

QC
Avro
C-105
P/WT/52
40

QCX
Avro
CF105
P-WT-52
30

FILE IN VAULT

C-105 ANALYZED P/WIND TUNNEL/52
CONFIGURATION AND
REYNOLD'S NUMBER INVESTIGATIONS
UNCLASSIFIED 30
C.A.L. Wind Tunnel Tests - October 1954.



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TO
A

DATE

Report no.: QCX-AVRO-CF105- P- WT-52

has been downgraded to: _____

de-classified

by (Name): Michel W. Drapeau

(Dept.): A/DND Coordinator, Access to Information

Date: Dec. 7, 1992

R. Auger
Signature



UNCLASSIFIED

A. V. ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT: C-105

REPORT NO. P/WIND TUNNEL/52

FILE NO:

NO. OF SHEETS: _____

TITLE:

ANALYZED

CONFIGURATION AND REYNOLD'S NUMBER INVESTIGATIONS

confirmed as:
 Classification ~~cancelled~~ / changed to: UNCLASSIFIED
 By authority of: DRDA 7/DARFT 5-8/DAS Eng 6-4-5
 Date: 5 Nov 1992
 Signature: B Aubrey
 Unit / Rank / Appointment: DSIS 3, Secretary CRAD HQ DRP



PREPARED BY C.A. Ford DATE Dec. 1954.
 CHECKED BY DATE
 SUPERVISED BY DATE
 APPROVED BY DATE

| ISSUE No | REVISION No | REVISED BY | APPROVED BY | DATE | REMARKS |
|----------|-------------|------------|-------------|------|---------|
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45120

12417661

FORM 1316A

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO P/WIND TUNNEL/52

SHEET NO 1

AIRCRAFT:

C-105

PREPARED BY

DATE

C.A. Ford

Dec. 1954.

CHECKED BY

DATE

1.0 C_L vs q

1.1 Reynold's No. Effect

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2.0 C_M vs q , C_L

2.1 Reynold's No. Effect - See 1.1

2.2 Effect of Extensions

2.3 Effect of Notches

2.4 Optimum Cases

2.5 Comparisons

3.0 C_D vs C_L

3.1 Comparisons

4.0 C_y vs β

4.1 Effect of Notches

TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. P/WIND TUNNEL/52

SHEET NO. 11

AIRCRAFT:

C-105

PREPARED BY

DATE

C.A. Ford

Dec. 1954.

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DATE

5.0 C_N vs β

5.1 Effect of Reynolds' No.

5.2 Effect of Fuselage Modification

5.3 Effect of Wing Extensions

5.4 Effect of Notches

5.5 Effect of Canopy and Faired Intakes.

6.0 C_Q vs β

6.1 Effect of Notches

7.0 C_{N_f} vs β

7.1 Effect of Reynold's No.

7.2 Effect of Wing Configuration.

7.3 Effect of Canopy and Faired Intakes.

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TECHNICAL DEPARTMENT (Aircraft)

REPORT NO. P/WIND TUNNEL/52

SHEET NO. 11

AIRCRAFT:

C-105

PREPARED BY

DATE

C.A. Ford

Dec. 1954.

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DATE

5.0 C_N vs β

- 5.1 Effect of Reynolds' No.
- 5.2 Effect of Fuselage Modification
- 5.3 Effect of Wing Extensions
- 5.4 Effect of Notches
- 5.5 Effect of Canopy and Paired Intakes.

