20th Part of Report No. A.A.E.E/766.

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT.

BOSCOMBE DOWN.

Lancaster I. D.G.595.
(4 Merlin XX.)

Level Speed Trials.

A.&.A.E.E.ref: 4497/48 Apx.62/2.
M.A.P. ref: Nil

DATE 13/12/42 | 2

Progress of Issue of Report.
12 | DATE 15/12/42

AUTHORISED

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.

Report No.	Title.
15th Part of Report A.A.E.E/766.	D.G.595 - Flame damping trials with A.&.A.E.E. Cascade Box.
16th " " " "	D.G.595 - Flame damping trials.
17th " " " "	L.7527 - Weights and loading data.
18th " " " " and Addendum.	D.G.595 & L.7535 - Carbon monoxide contamination.
19th " of Report " "	L.7527, L.7529 & L.7535 - Intensive flying trials.

1. Introduction.

Speed trials were required in order to find the loss of speed due to the fitting of the original A.&.A.E.E. Cascade box flame dampers and dorsal turret cam-track. Tests were made at light load on the second prototype Lancaster D.G.595 during December, 1941 for comparison with previous level speeds.

2. Condition of Aeroplane. (see Table III)

2.1. Loading. The first set of level speeds (condition A) were measured at a weight of 45,300 lb. and C.G. 46.5 ins. aft of the datum. The other tests (B, C and D) were made at 46,000 lb. with C.G. 47.7 ins. aft. The normal design C.G.limits are 41 inches and 58 inches aft of the datum.

2.2. Propeller data. Table I gives the main particulars of the De Havilland Hydromatic propellers:-

TABLE I.

No. of blades:	3	Blade type:	D.P.455800. A-50
Diameter:	13' 0"	Course pitch:	90°
Rotation:	R.H.	Fine "	25°
Hub type	P.X.511	Pitch range:	80°
Spinner type:	P-30430.A.		

	P.O.	P.I.	S.I.	S.O.
Hub serial No:	A.52657	A.52658	A.52659	A.52660
Blade serial No: 1.	C.M.491	C.M.542	C.M.538	C.M.529
2.	C.M.420	C.M.544	C.M.543	C.M.533
3.	C.M.525	C.M.551	C.M.550	C.M.534

2.3. External features. The most important features of the aeroplane are given in detail in Table II.

TABLE II.

Item.	Details for test A	Changes between tests A, B, C & D
Fuselage.		
Nose turret	F.N.5) no	cam ring fitted round dorsal turret for Test D. (see photograph).
Tail "	F.N.20) guns	
Dorsal "	F.N.50)	
Under "	F.N.64)	
Bomb doors.	Normal type fitting flush with lines of fuselage.	Large bomb doors fitted after Test.A.

/cont:-

ble II (cont:-)

Item.	Details for test A	Changes between tests A, B, C & D.
Astro-domes.	One in cabin roof above Navigator's table. Another above W/T.position (at rear end of cabin roof).	
Navigation blisters.	One each side of cabin.	
Cabin air extractors.	One each side of nose (fixed, rearward facing scoops).	
W/T.Aerials,etc.	D.F.loop inside cabin roof. Beam -approach aerials below rear fuselage. Main aerials from cabin roof to fins (no masts)	
Tail wheel.	Not retractable.	
Engine Nacelles (Beaufighter type) - rear part of Air intakes.	to flaps. No air cleaners or ice-guards.	inboard nacelles attached
Exhausts.	Multi-ejector fishtails.	Unlouvered duct shrouds fitted after Test A. A.&A.E.E.cascade boxes (illustrated in 15th Part of this Report) fitted for Test B.only.
Radiator flaps.	Thermostatically controlled. Closed during all level speeds.	
Undercarriage.	Completely retractable.	
Wings. Air intakes.	Rectangular intake for cabin air in leading edge between fuselage and inboard nacelles. Exit on under surface of wing at root.	
Barrage cutters.) De-icing.)	None fitted.	
Aileron control.	Single lever on upper surface.	

Photographs at the end of the report show the aeroplane in condition C, and a close-up of the dorsal turret and cam track. The Cascade boxes are illustrated in the 15th Part of this Report.

3. Summary of tests.

The first full throttle speeds were measured every 2,000 ft. from 2,000 feet to 25,000 feet, using both supercharger gears; maximum economic cruising speeds were measured between 8,000 feet and 25,000 feet.

In the later tests, only M.S.Supercharger gear was used, the height range being 8,000 feet to 16,000 feet.

The tests have been numbered according to the condition of the aeroplane, as shown in Table III.

Table III

Test.	Condition of Aeroplane.
A.	Normal bomb doors.
B.	Large bomb doors. Exhaust shrouds and cascade boxes.
C.	As(B) but cascade boxes removed.
D.	As (C) but with dorsal turret cam-ring fitted.

4. Results.

Results are given in the Appendix Tables V to X, and Figures 1 and 2, and were reduced on the $p^{\frac{1}{2}}\sigma^{\frac{1}{2}}$ basis. Speeds have been calculated using the position error curve given in the 14th Part of this Report (corrected for a weight of 60,000 lb.)

