

AIR FIGHTING DEVELOPMENT UNIT,
R.A.F. STATION, DUXFORD.

REPORT No.37

on

TACTICAL TRIALS - TYPHOON I AIRCRAFT

INTRODUCTION

1. On Air Ministry instructions, one Typhoon I (R.7580) was delivered to the A.F.D.U. on 31st August 1941, and a second (R.7581) on 7th September 1941, for tactical trials with full war load, in accordance with this Unit's standard programme.

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

General

2. The Typhoon is a single seater, single engined, low wing monoplane fighter. It has a fully retractable undercarriage and tailwheel, and split trailing edge flaps controllable throughout their range. It is fitted with a Napier Sabre II sleeve-valve engine of 2040 h.p., having a two-stage supercharger and a constant speed hydromatic airscrew. The armament of the aircraft available for trials consisted of 12 - .303 Browning guns. It is understood, however, that a 'universal' wing is being designed which will allow variations in armament; also that in the near future, the Typhoon I will be equipped with 4 - 20 mm. cannon in place of the 12 Browning guns.

3. The undercarriage, flaps and radiator shutter are hydraulically operated by an engine driven pump, and a hand pump is provided for use in the event of engine pump failure. If the hydraulic system cannot be operated by either pump, the undercarriage and tailwheel can be unlocked by depressing two emergency levers with the feet and the undercarriage will then come down under its own weight. Trimming tabs for the rudder and elevators are adjustable from the cockpit. The all-up weight of the aircraft with 12 - .303 Browning guns and ammunition is about 10,630 lbs.

Pilot's Cockpit

4. The Pilot's cockpit is roomy and comfortable and the positioning of the controls and instruments is good.

5. Access to the fully enclosed cockpit is by means of car-type doors fitted with roll-down type perspex windows which can be locked in any position. The roof of the cockpit is hinged on the port side and can be lifted to facilitate entry and exit on the ground. Both doors and the roof can be jettisoned in emergency.

Endurance

6. The fuel and oil capacities are 151 galls. and 16 galls., respectively. The fuel is contained in 4 self-sealing tanks situated in the wings. The main tanks between the two main spars each contain 40 galls., and the nose tanks in the leading edges of the mainplane hold 35½ galls. each. Each pair of tanks is inter-connected, but the system has not proved satisfactory as it was found that one tank emptied before the other if the aircraft was flown with a slight skid. If this occurs, it is necessary to change over to the other two tanks, as it is not possible to draw petrol from one tank alone when the other is empty. It is

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understood that a modification is being incorporated to provide an efficient cross-feed.

7. Approximate endurance figures, after allowing sufficient petrol for a quick climb and return to base, are as follows:-

	<u>Height</u>	<u>I.A.S.</u>	<u>Time</u>
Max. continuous cruising conditions	10,000 ft.	305	1 hr.
Most economical cruising	10,000 ft.	217	2 hrs. 30 mins.
Max. continuous cruising conditions	20,000 ft.	272	55 mins.
Most economical cruising	20,000 ft.	182	2 hrs. 20 mins.

TACTICAL TRIALS

Flying Characteristics

8. The aircraft is pleasant to fly and easy to land. The take-off is reasonably short but the aircraft tends to swing to starboard, and cross-wind take-offs with the wind on the starboard side should therefore be avoided. When throttling back preparatory to making the approach for landing, it was found that the engine had an unpleasant flat spot which caused 'cutting'. This occurred at comparatively high revs. and low boost, but the engine came on again as soon as the throttle was opened. This is considered most unsatisfactory, but it is understood that Messrs. Napiers have been instructed to rectify the fault as soon as possible, as it is prevalent in all the Sabre II engines.

9. The controls are well-balanced and comparatively light, and at speeds above 400 m.p.h., I.A.S., there is little tendency to "heavy-up", the elevators still being pleasantly light. The Typhoon has been dived up to 480 m.p.h., I.A.S., and although the aircraft tends to turn to the left at this speed, it can easily be kept straight by use of rudder bias.

10. A graph showing the approximate comparative speeds of the Typhoon I and Spitfire VB and the time taken for an operational climb to 30,000 feet is attached as Appendix 'B'. With full throttle and maximum revs. of 3700 r.p.m., the rate of climb falls off to 500 ft/min. at 31,500 feet. The operational ceiling for a squadron of these aircraft is considered to be about 26,000 feet, at which height the controls are still good and the maximum speed high.

11. The aircraft behaves normally in aerobatics, but the pilot is conscious of flying a fighter which is heavier than contemporary types.

Search

12. The all-round view from the pilot's cockpit is not good, especially to the rear. The forward view is restricted by the frames supporting the bullet-proof windscreen and cockpit roof, and the view to the rear is obstructed by the cockpit fairings. The roll-down perspex side windows are easily scratched and are then difficult to see through. It is understood that modifications improving the all-round view will be incorporated as soon as possible.