6.0 C_l vs β

- 6.1 Effect of Notches

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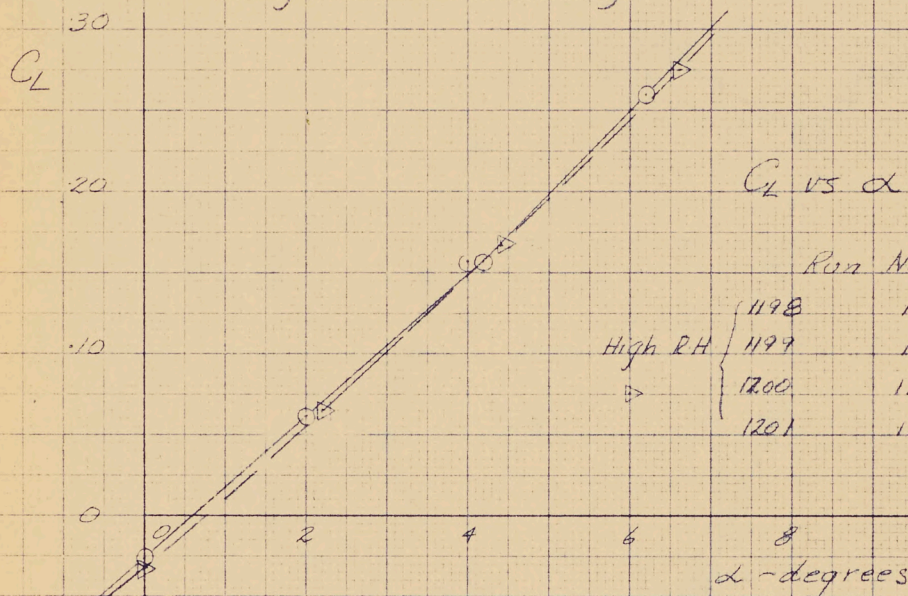
7.0 C_{N_f} vs β

- 7.1 Effect of Reynold's No.
- 7.2 Effect of Wing Configuration.
- 7.3 Effect of Canopy and Paired Intakes.

C-105

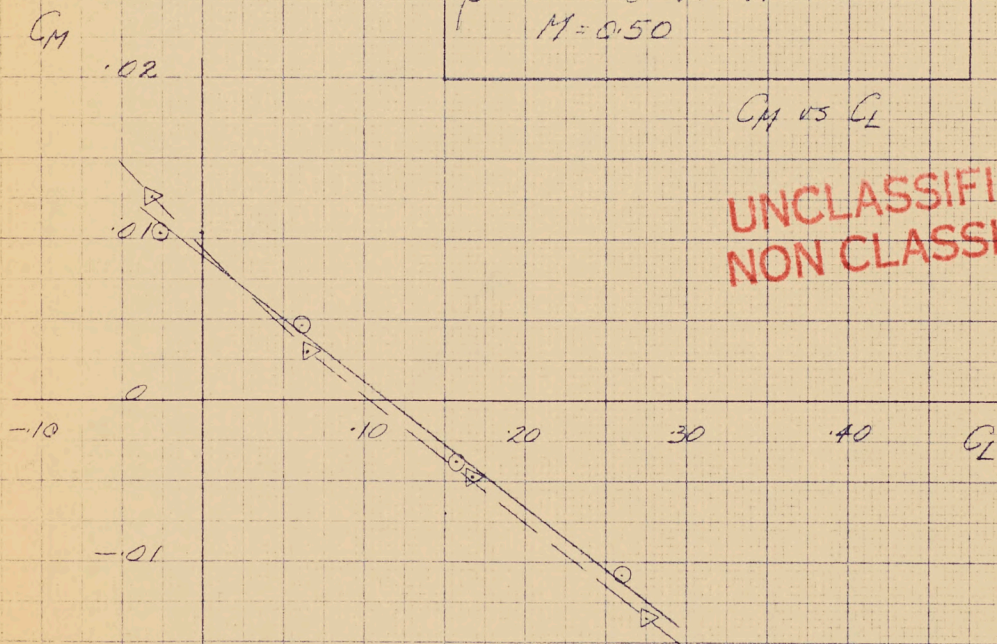
C.A.L. Tests ~
Oct. 1954

Reynolds Number Effects ~
 Longitudinal Stability



Configuration B₄ C₃ W₉ V₂ R₅ N_{as}
 $\beta = 0^\circ$ $\delta_a = \delta_a = \delta_r = 0$
 $M = 0.50$

CM vs CL



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E-105
CAL. WIND TUNNEL TESTS
OCTOBER 1954
CM 15

