

~~RESTRICTED~~

57th Part of Report No. A. & A. E. E. / 766.

28 JUN 1944

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

Lancaster I JB. 127
(4 Merlin 24)

Climb and level speed performance
with paddle-blade propellers

A. & A. E. E. ref: CTO/AM.62/15.
M.A.P. ref: RA.5853/RDL2(b).
Date of tests: May, 1944.

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 & action by the Ministry of Aircraft Production.

Progress of issue of report

Report No.	Title
52nd Part of A. & A. E. E. / 766.	L.L.905 - Performance and handling trials of a production aircraft.
53rd do.	J.B.127 - Engineering and maintenance appraisal of Dowty oil compression shock absorber in tail wheel strut.
54th do.	J.B.127 - Fuel consumption trials.
55th do.	J.B.127 - Position error trials.
56th do.	W.4963 - The effect of H2S blister on performance.

1. Introduction.

Performance trials have now been made on this aircraft with paddle-blade propellers fitted, for comparison with previous tests, reported in the 50th Part, when standard propellers (type A5/138) were fitted.

2. Condition of aircraft.

2.1. External features. This aircraft is a standard production Lancaster I as described in the 34th Part of this Report except for the following details:

Merlin 24 engines giving +18 lb/sq.in. boost for take-off and for 5 minutes all-out levels.
Navigation blister on starboard side only.
Larger type hemispherical bomb-aimer's cupola.
Dowty oil compression tail-wheel strut with Marstrand twin contact tail wheel tyre in lieu of smooth sectioned tyre.

2.2. Loading. All tests reported here were made at a take-off weight of 63,000 lb. with the C.G. 49.3" aft of the datum point.

2.3. Airspeed system. The pilot's airspeed indicator, used during the tests, was connected to the under-nose Mk.VIII D pitot head and to the port static vent.

2.4. Propellers. Hamilton constant speed propellers, type A5/148 (paddle blade) were fitted to all engines, the constant speed governors being type AY 118.

2.5. Engine numbers and limitations. The following Merlin 24 engines were fitted:

Position	Firm's No.	A.M.No.
PO	119137	403358
PI	119135	403357
SI	119139	403359
SO	119559	403569

The engine limitations for the Merlin 24 at the time of test were:

Condition	RPM	Boost lb/in ²
Take-off (5 mins. or 1000 ft)	3000	+18
Climb (1 hour)	2850	+ 9
Cruising	2650	+ 7
All-out level (5 mins.)	3000	+18

3. Tests made.

3.1. Climb. Full throttle climbs were made to 23,000 ft. with radiator flaps fully open at a speed of 156 mph ASI up to 15,000 ft., with a reduction in speed of 2 mph per thousand feet from that height to ceiling.

3.2. Level speeds. All out levels and cruising speeds were measured under the following conditions with radiator flaps closed:-

Height range (feet)	S/C gear	RPM	Boost
1000 to 13000	M.S.	3000	Controlled at +18 lb/in ² *
6000 to 21000	F.S.	"	or full throttle
2000 to 15000	M.S.	2650	Controlled at +7 lb/in ²
10000 to 22000	F.S.	"	or full throttle

* Although the maximum permissible boost is +18 lb/in², this could not be obtained during these tests.

4. Results of tests.

All climb and speed performance results have been reduced to standard ICAN conditions by the methods of Report No. A. & A.E.E./Res/170 using a supercharger constant C = 0.002.

The level speeds have been corrected to a mean weight of 60,000 lb. i.e. 95% of the take-off weight by the method of the same report. The position error corrections have been taken from curve (C) in the 55th Part of this Report.

4.1. Climb. (See Table I and Fig.1). The following summarises the climb performance:

Rate of climb in M.S. gear 800 ft/min at full throttle height 9500 ft.
 " " " " F.S. " 610 ft/min " " " " 16200 ft.

Service ceiling 23,500 ft.
 Time to 23000 ft. 44 mins.

