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AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT.

BOSCOMBE DOWN.

UNCLASSIFIED

TS. 18/7/63  
Kittyhawk A.K. 572.  
(Allison V.1710 - F3R)

Intensive Flying Trials  
Maintenance.

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This report deals with the aircraft (or equipment) as tested. Action to remedy defects or decisions to accept items not in strict compliance with the specification are matters for decision and action by the M.A.F.

A.&A.E.E.ref:- 4484/1 - A.S.76.

M.A.F. ref:- R.A.1871/D.A.N.A.1

1. Introduction.

Intensive flying trials were required on a Kittyhawk. The object of the trials was to prove the airframe and engine installation.

The trials were made during the period 7/2/42 to 28/2/42 and consisted of 150 hrs. flying. Although it was intended to complete as much of the flying as possible at or near the likely operational height of the aeroplane (15,000 ft) little of the total time was spent at such a height owing to the adverse weather conditions obtaining during the period.

It was intended, also, to obtain as much information as possible on the performance of the aeroplane so as to reduce the amount of work necessary to complete the type trials on the completion of the intensive flying programme. In fact, a considerable amount of information was obtained, but no one part of the performance test programme was in itself completed during the intensive flying, so that, although, as shown in Appendix 1, some part of the performance work was attempted in each flight, it was not until later that the separate tests were completed. These tests are being reported on separately in further parts of this Report.

2. Condition of aeroplane relative to tests:

The aeroplane was a standard American Curtiss P.40.E., or, in other words, it was not modified to suit British requirements.

The chief differences between the two types as far as the external appearance is affected are :-

- (1) This aeroplane had 4 - .50 machine guns in the wings. Later aircraft are to have 6.
- (2) A wireless mast is fitted on later aircraft.
- (3) In later aircraft, provision is made for the attachment of a fuel tank under the fuselage. This aeroplane had no such tank fitted.

3. Maintenance.

The greater part of the maintenance work was carried out at night in an unheated hangar. The aircraft, therefore, was not exposed to the full effect of the weather or operated under entirely dispersed conditions.

The maximum and minimum night temperatures during the test period were 39°F(+4°C) and 19°F(-7°C). Despite these low temperatures and the fact that the oil dilution system was not used during the test, on only one occasion was difficulty experienced in starting. This was after the engine had stood entirely uncowed for 19 hours in temperatures varying from 26°F(-3°C) to 32°F(0°C).

3.1. Engine Installation. No misalignment of cowling fasteners developed and no fasteners required renewal. The cowling showed no signs of wear or distortion.

With the exception of pipe line joint clips the installation has proved entirely satisfactory. No trouble was experienced with any auxiliaries and the accessibility suggests that no trouble should be experienced with the removal of any item. The oil system was drained at 60 hour intervals in accordance with the maintenance instructions and on no occasions was any deposit or foreign matter found in the oil filter.

3.2. Engine controls. No wear developed during the test but there was a tendency for both the throttle and mixture control levers to work back from some positions. In the absence of an adjustable friction device in the control box there is no ready means of overcoming this, other than the insertion of shims on the control spindle.

3.3. Fuel System. The American type of pipeline joint clip showed a tendency to work loose. Otherwise there were no maintenance troubles experienced.

The system consists of a main wing tank, a reserve wing tank and a fuselage tank of 51.5 gallons, 29 gallons and 42 gallons respectively -- a total of 122.5 gallons -- not interconnected and feeding to a common 4-way selector cock. A contents gauge is fitted to each tank.

The lack of a positive location at any position of the selector cock necessitated that the pilot should "feel" for the desired selection; this is open to criticism. Failure to position the cock correctly results in two ports being partially open with a consequent flow from one tank to another.

3.4. Oil System. One major trouble was experienced on account of a joint on the inlet to cooler pipe line being chafed through by the cooler mounting bracket. Local action was taken to prevent a recurrence and the constructors have introduced a modification to avoid this danger. This, with minor leaks through loosening of pipe joints, constitutes the only troubles experienced.

3.5. Coolant system. The system was entirely satisfactory, having given no trouble whatever. The total consumption of coolant for topping up during the whole of the test was only seven pints.

3.6. Hydraulic system. It is understood that modification action is being taken by the Constructors to overcome difficulties experienced with the gun charging circuits. Considerable fluid loss occurred through faulty valves and hoses until the circuits were isolated by blanking off. Apart from this, no trouble was experienced.

