AVRO AIRCRAFT LIMITED

PERIODIC PERFORMANCE REPORT 15A

PERFORMANCE OF THE ARROW 2

SECRET

NOVEMBER 1958

AVRO AIRCRAFT LIMITED

MALTON – ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: Arrow 2 SECRET REPORT NO: Periodic Performance Report No. 15A

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TITLE:

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PERFORMANCE OF THE ARROW 2

Aircraft 25206 with Derated Iroquois

(Engine Nos. 116 & 117)

Classification cancelled/changed to .....

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

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

PREPARED BY Performance Group R.A. Rose DATE Nov. 1958

RECOMMENDED FOR APPROVAL ..... DATE Nov. 1958.

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ARROW PERIODIC PERFORMANCE REPORT 15A

PERFORMANCE OF THE ARROW 2

AIRCRAFT 25206 WITH DERATED IROQUOIS

(Pre-production Engine Nos. 116 & 117)

(C.G. at 29.5% MAC)

SUMMARY

The performance data given in this report are based on the drag data given in AVRO Periodic Performance Report 15, and on propulsion data given in 72/Int. Aero/36 (Derated Iroquois with 7,650 maximum N_H rpm and derated afterburner). They represent the best estimate of the performance of aircraft 25206 with current flight limitations.

The main differences between this report and Periodic Performance Report number 15 are:-

1. Derated engine and afterburner performance.
2. Instrumentation pack carried, instead of Hughes MA-1 with MB-1 and GAR 3/4 missiles.
3. No fuel carried in pack.
4. No provision for 500 gallon ventral drop tank.
5. An increase in Operational Weight Empty of 409 lbs.

The loading and performance data are given in Table 1 and Figures 1 to 7 (c) inclusive.

TABLE I - LOADING AND PERFORMANCE

UNDER I.C.A.O. STANDARD ATMOSPHERE CONDITIONS

(Clean Aircraft)

WEIGHT:-

Operational Weight Empty	lb.	46,301
Maximum usable internal fuel	lb.	19,146
Gross Take-Off weight (Max. internal fuel)	lb.	65,447
Half max. internal fuel weight	lb.	55,874
Normal design landing gross weight	lb.	51,087
Maximum landing gross weight	lb.	65,447
Wing loading at gross take-off weight	lb/sq.ft.	53.4
Power loading at gross take-off weight	lb/lb.Thrust	1.77

Amended by AVRO letter 8251/20/J d 24 Nov. 1954

SPEED:-

True airspeed in level flight at Half Max. Internal Fuel Weight

Sea Level	(1)	Maximum Thrust A/B Lit	KTS.	~~425~~ * 375 Kts
	(11)	Maximum Thrust A/B Unlit	KTS.	~~425~~ * 375 Kts.
50,000 ft.	(1)	Maximum Thrust A/B Lit	KTS.	1,085

CEILING:-

Ceiling at Half Max. Internal Fuel Weight, rate of climb 500 ft./min. with maximum thrust at 1.5M A/B lit	ft.	55,000

RATE OF CLIMB:-

Steady State rate of climb at Half Max. Internal Fuel Weight

Sea Level	(1)	Maximum thrust, A/B Lit at 375 ~~425~~ KTS. *	Ft/Min.	25,800
	(11)	Maximum thrust, A/B Unlit at 375 ~~425~~ KTS.*	Ft/Min.	15,000
50,000 ft.	(1)	Maximum Thrust A/B lit at 1.5 M.N.	Ft/Min.	3,800

* Current EAS limitation on aircraft 25206 - see Figures 1 & 4.

TIME TO HEIGHT:-

Time to reach 50,000 ft. and 1.5M from engine start at gross take-off weight, maximum thrust A/B Lit — 7.46

MANOEUVRABILITY:-

Load factor at Half Max. Internal Fuel Weight

1. Maximum thrust A/B Lit 1.5M at 50,000 feet. — 1.31
2. Maximum thrust A/B Lit 1.8M at 50,000 feet. — 1.14

TAKE - OFF DISTANCE:-

Take-off distance over 50 ft. obstacle at sea level at Gross Take-Off weight

(1) Maximum thrust A/B Lit standard day — ft. 4525
(2) Maximum thrust A/B Unlit, standard day — ft. 6075
(3) Maximum thrust A/B Lit, hot day — ft. 5775

LANDING DISTANCE:-

Landing distance over 50 ft. obstacle at sea level at normal design landing gross weight — ft. 5325

STALLING SPEED:-

True stalling speed in landing configuration at Half Max. Internal Fuel Weight at sea level — KTS. 117

