

11 JUN 1943

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

Mosquito B Mk.IX LR.495
(2 Merlin 72)

UNCLASSIFIED

Performance trials without external bombs
or fuel tanksA.& A.E.E. ref: 4487/44-AM.61/18
M.A.P. ref: Res.Air.4681/11/RDE/ED.
Period of test: May, 1943.

DATE 19/11/52

STOCK

6

REDUCE TO 11 AUTHORIZED
Progress of issue of report

| Report No. | 12 | DATE 20.11.52 | Title |
|-------------------------------|----------|---|-------|
| 1st Part of A.& A.E.E./767,h. | LR.495 - | Weights and loading data. | |
| 2nd do. | LR.495 - | Position error of static vent. | |
| 3rd do. | LR.495 - | Cooling trials without external bombs or fuel tanks. | |

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.

Summary

Climb and level speed performance trials have been completed on this aircraft at a take-off weight of 21,910 lb., a loading corresponding to full fuel and oil and four 500 lb. bombs carried internally, but no external bombs or fuel tanks fitted.

The principal results are as follow:-

Max.rate of climb in MS gear (2850 rpm) +12 lb/sq.in.boost
= 2080 ft/min. at 14,000 ft. ✓
Max.rate of climb in FS gear (2850 rpm) +12 lb/sq.in.boost
= 1310 ft/min. up to 26,700 ft. ✓
Service ceiling (FS gear, 3000 rpm) = 37,000 ft.
Absolute ceiling (" ") = 37,800 ft.
Max.speed in MS gear (3000 rpm, +18 lb/sq.in. boost)
= 393 mph at 13,800 ft. ✓
Max.speed in FS gear (3000 rpm, +18 lb/sq.in. boost)
= 405 mph at 25,700 ft.

Further tests will be made with 2 - 500 lb. bombs on the wings.

1. Introduction.

Handling and performance tests were required on Mosquito B Mk.IX LR.495, fitted with Merlin 72 engines.

This Part of the Report gives the results of the performance tests in climbing and level flight without external bombs fitted. Provisional results were forwarded to MAP by letter dated 18th May, 1943.

2. Condition of aircraft relevant to tests.2.1. General. The following are the chief external features:

Aerial mast and W/T aerial; no IFF aerials.
Fully retracting tail wheel.
Guide for trailing aerial protruding about 2 ft. below the fuselage.
Extended engine nacelles.
Ice-guards fitted to the air intakes.
Intercooler radiator intakes in the nose of the engine nacelles.
Fuel cooler radiator on the starboard side of the fuselage beneath the wing root.
Multi stub ejector exhausts without flame damping shrouds.
Navigation blisters on either side of cockpit canopy.
No external bomb racks.

Details of the Mk.VIII B pressure head and the static vent on the nose were given in the 2nd Part of Report No.A.& A.E.E./767,h.

2.2. Loading. The tests were made at a take-off weight of 21,910 lb. with the C.G. at 16.6 in. aft of datum, undercarriage down. This weight corresponds to a loading with full fuel and oil, 2 crew and 4 x 500 lb. bombs carried internally.

2.3. Engine details and limitations.

2.31. The numbers of the Merlin 72 engines fitted at the time of test were:

| Port | Starboard |
|---|-----------------|
| 109461/A.399000 | 109463/A.399001 |
| (Propeller reduction gear ratio = 0.42) | |

2.32. The relevant limitations at the time of test were:

| Condition | Boost lb/sq. in. | R.P.M. |
|-------------------------------|---------------------|--------|
| Take-off (MS gear only) | +12 | 3000 |
| Max. for climbing (1 hour) | +12 | 2850 |
| Max. for level flight (5 min) | +18 | 3000 |
| Max. for cruising (rich) | + 7 | 2650 |
| Max. for cruising (weak) | + 4 | 2650 |

2.33 The engines were fitted with single lever carburettors, i.e. no mixture control lever was provided in the cockpit, the regulation being fully automatic. The super-charger gear change circuit was modified so that either MS or FS gear could be selected at will.

2.4. Propellers. D.H. Hydromatic 12 ft. diameter, 3-bladed (metal) type A.5/147.

| Hub serial No.: | Port | Starboard |
|-----------------|---------|-----------|
| | NK.4948 | NK.3768 |

3. Scope of tests.

3.1. The best climbing speed of a Mosquito PR Mk.VIII had been determined previously by partial climbs and a check was made on this Mk.IX aircraft. From this result the original climbing speed was raised slightly and all tests in this Report were made at the new speed.