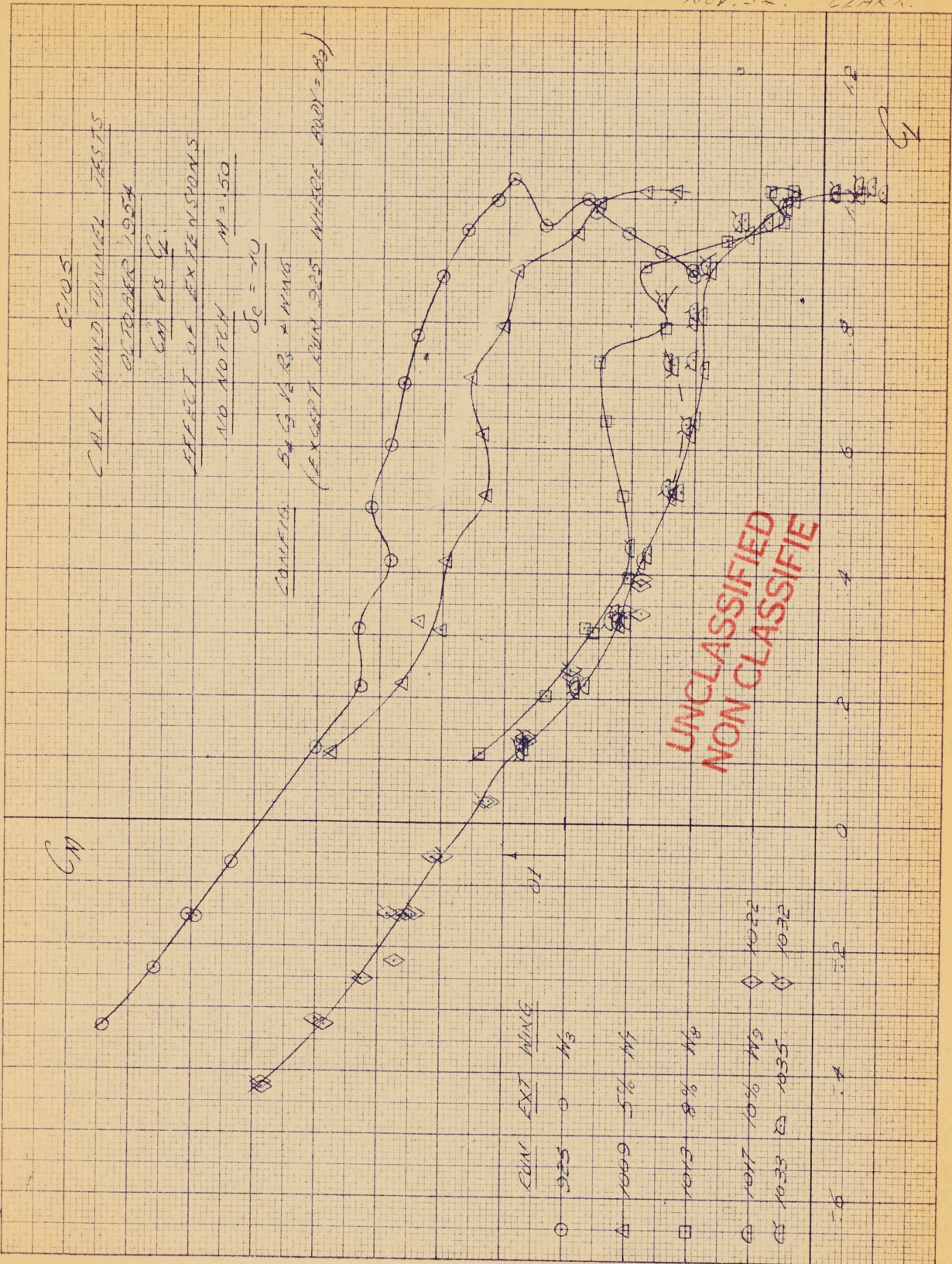
EFFECT OF EXTENSIONS
NO MOTION M=50
C_D = 1.0

CONFINED BY 1/2 B * WING
(EXCEPT RUN 825 WHERE AREA = B₂)

CM

| CON | EXT | WING |
|-----|-------|----------------|
| ○ | 0 | W ₃ |
| △ | 5% | W ₃ |
| □ | 8% | W ₃ |
| ◇ | 10% | W ₃ |
| ◇ | 10.33 | W ₃ |
| ◇ | 10.35 | W ₃ |
| ◇ | 10.32 | W ₃ |
| ◇ | 10.32 | W ₃ |