Formation Flying

13. The aircraft is simple to handle in formation, although its deceleration is poor owing to its clean lines. The take-off, provided care is taken to avoid a swing to starboard, is straightforward. Landing in formation, however, is not considered desirable until the flat spot in the engine is cured.

Manoeuvrability

14. The aircraft was compared with a Spitfire VB between 15,000 - 26,000 feet for manoeuvrability in dog-fighting, both aircraft carrying full war load. The Typhoon, although not quite as manoeuvrable as the Spitfire, could get in a good burst during the initial stages of a turn. During the turns it was found that the Spitfire could always turn more tightly than the Typhoon and that if the

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Typhoon was behind, the Spitfire could get on to the Typhoon's tail after about two complete turns. Use was made of the Typhoon's superior speed and consequent high initial rate of climb to get away from the Spitfire and obtain a height advantage. The Typhoon could then carry out continued diving attacks, similar to those adopted by the Me.109F and could use the speed obtained in the dive and breakaway to regain its advantage in height.

15. It must be remembered that indicated air speeds of over 400 m.p.h. can be obtained quickly when diving the aircraft, and that the closing speed is greater than in contemporary types. The Typhoon must therefore be ready to take evasive action as it may easily overshoot its target. Similarly if fighting near the ground, the Typhoon must be careful when diving steeply, as the height required to pull out is considerable.

16. At 26,000 feet, steep turns to the right were found to be more satisfactory than to the left, probably due to torque. To the right a sustained turn with 4 or more 'G' was comfortable, whereas when turning steeply to the left with much less 'G', the turn tightened itself and the aircraft eventually flicked over to the right, losing about 2,000 feet. Below 20,000 feet the Typhoon is good in all turns and combat manoeuvres, but severe vibration of the airframe is apparent in steep turns of over 4 G.

17. On being attacked from above, it was found that the best evasive manoeuvre was a steep climbing turn towards the Spitfire as it came into range, providing that the Typhoon was utilising its high cruising speed. If the Typhoon was cruising at a low speed, the best evasive manoeuvre was a steep diving turn towards the opposing fighter as it came into range, at the same time opening the throttle fully to obtain maximum speed quickly. It was found that the Typhoon could out-dive the Spitfire with ease and could break off the combat as desired in order to regain a tactical advantage of height.

18. The poor view to the rear was a great disadvantage during the dog-fights and it was essential to use the utmost vigilance to avoid being "jumped".

19. Against a bomber target, the Typhoon was able to deliver good quarter and astern attacks, provided the target's speed was in excess of 160 m.p.h.; at lesser speeds the Typhoon was in difficulty because of the fast closing speed.

Slipstream

20. The Spitfire engaged in dog-fighting the Typhoon found that at 200 yards slightly below the Typhoon, slipstream was so strong that it made accurate sighting extremely difficult.

Low Flying

21. Although the pilot's view is poor, low flying in good visibility presents no difficulty; but in bad visibility, due to the high speed of the aircraft and restricted forward view, is unpleasant.

Night Flying

22. The aircraft was inspected on the ground on a dark night, and it was found that the two white cockpit instrument lights caused a reflection on the perspex, and did not illuminate the essential instruments. There was no illumination for the rudder and elevator trimming controls. Before night flying tests were carried out it was considered necessary to replace the white bulbs with standard orange bulbs, and move the lights to new positions in order to illuminate the essential instruments and eliminate the reflections. In addition, an extra light was fitted above the trimming tab controls. The aircraft was flown on a cloudless night with a three-quarter moon and slight haze, and no difficulty was experienced. There is a very faint glow from the exhausts which cannot be seen either by the pilot or by another aircraft. It is not possible to dim the horn indicator lamp, which is too bright at night.

23. The landing lamp was used on one landing and it was noticed that the perspex former in the centre of the landing lamp cover reflected into the pilot's eyes when the lamp was in the 'down' position.

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Instrument Flying

24. The aircraft can be trimmed to fly 'hands and feet off' and is simple to fly on instruments.

Sights and Sighting View

25. The aircraft is fitted with a standard G.M.2 sight with sun-screen. Spare bulbs are provided and can be changed quickly in flight. For sighting, the view forward is slightly better than from the Spitfire, but it is not as good as from the Hurricane.

Armour

26. The armour protection for the pilot is heavier than in previous fighter types but provides no protection below the seat or from the fine quarter to beam. The pilot is protected in front by a flush fitting bullet-proof windscreen and by the engine. The fuel tanks are self-sealing and the oil tank is protected by a heavy gauge duralumin cowling, but the glycol tank which is in the nose has no protection other than that afforded by the airscrew boss.