Separate MS and FS climbs were made in addition to those where the supercharger gear was changed at 20,000 ft., and the rpm increased from 2850 to 3000 at 30,000 ft. The effect of closing the radiator flaps was tried near the ceiling.

3.2. In addition to all-out level speeds over a wide range of altitude, the speed at maximum weak mixture cruising conditions was measured.

The tests with the aircraft in this condition were not completed owing to the priority of other work.

4. Results.

These were corrected to standard conditions by the methods of Report No.AAEE/Res/170, the level speeds being corrected to 95% of the take-off weight. The compressibility correction to the ASI was based on the method given in Addendum to Report No.AAEE/Res/187.

The position error correction used was measured on this aircraft and is given in the 2nd Part of Report No.AAEE/767,h.

Details of climbs are given in Fig.1 and Table I and level speeds are in Fig.2 and Tables II and III.

5. Discussion of results.

5.1. About 500 ft. has been gained in ceiling by closing the radiator flaps, but coolant and oil temperatures rise rapidly and this expedient should only be used with care.

The only climb performance figures available on other Mosquito aircraft with intercooled Merlin engines which can yield a useful comparison are those relating to the PR Mk.VIII DK.324, which, though unpublished in report form, were forwarded in a letter dated 16th January. This aircraft was about 1500 lb. lighter and was

equipped with Merlin 61 engines. Compared with L.R.⁴95 the max. rate of climb (2380 and 1600 ft/min. in MS and FS gear respectively) is greater but the service ceilings are similar.

5.2. No level speeds are available on the PR Mk.VIII aircraft and thus the only comparison which can be made is with NF Mk.XV MP.469 (1st Part of Report No.AAEE/767g). This aircraft is much different from the Mk.IX, having Merlin 61 engines, extended wings, a gun trough beneath the fuselage and was flown at a load of 17,465 lb. At this condition the top speed was 408 mph at 27,800 ft. Correcting approximately for the weight and HP difference this aircraft would have a top speed of 403 mph at +18 lb/sq.in. boost.

Thus, if an allowance is made for the extra drag of MP.469, one would expect its top speed, when in the same state as LR.495, to be about 415-420 mph. By inference, therefore, the Mk.IX is rather slower than expected.

5.3. A calculation of the helical tip speed of the propeller at the full throttle height in FS gear has been made. With a forward speed of 405 mph and a rotational speed of 3000 rpm, the ratio of the tip speed to the speed of sound at ICAN conditions is 0.98. This high value may cause loss of thrust due to reduction in propeller efficiency at high rpm. Thus higher aircraft speed might be obtained at some engine speed below 3000 rpm; level speeds near full throttle height will be done later at varying rpm.

6. Further developments.

Performance and cooling trials will be made with the aircraft at the overload condition with 2 x 500 lb. bombs in faired racks fitted below the wings.

The effect of engine rpm on top speed will be investigated.

Table I

Full throttle climb MS/FS gear

Weight 21,910 lb.
Radiator shutters fully open

| Height ft. | Rate of climb ft/min | Time mins. | RPM | Boost lb/sq. in | | ASI mph | S/C gear |
|---------------|----------------------------|---------------|-----------|-----------------|----------|------------|-------------|
| | | | | Port | Stbd | | |
| 0 | 1970 | 0 | 2850 | 12.2 | 12.2 | 170 | MS |
| 4,000 | 2000 | 2.01 | | | | | |
| 8,000 | 2030 | 4.00 | | | | | |
| 12,000 | 2050 | 5.96 | | | | | |
| *14,000 | 2060 | 6.93 | | 12.2 | 11.6 | | |
| 16,000 | 1820 | 7.96 | | 10.8 | 10.1 | | |
| 18,000 | 1580 | 9.01 | | 9.1 | 8.4 | | |
| 20,200 | 1310 | 10.53 | | 7.5/12.4 | 6.8/12.4 | | FS |
| 24,000 | 1310 | 13.43 | | 12.4 | 12.4 | | |
| *26,700 | 1310 | 15.50 | | 12.4 | 12.4 | | |
| 28,000 | 1140 | 16.57 | | 11.5 | 10.9 | 166 | |
| 30,000 | 900/1040 | 18.54 | 2850/3000 | 9.7/10.3 | 9.2/9.8 | 163 | |
| 32,000 | 800 | 20.72 | 3000 | 8.5 | 8.0 | 160 | |
| 34,000 | 520 | 23.76 | | 6.7 | 6.3 | 157 | |
| 36,000 | 240 | 29.06 | | 4.9 | 4.4 | 154 | |
| 37,000 | 100 | 35.50 | | 4.0 | 3.7 | 152 | |
| 37,800 | 0 | - | | 3.5 | 3.2 | - | |

* Full throttle heights.