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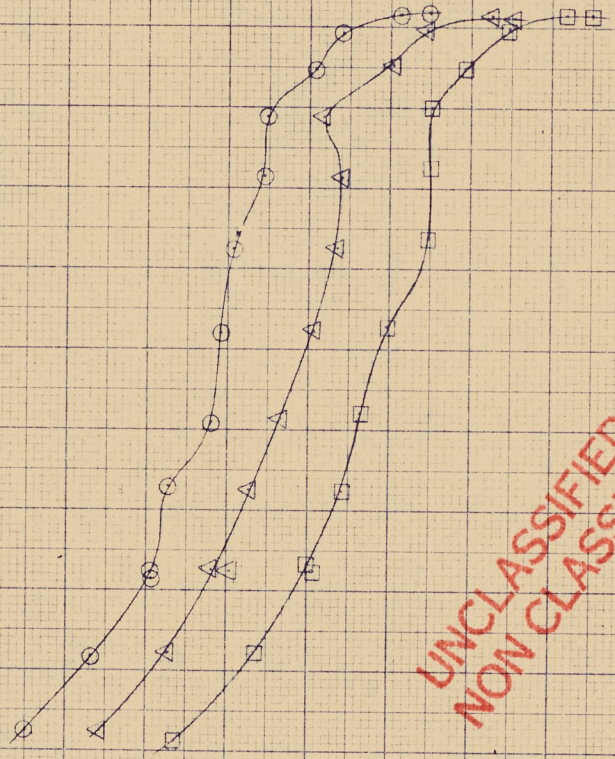
C1005
 C.A.K. WIND TUNNEL TESTS
 OCTOBER 1954

EFFECT OF EXTENSIONS
 ON WING
 5% NOTCH (Nose) $C_E = 10$ WING
 COEFFIC: $C_{D0} = 16.8 \times WING$

GM

0.01

WING EXT WING:
 ○ 1/10 5% WING
 △ 1/10 8% WING
 □ 1/10 10% WING



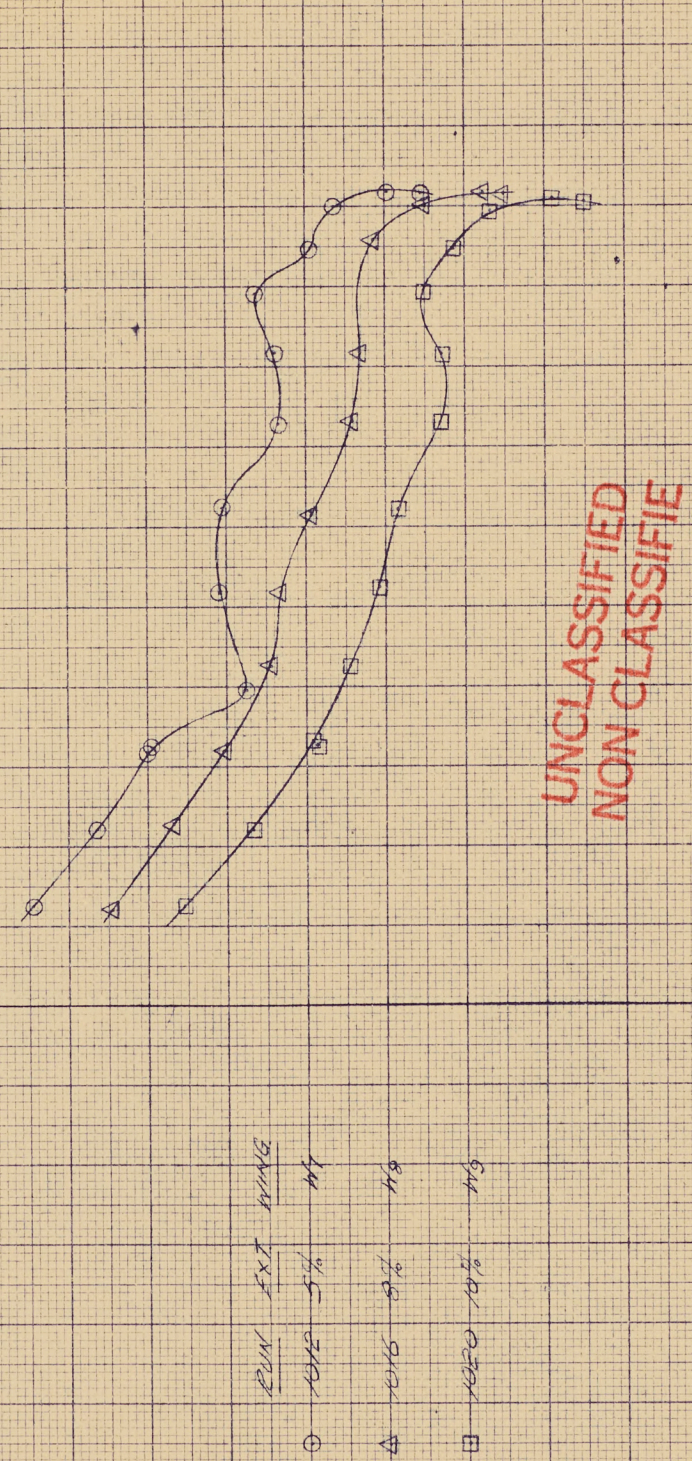
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12
 10
 8
 6
 4
 2
 0
 -2
 -4

