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CF-105 P/Power/59

PRELIMINARY NOTE ON THE
CF-105 INTAKE TESTS AT LEWIS LAB.

J. Morris, ~~CONFIDENTIAL~~ January 1956

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PRELIMINARY NOTE ON THE CF-105 INTAKE TESTS AT LEWIS LAB.

ANALYZED

An extensive set of tests were carried out on a 1/6 scale model of the CF-105 intake in the 8' x 6' Supersonic Tunnel at Cleveland. The test Mach No.'s were M = 0.63, 1.5, 1.7, 1.8, 1.9, 2.0 & 2.1, and covered an angle of attack range α = -2.5° to +9.5° and yaw ψ = -3 to +9°.

The results presented in this note have been selected from the data available (at the time of writing) on the final configuration.

(1) Pressure Recovery

The variation of pressure recovery at the compressor face with compressor face mass flow ratio is presented in Fig. 1 to 8. The effect of angle of attack is shown in Fig. 1 to 4 & angle of yaw in Fig. 5 - 8.

The intake is very insensitive to angle of attack at all Mach Numbers tested and the effect of yaw is negligible below M = 1.5. It becomes increasingly sensitive to yaw above M = 1.5, but the variation of pressure recovery with yaw at constant mass flow ratio is linear within the range tested and we do not therefore, anticipate any trouble due to yaw effects.

A comparison has been made between the estimated and measured pressure recoveries at the engine match point and is presented in Fig. 9, and the agreement is quite good.

(2) Flow Distortion at the Compressor Face

The distortion data is presented in Fig. 10, using the distortion parameter $\Delta H/H_4$, where ΔH is the maximum difference in the total head readings at the compressor face and H_4 is the mean compressor face total head. At the engine match points the distortion parameter is never greater than 0.07, which is less than Pratt & Whitney's requirement that $\Delta H/H_4 < 0.10$.

(3) Intake Stability

Buzz records were taken throughout the tests and a typical 'buzz intensity' plot at M = 2.0 is given in Fig. 11. Buzz intensity is defined as the percentage pressure fluctuation in the intake duct in terms of the free stream total head.

(3) Intake Stability Cont'd.

In summary, it could be said that buzz did not occur at any angle of attack tested at Mach numbers less than 1.7. At higher Mach numbers buzz did occur at low mass flow ratios and became severe at high angles of attack. The level flight buzz boundaries are presented in Fig. 12 for engine windmilling and idling conditions.

(4) Intake Modifications

The only intake modifications made as a result of the tests was an increase in the width of the porous suction strip on the ramp. The width was approximately twice and the hole area four times the original.

This modification was necessary to achieve a reasonable stable mass flow range at M = 2.0 and it also gave a substantial increase in pressure recovery at the engine match point.

SYMBOLS

α = angle of attack

ψ = angle of yaw

H = total pressure

M = Mach number

m = mass flow thro' compressor face

m_o = mass flow through free stream tube with area equal to inlet projected area

Subscripts

o - free stream

4 - compressor face

Fig 1

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CUBS INTAKE TESTS (FINAL CONFIGURATION)

