Report No. M/666,b/Int.2.

10th September 1937.

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT,

MARTLESHAM HEATH.

Gladiator K-7964 - Mercury IX (0.572 reduction).

A.M. Ref:- 431710/35/R.D.A.1/A.R.C.
A. & A.E.E. Ref:- M.H/4481/14/Eng - A.S.50/4.

In accordance with instructions received in Air Ministry letter 431710/35/R.D.A.1/A.R.C. dated 24th June 1937, short performance trials have been made during July 1937. The trials included climb to the service ceiling to investigate whether there was a tendency for the engine to cut out at high altitudes.

Engine and airscrew.

A Mercury IX engine with 0.572 reduction gear was fitted. The change of gear ratio from 0.5 was made in an attempt to obtain smooth running.

Particulars of the 3 blade Fairey Reed metal airscrew fitted for the tests are as follows:-

"F" No.	F.D.B. No.	Drg. No.	Angle.	Dia.	Pitch.
1261/1	03260 H				
1261/2	03265 H	61800/A/9	X.5.	10'-6"	14.7'
1261/3	03257 H				

Results.

The results of the vibration tests with the above engine airscrew combination are given in Report M/665,b/Int.1.

The results of the performance trials are given on

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the accompanying pages, and a summary of these compared with the performance of Gladiator K-5200 with a Mercury IX 0.5 reduction gear is as follows:- Mercury IX

	(A)	(B)	(C)
Aeroplane	K.7964	K.5200	K.5200
Weight. lb.	4646	4456	4402
Airscrew	3-blade metal.	3-blade metal.	2-blade wood.
Gear reduction	0.572/1	0.5/1	0.5/1
Take-off run. yds.	150	220	165
Distance to clear a 50 ft. screen.yds.	320	450	330
All out level flight at F.T. height.			
Maximum true speed. m.p.h.	245.5	253	248
R.P.M.	2725	2760	2740
Boost. lb/sq.in.	+3.5	+3.5	+3.5
Height. ft.	14200	14500	14400
Climbing at F.T. Height.			
R.P.M.	2300	2360	2360
Boost. lb/sq.in.	+5	+5	+5
Height. ft.	7600	8600	8000

Mercury VIII

For Case (A) with the override device in operation (4.9 lb boost) the top speed is 246.5 m.p.h. at 12400 ft. This override condition for level flight was not allowed when (B) and (C) was tested.

The difference in performance between (A) and the earlier trials may be due partially to the use of a different aeroplane. The performance is substantially the same with a wooden airscrew and 0.5 gear reduction as with the metal airscrew and 0.572 gear reduction. The increased gear ratio

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has the expected result of reducing the take-off run and the maximum level speed.

The aeroplane was climbed to 32400 ft. There was no tendency for the engine to cut out.

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Date.

SUMMARY OF TRIALS.

Tests reduced on the ~~p~~ ½σ ~~f~~ ½ Basis.

AEROPLANE Gladiator. No. K.7964.

SPEC. No. F.14/35.
CONTRACT. 442476/35.
CONTRACTOR. Gloster Aircraft Co.Ltd.

TYPE DUTY

ENGINE~~S~~. Mercury IX. (No.M.40394) Normal B.H.P. 706 at Rated Altitude 13000 / ft.
" " " " "

At 2400 R.P.M.
" "

			lb.
Tare weight			3502
Weight light			3276
Fixed military load			226
Service load			560.5
Fuel	72	gallons*	539
Oil	5		45
Flying weight on trials.			4646.5

5

* Based on 7.~~7~~. lb. per gallon.

At Full Throttle				Economical Speed			
						Range	
Height Feet	Top Speed M.P.H. ~~Kts.~~	Time to Climb Mins.	Rate of Climb Ft./Min.	M.P.H. Kts.	R.P.M. (Mean)	Miles Land Sea	Hours
S.L.	208.5	0	1920				
2,000	214.5	1.0	2110				
5,000	223.5	2.35	2390				
10,000	239	4.35	2340				
15,000	245	6.8	1800				
20,000	239.5	10.0	1300				
25,000	228.5	15	820				
30,000	199.5	23.8	360				

Service ceiling 32,900 ft.
Take off run 150 yds. Time. 12 secs.

