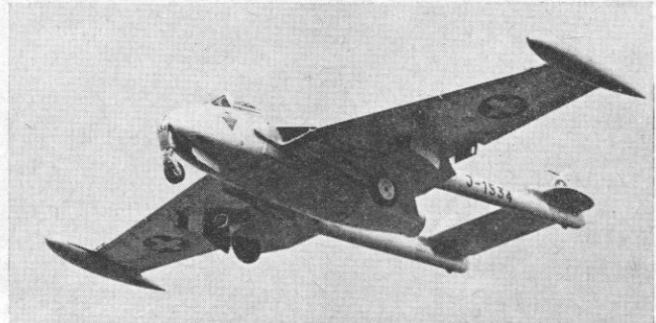


LEFT: One of two Mirage III conversion trainers
RIGHT: A Swiss-built Venom FB.50 (Photo: A. Breese)



sold to civil flying clubs, although a handful of each are still in service with the Swiss Air Force. Vampire T.55 trainers entered service with the Swiss A.F. in 1955, and seven Dornier Do 27H2s were purchased in 1958 for liaison work. Sud Alouette II helicopters are also now in service, as well as some S.O.1221 Djinnis and a Pilatus PC-6A Turbo Porter. Of the old wartime equipment the D-3800s and D-3801s have all gone, but a few aged C-3603s and two Fieseler Storchs are still in existence. The P-51D Mustangs were scrapped in 1958-59 and the surviv-

ing Bf 108 Taifuns were "retired" recently, being considered even too worn-out for sale on the civil market. The T-6 Texans are still in service and far from worn-out are the original three Junkers JU52/3Ms, all of which are as active as ever.

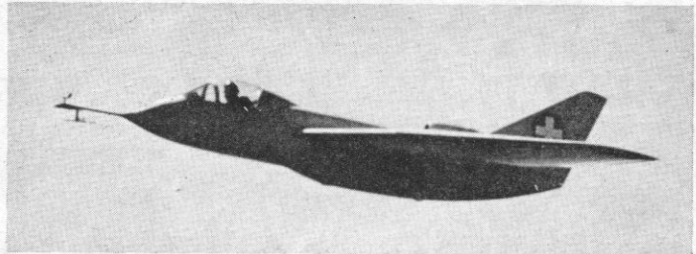
At present the Swiss Air Force comprises three regiments divided into wings of from two to four squadrons, with a total of twenty-four squadrons. Principal bases are Dübendorf, Payerne, Emmen, Magadino and Sion. Swiss Air Force pilots are, for the most part, still reservists and yet

attain a surprisingly high standard of flying on increasingly complex equipment. Can the Swiss Air Force not only maintain this standard on future equipment but also continue to find aircraft capable of successfully defending Switzerland's neutrality? The answer may well lie in the VTOL field.

Acknowledgments.—The author gratefully acknowledges the considerable help given by Dr. U. Haller in preparing the text, and the Swiss Air Force Public Relations Department for supplying most of the photographs.

The Swiss N-20 Jet Fighter-Bomber

by Dr. Ulrich Haller



NOW RECEIVING MACH 2 Mirage IIIS's, the Swiss Air Force had its first experience of jets in 1946 when four de Havilland Vampire F.1s were purchased for evaluation. These were followed in 1949-52 by 175 Vampire FB.6s and later by Venoms and Hunters.

As early as 1945, however, the Eidgenössischen Flugzeugwerke (Federal Aircraft Factory) at Emmen submitted two projects, designated N-10 and N-20, for jet fighter-bombers designed specifically for Swiss conditions. The N-20 seemed

the more attractive proposition but although design work on it had been completed by January 1947, it was not until May 1948 that a prototype was actually ordered.

Of modified delta-wing design, the N-20 embodied several features that were new at the time. Its powerplant consisted of four turbofan engines buried in the wing. The "cold" air from the fans was ducted through an additional combustion chamber on each side of the axial turbojet; this reheat device, which doubled the normal thrust of the engines, was to be used mainly for take-off and combat. For short take-off and landing the secondary airflow could be deflected through large slots on the upper and lower wing surfaces. When the lower slots only were open, the deflected air acted as an aerodynamic flap; with both systems in operation, the deflected air acted as a thrust-reverser. As a substantial proportion of the air flowed through about half the wingspan, the aerodynamic drag of the relatively thick wing was kept very low. To extend endurance, two of the four engines could be shut down in flight.