PRESSURE RECOVERIES

$M = .63$

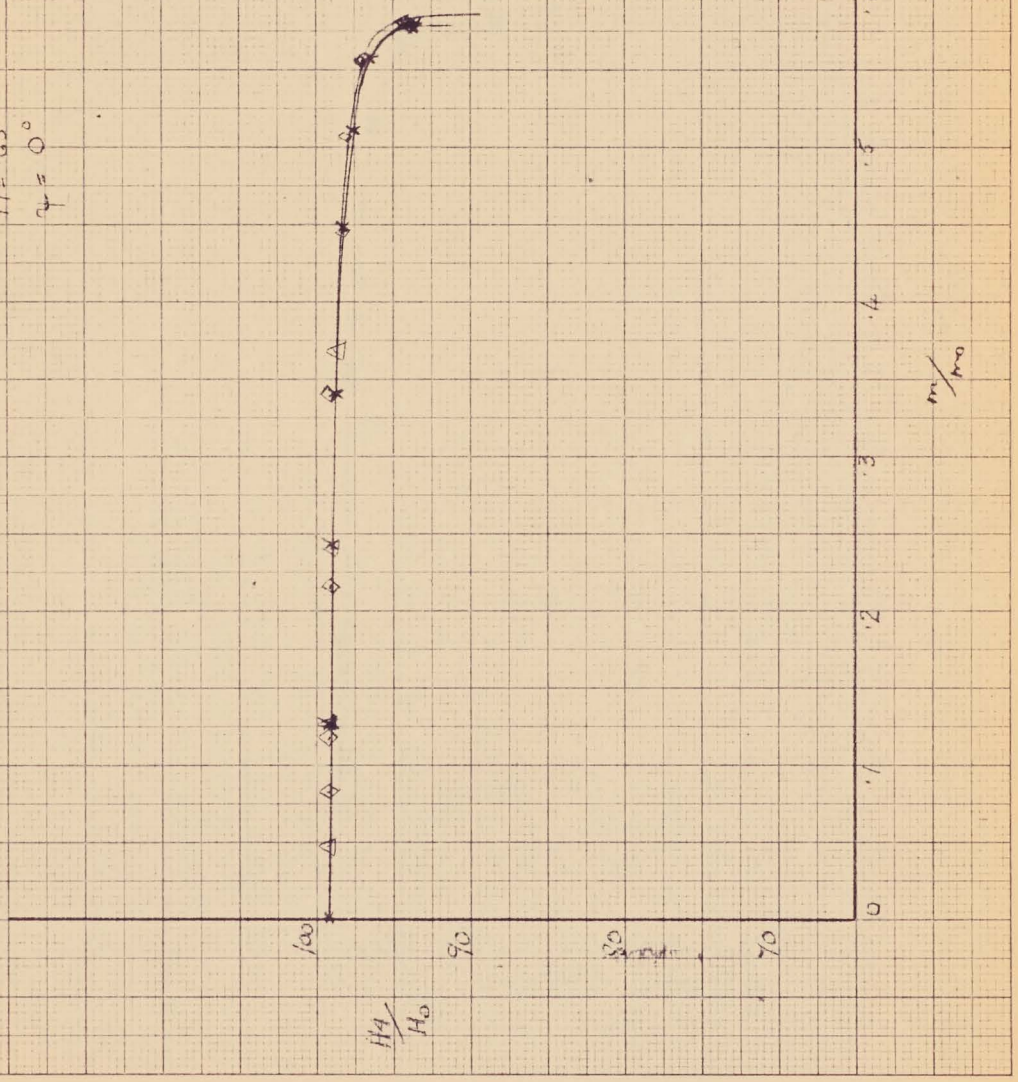
$\psi = 0°$

α

Δ - 0

$\diamond$ 5

$\times$ 9° 30'



C105 Intake Tests (Final Configuration)

