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AIRCRAFT CIRCULARS
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 31

DORNIER "SUPERWAL" COMMERCIAL SEAPLANE
Two Rolls-Royce "Condor" 650 HP. Engines

Washington
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DORNIER "SUPERWAL" COMMERCIAL SEAPLANE.*

Two Rolls-Royce "Condor" 650 HP. Engines.

In the month of September, 1926, the construction of a giant flying boat, far greater than the well-known Dornier "Wal," was approaching completion in the Manzell factory of the Dornier Metal Construction Company at Friedrichshafen.

On November 4, 1926, this flying boat, the Dornier "Superwal," (Figs. 1, 2, 3, and 4) made a three-quarter-hour exhibition flight around Lake Constance (a distance of over 90 miles) with 60 persons on board. This remarkable performance calls for more detailed information on this flying boat.

The "Superwal" is similar to all other Dornier flying boats, in that it has a stepped hull with its lateral stability augmented by a wing stub on each side. These stabilizing features are necessary because, as compared with an ordinary boat, the center of gravity is raised by the power plant, which is situated above the wing, and the great span of the seaplane makes it sluggish on rough water. The elevated position of the wing and power plant, however, protect both from the heavy seas. The bracing of each half of the wing at about the middle of its overhang by a pair of streamlined struts attached to the wing spars renders it possible to construct the wing with a moderately

* From "I.F.W." No. 21, 1926, and from a Circular published by the Dornier Company.

thick, aerodynamically favorable, cross section of uniform dimensions from the ends to the middle, in contrast with the full cantilever type, in which the wing, due to the stresses increasing toward the middle, must constantly increase in dimensions and weight up to the middle, thus offering more head resistance than the semicantilever wing of the "Superwal" which, notwithstanding the resistance and weight of the struts themselves, is much better in this respect.

The location of the power plant above the middle of the wing does not necessarily limit it to only two engines in tandem, as two or even three such double-engine power plants can be installed on the middle section of the wing at suitable distance from one another as determined by the propeller diameters. Any good engines can be installed at the wish of the purchaser, provided they furnish a total of 1400-2000 HP. Of course any increase in the engine power also increases the empty weight of the seaplane, but the carrying capacity is increased in a much greater degree, since the greater reserve power enables the seaplane to take off, even from very rough water, with a greater full load. The increase in the number of engines is naturally accompanied by the advantage that the failure of one engine removes a smaller fraction of the total power, so that the ability to remain in the air is maintained even with greater loads. On the failure of one of only two engines, the seaplane can still keep in the air with at least two-thirds of the usual load.

The full load of the "Superwal" is almost 10 metric tons (22046 lb.) or about 50% greater than that of the "Wal." With two Rolls-Royce "Condor" engines of 650 HP. each, it can attain about the same speed as the "Wal" with its air-cooled Bristol "Jupiter" engines. The hull has the imposing length of 23.5 meters (77 feet) and a maximum width of 3.5 meters (11.5 feet) without the wing stubs, which increase its width to a total of 7.5 meters (24.6 feet). Immediately behind the bow there is a cabin for 13 passengers. Behind this, on the port side, is the pilot room, which is entered through a narrow passage, opposite which, on the starboard side and behind the entrance to the hull, is the toilet room. Next comes the tank room, immediately under the wing, and the two-engine power plant, with a fuel capacity of 2000 km (1243 miles). Next in order come the baggage room and a cabin for 8 passengers. Behind the latter is the empty portion of the hull which can, however, be entered through several manholes, for making repairs. The hull is divided by bulkheads into several water-tight compartments, so that the leaking of one compartment will destroy only a small fraction of the total buoyancy.

The arrangement of the two propellers in tandem, instead of abreast, has not been found to be detrimental in any way since, although the pusher propeller must work in the slip stream of the tractor propeller, it can for this very reason eliminate the spiral motion of the slip stream produced by the forward propel-

ler by revolving in the opposite direction, as is now done on ships with a gain in power, so that the total efficiency is not diminished as compared with propellers functioning in the free air.