Stalling speed M.P.H. ~~Kts~~.
~~Best~~ landing A.S.I. 57 M.P.H. ~~Kts~~.
Take-off speed by panoramic camera:- 69 m.p.h.

Landing speed M.P.H. ~~Kts~~.
(Distance from rest to clear 50 ft. screen 320 yds.
Gliding in A.S.I. 75 M.P.H. ~~Kts~~.
(Distance to rest (with brakes) after clearing 50 ft. screen yds 420

Landing speed by panoramic camera 68 m.p.h.
Landing and take off tests corrected to 5 m.p.h. wind and standard conditions.

N.B. Full flaps for landing
Flaps closed for take-off.

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WEIGHTS AND LOADING DATA.

(in accordance with Weight Sheet Summary Serial No. 527 Issue 1 A.P. 1523 Vol. III., Part 3.)

	lb.
Tare weight	3502
Weight light	3276
Fixed military load	226
Service load	560.5
Fuel 72 galls. at 7.5 lbs per gallon	539
Oil 5 " " 9.0 " " "	45
Flying weight on trials	4646.5

Maximum capacity of tanks:-

Fuel 83 gallons.

(Marked) Oil 5 gallons.

Items.	Fixed Military Load.	Service Load.
1. Crew	-	200
2. Gun load	80.5	268.5
3. Bomb load	-	-
4. Torpedo load	-	-
5. Pyrotechnic load	1.0	6.5
6. Electrical load	84.0	16.0
7. Instrument load	27.0	15.0
8. Miscellaneous load	28.5	5.0
9. Wireless load	5.0	51.5
Totals	(A) 226 lb.	(B) 560.5 lb.

TOTAL MILITARY LOAD (A) + (B) 786.5 lb.

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

The Centre of Gravity with the above load is 5.8" aft of the datum point. The Basic Centre of Gravity range is 3.9" to 6.9" aft of the datum point. The extended range is 3.9" to 7.2" aft of the datum point (including 10% aft extension).
The datum point is on the L.E. Bottom Centre Section.

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CLIMBING TRIALS.

Height in Standard Atmosphere. Feet	Time from Start. Min.	Rate of Climb. Ft./Min.	True Air Speed. M.P.H. Knots.	A.S.I. M.P.H. Knots.	Position Error Correction. (See note 1 below). M.P.H.	R.P.M.	Boost. lb/sq.in	Radiator. (See note 2 below).
Sea Level	0	1920	128	125	+3	2060	+5.05	
1,000	0.5	2010	130	"	"	2090	"	
2 000	1.0	2110	132	"	"	2120	"	
3,000	1.5	2200	133.5	"	"	2150	"	
5,000	2.35	2390	138	"	"	2215	"	
6,500	3.0	2540	141	"	"	2265	"	
7,600*	3.4	2630	143.5	"	"	2300	"	
10,000	4.35	2340	146	122.5		2300	+3.4	
13,000	5.7	2000	148.5	118	+3.3	2295	+1.5	
15,000	6.8	1800	149.5	115	+3.3	2290	+0.3	
16,500	7.7	1650	149.5	112	+3.4	2285	-0.55	
18,000	8.6	1500	149.5	109.5	+3.4	2280	-1.40	
20,000	10.0	1300	150	106	+3.5	2275	-2.50	
23,000	12.7	1000	150	100	+3.7	2260	-4.00	
26,000	16.1	730	149.5	94.5	+3.8	2235		
28,000	19.5	540	148	90	+3.9	2215		
30,000	23.8	360	147.5	86	+4.0	2185		
32,900†	33.0	100	145.5	80	+4.1	2125		

Estimated absolute ceiling. 34,000 ft. Greatest height reached. 32,400

R.P.M. stationary on ground. Boost pressure lb./sq.in.

* Full throttle height. at +5.0 lb/sq.in. boost.
† Service ceiling.
Note 1:-For position error correction curve and position of pressure head see page 9A. Figs.13 and 13A.

Note 2:-For engine water or cylinder head temperatures see page 9B.

