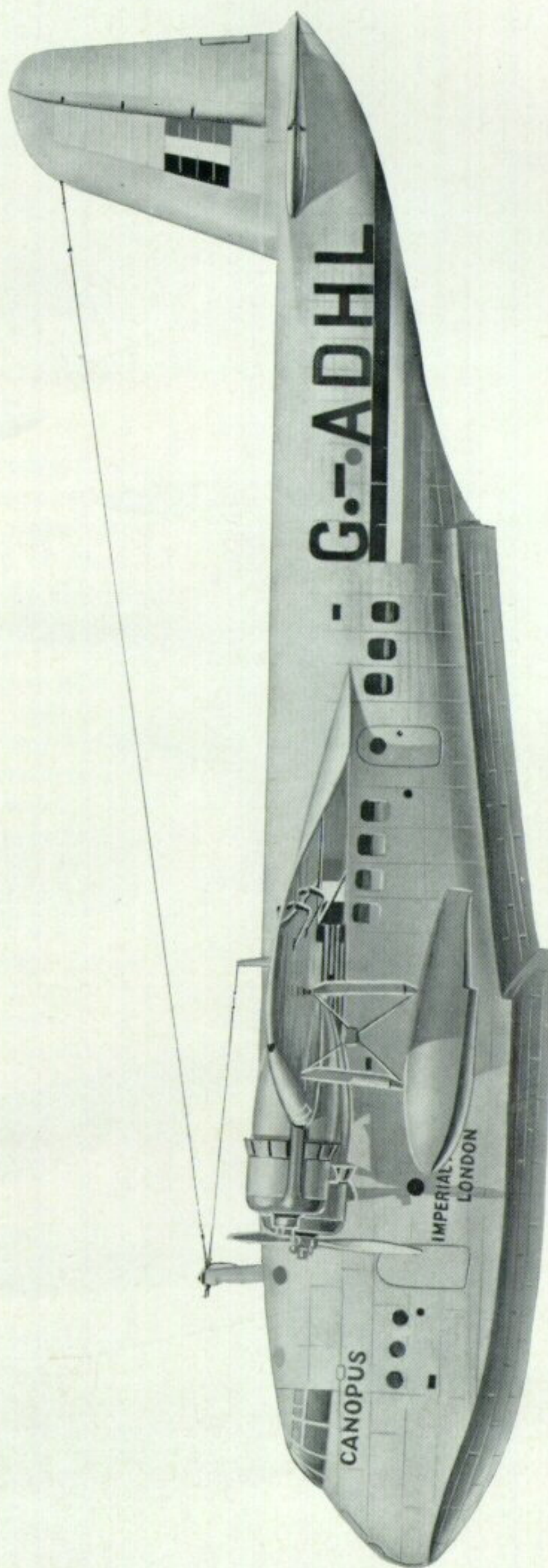


PROFILE PUBLICATIONS

The Short Empire Boats

NUMBER 84
TWO SHILLINGS





The SHORT "MERCURY" SEAPLANE, upper component of the "Mercury-Maia" composite experiment. Below: Perspective view of the composite with "Mercury" mounted.



The Short Empire Boats



by Geoffrey Norris

Cameronian, the twenty-fourth "C" Class boat to be constructed.

(Photo: Short Bros. and Harland)

When, in 1935, it was announced that Imperial Airways had placed an order for twenty-eight flying boats of a new type that had not yet been designed, yet alone flown, and that these new boats would weigh eighteen tons apiece, the act was hailed as one of the world's boldest experiments in aviation. But there were others, however, who referred to the order as a gamble.

The reason for Imperial Airways' hurry was not difficult to see. World-wide air travel was booming and the company was anxious to get more than its fair share of future business for Britain. Major R. H. Mayo, Imperial Airways' Technical Adviser, had been collecting statistics for some time and from this research had built up a specification for an aircraft which could be used for passengers and freight throughout the world. It would carry twenty-four passengers in spacious comfort and still have ample room for air mail or freight; cruising speed would be 160 m.p.h. and normal range 700 miles—although there would have to be room to stretch this to some 2,000 miles to serve the North Atlantic route which the company hoped to open later. Because the flying boat was in vogue and because it was thought impossible to build a landplane of this size and weight with acceptable landing and take-off characteristics, a flying boat was required.

It was obvious that the order should go to Short Brothers of Rochester. The company had already built several series of large flying boats both for the R.A.F. and Imperial Airways and these had an enviable record for both performance and safety. Nevertheless, Shorts were reluctant to build such an advanced aircraft straight into production and asked for time to build a prototype. Imperial Airways insisted that there was no time for this and, as an order for twenty-eight aircraft each costing some £45,000 could not lightly be turned down, Oswald Short, chairman of the company bearing his name, signed the contract.

The man responsible to Short for the design of the Empire Boat was Arthur Gouge and his starting point was the cubic capacity which Imperial Airways had specified for each passenger. Preliminary calculations indicated an aircraft with the wing carried on a hump

above the fuselage to provide the necessary clearance between propeller tip and water but it was then decided that there would be less drag if the fuselage depth could be increased up to the wing. This gave more volume than required but enabled the cantilever wing to be fitted into the fuselage in a manner that was both lighter and stronger than that possible with a hump.

Up to this time Short flying boats had been built with wide planing bottoms but, with a boat weighing eighteen tons, excessive water drag would inhibit take-off performance. Gouge therefore set out to design a new type of planing bottom and, after many experiments in Shorts' own water tank, succeeded in whittling the beam down to eighteen inches below that shown necessary by the first calculations.

As another aid to take-off and landing Gouge designed into the aircraft flaps patented by himself. The Gouge flaps fitted to the Empire Boats were designed to increase wing area with little or no increase in drag and without destroying the flow over the top of the aerofoil. Calculations, later borne out in operation, showed that the lift coefficient of the wing could be increased by 30% to reduce landing speed by 12 m.p.h. without any change in trim.

The basic aerodynamic design was built around the

Canopus at rest on the Medway at Rochester.

(Photo: Short Bros. and Harland)





Above and below: Canopus, first of the "C" Class boats. Top illustration shows Canopus on the slip-way ready for initial launching. (Photos: Short Bros. and Harland)

Short Scion Senior which virtually served as a half-scale prototype for the Empire Boats. This development of the twin-engined Scion was a high cantilever wing cabin monoplane powered by four Pobjoy Niagara engines of 90 h.p. each. First flown in 1935, it was built in both landplane and floatplane versions, had a span of 55 ft., a length of 42 ft. and a wing area of 400 sq. ft. As a floatplane it had a maximum speed of 134 m.p.h. and cruised at 121 m.p.h. at 3,200 r.p.m. or 115 m.p.h. at 3,100 r.p.m. All-up-weight was 5,750 lb.

The final design of the S.23 Class Empire Boat showed its obvious relationship with the Scion Senior. The Empire Boat was a clean-looking high-wing monoplane spanning 114 ft., 88 ft. long and 31 ft. 9½ in. high. Wing area was 1,500 sq. ft. The chosen powerplant was the Bristol Pegasus Xc engine which delivered 740 b.h.p. at 3,500 ft. Empty weight was 24,000 lb. and all-up-weight 40,500 lb. The useful load comprised 600 gallons of fuel weighing 4,560 lb.; 44 gallons of oil at 400 lb.; equipment, 3,340 lb.; payload and crew of five, 8,200 lb.

No machine of this size and complexity had been built before by the British aircraft industry and Shorts found many problems in construction which could only be overcome by developing new techniques. The mainplane spar booms, for instance, were machined from lengths of "T"-shaped Reynold's extrusions in Hiduminium R.R.56 alloy. These came in lengths of 22 ft. only and had to be joined end to end to make up one half spar boom. These sections then had to be machined to a constant taper from root to tip to an accuracy of within 0.005 in. and there was no machine



on the market capable of performing this task. Shorts accordingly built their own.

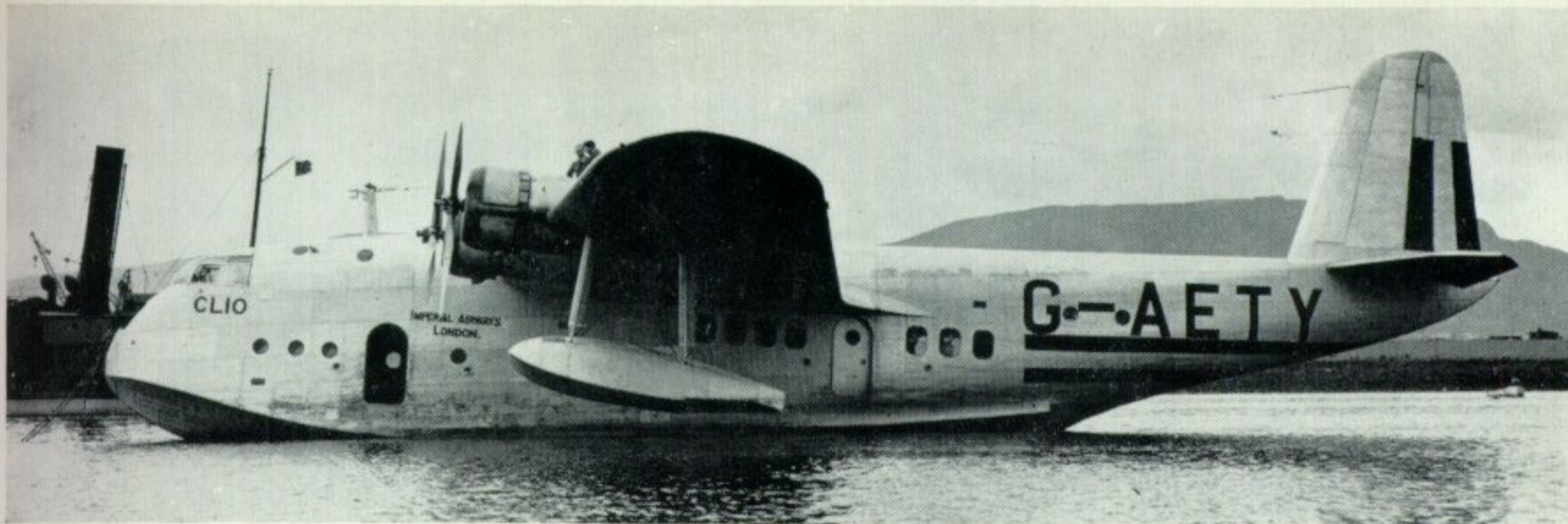
The wings were covered with flush-riveted Alclad and had Frise-type ailerons. The Gouge flaps were worked by screw jacks driven by a ½-h.p. Rotax electric motor running at 6,000 r.p.m. geared down to turn the jacks at 500 r.p.m. and which lowered the flaps in 60 seconds and raised them in 90. The size of the wings made accommodation of fuel tanks simple and the normal medium-range Empire Boat carried fuel to Air Ministry spec. D.T.D. 230 in two 325-gallon cylindrical tanks placed between the inner and outer engines.

Sections of the wing leading edge on each side of the four nacelles folded down to serve as servicing platforms for the engines and the floats, which were carried on a pair of struts in tandem attached to the main spar, had a shock absorber carried between the bracing wires which allowed them to move backwards some four inches and thus prevent undue torsional loads being transmitted to the wing if sudden waves were struck at speed.

Cambria, second of the long-range boats.

