AIR TRAFFIC CONTROL

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AN AIRCRAFT MAKING A "BLIND" LANDING UNDER THE DIRECTION OF RADAR (See page 42)

Rocket Propulsion

Details of Three Further Rocket-fighter Projects

By K. W. GATLAND

(*Continued from page 13, October issue*)

This is the HWK 109-509A1, first bi-fuel rocket engine to be fitted in service aircraft. It was produced in large quantities at the Heinkel works during 1944, and drawings were subsequently acquired by Japan at a cost of 20,000,000 Reichsmarks.

THE "Natter" was an altogether better solution, and it was *simplicity*, coupled with considerable *fire-power* in the shape of explosive rockets, that put Bachem points ahead of his competitors.

The "Julia," however, was a good runner-up, if only for the fact that it was designed to take off vertically.

On the ground and approaching from the side it would have been difficult to convince an observer that the "Julia" could climb at over 39,000ft. per minute, or, indeed, was anything more enterprising than a glider. A glider, of course, it was when the tanks had been drained, but with the HWK 109-509B Walter engine firing from the tail its *cruising speed* was nearly 500 miles per hour.

Design Features

Main identification features were the high wing location and the absence of a protruding cabin. The pilot was accommodated in a prone position at the extreme nose, and, hence the line of the fuselage was unbroken save for two landing skids, one beneath the cockpit and another about half-way between nose and tail. The fuselage, nevertheless, was not so refined aerodynamically as the more normal high-performance fighters, and its design, as in most machines of its type, was obviously very much a compromise between capacity within and streamlining without. The propellant, comprising 1,550lb. T-stoff and 490lb. C-stoff, was contained in tanks grouped about the c.g., and the machine's weight after take-off was 4,040lb., the wing loading 67.6lb./sq. ft., reducing to 27.0lb./sq. ft.

The wing had a span of 15.1ft. and an area, including anhedral tips, of 77.5 sq. ft. The wing fixing was high and about mid-way along the 23ft. length of the fuselage.

Operational Aspects

Designed to take-off along a vertical ramp, the "Julia" was assisted into flight by four 1,100lb. thrust di-glycol powder rockets, the initial acceleration being slightly in excess of 2g, and the rate of climb during the early phase 39,400ft. per minute.

The speed fell off from about 620 miles per hour just after take-off to 560 miles per hour at 36,000ft.

In comparison with the "Natter" the fire power of this machine was remarkably small. Two 30mm. cannons only were carried, housed in blisters one on either side of the cockpit and having 60 rounds per gun.

It is true that in this machine it would have been difficult to house a battery of explosive rockets without causing a disastrous movement of the c.g., after they had been fired, but apart from suspending them from beneath the wings, there appeared to be no easy solution. Wing mounts were not very desirable because of the extra drag that they would involve, and no doubt this was the main reason for fitting the two cannons.

If the rapid-climbing rocket interceptor is to hold a place in future defence systems, however, it is obvious that its fire-power must be substantially improved, and consequently the explosive rocket may be expected to displace the cannon shell. This implies the development of expendable or semi-expendable types, and the trend is evidenced by a report that large numbers of fighters, following the general design of the "Natter," are being produced for the Russian Air Force. It is well known that a great deal of research has been conducted since the surrender at Peenemunde, where Russian and German technicians now work side by side.

Of further interest is the fact that the "Natter" (along with the Me. 163B) was found under construction in Japan, drawings having been dispatched from Germany by submarine. The manufacturing rights of the Walter 109-509A1 engine had been previously acquired in 1944 at a cost of 20,000,000 Reichmarks.

The two remaining rocket types were the EF-127 "Walli" (Fig. 80), a Junkers project, and the Messerschmitt 1104 (Fig. 81), both of which had normal flight characteristics, taking off on jettisonable wheels and landing on skids. They were each to be powered by the standard HWK 109-509B Walter engine.

The Me. 1104

This small fighter was another that might easily have been mistaken for a light glider. The fuselage, 18ft. in length, was almost cylindrical in section, rounded at the nose and slightly tapered towards the tail. A tall oblong fin and rudder emerged vertically from the centre-line of the rear fuselage, and the square-tipped plane was attached to the fin just above the root.

A well-faired cockpit was placed about a third from the nose with a shoulder wing fixing for the 20ft. 4in. span mainplane, which, like the tail surfaces, was square cut.

The all-up weight was 5,300lb. at take-off, including 1,980lb. T-stoff and 660lb. C-stoff, and the initial wing loading 75.5lb./sq. in.

