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AIRCRAFT CIRCULARS  
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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No. 132

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FOCKE-WULF F 19a "ENTE" COMMERCIAL AIRPLANE (GERMAN)  
A Tail-First High-Wing Monoplane

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FOCKE-WULF F 19a "ENTE" COMMERCIAL AIRPLANE (GERMAN)\*

A Tail-First High-Wing Monoplane

The airplane type now designated by the term "Ente" (Duck) is characterized by the fact that, contrary to the conventional type, the horizontal control surfaces are placed at the forward end of the fuselage while the wing is farther aft (Figs. 1, 2, & 3). This type is by no means new, but goes back to the beginnings of aviation. One of the first flights in Europe was made by Santos Dumont in a biplane of the Ente type. Moreover, the airplanes of Prof. Reissner and of the Frenchman Voisin in 1910 and 1911 were of the tail-first or "Ente" type.

The work of the Focke-Wulf Airplane Company dates back to 1907, when the present director, Mr. Focke, together with his brother, experimented with "free-flying" models of the "Ente" type. These experiments led to the construction, in the following year, of an "Ente" with a 40 hp engine, which made a series of short flights at the Bornstedt Field in Potsdam in September, 1909. This work was resumed by Focke after the war. In 1925 the Focke-Wulf Company proposed to the D.V.L. (German Experimental Institute for Aeronautics) the construction of an "Ente" airplane, which, after exhaustive model tests, was built

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\*From a pamphlet issued by the manufacturers, and from Flight, Jan. 2, 1931.

at the Göttingen Experimental Institute. The test flights in the summer of 1927 gave excellent results. Unfortunately, the airplane crashed in September of the same year with fatal injuries to Mr. Wulf, the fellow-founder of the Focke-Wulf Airplane Construction Company. The death of Mr. Wulf, who had been very active in the solution of the "Ente" problem, was a serious loss. Nevertheless it was decided not to abandon the undertaking, but to build a new "Ente," all the more because it was evident that the accident with the first type was not due to any fundamental error in the design. After further exhaustive wind-tunnel tests, the construction was begun, only to be interrupted by the burning of the half-finished airplane in the fall of 1929. Nevertheless the new "Ente" with the type designation "F 19a" was ready for its first trial flights in May, 1930. The trial flights during the summer yielded very satisfactory results, so that the D.V.L. was able to finish the type tests with the full acceptance of the airplane, even for carrying passengers. The development of the "Ente" can therefore be pronounced entirely successful.

For two decades the arrangement with the wings in front and the tail behind has been accepted as the standard. It is therefore proper to ask the reason for such a decided departure as the "Ente" from this standard. It must first be considered that familiarity with the prevalent airplane type involves familiarity also with its imperfections. The "Ente" type avoids

a whole series of defects inherent in the normal type, although they may seem unimportant, due to familiarity.

Due to its aerodynamic characteristics, the "Ente" alone is "stallproof" without any special auxiliary device. The forward stabilizer or, better said, the forward wing is set at a slightly greater angle of attack than the main wing, in order to increase the longitudinal stability. With increasing upward inclination of the airplane, the forward wing will therefore reach its angle of maximum lift first, so that any further "stalling" is without effect, and the airplane can not be brought, even by the biggest error in piloting, into the critical position at which it loses its lateral stability and control.

Another important advantage consists in the fact that the "Ente" can not capsize on the ground, because its C.G. is far back of the foremost point of support, the front wheel. This enables the unrestrained use of the wheel brakes, so that the airplane requires only a very short distance for stopping.

Even in case of a break, the tail-in-front arrangement affords much better protection for the occupants than the normal tail-behind arrangement. In the event of striking an obstacle while making a forced landing, the long forward portion of the fuselage must first be destroyed before the cabin behind it can be crushed.

The tail-first arrangement helps the pilot to judge the altitude of the airplane in the air. It also enables him to observe the position of the most important control surface, namely the elevator.

