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7th Part of Report No. A.& A.E.E./767,e.

19 SEP 1943

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

Mosquito FB. Mk.VI. HJ. 679
(2 Merlin 25's)

Brief performance trials

This aircraft 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 Prodn.

A.& A.E.E. ref:- 4487/44 A.M.61/19.
M.A.P. ref:- SB. 45388/RDL1(b).
Period of tests:- 3rd July to 16th August, 1943.

Progress of issue of report

Report No.		Title
1st Part of A.& A.E.E./767,e.		H.J.662/G - Weights and loading data.
2nd	do.	H.J.662/G - Brief handling and diving trials of Intruder version.
3rd	do.	H.J.662/G - Take-off trials.
4th	do.	H.J.663 - Brief handling tests with, and drop tests of, auxiliary wing drop tanks.
5th	do.	H.J.663 - Position error of static vent with and without cover over drift recorder hole
6th	do.	H.J.679 - Position error trials.

1. Introduction.

The climb and level speed performance of the Mk.VI fighter-bomber version of the Mosquito has been measured with drop tanks fitted beneath the wings. A brief check of the level speed performance has also been made with the drop tanks off, to determine their effect on speed.

2. Condition of aircraft relevant to tests.

2.1. General. The aircraft was a production F.B. Mk.VI Mosquito, fitted with 2 Merlin 25 engines. The following items of equipment were fitted during the tests:-

(i) Full armament of 4 x 0.303" machine guns and 4 x 20 mm. guns Hispano with the muzzles sealed, but the fuselage blast tubes and ejector chutes unsealed.
(ii) Auxiliary wing drop tanks, each of 42 gallons capacity, one carried below each wing outboard of the engine nacelle.
(iii) An aerial mast with a single aerial running to the leading edge of the tailfin.
(iv) A static vent on the starboard side of the nose with the pressure head carried on a short strut from the leading edge of the fin. A full description is given in the 6th part of this report.
(v) The engines were fitted with multi-stub single ejector exhausts.

There were no external I.F.F. or A.I. aerials fitted. The carburettor air intake had neither ice guards nor air cleaners fitted.

2.2. Engine number and limitations. The following Merlin 25 engines were fitted:-

	Maker's No.	A.M. No.
Port	118005	A/402792
Starboard	118007	A/402793

These engines were fitted with single lever carburettors.

The following engine limitations applied at time of test:-

/table

	RPM	Boost lb/in^2	S/C gear
Take-off (1000ft or 5 mins)	3000	+18	M.S.
Climb (1 hour limit)	2850	+ 9	M.S. & F.S.
All-out level	3000	+18	"
Maximum cruising	2650	+ 7	"

2.3. Loading. The following loadings were used during the tests:-

Load-ing	Take-off weight lbs.	C.G. ins aft of datum	Condition
I	21,020	14.9	Auxiliary drop tanks on (Normal Typical Service load)
II	20,900	14.9	" " " off (ditto with tanks removed)
III	21,985	15.8	" " " on (Overload)

The centre of gravity positions quoted above are with the undercarriage down.

3. Scope of tests.

The following tests were done:-

(i) Comparative climb performance with radiator flaps fully open at Loadings I and III of para. 2.3. above. A climbing speed of 170 mph ASI to full-throttle height in F.S. supercharger and then reducing speed by 2 mph per 1000 feet was used at both weights, as the relatively small change in weight did not justify changing the climbing speed.

(ii) Level speed measurements with radiator flaps closed in M.S. and F.S. supercharger gears at all-out level power and at maximum permissible cruising power between 4000 and 24000 feet at Loading I, and in F.S. supercharger gear between 9000 and 24,000 feet at Loading II.

4. Results of tests:

The results have been corrected to standard atmospheric conditions, and the level speeds to a weight of 20,000 lb. (95% of the take-off weight of loading I) by the methods of A.& A.E.E./Res/170. The position error correction used was measured on this aircraft and is given in the 6th part of this report.