Without resorting to auxiliary rockets, the take-off run was only 170 yds., the designed rate of climb being the same as that specified for the "Julia," 39,400ft. per minute. The initial acceleration was 1.45g., and, having climbed to 40,000ft., the machine was said to be capable of gliding a distance of over 50 miles, which was usually ample to reach a landing base. The difficulty, however, was that the glide range was appreciably less should the motor cut out at a lower altitude.

The armament was limited to *one* MK.108 30mm. cannon, with 100 rounds.

Fig. 79.—The Heinkel "Julia," in which the pilot occupied a prone position. Like the "Natter," it took-off along a vertical ramp.

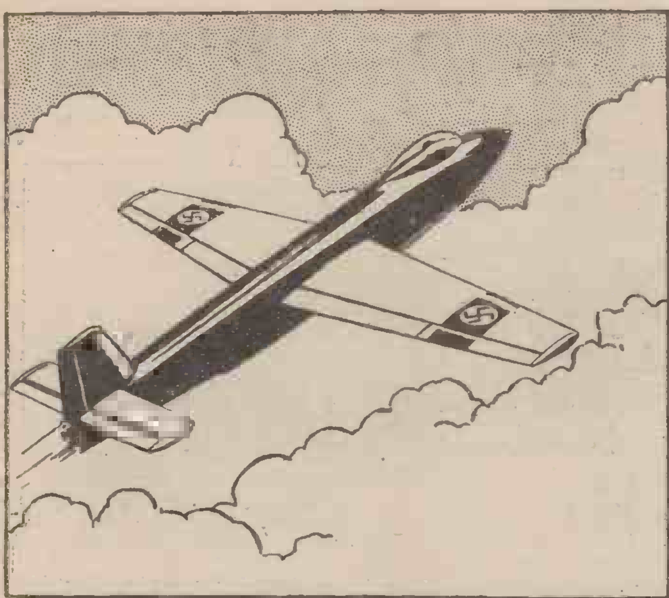


Fig. 80.—The Junkers "Walli." A better-looking aeroplane than its contemporaries, but lacking in many respects.

The "Walli"

There could be no excuse for mistaking the purpose of the "Walli." Its fuselage was cylindrical in section, pointed at the nose, narrowing towards the tail, and mounted high at the tail end was an oblong stabiliser with a single vertical fin and rudder. The short span wings were even more to the rear than in the previous designs, the root fixing being slightly below the fuselage centre-line.

As was the case in the Me. 163 and Ju. 8-263, a small wind-driven generator at the nose supplied the electrical services, whilst the pilot's cabin just aft of this was covered by a nicely designed "clear-view" hood.

Weighing 6,450lb. when fully fuelled, the machine was airborne within 370 yds. This was from a standing start, unaided by rockets or any other catapulting device, and rising from the ground at the rate of 26,000ft. per minute, the pilot experienced a maximum acceleration of only 0.67g.

The maximum speed achieved in level flight at sea-level was in the region of 630 miles per hour, but at 36,000ft. this figure had dropped to 560 miles per hour.

All other essential details, weights and dimensions, are as follow: propellant, T-stoff 2,400lb. and C-stoff 1,100lb.; weight (immediately following take-off), 6,140lb.; and weight (dry) 2,720lb. The wing loading at take-off was 68.0lb./sq. ft., reducing to 28.8lb./sq. ft. at the time of landing. The wing was only 20.7ft. in span with an area of 95.7 sq. ft.

It was intended to use two 1,100lb. thrust A.T.O. rockets acting for six seconds in the production version.

The armament was precisely the same as fitted in the "Julia," two Mk. 108 cannon firing 60 rounds per gun.

Summing Up

Despite many admirable points, it is obvious that these fast-climbing interceptors also embodied weaknesses, summarised as follow: (a) the limited duration of flight under power, (b) the need for a horizontal take-off run in the "Walli" and Me. 1104, (c) the small fire-power of all machines other than the "Natter," and (d) the increased liability to error in sighting due to the high speed of engagement.

Apart from (a) the semi-expendable "Natter" suffered none of the disadvantages, as obviously (d) did not apply as the machine was in essence a piloted missile—and a very effective one at that.

It was also obvious that to be fully effective these machines should take off from the precise spot from which they could rise directly in way of the attacking bombers as they formed for their "run in." Had it not been found possible to arrange vertical launching, special take-off strips would have had to be constructed and, of course, this was largely impossible within the suburbs of most cities. The only other alternative was to use the standard air-fields, most of which were placed on the outskirts of industrial areas, and whereas rocket fighters could be operated from these, their small-powered endurance did not permit them to cover all points of the compass. It thus became essential to disperse these interceptors more or less in a circle around the more vital potential targets, leaving the use of airfields to the jet and propeller fighters, which were less affected by their disposition at take-off.

