4th Part of Report No. A.A.E.E/783.a.

15 OCT 1942

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT.

BOSCOMBE DOWN.

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

Climb and level speed performance and position error

A.&.A.E.E.ref:- 4484/1-A.S.76/4
M.A.P.ref:- R.A.1862/D.A.N.A.1.

Progress of issue of report.

Report No.	Title.
1st Part of AAEE/783a.	F.L.220 - Weights and loading data.
2nd " " "	F.L.220 - Flame damping trials with short stub exhaust flame damper.
3rd " " "	F.L.220 - Carbon monoxide contamination tests.

SUMMARY.

Climb and maximum level speed performance has been measured on Kittyhawk II. F.L.220. Briefly, the results were :-

Max. rate of climb at full throttle height M.S. gear 2020 ft/min @ 10,200 ft.
" " " " " " " " F.S. " 1620 ft/min @ 17,000 ft.

Time to reach 10,000 ft. 5.0 mins.
" " " 20,000 ft. 10.9 "
" " " 30,000 ft. 21.8 "

Service ceiling. 34,300 feet.
Estimated absolute ceiling. 35,400 feet.

Max. level true air speed in M.S. supercharger gear 347 m.p.h. @ 14,700 ft.
" " " " " " F.S. " " 354 " @ 20,400 ft.

1. Introduction.

Level speed and climb trials have been carried out on Kittyhwak II.F.L.220, which is fitted with a Packard built Merlin V.1650-1 engine and a Curtiss Electric Propeller.

The tests were carried out in August, 1942. Preliminary results have already been forwarded to the Ministry of Aircraft Production in our letter ref. A.&.A.E.E/4484/1-A.S.76/4 dated 3rd September, 1942.

2. Scope of tests.

The climbs were made at the climbing speed recommended by the manufacturers of 160 m.p.h. A.S.I. to 20,000 feet, reducing speed by 2 m.p.h. per 1000 ft. thereafter. The change from M.S. to F.S. supercharger gear was made at 13,000 ft. and the engine speed increased from 2850 r.p.m. to 3000 r.p.m. at 20,000 feet. The gills were fully open during the climb.

The position error correction was measured by the aneroid method. Level speeds were measured in M.S. and F.S. supercharger gears.

3. Condition of aircraft relevant to tests.

The armament of this aircraft consisted of six 0.5" machine guns, three in each wing. The muzzles protruded about three inches from the leading edge and were tape-bound, but the ejector chutes under the wings were open.

/Aerials

Aerials stretched from the fin to the wing tips and to the rear of the cockpit. I.F.F. aerials were also fitted. There was no aerial mast.

An external mirror was mounted over the cockpit and slightly to port. Under the fuselage were fittings for an external petrol tank or bomb. There were also slots in the under surface of the wing for bomb racks. There was a landing lamp in the port wing. The aircraft was tested throughout at 8910 lb. weight.

Engine limitations for the Merlin V.1650-1 used on the tests were:-

	R.P.M.	Boost. (ins. of Hg).
Maximum for take-off.	3000	54½
Maximum for all-out level flt. (5 min: limit).	3000	48
Maximum on climb (below 20000 ft)	2850	48
Maximum for continuous (above 20000 ft)	3000	48
cruising rich...	2650	44
Maximum for continuous cruising weak...	2650	38

The propeller was a Curtiss Electric, three-bladed right handed type of 11' diameter with metal blades, number 32236.

4. Results.

The results of the climb trials are given in Table I and in figure 1, and of the level speed trials in Table II and figure 2.

The position of the pitot head is detailed in figure 3, the position error correction in figure 4, and the altimeter correction when corrected to the static of the pressure head in figure 5.

The results have been summarised on the first page of this report.

5. Discussion.

The results given are based on the $p^{\frac{1}{2}}\sigma^{\frac{1}{2}}$ correction method. When correction is by the method detailed in A.&.A.E.E. Memorandum dated 27.8.42., the following differences in performance are found:-

Maximum rate of climb at full throttle height M.S.gear increased by 70 ft/min. to 2090 ft/min. at 10,400 feet.

