AVIA18/715

3rd Part of Report No. A. & A.E.E./766,d.

4 MAY 1944

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

RESTRICTED

Lancaster VI JB.675
(4 Merlin 85)

Brief performance trials and position error

This report deals with the aircraft 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.P.

A. & A.E.E. ref:- CTO/AM.62/19
M.A.P. ref:- SB.53031/01/1/RDL2(b)
Date of tests:- February 1944

Progress of issue of report

Report No.	Title
1st Part of A. & A.E.E./766,d.	JB.675 - Engineering and maintenance appraisal of prototype engine installation.
2nd do.	JB.675 - Brief handling trials.

1. Introduction.

UNCLASSIFIED

A Mk.VI Lancaster, which differs from the Mk.I and III by the fitting of Universal power plants (Merlin 85 engines) came to this Establishment for general handling tests in order to ensure that, before proceeding on operations, the type possessed no unusual handling characteristics. Although the aircraft was only available for a few days, it was decided to carry out a few brief performance tests at the same time.

2. Description of aircraft.

2.1 External features. The exterior of the aircraft was similar to the standard production Mk.I and III Lancaster with the following exceptions:-

(i) Universal power plants (circular type) were fitted in place of Merlin XX or 28 power plants.

(ii) Merlin 85 engines were fitted.

(iii) Hamilton paddle-blade propellers, type A5/148, with a diameter of 13.0 ft. were fitted.

The aircraft was fitted with nose, tail and dorsal (including cam track) turrets. The extended (hemispherical) bomb aimer's cupola, and an H_2S blister were also fitted.

2.2 Engine limitations and numbers. The following limitations were in force for the Merlin 85 at the time of test:

Condition	RPM	Boost lb/sq.in.
Maximum for climb	2850	+12
" " cruising	2650	+ 7
" " all-out level (5 mins)	3000	+18

The engine numbers were:

Engine	Firm's No.	A.M.No.
PO	156395	A445008
PI	107565	A352044
SI	110679	A399609
SO	110681	A399610

2.3 Loading. The tests were made from a take-off weight of 65,000 lb. with the C.G. 51.0" aft of the datum point (undercarriage down).

2.4 Airspeed system. All airspeeds quoted refer to the pilot's ASI, the pitot side of which was connected to the undernose Mark VIII D head (details Fig.1), the static source being the port static vent (details Fig.2).

/This

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This vent is in the position known to give a satisfactory position error correction on Lancasters not fitted with the H_2S blister.

3. Tests made.

3.1 Position error. The position error of the port static vent was measured by the aneroid method over a speed range of 153 - 265 mph ASI with flaps and undercarriage up.

3.2 Climbs. Full throttle climbs were made to ceiling at an initial speed of 165 mph ASI up to 20,000 ft., from that height to ceiling the speed was reduced 3 mph per thousand feet. The radiator flaps were fully open throughout the climb.

3.3 Level speeds. All-out level and maximum cruising speeds were measured under the following conditions with radiator flaps closed:-

Height range (feet)	S/c gear	RPM	Boost (lb/sq.in)
22,000 to 17,000	F.S.)	3000	Controlled at +18 or full throttle
27,000 to 13,000 17,000 to 11,000	F.S.) M.S.)	2650	Controlled at +7 or full throttle

4. Result of tests.

4.1 Position error correction. It will be seen from Fig.3 that the position error correction curve does not satisfy the requirements of A.P.I. which limits the permissible error to ± 1 mph.

In order to ensure that this result is not an isolated case, it is intended to carry out a repeat test on another Mk.VI Lancaster shortly.

4.2 Performance results. All climb and speed performance results have been reduced to ICAN standard conditions by the methods of Report No. A. & A.E.E./Res/170 using a supercharger constant of 0.002. The level speeds have been corrected to a mean weight of 62,000 lb., i.e. 95% of the take-off weight, by the method of the same Report.

4.21 Climb. The following table summarises the climb performance:

Rate of climb in M.S. gear	1000 ft/min.
(At full throttle height	9800 ft.)
Rate of climb in F.S. gear	770 ft/min.
(At full throttle height	19800 ft.)
Time to 28,000 ft.	44.7 mins.
Service ceiling	28500 ft.
Absolute ceiling	29800 ft.

Full results are given in Table I and Fig.4.

4.22 Level speeds. A summary of the level speed measurement is given in tabular form below:-

Condition	TAS mph	Height ft.	S/c gear
Maximum cruising speeds (2650 rpm +7 lb/sq.in. boost)	279 258	23900 13500	F.S. M.S.
Maximum all-out speed (3000 rpm +18 lb/sq.in. boost)	313	18300	F.S.