MISSIONS

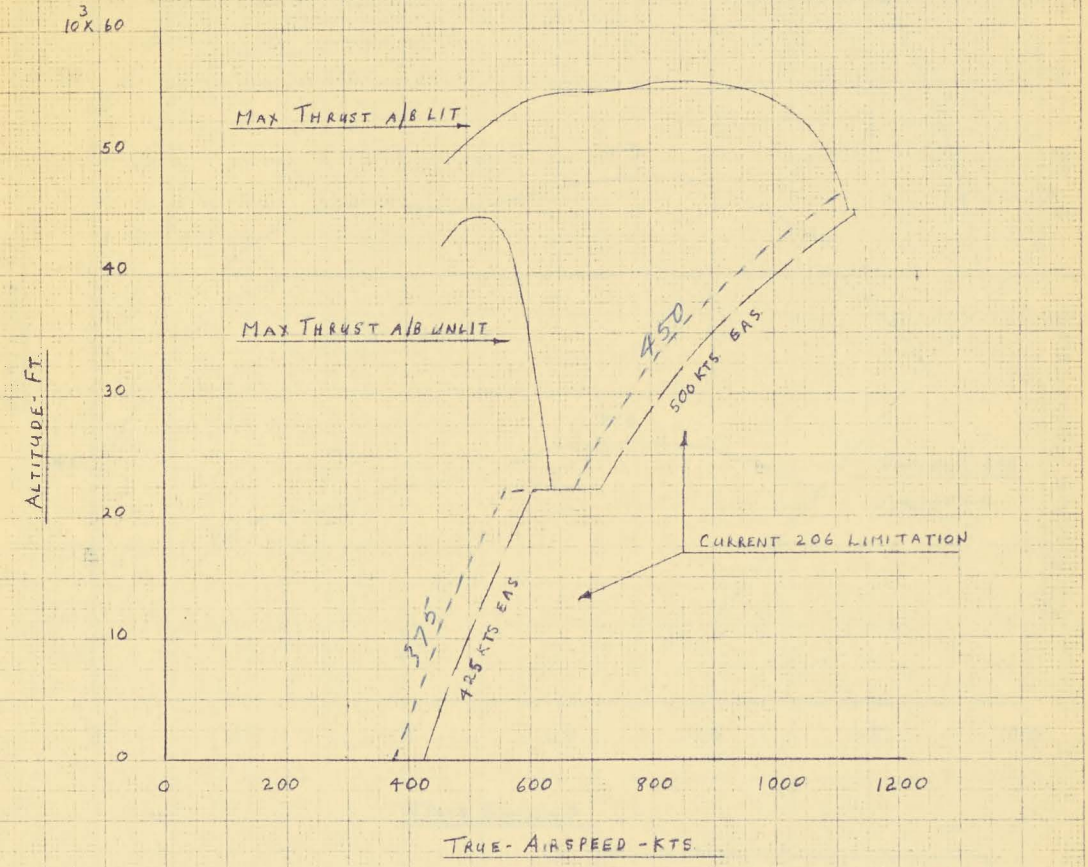
Ferry Mission (internal fuel only) — Range N.M. 1150

ARROW 2

MAX LEVEL SPEED AT HALF MAX INT FUEL (55874-85)

IROQUOIS DERATED ENGINE

(PRE PRODUCTION ENGINES 116:117)



DRAG - 71-2 / AERO-DATA / 17
PROPULSION - 72 / INT AERO / 36

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FIG. 1

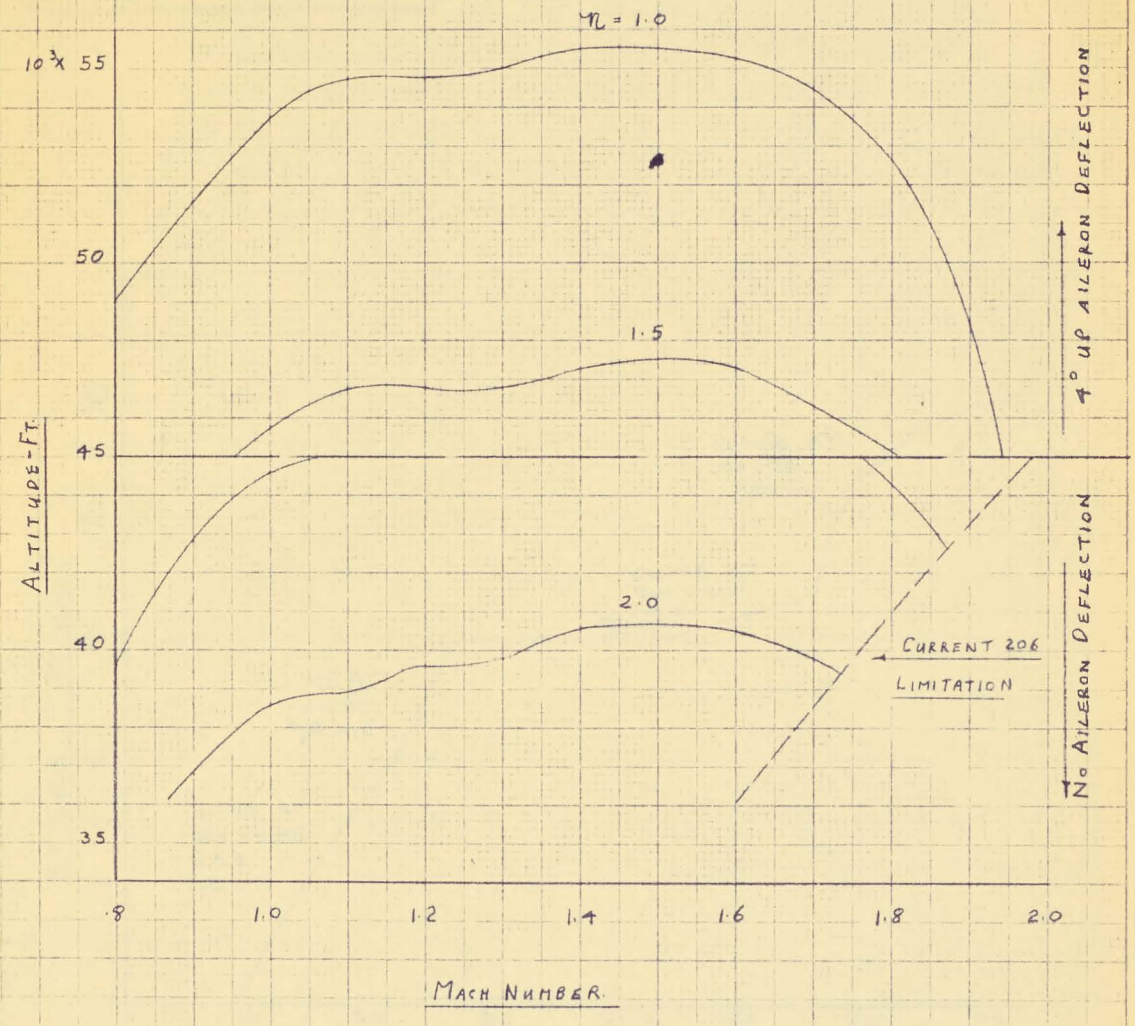
ARROW 2.