12
 10
 8
 6
 4
 2
 0
 -2
 -4

C103
 CAL. MIND TUNNEL TESTS (OCT 57)
 CM 15.6
 EFFECT OF EXTENSIONS
 8% NOTCH $d_c = 10$ $n = .50$
 CONSIG. BaG 1/2 B A 100 + MME.

CM



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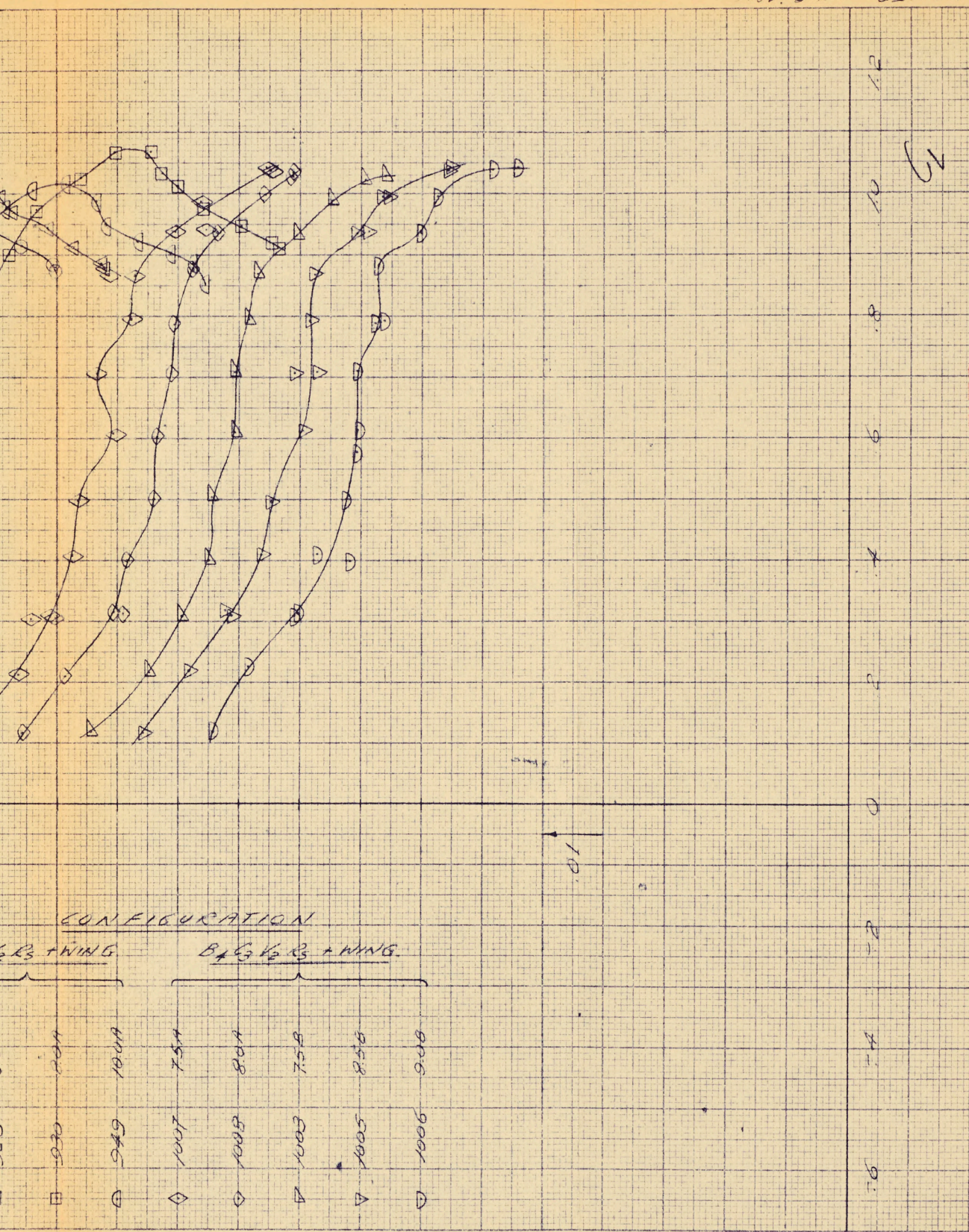
12
 10
 8
 6
 4
 2
 0