4.1 Climb performance. The performance on climb at loading I is given in Table I and Fig.1., and at loading III in Table II and Fig.1. These results are summarised as follow:-

(i) Loading I (21020 lb.) Max. rate of climb in M.S. gear = 1740 ft/min @ 10400 ft.
" " " in F.S. gear = 1440 ft/min @ 17000 ft.
Time to reach 20,000 ft. = 12.85 mins.
" " " 25,000 ft. = 18.8 mins.
Estimated service ceiling = 29800 feet
" absolute " = 31000 feet

These results were obtained with the boost control in operation, and full boost of + 9 lb/sq.in. was not obtained (see para.5).

(ii) Loading III (21,985 lb). Maximum rate of climb in M.S. S/c gear = 1560 ft/min @ 10400 feet.
" " " " F.S. " " = 1300 ft/min @ 17200 feet.
Time to reach 20,000 feet = 14.25 minutes
" " " 25,000 feet = 21.05 "

/Estimated

Estimated service ceiling = 29,100 feet
" absolute " = 30,400 "

The above results were obtained by use of the boost control cut-out to maintain the maximum permissible boost of +9 lb/sq.in. below full throttle height (see para.5.)

4.2. Level speed performance. The level speed performance in M.S. and F.S. supercharger gears at loading I, corrected to a weight of 20,000 lb., is given in Table III and Fig.2. The level speeds performance in F.S. supercharger gear at loading II, also corrected to a weight of 20,000 lb., is given in Table IV and Fig.2. These results are summarised below:-

Condition	S/C gear	Max. T.A.S. (mph)		Respective full throttle height	
		All-out level	Max. cruising	All-out level	Max. cruising
Loading I (Aux. tanks on)	M.S.	351	321	4,700	12,200
	F.S.	363	332	11,900	18,600
Loading II (Aux. tanks off)	F.S.	368	338	12,000	18,700

The increase in true air speed below full throttle height by removing the auxiliary wing drop tanks is 5 mph at all-out level, and 6 mph at maximum cruising power in F.S. gear, increasing to 12 mph and 9 mph at 24,000 feet in all-out level and maximum cruising powers respectively.

5. Discussion of results.

From Tables I and II and Fig.1, it will be noticed that there was some variation of boost experienced during the full throttle climbs. The climbs done at a take-off weight of 21,020 lb were done with the automatic boost control operating, and maximum permissible boost was not obtained below the full throttle heights. This has occurred on other Mosquito variants. When the climbs at the higher weight were done, the boost cut-out control was operated and the boost hand controlled at the maximum permissible boost value of + 9 lb/sq.in. Above full throttle height in F.S. supercharger, an increase of from 0.4 to 0.6 lb/sq.in. in boost was obtained as compared with that previously obtained during the climbs at the lighter weight. No explanation for this discrepancy could be found.

Notwithstanding this increase of boost at the higher weight, the reduction in the rate of climb is greater than would be expected for an increase of weight of about 5%. This discrepancy decreased with altitude and at high altitudes the reduction in rate of climb with weight was in fair agreement with values calculated by the methods of Report No. A.& A.E.E./Res/170.

6. Effect of increase in power from use of Merlin 25 engines.

The Merlin 25 engine is basically similar to the Merlin 21, having the same supercharger compression ratio and differs mainly by virtue of limitations.

Level speed measurements in F.S. supercharger were previously made on the Merlin 21 installation in Mosquito II W 4076 (see 8th Part of Report No. A.& A.E.E./767a).

These results have been corrected to the same weight as those of HJ 679 and it is found that at the same height and boost pressure i.e. 20700 ft., +9 lb/sq.in. boost, the true level speed of W 4076 is 364 mph and HJ 679 is 361 mph. It would have been expected that for the same power HJ 679 would be approximately 15 mph faster than W 4076 since it had multi-stub ejector exhausts instead of ducted fishtails and no A.I. aerials.

