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Note on the performance in flight of the German jet-propelled aircraft Messerschmitt 262, Heinkel 162 and Arado 234

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SUMMARY

This note describes flight tests on the German jet propelled aircraft Me 262, He 162 and Ar 234 to determine their maximum level speed and rate of climb at various heights. Analysis of the climb and level speed results has enabled the aircraft drags and engine thrusts to be obtained.

1 Introduction

Flight tests were required on the German jet propelled aircraft Me 262, He 162 and Ar 234 to determine their maximum level speeds and rates of climb and to find the aircraft drags and the engine thrusts. The Me 262 is a high speed twin-engined fighter, the He 162 a single-engined fighter with the engine in an unusual position on the top of the fuselage, and the Ar 234 a high wing twin-engined single-seater bomber with bombs carried externally under the fuselage and nacelles. The aircraft tested were in operational condition except that there was no ammunition in the fighters and no bombs on the bomber. Relevant details are given in table 1.

2 Description of tests

The Me 262 and Ar 234 were fitted with Jumo 004B axial flow jet propulsion units of 2000 lb. nominal static thrust. These engines have variable exit nozzles controlled hydraulically. The exit area is normally at its largest except above 8000 r.p.m.(8700 is the maximum) or above 300 m.p.h. A.S.I. forward speed when a servo unit moves the exit nozzle bullet to reduce the exit area. To enable thrust and drag to be determined from climbs and level speeds the forward speed servo control was disconnected so that there was no change in jet exit area from climbing speed to top level speed. To find the maximum level speed of the aircraft this servo control was reconnected.

The He 162 was fitted with a B.M.W. 003 axial-flow jet propulsion unit reputed to have 1760 lb. static thrust. Here again the jet pipe exit area can be varied by a sliding bullet but the three positions of the nozzle can be selected by the pilot. These positions are referred to as "H" for high altitude use (the largest exit area) "S" the standard position for normal use and "F" for high speed flight (the smallest exit area). Top level speeds were obtained with all three nozzle positions; climbs were made in "S" position and thrust and drag analysis made on the climbs and levels in "S" nozzle position.

All tests were made at maximum engine R.P.M., 8700 R.P.M. for the Jumo 004B and 9500 for the B.M.W. 003. Where these R.P.M.'s could not be obtained exactly due to engine automatic controls the results were corrected to the above standard R.P.M.'s.

3 Results

The results obtained were corrected by the temperature height method given in ref.1. The advantage of this method is that few assumptions need to be made about the engine characteristics which in this case were practically unknown. The top speeds and maximum rates of climb are shown for the three aircraft in figs. 1, 2 and 3. The performances of Me 262 and Ar 234 agree well with the German figures obtained to date. The He 162 falls short of the 490 m.p.h. ground level and 522 m.p.h. at 20,000 ft. quoted by the German sources of information, but this is mostly due to the poor thrust of the engine.

Analysis of the results have shown the aircraft profile drags at a Reynolds number of approximately 20 millions to be 66 lb. for the Me 262, 34 lb. for the He 162 and 79.5 lb. for the Ar. 234, all quoted at 100 ft/sec. The estimated values were 66.3, 33.7 and 78.2 lb. respectively. A drag analysis is given in Table II.

The thrusts of the Jumo 004B and B.M.W. 003 recorded in flight are shown in fig. 4 as a function of altitude, corrected to I.C.A.N. conditions. The thrust variation of the Jumo 004 with altitude appears to be proportional to air pressure/(air temperature)^n where $n = 2$ at top speed and $n = 1.4$ in the climb at 290 m.p.h. mean true speed. These variations are quite usual. On the B.M.W. 004 the variation is of the same form with $n = 4$ at top level speed. This value is unusually high.

Considerable interest has been shown in the difference between the top speeds of Me 262 and Meteor III. The difference is due to the higher profile drag of the Meteor caused by its higher wing drag, associated with its lower wing loading. This can be seen from Table 2 where a Meteor drag analysis is included for comparison with Me 262. For this reason the Meteor would be roughly 20 m.p.h. slower than the Me 262 fitted with engines of the same thrust. The advantages of the lower wing loading lies in the reduced take-off distance and increased manoeuvrability.

4 Conclusions

The performances of Me 262 and Ar 234 agree with the estimated values and those given by German sources. The He 162 performance is less than predicted, due mainly to low engine thrust.