(Photo: Short Bros. and Harland)





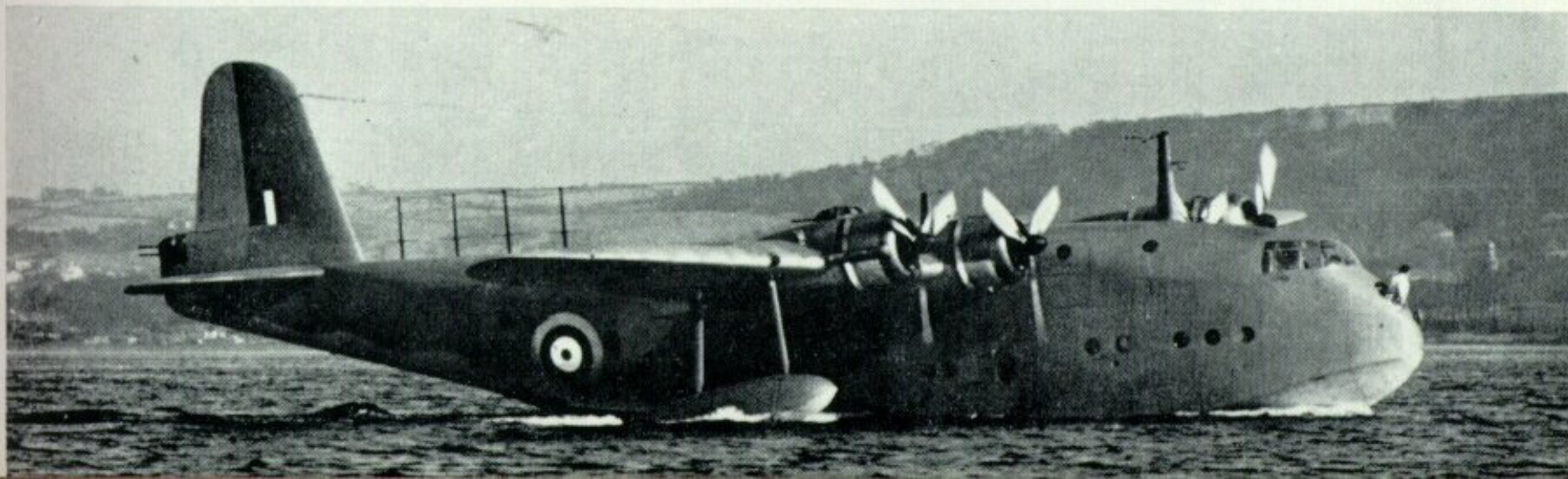
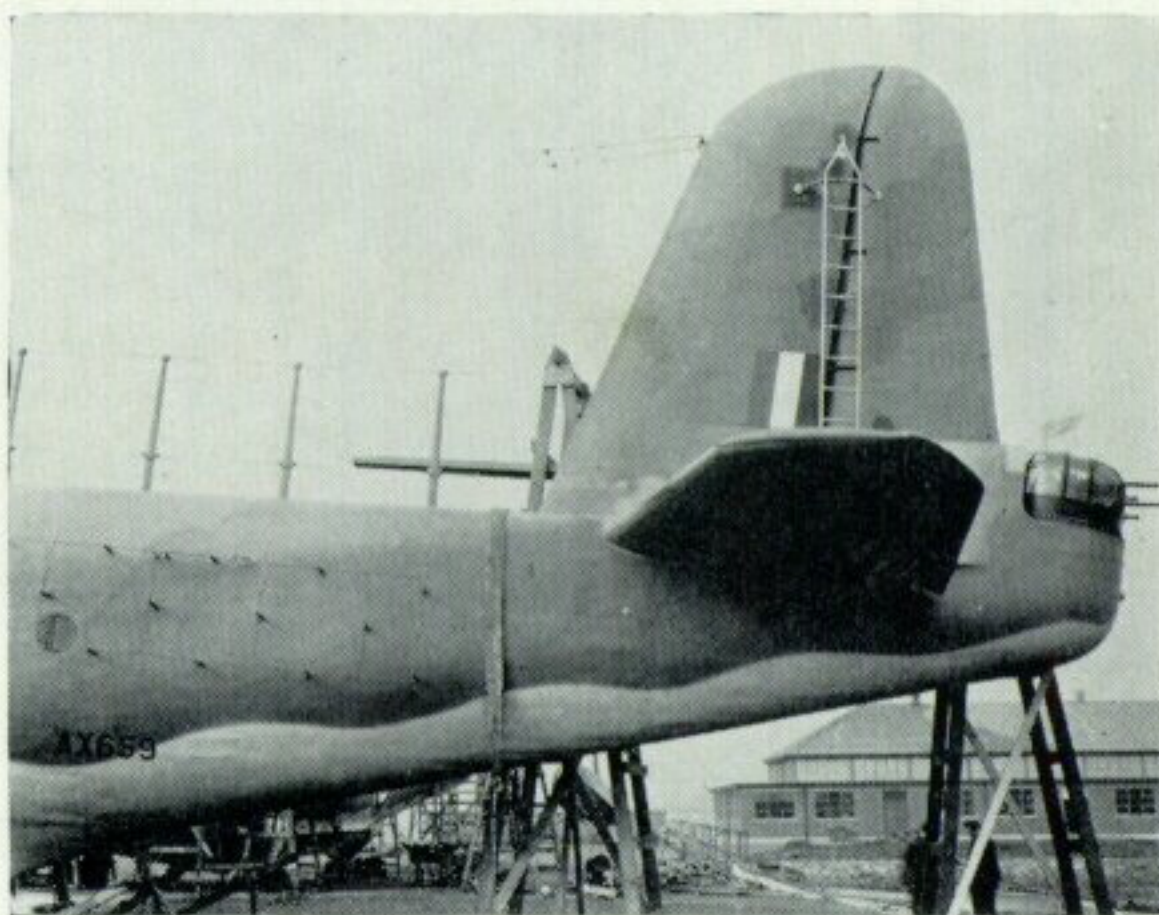
Above and below: Clio before and after conversion for long-range reconnaissance duties with Coastal Command during W.W.II. Note the dorsal radar aerials. (Photos: Short Bros. and Harland)

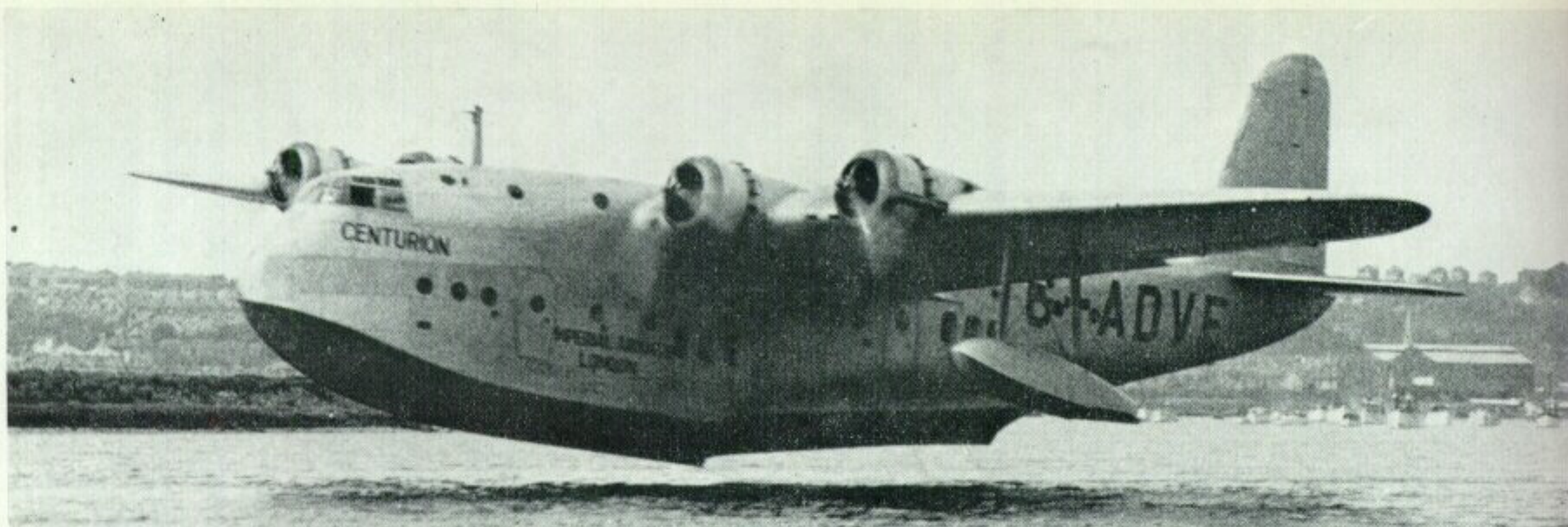
Although the hull was radically new in shape its construction generally followed the practices evolved in previous Short boats and stringers were interrupted at formers instead of being notched to run continuously. The Empire Boats had stringers of "Z" section which were attached to the formers by plain angle brackets. The keel was built up on an "I" section girder and, with the two chines (the angle where the fuselage sides meet the planing bottom) formed a triangular section. Earlier Short boats such as the Kent Class and the Calcutta had been characterised by a sudden reduction in beam above the chines, the sides of the fuselage being faired into the chines by a planking of double or "S" curvature—a difficult form of construction involving considerable panel beating. In order to simplify construction—and to help achieve the necessary interior volume, this system was discontinued in the Empire Boats which had only a light curve sweeping the sides into the chines.

The 17-ft. deep hull made it possible to provide accommodation on two decks. The pilot and co-pilot sat in a spacious cockpit dignified with the word "bridge", with the radio operator facing rearwards behind the captain. Aft of this on the upper deck was a long compartment divided longitudinally to provide space for 3,000 lb. of freight and mail on the port side and the ship's clerk's office to starboard. The clerk had charge of a panel containing fuses and switches for all circuits and lighting inside the boat. He also had access to handles controlling the opening of the annular skirts of the cooling flaps for the four engines, fuel cocks and ventilation air intake controls. A step-ladder at the aft end of the clerk's office led to the galley in the lower deck. Behind the clerk's office, but

not directly accessible from it was a storage space for bedding and other sundries.

A spacious marine compartment was located at the forward end of the lower deck and this carried an anchor, two drogues, a retractable mooring bollard and a boat hook. A retractable Harley lamp was mounted on a hinged panel off-set to port. Direct communication between the "bridge" and mooring compartment was by step-ladder. Aft of the mooring compartment was the forward passenger saloon with three seats along the port side facing inwards, two to starboard also facing inwards and another pair facing forwards. Behind this was a central corridor flanked on the port by toilets and to starboard by the galley. A mid-ship cabin aft of this accommodated three passengers by day and four at night and led on to the promenade cabin, a spacious compartment with seats





Centurion, which crashed on Hooghly River, India, in June 1939.

(Photo: Short Bros. and Harland)

for eight or sleeping accommodation for four. On the port side there was a rail where passengers could lean and look out of the windows. An after-cabin at the rear, ending level with the after-step of the planing bottom, had six seats for daylight flying or bunks for four. Aft of this again was another freight and mail compartment extending well back into the after fuselage.

The flight deck was, for its day, very well equipped. Rudder, elevator trim and the flap-operating switch were carried above the windscreen between the two pilots. Engine starter switches were placed at the top of the central coaming and below this were the engine switches and auto-pilot panel. The throttle quadrant was normal but carried on each side two large "cut out levers". Large boats were often called on to do much taxiing after a flight and engines tended to overheat and continue firing after being switched off. The "cut out levers" cut the fuel at the jets to make the engines dead. Below the throttle and mixture controls were the switches for the auto-pilot and, at the base of the central console, the four switches for controlling the de Havilland variable-pitch propellers.

The flying instruments included a Hughes turn indicator, Sperry artificial horizon and directional gyro, a Kollsman sensitive altimeter, a liquid pitch indicator, a Hughes rate-of-climb indicator, a Marconi homing indicator and a special Smith's chronometer. Both pilots also had a Hughes P/4/11 compass.

The radio officer sitting behind the captain had Marconi sets for receiving and transmitting on 600–2,000 metres and in the 16–75-metre band. The sets were mounted in shock-proof supports and incorporated the direction-finding receiver. The loop for

this was on a retractable mounting which had provision for turning the assembly athwartships so that it could be used for visual or aural homing.

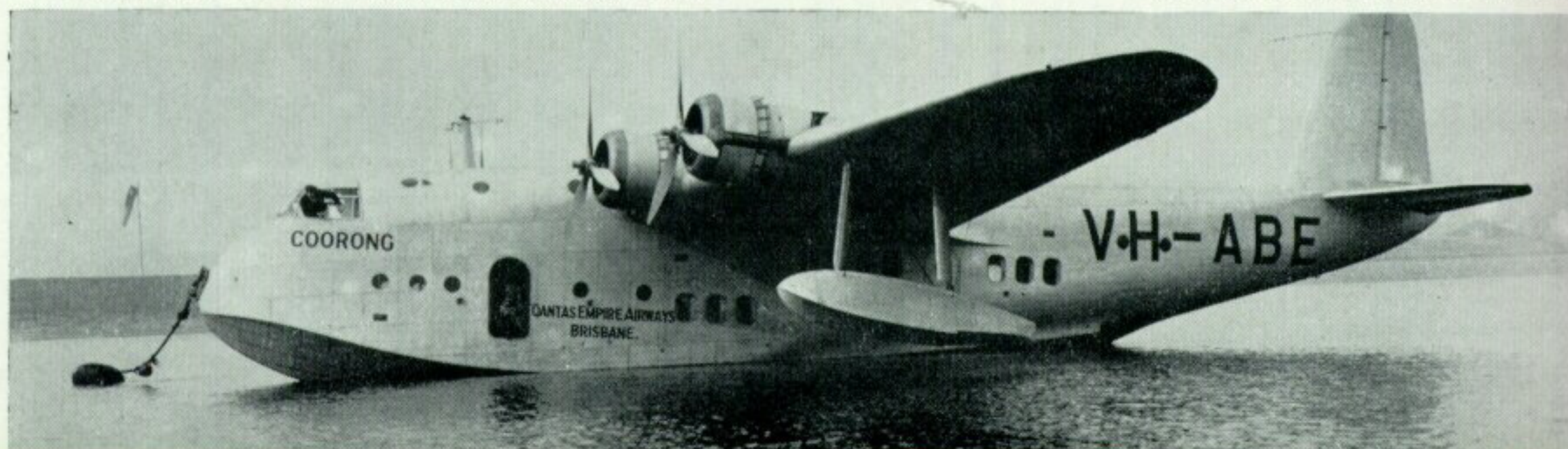
The nine-cylinder, radial, air-cooled Pegasus Xc engines were the commercial version of the Pegasus X and were rated at 740 b.h.p. at 3,500 ft. 910 b.h.p. was available for take-off with the de Havilland v.p. propeller permitting the engine to turn at 2,475 r.p.m. Normal cruising output was 510 b.h.p. The 28.7 litre engine weighed 1,010 lb. and measured 55.3 in. in diameter. Rotax-Eclipse direct-cranking starters with hand-turning gear operated from 12 volts and turned the engines at some 25–30 r.p.m.