The center of gravity of the power plant lies directly above the c.g. of the whole seaplane, so that any difference in weight of the engines stipulated by the purchaser would not affect the c.g. but only the empty weight. Likewise, the c.g. of the tank room lies near that of the whole seaplane, so that the decrease in the weight of the fuel during flight does not affect the equilibrium of the seaplane. It is necessary, regardless of the utilization of the rest of the hull, to locate the tank room between the two main bulkheads which receive from the spars and struts the lifting force of the wing. Generally four 600-liter fuel tanks are located on the floor of the tank room and four 285-liter tanks are suspended from the ceiling of the room. This fuel load of 3540 liters (935 gallons) weighs 2760 kg (6085 lb.) if, as is now customary, 40% of benzol is added to the gasoline. This quantity of fuel is sufficient for a non-stop flight of 2000-2200 km (1243-1367 miles) at the economical air speed.

This complete separation of the fuel from the engine still further reduces the fire risk, which is already quite small on all-metal airplanes. A geared pump, driven by a windmill, pumps the fuel into a small gravity tank, from which it flows to the carburetors.

For the purpose of slight repairs during long flights, the tank room is connected with the engine nacelle by a vertical passage, in the front portion of which there is a frontal radiator and which tapers at the rear into a broad open slot for the discharge of the air heated by the radiator. This slot can be closed, however, when the outside temperature is low, thus reducing, on the one hand, the strong cooling effect of the cold air on the mass flow and, on the other hand, enabling the use of the heated air for warming the passenger cabins.

The pilot room, which is located in front of the tank room for the sake of better visibility, has two seats and dual controls and the usual navigation instruments and gauges.

A very large baggage and mail room is located behind the tank room. For the uniform distribution of the weight of the passengers, there are two passenger cabins, one forward, and one rear; the latter, according to the wishes of the purchaser, can be put either immediately forward and aft of the tank room or with the interposition of the pilot and baggage rooms.

At its widest point, the hull measures about 3.5 m (11.5 ft.) so that, with practically the same length of the forward cabin, a very imposing room is provided, in comparison with present-day commercial airplanes. The length of the hull is 23.5 m (77 ft.); the span, 28.5 m (93.5 ft.). Speeds of 190 and 210 km (118 and 130 miles) per hour are attainable, according to the engines installed.

In the test flights, the "Superwal" has already taken off with a useful load of 6000 kg (13228 lb.), which is greater than its empty weight and assures it a radius of action of over 4000 km (2486 miles), although with a smaller useful load.

As shown in Fig. 8, the framework of the hull was assembled upside down, the bulkheads being supported on beams. The sides and bottom were then covered (Fig. 5). The hull was then raised and turned about its longitudinal axis (Fig. 12), so as to bring the still uncovered top side up (Fig. 6). After the top of the hull had also been covered, the engine nacelle was installed above the middle of the now completed hull (Fig. 9). After the engine nacelle had been braced with struts against the hull, the two engines were installed. Then the finished wings were attached and braced against the lower wing stubs by struts attached at about the center of each wing (Fig. 9).

The engine nacelle had been previously constructed in a similar manner (Fig. 11), by covering vertically placed bulkheads (Fig. 7). Fig. 10 shows the structure of the central portion of the wing between the two steel spars. The spars are connected by bridge-like double ribs, which determine the shape of the wing. These double ribs are braced against one another by rods lying parallel to the spars. The perpendicular distance between these rods is maintained by vertical rods. The wing structure is now completed by attaching to it the closed

leading edge structure and the open trailing edge structure ready to be covered with fabric.

General Characteristics

Length of hull	23.5 m	(77.0 ft.)
Width of hull without wing stubs	3.5 "	(11.5 ")
Width of hull with wing stubs	7.5 "	(24.6 ")
Span	28.5 "	(93.5 ")
Weight of fuel	2760 kg	(6085 lb.)
Fuel load	3540 liters	(935 gal.)
Full load	almost 10 metric tons (22,046 lb.)	

