

## THE FELIXSTOWE FLYING-BOATS . . .

In its original form the hull had only one step, which was situated below the rear spar of the lower wings. It was found that take-off was hampered by tail drag, and a second step was fitted about 12ft behind the first. This made take-off possible, but at a lower weight than earlier hulls. A third step was added, at a distance of 5ft 4in behind the front step, and the Porte I was then able to take off at the same loaded weight as its predecessors. In this form, the hull had excellent landing and take-off characteristics, and its full, flared bows prevented the shipping of water.

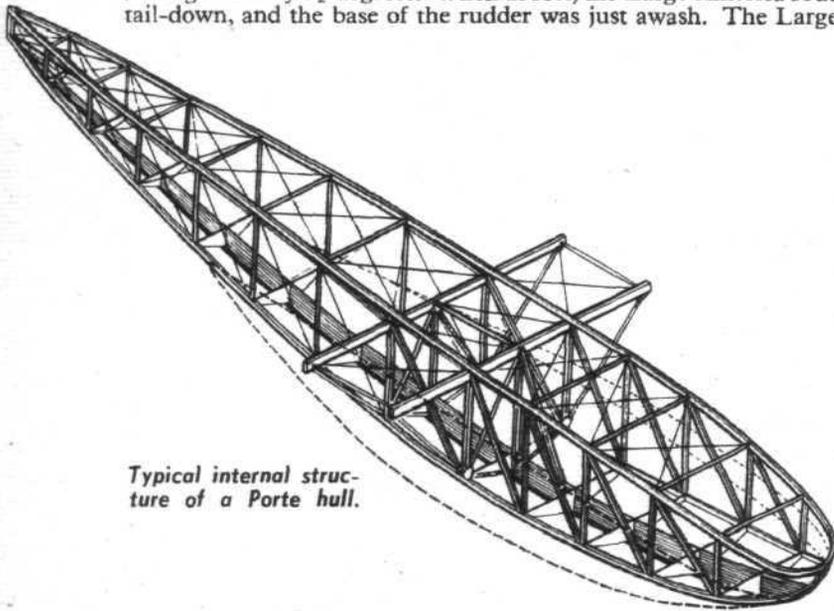
The performance of the aircraft must have been assisted considerably by its power installation: it had two 150 h.p. Hispano-Suiza engines driving tractor airscrews. The wings and tail unit were standard Curtiss H.4 components.

The aircraft with the Porte I hull was named F.1, a designation which established it as the first of the great line of flying-boats which were designed at Felixstowe, and which were to play a substantial part in the achievement of ultimate victory.

At an early stage of the war Porte had realized that the Curtiss H.4 was inadequate for long-range patrol work. He therefore asked Glenn Curtiss to develop a larger flying-boat with greater range and load-carrying capabilities. An official order for fifty such boats was placed before the end of 1915, and the first arrived in England in July 1916.

The new Curtiss flying-boats were known as Large Americas, and after their advent the H.4s became Small Americas. The Large America type, as delivered, had two Curtiss engines of 160 h.p. each; in this form it was officially designated Curtiss H.8. The Curtiss units proved to be unsatisfactory and were replaced by two 250 h.p. Rolls-Royce engines. Thus modified, the aircraft was designated Curtiss H.12 and did much good work.

But the hulls of the big new Curtisses were still not completely satisfactory for service in the sea conditions around Britain. Like the hulls of the Small Americas, they were single-step boat-built structures; 40ft long, 11ft at maximum beam, and with a fore-and-aft angle of only  $7\frac{1}{2}$  degrees. When at rest, the Large America rode tail-down, and the base of the rudder was just awash. The Large

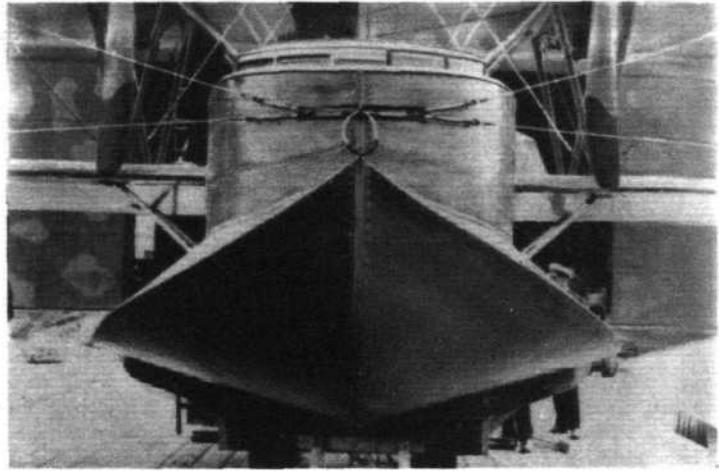


Typical internal structure of a Porte hull.

