QCX
Avro
CF105
MR-2

FILE IN VAULT

37

UNCLASSIFIED

CF-105

ANALYZED

MONTHLY PERFORMANCE REPORT

NO. 2

November '55

National Research Council Canada
C.I.S.T.I.
Aeronautical and Mechanical Engineering Library

Conseil national de recherches Canada
I.C.I.S.T.
Bibliotèque d'aéronautique et de génie mécanique

TO
A

DATE

Report no.: QC AVRO CF105 MR-2

has been ☐ downgraded to : _____

☒ de-classified

by (Name): J.M.D. Henrie

(Dept.): DND Coordinator, Access to Information

Date: Aug 4, 1992

Renee Auger
Signature

Introduction

This is the second of a series of monthly performance reports for internal usage, to be issued from the Aerodynamics Department. Only a minor change has occured since the first report, and applies only to the CF-105 Performsnce with Pratt and Whitney JT 4A-25 Engines. This alteration is due to a reduction in the ejector performance estimate for the JT 4A-25. The pertinent changes are noted in their appropriate sections.

Successive reports will present the latest dsta, with the alterations from the previous report noted. The report is divided into three major sections:-

1. CF-105 Performance
2. CF-105 Drag
3. Engine Data

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: CF-105

REPORT NO. Monthly Report No. 2

FILE NO.

NO. OF SHEETS:

TITLE:

UNCLASSIFIED

SECRET

Classification cancelled/changed to .....

by authority of ..... (date) .....

Signature ..... Rank .....

CF-105 MONTHLY PERFORMANCE REPORT

(Issued Mid-Monthly)

This is Copy Number .....8.....

Issued to ..R.C.A.F.....

Date ..NOV.15.1955.....

PREPARED BY DATE

CHECKED BY DATE

SUPERVISED BY DATE

APPROVED BY DATE

UNCLASSIFIED

SECRET

ISSUE NO.	REVISION NO.	REVISED BY	APPROVED BY	DATE	REMARKS

FORM 1316A

PERFORMANCE

DRAG

ENGINE

PERFORMANCE

DRAG

ENGINE

1A CF-105 PERFORMANCE WITH PRATT AND WHITNEY (J-75) JT 4A-25 ENGINES

(C.G. = 29% MAC)

SECRET

UNCLASSIFIED

The following CF-105 - (J-75) JT 4A-25 performance estimate is based on the Wind Tunnel configuration designated B_2 V_1 W_1 E_{10} N_5 D_{8-4}. The particular feature of this configuration is the extended, notched, and cambered leading edge of the wing. The drag of this configuration is summarized (extract P/Aero Data/58) and is presented in section 2 of the CF-105 Monthly Performance Report No. 1 issued October 1955.

The considerations for the installed engine data is summarized (Extract P/Power/51) and is presented in section 3 of the CF-105 Monthly Report No. 1. However an error has been made in the ejector calculations, and the revision of the thrust with full afterburning is given in Section 3 of this report. Only this alteration has been allowed for as changes to fuel consumption, and non afterburning engine performance would not be significant.

The pertinent CF-105 performance changes are listed below.

Δ Combat 'g' at 1.50 M.N. at 50000 feet	=	~ .03g
Δ Maximum speed at 50,000 feet	=	- 37 kts.
Δ Combat ceiling at 1.50 M.N.	=	- 1000 ft.

also

Δ Steady rate of climb at 50000' & MN=1.5 ------ - 1000 fpm

Δ Time to 50000' at MN 1.5 ------ + 0.2 min.

DRAG

ENGINE

UNCLASSIFIED

SECRET

LOADING AND PERFORMANCE

Performance Under N.A.C.A. Standard Atmospheric Conditions

To R.C.A.F. Specification AIR 7-4

(With Two J-75 Engines)

WEIGHT:

Take-Off Weight with 15,298 Lb. Fuel (77.1% Max.)	Lb.	58,982
Operational Weight Empty	Lb.	43,684
Combat Weight (1/2 Fuel)	Lb.	51,333
Landing Weight (With Reserve Fuel + Missiles)	Lb.	44,200
Wing Loading at Normal Take-Off Weight	Lb./Sq.Ft.	47.0
Power Loading at Normal Take-Off Weight	Lb./Lb. Thrust	1.61

SPEED

True Air Speed in Level Flight
At Sea Level at Combat Weight

Maximum Thrust	Kts.	★ 755
Military Thrust	Kts.	640

True Air Speed in Level Flight
At 50,000 Ft. at Combat Weight

Maximum Thrust	Kts.	1,110

CEILING

Combat Ceiling at Combat Weight, Rate of Climb = 500 F.P.M.

Maximum Thrust at 1.5 M.N.	Ft.	56,200

RATE OF CLIMB

Steady Rate of Climb at Sea Level, Combat Weight

Maximum Thrust at M.N. = .92	F.P.M.	51,400
Military Thrust at 530 Kts.	F.P.M.	15,800

Steady Rate of Climb at 50,000 Ft., Combat Weight

Maximum Thrust at M.N. = 1.5	F.P.M.	6,700

TIME TO HEIGHT

Time to 50,000 Ft. M.N. = 1.5 from Engine Start at Take-off Weight = 58,982

Maximum Thrust	Mins.	4.6

MANOEUVRABILITY

Combat Load Factor at Combat Weight Maximum Thrust at M.N. = 1.50 at 50,000 Ft.	1.47
Combat Load Factor at Combat Weight Maximum Thrust at M.N. = 1.70 at 50,000 Ft.	1.52

★ Placard Speed = 720 Kts.

TAKE-OFF DISTANCE

Take-Off Distance over 50 Ft. Obstacle at Sea Level
Take-Off Weight = 58,982 Lb.

Maximum Thrust	Ft.	3,400
Military Thrust	Ft.	6,700
Maximum Thrust, Hot Day	Ft.	4,600

LANDING DISTANCE

Landing Distance over 50 Ft. Obstacle at Sea Level at Combat Weight	Ft.	5,300

STALLING SPEED

True Stalling Speed in Landing Configuration at Combat Weight at Sea Level	Kts.	110

RANGE

Combat Radius of Action at 50,000 Ft., Climb at M.N. = .92, Cruise out at M.N. = 1.5, Combat for 5 Mins. at M.N. = 1.50, Cruise Back at M.N. = .92, 15 Min. Stack at 40,000 Ft., 5 Min. Fuel Reserve on Landing

High Speed Mission with 15,298 Lb. Fuel	N.M.	200
High Speed Mission with Full Internal Fuel	N.M.	309

Combat Radius of Action at 50,000 Ft., Mission as above except climb at 530 Kts. and cruise out at M.N. = .92

Maximum Range Mission with 15,298 Lb. Fuel	N.M.	406
Maximum Range Mission with Full Internal Fuel	N.M.	605

Combat Radius of Action at Sea Level, Cruise out at .6 M.N. and Combat at M.N. = .92 at Sea Level, Cruise Back at .92 M.N. at 40,000 Ft., 15 Min. Stack, 5 Min, Fuel Reserve on Landing

Sea Level Mission with 15,298 Lb. of Fuel	N.M.	325
Sea Level Mission with Full Internal Fuel	N.M.	470

Ferry Range Mission at Economical Cruise Speed (M = .92 and Height, including 15 Mins. Stacking at 40,000 Ft., 5 Min. Fuel Reserve on Landing

Range with Full Internal Fuel and 500 Gal. - External Tank	N.M.	1,859
Range with full internal fuel	N.M.	1,609