Performance

Speeds 190 and 210 km/hr (118 and 130 M.P.H.)

Translation by Dwight M. Miner,
National Advisory Committee
for Aeronautics

1 Passengers	4 Pilots	7 Entrance
2 Baggage	5 Passengers	8 Radio
3 Fuel	6 Toilet	9 Entrance

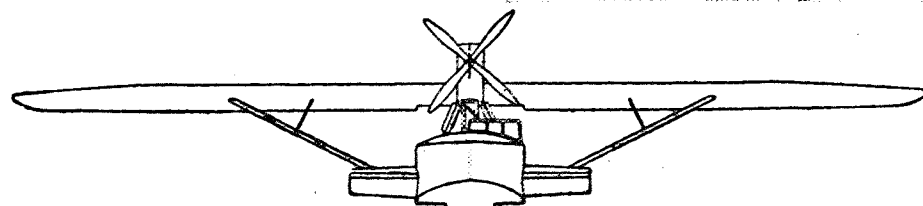
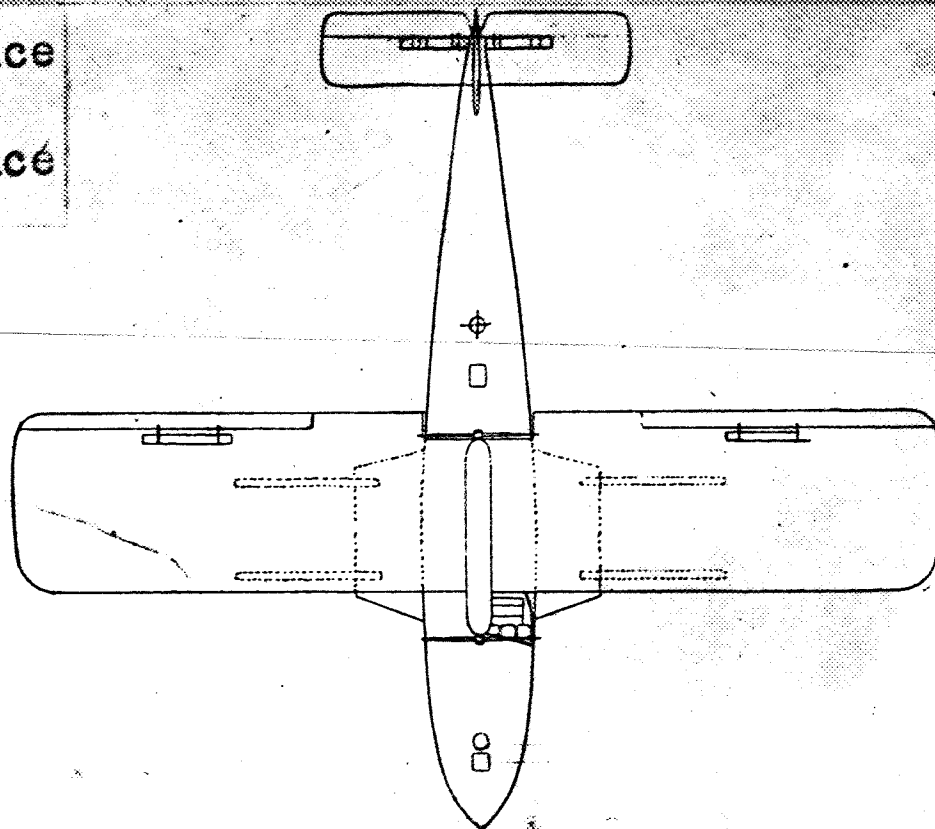
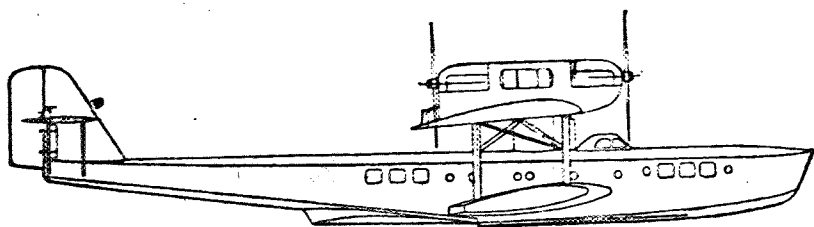
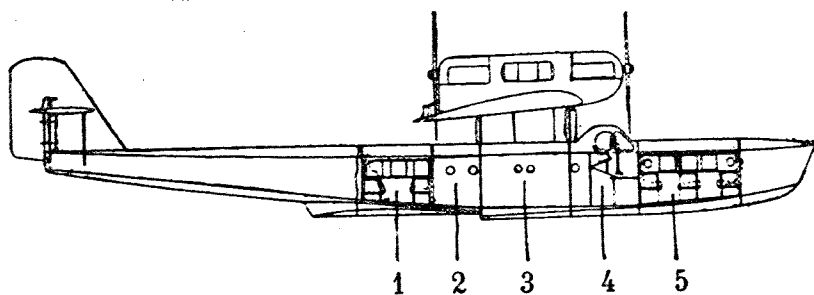
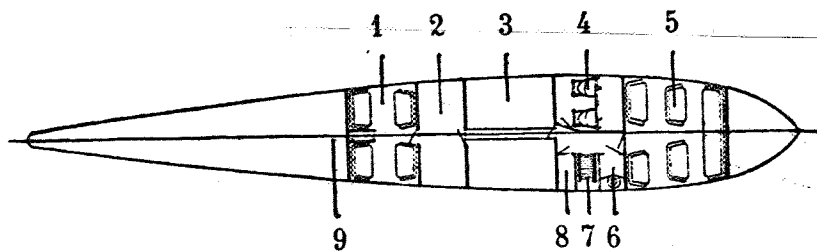
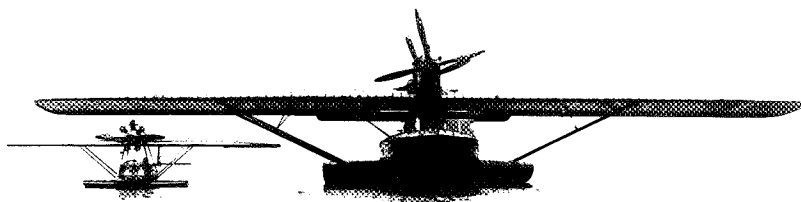
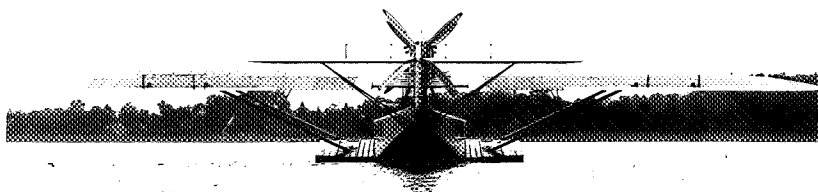