Service ceiling = 37,000 ft.
Absolute ceiling = 37,800 ft.
Greatest height reached = 37,000 ft.

Table II

All-out level speeds

Corrected to 20,800 lb. (95% T.O. weight)
Radiator shutters closed

| Height ft. | TAS mph | ASI mph | Corr ⁿ to ASI | | Mean boost lb/sq. in. | RPM | S/C gear |
|---------------|------------|------------|--------------------------|------------------|-----------------------------|------|-------------|
| | | | PE mph | CE mph | | | |
| 10,000 | 379 | 337 | -8 | -4 | +18.4 | 3000 | MS |
| 12,000 | 387 | 335 | -7 $\frac{1}{2}$ | -5 | +18.4 | ↓ | ↓ |
| *13,800 | 393 | 331 | -7 $\frac{1}{2}$ | -5 $\frac{1}{2}$ | +18.4 | | |
| 16,000 | 392 | 319 | -7 | -6 | +16.0 | | |
| 18,000 | 391 | 308 | -7 | -6 $\frac{1}{2}$ | +13.8 | | |
| 20,000 | 388 | 296 | -6 $\frac{1}{2}$ | -6 | +11.8 | | |
| 22,000 | 384 | 283 | -6 | -6 | + 9.8 | | |
| 24,000 | 378 | 269 | -5 $\frac{1}{2}$ | -6 | + 7.9 | | |
| 14,000 | 366 | 306 | -7 | -4 $\frac{1}{2}$ | +18.2 | 3000 | FS |
| 16,000 | 372 | 301 | -6 $\frac{1}{2}$ | -5 | +18.2 | ↓ | ↓ |
| 18,000 | 378 | 298 | -6 $\frac{1}{2}$ | -6 | +18.2 | | |
| 20,000 | 385 | 293 | -6 $\frac{1}{2}$ | -6 | +18.2 | | |
| 22,000 | 392 | 289 | -6 | -6 $\frac{1}{2}$ | +18.2 | | |
| 24,000 | 399 | 285 | -6 | -7 | +18.2 | | |
| *25,700 | 405 | 280 | -6 | -7 $\frac{1}{2}$ | +18.2 | | |
| 28,000 | 399 | 266 | -5 $\frac{1}{2}$ | -8 | +15.0 | | |
| 30,000 | 391 | 252 | -5 | -8 | +12.5 | | |
| 32,000 | 381 | 237 | -4 $\frac{1}{2}$ | -8 | +10.3 | | |
| 34,000 | 369 | 222 | -4 | -8 | + 8.0 | | |
| 36,000 | 352 | 204 | -3 $\frac{1}{2}$ | -8 | + 5.8 | | |

* Full throttle heights.

Table III

Max. weak mixture cruising level speeds

Corrected to 20,800 lb. (95% T.O. weight)
Radiator shutters closed

| Height | TAS | ASI | PE | CE | Boost | RPM | Gear |
|--------|-----|-----|------------------|------------------|-------|------|------|
| 10,000 | 300 | 266 | -5 $\frac{1}{2}$ | -2 | +4 | 2650 | MS |
| 12,000 | 307 | 264 | -5 $\frac{1}{2}$ | -2 $\frac{1}{2}$ | | ↓ | ↓ |
| 14,000 | 313 | 261 | -5 | -2 $\frac{1}{2}$ | | | |
| 16,000 | 320 | 258 | -5 | -3 | | | |
| 14,000 | 292 | 242 | -4 $\frac{1}{2}$ | -2 | | ↓ | FS |
| 16,000 | 298 | 240 | -4 $\frac{1}{2}$ | -2 $\frac{1}{2}$ | | | ↓ |
| 18,000 | 305 | 238 | -4 $\frac{1}{2}$ | -2 $\frac{1}{2}$ | | | |
| 20,000 | 312 | 236 | -4 $\frac{1}{2}$ | -3 | | | |
| 22,000 | 318 | 233 | -4 $\frac{1}{2}$ | -3 $\frac{1}{2}$ | | | |
| 24,000 | 325 | 230 | -4 | -3 $\frac{1}{2}$ | | | |
| 26,000 | 332 | 227 | -4 | -4 | | | |
| 28,000 | 338 | 223 | -4 | -4 $\frac{1}{2}$ | | | |
| 30,000 | 345 | 220 | -3 $\frac{1}{2}$ | -5 | | | |
| 32,000 | 352 | 216 | -3 $\frac{1}{2}$ | -5 | | | |