JT4A-25

SECRET PIPERF/105

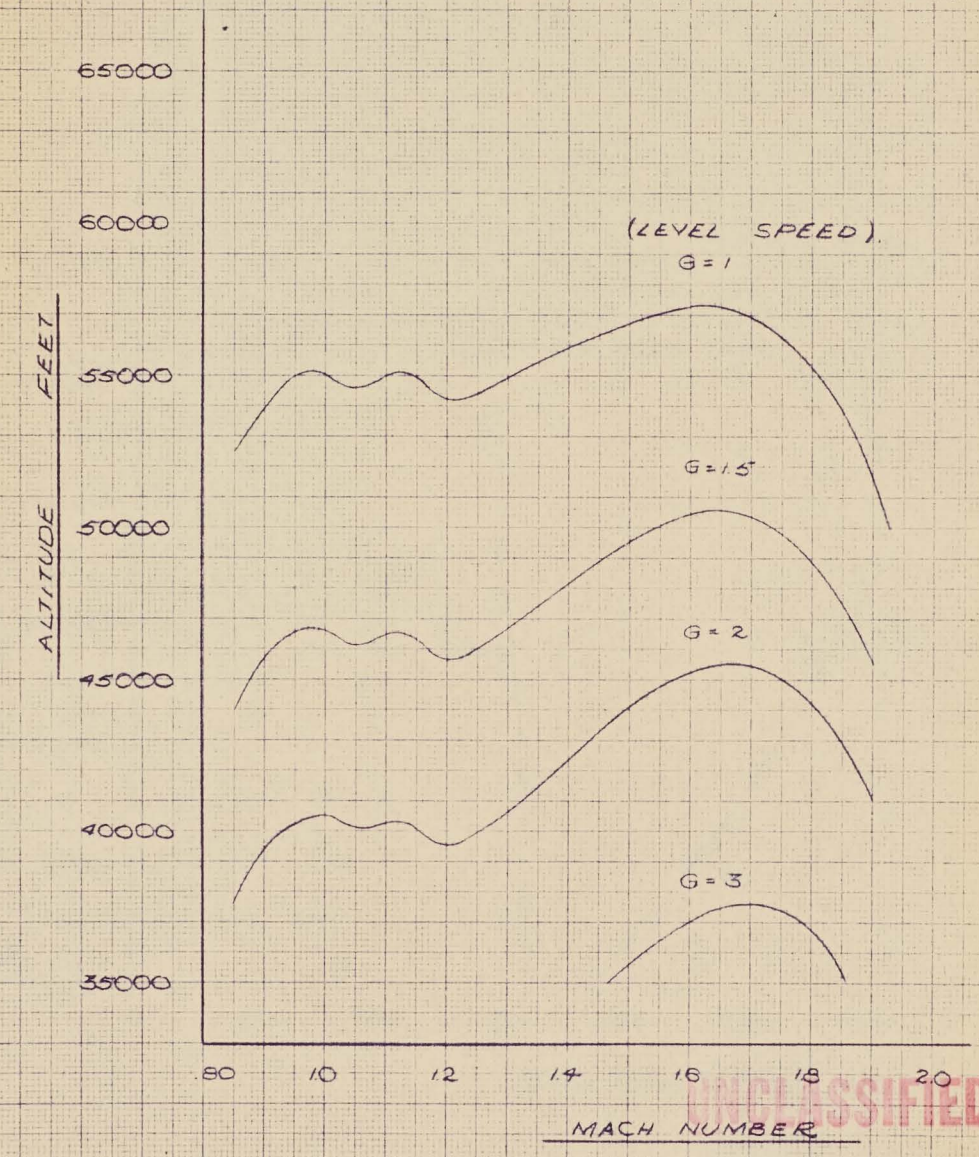
CG = 29 % C

APPENDIX

MAXIMUM G SUSTAINED IN LEVEL TURN

UNCLASSIFIED

COMBAT WEIGHT = 51333 LB



UNCLASSIFIED

SECRET

DRAG

ENGINE

JT4A-25

SECRET

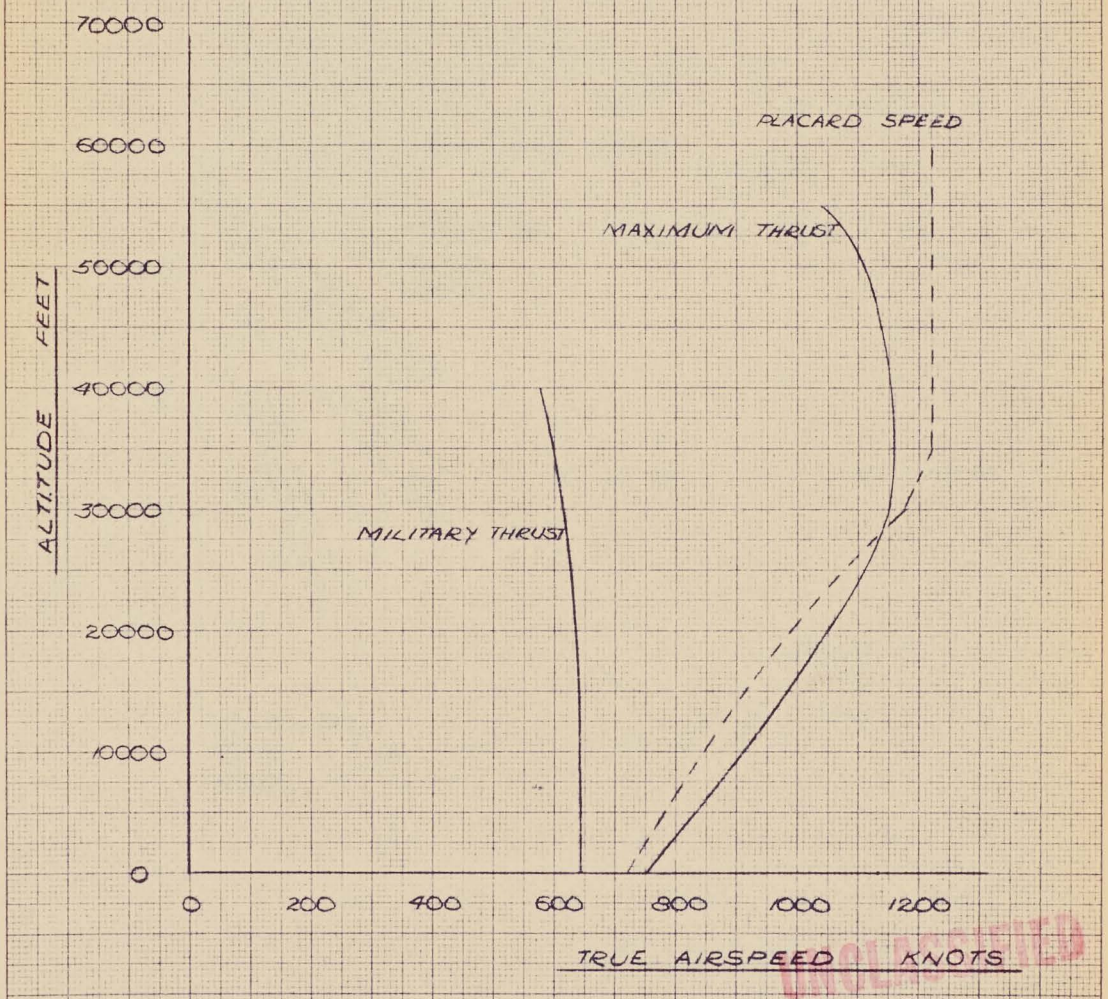
CG = 29% C

PIPER PA-1105 APPENDIX

LEVEL FLIGHT TRUE AIRSPEED

UNCLASSIFIED

COMBAT WEIGHT = 51,333 LB



UNCLASSIFIED

SECRET

DRAG

ENGINE

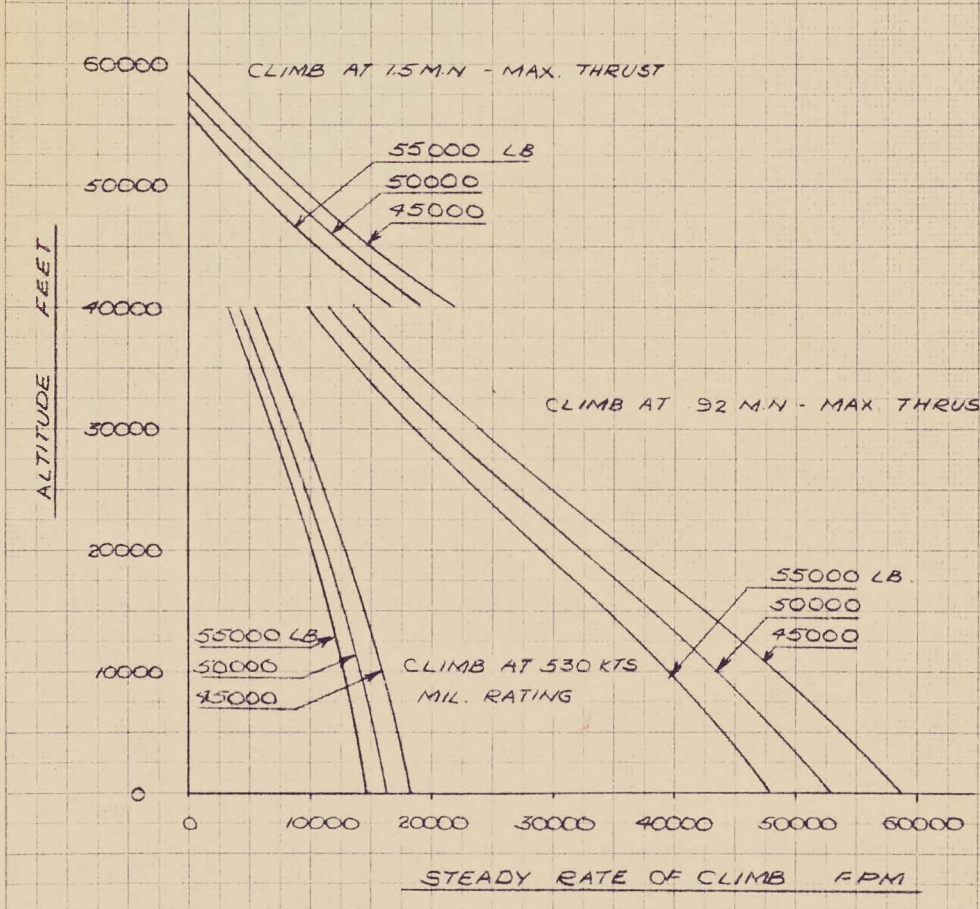
10 X 10 TO THE CM. 359-14
KEUFFEL & ESSER CO.