As the emergency system operates on the main wheels only, and does not lower the tail wheel, the system was not tried, owing to the danger of damage to the tail unit, for which spares were not available.

3.7. Ignition System. Although the magnetos and booster coils were entirely satisfactory, a considerable amount of trouble was experienced with the ignition harness during the last thirty hours flying.

This trouble was confined to the ignition plug end of the leads where the rubber insulation of individual leads broke down, possibly through local overheating and from which the spring contacts broke away from the core of the leads.

It would appear that the maximum effective life of the existing type of harness is approximately 120 hours.

3.8. W/T. Installation. In the absence of a wireless mast and V.H.F. equipment, no wireless trials were carried out.

3.9. Electrical Installation. The aircraft was fitted with a Leece-Neville voltage regulator which is known to be sub-standard and to permit of overloads in the system, which result in frequent breakdown of the regulator fuses with consequent failure of the charging system.

It is understood that this particular type of regulator is being replaced by one of different manufacture.

Apart from this item, the installation was satisfactory.

3.10. Instrument Installation. All the instruments worked satisfactorily, except the fuel contents gauges which under-read by about 5 gallons, and the artificial horizon which was replaced at 120 hours.

The instruments are not subjected to undue vibration. Removal and installation presents no difficulty in excess of normal.

3.11. Oxygen system. Entirely satisfactory.

3.12. Heating system. The cockpit heating system functioned satisfactorily whenever employed throughout the tests.

3.13. Flying controls. The ground locking device is satisfactory and easily fitted. Access for control adjustment calls for no criticism. No wear or backlash developed during the test.

3.14. Mainplanes. There are no signs of deterioration or of loose rivets.

3.15. Tailplane and fin. The remarks for the mainplane apply.

3.16. Control surfaces. No servicing has been necessary and no backlash has developed in the trimmer controls.

3.17. Fuselage. As for mainplanes.

3.18. Undercarriage and tyres. After rather less than 90 hours flying, the starboard undercarriage door was damaged through stickiness of the oleo leg gland preventing the leg extending fully immediately the aircraft became airborne.

A delay in retracting the undercarriage sufficient to allow the leg to extend fully would have prevented this.

In the absence of spare glands and to prevent a recurrence, the door was trimmed to clear the defective retracting leg. No other trouble was experienced.

The original tyres were used throughout and were retained on the aircraft at the completion of the test. No measurable creep was recorded.

3.19. Ancillary equipment. The equipment provided for towing, picketing and jacking is adequate and was used for all operations without difficulty. The slinging arrangements for salvage operations are satisfactory.

#### 4. General Maintenance.

The accessibility generally appears superior to that of most American fighter types and consequently maintenance is somewhat easier.

Daily inspections can be completed in 35 minutes whilst 30 and 60 hour inspections entail 40 and 60 man-hours respectively.

Refuelling the aircraft has averaged 15 minutes.

#### 5. Modifications recommended.

The American type of joint clip, due to it being very coarse thread, is not reliable and should be replaced by an approved type of English manufacture.

A hand controlled friction device on the throttle control box as used in this country would be of distinct benefit to the pilot.

The fuel selector cock should be provided with some form of positive positioning.

Installation has  
any auxiliaries  
interfered with the  
series in accord-  
any deposit or

Ignition harness lead ends should have fitted over the rubber insulation, a protecting composition sleeve and the attachment of the spring contacts should be improved.

There appears to be small advantage in incorporating an under-carriage emergency lowering system which does not operate the tail wheel; consideration of extension of the system to include this unit is recommended.

APPENDIX.

The following appendices are included for information:-

- APPENDIX I. ... Nature of flights undertaken, with a record of fuel and oil consumed.
- APPENDIX II. ... Record of condition of sparking plugs.
- APPENDIX III. ... Items of equipment repaired and replaced.

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Studs out the spring  
over the rubber

APPENDIX I.  
Consumption of Fuel and Oil During Tests.