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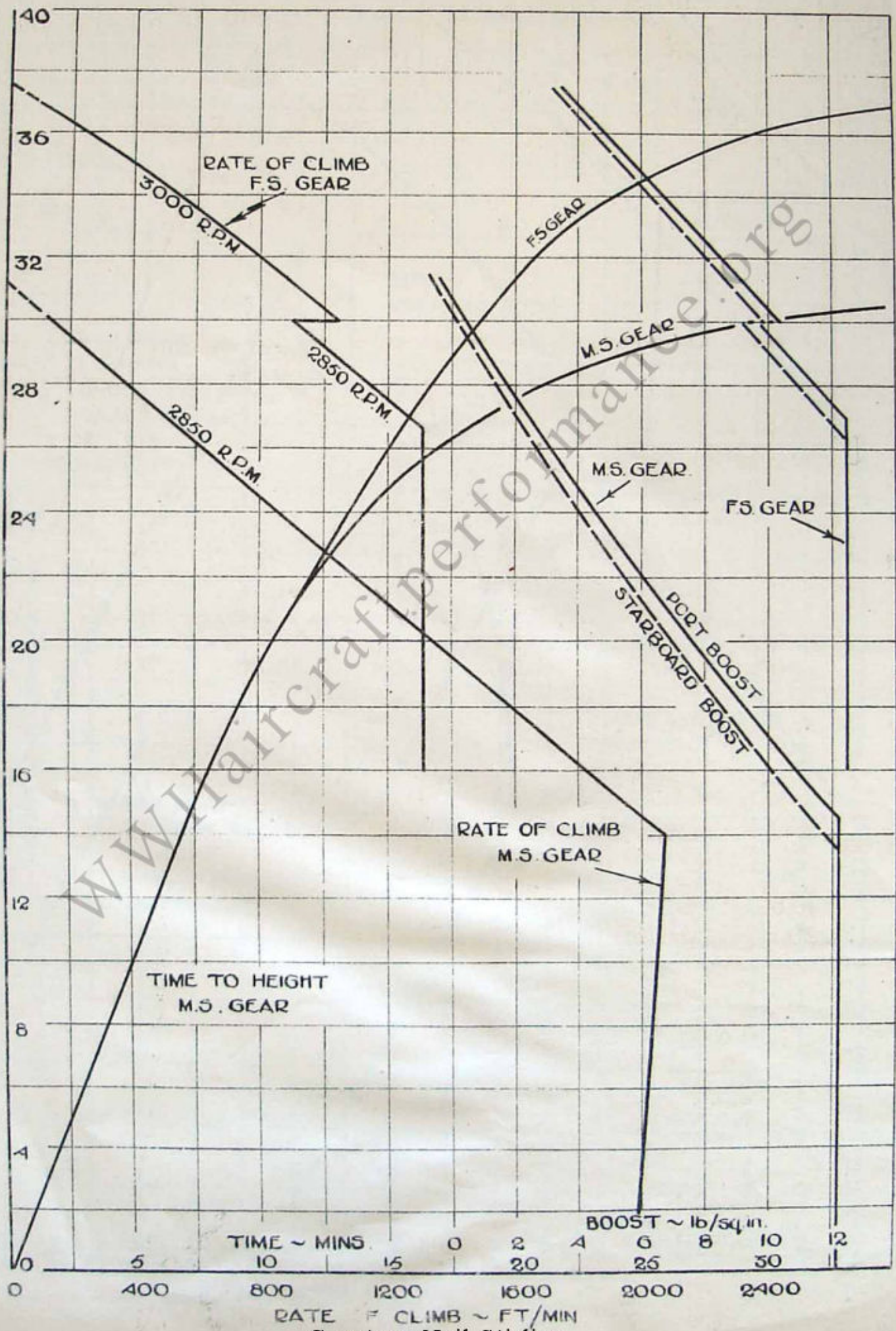
MOSQUITO B Mk IX LR-495

(2 MERLIN 72s)

CLIMB PERFORMANCE

WEIGHT ~ 21,910 LB.