Radio

27. The aircraft is fitted with standard fighter radio equipment and the TR.1133 was quite satisfactory in range and reception.

Oxygen Equipment

28. Two oxygen bottles are provided, one in each wheel bay, and can be replaced quickly. The oxygen pipe bayonet union on the port side of the pilot's seat is readily accessible.

Engine Starting and Running-up

29. The aircraft is fitted with a Coffman cartridge starting system which is operated from the cockpit, six spare cartridges being carried in a bag in the port wheel bay. If the engine is overprimed it will be extremely difficult to start. It is thought that it will not be possible to guarantee a quick start in cold weather. Starting difficulties are believed to be due to carburation defects and it is understood that stops are being taken to remedy them.

30. The engine should not be run at full power on the ground unless the tail is lashed to pickets or holding-down rings, as due to the powerful slipstream it is dangerous for airmen to hold down the tail in the normal manner.

Quick Take-off

31. Several quick take-offs from 'Readiness' have been carried out with a single aircraft, and it was found that the time from receiving the order to take off to the aircraft being airborne averaged 4 minutes. It must be borne in mind, however, that this average was due to the engine starting on the first cartridge, in each case.

ARMAMENT CHARACTERISTICS

Gun Installation

32. The armament consists of twelve .303 Browning guns, six in each wing. The guns are fired by a standard type firing button, which is coupled to an electro-pneumatic relay in the gun bay.

33. The ammunition capacity is as follows:-

Port 1 & 6	- 460 rounds.
Starboard 1 & 6	- 460 rounds.
All other guns	- 500 rounds.

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Harmonisation

34. The method of harmonisation is similar to that of the 8-gun Hurricane, and all guns can be harmonised in about 30 minutes. A harmonisation diagram is attached as Appendix 'C'.

Stop-Butt Trials

35. It was not considered necessary to carry out stop-butt trials, as the gun installation is similar to that of the Hurricane.

Air Firing Trials

36. All guns were fired in level flight and under 'G' conditions at 2,000 and 30,000 feet, a total of 5350 rounds. Ten stoppages were experienced during these trials, five due to tight packing in the links causing misfeeds, three to lightly struck caps, and two to broken sears.

37. The aircraft shows little tendency to dip the nose whilst firing, and appears to be a steady gun platform. Cine camera gun films, however, have shown considerable vibration of the wings in level flight without the guns being fired.

Re-Arming

38. A quick re-arm can be carried out in 13 minutes by two armourers. Spare tanks for re-arming are unnecessary as the time taken to re-arm by changing tanks would be considerably longer.

Maintenance

39. The guns are easy to maintain and can be quickly removed, but the recoiling portions cannot be removed whilst the guns are installed.

Cine Camera Gun

40. The cine camera gun is mounted out-board of the gun bay on the port wing. The films taken during the trials have shown that considerable vibration is taking place and accurate assessment of the results is not possible. It is not easily placed for maintenance, the changing of a film taking about 15 minutes.

CONCLUSIONS

41. The pilot's cockpit is comfortable and well laid out. (para. 4).

42. The aircraft is comparatively light on controls, especially at high speeds. It is pleasant to fly and easy to land, but cross-wind take-offs with the wind on the starboard side should be avoided. (paras. 8 & 9).

43. The Typhoon I is about 40 m.p.h. faster than the Spitfire VB at all heights above 14,000 feet, and below this height is even faster. The true top speed of the Typhoon I is approximately 412 m.p.h. at 20,500 feet. (Appendix 'B').

44. The operational ceiling of a Typhoon squadron is considered to be about 26,000 feet. (para. 10).

45. The aircraft behaves normally in aerobatics. (para. 11).


46. The all-round view from the cockpit is poor; this disadvantage is keenly felt when searching and dog-fighting. (para. 12).

47. The Typhoon is not quite as manoeuvrable as the Spitfire VB. The Typhoon's best method of attacking an aircraft similar to the Spitfire, is to carry out short diving attacks, using its superior speed to regain height for further attacks. (paras. 14, 15 & 17).

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48. Against a bomber target, the Typhoon is able to deliver good quarter and astern attacks, provided the target's speed is more than 160 m.p.h. (para. 1.).
49. Low flying in good visibility presents no difficulties, but is unpleasant in bad weather. (para. 21).
50. No difficulty was experienced in flying the aircraft at night. The exhaust flames cannot be seen either by the pilot or by an observing aircraft. (para. 22).
51. The aircraft can be trimmed to fly 'hands and feet off' and is simple to fly on instruments. (para. 24).
52. The aircraft is fitted with a standard G.M.2 sight with sun-screen, and the installation is considered satisfactory. (para. 25).
53. The armour protection for the pilot is heavier than in contemporary types but provides no protection below the seat or from the fine quarter to the beam. (para. 26).
54. Engine starting and running-up requires care. (paras. 29 & 30).
55. A quick take-off from 'Readiness' takes about 4 minutes provided there is a good engine start. (para. 31).
56. The aircraft has a good armament and ammunition capacity. (paras. 32 & 33).
57. All guns can be harmonised in about 30 minutes. (para. 34).
58. All guns were fired in level flight and under 'G' conditions at 2,000 feet and 30,000 feet. (para. 36).
59. The aircraft provides a steady gun platform. (para. 37).
60. The re-arm can be carried out in 13 minutes by two armourers. (para. 38).
61. Films taken from the cine camera have shown that considerable vibration is taking place. (para. 40).