In order to obtain the effect of the higher boost pressures +18 lb/sq.in. used on HJ 679, the corrected level speeds obtained for W 4076 have been extrapolated under the full throttle height from 18000 feet down to 12000 ft.

/the full

the full throttle height of HJ 679 at 18 lb/sq.in. boost. At this height the difference in true level speeds is approximately 40 mph and this is in good agreement with the effect to be expected from calculation by the methods of A.& A.E.E. Res/170.

7. Conclusions.

While the use of Merlin 25 engines appears to increase the true level speed by approximately 40 mph it is evident that HJ 679 has more drag than W 4076 since although it has multi-stub exhausts in lieu of ducted saxaphone type and has no A.I. aerials, it is no faster than W 4076 at the same power and altitude. It is therefore thought that HJ 5679 may not be truly representative of the type and it is recommended a check be made on another of these aircraft.

TABLE I

Performance on climb

Weight:-21,020 lb (auxiliary tanks on) Radiator flaps open Cold air intake

Standard height feet	Rate of climb Ft/Min	Time from start (mins)	A.S.I. m.p.h.	T.A.S. m.p.h.	R.P.M.	Boost lb/sq.in.	Mixture Automatic	S/C gear M.S.
0	1690	0	-	-	-	-		
2000	1700	1.15	170	176	2850	8.7		
4000	1710	2.35		181		8.7		
6000	1720	3.55		187		8.7		
8000	1730	4.7		192		8.6		
*10400	1740	6.1		200		8.3		
12000	1555	7.1		205		7.4		
/13200	1425	7.85		208		6.0 / 8.6		F.S.
14000	1425	8.4		211				
16000	1435	9.8		218				
*17000	1440	10.5		221				
18000	1335	11.2	168	222		7.7		
20000	1130	12.85	164	224		6.2		
22000	925	14.8	160	226		4.7		
24000	720	17.25	156	226		3.3		
26000	515	20.4	152	227		2.0		
28000	310	25.35	148	225		0.6		

Estimated service ceiling = 29,800 feet.
" absolute " = 31,000 feet

TABLE II

Performance on climb

Weight:- 21,985 lb (auxiliary tanks on) Radiator flaps open Cold air intake

Standard height feet	Rate of climb Ft/min	Time from start (mins)	A.S.I. m.p.h.	T.A.S. m.p.h.	R.P.M.	Boost lb/sq.in.	Mixture Automatic	S/C gear M.S.
0	1515	0	-	-	-	-		
2000	1525	1.3	170	176	2850	9.0		
4000	1535	2.6		181				
6000	1545	3.9		187				
8000	1555	5.25		192				
*10400	1560	6.75		200				
12000	1395	7.85		205		7.5		
/13000	1290	8.65		208		6.7 / 9.0		F.S.
14000	1290	9.4		211				
16000	1295	10.9		218				
*17200	1300	11.8		221				
18000	1225	12.45	168	222		8.3		
20000	1030	14.25	164	224		6.6		
22000	835	16.4	160	226		5.1		
24000	635	19.2	156	226		3.7		
26000	440	22.85	152	227		2.4		
28000	240	28.75	148	225		1.2		

* Full throttle heights
/ Change gear height

Estimated service ceiling = 29,100 feet.
" absolute " = 30,400 feet.