Full results are given in Table II and Fig.5.

5. Conclusions.

5.1 Position error correction. The established curve does not satisfy the requirements of A.P.I. which limits the permissible error to ± 1 mph.

Another Lancaster VI is coming to this Establishment shortly for a check on the position error.

/5.2

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5.2 Performance. The Lancaster VI at a take-off weight of 65,000 lb. has the following performance:

(a) Max. all-out speed: 313 mph at 18,300 ft.
(b) Max. cruising speed: 279 mph at 23,900 ft. (F.S. gear)
258 mph at 13,500 ft. (M.S. gear)

(c) Service ceiling: 28500 ft.
(The climb to 28,000 ft. takes 45 mins.)

TABLE I

Full throttle climb performance
Radiator flaps fully open S/c gear change 12,500 ft.

Height (feet)	Time (mins)	R/c ft/min	ASI (mph)	Boost lb/in^2	S/c gear
2000	1.8	1080	165	12.0	M.S.
4000	3.7	1060	↓	↓	↓
6000	5.6	1040			
8000	7.6	1015			
9800M	9.4	1000			
12000	11.8	830		10.2	
14000	14.3	755		12.0	F.S.
16000	19.5	765		↓	↓
19800M	21.9	770	↓		
22000	25.2	600	159	10.1	
24000	29.1	445	153	8.4	
26000	34.6	295	147	6.8	
28000	44.7	140	141	5.3	↓

M Full throttle height

/TABLE II

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TABLE II

Level speeds at 62,000 lb.

Radiator flaps closed

Height (feet)	TAS mph	PEC mph	CEC mph	ASI mph	Boost lb/in^2	RPM	S/c gear
11000	250	-3.0	-1.0	215	7.0	2650	M.S.
13500M	258	-2.9	-1.2	213	7.0	↓	↓
15000	256	-2.6	-1.4	207	5.8	↓	↓
17000	249	-1.9	-1.5	195	4.4	↓	↓
16000	253	-2.2	-1.3	201	7.0	2650	F.S.
18000	259	-2.2	-1.6	199	↓	↓	↓
20000	266	-2.1	-1.8	198	↓	↓	↓
22000	272	-2.0	-2.0	196	↓	↓	↓
23900M	279	-1.9	-2.2	195	↓	↓	↓
25000	274	-1.1	-2.2	187	6.0	↓	↓
27000	254	-0.5	-2.0	167	4.2	↓	↓
17000	309	-4.1	-2.6	244	18.0	3000	F.S.
18300M	313	-4.0	-2.8	242	18.0	↓	↓
20000	310	-3.7	-2.8	231	15.7	↓	↓
22000	302	-3.2	-2.7	219	12.9	↓	↓