Canopus, the first of the Empire Boats, made her maiden flight on 4th July 1936, with Shorts' Chief Test Pilot, John Lankester Parker at the controls. She gave no trouble and Lankester Parker pronounced himself pleased with her performance. The new style of planing bottom proved its value when *Canopus* unstuck after a run lasting only seventeen seconds—



Above: Cabot, which gave its name to the improved class of Empire Boat. Below: Coorong, last of the first order for twenty-eight "C" boats. Shot down off the Timor Sea in January 1942.

(Photos: Short Bros. and Harland)





Champion, first of the improved Empire Boats.

(Photo: Imperial War Museum)

although on this occasion she was flown at something like $1\frac{1}{2}$ tons below her maximum all-up-weight.

Performance figures proved by test flights showed a maximum speed of 200 m.p.h. at 5,500 ft., a maximum cruising speed of 165 m.p.h. using 510 b.h.p. per engine and a minimum flying speed of 73 m.p.h. Rate of climb at sea level using coarse pitch was 950 ft. per min., absolute ceiling was 20,000 ft. and normal still air range, 760 miles. Take-off time at maximum all-up-weight was twenty-one seconds.

The first flight on behalf of Imperial Airways was made on 17th September by Squadron Leader (later Air Commodore) H. G. Brackley, I.A.'s Air Superintendent, and the final proving and delivery flight to Marseilles for use on the Mediterranean route was made on Thursday, 22nd October. Bad weather

delayed the boat's arrival at Marseilles until 25th October.

Caledonia, the second Empire Boat, had made her maiden flight on 15th September and was delivered to Imperial Airways on 4th December 1936. She was the first of the long-range boats and had three fuel tanks in each wing containing 380 gals., 325 gals. and 175 gals. each, plus another two tanks each containing 280 gals. fitted inside the wing torsion box at the top of the fuselage.

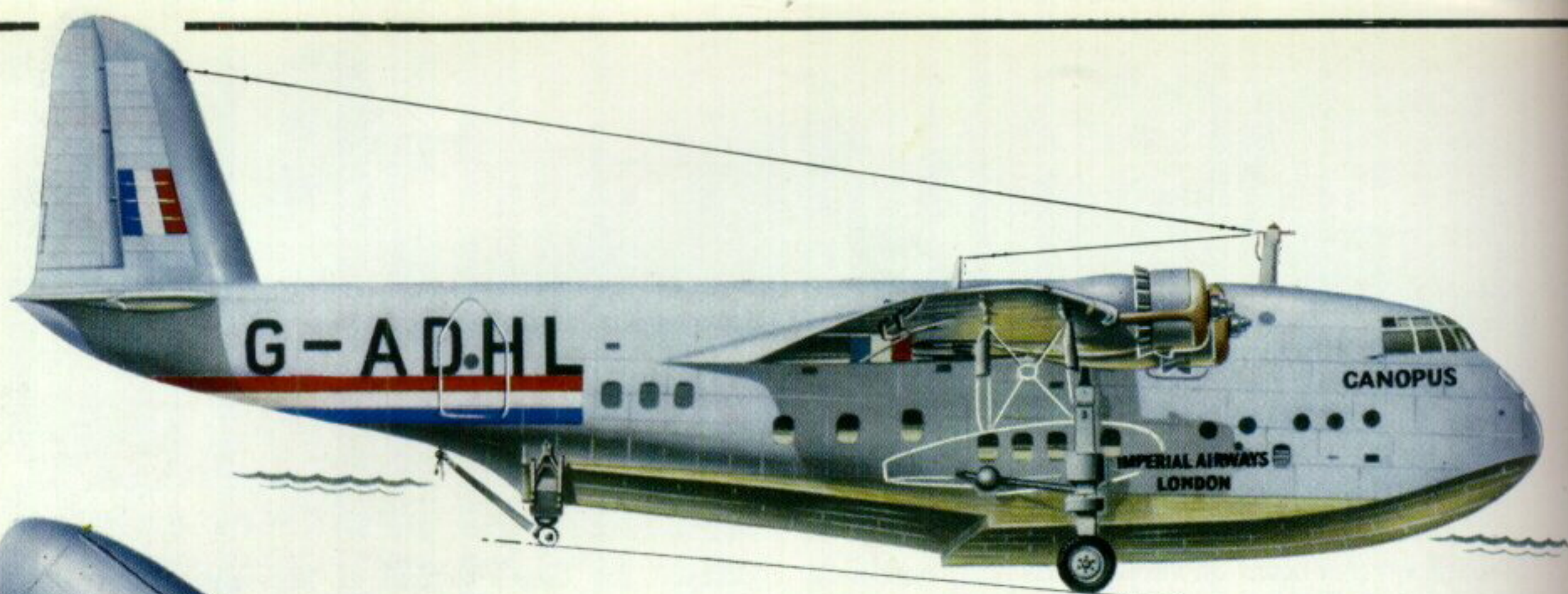
From September the Empire Boats were completed at a rate of rather more than one per month and delivery dates were never more than a few days after the first flight—sometimes an aircraft was handed over to Imperial Airways immediately after its first flight. *Coorong*, the last of the initial order of twenty-eight

(continued on page 10)



Above: Ao-tea-roa, a Cabot class boat used on the New Zealand–Australia run with the registration ZK-AMA. (Photo: Short Bros. and Harland). Below: Cleopatra, last of the Empire "C" boats to be constructed. (Photo: Imperial War Museum)





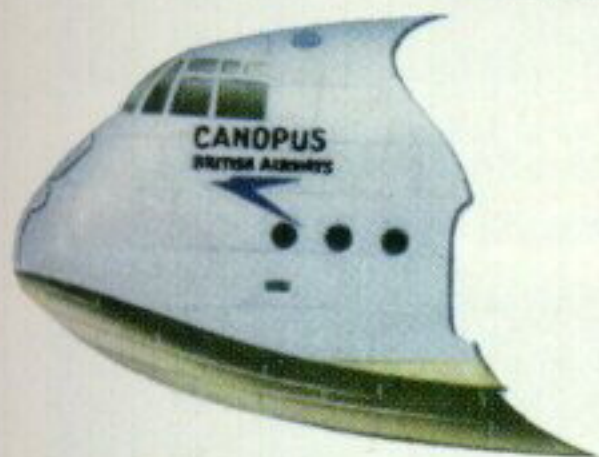
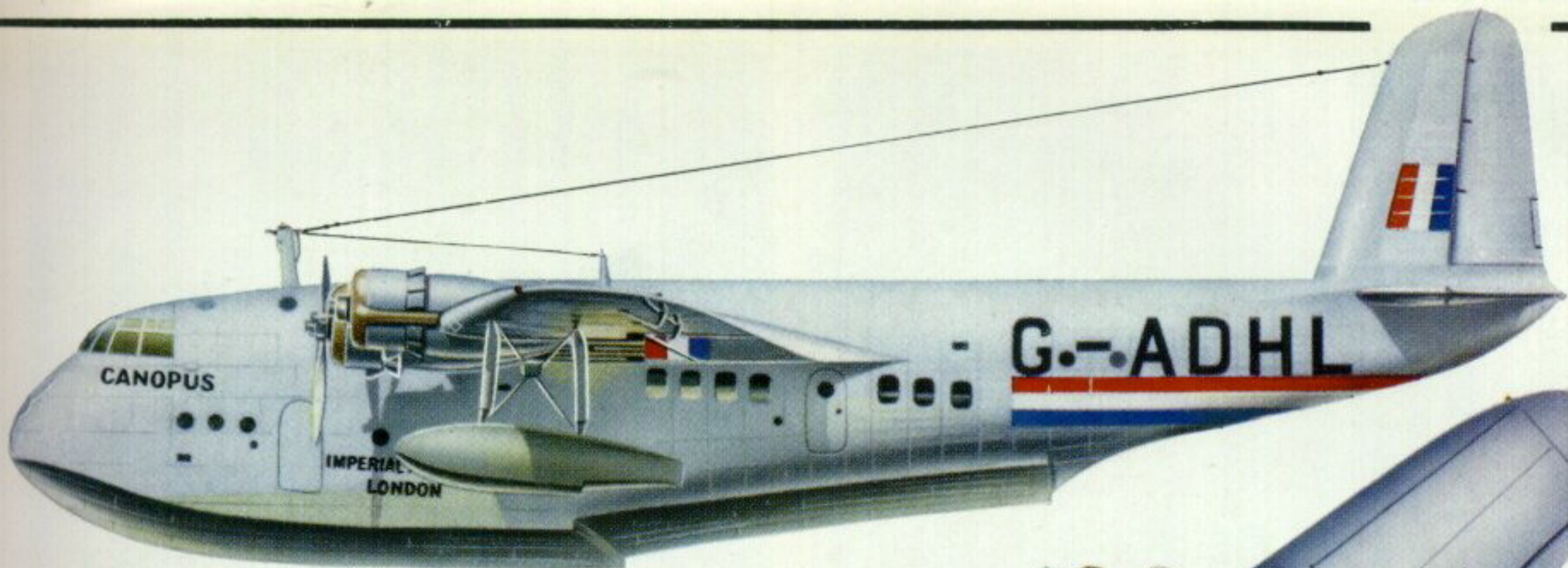
← Beaching gear →



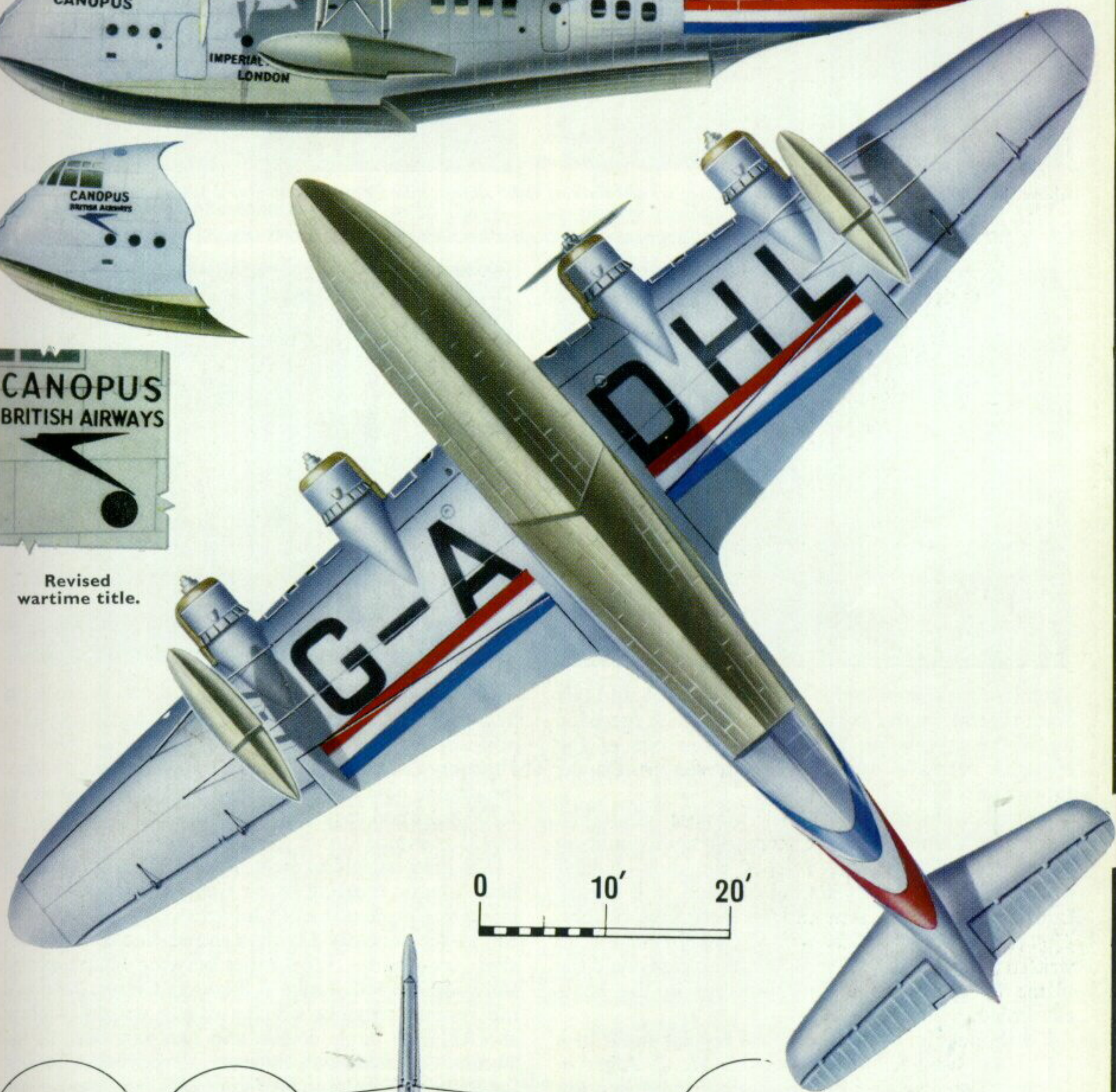
Pre-war airline title.