JT 4A-25

C G = 29 % C

PIPER F 1105
APPENDIX

RATE OF CLIMB



DRAG

ENGINE

JT4A-25

C G = 29% C

SECRET

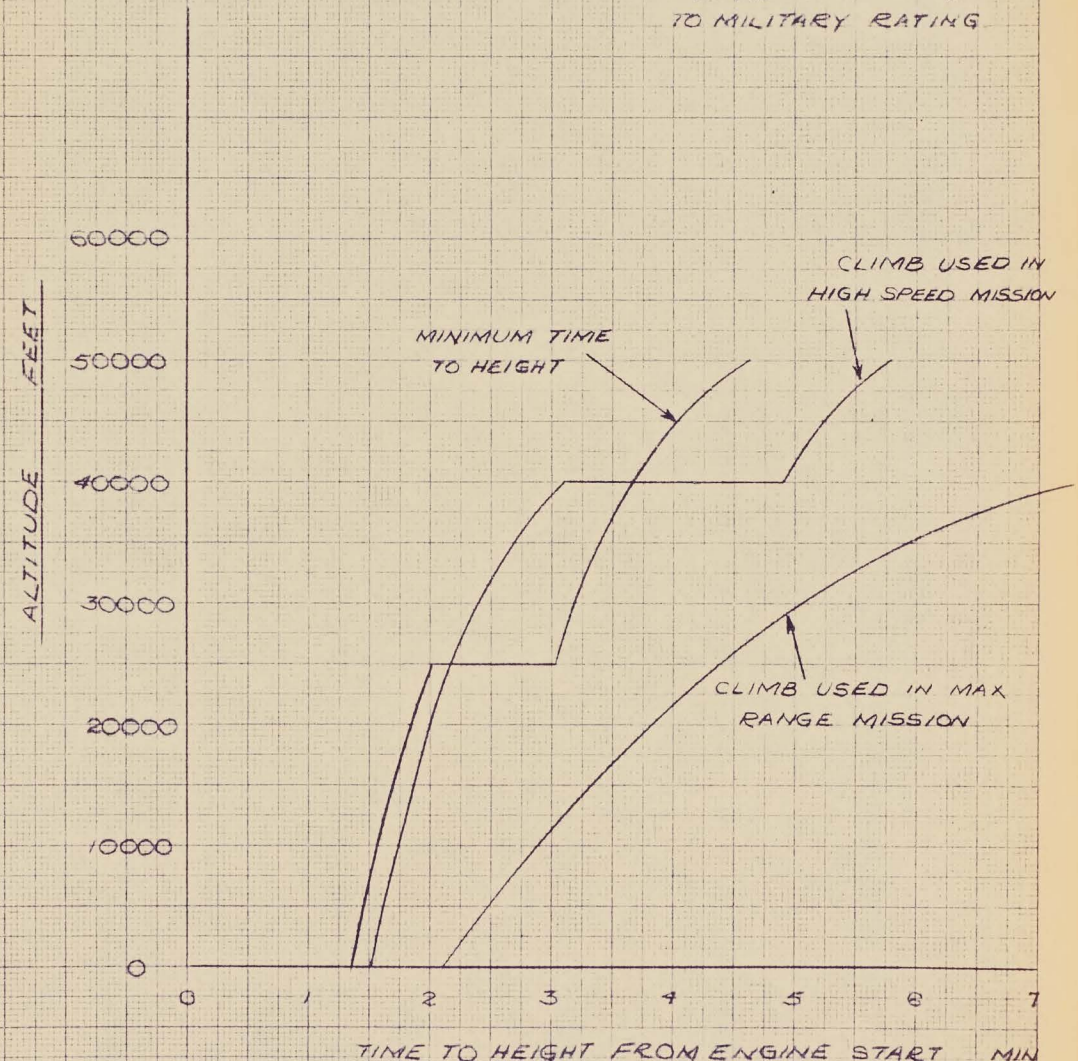
PIPERF/105
APPENDIX

UNCLASSIFIED

TIME TO HEIGHT

TAKEOFF WT = 58982 LB

NOTE: 1/2 MINUTE ALLOWED FROM ENGINE START TO MILITARY RATING



UNCLASSIFIED

SECRET

DRAG

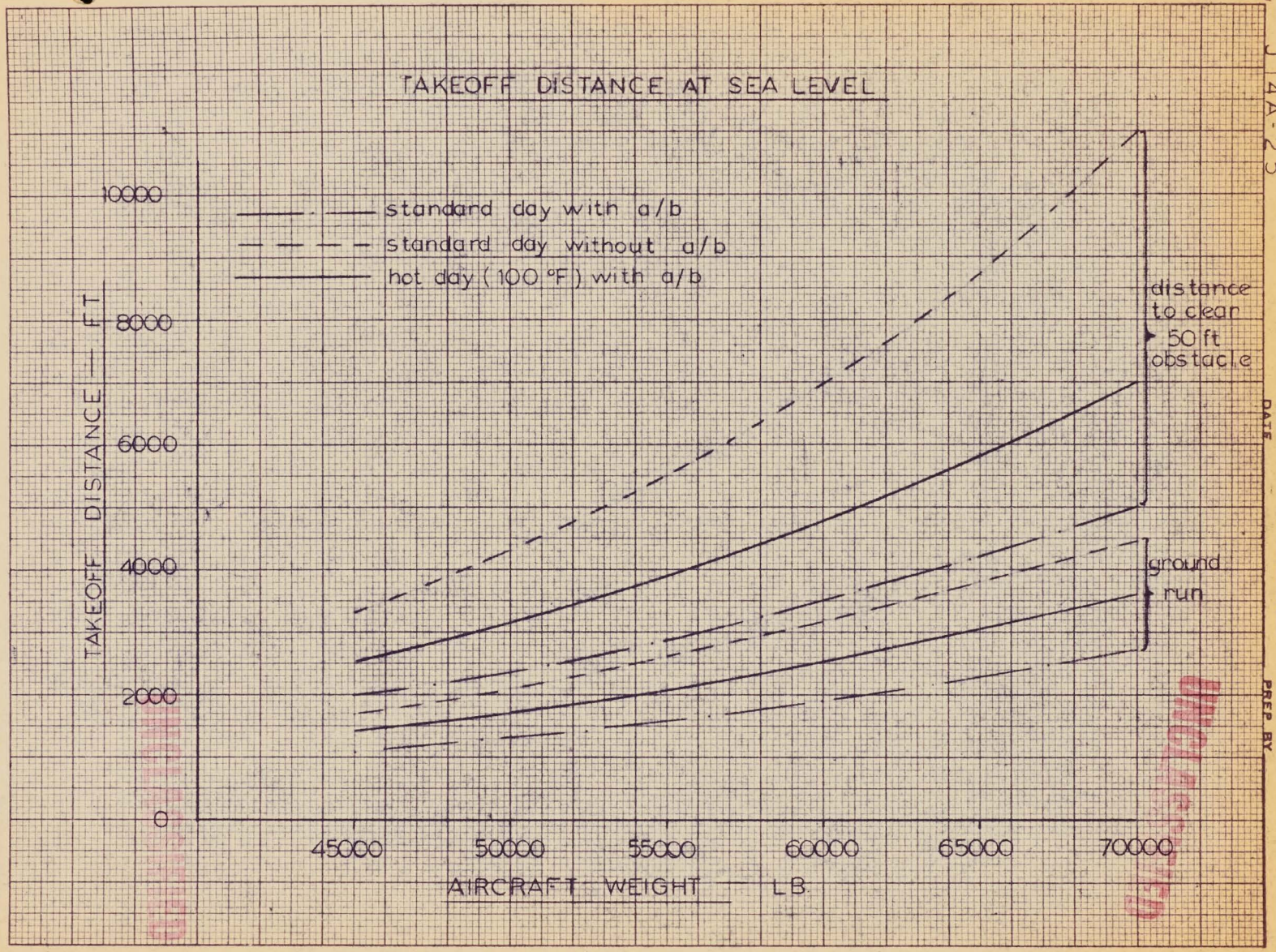
ENGINE

AIRCRAFT J T4A-25 COMPONENT A.U.W.

SHEET No. SECRET REPORT No. P/PERF/105

DATE PREP. BY

TAKEOFF DISTANCE AT SEA LEVEL

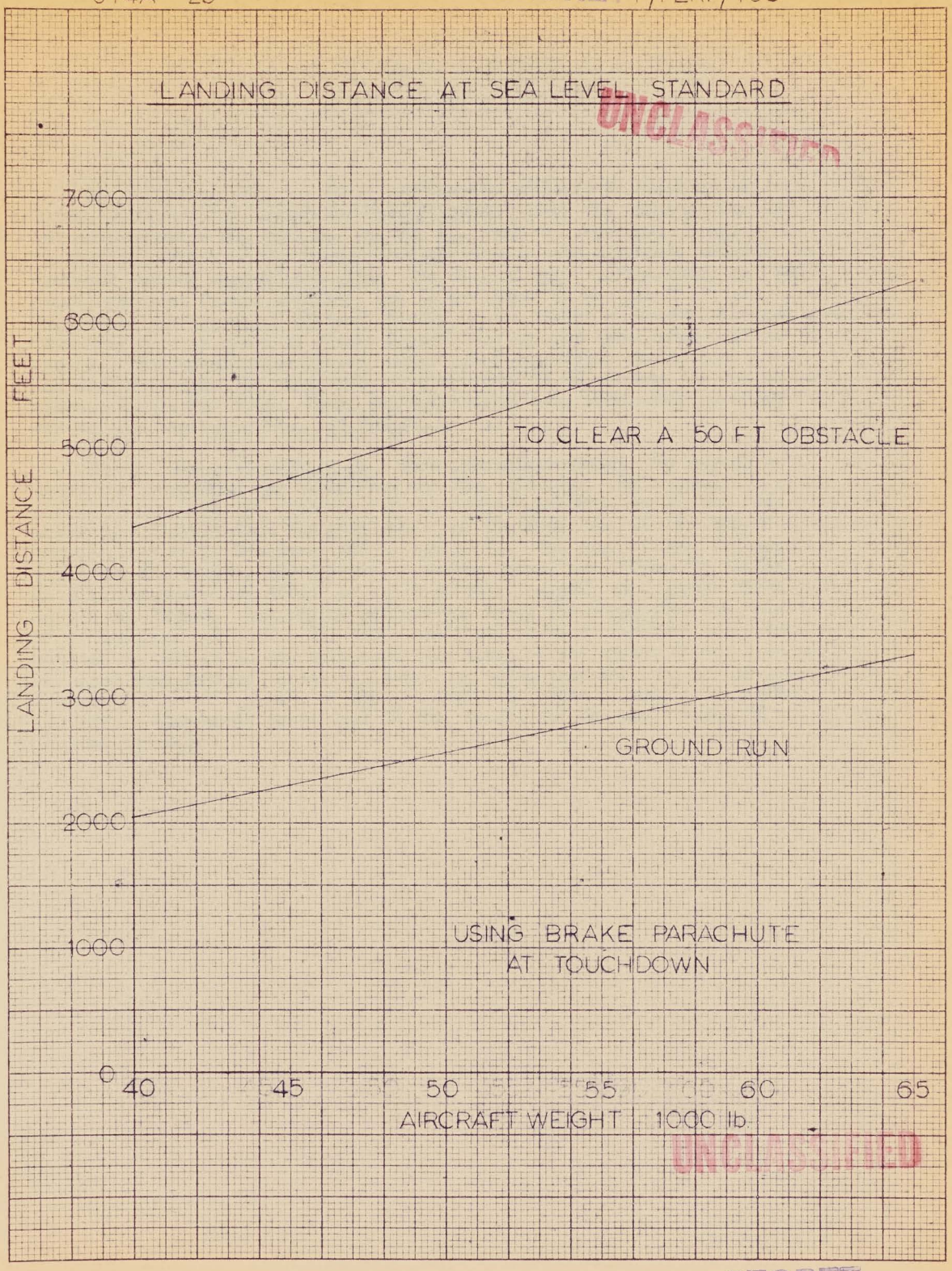


SECRET

FORM 1746

ENGINE

DRAG



DRAG

ENGINE

1B. CF-105 PERFORMANCE WITH ORENDA PS 13 ENGINES

(C.G. = 29% M.A.C.)

The following CF-105 - PS 13 performance estimate is based on the wind tunnel configuration designated $B_2V_1W_1E_{10}N_5D_8$-4 over the subsonic portion, and configuration W_9, N_{A5}, B_4, C_3, V_2, R_8, over the supersonic range. The particular feature of the former configuration is the extended, notched, and cambered leading edge of the wing. The drag of this configuration is summarized, (Extract P/Aero Data/58), and is presented in section 2 of this report. The latter configuration differs chiefly by not having a cambered leading edge. This drag data is given in P/Aero Data/48 but has not been summarized for this report. This constitutes little change under supersonic cruise conditions, and only decreases the supersonic drag by about 4% at maximum 'g' due to less elevator angle for trim. Thus, the performance does reasonably represent that for the one configuration, $B_2V_1W_1E_{10}N_5D_8$ - 4.