M Full throttle height

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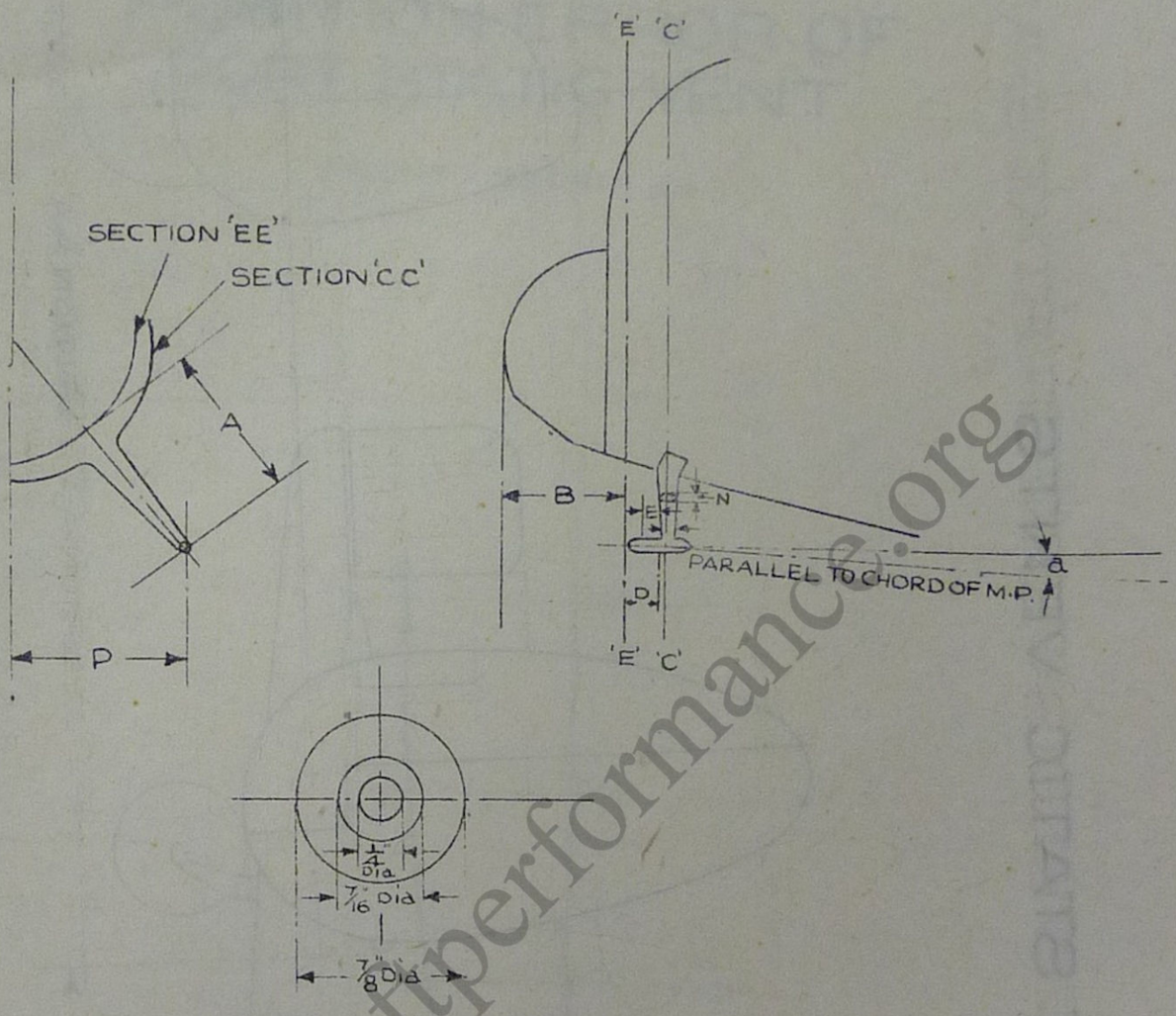
FIG 1

PRESSURE HEAD POSITION



DETAIL OF APERTURE.

Type of Pressure Head _____ MK VIII D. 24 V. REF NO 6A/731 SERIAL No 12925/43.

Ratio of Aperture of Tube to External dia of Static Tube _____ SEE SKETCH

Incidence of Main Plane (at Root) _____ +4°-20'

a. Angle of Head to Chord of Main Plane _____ -4°-40'

A. Nose of Head to Fuselage (minimum distance) _____ 23½"

B. " " " " Nose of Fuselage (parallel to datum line) _____ 23 3/8"

D. " " " " Strut (minimum distance) _____ 6"

E. Strut to Static Holes (mean) _____ 2 5/8"

M. Major Axis of Strut. _____ 6" TAPERING TO 2"

N. Minor " " " _____ 1½ " " ¾"

P. Position of Pressure Head. _____ 31 3/8" TO PORT OF ℄ OF A/C

5 | PART OF REPORT No A&AEE/7662 | LANCASTER VI. JB 675 | SKETCH No 2778. | TRACED ~ Anderson | DATE ~ 23.4.44 | CHECKED ~ Maine | APPROVED ~ [illegible]