The engine thrust and variation of thrust with height on the Jumo 004 are as expected. The thrust of the B.M.W. 003 is low at ground level but it does not fall off with altitude so rapidly as that of the Jumo 004. The profile drags of the aircraft obtained from analysis of the flight tests have shown substantial agreement with the estimated values.

References:

No.	Author	Title etc.
1	F. Smith	Note on various methods of performance reduction for jet propelled aircraft. Technical Note No. Aero. 1348. December 1943.

Attached:

Drg. Nos. 17820S- 17823 S
Table I - Table II

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Table I

Aircraft Data

	Me 262	He 162	Ar 234
Wing Area	226 sq.ft.	120 sq.ft.	298 sq.ft.
Aspect Ratio	7.5	4.65	5.8
All up weight of aircraft	14,730 lbs*	5920 lbs*	17,770 lbs+
Weight with tanks empty	11,120 lbs	4610 lbs	11,110 lbs
Wing Loading at take-off	65	49	60

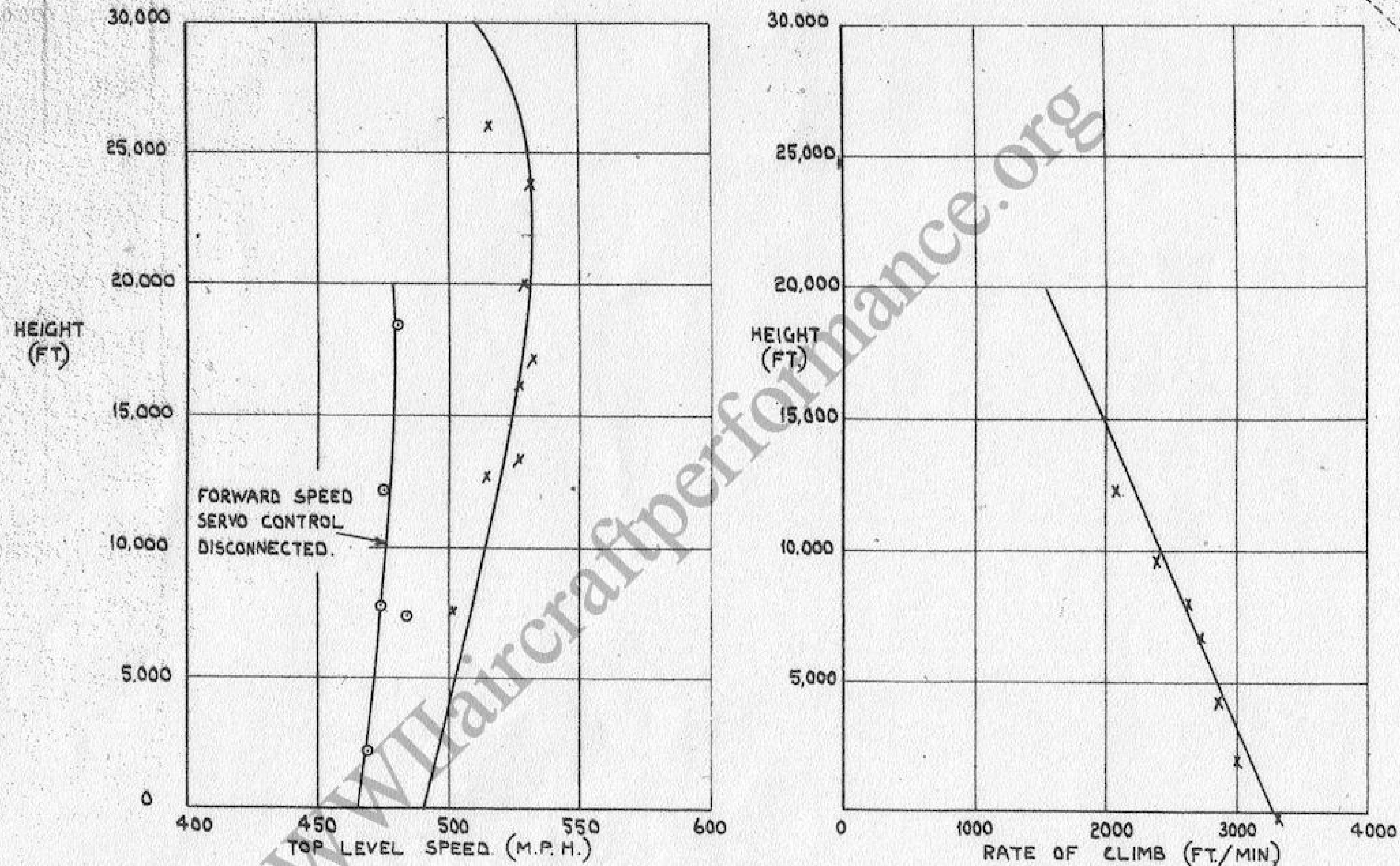
* Without ammunition

\+ Without bombs

Table II

Analysis of Aircraft Drag

Aircraft Component	Meteor III	Me 262	He 162	Ar 234
Wings	28.0	20.3	8.7	29.5
Tailplane	12.0	7.1	3.0	9.3
Fuselage	11.0	10.4	6.0	11.4
Nacelles	12.0	15.0	5.0	15.0
Cabin	1.5	2.0	1.5	2.0
Guns	4.0	3.0	2.0	-
Pitot	0.5	0.5	0.5	0.5
Miscellaneous (Interference etc.)	3.0	8.0	7.0	10.5
Total	72.0 lbs. at 100 ft/sec.	66.3 lbs at 100 ft/sec.	33.7 lbs at 100 ft/sec.	78.2 lbs at 100 ft/sec.



PERFORMANCE OF MESSERSCHMITT 262.

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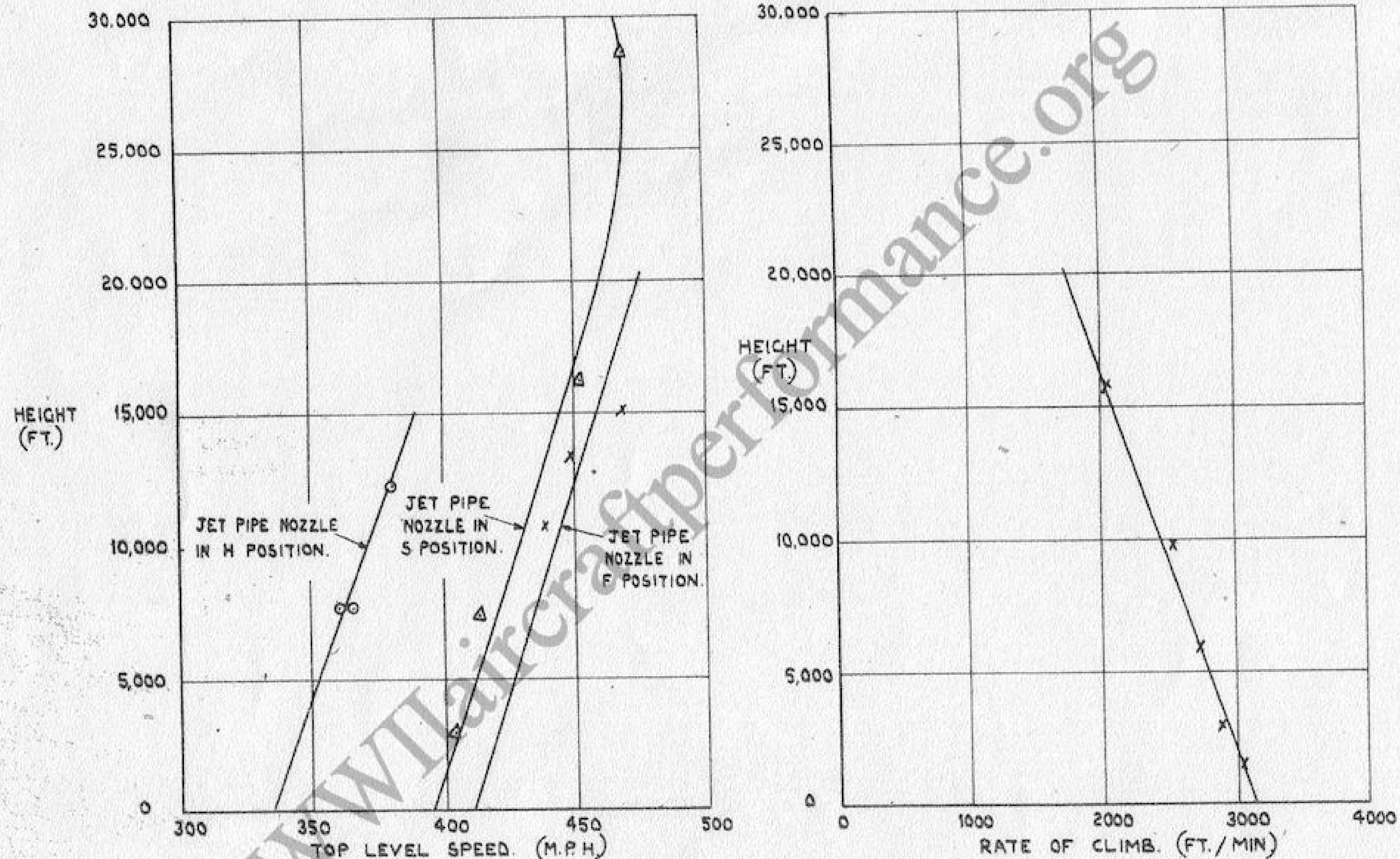
FIG. 1