/ Table III

TABLE III

Level speed performance

Auxiliary wing drop tanks on. Mean weight:-20,000 lb. Radiator flaps closed

Standard height feet	T.A.S. m.p.h.	A.S.I. m.p.h.	Corrections (m.p.h.) P.E.	C.E.	R.P.M.	Boost lb/in^2	Mixture	S/C gear
4000	348	326	+2.8	-1.2	3000	+18.0	Automatic	M.S.
* 4700	351	326	+2.8	-1.4		18.0		
6000	351	320	+3.1	-1.7		16.7		
8000	350	309	+3.4	-2.1		14.8		
10000	350	300	+3.6	-2.5		13.0		
12000	348	289	+3.7	-2.9		11.1		
14000	346	278	+3.9	-3.2		9.3		
16000	343	267	+4.0	-3.4		7.5		
18000	338	255	+4.0	-3.5		5.8		
4000	293	273	+4.0	-0.7	2650	+ 7.0		
6000	299	271	+4.0	-1.1				
8000	307	270	+4.0	-1.5				
10000	313	267	+4.0	-1.9				
* 12200	321	265	+4.0	-2.2				
14000	317	254	+4.0	-2.5		5.4		
16000	310	241	+4.0	-2.5		3.8		
18000	296	222	+3.7	-2.3		2.3		
8000	347	306	+3.4	-2.1	3000	+18.0		F.S.
10000	355	305	+3.5	-2.7				
* 11900	363	302	+3.5	-3.3				
14000	363	292	+3.6	-3.6		15.6		
16000	361	282	+3.8	-3.9		13.4		
18000	359	271	+4.0	-4.1		11.4		
20000	355	260	+4.0	-4.3		9.5		
22000	348	246	+4.0	-4.1		7.7		
24000	337	230	+3.8	-3.8		6.0		
8000	293	256	+4.0	-1.2	2650	+ 7.0		
10000	300	256	+4.0	-1.6				
12000	307	253	+4.0	-2.0				
14000	315	252	+4.0	-2.4				
16000	322	250	+4.0	-2.8				
18000	330	248	+4.0	-3.2				
* 18600	332	247	+4.0	-3.4				
20000	330	240	+4.0	-3.3		5.7		
22000	323	227	+3.8	-3.2		4.2		
24000	311	212	+3.4	-3.0		2.7		

* Full throttle heights.

TABLE IV

Level speed performance

Auxiliary wing drop tanks off. Mean weight:-20,000 lb. Radiator flaps closed

Standard height feet	T.A.S. m.p.h.	A.S.I. m.p.h.	Corrections (m.p.h.) P.E.	C.E.	R.P.M.	Boost lb/in^2	Mixture	S/C gear
8000	353	312	+3.3	-2.2	3000	+18.0	Automatic	F.S.
10000	360	309	+3.3	-2.8				
* 12000	368	307	+3.4	-3.4				
14000	368	297	+3.6	-3.8		15.7		
16000	367	287	+3.8	-4.1		13.5		
18000	365	276	+3.9	-4.3		11.5		
20000	363	266	+4.0	-4.5		9.6		
22000	357	253	+4.0	-4.5		7.8		
24000	349	238	+4.0	-4.2		6.0		
8000	297	260	+4.0	-1.3	2650	+ 7.0		
10000	304	259	+4.0	-1.7				
12000	312	258	+4.0	-2.1				
14000	320	256	+4.0	-2.6				
16000	327	254	+4.0	-3.0				
18000	335	252	+4.0	-3.4				
* 18700	338	251	+4.0	-3.5				
20000	336	245	+4.0	-3.6		5.8		
22000	331	233	+3.9	-3.5		4.3		
24000	320	218	+3.6	-3.2		2.8		

* Full throttle heights

FIG 1

MOSQUITO VI. HJ679

(2 MERLIN 25's)