It will be noted that the full throttle boost obtained in Test A was $\frac{1}{2}$ to $\frac{3}{4}$ lb./sq.in. greater than the boost obtained in Tests B, C and D. This discrepancy has been allowed for in the results summarised in Table IV below.

TABLE IV.

Items affecting speed.	Speed difference at F.T.height.	Tests.
A.&.A.E.E.Cascade boxes.	14 m.p.h.	B & C.
Dorsal turret cam-track.	Nil.	C & D.
Large bomb doors and exhaust shrouds.	2 to 3 m.p.h.	A & D.

5. Conclusions.

The top speed of the Lancaster is reduced by 5% (i.e. 14 m.p.h. at full throttle height) by the original A.&.A.E.E. cascade box flame dampers. The cam track fitted to the dorsal turret has no apparent effect on speed. The combined effect of exhaust shrouds and large bomb doors is small, the top speed being reduced by about 3 m.p.h.

APPENDIX.

TABLE V.

Full throttle speeds. Condition A.
3000 r.p.m.
Wt. 45300 lb.

Height. Feet.	T.A.S. m.p.h.	A.S.I. m.p.h.	P.E.C. m.p.h.	Comp. error. m.p.h.	Mean Boost lb/sq.in.	Supercharger gear.
4000	251	241	-4.0	-.4	+8.9	M.S.
6000	257	240	-4.0	-.7	+8.9	
8000	263	238	-4.0	-1.0	+8.6	
10000	269	236	-4.1	-1.2	+8.5	
13000*	278	233	-4.1	-1.6	+8.5	
16000	275	221	-4.2	-1.8	+6.1	
18000	271	211	-4.3	-1.8	+4.6	
20000	265	199	-4.4	-1.8	+3.1	
19000	282	216	-4.3	-2.2	+8.2	F.S.
20000*	286	215	-4.3	-2.4	+8.2	
22000	280	204	-4.4	-2.4	+6.6	
25000	264	183	-4.5	-2.0	+4.3	

TABLE VI.

Maximum economic cruising speeds. Condition A.
2650 r.p.m.
Weak mixture.

8000	242	219	-4.2	-.7	+4.0	M.S.
10000	247	217	-4.3	-.9	+4.0	
12000	252	215	-4.3	-1.1	+4.0	
14800*	259	212	-4.3	-1.5	+4.0	
17000					+2.6	
18000	260	202	-4.4	-1.6	+4.0	F.S.
20800*	267	199	-4.5	-2.0	+4.0	
22000	263	192	-4.5	-1.9	+3.2	
25000	251	174	-4.3	-1.7	+1.2	

TABLE VII.

Full throttle speeds. Condition B. Wt.46000 lb.
M.S.supercharger gear.
3000 r.p.m.
Rich mixture.

8000	247	224	-4.2	-.7	+7.8	
10000	251	221	-4.2	-1.0		
12000	256	218	-4.3	-1.2		
13300*	259	217	-4.3	-1.3		
14000	257	213	-4.3	-1.4	+7.2	
16000	249	200	-4.5	-1.4	+5.6	

TABLE VIII.

Maximum economic cruising speeds. Condition B.
M.S. supercharger gear.
2650 r.p.m.
Weak mixture.

8000	225	204	-4.3	-.6	+4.0	
10000	230	203	-4.4	-.7		
12000	235	201	-4.4	-.9		
13600*	239	199	-4.4	-1.1		
14000	237	197	-4.5	-1.1	+3.8	
16000	226	182	-4.5	-1.1	+2.6	

* Full throttle heights.

/TABLES IX and X.

TABLE IX.

Full throttle speeds. Conditions C and D.Wt. 46000 lb.

M.S.supercharger gear.
3000 r.p.m.
Rich Mixture.

Height feet.	T.A.S m.p.h.	A.S.I. m.p.h.	P.E.C. m.p.h.	Comp. error. m.p.h.	Mean boost lb/sq.in.
8000	257	232	-4.1	-.8	+7.8
10000	263	231	-4.1	-1.1	
12000	269	229	-4.2	-1.3	
13300*	273	228	-4.2	-1.6	
14000	272	225	-4.2	-1.6	+7.2
16000	265	213	-4.3	-1.7	+5.6

* Full throttle height.

TABLE X.

Maximum economic cruising speeds. Conditions C.& D.

M.S.supercharger gear.
2650 r.p.m.
Weak mixture.

8000	238	216	-4.3	-.7	+4.0
10000	243	214	-4.3	-.8	
12000	248	212	-4.3	-1.1	
13600*	252	210	-4.3	-1.2	
14000	251	208	-4.3	-1.3	+3.8
16000	243	196	-4.5	-1.3	+2.6

* Full throttle height.