Pressure Recoveries

M = 1.4

γ = 0°

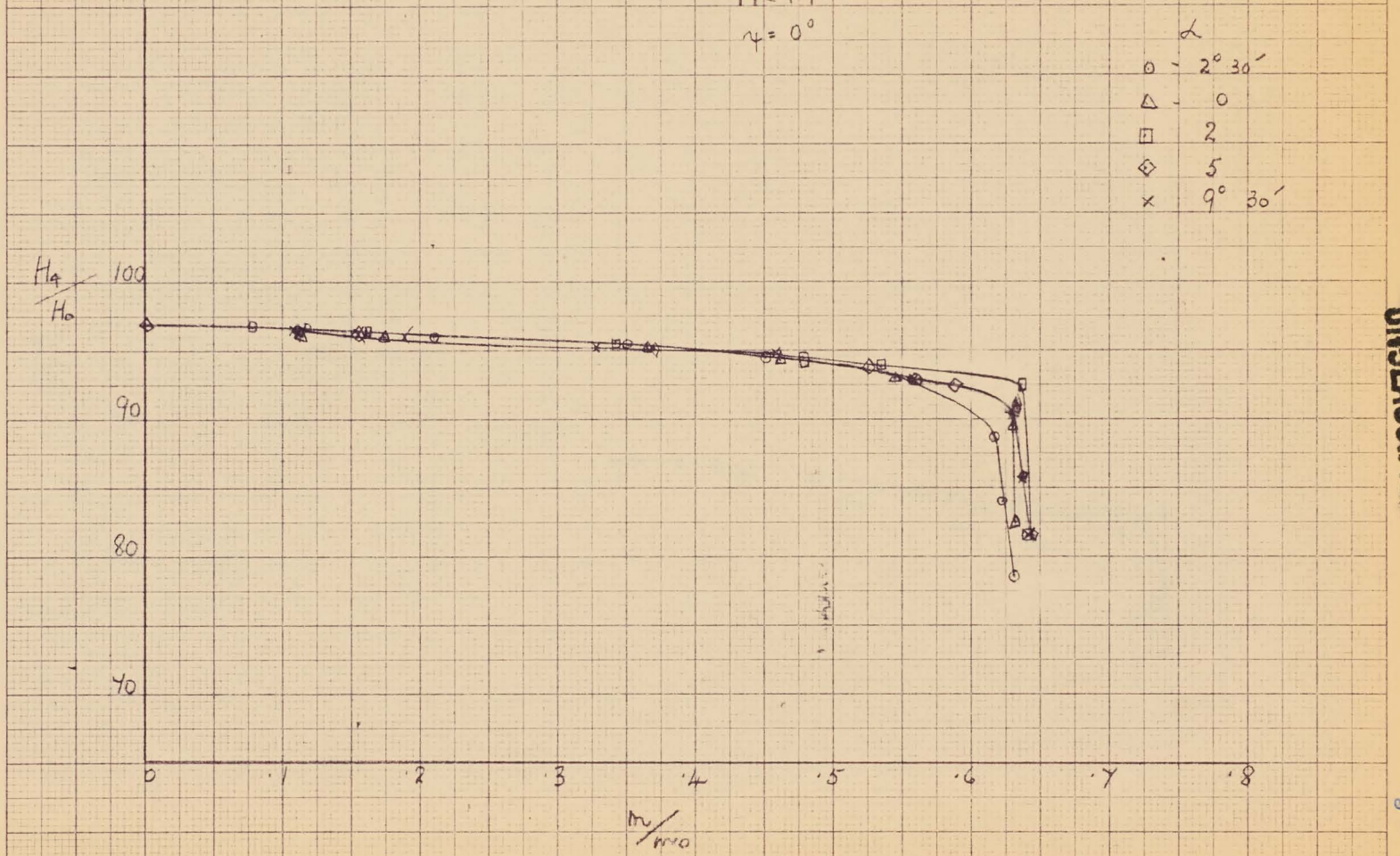