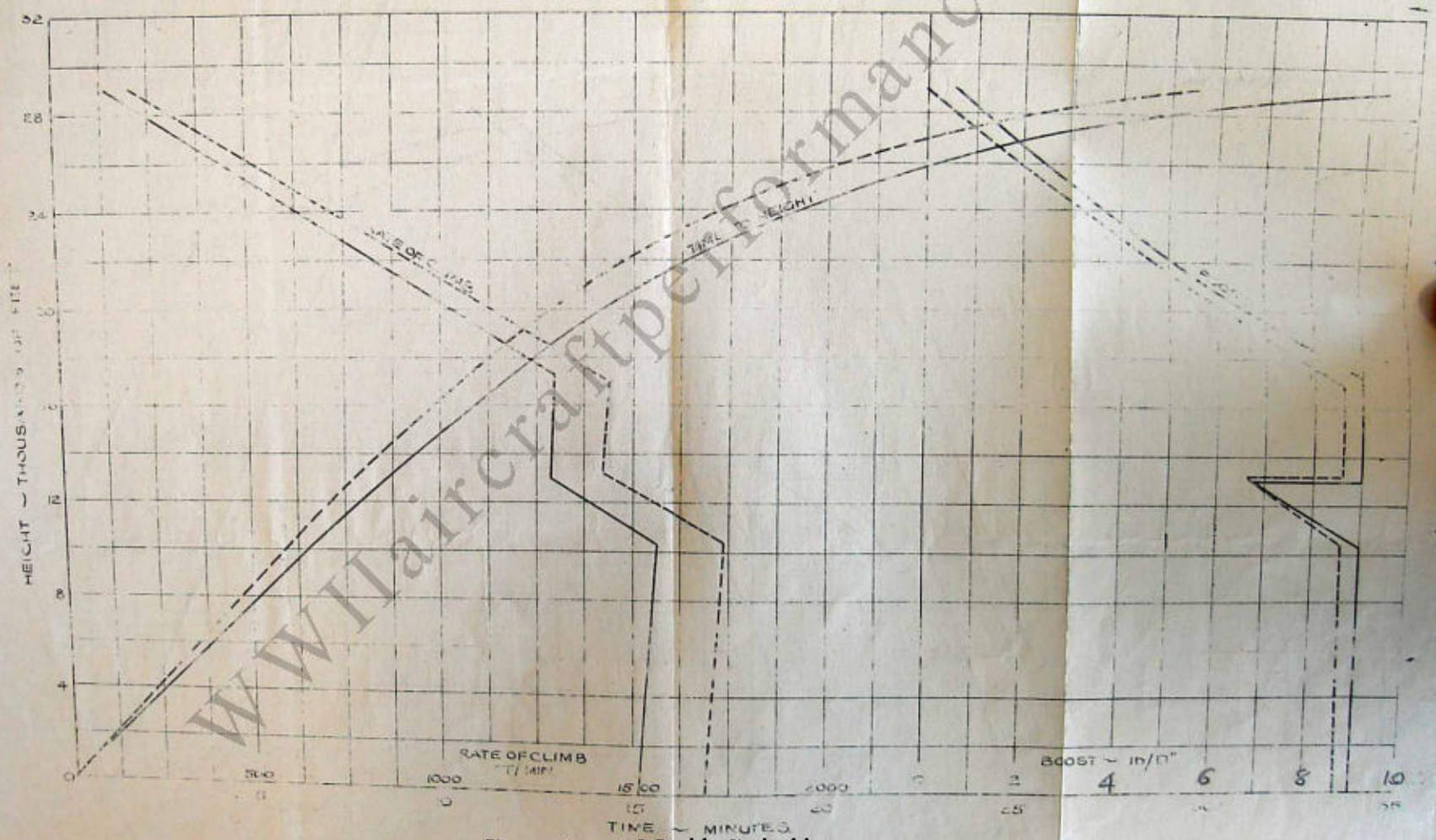
PERFORMANCE ON CLIMB

——— WEIGHT ~ 21980 lb

- - - - - WEIGHT ~ 21020 lb

RADIATOR FLAPS FULLY OPEN.

AUXILIARY WING DROP TANKS ON.