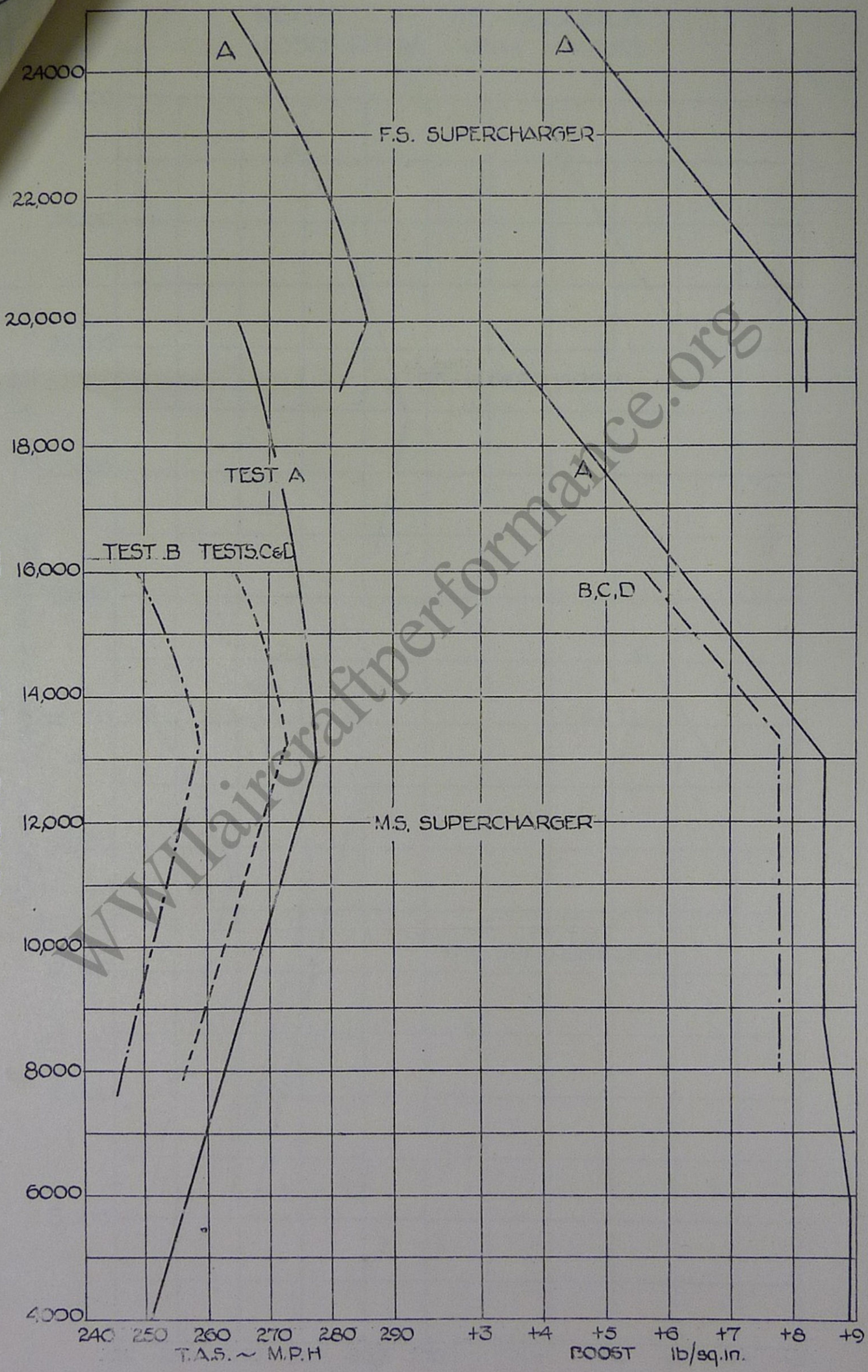
Circulation List

C.R.D.
D.C.R.D.
D.G.A.P.
D.T.D.
D.D.T.D.
D.O.R.
D.D.R.D.A.
D.D.R.D.T.
A.D.R.D.T.1.
D.R.A.E. Four copies
R.D.T.3.
D.E.D.
A.D.R.D.E.1.
A.D.R.D.E.2.
D.A.D.R.D.E.4.
A.D.R.D.L. Two copies (1 for Action)
A.D.D.A.(N.A.) One copy
C.I. Accidents.
Chief Overseer.
Central Group Supervisor.
R.D.T.5. 6 copies
R.T.P.2. 13 copies + 6 copies
R.T.O. A.V. Roe 2 copies
R.T.O. Rolls Royce (Derby) 2 copies
R.T.O. " " (Hucknall) 2 copies

LANCASTER D.G. 595 FIG.1.

FULL THROTTLE SPEEDS

WEIGHT ~ 45-46000 LB
3000 R.P.M.



20TH PART OF REPORT N° A&AEE/766 | CURVE N° 2873 | TRACED M Washley | DATE OF TEST DEC/41 | CHECKED

LANCASTER D.G. 595 FIG.2

MAXIMUM ECONOMIC CRUISING SPEEDS

WEIGHT ~ 45 - 46000 LB
2650 R.P.M. WEAK MIXTURE