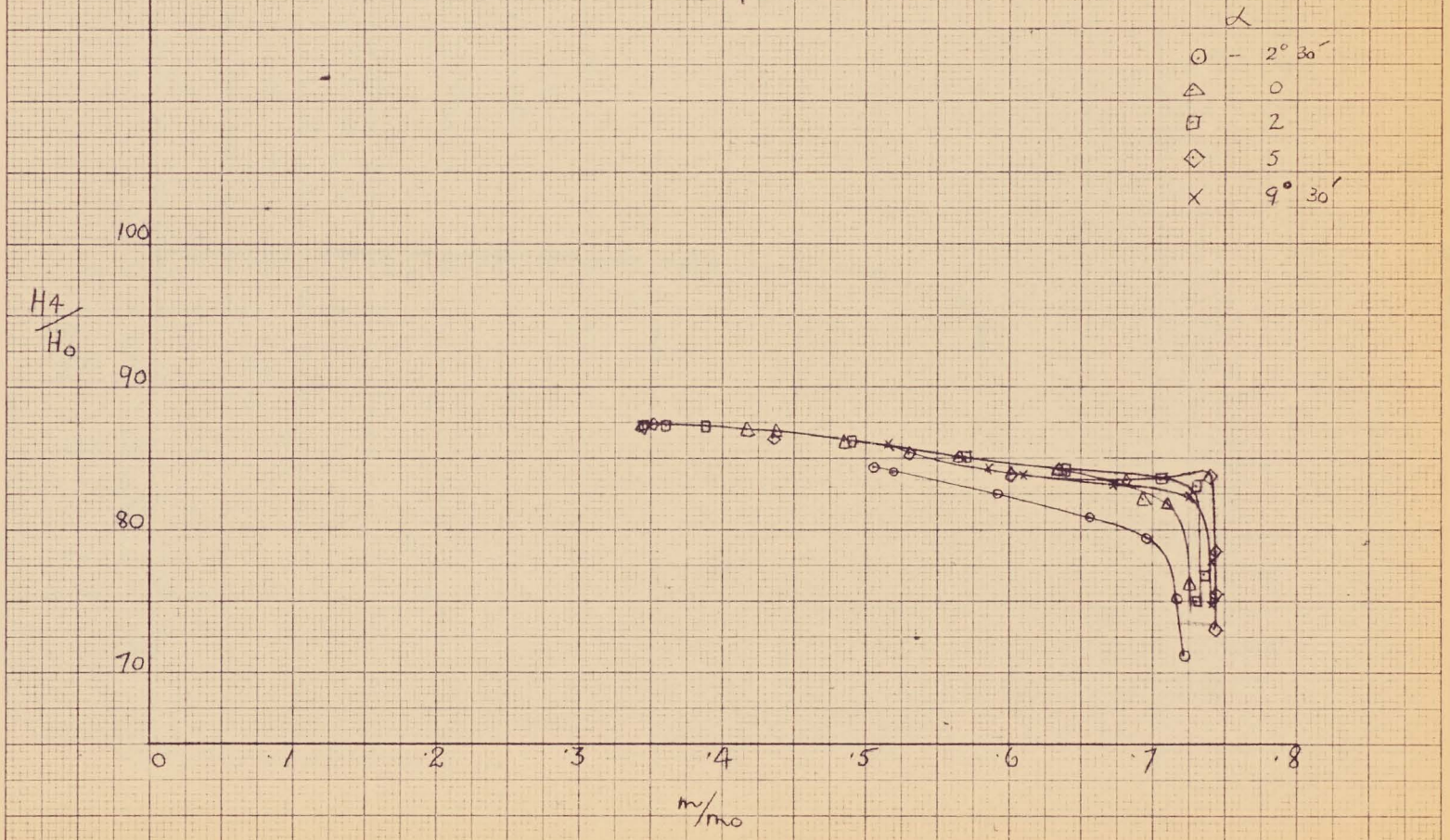
Fig 3

C105 Intake Tests (Final Configuration)