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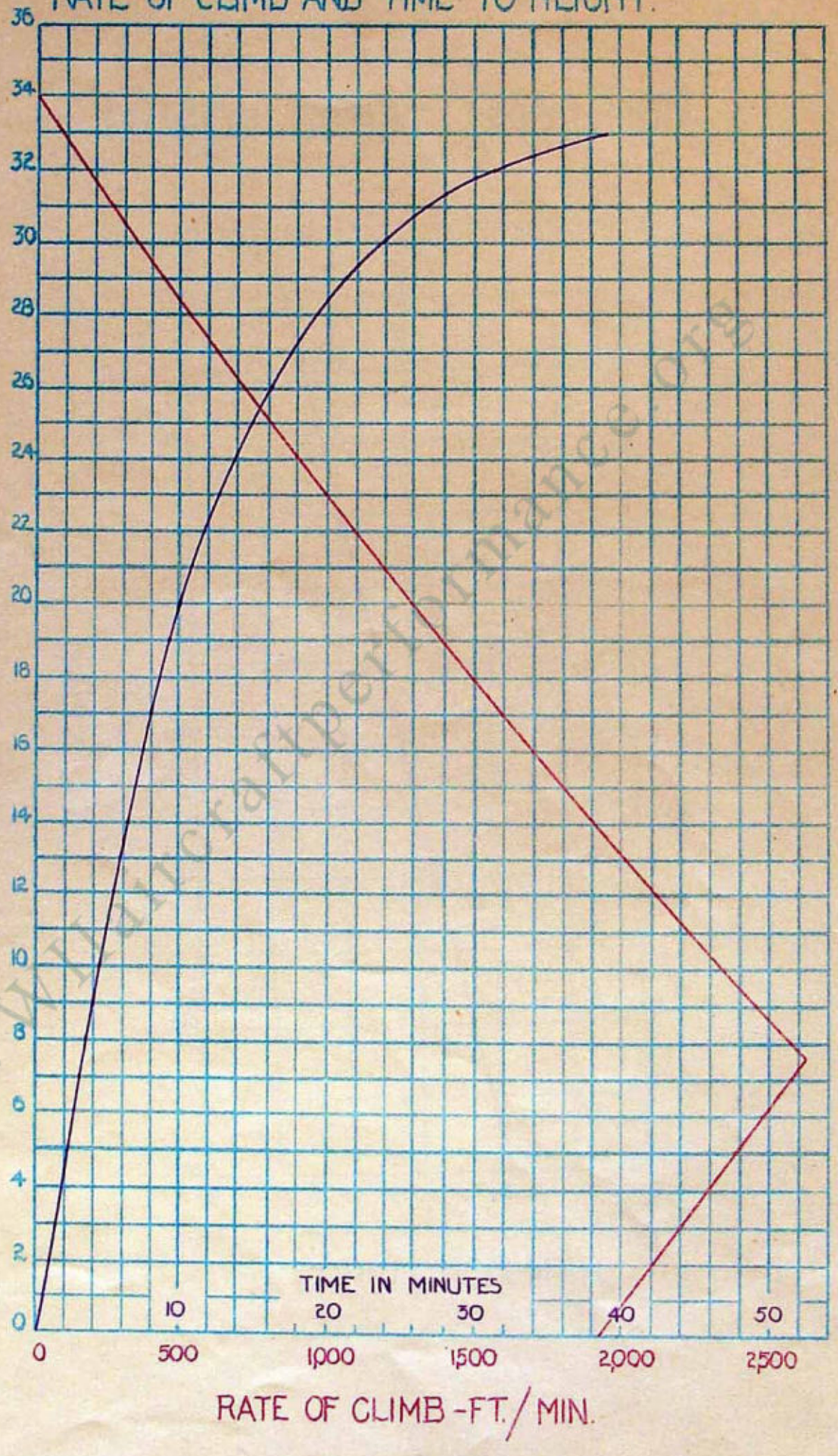
FIG 1

GLADIATOR K-7964

RATE OF CLIMB AND TIME TO HEIGHT.



A&AEE.	DRAWN	P.K. Nash	DATE	26-8-37	CHECKED	a.e. Cox	APPROVED	a.e. Cox	DO	APPROVED G.M.W.