R



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PERFORMANCE OF HEINKEL 162.

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FIG. 2

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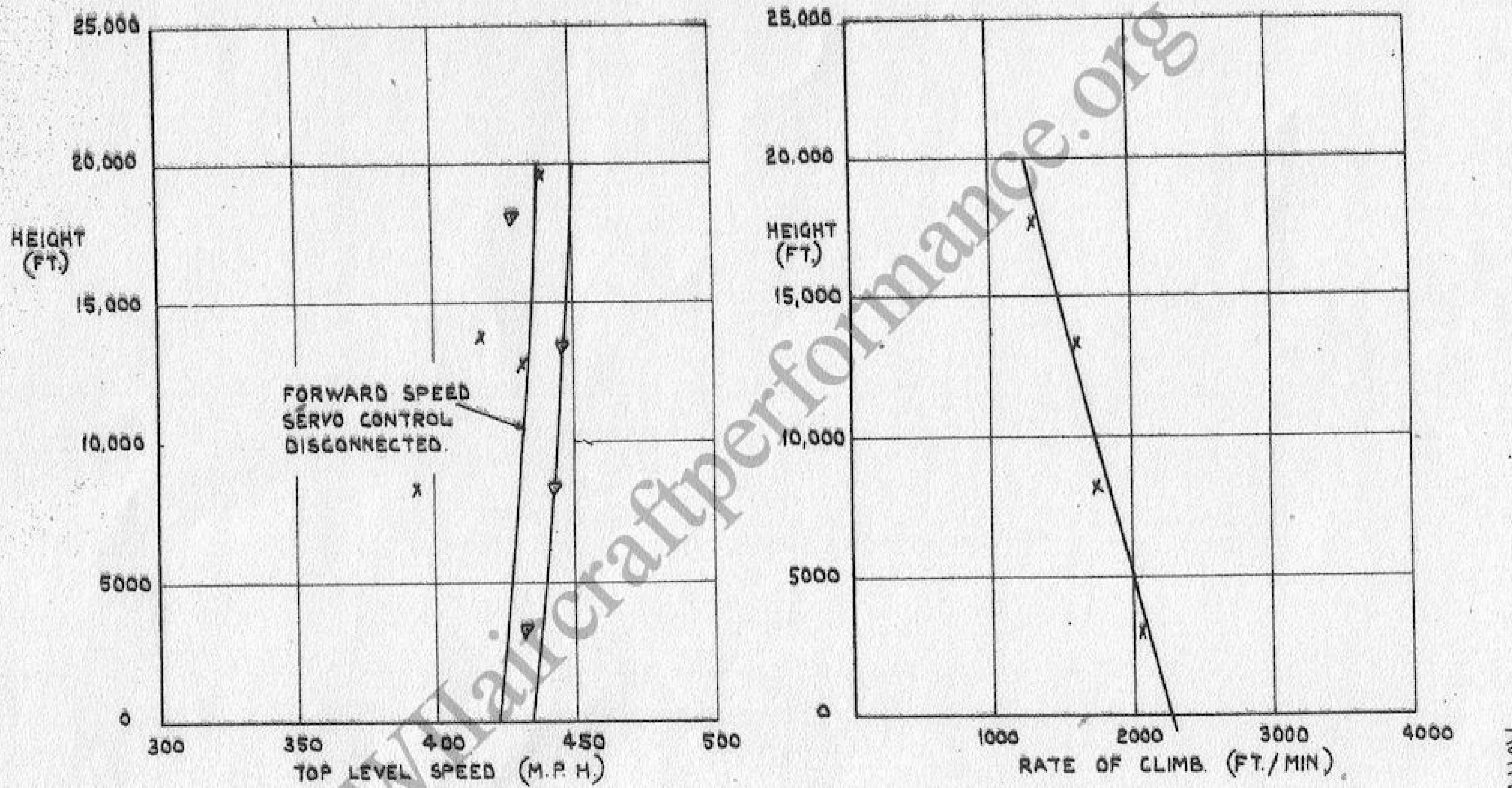
CH. J.G.
APP.