Future Defence Methods

The exceptional climbing rate is, of course, the most favourable advantage, especially in view of the present trend towards jet-powered bombers, which should prove able to range abroad with almost the same fleetness as present patrol fighters.

Such high-speed invaders will not allow much time for even jet fighters to fly off and climb to interception height. It will therefore become increasingly more the job of the guided missile, and (though perhaps only as an interim measure) the expendable interceptor, to check the initial assault, leaving the rocket-boosted "jets" to engage where possible, but coming into full play as the bombers turn for home.

Eventually, with the further development of radar guiding technique, there is no doubt that the human element will be eliminated altogether, making obsolete the orthodox fighter; but then by the same token so also will the piloted bomber have become a weapon of the past. It is no secret—although only because rocket experiments are difficult to conceal—that technicians in each of the principal nations are pressing ahead with research to make the long-range rocket strategically accurate. Already, in fact, the establishment of a regular Atlantic rocket-mail service, England to America, is officially contemplated, not as a possibility of the remote future, but in terms of a few years' further development. The long-range mail rocket obviously is not far removed from the war rocket, with its more sinister cargo of plutonium explosive.

The significance here does not remain alone in terms of a weapon with better potentialities for destruction. From the political viewpoint we may find the rocket of infinitely greater value than a thousand Peace Conferences, for few nations, no matter how ambitious in outlook, would wish to enter into a war in which atomic bombs could be so simply exchanged on all sides.

Walter Units—Early Tests

These few details of German attempts at rocket interceptor design are sufficient to give some idea of the faith the German Air Ministry placed in the Walter engines, which, contrary to general belief, were not purely a wartime development.

It is, in fact, surprising to find that the first flight tests of a T-stoff rocket unit took place in the autumn of 1936; the 'plane a small primary trainer, the Heinkel 72 "Kadett."

This pioneer motor was exceptionally small, and very simple. The T-stoff (concentrated hydrogen peroxide) was fed by air pressure into a single combustion chamber which itself was filled with a paste catylist. Combustion was, of course, spontaneous, and although the thrust was virtually constant, a degree of control was afforded by an "on"-"off" lever which worked a cock in the compressed air line.

A thrust of 150kg. (330.7lb.) was obtained for a specific consumption of about 9g/kg/sec., the power lasting for some 45 seconds.

This was quite an achievement in those early days, but the D.V.L. pilots who carried out the tests were not that much overawed by the results. The thrust and power duration were reasonable, but these factors were greatly outweighed by the lack of control. This was apparent from the outset, and consequently no very extensive flight trials were made with this installation. Instead, research was directed towards perfecting a suitable *liquid* catylist, and eventually success was found in the use of Z-stoff, a saturate aqueous solution of calcium (or sodium) permanganate.

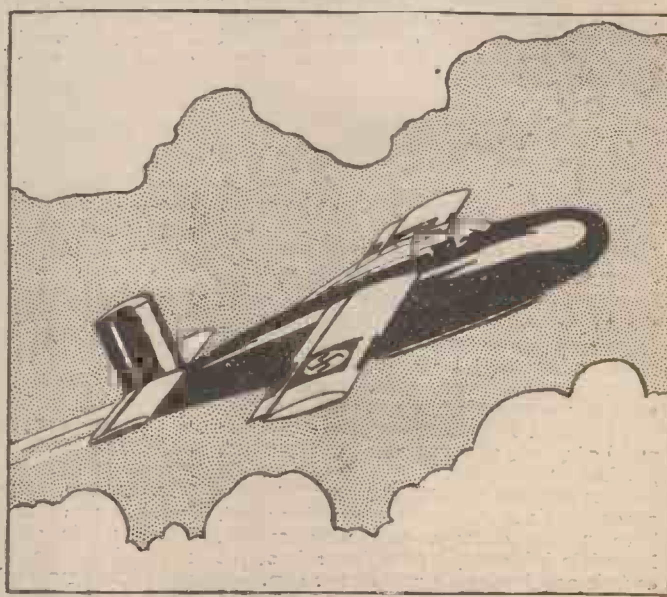


Fig. 81.—Another enterprising project, the Me.1104. Although strictly "utility" in appearance, it could climb at over 39,000 feet per minute. A great weakness was the fact that it carried only one cannon.

A new motor was then built, and after a series of bench tests was fitted in a F.W.56 "Stösser." The results of flight trials at Neuhardenberg in the summer of 1937 proved beyond all doubt the efficiency of the system, but it was somewhat surprising that again no attempt was made at varying the thrust. It was, however, an easy matter to throttle two liquids, and this further refinement was left to later development.