CURVE Nº. 1123

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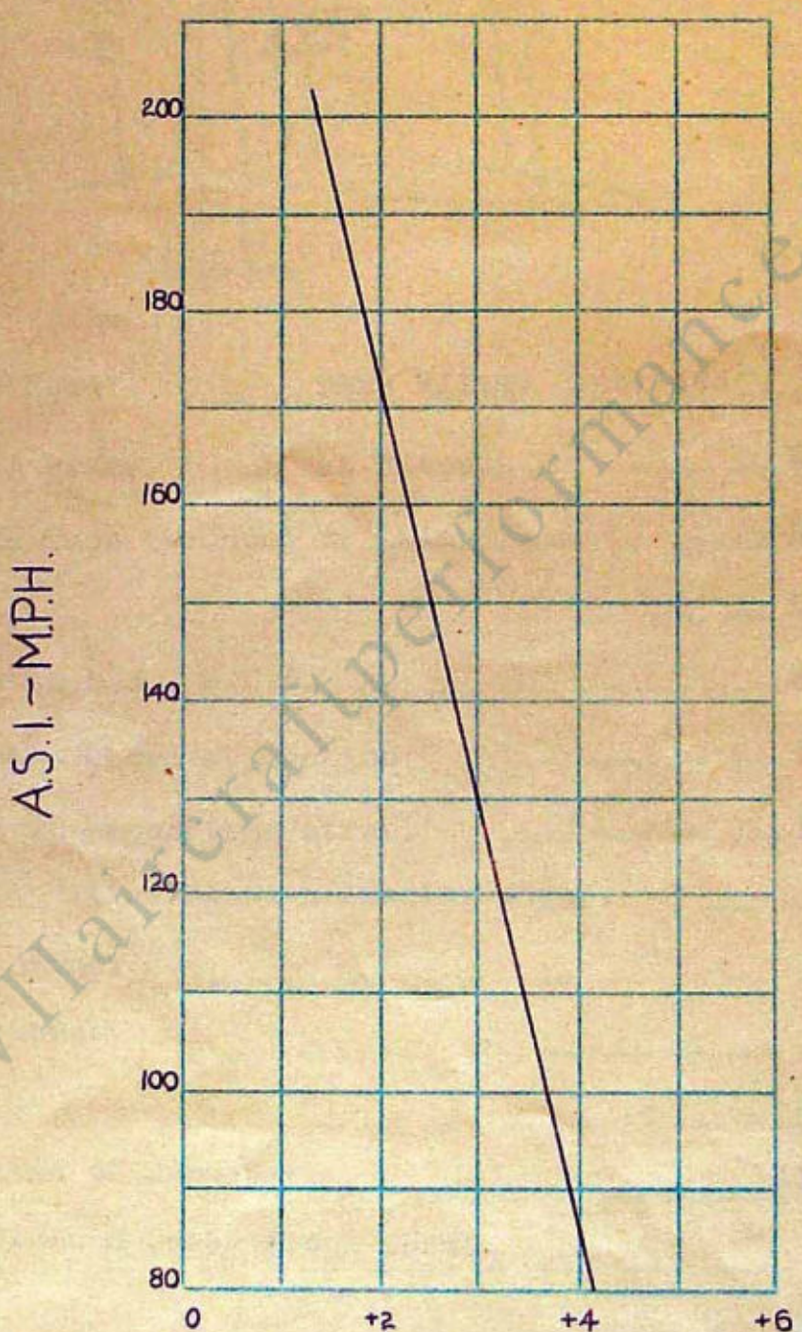
FIG 13