Date.	Hours flown.	Nature of flights.	Fuel used(galls).	Oil used(galls).	Remarks.
FEB:					
7	7.00	Handling & experience of type.	237	3	
8	7.35	Aerobatics, and experience	274	2	
9	5.20	" " "	208	1.5	
10	7.25	Oil cooling levels, etc.	277	1.5	
11	4.40	A.D.M.293, High Partial	166	1	
12	8.20	Aerobatics, weak cruise.	307	9.5	Oil leaks.
13	8.30	Climbs, rich cruise, aerobatics.	287	7.5	" "
14	8.45	Ceiling climbs, levels, cooling levels, A.D.M.293	336	20.5	Severe oil leaks due to severed joint.
16	8.20	Level speeds, oil cooling levels.	270	2.	
17	10.05	Weak cruising, aerobatics.	310	1.5	
18	9.35	Weak cruising, consumptions.	280	1.5	
19	6.35	Consumptions and P.E. trials.	205	1.	
20	7.35	Consumptions.	215	1.5	
21	7.00	Consumptions.	255	1	
22	9.25	Consumptions, aerobatics.	290	1	
23	2.05	Handling.	75	-	
24	9.35	Aerobatics, rich cruise.	335	2.5	
25	10.40	Full throttle climbs, dives, aerobatics, level speeds.	400	3	
26	6.10	Rich cruising	225	1	
27	5.00	Weak cruising and aerobatics.	150	.5	

Total hours flown:- 150.05.

Total fuel consumed:- 5102 gallons.

Total oil used (for topping up): 62 galls.  
" " " (for inspection. Oil changes):  
21½ galls.

NOTE:

During the first three days of the tests it was noticed that considerable spillage of fuel was taking place from the scupper drains. The reason was sought, and it was discovered that there had been a tendency to overfill the aircraft tanks. A careful check was instituted and an improvement effected in this respect. After that period no spillage was apparent from the drains. The consumption of coolant during the tests was remarkably low. A careful check was maintained and the total used for topping up purposes throughout the tests was seven pints.

APPENDIX II.

Record of Sparking Plug Maintenance.

Date:	Plugs changed.	Condition of Plugs.	Remarks.	
FEB: 7	Exhaust.	Fairly clean. Greyish deposit on plugs from Nos. 4 cylinders both blocks.	Probably leads. Leads to these plugs eventually gave trouble.	
8	Inlet.	Fairly clean. Slight fouling, oil on one plug.		During first few days, roughness of engine ascribed to ignition, and plugs were examined. Subsequent the roughness was shown to be carburation roughness which was rectified by frequent venting of carb. fuel regulator chamber.
11.	Both	Fairly clean and free from fouling.	30 hr. inspection.	
15.	Both	Plugs in good condition.	60 hr. inspection.	
19.	Both	" " " "	90 hr. inspection.	
22.	Both	Several plugs showed signs of oiling and some leads bore evidence of shorting across the ends.	Condition of lead ends has been commented upon under the remarks on Ignition system.	
25.	Both plugs in No.4 cyl: both blocks.	Plugs were fouled and lead ends bore signs of shorting.		

Cleaned at 30 hrs.

Original set completed 150 hrs.

B.G.L.S.321.

APPENDIX III.

Items of equipment and components repaired and/or replaced during the tests.

<u>Date:</u>	<u>Description.</u>	<u>Reason for removal or repair.</u>
<u>FEB:</u> 6	Rage of limb Indicator.	Aircraft arrived with instrument U/S. This was replaced by instrument taken from another aircraft.
8.	Wireless aerial. between wing tips and top of fin.	Found broken at end of first flight of day. Repaired and replaced.
9.	Bracket holding fuel pressure warning.	Found fractured on daily inspection. Removed, welded, and replaced. The damage was not such as to immediately endanger the security of the warning device.
10.	Stbd. wheel brake.	Brake seized on turning. Wheel removed, brake examined, pressure found to have remained on owing to slight clogging of vent hole in the system. This was cleaned, the unit reassembled and replaced, and the system worked satisfactorily.
12.	Stbd. u/c door.	Found damaged at end of last flight of day. This was removed, straightened and replaced.
13.	Oil pipe joint clips.	Seepage of oil noted at joint to inlet side of cooler. The American type clips here were replaced with Jubilee clips.
15.	Stbd. u/c door.	Again found to be bent and cracked at outer edge, rear. This was discovered to be due to the starboard u/c leg not extending immediately the weight was removed on take-off, due to stickiness at the gland. As no packings were available for remaking the gland the door was cut two inches diagonally at the rear outboard side, stiffened, and refitted.
21.	Artificial horizon.	Found unserviceable and replaced with one taken from Mustang aircraft.
15.	Oil joint.	Oil joint on outlet pipe from cooler found partially severed. This was removed and replaced by another joint.

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