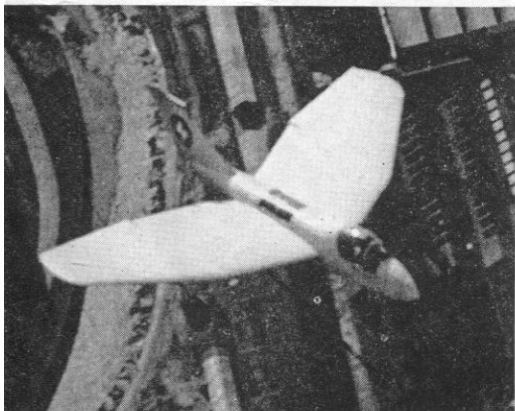
The three-fifth-scale experimental glider being towed by a C-3604

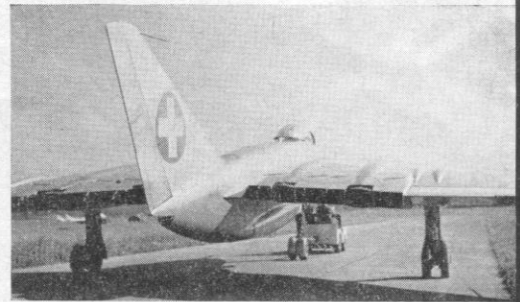
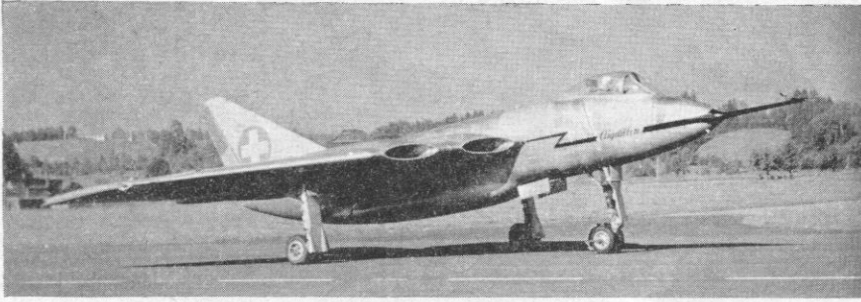
The Arbalète, a three-fifth-scale model of the N-20, powered by four Piméné Is, two above and two below the wing

Performance estimates made in 1948 were as follows: maximum speed 680 m.p.h. at 3,280 ft.; time from 3,280 ft. to 32,800 ft., 2 minutes; take-off run 760 ft. and landing run 777 ft.

The N-20 was designed to have a detachable weapons-bay that could be changed in 10 minutes. Alternative loads were 1,764 lb. of bombs, six 20-mm. cannon, four 30-mm. cannon, thirty-two missiles, cameras or additional fuel; in addition there were two permanent 20-mm. cannon in the nose. The pilot was provided with a watertight escape capsule, ejected by an 8,810-lb. thrust rocket.

The behaviour of the unorthodox wing shape was tested in a large new wind tunnel at Emmen. For actual flight tests, the Federal Aircraft Factory built a three-fifth-scale glider, mainly of wood, which first flew on 17th April 1948. After many successful flights, proving the feasibility of the design, the glider was destroyed in a landing accident. A second aircraft of similar dimensions but powered by four 220-lb. s.t. Turboméca Piméné I turbojets and fitted with a retractable undercarriage





LEFT: The N-20 during taxi-ing trials. RIGHT: This view of the N-20 shows the square outlets (flanking the jet pipes) for the secondary airflow. Also visible are the slots for the thrust reverser/aerodynamic flap system

Swiss N-20 . . .

was then built. Named Arbalète ("Cross-bow") and painted yellow, it flew on 16th November 1951 and had a maximum speed of 466 m.p.h.; manoeuvrability was excellent. The Arbalète is still airworthy, having been used for further research in recent years, but will eventually be placed in the Swiss Transport Museum at Lucerne.