GLADIATOR K-7964

POSITION ERROR CORRECTION



CURVE No. 1122

A&AEE	DRAWN	DATE	CHECKED	APPROVED	APPROVED	DO	APPROVED
	P.K.	18-8-37					

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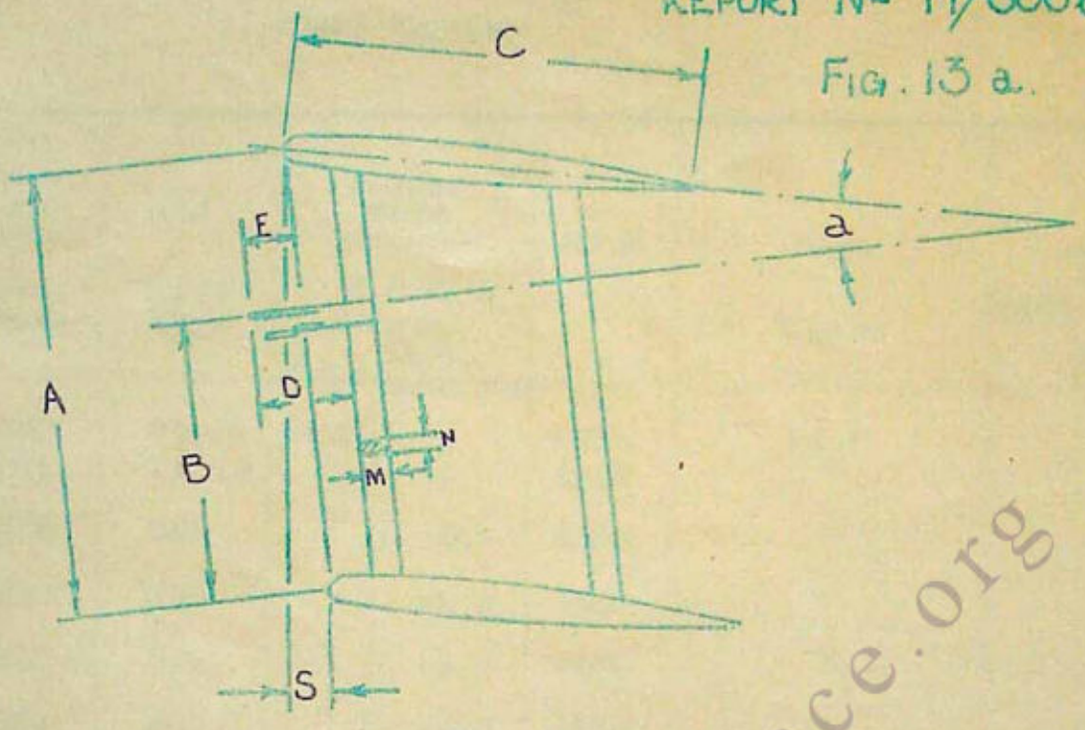
FIG. 13 a.



Type of Pressure Head	Mark VII.A. Anti-Ice
Incidence of Main Plane At Pitot	2° - 10'
a Angle of Static Tube to Chord of Main Plane	-0° - 54'
A Gap	5' - 9½"
B Nose of Static to L.E., B.M.P.	3' - 9⅛"
C Length of nearest Chord at section	5' - 9½"
D Nose of Static to supporting strut.	1' - 2"
E " " " " Line between leading edges.	6"
M Major Axis of Strut.	3⅞"
N Minor axis of Strut	1⅛"
S Stagger.	2' - 2⅞"
Distance from Plane of Symmetry.	11 - 9¼"
Position. Left Hand Outer Front Strut	
Semi span	16' - 1½"
Wing section.	

A. & A.E.E.		DATE.	PRESSURE HEAD POSITION	S.K. Nº
DRAWN	M.D. Knowles	1-9-37		
CHECKED	A.L.	D.O.	GLADIATOR K 7964	1755
APPROVED	A.E. Co			

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SPEED TRIALS.

Height in Standard Atmos-phere. Feet	True Air Speed. M.P.H. ~~Knots~~	A.S.I. M.P.H. ~~Knots~~	Position Error Correction. M.P.H. (See note 1) P.E.C.	Comp. Correction	R.P.M.	Boost. lb./sq. in.	Speed at Normal (2400) Revs. M.P.H.
Sea Level	202	200.7	+1.3	-	2255	+3.5	-
1,000	205	200.7	"	-	2290	"	-
2,000	208	201	"	-0.1	2325	"	-
3,000	211	201	"	-0.2	2355	"	-
5,000	217.5	201	"	-0.3	2420	"	214
6,500	222	200.5	"	-0.5	2470	"	213.5
10,000	232.5	199.5	1.4	-0.7	2585	"	212.5
13,000	242	197.5	1.5	-0.9	2685	"	211.5
14,200*	245.5	197	1.5	-1.0	2725	"	211
15,000	245	194	1.5	-1.1	2725	+2.9	210.5
16,500	243.5	188	1.7	-1.1	2720	+1.85	210
18,000	242	182	1.8	-1.2	2715	+0.75	209.5
20,000	239.5	174	2.0	-1.2	2705	-0.55	209
23,000	234	161	2.3	-1.2	2675	-2.40	208
26,000	224.5	146	2.6	-1.2	2615		206
28,000	214	133.5	2.9	-1.0	2555		201.5
30,000	199.5	118.5	3.2	-0.8	2470		194.5