Another very important advantage of the "Ente" is that it has no horizontal nonlifting, drag-producing surface like the stabilizer and the elevator on a tail-behind airplane. The forward wing and elevator on the "Ente" combine in the production of a lift which is greater per unit area than that of the main wing. A very strong directional control can also be exerted without additional drag. If, e.g. the forward wing is given a lateral inclination, it produces a lateral lift component, which produces an effective lateral moment without additional drag. This is very important for enabling rectilinear flight in the event of the stopping of one of the engines.

The absence of non-lift-producing surfaces naturally has a favorable effect on the attainable economy of flight, which, for a given engine power, determines the speed and climbing ability. Even for the "Ente" under consideration, the flight performances are as great as for the best commercial airplanes of the conventional type, despite the twenty-year scientific and practical development of the latter. It may therefore be assumed that, in the future, the "Ente" type will attain flight performances considerably better than any yet attained.

In brief, it may be said that the "Ente" type represents progress toward the solution of the safety problem and also promises increased economy of flight. These reasons appear to justify the experiment of departing from the present conventional type of airplane.

The Focke-Wulf F 19a "Ente" is like the 1927 "Ente," except for a series of structural improvements. It has the form of a cabin airplane for one pilot and three passengers.

The distinctive characteristic of the Focke-Wulf "Ente" is the small stabilizing wing in front of the main wing (Figs. 4 & 5). This forward wing also serves as the elevator. In this arrangement the longitudinal stability depends on the difference between the angles of attack of the main and forward wings, on the consequent higher loading of the smaller forward wing, and on the necessitated position of the C.G. in front of the main wing.

The former has a span of 16.4 ft. and a lifting surface of 64.6 ft. It is trapezoidal, or almost triangular in shape, with a straight and long leading edge. The trailing edges meet at an obtuse angle, and their under surfaces are recessed for the elevators. These are compensated and supported by a number of brackets holding them so that there is a slot between them and the wing, which slot becomes narrower when the elevators are depressed for climbing, and the larger when they are raised for going down. The trailing edges of the elevators are formed

by a strip of aluminum, 1/8 in. in thickness, and standing out rearwards for approximately 1 in.

The "Ente" has the form of a high-wing cantilever monoplane. The dimensions and structure of the main wing are like those of one of the smaller Focke-Wulf commercial airplane. The wing has a thick profile, a slight dihedral and the characteristic "Zanonia" tips, whose lateral stabilizing properties are well known.

The main wing has the standard Focke-Wulf structure, consisting of a four-member plywood box girder with leading-edge and trailing-edge formers. The covering is partly plywood and partly fabric. It lies on top of the fuselage and is secured there in a recess, its leading edge being about 12 ft. away from the rear end of the fuselage. The forward wing has a similar plywood structure.

Halfway between the main and forward wings the fuselage loses one-third of its height and tapers to a point at the front end, which carries the steel-tubing supports of the forward wing. The elevated portion of the fuselage immediately in front of the main wing forms a cabin, in front of which is the pilot's cockpit. The cabin is equipped for three passengers and is accessible through a door on the right-hand side.

In contrast with the 1927 "Ente," the fuselage framework is of welded steel tubing. It is covered with fabric, excepting the top which is sheathed with light metal. The cabin is

sheathed with plywood.

The lateral control is effected in the conventional manner by means of ailerons on the main wing. The vertical control is effected by two narrow elevator flaps attached to the trailing edge of the forward wing in such a way as to produce a slot effect. For regulating the trim of the airplane, the angle of setting of the forward wing can be adjusted on the ground. The fin and rudder are above and behind the main wing. The exceptionally large fin is necessary to prevent yawing. For the same reason two other vertical stabilizing surfaces are mounted under the main wing. Directional control can also be exercised by tilting the forward wing about the longitudinal axis of the airplane. This possibility, however, will first be tried out in later tests.

The three normal controls are operated by a wheel control column and rudder bar by means of rods and cables. A separate hand wheel is used to tilt the forward wing.

The main landing gear is behind the C.G. It consists of two separate parts, each with two arms hinged to the bottom of the fuselage and a shock-absorber strut attached to the bottom of the engine nacelle (Fig. 6). The third point of support is a wheel partially inclosed in the fuselage about 4 m (13 ft.) in front of the C.G. with conventional rubber shock absorber. This wheel is dirigible laterally in connection with the rudder. The rear wheels have brakes operated by small pedals on the rudder bar.