Fig.1 Dornier Superwal seaplane.



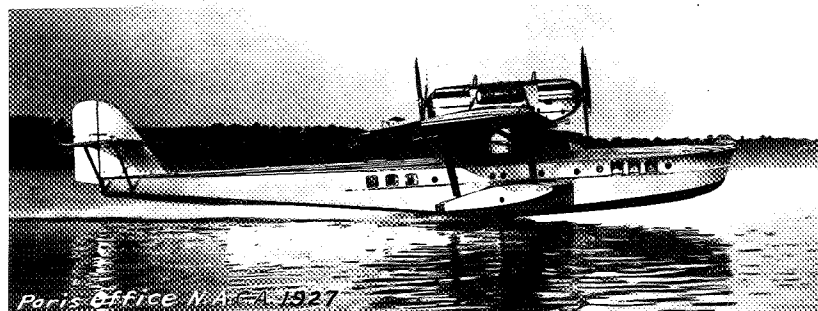
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Fig. 3



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Fig. 3



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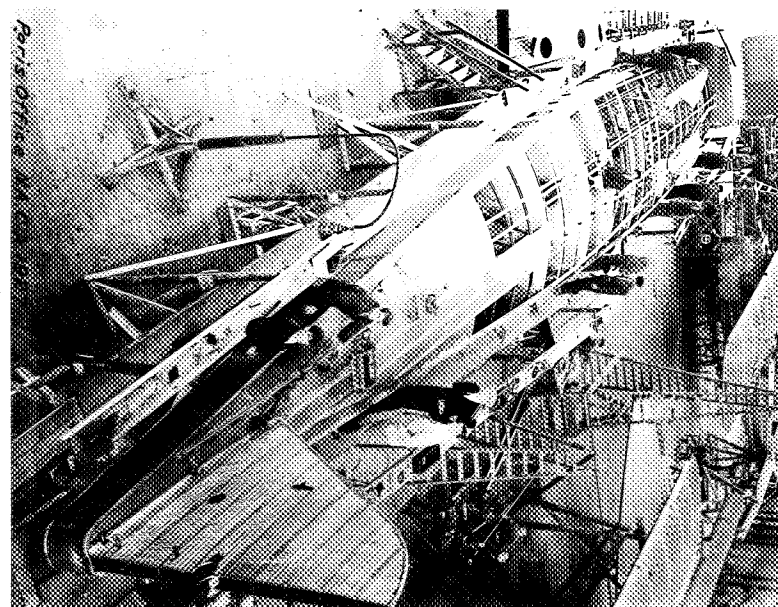
Fig. 4

Dornier Superwal seaplane.

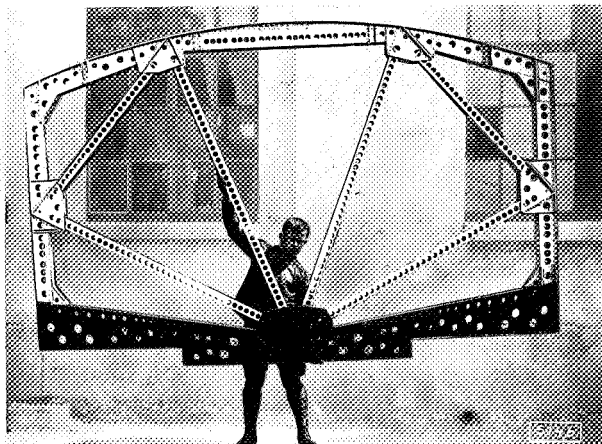


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Fig. 5. Ship hull just before lifting and turning over.

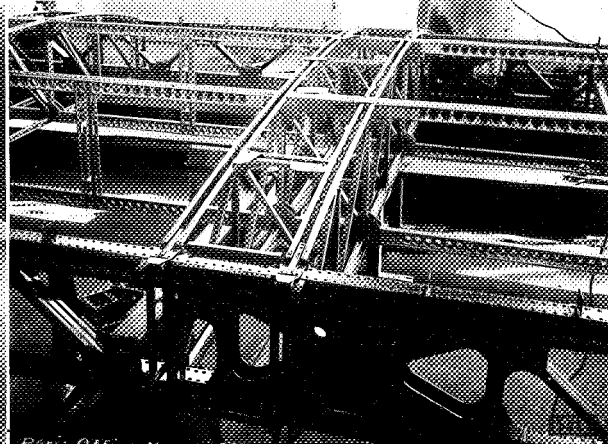


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Fig.7 Duralumin bulkhead of Dornier Superwal seaplane easily lifted by one man notwithstanding its width of 3.5m(11.48 ft.).



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Fig.10 Wing structure of Dornier Superwal seaplane.