PART OF REPORT NO. A4442/707 R. CUPVE NO. 5306 TRACED IMP. DATE OF TEST MAY 43
CHECKED 2/16 APPROVED 2/16



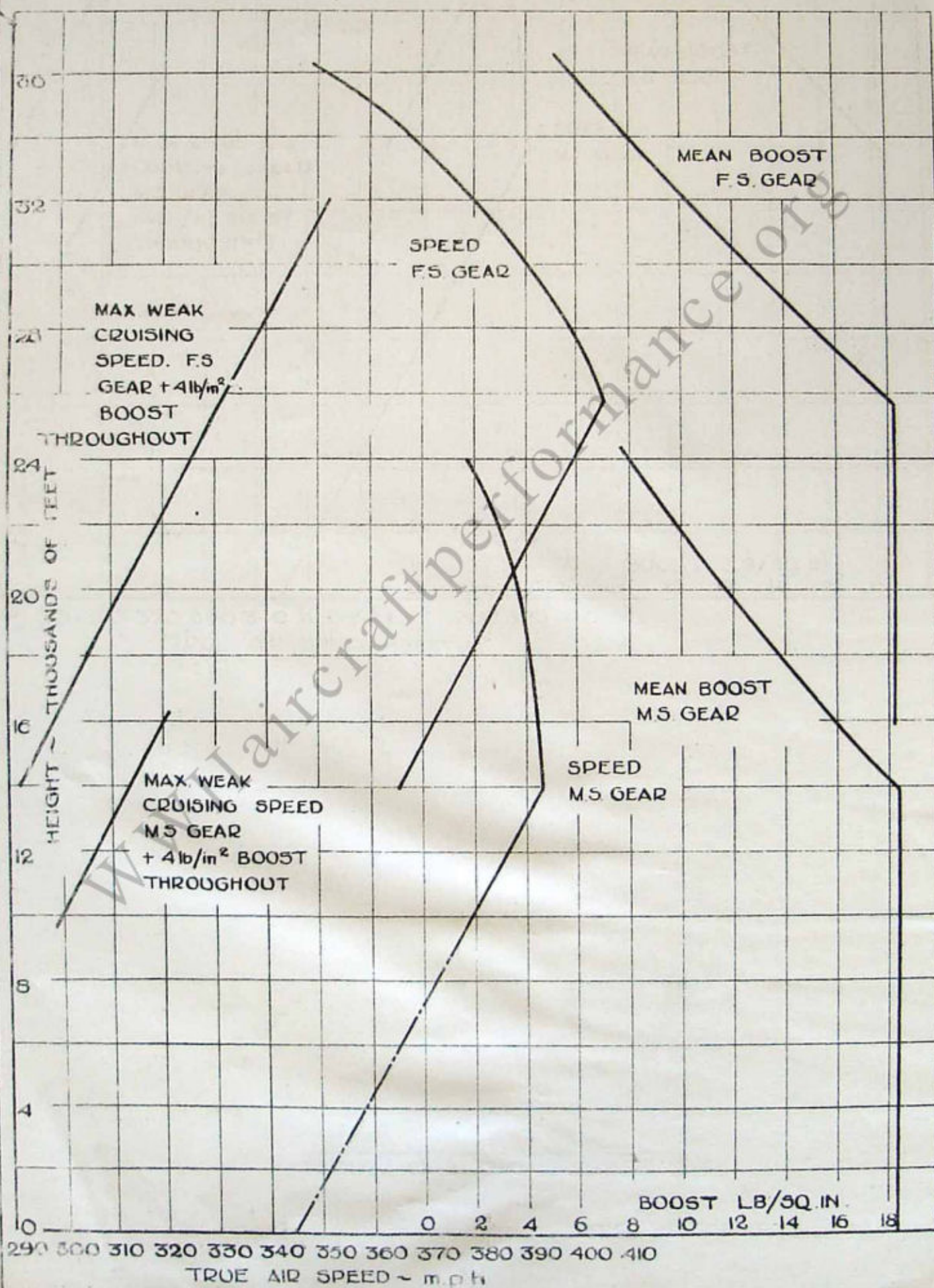
MOSQUITO B Mk IX LR-495

(2 MERLIN 723)

LEVEL SPEED PERFORMANCE.

MAX WEAK CRUISING CONDITIONS ~ 2650 RPM. + 4 lb/sq. in. BOOST.

----- ESTIMATED CURVE



Courtesy Neil Stirling