Landing and take off tests corrected to 5 m.p.h. wind and standard atmosphere
Take off run 150 yds. Time 12.0 secs.
Distance from rest to clear 50 foot screen 320 yds.
Gliding in A.S.I. 75 M.P.H./~~Kts~~. Stalling speed M.P.H./Kts.
~~Best~~ landing A.S.I. 67 M.P.H./~~Kts~~.
Distance to rest (with brakes) after passing over 50 ft. screen 420 yds.
Landing run with brakes 205 yds. Landing run without brakes 335 yds.

Take-off speed by panoramic camera 69 m.p.h.

Landing speed by panoramic camera 68 m.p.h.

N.B. Full flaps for landing.
Flaps closed for take-off.

* Full throttle height. At +3.5 lb/sq.in. boost.
Note 1:-For position error correction curve and position of pressure head see ~~page 9A~~. Figs.13 & 13A.
~~Note 2:-For engine water or cylinder head temperatures see page 10A.~~

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SPEED TRIALS. using boost override and enrichening device.

Height in Standard Atmos-phere. Feet	True Air Speed. M.P.H. Knots	A.S.I. M.P.H. Knots	Position Error Correction. M.P.H. (See note 1) P.E.C.	Comp. corrn.	R.P.M.	Boost. lb./sq. in.	Speed at Normal Revs.
Sea Level	208.5	207.5	+1.1	-	2315	+4.9	
1,000	211	207	+1.1	-	2350	+4.9	
2,000	214.5	207	+1.1	-0.1	2380	+4.9	
3,000	217	207	+1.1	-0.2	2415	+4.9	
5,000	223.5	207	+1.1	-0.4	2480	+4.9	
6,500	228.5	206.5	+1.1	-0.5	2530	+4.9	
10,000	239.0	204.5	+1.2	-0.8	2645	+4.9	
12,400* 13,000	246.5	203	+1.3	-1.0	2725	+4.9	
15,000							
16,500							
18,000							
20,000							
23,000							
26,000							
28,500							
30,000							

Landing and take off tests corrected to

Take off run yds. Time secs.

Distance from rest to clear foot screen yds.

Gliding in A.S.I. M.P.H./Kts. Stalling speed M.P.H./Kts.

Best landing A.S.I. M.P.H./Kts.

Distance to rest (with brakes) after passing over 50 ft. screen yds.

Landing run with brakes yds. Landing run without brakes yds.

* Full throttle height at 4.9 lb/sq.in. boost.

Note 1:-For position error correction curve and position of pressure head see page 9A.

Note 2:-For engine water or cylinder head temperatures see page 10A.

