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A.F.C. 123

AIR FIGHTING DEVELOPMENT UNIT

REPORT No. 38

on

TACTICAL TRIALS - MESSERSCHMITT 110

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R.A.F.STATION, DUXFORD.

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INTRODUCTION

1. In accordance with instructions received from Air Ministry (D.D.A.T.) a captured Me.110 fighter, which forced landed in this country in July 1940, was delivered to this Unit on 13th October 1941, for tactical trials.

2. The aircraft had been damaged and had to be dismantled and rebuilt by the R.A.E., Farnborough. During the period at Farnborough the superchargers were modified to bring the engines up-to-date. When captured this aircraft was not fitted with armour protection and the two cannon had been removed and replaced with a vertical camera, as the aircraft was on reconnaissance duties. In order to bring the weight of the aircraft up to its approximate full war load as a fighter, the camera was removed and ballast representing the weight of the two cannon and the ammunition for all guns was carried. It can therefore be assumed that apart from armour, the aircraft carried the full war load of the fighter version.

3. The Me.110 is also used by the G.A.F. as a low attack bomber in which case it can carry up to 2,000 kilos bomb load.

4. Owing to defects in the clutch of the superchargers on both engines, it was not possible to carry out representative trials above 20,000 feet.

BRIEF DESCRIPTION OF THE AIRCRAFT
(See Photograph at Appendix 'A')

General

5. The Me.110 is a low wing, twin engined, fighter monoplane fitted with two Mercedes Daimler-Benz 601A engines, and V.D.M. fully feathering variable pitch propellers. The airframe is of all-metal construction, with the exception of the control surfaces which are fabric covered.

6. A crew of three can be carried and is composed of a pilot, wireless-operator, and rear gunner for normal bomber and reconnaissance duties. When used as a fighter the crew is usually two.

Cockpits

7. Pilot's Cockpit - The pilot's cockpit is well laid out and is provided with a full set of blind flying instruments. The layout of the various controls is excellent and they are readily accessible. No heating is provided for either cockpit and during trials the crew suffered extreme discomfort at high altitude in cold weather. Provision however, is made for the use of electrically heated clothing but it was not possible for it to be tested by this Unit.

8. Rear Cockpit - The rear cockpit is large and comfortable and is fitted with a canopy which opens upwards to about 45 degrees and forms a very effective airflow deflector. The gunner is able to operate the free gun easily except under the influence of 'G', when it was found impossible to shoot with any degree of accuracy. The gun may be operated with the rear portion of the canopy open or closed. When it is closed the field of fire is very limited and vision poor.

Fuel and Oil Tanks

9. Two fuel tanks are carried in each wing root, one main, of 82 gallons and one reserve of 57 gallons, giving a total capacity of 278 gallons. Fuel is supplied to the engines from the main tanks only, and the contents of the reserve tanks are pumped electrically into the main tanks as required.

10. The oil is carried in two tanks, one in each wing behind the engine bulkhead; each tank holds approximately 8.8 gallons.

11. All fuel and oil tanks are self-sealing and appear to be of similar construction to those used on the Heinkel 111H.

Endurance

12. With normal tankage the maximum range is approximately 900 miles at a cruising speed of 200 m.p.h. Overload tanks can be fitted allowing a total of 745 gallons to be carried and extending the range to 2,000 miles.

AIRCRAFT CHARACTERISTICS

Fire Power

13. The normal armament of the Me.110 consists of 4 fixed MG-17 7·9 m.m. machine guns and 2 fixed Oerlikon 20 m.m. cannon all of which are situated in the fuselage firing forward. The rear gunner is provided with a hand-held MG-15 7·9 m.m. machine gun. On the aircraft available for trials the cannon were not fitted and ballast was carried in lieu.

14. The 4 MG-17 machine guns are belt fed, having an ammunition capacity of 1,000 rounds per gun. The 2 cannons are magazine fed, each magazine holding 60 rounds and they are mounted sufficiently far aft for the breech end to be in the rear cockpit so that magazines can be changed by the air gunner or Wireless Operator. Stowage is provided for a total of six spare magazines.

15. The cannon and fixed machine guns are cocked electro-pneumatically and fired electrically. Separate firing buttons for cannon and machine guns are fitted on the control column and the guns can be selected and fired in the following combinations:-

(i) 2 Machine Guns.
(ii) 2 Machine Guns and 2 Cannon.
(iii) 4 Machine Guns.
(iv) 4 Machine Guns and 2 Cannon.

16. The MG-15 for the rear gunner is magazine fed, each magazine holding 75 rounds and there is stowage for 10 spare magazines. An experienced gunner should be able to change a magazine in about 10 seconds.

Field of Fire

17. The field of fire of the rear gun is greatly restricted, extending about 30° on either side of the centre line of the aircraft. The maximum elevation is 60° and it is not possible to fire below the horizontal.

Firing Trials

18. No firing trials were carried out by this Unit owing to the absence of the two cannon and the fact that the 7.9 mm. Machine gun had been fired during the Ju.88 trials. (See Report No.33, - A.F.C.117 - para.9).

