

AVIA 18/716

BOSCOMBE DOWN

Mosquito IV D.K.290  
(2 Merlin 21)

UNCLASSIFIED

Comparative level speeds  
with ducted saxophone and multi stub exhausts

A. & A.E.E. ref: 4487/44-AM.61/9.

M.A.P. ref: 11.SF. SB.33571/RDL1(b).

Period of tests: December, 1942 - March, 1943

DATE	18/12/52	STOCK	9
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This report deals with the aircraft (or equipment) as tested. Action to remedy defect or decisions to accept items not in strict compliance with the specification are matters for decision and action by the Ministry of Aircraft Production.

Progress of issue of report

Report No.	Reduce to	DATE	TITLE
7th Part of A. & A.E.E./767, c	11	19.7.52	AUTHORISED Limited circulation.
8th do.	12	19.7.52	D.K.290 - Most Secret. Fuel consumption measurements of 2 Merlin 21 engines at 2,000 ft.
9th do.			D.K.290 - Fuel consumption measurements of 2 Merlin 21 engines at 2,000 ft.
10th do.			D.K.327 - Position error trials.
11th do.			D.Z.594 - Brief handling trials at light load.

Summary

Level speed measurements have been made at all-out level power conditions with both ducted saxophone and multi stub exhausts fitted.

The multi stub exhausts increase the true airspeed by 15 mph in MS gear and 13 mph in FS gear below the respective full throttle heights.

1. Introduction.

It was proposed to introduce multistub exhausts into production on the Mosquito aircraft, replacing the ducted saxophone type fitted as standard. Comparative level speed measurements were required with each of these exhaust systems fitted. For the purpose of acquiring adequate flame damping with the multi stubs it was intended to partially flatten the outlets and to cover the stubs with a duct. The tests were, however, curtailed by MAP before this third type of exhaust system could be tested for performance.

2. Condition of aircraft relevant to tests.

2.1 General. The aircraft was a production B Mk.IV Mosquito, second series, i.e. it had extended engine nacelles and 20'9" span tailplane. The aircraft was in grey green camouflage of smooth finish.

A W/T aerial mast was fitted on top of the fuselage and from this mast an aerial ran to the fin and another to about midway out along the port tailplane.

The aircraft, being a bomber version, had a moulded transparent nose with a flat bomb aimer's window but no guns.

The pilot's windscreen was V-shaped.

The pressure head, which was of usual unmarked Mosquito type situated on the fin, together with the usual Mosquito static vent on the port side of the nose, were identical in type and position with those of Mosquito IV D.K.327 (see 10th Part of Report No. A.A.E./767, c).

2.2 Details of exhaust systems.

2.21 Standard system. The system originally fitted to the aircraft and fitted for the first series of tests was the ducted saxophone type.

2.22 Multi stub system. The system fitted at this Establishment and fitted for the second series of tests was composed of separate stub pipes one

from each cylinder.

It will be seen from the photograph attached that the stubs were facing rearward at approximately 25° below the horizontal.

2.3 Engine numbers and limitations. The numbers of the Merlin 21 engines fitted in Mosquito DK.290 were:-

<u>Port</u>	<u>Stbd.</u>
A.242624, 49007	A.251517, 62013

Relevant limitations obtaining at time of test were:-

	<u>Boost</u> lb/sq.in	<u>Engine speed</u> rpm.	<u>S/C</u> <u>gear</u>
All-out level	+9	3000	MS & FS

2.4 Loading. The tests were made at a take-off weight of 20,700 lb. with C.G. at 16.2" aft of datum; this is approximately the normal typical Service load.

3. Scope of tests.

Level speed measurements were made at all-out level power with both types of exhaust systems fitted in turn,

between 6,000 and 18,000 ft. in MS supercharger  
and 16,000 and 24,000 ft. in FS supercharger

The radiator flaps were in the closed position.

4. Results of tests.

In the reduction of the results the position error for Mosquito DK.327 was used (see 10th Part of Report No. AALL/767,a). It was intended to obtain a position error measurement on Mosquito DK.290 but the opportunity was lost when the aircraft was considerably modified for a special operational role (see 5th Pt. of Report No. AALL/767,c, limited circulation).