MANOEUVRABILITY - STEADY G's AVAILABLE

AT HALF MAX. INT. FUEL WEIGHT - (55874 LBS)

IROQUOIS DERATED ENGINE

(PRE PRODUCTION ENGINES 116 : 117)



DRAG :- 71-2/AERO DATA/17

PROPULSION :- 72/INT. AERO/36

FIG. 2.

ARROW 2 IROQUOIS SERIES 2 DERATED ENGINES

[PRE-PRODUCTION ENGINES 116 AND 117]

TIME TO HEIGHT

MINIMUM TIME - A/B LIT THROUGHOUT FLIGHT PLAN

REF: PROPULSION 72/INT. AERO/36
DRAG 71-2/AERO DATA/17

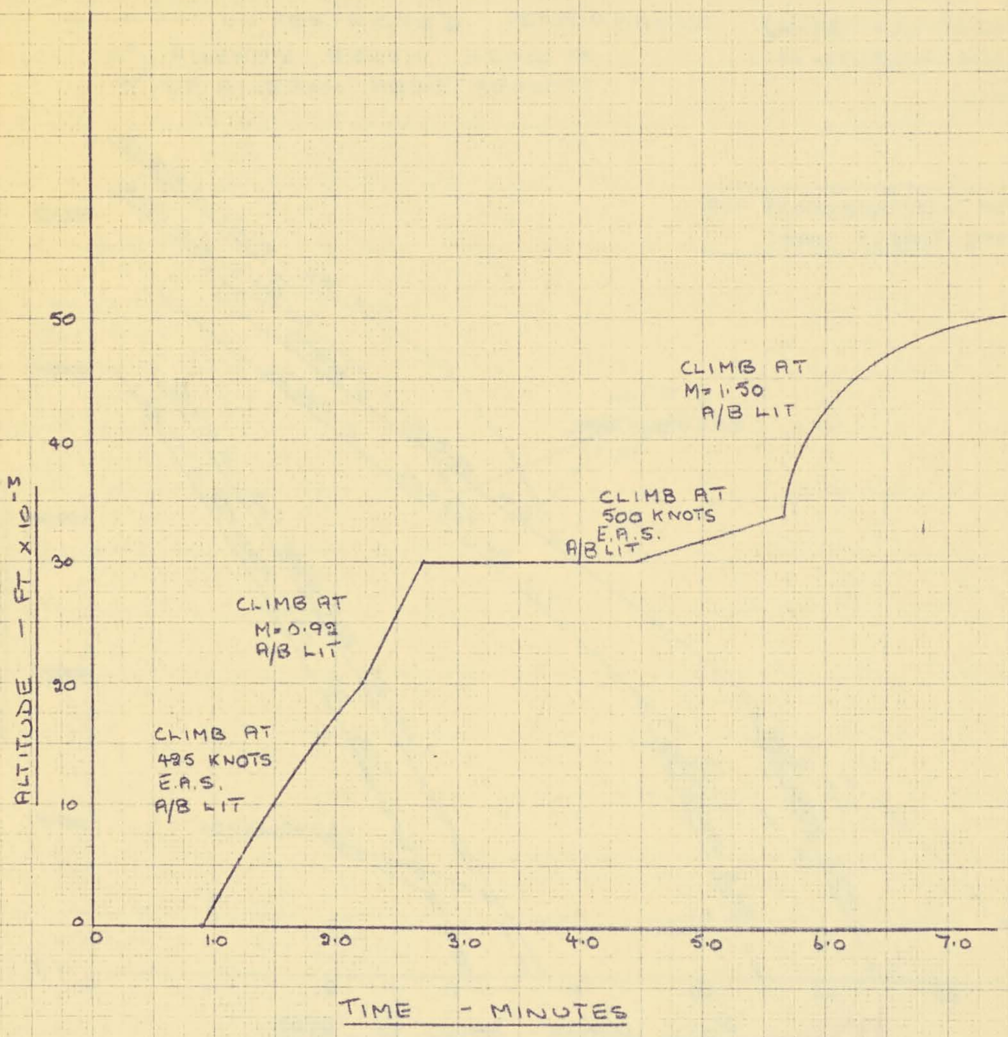


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FIG. 3.

ARROW 2 IROQUOIS SERIES 2 DERATED ENGINES
[PRE-PRODUCTION ENGINES 116 AND 117]
STEADY STATE RATES OF CLIMB

CLIMB SPEED	425 KNOTS E.A.S.				600 KNOTS E.A.S.		M=·92		M=1·50	
ALTITUDE - FT.	S.L.	5,000	10,000	15,000	30,000	35,000	S.L. TO 36089	ABOVE 36,089	S.L. TO 36089	ABOVE 36,089
KINETIC ENERGY FACTOR	0·807	0·776	0·746	0·705	0·481	0·404	1·127	0	1·48	0

——— CURRENT CLEARANCE LIMITATIONS FOR A/C 25206

— — — UN RESTRICTED PERFORMANCE (NOTE: INSUFFICIENT TIME TO OPTIMISE SUBSONIC CLIMB.)

0° AILERON BELOW 45,000 FT.
4° UP AILERON ABOVE 45,000 FT.