SHORT S.23 "C" CLASS EMPIRE FLYING BOAT "CANOPUS" (4×920 h.p. Pegasus XC.) of Imperial Airways.

NOTE: The boat is shown carrying national recognition markings which were introduced in the early months of W.W.II. These were subject to some variation among machines of the airlines fleet. The airline title was changed also as indicated by details, registration letters remained as pre-war.

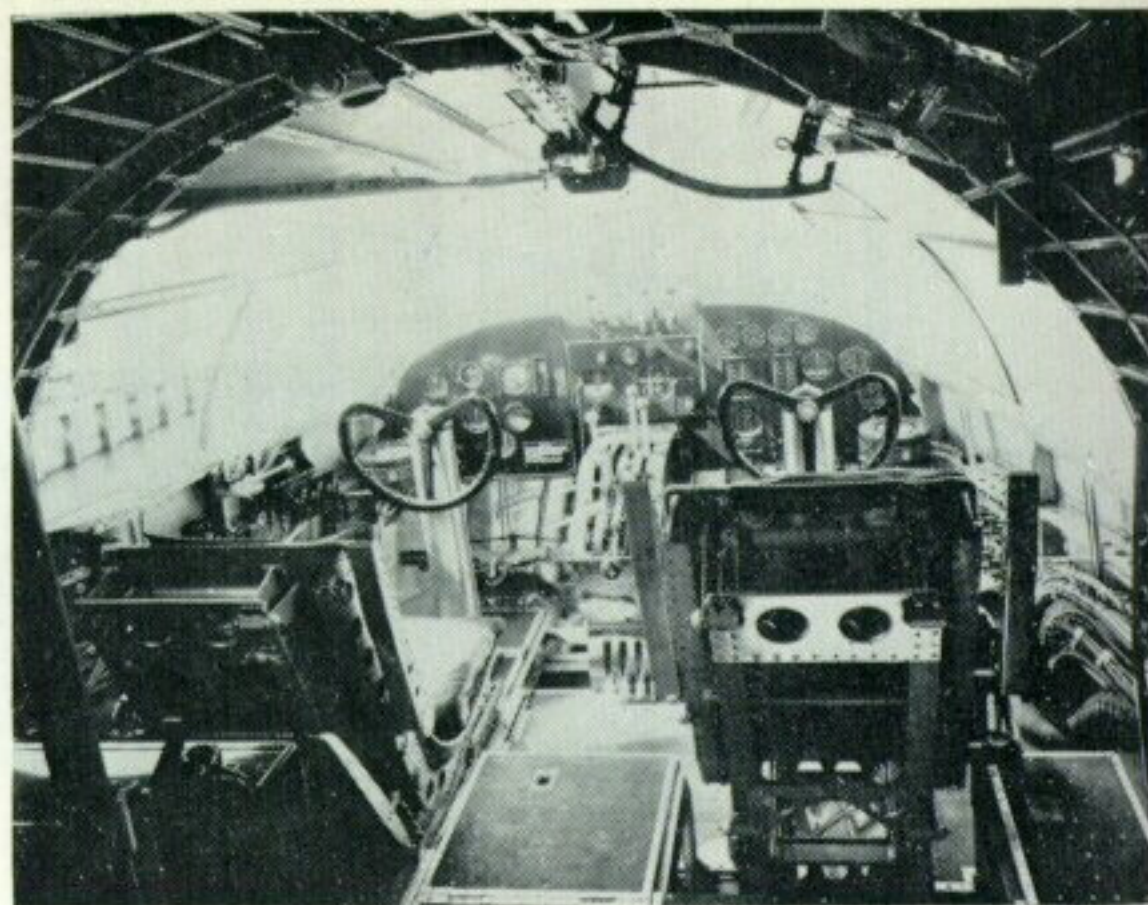
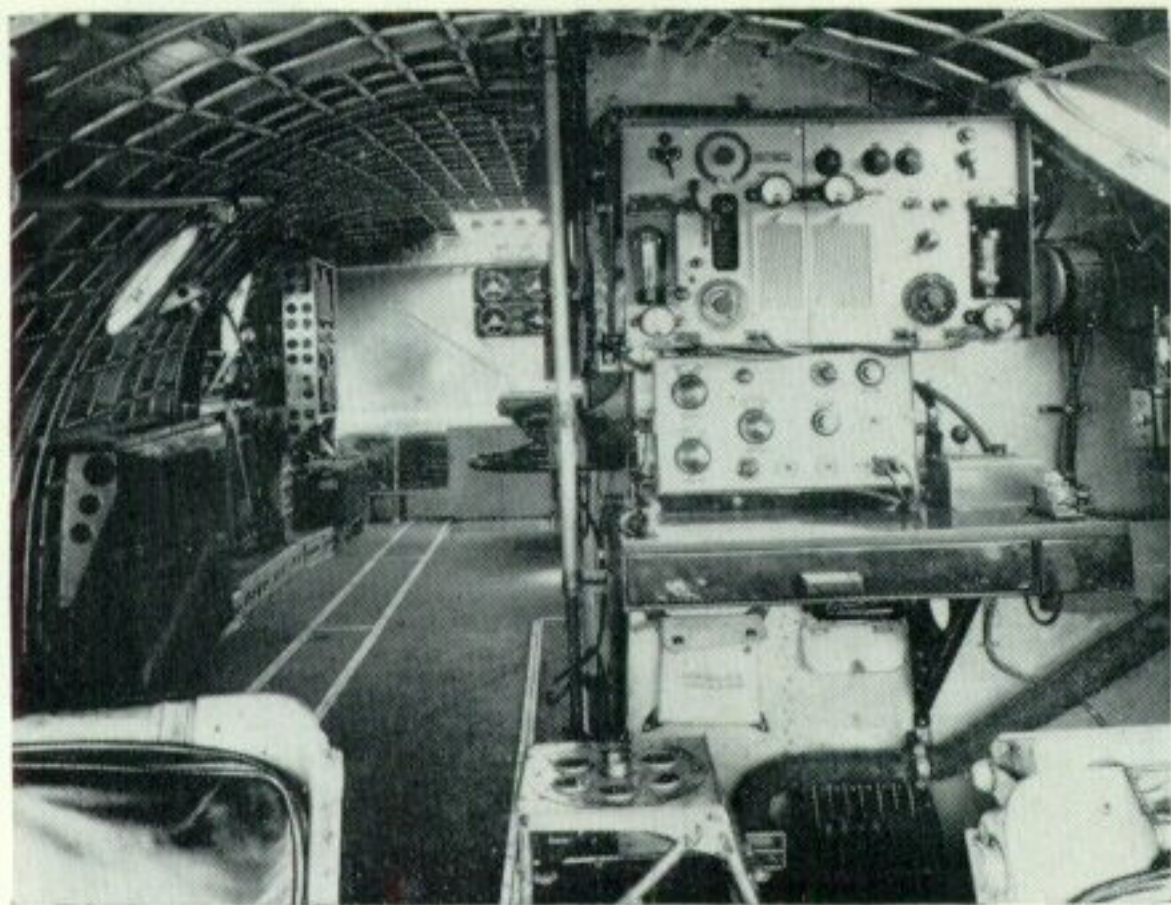


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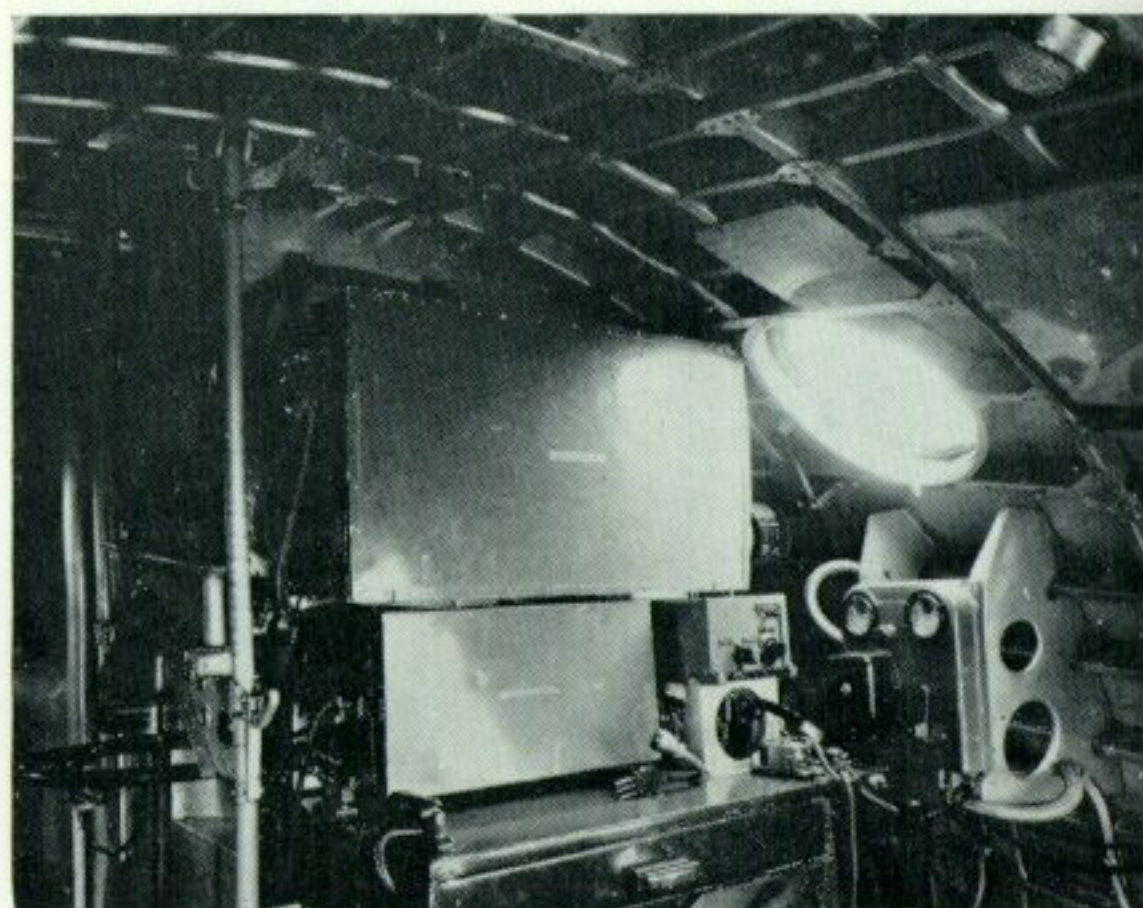
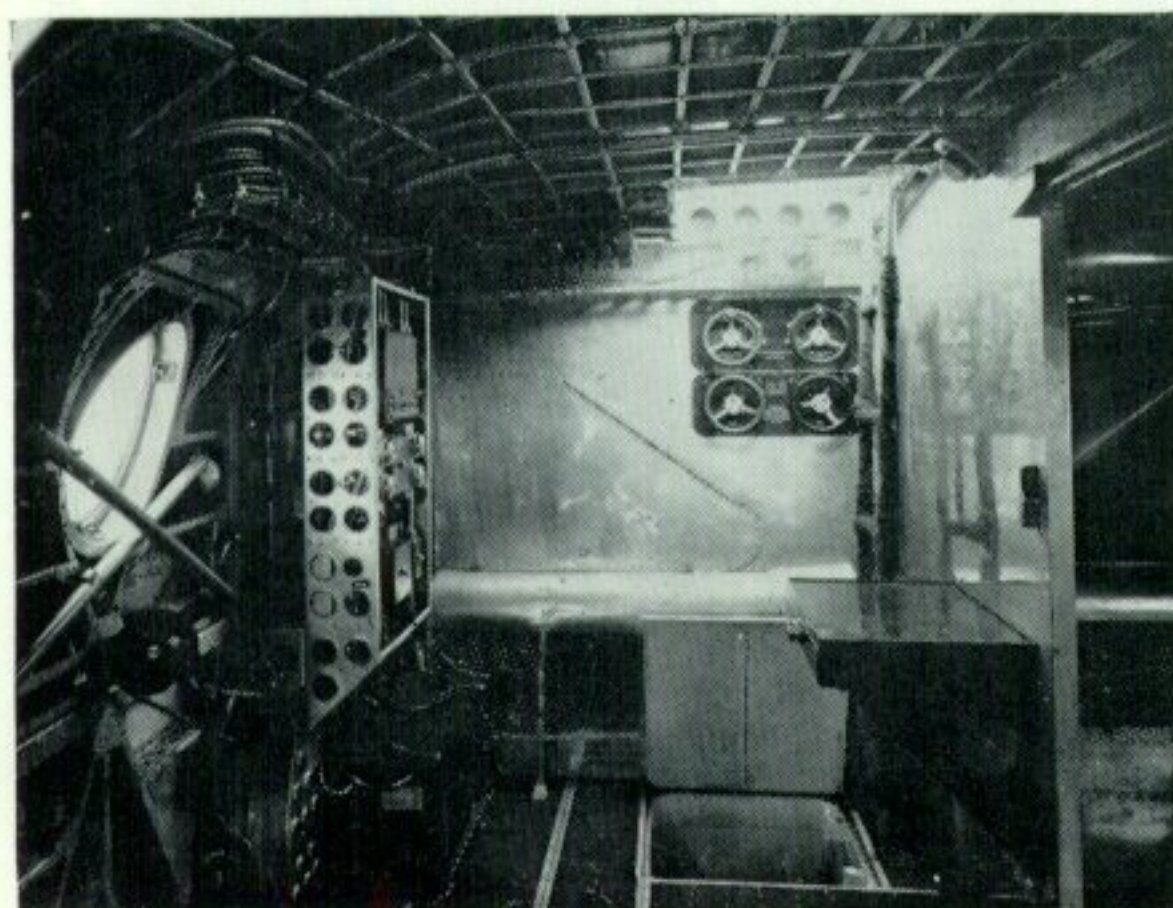
© KEITH BROOMFIELD