4.2. Level speeds. (See Table II and Fig.2). A summary of the level speed measurements is given in tabular form below:-

Condition	Height feet	TAS (mph)	S/C gear
Max. all-out level	2500	268	M.S.
3000 rpm.	10000	280	F.S.
Max. cruising	10000	249	M.S.
2650 +7 lb/in ² boost	16300	258	F.S.

5. Comparison with previous results.

This comparison is made with the performance results obtained on this aircraft when fitted with standard propellers, type A5/138, as given in the 50th Part of this Report.

5.1. Climb. A comparison shows that there is no marked change in M.S. gear, but there is an improvement in the rate of climb of about 100 ft/min. in F.S. gear and a resultant increase in the service ceiling of 1500 ft. The time taken to reach 22000 ft. has been reduced by about 10 minutes.

5.2. Level speeds. The paddle-blade propellers increase the level speed performance by 6-10 mph above about 16000 ft. Around 10000 ft. the level speeds are unchanged and become slightly inferior below that height.

/5.3.

5.3. Full throttle heights. It has been found that all full throttle heights have increased slightly but no particular significance is attached to this.

6. Conclusions.

6.1. Lancaster I JB.127 when fitted with type A5/148 propellers has the following performance:

(a) Max. all-out level	268 mph at 2,500 ft.	MS gear.
	280 " " 10,000 ft.	FS "
(b) Max. cruising speed	249 mph at 10,000 ft.	MS gear..
	258 " " 16,200 ft.	FS "

6.2. The results when compared with the performance with normal type A5/138 propellers, show an increase in service ceiling of 1500 ft., an increase in level speed performance of 6 - 10 mph above about 16000 ft., but at low altitudes the performance is slightly inferior.

7. Further developments.

The aircraft is now to be fitted with four fishtail ejector exhausts and the effect of these on the performance of the aircraft is then to be determined.

TABLE I.
Full throttle climb performance
Radiator flaps fully open Take-off weight 63,000 lb.

Height feet	Time mins	ft/min.	ASI (mph)	Boost lb/in ²	S/C gear
2000	2.5	800	156	+ 9	M.S.
4000	5.0				
6000	7.5				
8000	10.0				
* 9500	11.9	∇		∇	
11000	13.9	690		+7.7	
∅ 12400	16.1	590		(+6.5 (+9.0)	F.S.
14000	18.7	595	∇		
* 16200	22.4	605	154		
18000	25.6	480	150	+7.5	
20000	30.5	340	146	+5.9	
23000	43.8	140	140	+3.5	∇

* Full throttle heights.

∅ S/C gear change height.

/Table II.

TABLE II
Level speed performance at 60,000 lb.
Radiator flaps closed.

Standard height feet	TAS mph	PEC mph	CEC mph	ASI mph	Mean boost lb/in ²	Mean RPM	S/C gear
2000	223	- 1	-0.2	217	7	2650	M.S.
5000	232		-0.4	216	7		
8000	242		-0.8	216	7		
*10000	250		-1.0	216	7		
13000	247		-1.2	204	4.8		
15000	242		-1.2	194	3.2		V
10000	236		-0.8	205	7		F.S.
13000	246		-1.2	204	7		
*16300	258		-1.5	204	7		
19000	250		-1.5	189	5		
22000	235	V	-1.3	168	2.9	V	V
1000	264	- 1	-0.2	260	17.2	3000	M.S.
* 2500	268		-0.4	258	17.2		
5000	267		-0.8	250	14.9		
8000	265		-1.0	237	12.3		
11000	262		-1.2	224	9.7		
13000	259		-1.3	214	8.2		V
8000	273		-1.1	244	17.4		F.S.
*10000	280		-1.3	243	17.4		
13000	278		-1.6	231	14.2		
16000	276		-1.7	218	11.4		
19000	271		-1.8	204	9.0		
21000	265	V	-1.8	193	7.4	V	V

* Full throttle height.

Circulation List.