REF: PROPULSION 72/INT. AERO/36
DRAG 71-2/AERO DATA/17

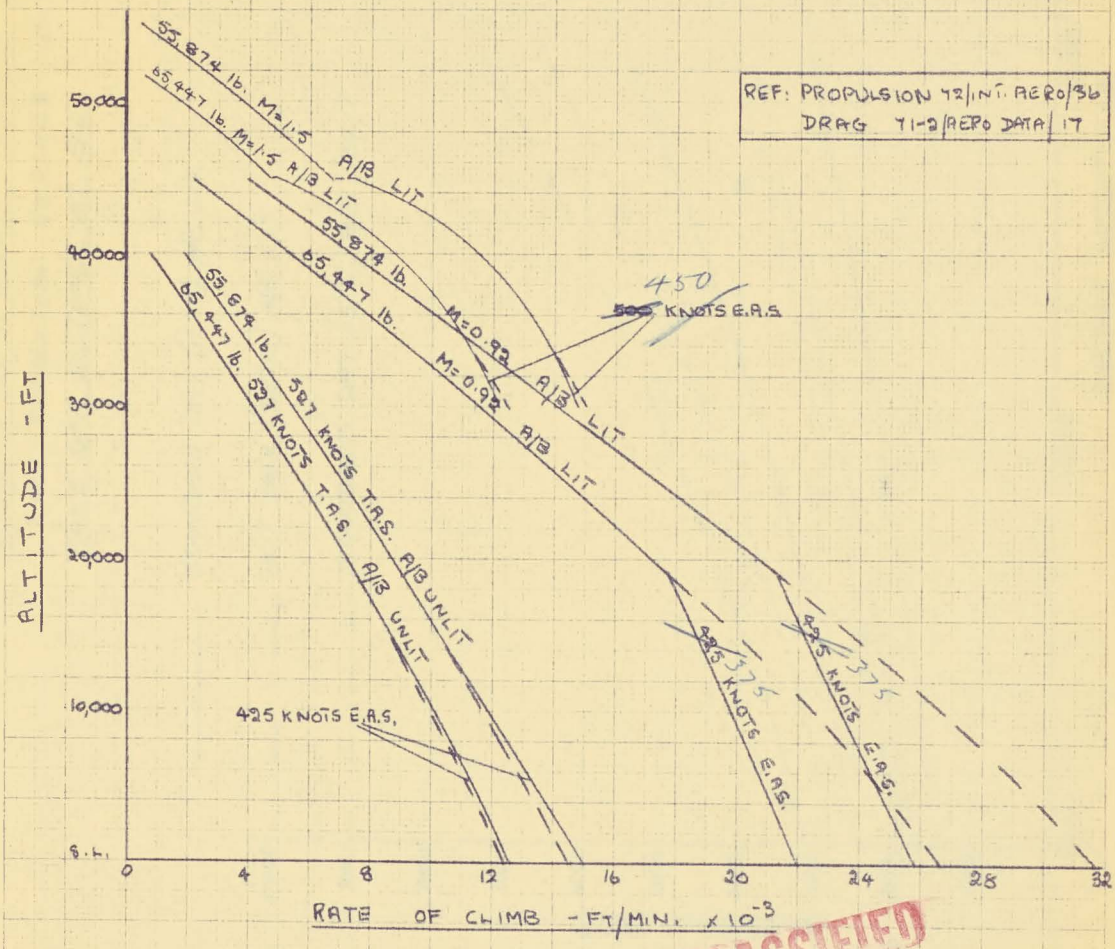

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FIG. 4

ARROW 2 WITH DERATED IROQUOIS ENGINES
[PRE-PRODUCTION ENGINES 116 AND 117]
TAKE OFF DISTANCE AT S.L.