The PS 13 engine data is in a more incomplete state. The engine data above the tropopause was taken from the Dec. '54 Memo, (Ref. Orenda P11-1-1) on the PS 13, with the exception of the cruise operation at .92 M.N. and 40,000 Ft., where insufficient data was available from the Memo, and we were forced to use the original PS 13 Brochure (EMS 8) April '54. The memo of Dec. '54 assumes a 6.5 Sq. Ft. intake, and pressure recovery curve from P/Power/23 APP/A/10. It also considers the effect of a 39" ejector, as well as a bypass which opens to 118 sq. Inches. For engine performance below the tropopause the original PS 13 Brochure was used. The above mentioned pressure recovery correction were applied to this data, but no account was taken of the bypass effect. It should be noted that revised thrust estimates now being prepared indicate an increase in maximum thrust at 1.5 M.N. of approximately 4%. This offsets the slightly optimistic supersonic drags used in this report for the performance of the PS 13 engines version.

DRAG

ENGINE

LOADING AND PERFORMANCE

Performance Under N.A.C.A. Standard Atmospheric Conditions

To R.C.A.F. Specification AIR 7-4

With Two PS 13 Engines

WEIGHT:

Take-Off Weight with 15,510 Lb. Fuel (78.2% Max.)	Lb.	55,889
Operational Weight Empty	Lb.	40,379
Combat Weight (1/2 Fuel)	Lb.	48,130
Landing Weight (With Reserve Fuel + Missiles)	Lb.	42,200
Wing Loading at Normal Take-Off Weight	Lb./Sq.Ft.	44.5
Power Loading at Normal Take-Off Weight	Lb./Lb. Thrust	1.19

SPEED

True Air Speed in Level Flight At Sea Level at Combat Weight		
Maximum Thrust	Kts.	* 720
Military Thrust	Kts.	650
True Air Speed in Level Flight At 50,000 Ft. at Combat Weight		
Maximum Thrust	Kts.	1,110

CEILING

Combat Ceiling at Combat Weight, Rate of Climb = 500 F.P.M. Maximum Thrust at 1.5 M.N.	Ft.	62,200

RATE OF CLIMB

Steady Rate of Climb at Sea Level, Combat Weight		
Maximum Thrust at M.N. = .92	F.P.M.	50,000
Military Thrust at 530 Kts.	F.P.M.	25,200
Steady Rate of Climb at 50,000 Ft., Combat Weight		
Maximum Thrust at M.N. = 1.5	F.P.M.	11,500

TIME TO HEIGHT

Time to 50,000 Ft. M.N. = 1.5 from Engine Start at Take-Off Weight = 55,889 Lb.		
Maximum Thrust	Mins.	4.1

MANOEUVRABILITY

Combat Load Factor at Combat Weight Maximum Thrust at M.N. = 1.50 at 50,000 Ft.	1.84

* Placard Speed = 720 Kts.

TAKE-OFF DISTANCE

Take-Off Distance over 50 Ft. Obstacle at Sea Level .....
Take-Off Weight = 55,889 Lb.

Maximum Thrust	Ft.	2,500
Military Thrust	Ft.	3,800
Maximum Thrust Hot Day	Ft.	3,300

LANDING DISTANCE

Landing Distance over 50 Ft. Obstacle at Sea Level at Combat Weight Ft. 5,000

STALLING SPEED

True Stalling Speed in Landing Configuration at Combat Weight at Sea Level ..... Kts. 105

RANGE

Combat Radius of Action at 50,000 Ft., Climb at M.N. = .92, Cruise out at M.N. = 1.5, Combat for 5 mins. at M.N. = 1.50, Cruise Back at M.N. = .92, 15 Min. Stack at 40,000 Ft., 5Min. Fuel Reserve on Landing

High Speed Mission with 15,510 Lb. Fuel	N.M.	200
High Speed Mission with Full Internal Fuel	N.M.	318

Combat Radius of Action at 50,000 Ft., Mission as above except Cruise Out at M.N. = .92

Maximum Range Mission with 15,510 Lb. Fuel	N.M.	315
Maximum Range Mission with Full Internal Fuel	N.M.	491

Combat Radius of Action at Sea Level, Cruise Out at .6 M.N. and Combat at M.N. = .92 at Sea Level, Cruise Back at .92 M.N. at 40,000 Ft., 15 Min. Stack, 5 Min. Fuel Reserve on Landing

Sea Level Mission with 15,510 Lb. of Fuel	N.M.	217
Sea Level Mission with Full Internal Fuel	N.M.	318

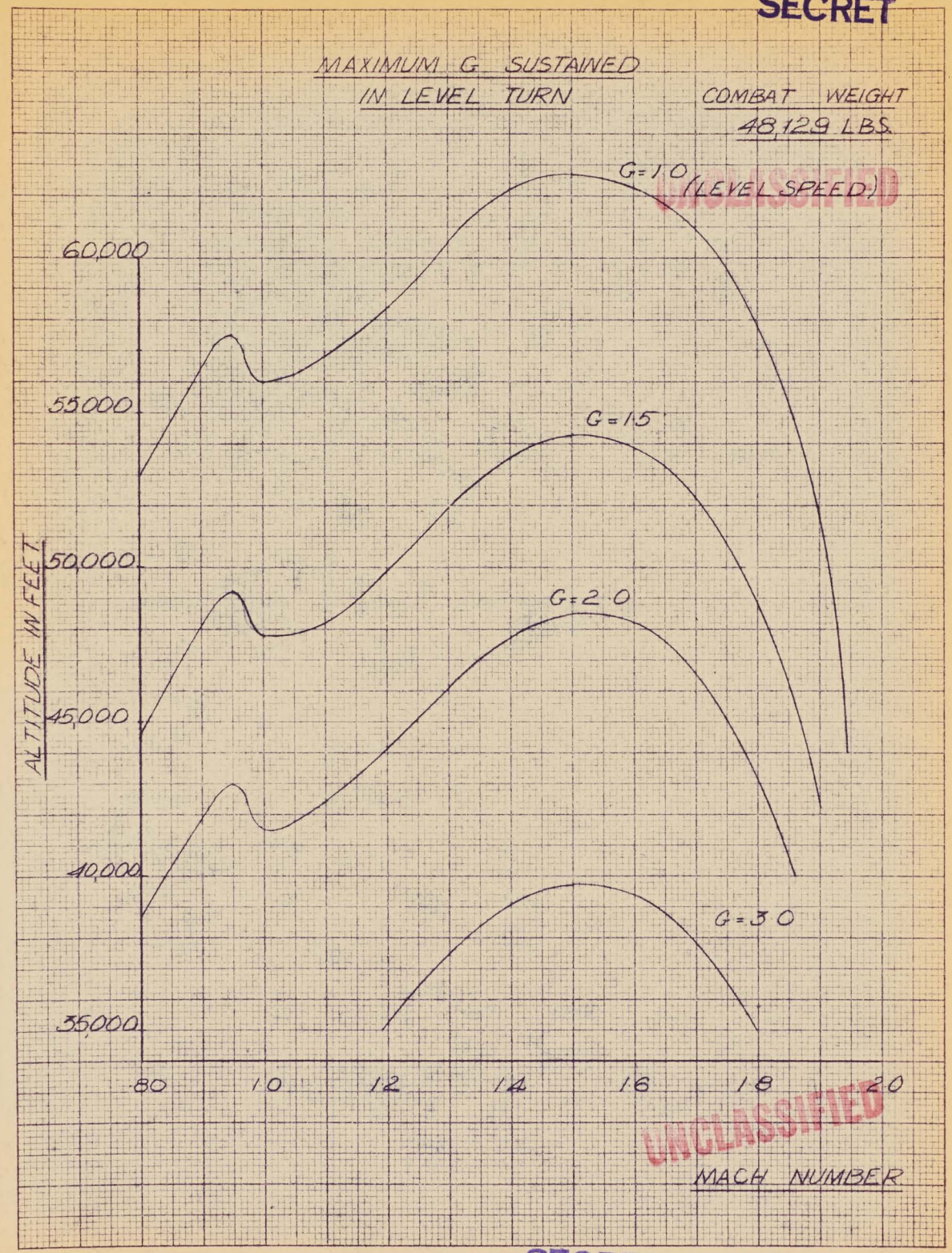
Ferry Range Mission at Economical Cruise Speed (M = .92 and Height, including 15 Mins. Stacking at 40,000 Ft., 5 Min. Fuel Reserve on Landing

Range with Full Internal Fuel and 500 Gal. - External Tank .	N.M.	1,675

RS 13 ENGINES

PIPERF102

SECRET



DRAG

ENGINE

K&E 10 X 10 TO THE ½ INCH 359-12 KEUFFEL & ESSER CO. MADE IN U.S.A.