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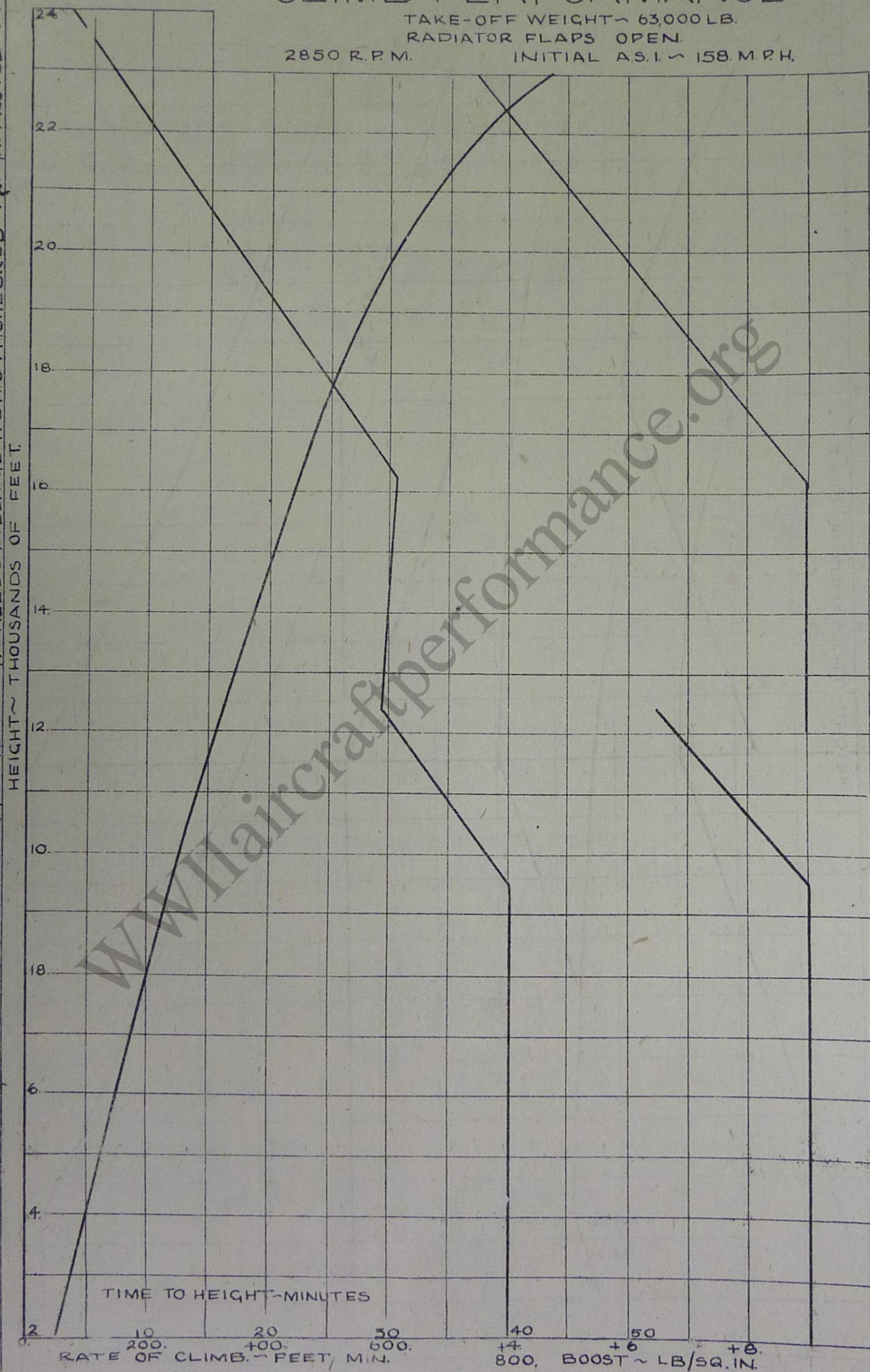
CLIMB PERFORMANCE

TAKE-OFF WEIGHT ~ 63,000 LB.