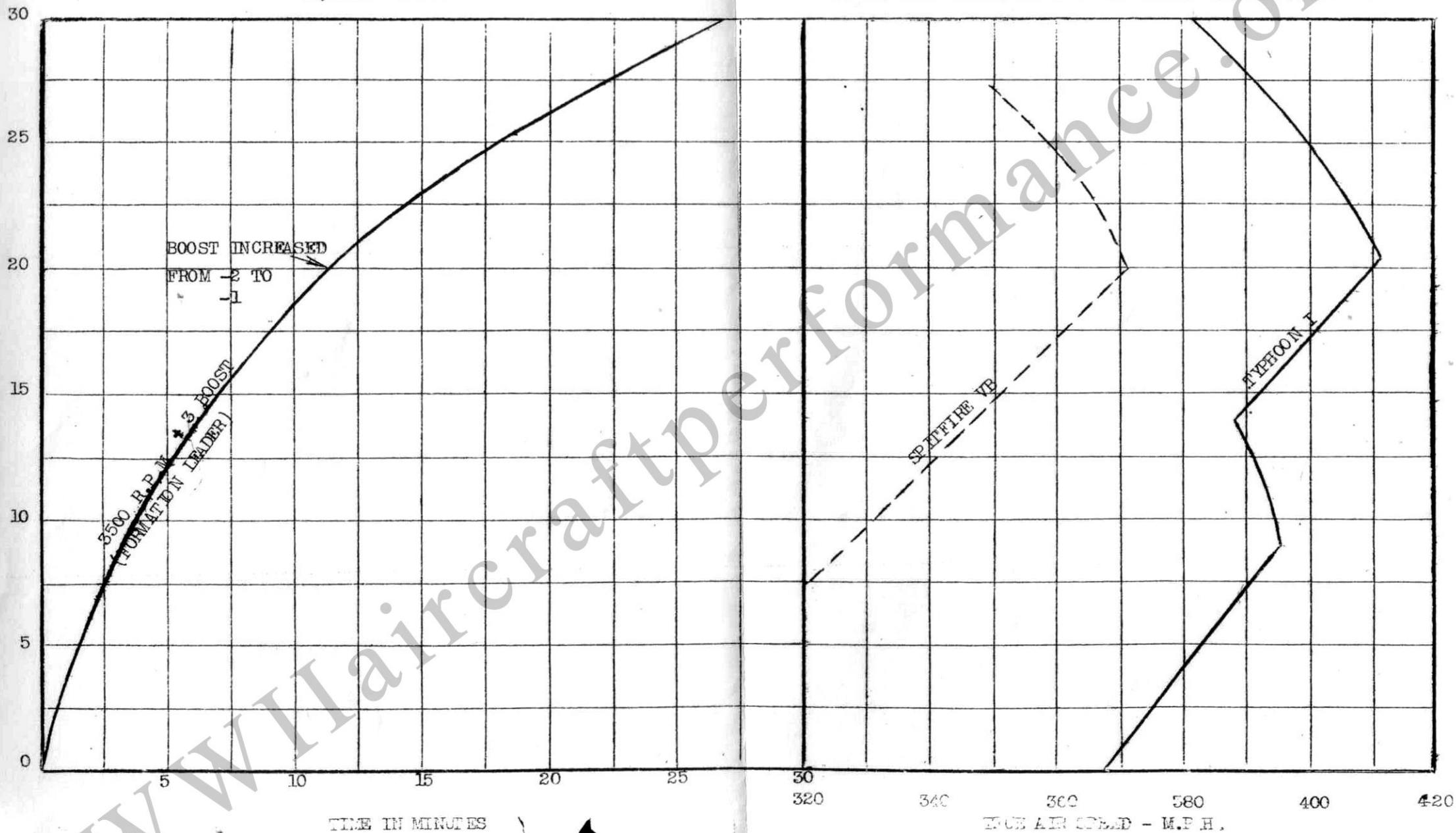
AFDU/3/19/50
30th October 1941.


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

TYphoon I

SQUADRON CLIMB

APPROXIMATE COMPARATIVE LEVEL SPEEDS WITH SPITFIRE VB



Appendix 'A'