Above, left and right: Canopus cockpit looking aft and showing radio station, pilots' controls and greenhouse.

(Photos: Short Bros. and Harland)

Below, left and right: Ship's clerk station on Canopus; radio operator's station on Centaurus. (Photos: Short Bros. and Harland)



aircraft was delivered on 26th February 1938 and this boat, together with *Coogee* and *Corio* which preceded it on the production line, were taken out of the Imperial Airways order and delivered to Qantas Empire Airways.

These S.23 boats served their purpose admirably. They were seldom out of the news and rapidly built-up what must still rank as one of the most highly-developed air networks linking England with Africa, India and Australia. True enough there were crashes, *Cygnus*, *Capricornus*, *Courtier* and *Calpurnia* had been written off by the end of 1938, but in no case could the blame be placed on a fault inherent in the boats concerned.

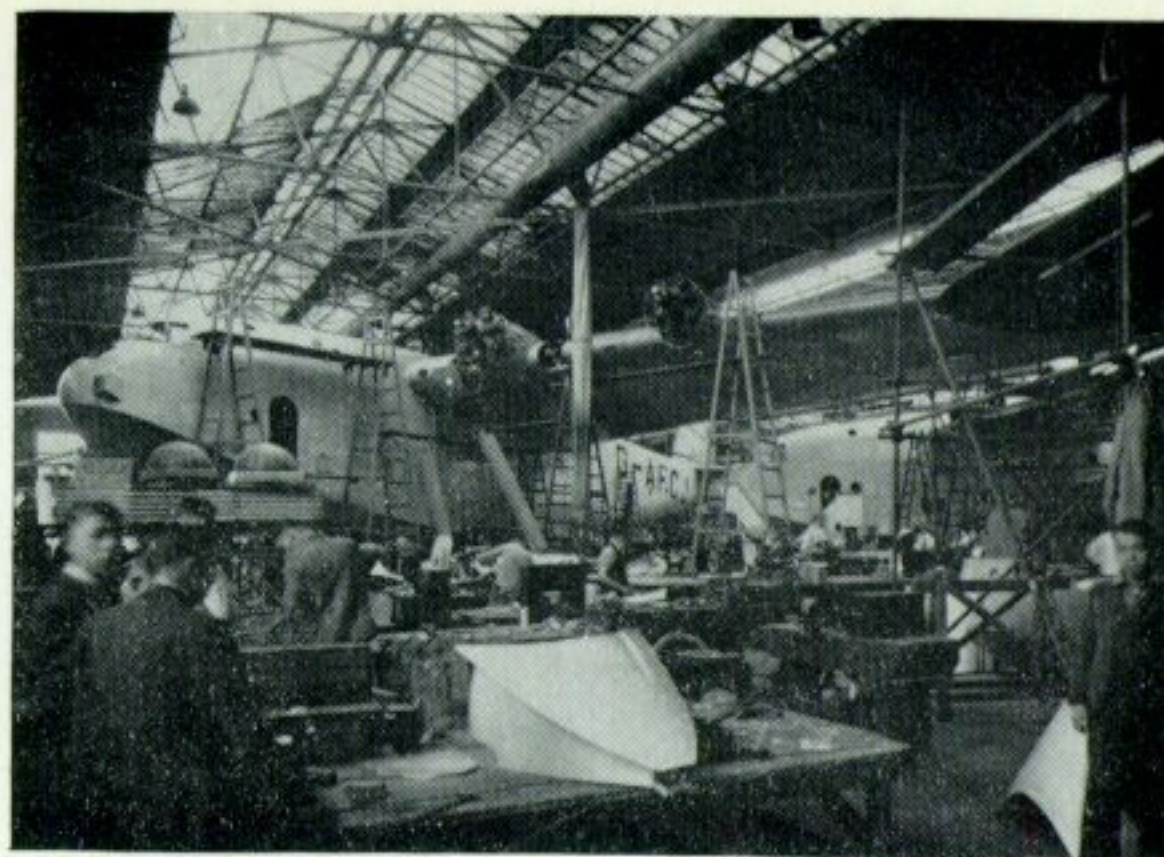
The honour of making the first regular flight in a "C" Class boat fell to Captain H. W. C. Alger in *Castor*. The journey should have started on 6th February 1937 and the boat did, in fact, take off promptly at 11.45 a.m. from Hythe carrying eight passengers and more than a ton of freight and mail, including bullion. Unfortunately the plugs had become oiled up and, after circling Southampton for an hour, *Castor* landed again. Bad weather prevented take-off on the following day and Captain Alger and his passengers finally left for Alexandria on 8th February.

Ten days later the long-range boat *Caledonia*, flown

by Captains W. N. Cumming and A. S. Wilcockson flew the 2,300 miles between Calshot and Alexandria non-stop at an average speed of 170 m.p.h. On 21st February Captain J. G. Powell took *Cambria*, another long-range boat, on a circuit of Britain flight covering 1,300 miles non-stop in 8 hr. 42 min., an average speed of 135 m.p.h.

The greatest achievement of 1937 was, however, the first Atlantic crossing by an Empire Boat which was made by *Caledonia* on 5th July with Captain Wilcockson at the controls. Flying a rhumb-line course *Caledonia* covered the 1,993 miles between Shannon and Botwood in 15 hr. 3 min. A Sikorsky Clipper III made the reverse crossing simultaneously on the slightly shorter great circle course and her time was 12 hr. 34 min. *Caledonia* was, however, to regain the honour for Britain. Simultaneous return crossings were made on 22nd July and *Caledonia's* time for the West-East journey was 12 hr. 7 min. against the Clipper III's 16 hr. 24 min. for the East-West crossing. After all allowances for wind differences and other variables, the Empire Boat was fastest overall.

Proof that Imperial Airways thought their original conception of the Empire Boat was correct and that Shorts had provided an excellent realisation came at the end of 1937 when the airline ordered another



Left: "G" Class boats under construction at Rochester. Right: Grenadier and Grenville, names which were later changed to Golden Fleece and Golden Horn respectively. (Photos: Short Bros. and Harland)

eleven aircraft which brought the total up to thirty-nine and the largest single order for a British civil aircraft ever placed at that time. The first three boats of this new order were to complete the need for six for Qantas Empire Airways and *Carpenteria*, *Coolangatta* and *Cooee* were of the normal S.23 Class. The rest were built under the designation S.30 and, except for one boat, were re-engined with the Bristol Perseus XIIc which developed 890 h.p. against the 920 h.p. of the Pegasus used in the S.23 boats. Despite this drop in power, some strengthening in the fuselage and the use of heavier gauge sheeting on the fuselage and wings, the new boats had the same performance as those in the S.23 Class. These apparently magical advantages with less power were obtained because the new engines fitted into nacelles three inches less in diameter than those demanded by the Pegasus to give a significant decrease in drag. In addition these boats were cleared to take off at 46,000 lb. all-up-weight or to take on fuel up to 53,000 lb. all-up-weight if refuelled in the air—and these models were fitted with aerial refuelling equipment. Wing loading was increased from 30 lb. to 31 lb. per sq. in.

Champion was the first S.30 boat to be laid down but *Cabot*, the aircraft which retained Pegasus engines, was the first to be completed as it was not immediately fitted out but was used by Shorts for tests. Early in December 1938 *Cabot* made the first successful take-off at 46,000 lb. all-up-weight—a trouble-free flight by Lankester Parker from Rochester with a take-off time of only 21 secs. G-AFCY, G-AFCZ and G-AFDA, the last three boats of this additional order, were re-registered ZK-AMA, ZK-AMB and ZK-AMC and named *Ao-tea-roa*, *Australia* and *Awarua* respectively

for use by Tasman Airways on the Sydney–Auckland route. *Australia* was placed back on the British register when BOAC was formed in April 1940 and given her original name, *Clare*.

One other S.30 boat was ordered during 1939 and G-AFKZ *Cathay* was delivered to Imperial Airways during its last days in March 1940. Another three boats ordered by I.A. in 1939 were built to the same basic construction as the others but were powered by Pegasus XI engines and cleared only up to 40,500 lb. all-up-weight. They were, therefore, virtually the same as the original S.23 boats but were built as the S.33 Class. Only two boats were completed and *Clifton* and *Cleopatra*, as they were named, were delivered direct to BOAC.