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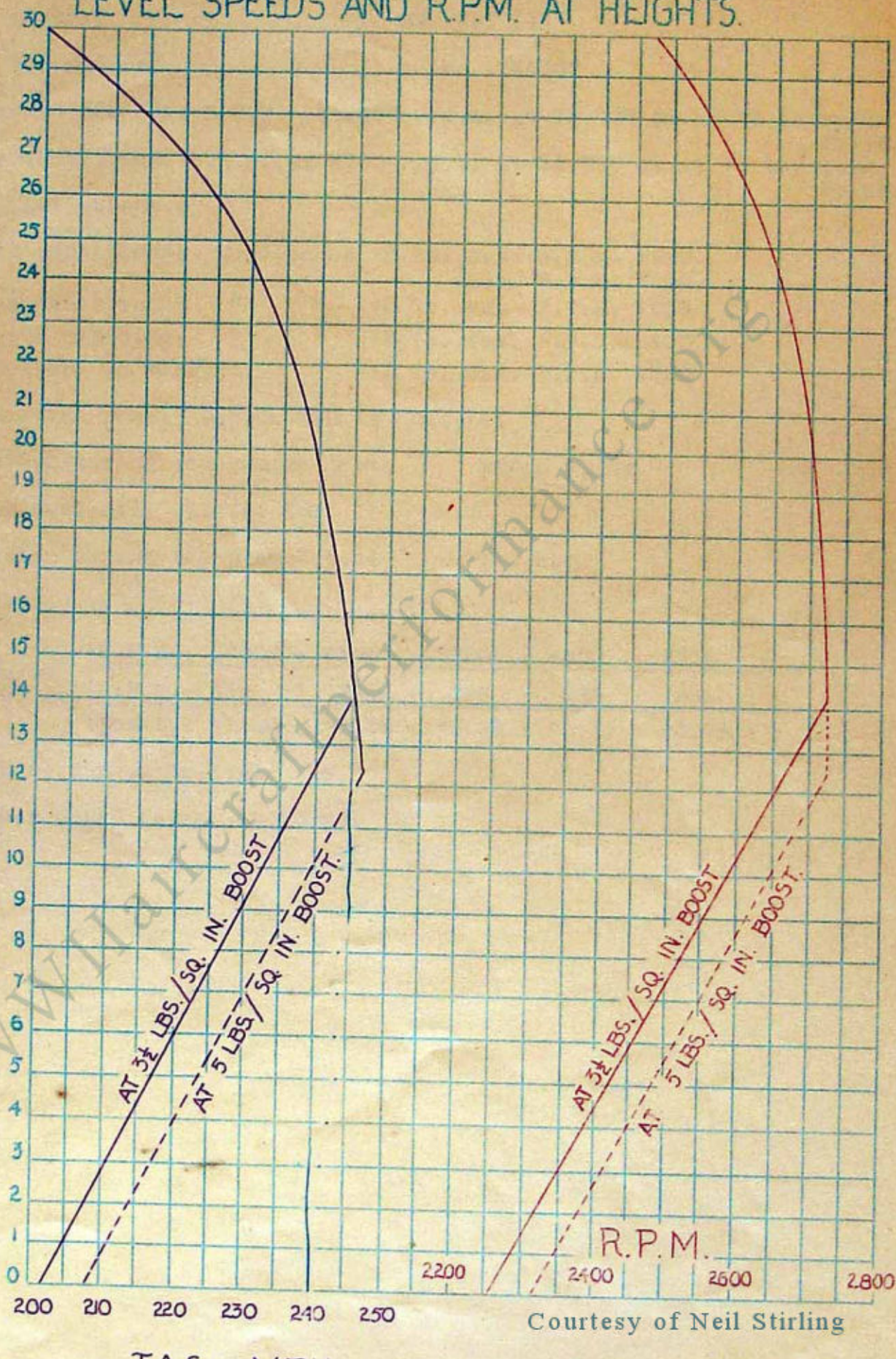
GLADIATOR K-7964 FIG. 2

LEVEL SPEEDS AND R.P.M. AT HEIGHTS.



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Written aircraft performance ops

A&A.EE	DRAWN	P.Hyall.	DATE	27-8-37	CHECKED	[illegible]	APPROVED	[illegible]	DO.	APPROVED	[illegible]

CURVE No. 1124

Extracts from Engine Log Book.

ENGINE.

Type. Mercury Mk. No. IX.

Makers No. M.40394. A/ No. 114557

Rated power 795/825. B.H.P. at 2650 r.p.m. at 13,000 ft. at +5 lb/sq.in. boost.

Max. power 810/840. B.H.P. at 2750 r.p.m. at 14,000 ft. at +5 lb/sq.in. boost.

Engine Limitations.

Take-off conditions: Max. boost +5 lb. Max. R.P.M. 2650
Min. R.P.M. 2050

Climbing conditions: " " +5 lb. Max. R.P.M. 2650

Continuous cruising: " " +3½ lb. Max. R.P.M. 2400

All out level (5 mins) " " +5 lb. Max. R.P.M. 2750

Type approval Fuel: D.T.D. 230 (87 Octane)

Consumption during acceptance test: pts/H.P./Hr.

Type approval Oil: D.T.D. 109.

Consumption during acceptance test pts/Hr.

Gear ratio: .5

Power curve at 13,000 ft.

R.P.M.:	2200	2400	2500	2650	2750
B.H.P.:	596	706	759	826	856
Boost.:	+1.83	+3.36	+3.96	+5.17	+5.76

Total hours run on arrival: 19.

Date power curve taken 15.10.36.

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