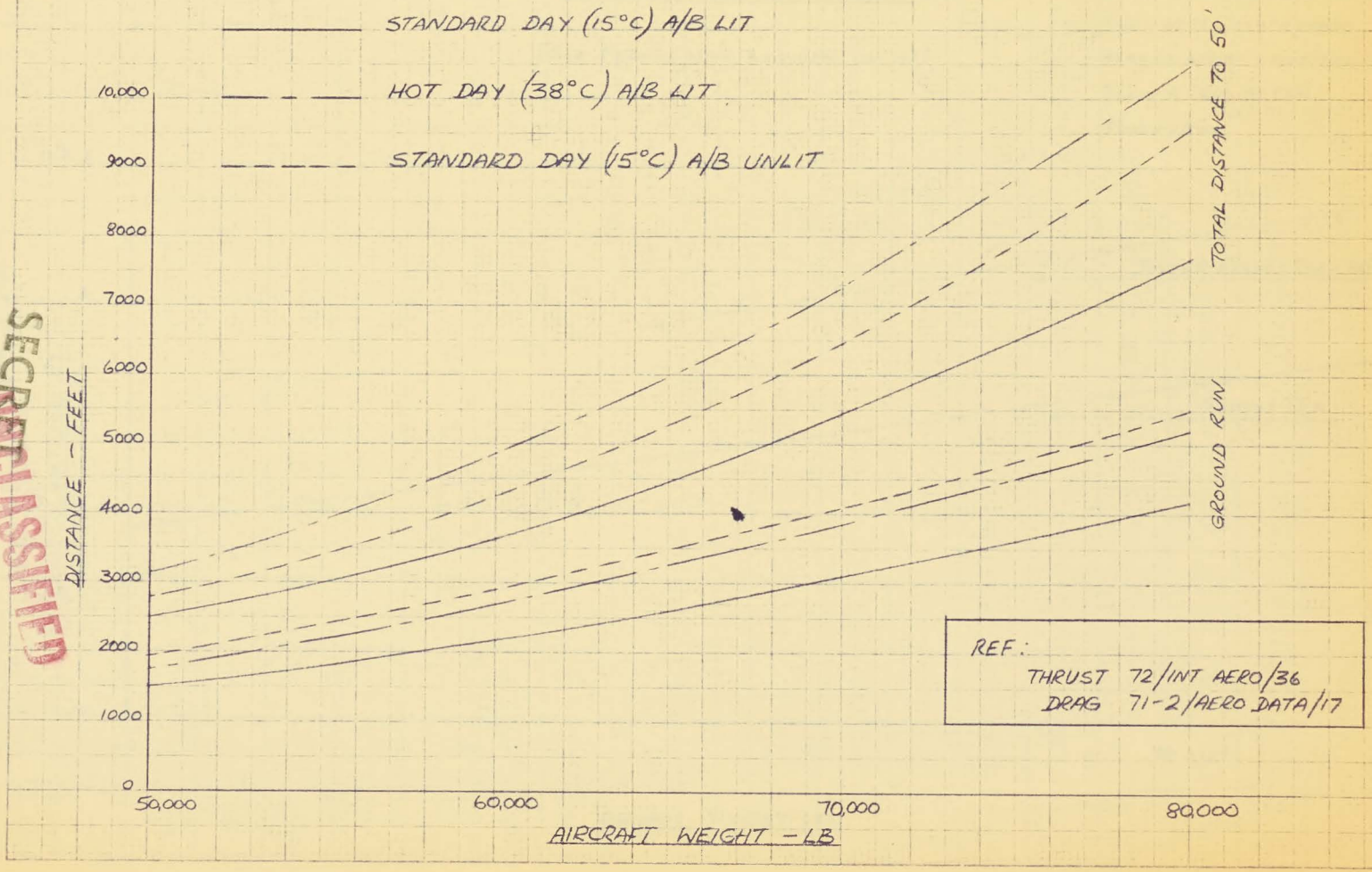

FIG. 5

ARROW 2.

LANDING DISTANCE AT S.L.

IROQUOIS DERATED ENGINE

(PRE PRODUCTION ENGINES 116 : 117)

ICAO STANDARD DAY
24' DIA. PARACHUTE ASSUMED TO BE FULLY EFFECTIVE 4 SECS AFTER TOUCH DOWN.
BRAKES APPLIED AND NOSEWHEEL DOWN 4 SECS AFTER TOUCHDOWN

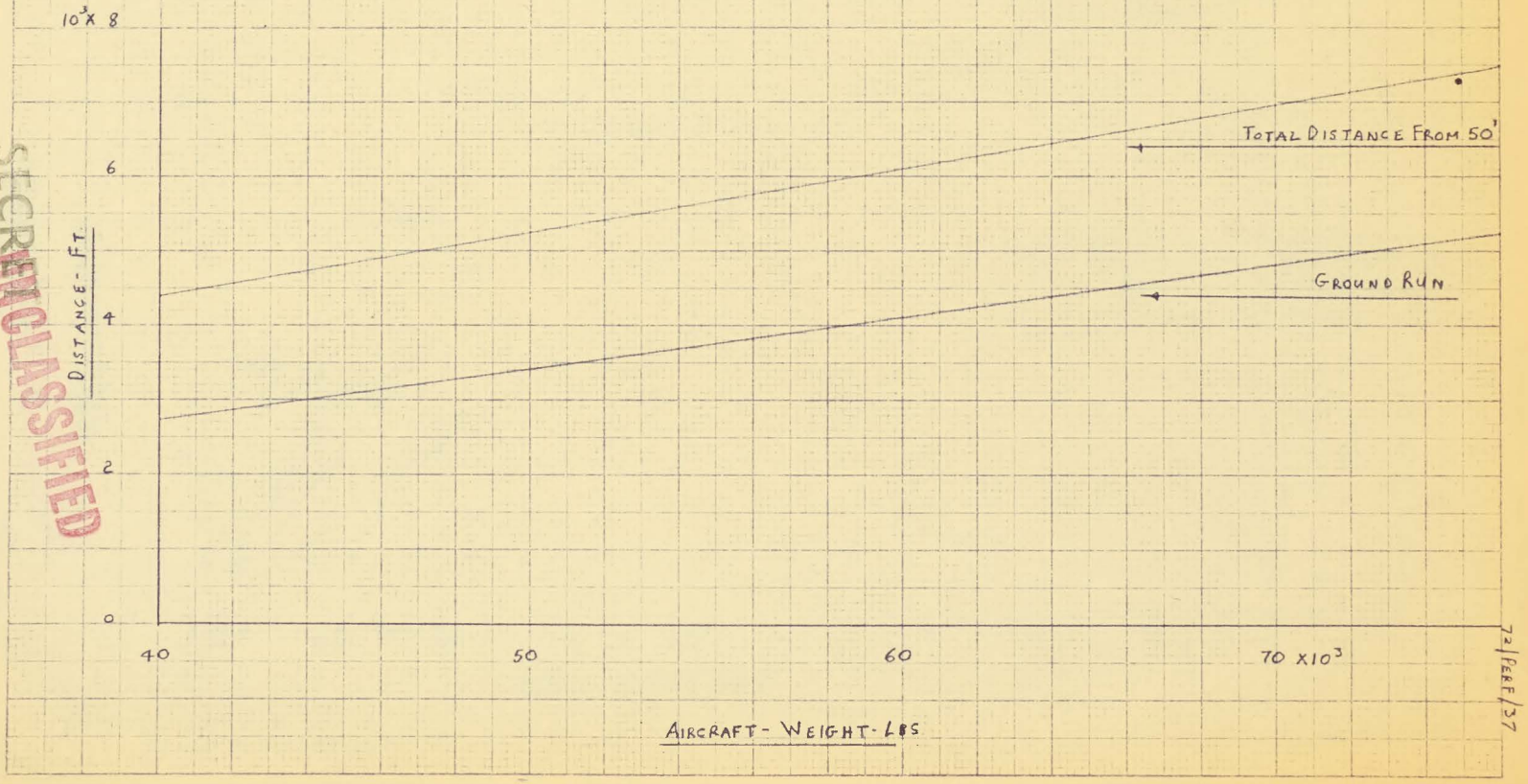

FIG. 6

72/FERF/37

ARROW 2 - IROQUOIS SERIES 2 DERATED ENGINES A/B LIT

[PRE-PRODUCTION ENGINES 116 AND 117]