C105
CAL. WIND TUNNEL TESTS
C1156
EFFECT OF NOTCHES
ZERO EXTENSION WIND
N=50 $\sigma_c = 10$

C11

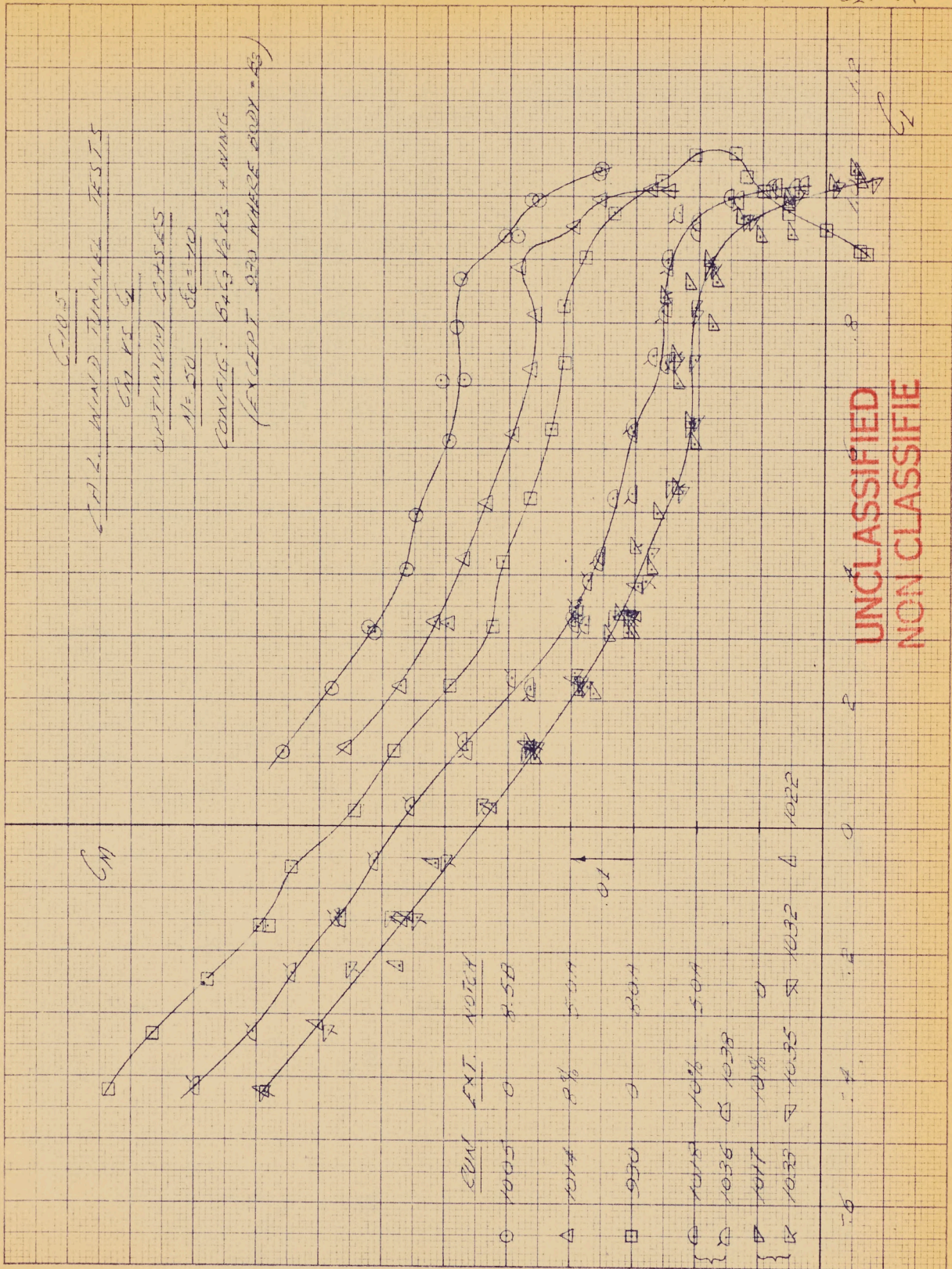


| RUN NUMBER | CONFIDENCE |
|------------|------------|
| 925 NONE | ~1.5 |
| 926 6.514 | ~1.2 |
| 930 NONE | ~1.0 |
| 949 10.019 | ~1.1 |
| 1007 7.514 | ~1.3 |