SECRET

JULY 55 T. GRAYSON

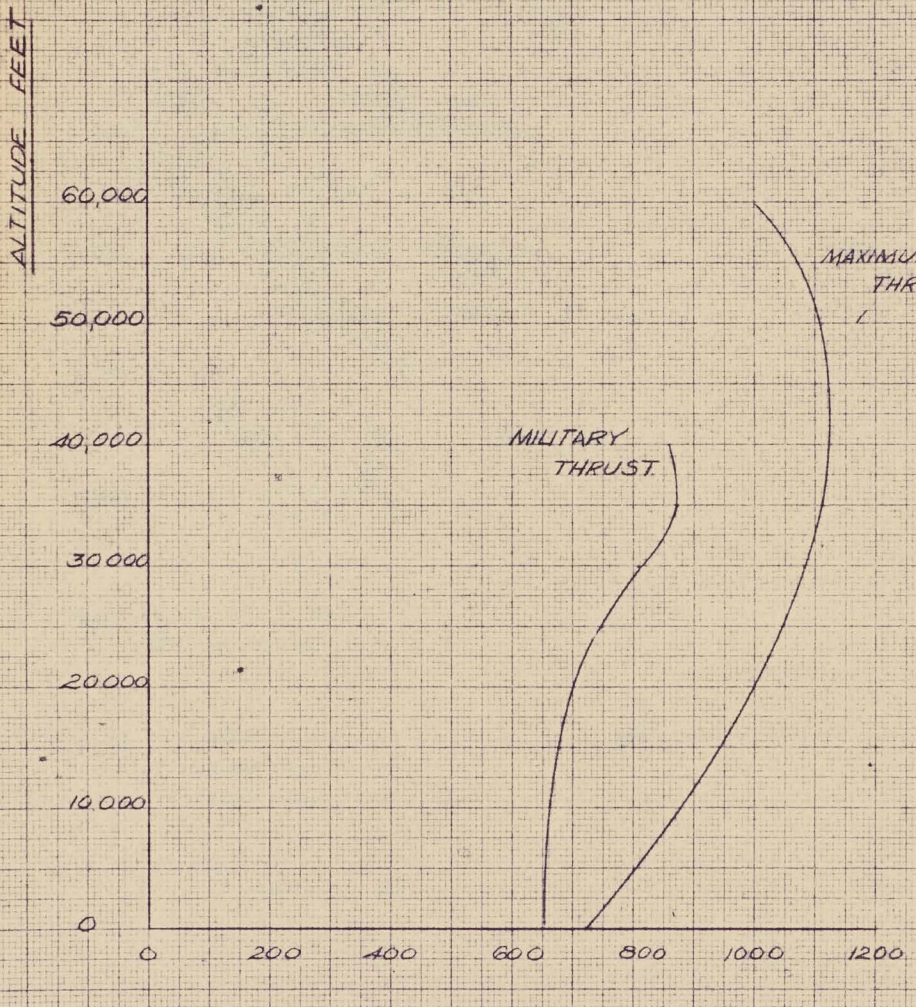
RS 13 ENGINES

SECRET

PIPERF/1102

LEVEL FLIGHT TRUE AIRSPEED

COMBAT WEIGHT = 48129LB.