Sights

19. The reflector sight fitted in the pilot's cockpit is very efficient. The lines are thinner than those of the G.M.2 sight and can be dimmed right down to "off". There is no adjustment for range or wing span of target.

20. The rear gunner's sight is a ring and bead, with the bead close to the gunner's eye and the ring at the muzzle end of the gun.

Harmonisation

21. It was not possible to ascertain the harmonisation scheme as the guns had been removed whilst the aircraft was being rebuilt. The four fixed MG-17 guns were replaced before the aircraft was delivered to this Unit. On examination it was found that the amount of adjustment available on the four guns was good and gave a large choice of harmonisation schemes.

Armour

22. The aircraft was not fitted with armour plate, but the armour now normally carried is shown in Appendix 'B'. The protection for the rear gunner is thought to act also as a strengthening bulkhead and is probably a standard fitting on the later versions of the Me.110.

TACTICAL TRIALS

Flying Characteristics

23. General - The aircraft is very pleasant to fly and easy to take off and land. It handles more like a single engined fighter than a twin, the controls being comparatively light at all speeds. It was found that when dived at an indicated air speed of 340 m.p.h. the controls do not stiffen appreciably and the aircraft is still fully manoeuvrable.

24. Performance - Comparative speed trials were carried out with a Hurricane I, and a Spitfire VB. Trials were not carried out above 20,000 ft. as the performance of the engines of the Me.110 was not reliable above this height. At 5,000 ft. the Hurricane was 15 - 20 m.p.h. faster than the Me.110 but at 20,000 ft. the Me.110 was 2 or 3 miles faster than the Hurricane. The Spitfire was considerably faster at all altitudes the difference being about 40 m.p.h. at 20,000 ft. The rated altitude of the Me.110 is about 17,000 ft.

25. Instrument Flying - The aircraft can be trimmed to fly "hands-off" and this, combined with the well-balanced controls and good view of the instrument panel, makes instrument flying easy.

26. Single-engine flying - The aircraft flies well on either engine. It is able to climb and maintain height easily without feathering the propeller. With the propeller feathered the single engine performance is improved considerably, and the aircraft may be turned comfortably both with and against the live engine.

27. Low Flying - This aircraft is very suitable for low flying due to its good manoeuvrability, handling qualities and pilot's view.

28. Formation Flying - The aircraft is easy to handle in formation due to the pilot's good view, good throttle response and deceleration.

29. Night Flying - No night flying was carried out with this aircraft but the engines were run at various throttle openings to ascertain the amount of illumination given from the exhausts at night. This illumination was found to be extremely slight. From immediately ahead and astern no light was visible at more than 50 yards. At 50 yards only four small pale orange specks could be seen. From either beam no light was noticeable at 100 yards and at 50 yards only a thin pale orange line could be seen.

30. The instrument panel is illuminated by two screened lights situated on the top of the panel and the compass by a separate low power light. The lighting generally appears satisfactory and even when full on gives no reflection on the canopy.

Search

31. The all-round view from the pilot's cockpit is exceptional, an unusual feature being that when looking to the rear it is possible to see the whole tail unit through the perspex canopy. The usual German practice of fitting flat panels gives the crew an undistorted view. The view from the rear cockpit is also excellent.

Sighting View

32. The sighting view is excellent and enables the pilot to carry out deflection shooting from all angles. The sight is mounted so that the ring appears in the centre of the windscreen and well above the nose cowlings.

Slipstream

33. The slipstream at 100 yards is strong and drops about 5 degrees below the aircraft. At 200 yards it is dead astern and at its strongest. It then gradually diminishes until at 300 yards it is not likely to upset the aim of a fighter pilot.

Manoeuvrability

34. Introduction - The Me.110 is very manoeuvrable and no difficulty was found in placing and holding a bomber target in the sight. Results of cine films taken show very steady shooting. Its manoeuvrability was compared with that of a Hurricane I and Spitfire VB at various heights.

35. Turning - The Me.110 was positioned immediately behind each of the other aircraft in turn. The leading aircraft then turned as quickly as it could with the Me.110 attempting to follow. The number of turns taken for the leading aircraft to position itself on the tail of the Me.110 was noted. It was found that each of the single seater aircraft could easily out-turn the Me.110 at low altitude but the advantage was less marked as height was increased up to 20,000 ft. when the average number of turns required was four.

36. Diving - The controls do not stiffen appreciably during a dive and with direct injection fuel systems the engines do not cut under application of negative 'G'. To test the tactical aspect of this, the Me.110, Hurricane I and Spitfire VB were flown in line abreast. The control column of the Me.110 was then pushed forward very quickly. The Hurricane and Spitfire lost a few lengths, as their engines cut, but were able to make up the lost distance rapidly and hold the Me.110 throughout the remainder of the dive.