PERFORMANCE OF ARADO 234.

FIG. 3

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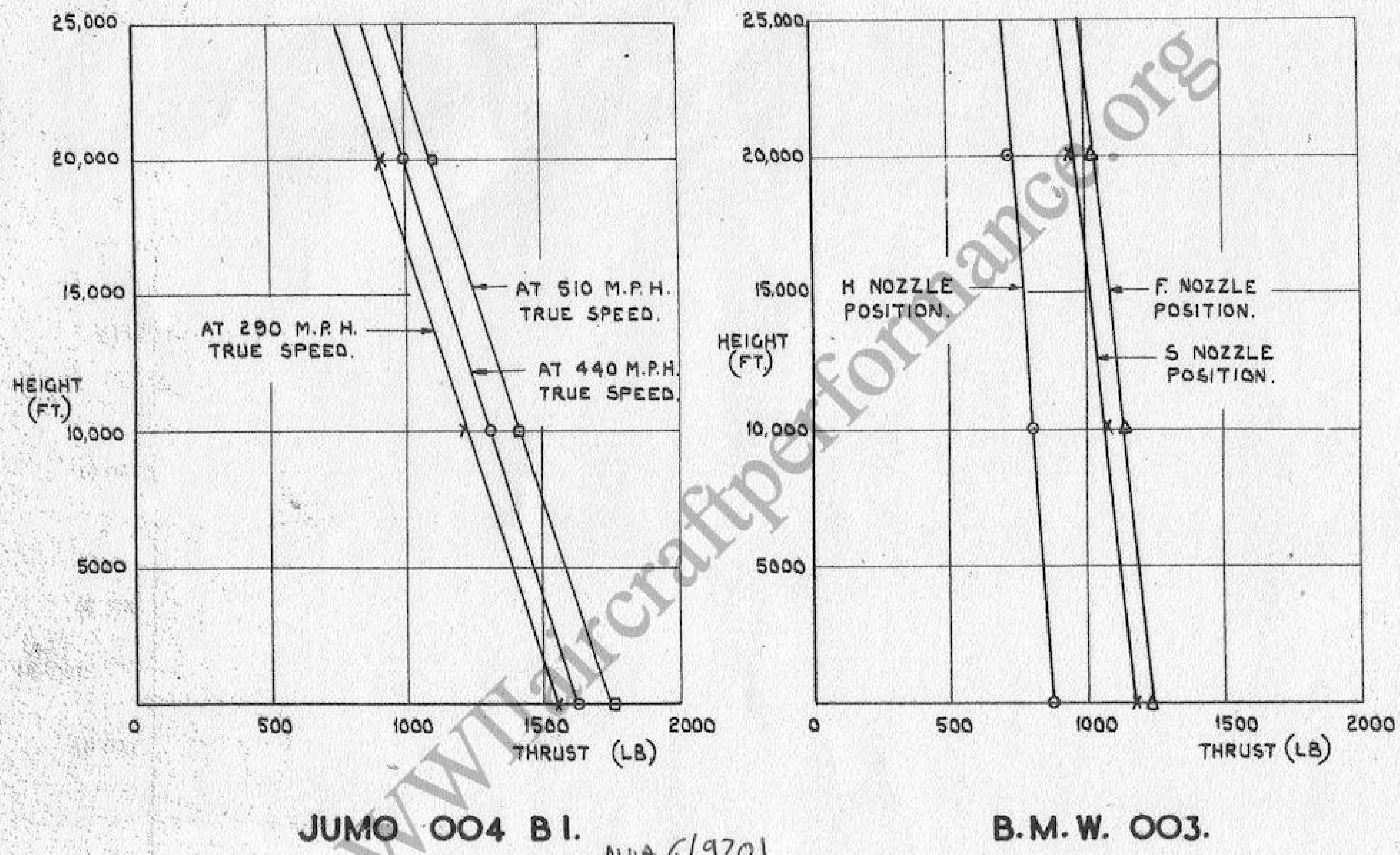

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ENGINE NETT THRUST - HEIGHT.

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FIG. 1.

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