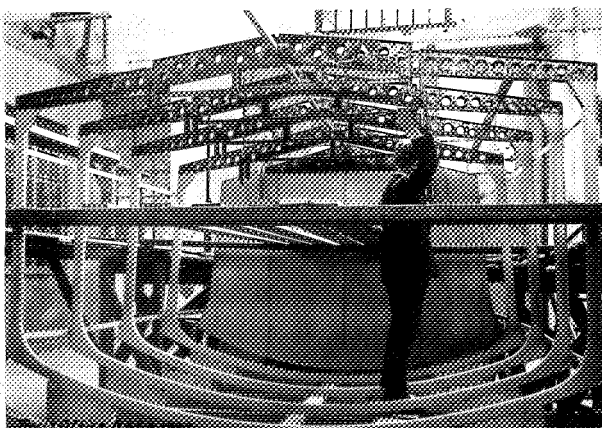
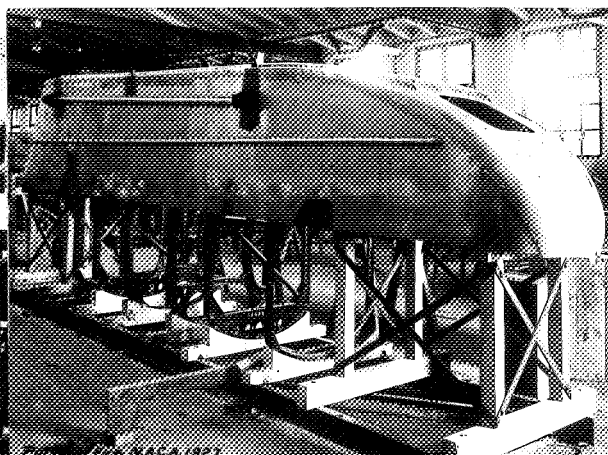


Fig.8 Structure of passenger cabin of Dornier Superwal seaplane.



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Fig.11 Structure of engine nacelle (of Dornier Superwal seaplane) with plywood covering on three sides.

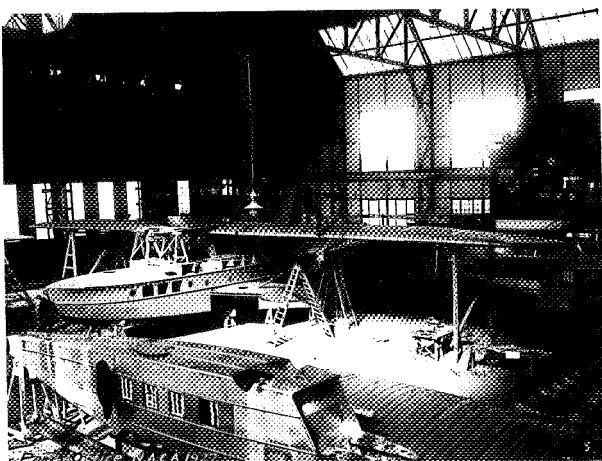
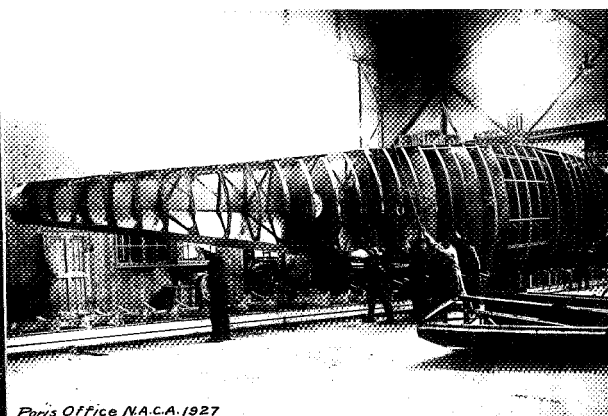


Fig.9 Installing wing on hull.



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Fig.12 Turning the hull of the Dornier Superwal seaplane (top not yet covered).