TIME TO ACCELERATE FROM M=0.92 TO M=2.0

AT COMBAT WEIGHT = 55,874 lb

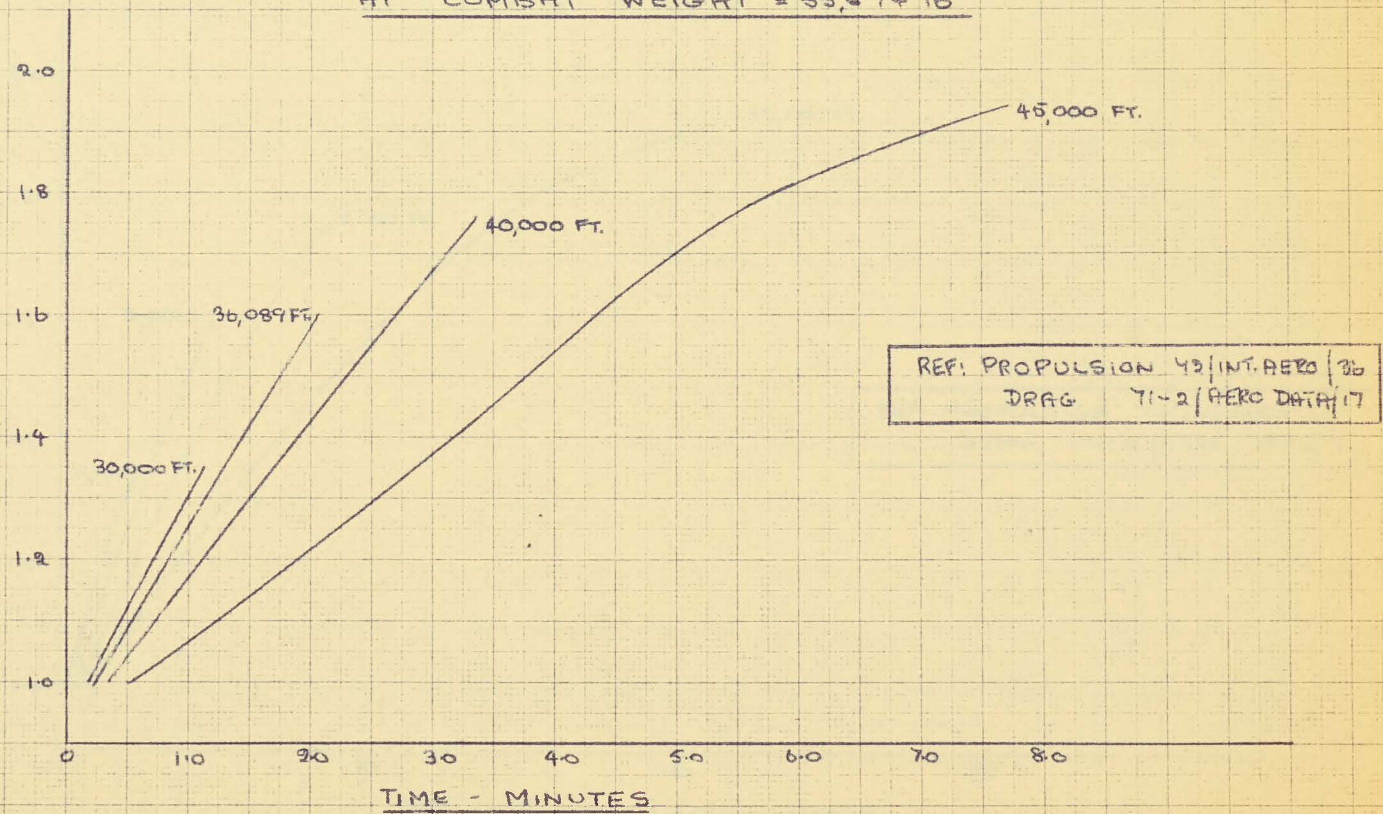

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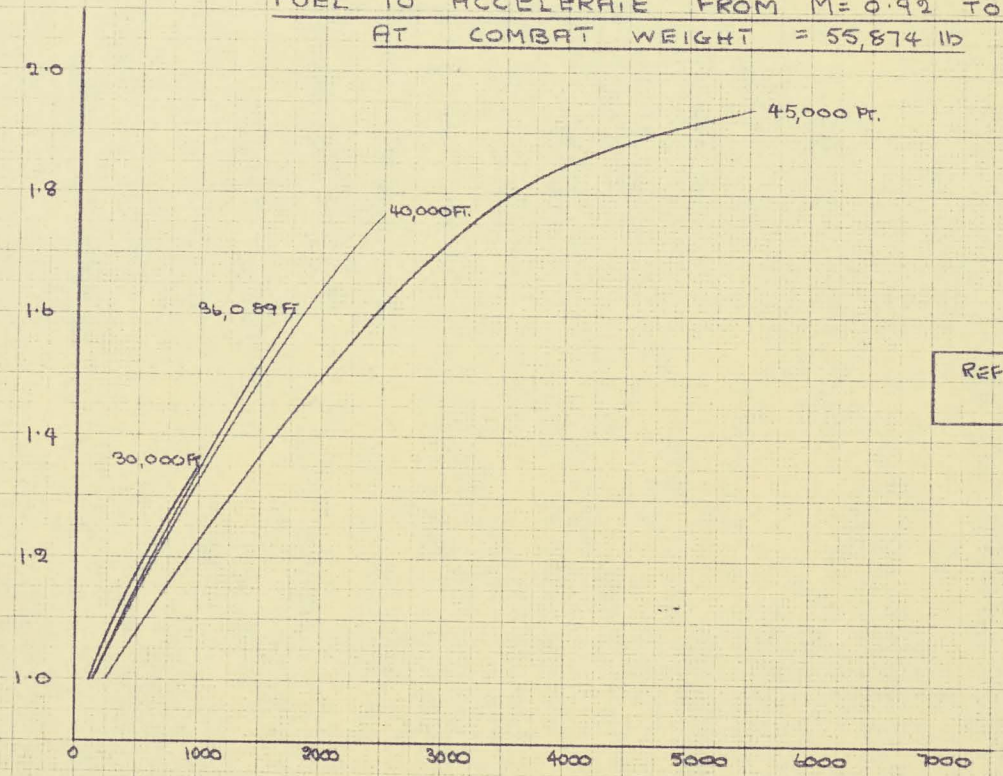
FIG. 7A

ARROW 2 - IROQUOIS SERIES 2 DERATED ENGINES A/B LIT

[PRE - PRODUCTION ENGINES 116 AND 117]

FUEL TO ACCELERATE FROM M = 0.92 TO M = 2.0
AT COMBAT WEIGHT = 55,874 lb



REF: PROPULSION 72/INT. AERO/36
DRAG 71-2/AERO DATA/17

FIG. 7C

REPORT NO. 72/PERF/37

N.W. Nov '58

SECTION 2 PROPULSION DATA