Maximum rate of climb at full throttle height F.S. gear increased by 50 ft/min. to 1670 ft/min. at 17,100 ft.

Maximum level true air speed in M.S. supercharger gear increased by 6 m.p.h. to 353 m.p.h. at 15,000 ft.

Maximum level true air speed in F.S. supercharger gear increased by 4 m.p.h. to 358 m.p.h. at 20,400 ft.

TABLE I.

Performance on Climb.
Gills fully open.

Standard height (ft)	Rate of climb. (ft/min)	Time (mins)	T.A.S. m.p.h.	A.S.I. m.p.h.	Corrections m.p.h. P.E.	Corrections m.p.h. Comp:	R.P.M.	Boost Ins. of Hg.	Supercharger gear.
2000	2020	1.0	168	160	+3.7	-0.1	2850	48.0	M.S.
4000	↓	2.0	174	↓	↓	-0.2	↓	↓	↓
6000	↓	3.0	179	↓	↓	-0.3	↓	↓	↓
8000	↓	4.0	184	↓	↓	-0.4	↓	↓	↓
10000	↓	5.0	190	↓	↓	-0.5	↓	↓	↓
10200*	↓	5.05	191	↓	↓	-0.5	↓	↓	↓
12000	1830	6.0	196	↓	↓	-0.6	↓	45.2	↓
14000	1620	7.2	202	↓	↓	-0.7	↓	48.0	F.S.
16000	↓	8.3	209	↓	↓	-0.8	↓	↓	↓
17000ϕ	↓	9.0	212	↓	↓	-0.9	↓	↓	↓
18000	1530	9.6	215	↓	↓	-1.0	↓	46.2	↓
20000≠	(1350	10.9	220	158	+3.6	-1.0	↓	(42.7	↓
	(1500						2990	(44.7	↓
22000	1300	12.5	222	154	+3.5	-1.1	↓	41.7	↓
24000	1100	14.2	223	150	+3.3	-1.2	↓	38.8	↓
26000	910	16.1	225	146	+3.2	-1.2	↓	36.0	↓
28000	720	18.5	227	142	+3.0	-1.3	↓	33.2	↓
30000	520	21.8	228	138	+2.8	-1.3	↓	30.7	↓
32000	320	26.7	230	134	+2.7	-1.4	↓	28.0	↓
34000	130	35.8	231	130	+2.5	-1.5	↓	25.5	↓

* Full throttle height M.S. supercharger gear.
ϕ " " " F.S. " "
≠ R.P.M. increased.
Service ceiling ... 34,300 ft. Estimated absolute ceiling .. 35,400 ft.

TABLE II.

Level speeds and boost at height.
Gills in neutral position.

Standard height. (ft)	True Airspeed m.p.h.	A.S.I. m.p.h.	Position error correction.	Compress-ibility correction.	R.P.M.	Boost ins. of Hg.	Supercharger gear.
8,000	320	277	+7.9	-1.5	3000	48.1	M.S.
10,000	328.5	276	+7.9	-1.8	↓	48.1	↓
12,000	336	274	+7.9	-2.3	↓	48.1	↓
14,000	344.5	272.5	+7.8	-2.8	↓	48.1	↓
14,700 *	347	271	+7.8	-3.0	↓	48.1	↓
16,000	346	265	+7.6	-3.1	↓	46.1	↓
18,000	342	254	+7.2	-3.2	↓	42.6	↓
20,000	337	242.5	+6.8	-3.3	↓	39.3	↓
16,000	336	257.5	+7.3	-3.0	2980	48.0	F.S.
18,000	344	255.5	+7.2	-3.4	↓	48.0	↓
20,000	352.5	254	+7.2	-3.7	↓	48.0	↓
20,400 ϕ	354	253.5	+7.2	-3.8	↓	48.0	↓
22,000	352	245.5	+6.9	-3.9	↓	45.3	↓
24,000	349	235.5	+6.4	-3.9	↓	41.8	↓
26,000	344.5	224.5	+6.1	-3.9	↓	38.3	↓

* Full throttle height M.S. supercharger gear.
ϕ " " " F.S. " "