hands and feet off throughout its normal operating range. There is a spring linkage, similar to that on some Piper aircraft, between the aileron and rudder controls; by this means rudder movement is made to apply aileron and *vice versa*, and this permits the aircraft, once trimmed, to

be flown either hands or feet off for considerable periods. There is noticeable aileron drag, but once a turn is established the Porter can be held steadily in it with feet off.

The Porter, in the conditions flown, proved to be stable fore and aft, and quite sharp disturbances damped out quickly. The aircraft is also stable directionally, and just stable laterally, due no doubt to the high wing. Ailerons are a good deal heavier than is now customary in many similar size aircraft, and so are elevator forces, unless the fore-and-aft trimmer is used to relieve them.

Lowering the flaps results in a moderate nose-up change of trim during the first part of the movement and *vice versa.* Increased power raises the nose, while reducing power lowers it; the engine on-and-off effect is very marked but, nevertheless, no particular sudden change of trim is experienced in an overshoot, and there is plenty of time to re-trim before stick forces become heavy.

The clean engine-off level stall was preceded by the stall warning horn and red-light indicator at 60 m.p.h. I.A.S. (52 knots). At 53 m.p.h. I.A.S. (46 knots) a very slight buffet on the tail was just noticeable, and at 50 m.p.h. (43 knots) the stick was fully back on the stops and the aircraft just on the stall. There was still some aileron control and no great rate of sink.

With full flap the stall warning sounded at 47 m.p.h. I.A.S. (41 knots); this time there was no detectable buffet and the stick was fully back at 40 m.p.h. (35 knots), still with no great rate of sink. In each case the Porter recovered quickly and normally to normal flight as soon as the stick was allowed to go forward. Use of engine limited the height lost in recovery to a few hundred feet, but recovery without power required rather more height.

Slow flying

Slow flying in the Porter is extremely pleasant. With half-flap, and 60 m.p.h. (52 knots) on the indicator, the aircraft dawdles along with excellent control response and a notably good view ahead for the pilot. This is the appropriate configuration for getting into position to approach the landing strip; having thus manoeuvred to the position from which the desired point of touch-down is straight ahead, the airscrew control may be moved to fully fine and flaps full down. About 16 to 17 in. Hg manifold pressure will then result in quite a steep approach path, during which the intended point of landing, as well as any obstacles, are in easy view over the top of the engine cowling; adjustment of power ensures that the glide path is maintained as required.

During the round-out the flaps, fully down, exert a powerful braking effect and speed falls off rapidly. Actual contact with the ground feels a gentle affair during which the long-stroke undercarriage progressively takes the load from the wings. Successive landings against a 12-knot wind all resulted in a ground run of well under 100 yards. Swiss Government tests quote a landing distance, at full load, at sea-level and no wind, of 665 ft. over an obstacle 50 ft. high—which is very good indeed, and consistent with the remarkably short runs obtained without difficulty by a pilot inexperienced on the aircraft in this air-test.

What it costs

The first cost of a new Porter, similar to HB-FAG, radio equipped and duty paid, is quoted as £17,000; the exact price varies according to equipment fitted. Operating costs given in the accompanying table are as estimated by the makers.

A.—Fixed costs per annum

	£
Depreciation (six years with 20 per cent residual value)	2,340
Interest on capital (6½%)	1,140
Insurance on aircraft	600
Hangarage and landing fees	350
Fixed maintenance and crew staff costs	1,000
"A" costs total	£5,430

B.—Variable costs per hour

	£ per hr.
Fuel and oil (U.K. operations: all tax paid)	3.05
Periodic maintenance (and spares required)	1.25
Airframe overhaul (and spares)	0.50
Engine overhaul (and spares)	1.50
Crew salary	1.50
"B" costs total	£7.80

C.—Aircraft utilisation
(in flying hours per year including both "A" and "B" costs)

400 hours	cost/hour £21.4
600 hours	cost/hour £16.8
800 hours	cost/hour £14.6

The payload and block speed of the Porter can be taken as 1,400 lb. and 115 m.p.h. on the type of flight sector most likely to be flown by an owner in the U.K. With a utilisation of 800 hours per year, specific costs are approximately 4.3 pence per seat-mile and 43 pence per ton-mile.

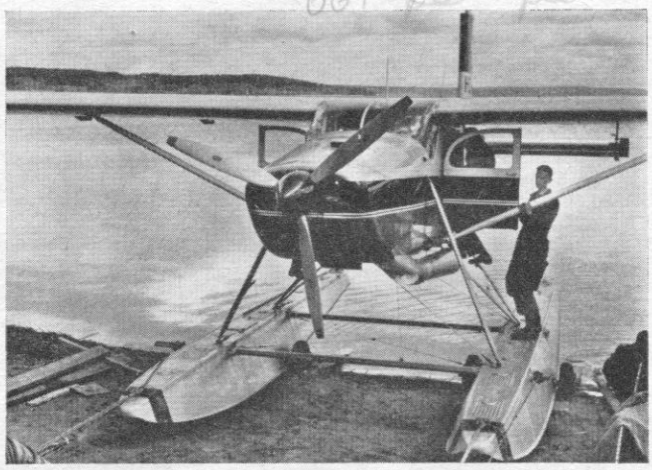
At the present time there are few aircraft obtainable with qualities similar to the Porter. It is in the same work category as aircraft like the D.H. Canada Beaver, and might be looked upon as a smaller cousin. It makes few concessions either to luxury or beauty of line; nevertheless it has the same purposeful look as many other pieces of machinery well designed for the job to be done. In the case of the Porter, this is lifting a good load into and out of otherwise inaccessible places at an economic cost. In this the Porter should be brilliantly successful, for it combines simple and tough construction with handling qualities perfectly suited to its purpose.

Other likely jobs for the Porter include its use by civil contractors for ferrying men, stores and parts of machinery to fields alongside their work; flying doctors obviously should be interested, and so should factory owners who would like to fly from their sports fields. The Porter could also have uses in a simpler role, such as shuttling between the Isle of Wight and the mainland, and similar routes.

Air Pictorial would like to express its thanks for the opportunity to do this Air-Test to Air Porter Ltd., of 2 Basil Street, Knightsbridge, London, S.W.3, who are the U.K. concessionaires, and in particular to S/Ldr. Ted Tennant, formally chief test pilot for Follands, who now demonstrates the Porter in the U.K. and is one of the directors of the firm.

Porter PC-6/350 specification

Span	49 ft. 10½ in.
Length	33 ft. 5½ in.
Height	10 ft. 6 in.
Weight empty	2,360 lb.
Take-off weight	4,320 lb.
Max. speed	145 m.p.h.
Economical cruising speed (60 per cent power at 6,500 ft.	116 m.p.h.
Rate of climb at S/L	850 ft./min.
Service ceiling	14,700 ft.
Range	930 st. miles



The Porter is also available as a very attractive looking seaplane; a ventral fin is added to counteract the side area of the floats. Land versions can have 24-in. or 32-in. diameter main-wheels, or a combined ski and wheel undercarriage