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9th Part of Report No.A.& A.E.E./783,a.

3 MAR 1943

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

Kittyhawk II F.L.220
(Merlin V.1650-1)

Brief handling trials

A.& A.E.E. ref: 4484/1-A.S.76/4.
M.A.P. ref: R.A.1871/D.A.N.A.1.
Period of tests: August-October, 1942.

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 Ministry of Aircraft Production.

Progress of issue of report.

Report No.	Title
4th Part of Report No.783,a.	F.L.220 - Climb and level speed performance and position error.
5th do.	F.L.220 - Engine cooling trials.
6th do.	F.L.220 - Radio trials - Communication sets.
7th do.	F.L.220 - Cabin heating tests.
8th do.	F.L.220 - Fuel consumption tests.

1. Introduction.

This report records the handling characteristics noted on this aircraft during the course of the performance tests carried out while the aircraft was at this Establishment. The aircraft was very similar to a Kittyhawk I, the principal change being the installation of a Packard built Merlin V.1650-1 in place of the Allison V.1710-F.3.R. Only those features differing from the Mk.I are detailed and reference should be made to the 17th Part of Report No.A.& A.E.E./783 for handling tests on the Mk.I. This report is issued chiefly for record purposes.

2. Condition of aircraft relevant to tests.

2.1. General. The principal features of the aircraft were:-

A Curtiss electric, 3-bladed propeller, 11 ft. diameter, metal blades.
Six ejector stub exhausts.
Aerials from fin to each wing tip and to rear of cockpit.
I.F.F. aerials.
External rear view mirror.
Three 0.5 in. guns in each wing, with muzzles protruding about 3 in. from the leading edges of the wings. Muzzles were tape bound.
Ejection chutes beneath wings open.
Fittings beneath fuselage for external bomb or fuel tank, neither of which were fitted.
Camera gun housing beneath starboard wing.

2.2. Loading. The aircraft was flown at the following loadings:-

	All-up weight	Distance of C.G. aft of datum
(i) Typical service fighter load	8910 lb.	24.7 in.
(ii) Forward C.G. limit	8030 lb.	19.1 in.

The limits of the centre of gravity range due to dissipation of load are from 19.1 in. to 25.4 in. aft of the datum.

All the above centre of gravity positions are with the undercarriage down. Retracting the undercarriage moves the centre of gravity aft by 1.3 in. at maximum load.

Tests at a further aft centre of gravity position were not made since it was considered that the tests on the Kittyhawk I adequately covered this, tests then being made with the centre of gravity 26.5 in. aft of the datum.

3. Tests made.

General handling tests, including dives, were made at each of the above loadings. The cockpit layout is also commented on.

/4.

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TEST REPORT No.

WEIGHTS AND LOADING DATA.

(in accordance with Weight Sheet Summary Serial No. A.P. Vol. III., Part 3.)

lb.

Tare weight
Weight light
Fixed military load
Service load
Fuel
Oil
Flying weight on trials
Maximum capacity of tanks:-
Fuel gallons.
Oil gallons.

Items.	Fixed Military Load.	Service Load.
1. Crew		
2. Gun load		
3. Bomb load		
4. Torpedo load		
5. Pyrotechnic load		
6. Electrical load		
7. Instrument load		
8. Miscellaneous load		
9. Wireless load		
Totals	(A).....lb.	(B).....lb.

TOTAL MILITARY LOAD (A) + (B) lb.

CENTRE OF GRAVITY with above load, including C.G. limits.

Results of test
4.1. Cockpit lay
Kittyhawk I. The p
(a) The radiat

4. Results of tests.

4.1. Cockpit layout. The layout of the cockpit was similar to that of a Kittyhawk I. The principal differences were:-

(a) The radiator exit duct gills were now controlled electrically instead of manually. The control was conveniently situated on the right hand side of the cockpit, and the position of the gills was satisfactorily indicated on a dial in front of the control switch.

(b) A friction locking device was incorporated on the throttle box which functioned satisfactorily.

(c) The rear view mirror was moved to starboard giving some improvement in the view.

4.2. Handling characteristics. The following remarks apply to the aircraft under both loading conditions unless the contrary is stated.

4.21. Ground handling. The handling on the ground was similar to the Kittyhawk I. When loaded to the forward centre of gravity position there was no tendency for the aircraft to nose over.

4.22. Take-off and initial climb. At the normal load take-offs were made with the elevator trimmer set to the marked take-off position. The take-off itself was normal and similar to a Mk.I. During the run there was a tendency to pitch longitudinally.