The main problem in the development of the N-20 was the provision of suitable turbofan engines. Originally the Swiss firm of Sulzer Brothers were to have developed the engines but abandoned this project in 1947, whereupon the Federal Aircraft Factory had to take over engine development as well. Three British engine designs—by Sir Roy Fedden, Napier and Armstrong-Siddeley — were studied and from these the Armstrong - Siddeley Mamba was chosen as the basis for the Swiss turbofan. The turboprop Mamba's reduction gear was replaced by a low-pressure compressor which produced the

necessary "cold" air for the by-pass system.

Thrust from the Mamba 1, and thus the converted Swiss-Mamba SM-1, was below requirements however; but it was anticipated that with development through the SM-3 to the twin-shaft SM-5, the full 3,300-lb. thrust needed for the N-20 would eventually be achieved. A de Havilland Mosquito was used from 1948 until 1952 as a flying test-bed for the SM-1, which was therefore the first turbofan engine ever flown.

Meanwhile the first prototype of the full-scale N-20 Aiguillon ("Sting") had been completed at Emmen and equipped with four early SM-1 engines. Taxi-ing trials and some hops on the then very short runway at Emmen began on 8th April 1952, but no actual flights could be undertaken as no more funds were available. At the same time the Air Force was pressing for an early delivery date.

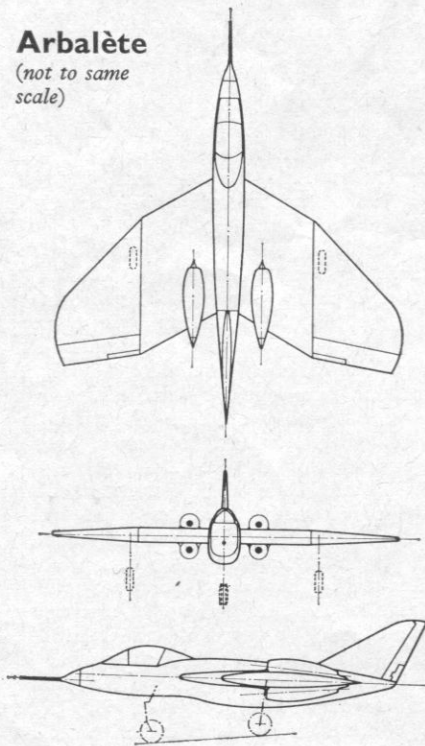
Development of the Swiss Mamba and the N-20 was cancelled in 1952. The Federal Aircraft Factory then put forward

a simplified version, the N-20/20 powered by two Rolls-Royce Avons or Armstrong-Siddeley Sapphires. Lacking the STOL devices of the original N-20, this version was not nearly so attractive and was therefore dropped. As no suitable Swiss type was then available, an order for 250 Venom FB.50s was placed with the Swiss aircraft industry — although Flugzeugwerke Altenrhein (FFA) obtained a development contract for their P-16. The latter flew well and showed considerable promise but eventually it too was dropped. The N-20 prototype, displaying many advanced features for its time, today remains unflown, parked in the open at Emmen airfield but will eventually go to the Museum at Lucerne.

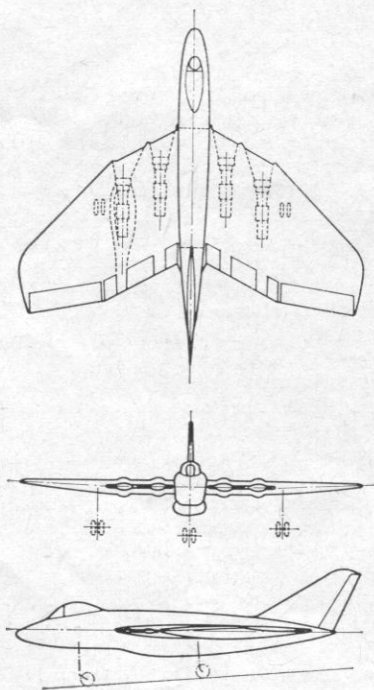
Specifications

	Arbalète	N-20
Span . . .	24 ft. 10 in.	41 ft. 4 in.
Length . . .	24 ft. 9 in.	41 ft.
Height . . .	7 ft. 7 in.	12 ft.
Wing area . . .	209 sq. ft.	570 sq. ft.
Take-off weight	3,968 lb.	19,200 lb.

Arbalète
(not to same scale)



N-20



N-20/20