Pressure Recoveries

M = 2.0

$\Psi = 0°$

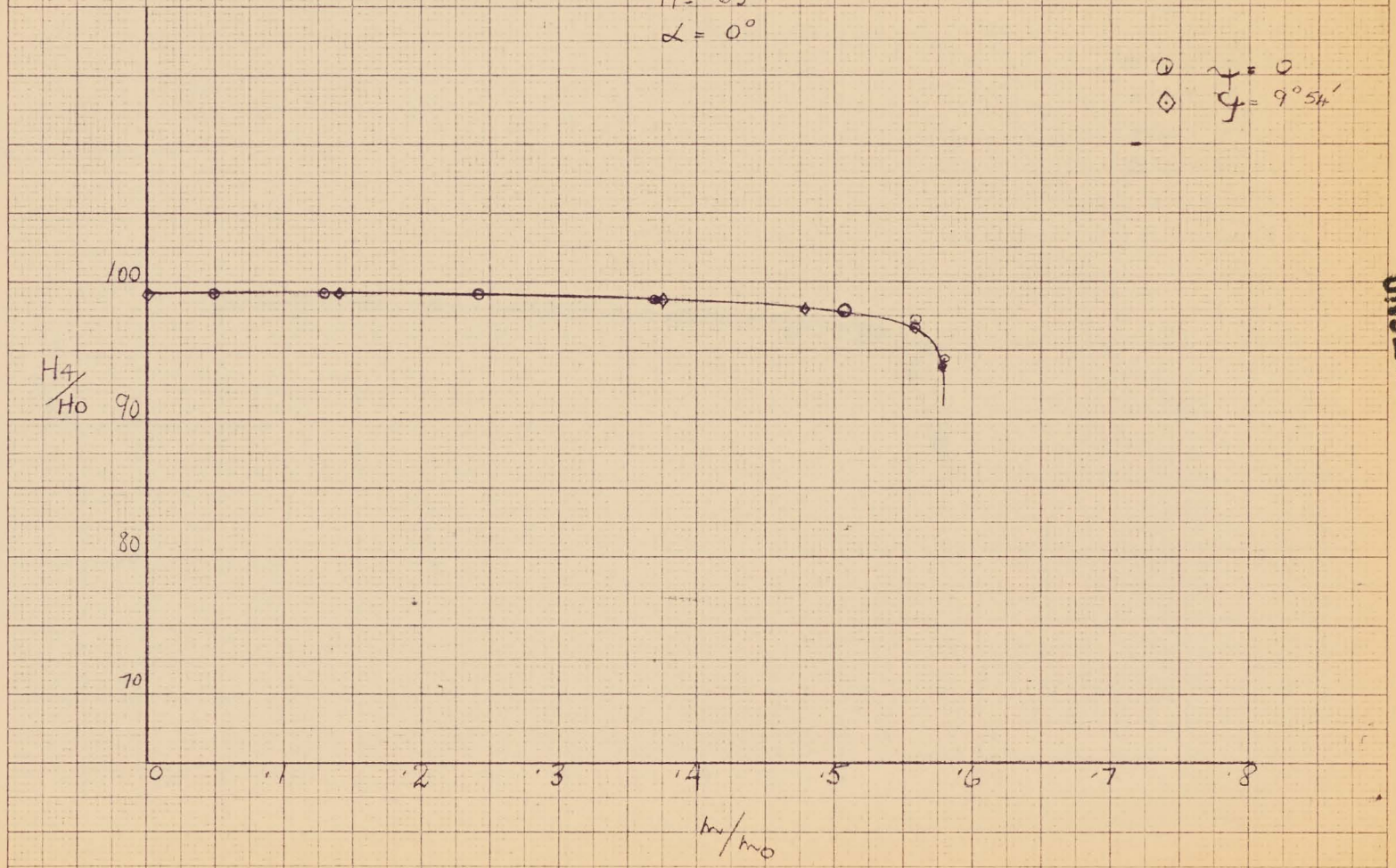


C105 Intake Tests (Final Configuration)

Pressure Recoveries

M = .63

α = 0°



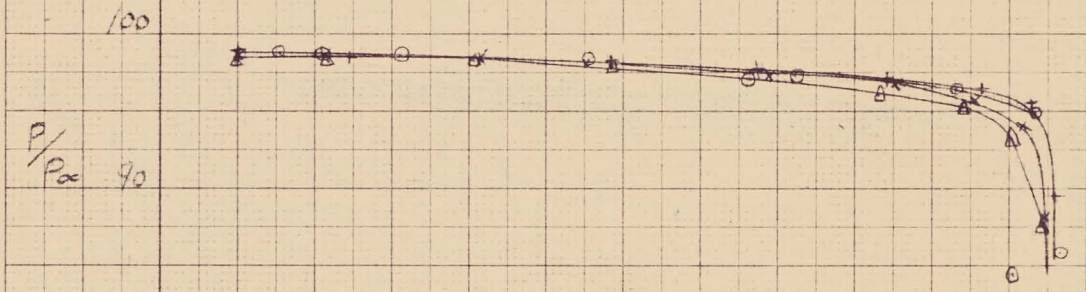
C105 Intake Tests (Final Configuration)

Pressure Recoveries

M = 1·5

α = 0

+ ψ = -2° 30'
⊙ ψ = 0
× ψ = 3°
△ ψ = 6°



P/P∞

100
90
80
70

0 ·1 ·2 ·3 ·4 ·5 ·6 ·7 ·8

m/m₀

Fig 6

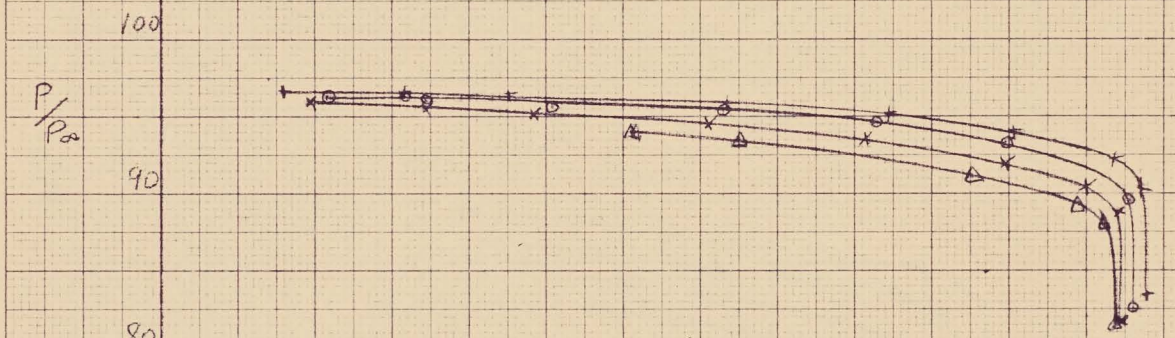
C105 Intake Tests (Final Configuration)

Pressure Recoveries

M = 1.4

α = 0

+ ψ = -2° 30'
⊙ ψ = 0
× ψ = +3°
△ ψ = +6°



P/P∞

100
90
80
70

0 .1 .2 .3 .4 .5 .6 .7 .8

m/m₀

C165 Intake Tests (Final Configuration)