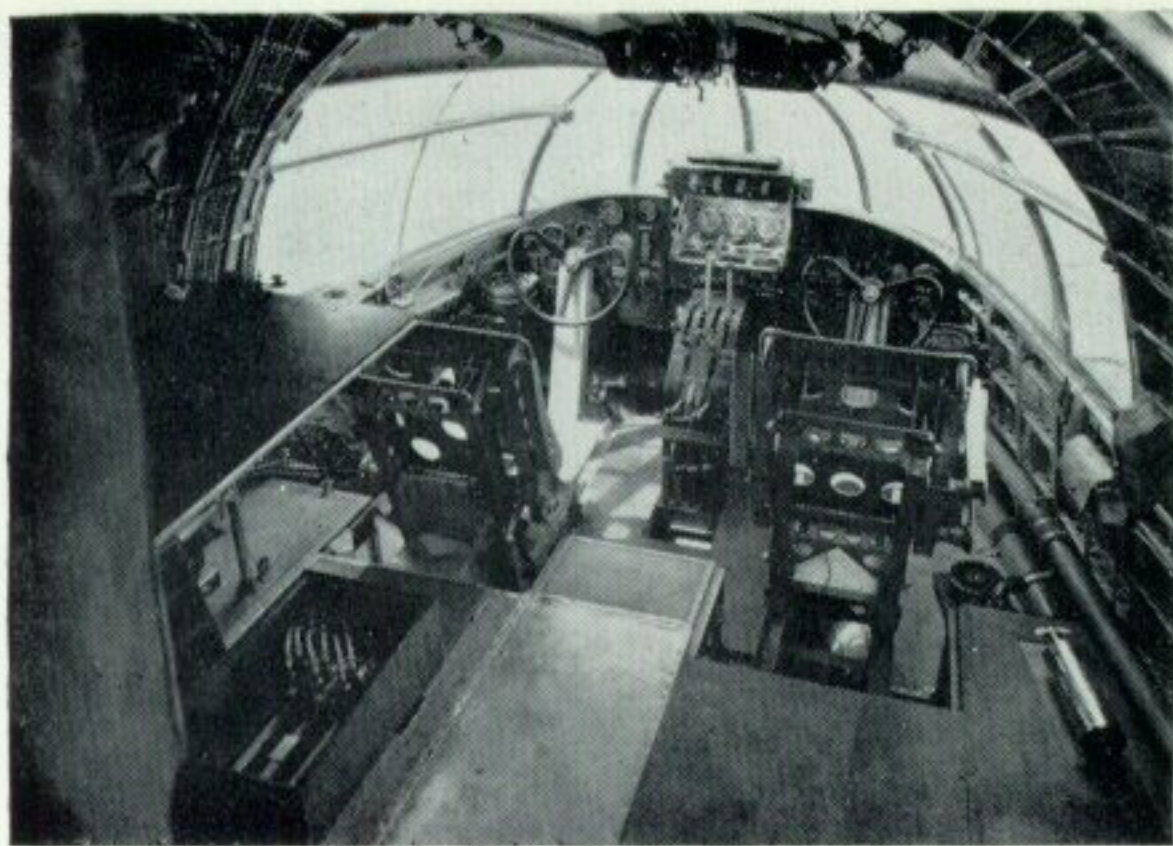
PICK-A-BACK EXPERIMENT

No mention of the Empire Boats would be complete without including what is still one of the most remarkable aerial experiments of all time. Major R. H. Mayo, who had played no small part in the conception of the Empire Boats, had long been of the opinion that both range and payload could be increased tremendously if an aircraft did not have to heed the demands of take-off and climb. Cobham had, of course, been pursuing the same line of thought with his aerial refuelling experiments but Mayo's thoughts were more revolutionary. He reasoned that a large aircraft could be designed to carry a smaller machine well on its way and then release it to fly alone to its destination, already at cruising height and with full tanks. This, coupled with the fact that the smaller aircraft could also start its journey at an all-up-weight unthinkable if it had to take-off by itself, meant that a compara-

Golden Hind which had a Sunderland-type planing bottom fitted.

(Photo: Short Bros. and Harland)





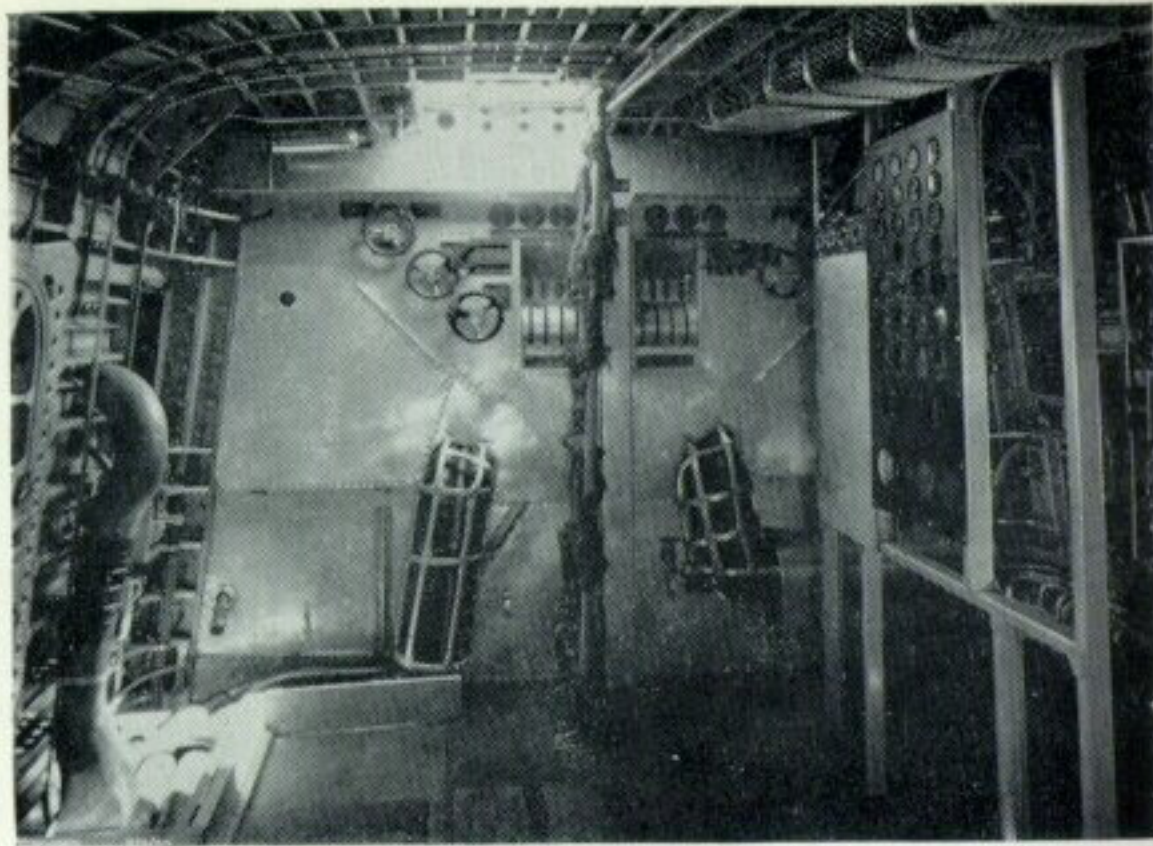
Left and right: *Flight deck and ship's clerk bay.*

tively small aircraft could carry a very heavy load, or a medium load a great distance. Mayo's reasoning impressed both Imperial Airways and the Air Ministry and the latter placed an order with Shorts. Design work on the two aircraft needed was started before that on the S.23 boats but *Maia*, the larger of the two, was closely related to the Empire Boats. The most obvious difference was the superstructure to carry the upper component but, compared with normal S.23 boats, *Maia* was wider in the fuselage, had a more pronounced flare at the chines to give added water stability, more fin and rudder area and 250 sq. ft. more wing area. The outboard Pegasus engines were placed farther out to provide greater clearance for the floats of the upper aircraft.

Mercury, the upper component, was a four-engined, high-wing monoplane which also had an obvious affinity with the Scion Senior. Power was provided by Napier Rapier V engines each developing a maximum of 340 h.p. at 13,000 ft. Span was 73 ft. and all-up-weight 12,500 lb. when flying alone but increasing to 20,500 lb. when air-launched from *Maia*. These weights were later increased to 14,000 lb. and 20,800 lb. respectively when the engines were changed to Rapier VIs developing a maximum of 395 h.p.

Tests of the two aircraft continued individually during the latter part of 1937 with Lankester Parker being responsible for *Maia* and Harold Piper, another Shorts' test pilot, flying *Mercury*. Neither aircraft displayed any alarming symptoms although there was trouble with the telephone communication between the two aircraft when they were coupled and this was to lead to a slight delay in the crucial test for combined flying and release.

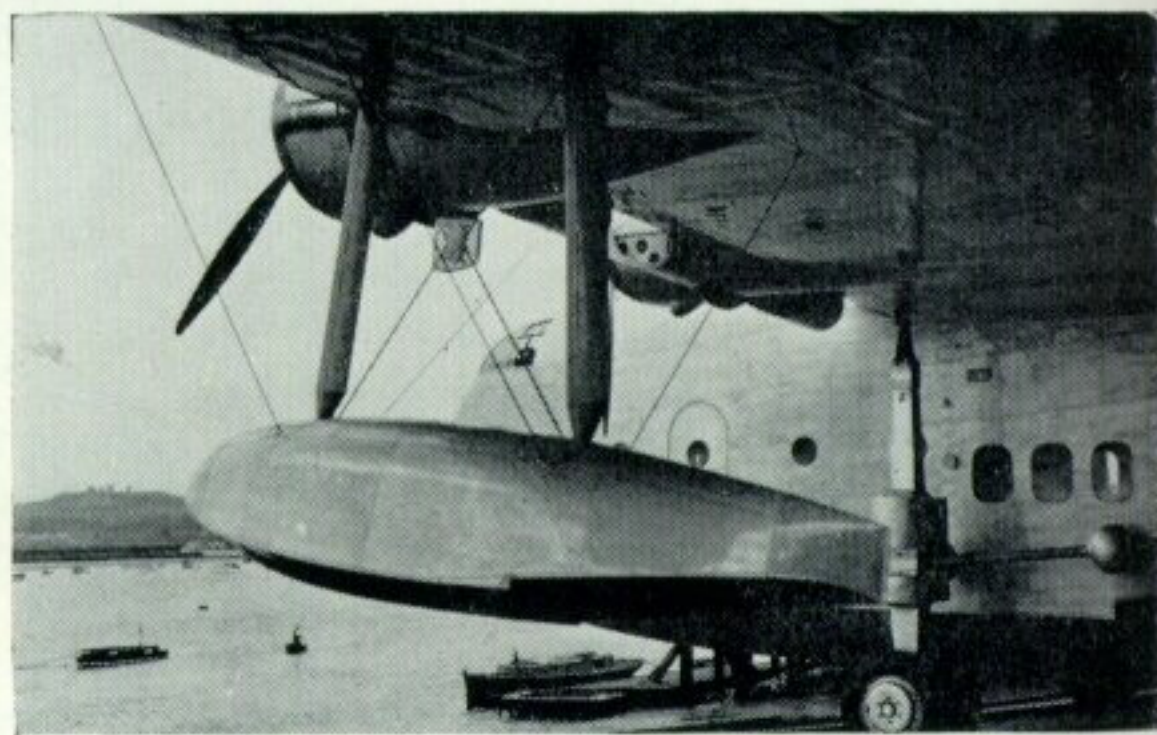
All eight engines were used during combined flight but the controls of *Mercury* were locked. The aerofoil designs of the two aircraft were such that *Mercury's* wings were carrying the major part of the air load at the speed and height chosen for separation. Safety locks prevented separation until this speed and height were reached and both pilots had an unlocking handle, both of which had to be pulled to cause release. The first test of this seemingly foolproof theory came on 6th February 1938. The first separation was carried out well over the Thames Estuary and away from the prying eyes of the Press, but there was no cause for



(Photos: Short Bros. and Harland)

worry. *Mercury* leapt upwards as planned and *Maia*, deprived of the lift of her smaller companion, went into a shallow dive.

The first attempt on the Atlantic came on 21st July 1938. Captain Wilcockson was at the controls of *Maia* and Captain D. C. T. Bennett, later of Pathfinder fame, piloted *Mercury* when the composite took off from Foynes on the west coast of Ireland. *Mercury*, which carried 600 lb. of freight and mail, arrived at Boucherville, Montreal, 20 hr. 20 min. later, having flown the 2,860-mile course at an average ground speed of 141 m.p.h. Average air speed was 177 m.p.h. Later that year, on 6th October, the same technique was used for *Mercury*, again flown by Bennett, to fly from Dundee, Scotland, to Orange River, South Africa, a distance of 6,045 miles, in 42 hr. 5 min.



Above and below: *Forward and rear beaching gear of Canopus.*
(Photos: Short Bros. and Harland)



So successful were the experiments with this pair that there was little doubt that they would have continued with landplane versions, but the war intervened. The scheme was to be resurrected, however, when a means was sought to provide aerial protection for Atlantic convoys. A Liberator/Hurricane composite was proposed and work was well-advanced at Hawkers but discontinued when other means of convoy protection became available.