37. During the tactical trials it was found impossible for the pilot of the Me.110 to maintain maximum permissible output from the engines and keep the r.p.m. within the limits when engaged in air combat. The pitch of the propellers is infinitely variable and is changed manually by the pilot who has to hold two electric switches in an "up" or "down" position whilst the pitch is changing. The rate of change of pitch appears very slow compared with the rapid variation in r.p.m. when the aircraft is suddenly put into a dive or climb. This is particularly noticeable in the dive and during dog-fighting when it is very easy to exceed the maximum permissible r.p.m.

Attacks

38. Astern Attacks - A fighter attacking the Me.110 from astern can avoid return fire from the single MG-15 machine gun providing he keeps below the tail plane. Whilst some protection is given to the crew by armour plate, as is shown in para.22 and Appendix 'B', the engines are unprotected.

39. Quarter and Beam Attacks - Return fire can be avoided if the attack is made from below. From level or above up to 60°, return fire from the rear gun can only be effective when the fighter is between 30° and astern, but if the Me.110 is taking evasive action it has been found that due to the limitations of the free gun mounting and the effect of 'G', accurate shooting is extremely difficult. The pilot and crew have no armour protection from these attacks.

40. Head-on Attacks - The Me.110 pilot and crew are well protected with armour plate from frontal attacks and an attacking fighter would of course be met with the return fire of the fixed armament of four machine guns and two cannon.

41. Night Fighter Attacks - Fighters should normally attack from astern and slightly below. Free gun fighters from anywhere below.

Evasive Action

42. Comparative climbs were carried out with Hurricane I and Spitfire VB at heights up to 20,000 ft. It was found that there is little difference between the rates of climb of the Me.110 and Hurricane, but the Hurricane fell away when it attempted to follow and shoot on the climb, owing to the much steeper angle of the Me.110. The Spitfire can easily outclimb the Me.110, but does so at a faster air speed and less steeply. If it attempted to follow the Me.110 it sacrificed its superior rate of climb.

Trials showed that at heights below 5,000 feet it could follow and could shoot with reasonable accuracy, but it fell behind as height was gained up to about 15,000 feet. Above this height, however, due to the state of the Me.110's engines and the fact that the Spitfire was reaching its rated altitude, it was able to close range on the climb. It was thought that had the Spitfire attempted to fire its cannon between 5,000 and 15,000 feet, it would have stalled as its air speed was very low. Generally, therefore, if the Me.110 attempts to evade in a long climb the fighter should not follow but should gain height at its own best speed in order to avoid being at a tactical disadvantage.

43. As the trials have shown, the Me.110 can be easily outmanoeuvred especially at low altitudes by single engined fighters but having good deceleration and a steep climbing angle it can temporarily break off from an attacking fighter by pulling its nose up to its steepest climbing position, thus causing the attacker to overshoot. This does not give the Me.110 any tactical advantage if the fighter comes in to attack again quickly.

44. If a fighter is positioning to attack from astern and is seen early by the crew of the Me.110 a quick turn through 180° when the fighter is about 1,000 yards away will give the fighter a difficult head-on attack and allow the Me.110 a chance of using its front armament. Although this manoeuvre can be repeated several times, sooner or later the fighter will be able to close range and obtain the advantage.

CONCLUSIONS

45. The forward armament of 2 cannons and 4 machine guns is formidable, but the rear armament consists of a single gun with a very limited field of fire. (paras.13-17).

46. The pilot is particularly well protected by armour plating in front of him, and it appears that it is now standard to fit an armoured bulkhead behind the rear gunner. The engines are not protected but the fuel and oil tanks are self-sealing. (paras. 11 and 22).

47. The Me.110 is very manoeuvrable for a twin-engined aircraft and the controls are comparatively light at all speeds. (para.23).

48. Comparative speeds obtained showed the Hurricane I to be faster than the Me.110 by 15-20 m.p.h. at 5,000 ft., but slower by 2-3 m.p.h. at 20,000 feet. The Spitfire was faster at all altitudes. (para.24).

49. The single engine performance is good. (para.26).

50. The exhaust flames are well damped so that by night they cannot be observed from ahead or astern at more than 50 yds. (para.29).

51. The all-round view from both cockpits is exceptional. (para.31).

52. The pilot's sighting view is excellent. (para.32).

53. The Me.110 is a very steady gun platform. (para.34).

54. The Hurricane I and Spitfire VB were able to out-turn the Me.110 at all heights but their advantages were less marked at altitude. (para.35).

55. The initial acceleration of the Me.110 in the dive was better than that of the Hurricane or Spitfire VB but both were able to catch up and hold the Me.110 easily. (para.36).

56. In combat it was impossible to maintain the maximum output of the engines without exceeding the r.p.m. limits. (para.37).

57. Attacks on the Me.110 should be from astern, quarter or beam and from slightly below in order to avoid return fire from the single rear gun, head-on attack being avoided as far as possible. (paras. 38-40).

58. The angle of climb of the Me.110 is steeper than that of Hurricane I or Spitfire VB and these aircraft should not attempt to follow in the climb as they will not be making the best of their own rates of climb, which, in the case of the Hurricane is equal to the Me.110 and in the Spitfire is considerably superior. (para.42).

A.F.D./3/19/53.
16th March 1942.

Wing Commander,
Commanding, A.F.D.U.