All results have been corrected to 19,700 lb., i.e. 95% of the take-off weight, and to standard conditions by the method of AALL Report/Res/170.

The results are given fully in Tables I and II and Fig.1, and are summarised below.

Height	S/c gear	True air speed (mph)	
		Ducted saxophone system	Multi stub system
6,000	M.S.	324	340
15,000	M.S.	358 /	373 /
18,000	M.S.	351*	369
16,000	F.S.	346	360
21,600	F.S.	367 /	380 /
24,000	F.S.	358	374

\* It will be seen from Fig.1 that above 15,000 ft. using MS gear, i.e. above the full throttle height, the boost pressure with ducted saxophones was 0.7 lb/sq.in. lower than for the speeds with multi stub exhausts but when employing FS gear the comparative difference was only 0.3 lb/sq.in. It is thought that the larger difference of 0.7 lb/sq.in. encountered was due to a great extent to a defect in the carburettor possibly in the butterfly mechanism and hence the speeds in MS gear above the full throttle height should not be used for determining the comparative effect of the exhausts.

/ It will be seen that at constant boost the effect on true air speed of fitting the multi stub exhaust system is a gain of 15 mph in MS supercharger and 13 mph in FS supercharger.

TABLE I

Level speed performance

Corrected to standard atmospheric conditions  
and 19,800 lb. weight.

Radiator flap closed.

Cold air intake.

Ducted saxophone exhausts fitted

Height (ft)	TAS mph	ASI mph	Corrections m.p.h.		Boost lb/sq.in	RPM.	Mixture Control	S/C gear
			P.E.	C.L.				
6,000	324	298	+0.7	-1.3	+9.0	3000	Rich	M.S.
8,000	332	295	+0.7	-1.8	↓	↓	↓	↓
10,000	339	293	+0.7	-2.4	↓	↓	↓	↓
12,000	347	291	+0.8	-2.9	↓	↓	↓	↓
14,000	354	288	+0.8	-3.5	↓	↓	↓	↓
15,000	358	287	+0.8	-3.8	↓	↓	↓	↓
16,000	356	281	+0.9	-3.7	+8.0	↓	↓	↓
17,600	352	271	+1.0	-4.0	+6.5	↓	↓	↓
18,200	350	266	+1.1	-4.0	+6.1	↓	↓	↓
16,000	346	273	+1.0	-3.6	+9.0	↓	↓	F.S.
17,600	352	271	+1.0	-4.0	↓	↓	↓	↓
20,000	361	267	+1.1	-4.6	↓	↓	↓	↓
21,600	367	264	+1.2	-5.0	↓	↓	↓	↓
23,000	362	255	+1.3	-4.9	+7.7	↓	↓	↓
24,000	358	247	+1.3	-4.7	+6.7	↓	↓	↓