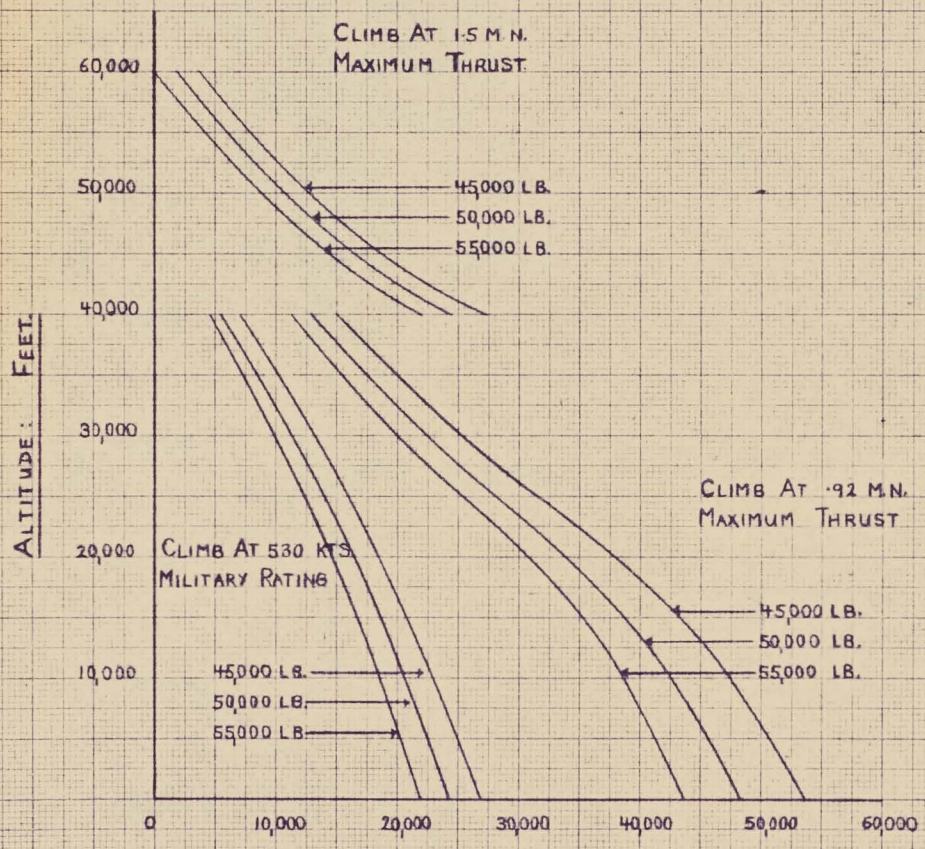


DRAG

ENGINE

SECRET

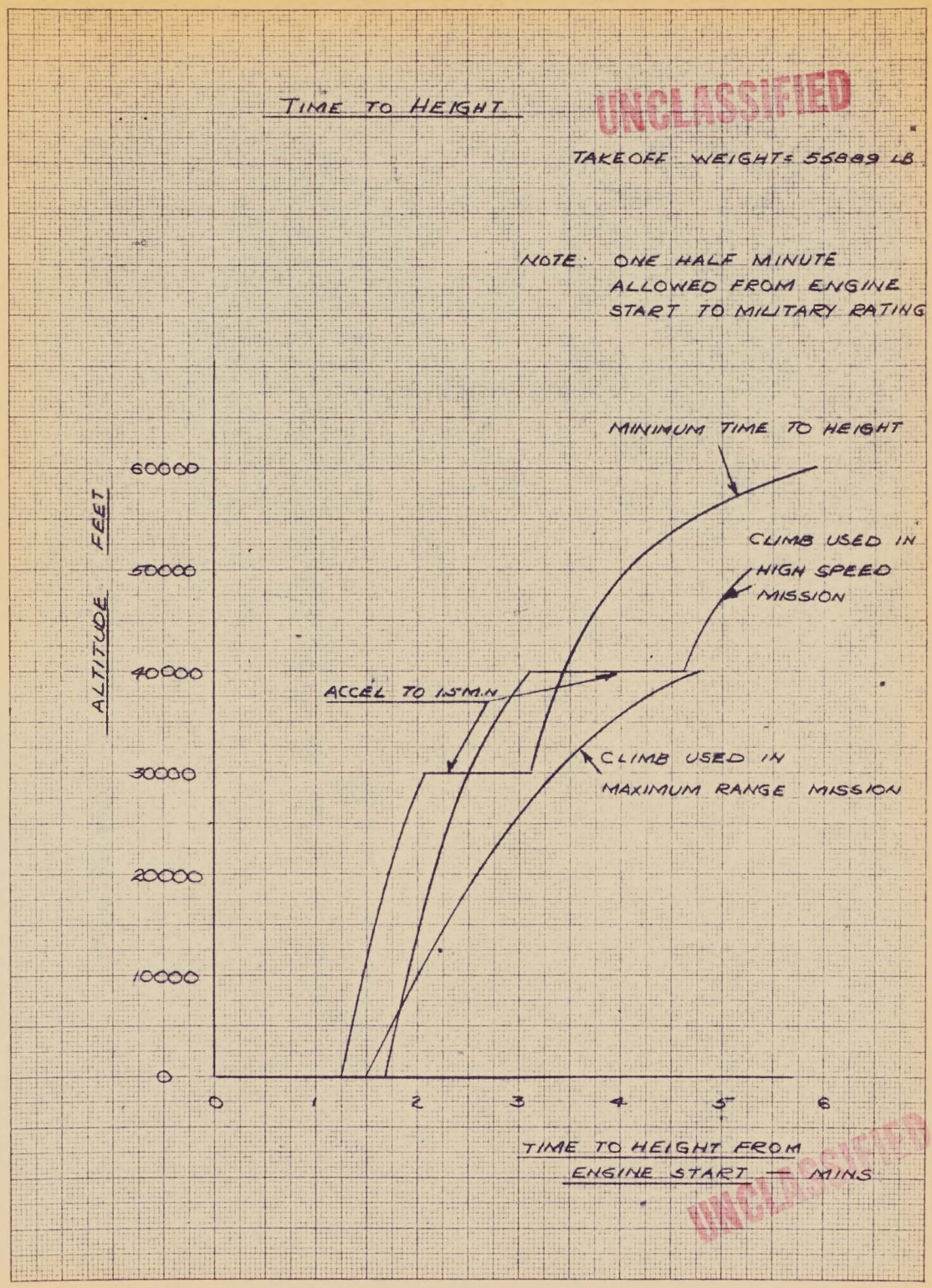
RATE OF CLIMB



PS 13 ENGINES

SECRET

PIPER # 1102



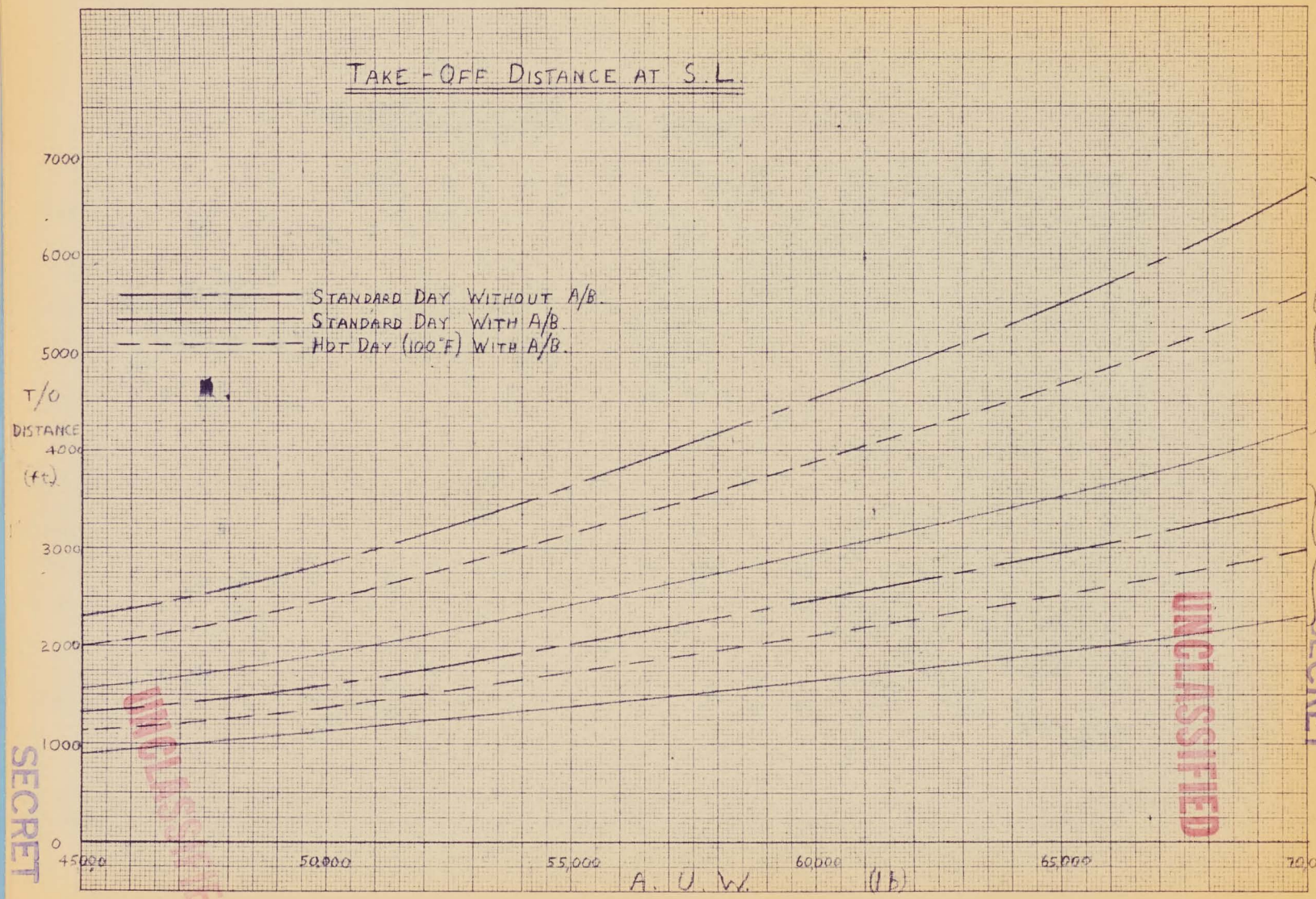
DRAG

ENGINE

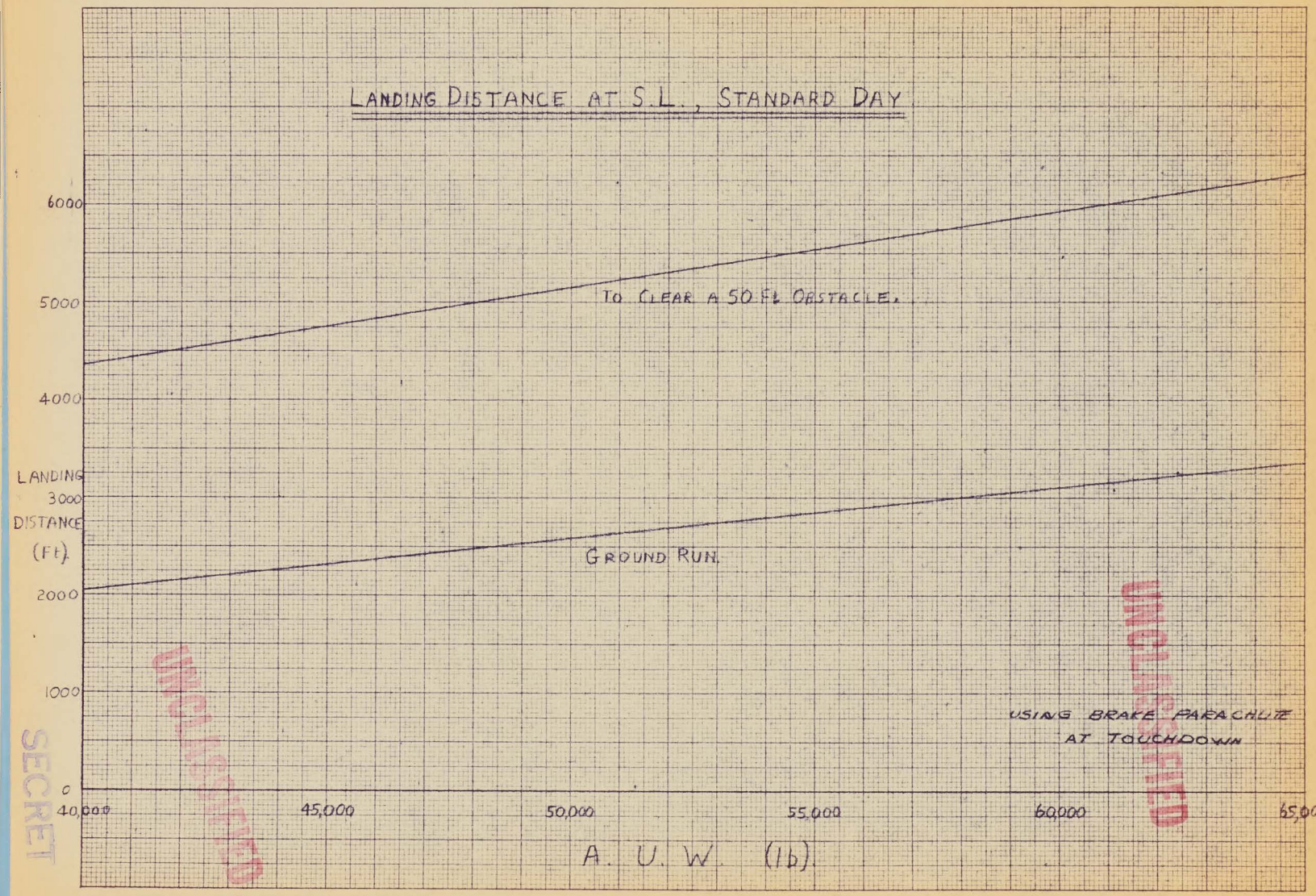
K&E 10 X 10 TO THE CM. 359-14 KEUFFEL & ESSER CO. MADE IN U.S.A.

SECRET

TAKE-OFF DISTANCE AT S.L.



ENGINE | DRAG



RS 13 ENGINES

PIPER F/102

ENGINE

DRAG

DRAG

ENGINE

CF-105 (CONFIGURATION B_2 V_1 W_1 E_{10} N_5 D_{3-4}) DRAG NOTE

SECRET

"The drag of this configuration is summarized (Extract P/Aero Data/58) and is presented in section 2 of the CF-105 Monthly Performance Report No, 1 issued October 1955."

No Revisions have been made.

ENGINE

ENGINE

3. CF-105 INSTALLED ENGINE DATA

(J-75) JT 4A-25 ENGINES

SECRET

The methods of estimating installed engine data and the subsequent installed engine data estimates (Extract P/Power/51), has been presented in section 3 of CF-105 Monthly Report No. 1. However an equation used was found to be in error and should read:

$$F_{A_e} = \left(F_n^{\,1} - \Delta F_D + \frac{M_e V}{g}\right) \frac{F_e}{F_{JET}} - \left(\frac{MV}{g} + \Delta F_s\right)$$

where M_e (engine mass flow) replaces M (duct mass flow).

This only produces a significant change with A/B lit and accordingly only this change has been made at this time.

Fig. 13, net thrust with afterburner lit, versus mach. no. and altitude, then has been revised and reissued in this report as fig. 13 issue 2.

SECRET

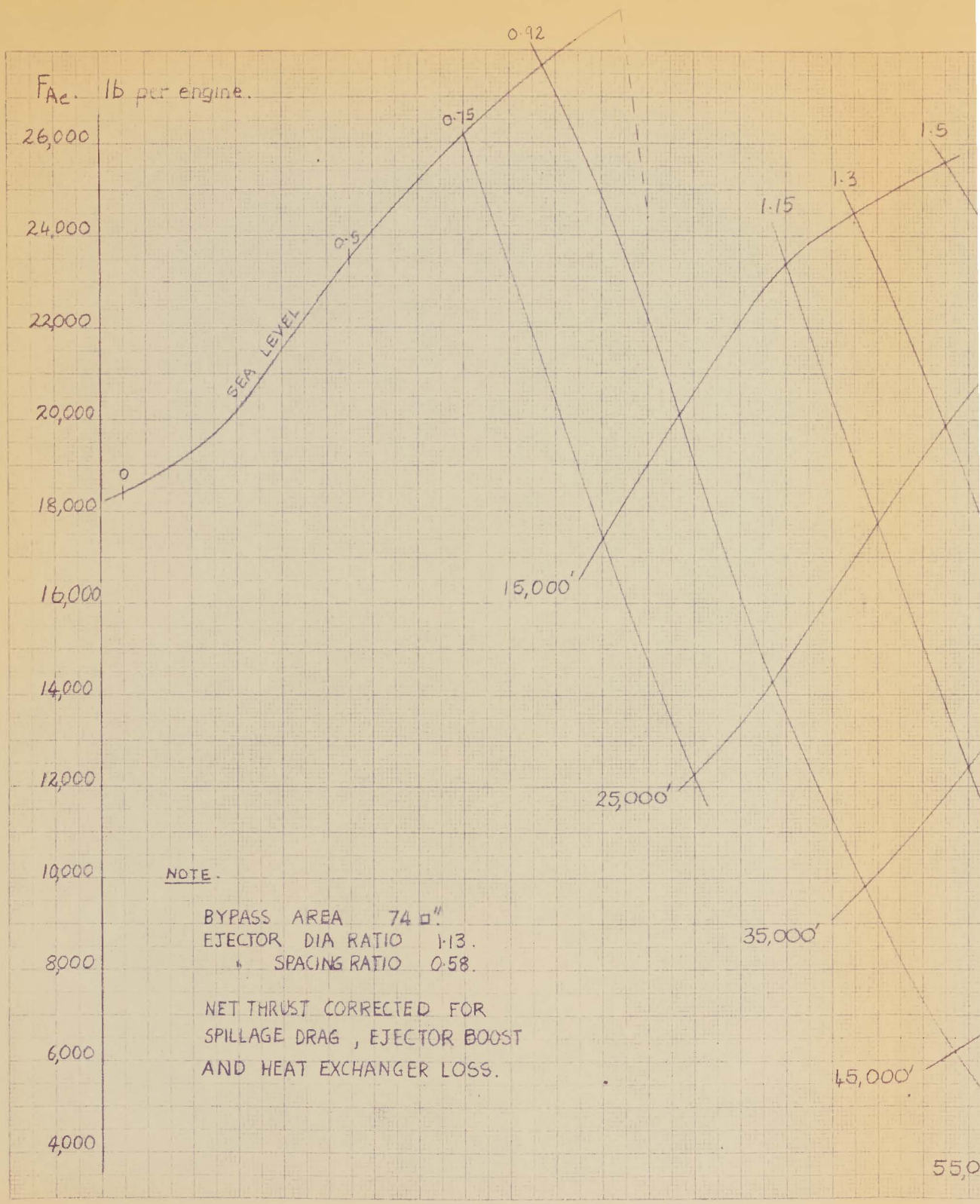

F_{Ac}. lb per engine.
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
SEA LEVEL
0
0.5
0.75
0.92
15,000'
1.15
1.3
1.5
25,000'
35,000'
45,000'
55,0
NOTE.
BYPASS AREA 74 □".
EJECTOR DIA RATIO 1.13.
& SPACING RATIO 0.58.
NET THRUST CORRECTED FOR
SPILLAGE DRAG, EJECTOR BOOST
AND HEAT EXCHANGER LOSS.

FIG 13 (ISSUE 2) JTL4-25 A/B LIT

NET THRUST AGAINST ALTITUDE AND MACH NO.

J.R. MONK 26 OCT 1955.