With the centre of gravity at its forward limit and using the same longitudinal trim setting the aircraft had to be pulled off the ground by a considerable force on the control column. It is, therefore, recommended that the trim be set about 4 divisions further back in this case. It is pointed out that, using normal service loadings, take-offs are not likely to be made with the C.G. as far forward as this since the case only occurs due to dissipation of load. The tail could be raised more easily at this loading, and the tendency to pitch longitudinally during the run was much less marked.

The characteristics on the initial climb and on retracting undercarriage and flaps were similar to the Mk.I.

4.23. General flying. The control and stability characteristics of the aircraft were very similar to those of the Mk.I. On this particular aircraft there was considerable friction in the aileron circuit which produced an adverse effect on self-centreing properties of the control.

When loaded to the forward C.G. limit it was not possible to trim the aircraft into a glide with flaps and undercarriage down at a speed below 108 m.p.h. A.S.I. A slight pull force on the control column was necessary at lower speeds. At the normal loading the precise speed at which it ceased to be possible to trim the aircraft was not noted, but it could be trimmed at the best approach speed with flaps and undercarriage down of 100 m.p.h. A.S.I.

4.24. Stalling characteristics. The following stalling speeds were observed:-

		Loading (i)	Loading (ii)
Flaps and undercarriage	UP	93 m.p.h.A.S.I.	89 m.p.h.A.S.I.
" " "	DOWN	83 m.p.h.A.S.I.	80 m.p.h.A.S.I.

In most respects the stalling characteristics were similar to those on the Mk.I. The following characteristics were observed during the brief tests made:-

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(in accordance with Weight Sheet Summary Serial No. A.P. Vol. III., Part 3.)

lb.

Tare weight
Weight light
Fixed military load
Service load
Fuel
Oil
Flying weight on trials
Maximum capacity of tanks:-
Fuel gallons.
Oil gallons.

Items.	Fixed Military Load.	Service Load.
1. Crew		
2. Gun load		
3. Bomb load		
4. Torpedo load		
5. Pyrotechnic load		
6. Electrical load		
7. Instrument load		
8. Miscellaneous load		
9. Wireless load		
Totals	(A) lb.	(B) lb.

TOTAL MILITARY LOAD (A) + (B) lb.

CENTRE OF GRAVITY with above load, including C.G. limits.

Flaps and undercarriage UP	Flaps and undercarriage DOWN
At loading (i) (C.G. normal)	
Warning of the stall was given by a slight vibration and the high position of the nose. At the stall the nose dropped, accompanied by a slight drop of the right wing. This occurred with the control column about central. When the control column was pulled right back the left wing dropped sharply. Recovery was effected by moving the control oolumn forward.	At the stall the right wing dropped sharply through a small angle. This was accompanied by some snatching of the ailerons and rudder. Recovery was effected by moving the control column forward.
At loading (ii) (C.G. at forward limit)	
At the stall the right wing and nose dropped sharply, the control column being about half way back from central. If the control column was pulled right back the left wing dropped more sharply than the right wing dropped previously. Considerably heavier pull forces were required than in the normal loading case.	Considerably larger control column force was required to produce the stall which occurred with the column almost fully back. The right wing then dropped fairly sharply.

4.25. Dives. The aircraft was trimmed for all-out level flight and dived to 450 m.p.h. A.S.I. at both loadings. In both cases it tended to yaw to the right and above about 400 m.p.h. A.S.I. the force required on the rudder pedal to hold the aircraft straight became excessive and some retrimming was necessary. The rudder control was very heavy at high speeds.

The push force on the control column during the dive was moderately heavy for the normal loading, but was excessive above 400 m.p.h. A.S.I. at the loading giving the forward C.G. limit. The aircraft was steady in the dives.

Recovery was normal on releasing the push force, no excessive accelerations resulting.

4.26. Approach and landing. At the normal loading the approach and landing characteristics were similar to the Mk.I. As already mentioned, with the C.G. at its forward limit and the aircraft trimmed fully tail heavy a slight pull on the control column was necessary at the best approach speed (100 m.p.h.A.S.I.) with flaps and undercarriage down. Using no engine a tail down landing could just be made by bringing the control column right back. Using a little engine there was more elevator control in hand.

4.27. Baulked landing. The tail heavy change in trim on opening up the engine following a baulked landing could be satisfactorily held until the aircraft was retrimmed. The aircraft would climb away satisfactorily with flaps and undercarriage fully down as for landing. A safe height should be reached before retracting the flaps as some sink then occurs.

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