TABLE II

Multi stub exhausts fitted

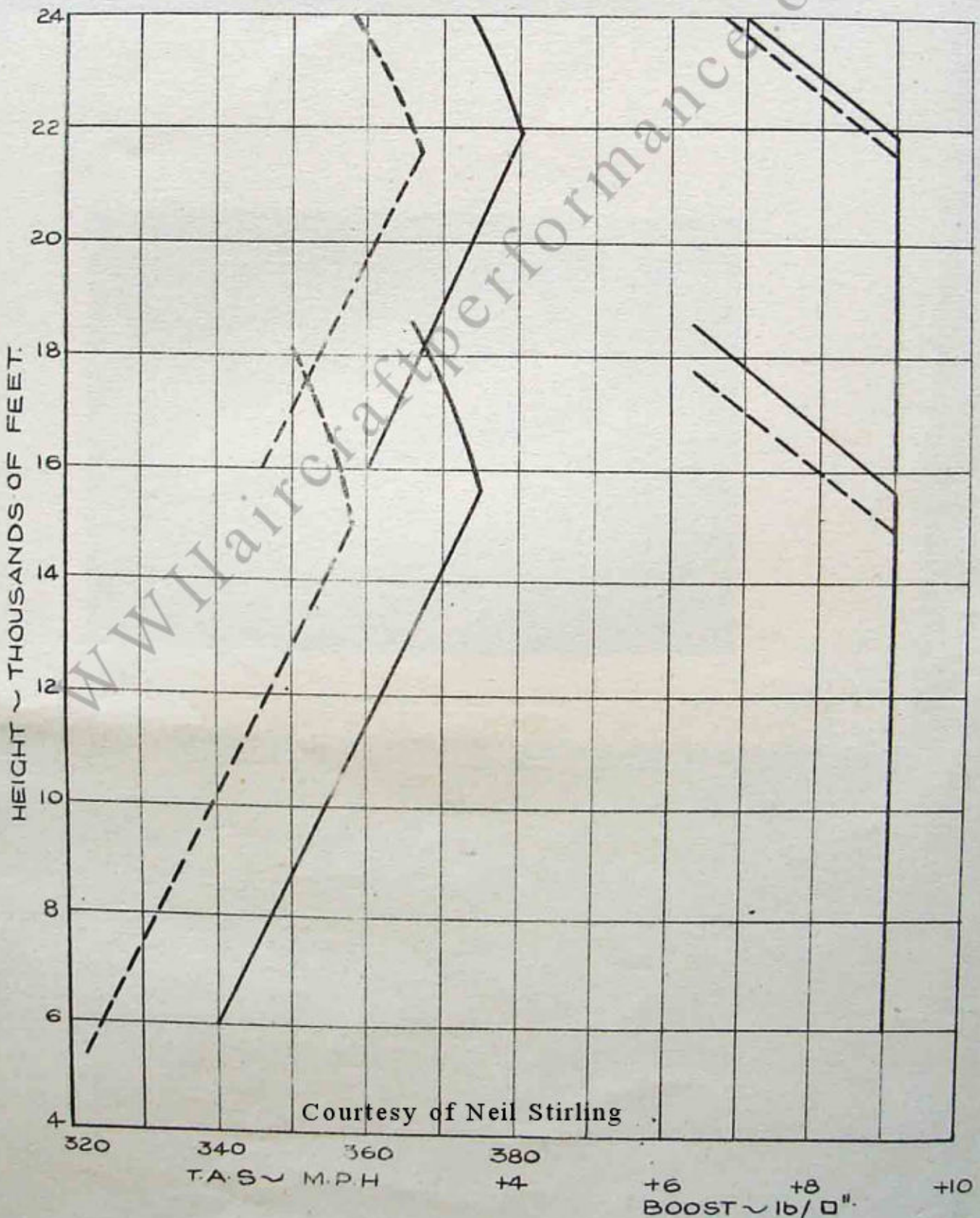
Other details as above

6,000	340	312	+0.4	-1.6	+9.0	3000	Rich	M.S.
8,000	347	309	+0.5	-2.1	↓	↓	↓	↓
10,000	355	307	+0.5	-2.7	↓	↓	↓	↓
12,000	362	304	+0.5	-3.4	↓	↓	↓	↓
14,000	369	301	+0.6	-3.9	↓	↓	↓	↓
15,700	375	298	+0.7	-4.5	↓	↓	↓	↓
17,000	372	290	+0.7	-4.6	+7.8	↓	↓	↓
18,200	368	280	+0.8	-4.6	+6.7	↓	↓	↓
18,600	366	277	+0.9	-4.6	+6.3	↓	↓	↓
16,000	360	284	+0.8	-4.1	+9.0	↓	↓	F.S.
18,200	368	280	+0.8	-4.6	↓	↓	↓	↓
20,000	374	277	+0.9	-5.0	↓	↓	↓	↓
21,900	380	273	+1.0	-5.5	↓	↓	↓	↓
23,000	377	265	+1.1	-5.5	+7.9	↓	↓	↓
24,000	374	259	+1.2	-5.5	+7.0	↓	↓	↓

# MOSQUITO IV DK 290 LEVEL SPEEDS.

COMPARISON OF PERFORMANCE WITH  
MULTI STUB AND DUCTED SAXAPHONE  
EXHAUSTS.

----- DUCTED SAXAPHONE  
 \_\_\_\_\_ MULTI STUB EXHAUSTS.



Courtesy of Neil Stirling

APPROVED *[Signature]* CHECKED *[Signature]*  
 DATE OF TEST ~ DEC 42 ~ MARCH 43.  
 TRACED ~ ALHWOOD.  
 CURVE NO 5636  
 CURVE 767C  
 NO A6AEE/767C  
 PART OF REPORT