The propulsion system consists of an engine derated to maximum high pressure rotor r.p.m. of 7650 as limited by handling and vibration problems at the present state of development, and afterburner derated to efficiencies obtainable at present state of development as given by Tullahoma test.

The significant parameters as suggested by Orenda Engines Limited are:-

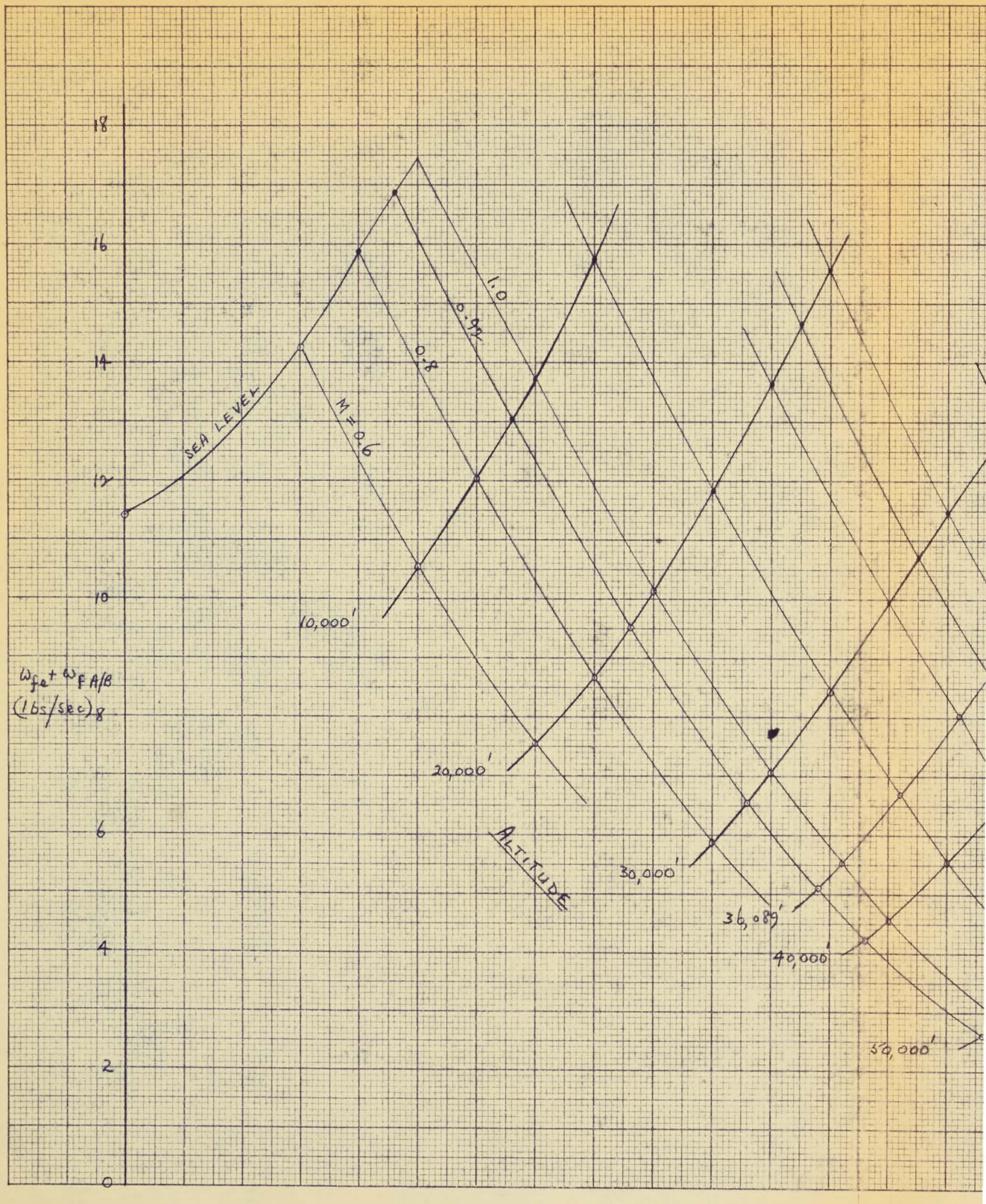
(a) The maximum high pressure rotor speed is 7650 r.p.m. The engine non-dimensional charts OEL-X-16479 through OEL-X-16493 (basis of EMS-8-2 performance) were used but with N_H factored by 8150/8050. Thus on the charts 7650 r.p.m. gives a swallowing capacity identical to 7745 r.p.m.