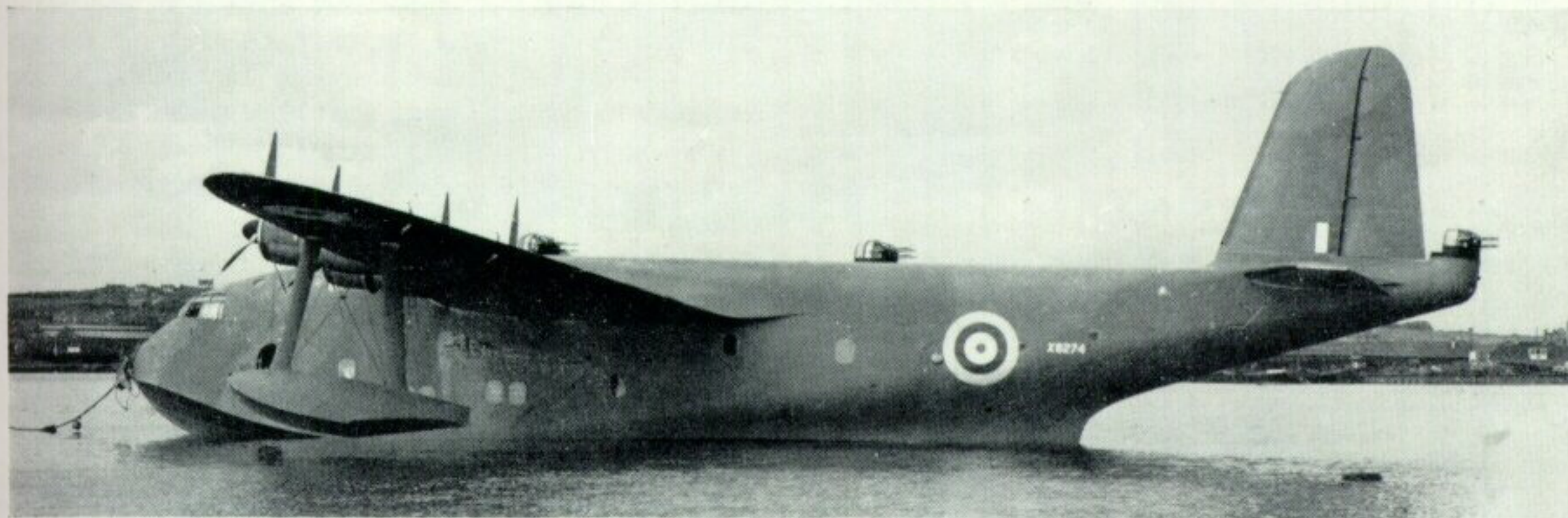
BIGGER STILL

There was to be one other development of the Empire Boats and that was the S.26 or "G" Class. Three of these were ordered by Imperial Airways. Basically similar to the "C" Class but bigger in every way, they were designed to an all-up-weight of 73,500 lb., had a span of 134 ft. 4 in., and were powered by four Bristol Hercules IV engines. Maximum speed was 209 m.p.h. and cruising speed 175 m.p.h. at 5,000 ft. Outwardly they looked like normal "C"-Class boats but had a Sunderland-type planing bottom with its sharp, V-shaped step at the aft end, and a cleaner sweep to the lines at the forward end of the fuselage. Imperial Airways planned to use these boats on the North Atlantic route but war intervened. *Golden Hind* was the first of these boats and the other two were originally named *Grenadier* and *Grenville*, but these were re-christened before launching as *Golden Fleece* and *Golden Horn*. All three were impressed into R.A.F.

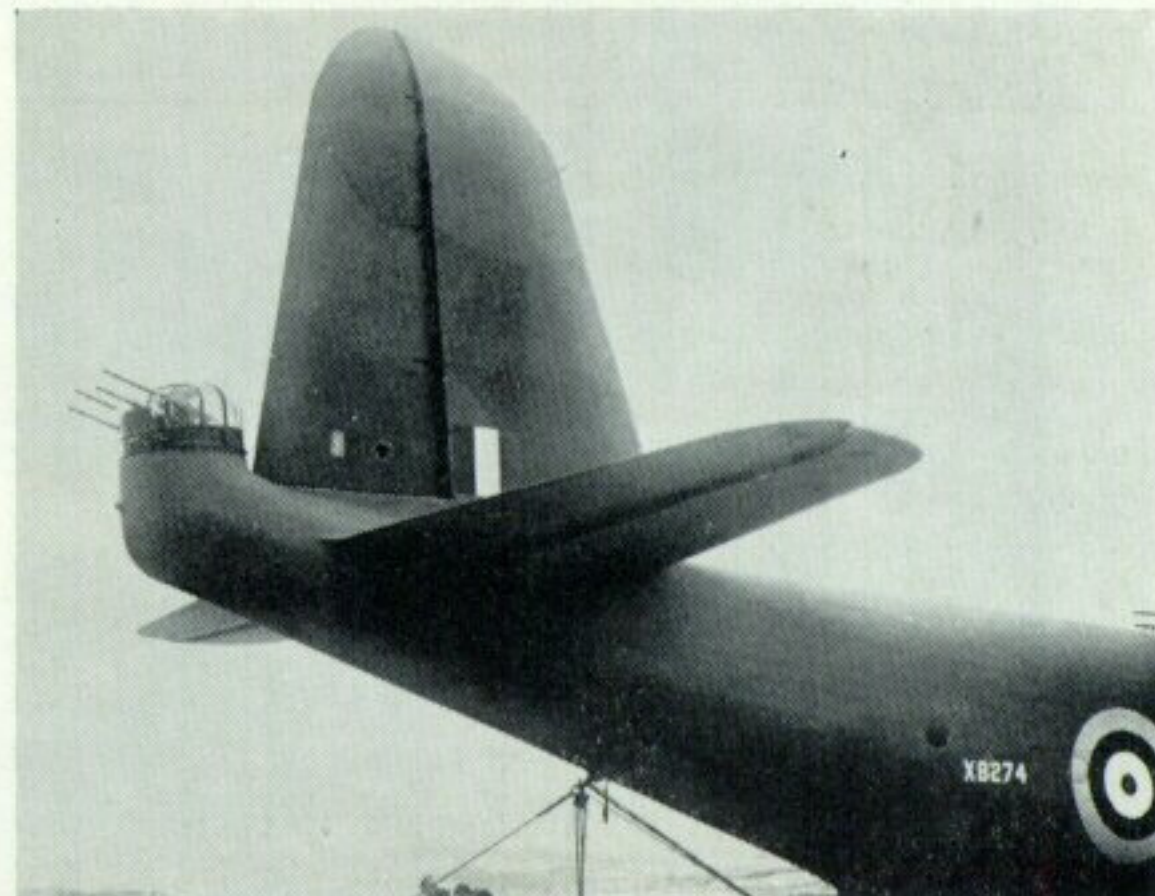
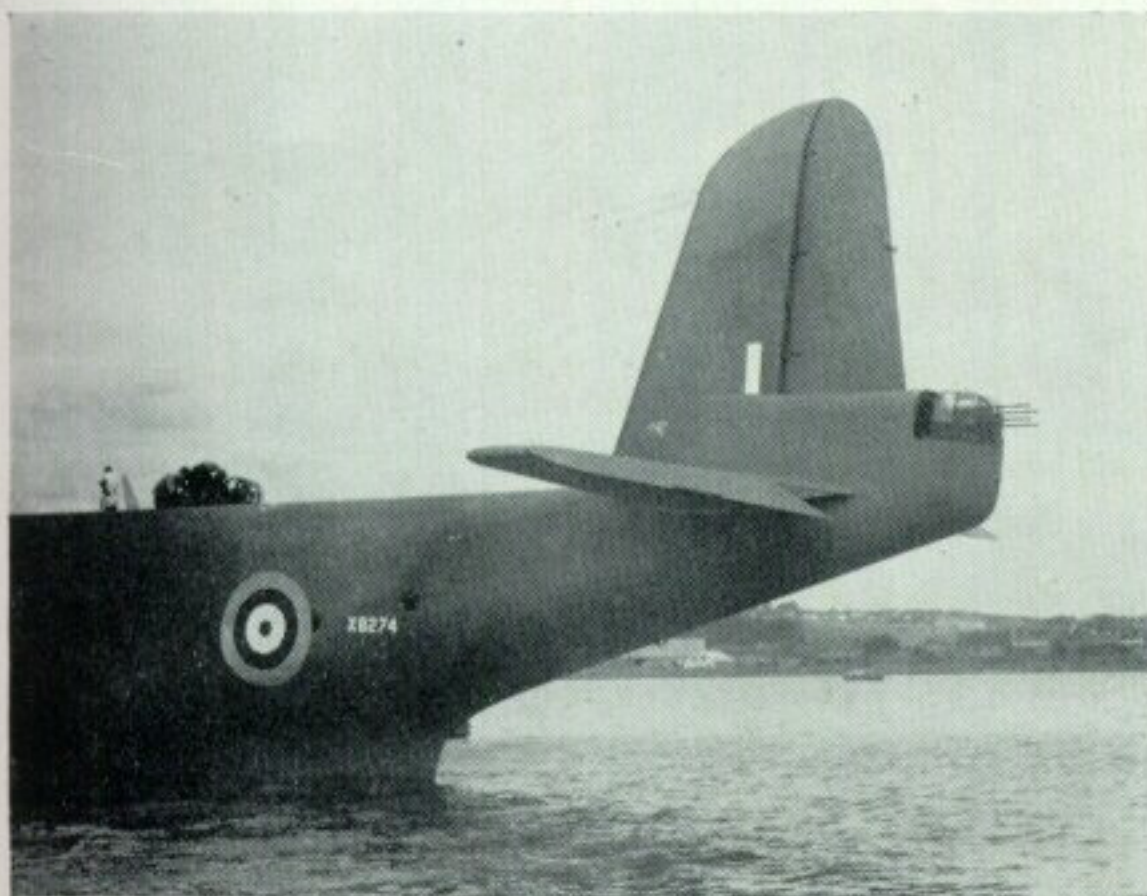


Cabot, first "C" Class boat to take-off at an a.u.w. of 46,000 lb. (Photo: Short Bros. and Harland)

service and fitted with turrets before being used as V.I.P. transports. Neither *Golden Fleece* nor *Golden Horn* survived the war but *Golden Hind* soldiered on and was probably the longest lived of the Empire Boats. After the war she was used on routes to Australia and Africa by the Ministry of Aviation and sold to BOAC in 1948 when her Certificate of Airworthiness expired. The airline seemed in no hurry to put her into service and several other interested parties announced plans for getting her flying again, but nothing came of these. She was eventually



Golden Fleece as a wartime V.I.P. transport. Right-hand illustration below shows the original turret before fairing (left) was fitted. (Photos: Short Bros. and Harland)



Mercury and Maia, the "C" Class composite.



damaged during a storm in 1954 and broken up soon after.

Many other Empire Boats played their part in the war, mainly as transports with BOAC or QEA. Two of them were returned to Short Brothers and Harland at Belfast at the beginning of 1941 and modified to incorporate gun turrets and an array of ASV aerials on the top and sides of the fuselage. *Clio* arrived at Belfast having flown 4,382 hr. 55 min. in her civilian rôle and was re-launched on 12th March 1941 as AX659. *Cordelia* flew 4,261 hours with airlines and became AX660 when she was re-launched at Belfast on 16th April.

S.23 CLASS

Dimensions: Span, 114 ft.; length, 88 ft.; height, 31 ft. 9½ in.; wing area, 1,500 sq. ft.

Weights: Empty, 24,000 lb.; loaded, 40,500 lb.

Engines: Four Bristol Pegasus Xc each rated at 740 b.h.p. at 3,500 ft.

Performance: Maximum speed 200 m.p.h. at 5,500 ft.; cruising speed at 510 b.h.p. per engine, 165 m.p.h. Normal still air range, 760 miles.

S.30 CLASS

Dimensions: As for S.23 Class.

Weights: Empty, 27,825 lb.; loaded, 46,000 lb.

Engines: Four Bristol Perseus XIIc rated at 700 b.h.p. at 3,500 ft.

Performance: Speeds as for S.23 Class. Normal still air range, 1,870 miles.

"G" CLASS

Dimensions: Span, 134 ft. 4 in.; length, 103 ft. 2 in.; height, 37 ft. 7 in.; wing area, 2,160 sq. ft.

Weights: Empty, 37,705 lb.; loaded, 73,500 lb.

Engines: Four Bristol Hercules IV rated at 1,030 h.p. at 3,000 ft.

Performance: Maximum speed, 209 m.p.h. at 4,500 ft.; cruising speed, 177 m.p.h. at 5,000 ft. Cruising range against 40 m.p.h. headwind, 2,500 miles.

MERCURY

Dimensions: Span, 73 ft.; length, 50 ft. 11½ in.; height, 20 ft. 3 in.; wing area, 611 sq. ft.

Weights: Empty, 10,000 lb.; loaded (for solo take-off), 12,500 lb.; loaded for air launch, 20,500 lb.

Engines: Four Napier Rapier V rated at 1,020 h.p. for maximum continuous cruise at 10,000 ft.

Performance: Maximum speed, 207 m.p.h. at 13,000 ft.; cruising speed, 180 m.p.h. at 10,000 ft. Still air range with solo take-off, 350 miles; still air range with air launch, 3,800 miles.

MAIA

Dimensions: Span, 114 ft.; length, 84 ft. 10¾ in.; height, 32 ft. 7½ in.; wing area, 1,750 sq. ft.

Weights: Empty, 2,400 lb.; loaded (solo) 38,000 lb.

Engines: As for S.23 Class.