The power plant consists of two 110 hp Siemens Sh 14, air-cooled, 7-cylinder engines. They are suspended from the main wing so that the tractor propellers revolve in front of the leading edge. The engine bearers consist of welded steel tubing. The nacelles are streamlined with metal sheathing. Behind the engines, and inside the nacelles, are fireproof bulkheads, and again behind these are the upper ends and the rubber ring shock absorbers of the telescopic legs. The wheels beneath the main wing are supported on divided axles.

The two fuel tanks are located on each side of the fuselage in the leading edge of the wing and have a capacity of 125 liters (33 gal.) each. The feed is by gravity. The two oil tanks are located in the leading edge of the wing over the engine nacelles. Each tank holds 12 liters (3.2 gal.)

The trial flights thus far made with the F 19a "Ente" indicate that it has about the same flight characteristics as any other normal airplane of recent construction. Moreover, it is stallproof. It is now in the hands of the D.V.L., which will make further exhaustive tests of its flight characteristics in the near future.

## Characteristics

Length	10.53 m	34.55 ft.
Span of main wing	10.00 "	32.81 "
Span of forward wing	5.00 "	16.40 "
Area of main wing	29.5 m <sup>2</sup>	317.54 sq.ft.
Area of forward wing	6.0 "	64.58 " "
Weight equipped for three passengers	1175. kg	2590.43 lb.
Load	475 "	1047.19 "
Weight loaded	1650 "	3637.62 "
Wing loading (incl. ailerons)	46.5 kg/m <sup>2</sup>	9.52 lb./sq.ft.
Power loading	7.5 kg/hp	16.31 lb./hp
Wing power	6.2 hp/m <sup>2</sup>	0.577 hp/sq.ft.

## Performances

Maximum speed	142 km/h	88.2 mi./hr.
Cruising speed	128 "	79.5 "
Landing speed	83 "	51.6 "
Climb to 1000 m (3280 ft.)		8.3 min.
Distance from start to 20 m (66 ft.) altitude	405 m (1329 ft.)	
Distance from 20 m (66 ft.) altitude to stop	415 m (1362 ft.)	

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

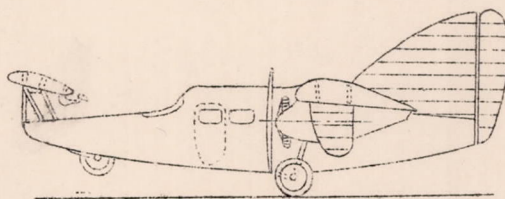
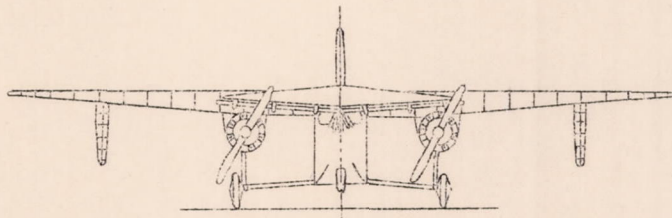
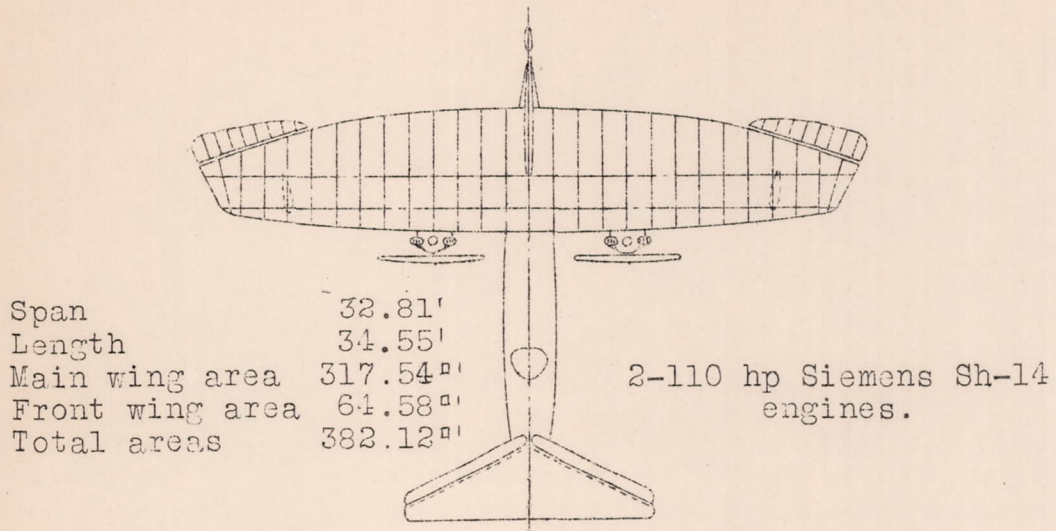