RADIATOR FLAPS OPEN

2850 R.P.M.

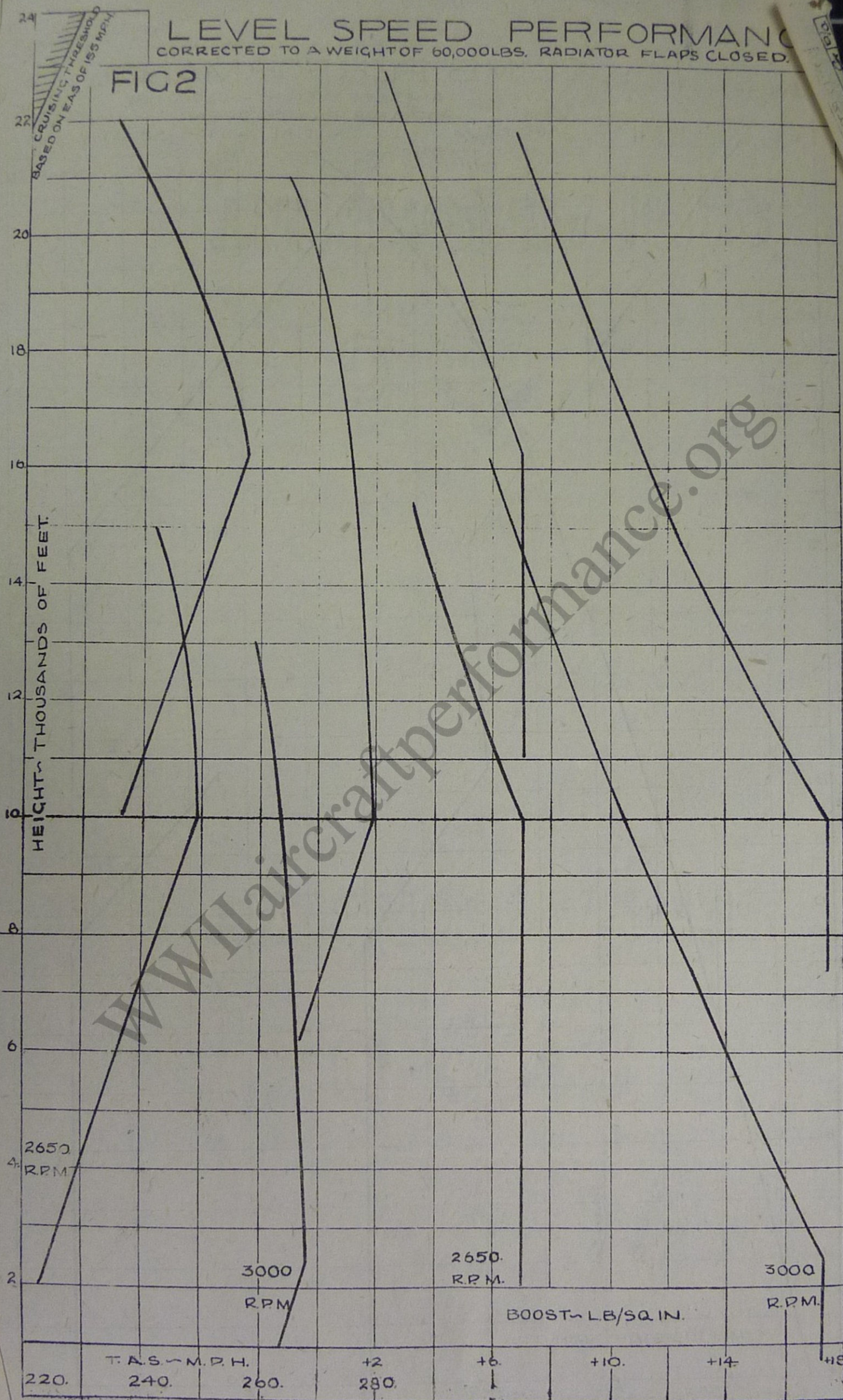
INITIAL A.S.I. ~ 158 M.P.H.



LEVEL SPEED PERFORMANCE

CORRECTED TO A WEIGHT OF 60,000 LBS. RADIATOR FLAPS CLOSED.

FIG 2



AT NO AAE/766 LANCASTER JB127 CURVE NO 64631 TRACED EQ2 DEAR DATE 14.6.44 CHECKED WJH APPROVED J. G. B.