Pressure Recoveries

$M = 2.0$

$\alpha = 0$

+ $\gamma = -2^\circ 35'$
○ $\gamma = 0^\circ$
× $\gamma = +3^\circ$
△ $\gamma = +6^\circ$

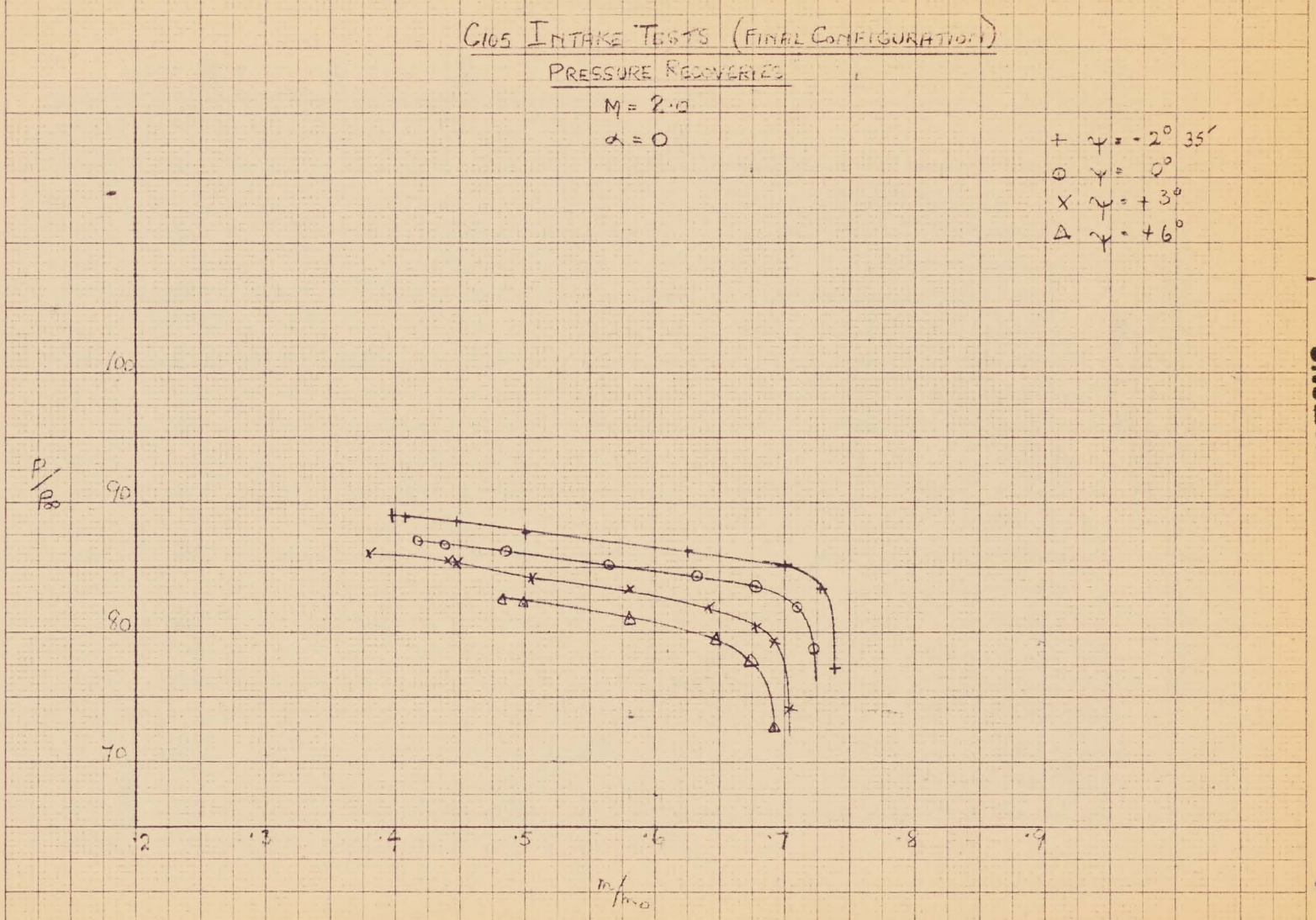


Fig 8

Fig 12

C 105

LEVEL FLIGHT BUZZ BOUNDARIES