(b) The final nozzle area was taken to be constant at 668 sq.in. However, the actual geometric area of the final nozzle to pass the internal flows, afterburner off, is 760 sq.in. This implies a final nozzle flow coefficient of 88% rather than the 98.5% used to date. A flow coefficient of 88% was also used afterburner lit, where the maximum geometric final nozzle area remains at 1075 sq.in.

(c) The afterburner efficiency used is that given from Tullahoma test on OEL-X-18942, a deterioration of the order of 25% from that used to date.

The propulsion system geometry is comprised of a fixed intake with throat area of 6.0 sq.ft., bypass inlet of 180 sq.in., restrictor flow area varying between 95 and 250 sq.in. as determined by the spring characteristic of OEL-X-18894, a fixed divergent ejector of throat 40 in. and exit 49 in. diameter.

Prepared by Internal Aero Group -
November, 1958.



Ref: 72/Int Anor/136

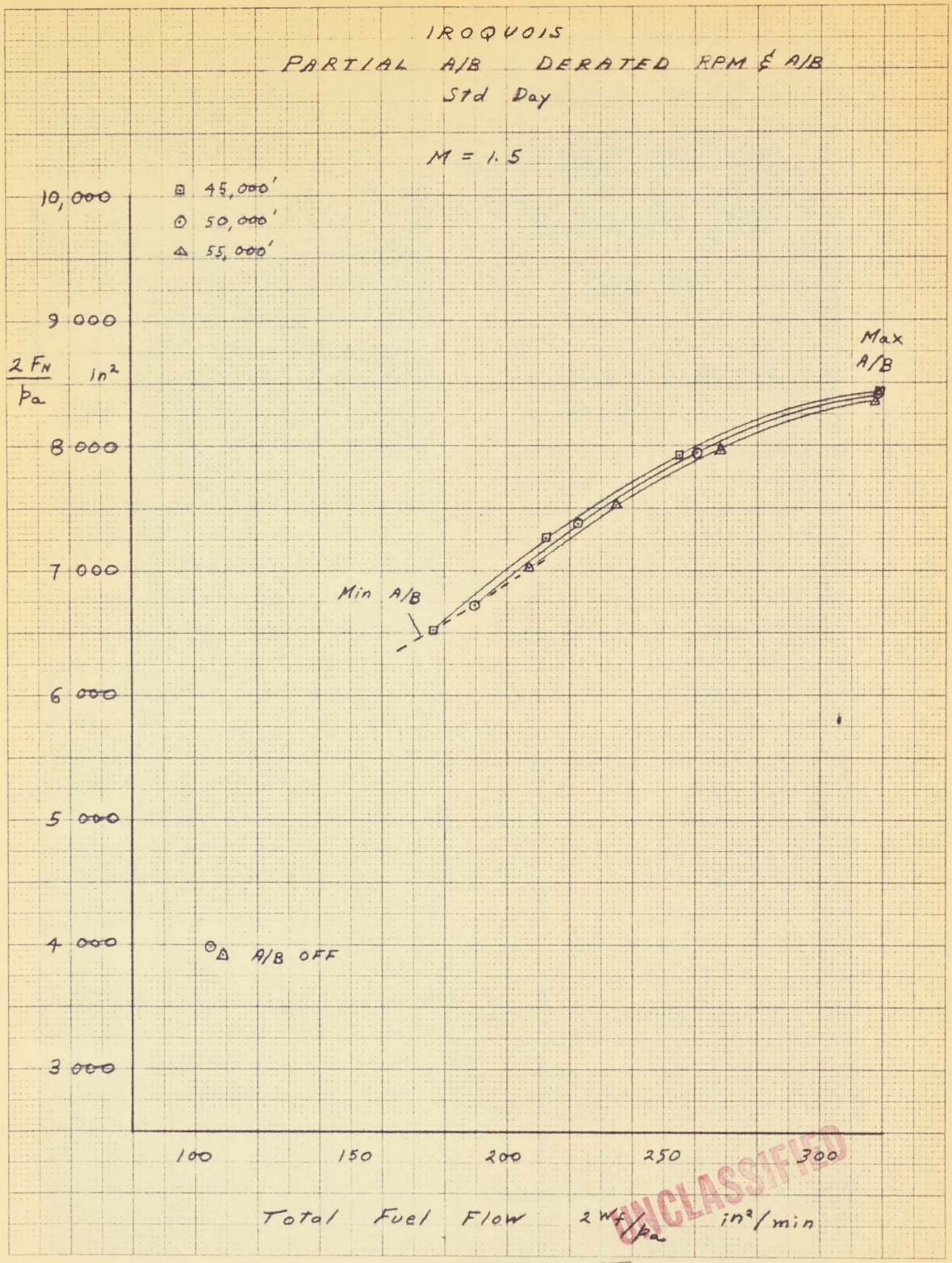


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FIG. 10.