Courtesy Neil Stirling

FIG 2

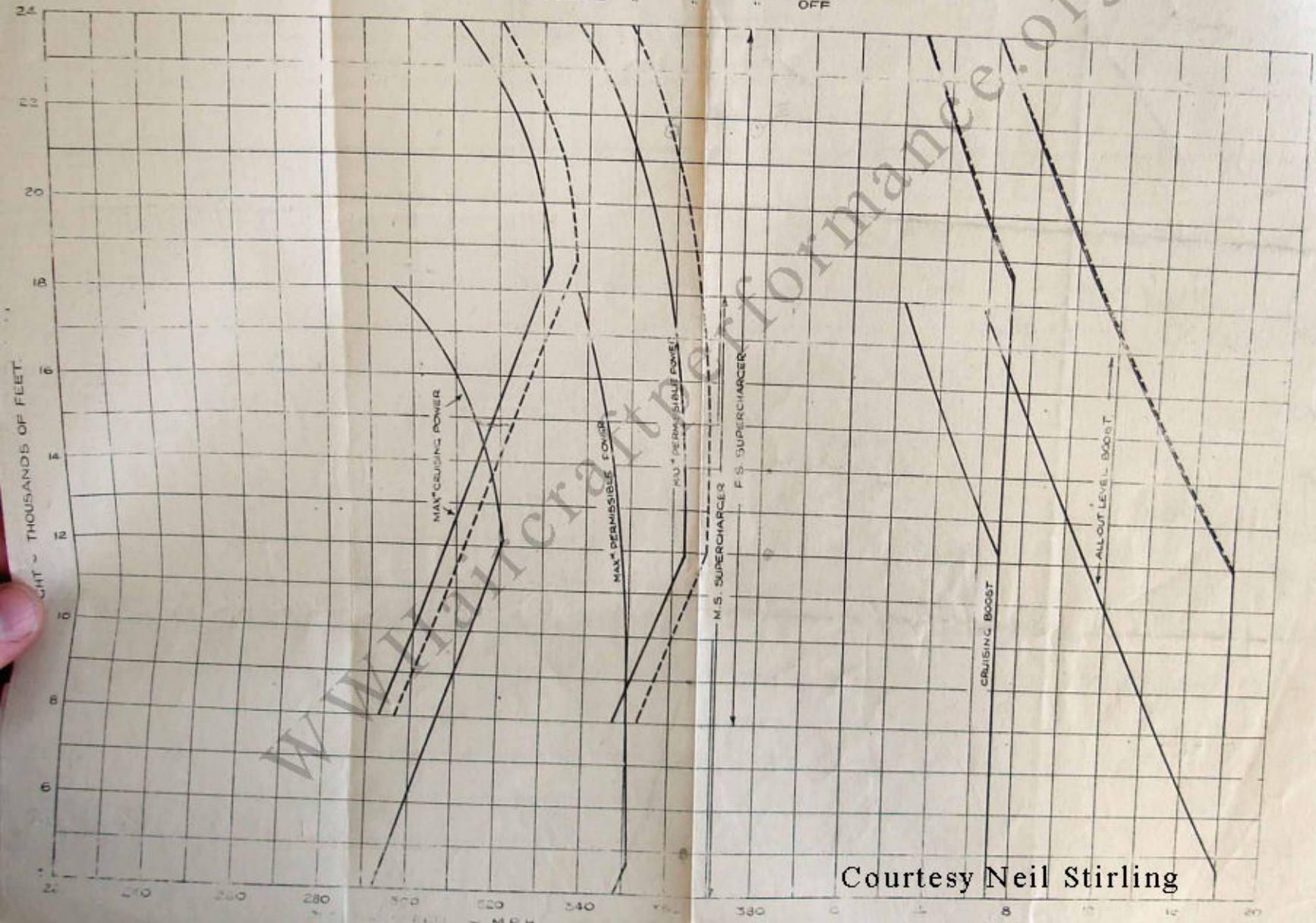
MOSQUITO VI. HJ 679

LEVEL SPEEDS AT HEIGHT

MEAN WEIGHT ~ 20,000 lb. RADIATOR FLAPS CLOSED.

——— LONG RANGE TANKS ON.

- - - - - " " " OFF



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DATE | CURVE No. 5626 | TRA. ED ~ | DATE OF TEST ~ | CHECKED ~ | APPROVED ~