Fig. 1 General arrangement drawings of the Focke-Wulf "Ente". Note the peculiar plan form of the front wing.

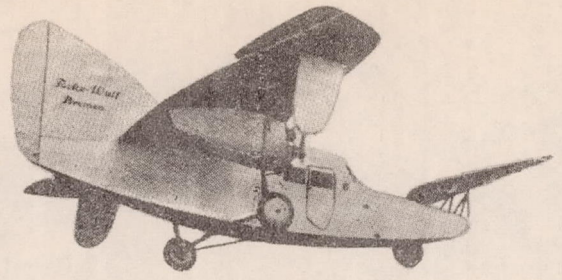


Fig. 2 Three-quarter rear view of the Focke-Wulf "Ente" in flight.

← Fig. 6 Views taken from "Flight." Reproduced by permission.

Fig. 3 Three-quarter front view.

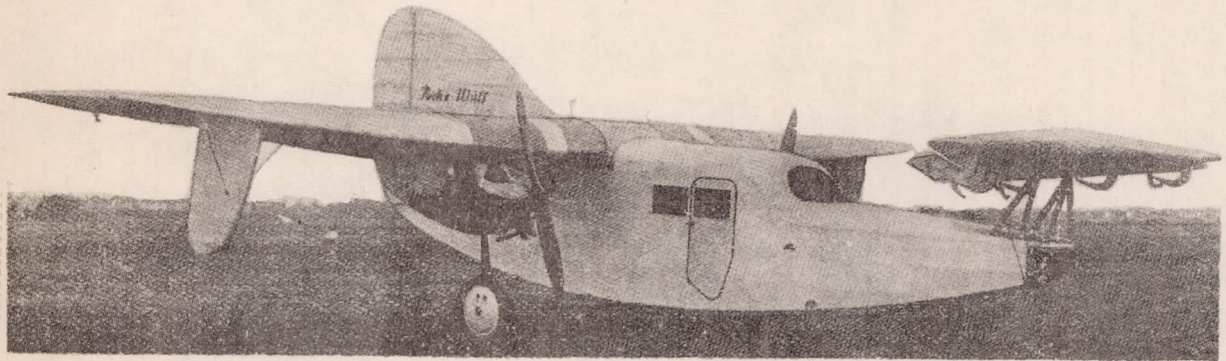


Fig. 4 Three-quarter front view. Note slot arrangement of elevator flaps.

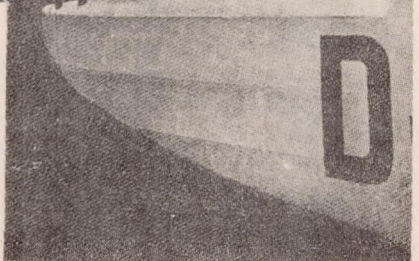
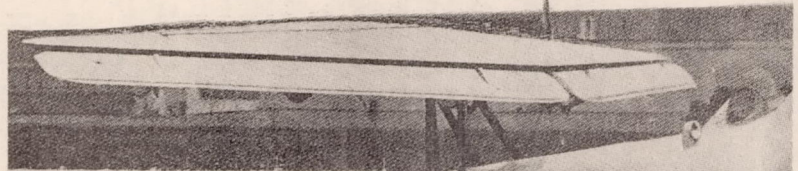


Fig. 5 Rear view. Note trailing edges of elevators.