America hull, like its predecessors, was structurally weak, a disadvantage which was not improved by somewhat inferior workmanship: the structure was liable to fail at the step, and pilots had to exercise all their skill to avoid damage at take-off and touch-down. The risk of damage was present even in a slight sea, and the operational effectiveness of the aircraft was therefore limited. Furthermore, the shape and construction of the hull made it difficult to fit machine-guns in good defensive positions: no gun could fire directly downwards, and the rear gun's field of fire was obstructed by the tail unit.

Encouraged by the excellent results obtained with the Porte I hull, John Porte decided to build a hull of similar design for the Curtiss H.12 superstructure. To determine the characteristics of the original Curtiss hull, he conducted a series of tests with the first of the big Curtiss boats, No. 8650, which still had its Curtiss engines when Porte set to work upon it. In its underpowered state, the boat would not take off at a loaded weight of 8,700 lb. After the substitution of two 250 h.p. Rolls-Royce engines, the H.12 took off with difficulty, for the hull's short forebody did not give sufficient buoyancy forward and it had a pronounced hump speed of 18 kt.

The new hull for the Large America was known as the Porte II. It measured 42ft 2in from stem to sternpost and had two steps, one directly under the rear spar of the wings, the other 6ft 5in farther aft. Porte II had the same maximum beam as the Curtiss H.12



The boat with the Porte II hull, designated F.2.

hull, but its fore-and-aft angle was 20 deg, and the side fins were about 30ft long. On test its performance was greatly superior to that of the Curtiss hull. With the Porte II hull the aircraft took off at 10,500 lb loaded weight after accelerating quickly and smoothly to take-off speed.

The flying-boat with the Porte II hull was designated F.2. It had the mainplanes of a Curtiss H.12, but a new tail unit was fitted.

The structure of the Porte II hull was the prototype for all the succeeding Felixstowe boats, and it changed very little in its essentials throughout the war. The four wooden longerons and spacers formed a box-girder, the sides being "N" girders forward of the spar; all other cross-bracing was by means of wires or tie-rods. The spars of the lower centre-section were integral members of the fuselage. The bottom longerons were spaced by transverse "floors" of solid mahogany which were vee-shaped and formed the central planing bottom. These floors were notched out for two-thirds of their depth to fit over the solid keelson, which was correspondingly notched for one-third of its depth; the keelson ran as a continuous member from stem to stern.

The side fins were built on to the outside of the hull. Continuous timbers of rock elm ran from chine to chine beside and between the mahogany floors; the planking was attached to these timbers. The planking was double diagonal, consisting of an inner ply of  $\frac{1}{8}$ in-thick cedar and an outer ply of  $\frac{1}{8}$ in mahogany, the two being separated by a layer of varnished fabric. On the early F-boats the bottom planking was continuous from stem to stern with the step planking superimposed, and the planking was five inches in width. Three-ply planking was applied to the fin tops and to the sides of the hull as far aft as the rear spar, abaft which point the sides were fabric-covered with a solid mahogany washboard one foot deep along the lower longerons. The top decking was planked in front of the cockpit; the rear portion was fabric-covered.

Porte had intended only to produce a flying-boat which would operate from sheltered harbours such as Harwich, but the demands of war found the F-boats working from exposed waters, often with lengthy periods at their moorings. Such conditions proved too much for the hull covering: the 5in planks warped, water seeped into the joints in the three-ply covering of the fin tops and hull sides, and the mahogany washboards split and the fabric rotted. Narrower planks had to be fitted, double-diagonal planking of cedar and mahogany was applied to the fin tops, and the sides were either planked with a single layer or covered with fabric and planked with "Consuta." Several structural modifications had also to be made as operational experience was gained. In particular the planking of the steps had to be modified, for in some instances they had been wrenched off the hull bottom.

Not only did the F.2 flying-boat prove to be superior to the Curtiss H.12 in strength and seaworthiness, but the fundamentally simple structure of its hull design made it an excellent production proposition, for it could be built by firms which had no experience of boat-building. The F.2 design was therefore ordered into production in 1917. This was a well-deserved acknowledgment of the work of John Porte who, in the words of Sqn. Cdr. Hallam, "carried out his plans with a scratch collection of draughtsmen, few with any real knowledge of engineering; with boat-builders and carpenters he had trained himself; and he only obtained the necessary materials by masterly wangling. He frequently started a new boat and then asked the authorities for the grudging permission. But in all things connected with the building of flying-boats his insight amounted to genius, and the different types of boats kept getting themselves born."

Porte's Chief Technical Officer was Lt. (later Maj.) J. D. Rennie, who assisted considerably in the work connected with the evolution of the F-boats.

(To be continued)