The Z-stoff was fed by air pressure in precisely the same manner as the peroxide, the two components coming together in the ratio of about 1 : 20 to yield 300kg. thrust for 30 seconds. A specific consumption of approximately 10g/kg/sec. was maintained throughout.

From this point on, progress was largely in the perfection of details, with Walter working at Keil mainly responsible for the fundamental research. Then, with the coming of war, another experimental factory was set up at Beerberg, in Silesia, where in 1942 Dr. I. N. Schmidt was put in charge of development. It was here that most of the prototype Walter engines were built and bench tested before being handed over to the Heinkel works at Jenbach for production. Flight tests were carried out at Peenemunde, Rechlin, Lechfeld and other airfields in the Beerberg area.

Among the first service aircraft to be fitted with controllable rocket boosters were the Messerschmidt 109E and the Junkers 88. Both of these installations were, however, experimental, and it was not until late 1943 that the rocket engine was sufficiently developed for operational use.

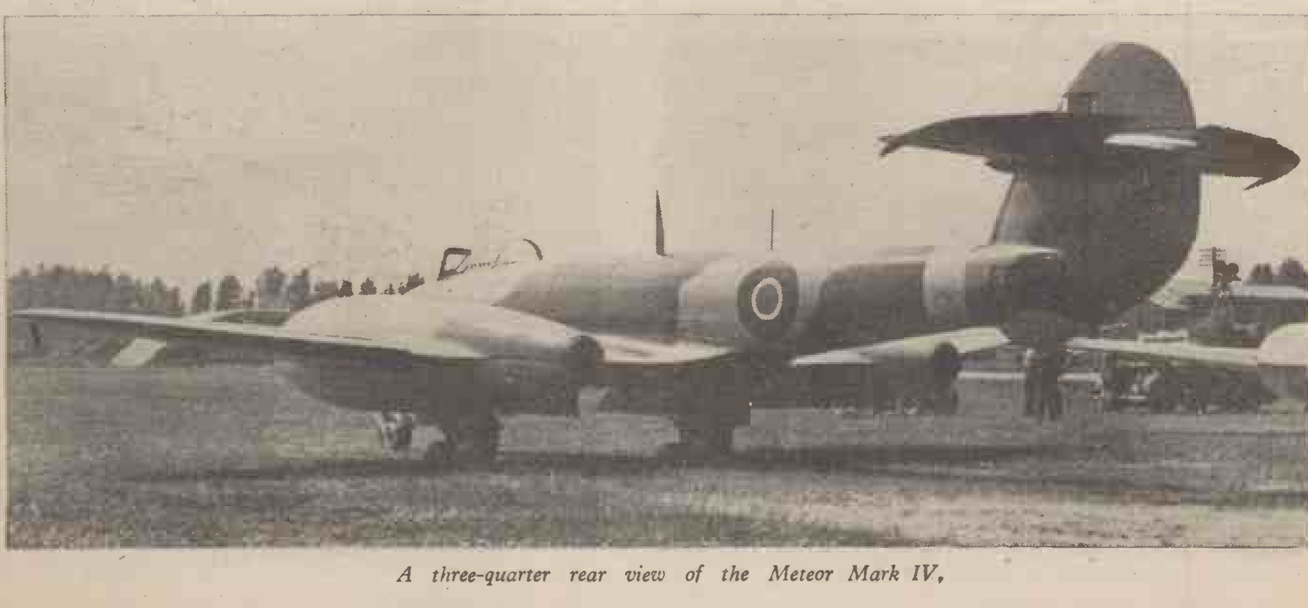
(To be continued)

The Air-speed Record

The Meteor Mark IV in flight, piloted by Group Captain E. M. Donaldson.

THE attempt to raise the air-speed record above the 606.25 miles an hour established on November 7th, 1945, was made on Saturday, September 7th this year, and a new record of 616 miles an hour was established over the three-kilometre course between Bognor Regis and Worthing. The speeds for the four laps flown by Group Captain Donaldson were 623, 610, 623 and 609 miles an hour, giving an average of 616 miles an hour. Squadron Leader Waterton averaged 614 miles an hour in four laps in a similar machine. The aircraft were similar to those used for the previous record, namely Gloster Meteor Mark IV fighters, powered by two Rolls-Royce Derwent Mark V jet-propulsion engines. The thrust of the Derwent V engine, as fitted in the standard service machine, is 3,500lb., but the jet-propulsion units used for the previous record were adjusted to give 3,600lb. thrust. For the latest record the thrust was given as 4,200lb.

Group Captain Donaldson checking up on the controls of the special Meteor IV.



A three-quarter rear view of the Meteor Mark IV,