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FIG3

POSITION ERROR OF PORT STATIC VENT

WEIGHT ~ 55,000 LBS

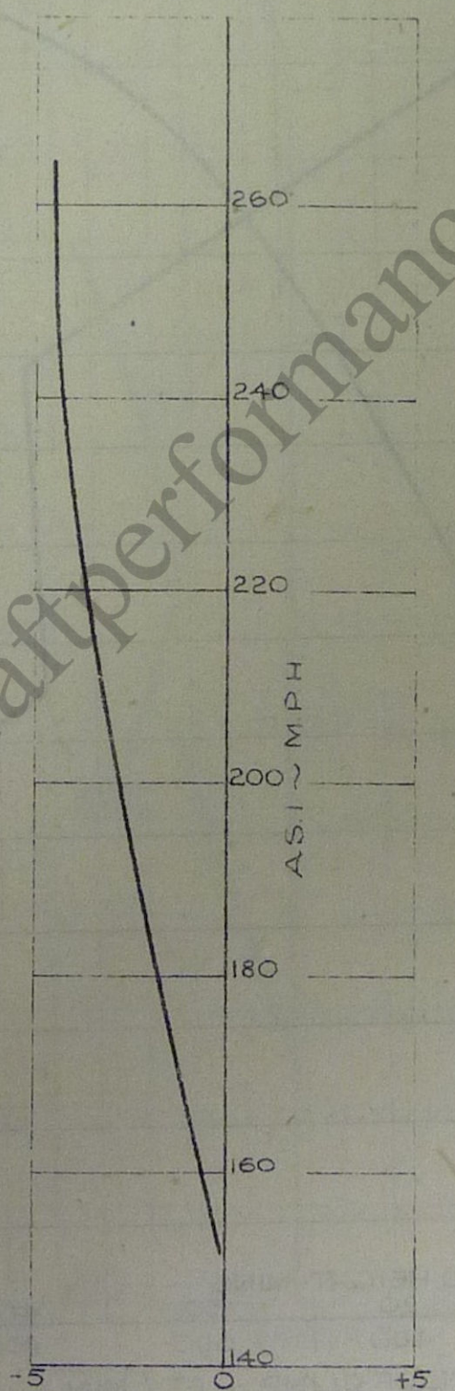

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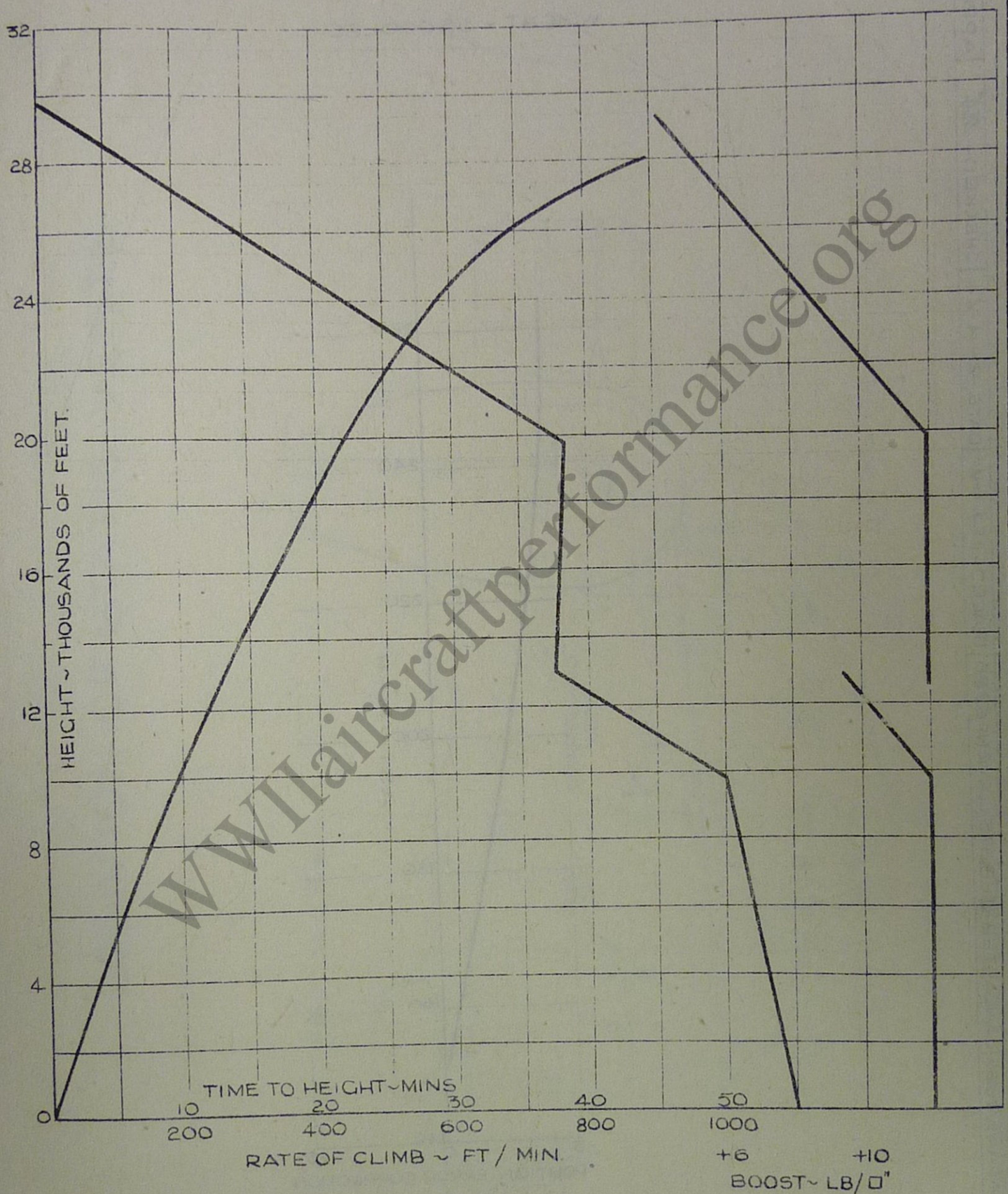
FIG 4

F. T. CLIMB PERFORMANCE

TAKE-OFF WEIGHT ~ 65,000 LB. 2850 R.P.M.