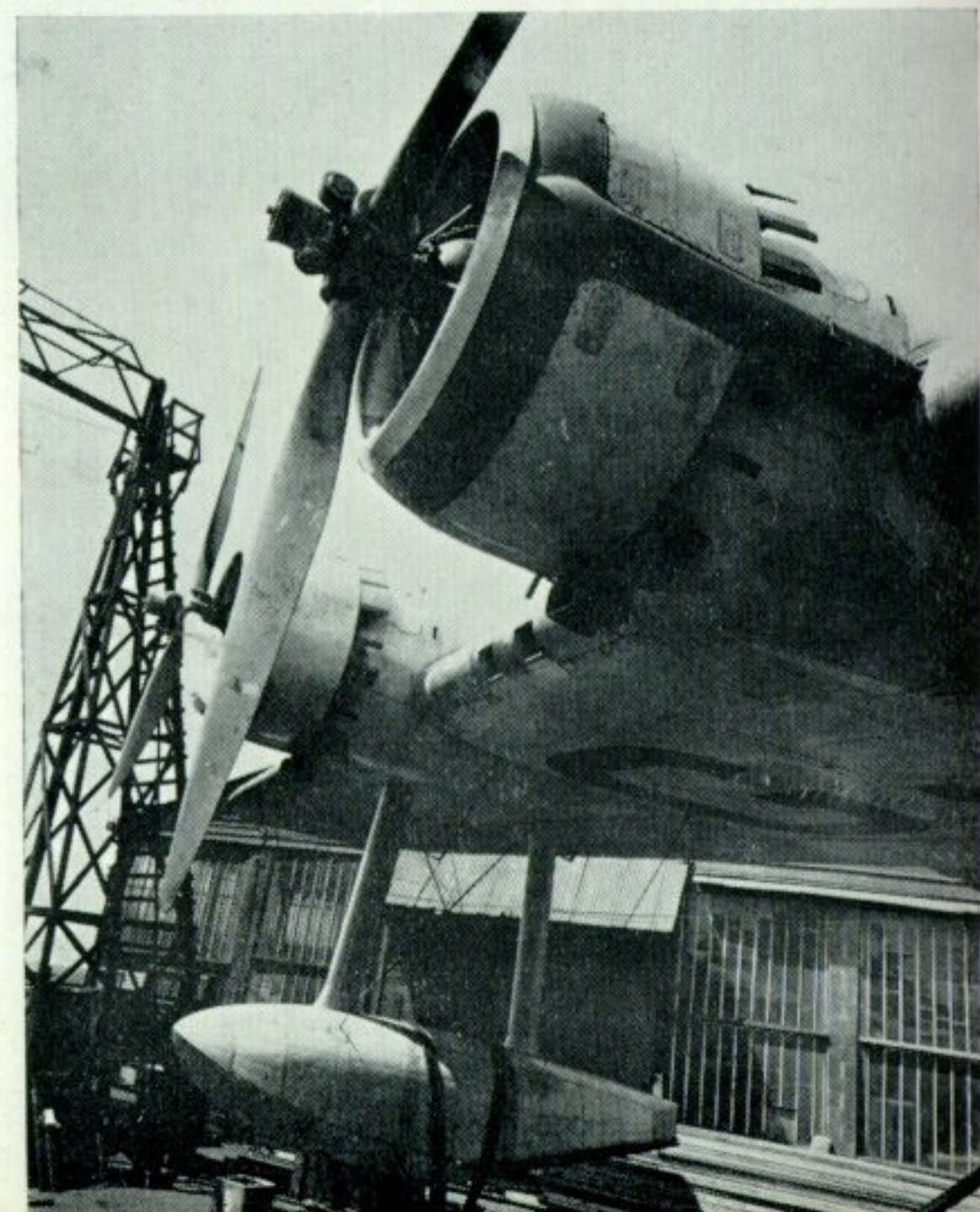
Performance: Maximum speed, 200 m.p.h.; cruising speed, 165 m.p.h. at 5,000 ft. Still air range at cruising speed, 850 miles.



Unfortunately for the flying boat the war turned virtually the entire British aircraft industry towards landplane development and by 1945 the flying boat had been left behind in performance. Nevertheless, the Sandringhams and Hythes which provided flying boat services with BOAC and other airlines in the years immediately following the war owed their design directly to the Empire Boats and, in fact, their influence can be seen in every flying boat built since. This is no mean achievement for an aircraft which was designed, built and in service within eighteen months of an order being placed.

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Perseus engine of Cabot. (Photo: Short Bros. and Harland)



"C" Class Flying Boat AO-TEA-ROA, Imperial Airways.



"C" Class Flying Boat Clio, Imperial Airways.



"C" Class Flying Boat
Coorong, Qantas Empire
Airways, Brisbane.



"C" Class Flying Boat
Champion.



"G" Class Flying Boat Golden Hind, Imperial Airways.



"C" Class
Flying Boat
Centurion,
Imperial
Airways.



"C" Class Flying Boat
Clio as modified
during W.W.II.



SHORT "C" CLASS FLYING BOATS

Serial	Registration	First Flight	Delivery	Name and Remarks
S.795	G-ADHL	4.7.36	22.10.36	<i>Canopus</i> . Passed to BOAC, April 1940.
S.796	G-ADHJ	2.9.37*	March, 1938	<i>Mercury</i> . Built for Air Ministry. Passed to BOAC April 1940. Reduced to produce at Rochester 21.8.41.
S.797	G-ADHK	11.8.37	March, 1938	<i>Maia</i> . Built for Air Ministry. Passed to BOAC April 1940. Destroyed in air raid 11.5.42.
S.804	G-ADHM	15.9.36	4.12.36	<i>Caledonia</i> . First long-range boat with extra tanks. Made first Atlantic crossing by Empire Boat. Passed to BOAC.
S.811	G-ADUT	18.11.36	7.12.36	<i>Centaurus</i> . Bermuda Boat. Surveyed Far East route to Australia and New Zealand. Commandeered by Australian Government, September 1939.
S.812	G-ADUU	30.11.36	10.12.36	<i>Cavalier</i> . Bermuda Boat. Dismantled and shipped to Bermuda. Made first New York-Bermuda run. Crashed in Atlantic 21.1.39.
S.813	G-ADUV	14.1.37	21.1.37	<i>Cambria</i> . Second long-range boat. Made circuit of Britain flight. Used by Cobham in air refuelling experiments. Passed to BOAC.
S.814	G-ADUW	22.12.36	2.1.37	<i>Castor</i> . Made first regular Southampton-Alexandria flight 6.2.37. Passed to BOAC.
S.815	G-ADUX	25.1.37	1.2.37	<i>Cassiopeia</i> . Passed to BOAC. Crashed at Sabang 22.12.41.
S.816	G-ADUY	15.2.37	16.2.37	<i>Capella</i> . Crashed March 1939.
S.817	G-ADUZ	3.3.37	3.3.37	<i>Cygnus</i> . Crashed at Brindisi 5.12.37.
S.818	G-ADVA	15.3.37	16.3.37	<i>Capricornus</i> . Crashed near Macon, France, 24.3.37.
S.819	G-ADVB	5.4.37	8.4.37	<i>Corsair</i> . Passed to BOAC.
S.820	G-ADVC	22.4.37	23.4.37	<i>Courtier</i> . Crashed near Athens 1.10.37.
S.821	G-ADVD	5.5.37	6.5.37	<i>Challenger</i> . Crashed on landing at Mozambique 1.5.39.
S.822	G-ADVE	28.5.37	29.5.37	<i>Centurion</i> . Crashed on Hooghly River, India, 12.6.39.
S.838	G-AETV	17.6.37	17.6.37	<i>Coriolanus</i> . Passed to BOAC.
S.839	G-AETW	27.6.37	30.6.37	<i>Calpurnia</i> . Crashed on landing on Lake Habbaniyah 27.11.38.
S.840	G-AETX	15.7.37	17.7.37	<i>Ceres</i> . Passed to BOAC.
S.841	G-AETY	28.7.37	30.7.37	<i>Clio</i> . Passed to BOAC. Impressed as AX659, served with 201 Squadron, crashed 22.8.41.
S.842	G-AETZ	13.8.37	16.8.37	<i>Circe</i> . Passed to BOAC. Shot down off Tjilaejap 28.2.42.
S.843	G-AEUA	27.8.37	27.8.37	<i>Calypso</i> . Passed to BOAC.
S.844	G-AEUB	11.9.37	13.9.37	<i>Camilla</i> . Passed to BOAC.
S.845	G-AEUC	24.9.37	29.9.37	<i>Corinna</i> . Passed to BOAC. Destroyed in air raid at Darwin 3.3.42.
S.846	G-AEUD	8.10.37	9.10.37	<i>Cordelia</i> . Passed to BOAC. Impressed as AX660, took part in depth charge trials with 119 Squadron. Released to BOAC 19.9.41. Broken up at Hythe 6.3.47.
S.847	G-AEUE	21.10.37	23.10.37	<i>Cameronian</i> . Passed to BOAC.
S.848	G-AEUF	5.11.37	6.11.37	<i>Corinthian</i> . Passed to BOAC. Crashed at Darwin, March 1942.
S.849	G-AEUG	1.1.38	3.1.38	<i>Coogee</i> . Used by QEA under registration VH-ABA.
S.850	G-AEUH	9.2.38	10.2.38	<i>Corio</i> . Used by QEA under registration VH-ABD. Commandeered by Australian Government, September 1939. Shot down by Jap fighter off Koepang 10.1.42.
S.851	G-AEVI	25.2.38	26.2.38	<i>Coorong</i> . Used by QEA as VH-ABE. Passed to BOAC. Shot down off Timor 30.1.42. Last of initial order of 28 aircraft by Imperial Airways.
S.876	G-AFBJ	25.11.37	3.12.37	<i>Carpentaria</i> . Passed to QEA as VH-ABA.
S.877	G-AFBK	17.12.37	18.12.37	<i>Coolangatta</i> . Passed to QEA as VH-ABB.
S.878	VH-ABF	28.3.38	31.3.38	<i>Coote</i> . Used by QEA.
S.879	G-AFCT	22.10.38	28.10.38	<i>Champion</i> . First S.30 boat at increased all-up-weight but with Pegasus engines.
S.880	G-AFCU	8.12.38	27.7.39	<i>Cabot</i> . S.30 boat with Perseus engines. Made first take-off at 46,000 lb., December 1938. Passed to R.A.F., September 1939 as V3137. Destroyed at Bodo 5.5.40.
S.881	G-AFCV	14.12.38	13.7.39	<i>Caribou</i> . Long-range boat used for in-flight refuelling experiments. Passed to R.A.F. as V3138. Destroyed in air raid at Bodo 6.5.40.
S.882	G-AFCW	24.3.39	24.3.39	<i>Connemara</i> . Long-range boat. Burned out during refuelling at Hythe 19.6.39.
S.883	G-AFCX	27.3.39	27.3.39	<i>Clyde</i> . Long-range boat. Passed to BOAC. Wrecked in gale at Lisbon 14.2.41.
S.884	G-AFCY	20.4.39	21.4.39	<i>Ao-tea-roa</i> . Medium-range boat used on Sydney-Auckland route as ZK-AMA.
S.885	G-AFCZ	5.4.39	6.4.39	<i>Australia</i> . Medium-range boat used on Sydney-Auckland route as ZK-AMB. Passed to BOAC and renamed <i>Clare</i> . Lost off Bathurst 14.9.42.
S.886	G-AFDA	10.5.39	12.5.39	<i>Awarua</i> . Medium-range boat used on Sydney-Auckland route as ZK-AMC.
S.1003	G-AFKZ	21.2.40	8.3.40	<i>Cathay</i> . S.30 Boat with Pegasus engines.
S.1025	G-AFPZ	9.4.40	17.4.40	<i>Clifton</i> . S.33 Boat with Pegasus XI engines.
S.1026	G-AFRA	4.5.40	10.5.40	<i>Cleopatra</i> . S.33 Boat with Pegasus XI engines.
S.1027	G-AFRB	—	—	—, S.33 Boat not completed.

* Date of launch.

SHORT "G" CLASS FLYING BOATS

S.871	G-AFCI	14.7.39	24.9.39	<i>Golden Hind</i> . Passed to R.A.F. as X8275. Passed to BOAC 1948. Scrapped 1954.
S.872	G-AFCJ	8.7.40	14.8.1940	<i>Golden Fleece</i> . Delivered to R.A.F. as X8274. Used by "G" Flight and later 10 Squadron R.A.A.F. Sank off Cape Finisterre 20.6.41.
S.873	G-AFCK	21.1.40	16.5.40	<i>Golden Horn</i> . Delivered to R.A.F. as X8273. Crashed River Tagus, Lisbon, 9.1.43.