RADIATOR FLAPS OPEN. INITIAL A.S.I ~ 165 m.p.h.



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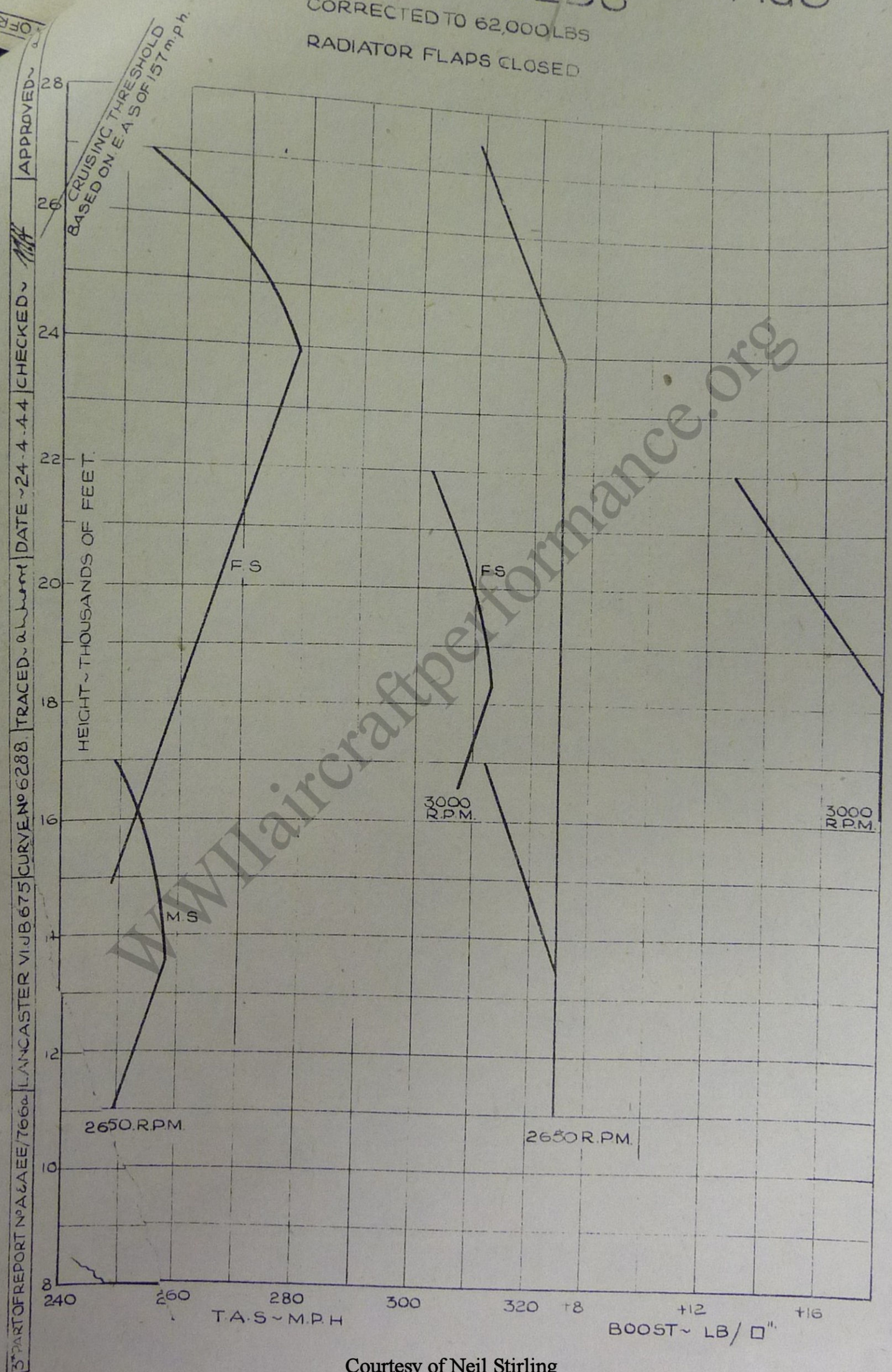
LEVEL SPEEDS

FIG 5

CORRECTED TO 62,000 LBS

RADIATOR FLAPS CLOSED



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