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61

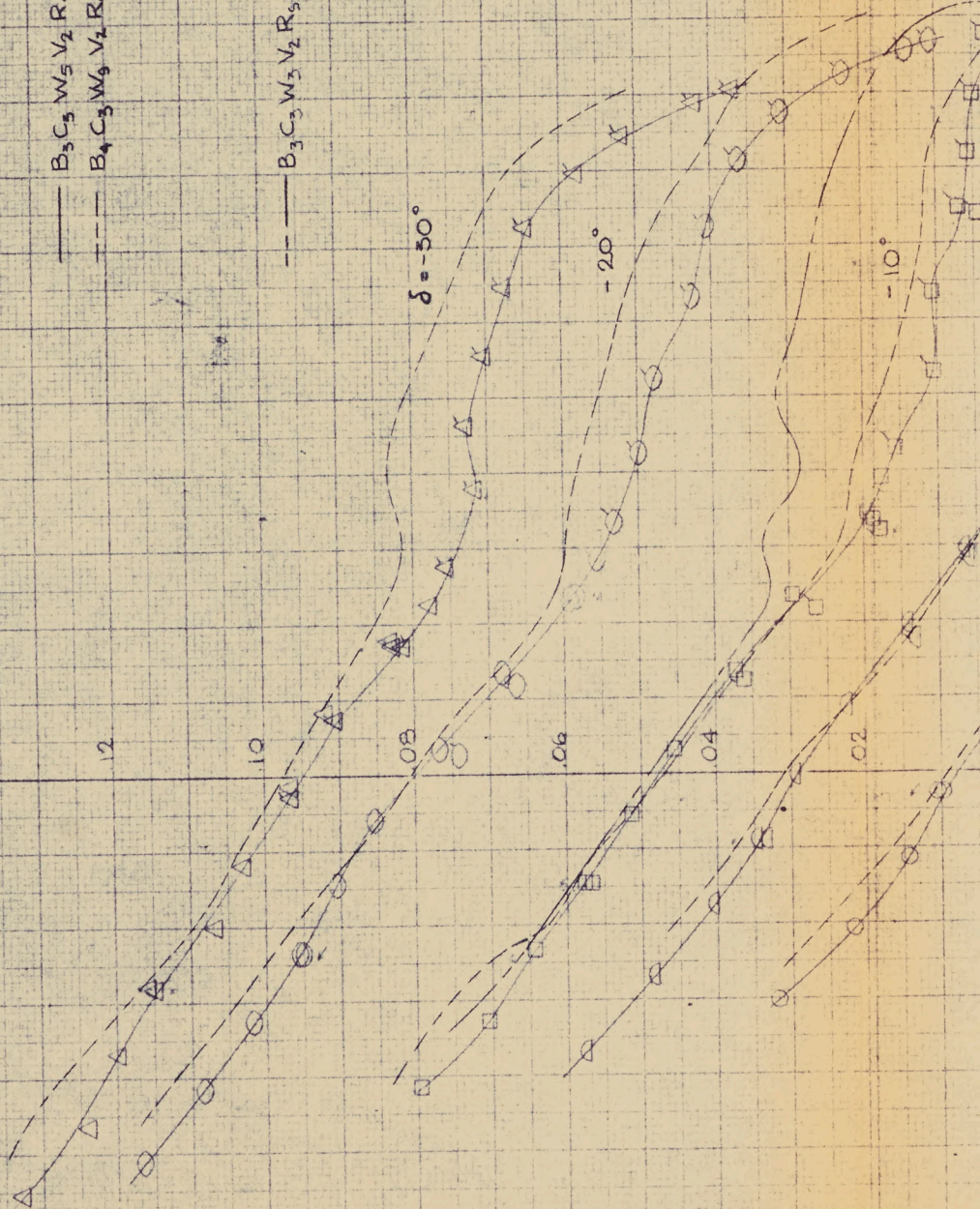


C-105
 CAL WIND TUNNEL TESTS

$C_M \sim C_L$
 M.50

C_M

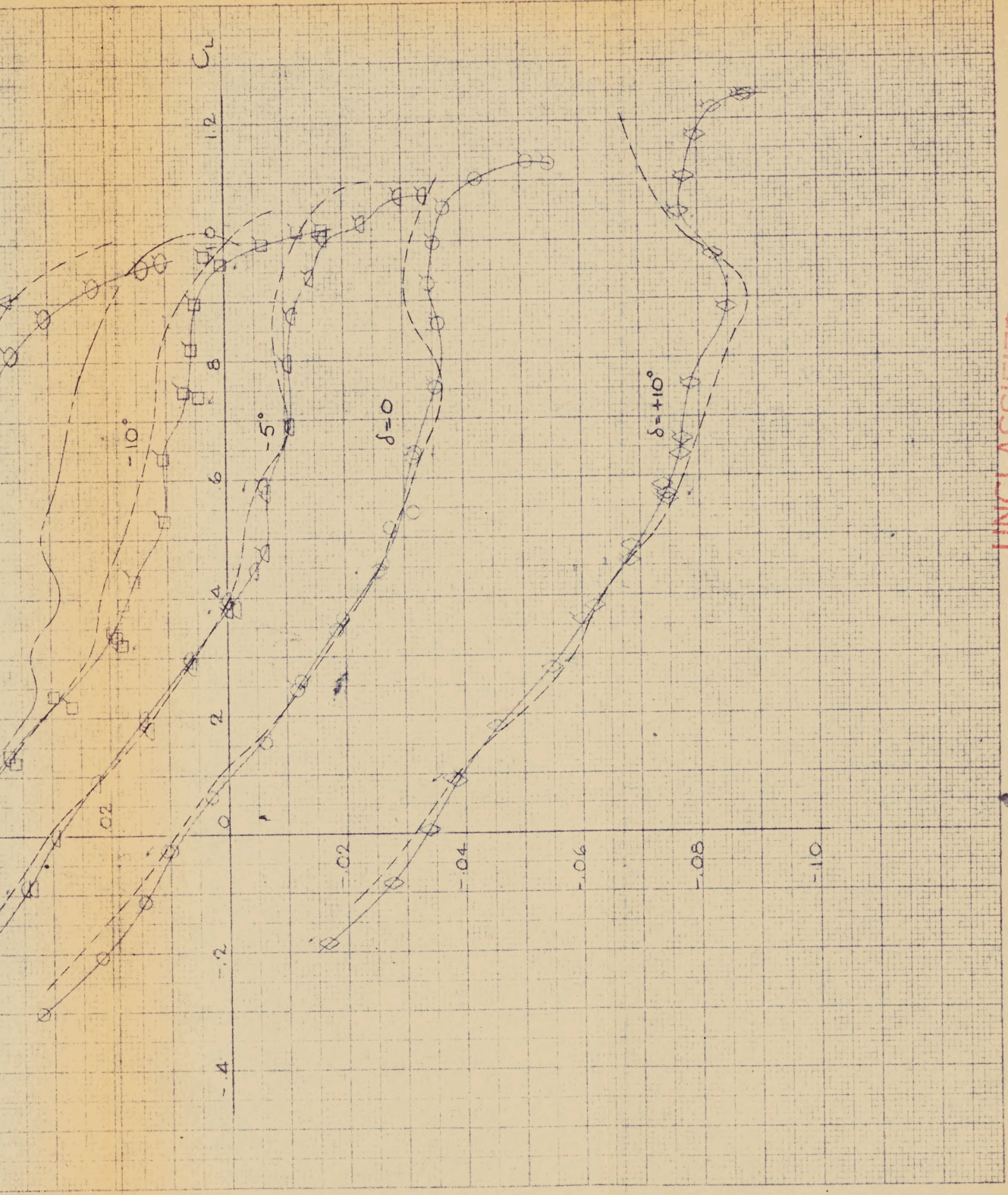
| | NOTCH EXTENS |
|-----------------------------------|--------------|
| — $B_3 C_3 W_5 V_2 R_5$ | (8% 0) |
| - - - $B_4 C_3 W_6 V_2 R_5 N_4 S$ | (5% 10%) |
| | t/c 3 1/2% |
| | CAMBER 0.75% |
| — $B_3 C_3 W_3 V_2 R_5$ | (0 0) |



PWT/52

25

NOV/54 R. Leflette



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CAL WT. TESTS

$C_3 \sim C_1$

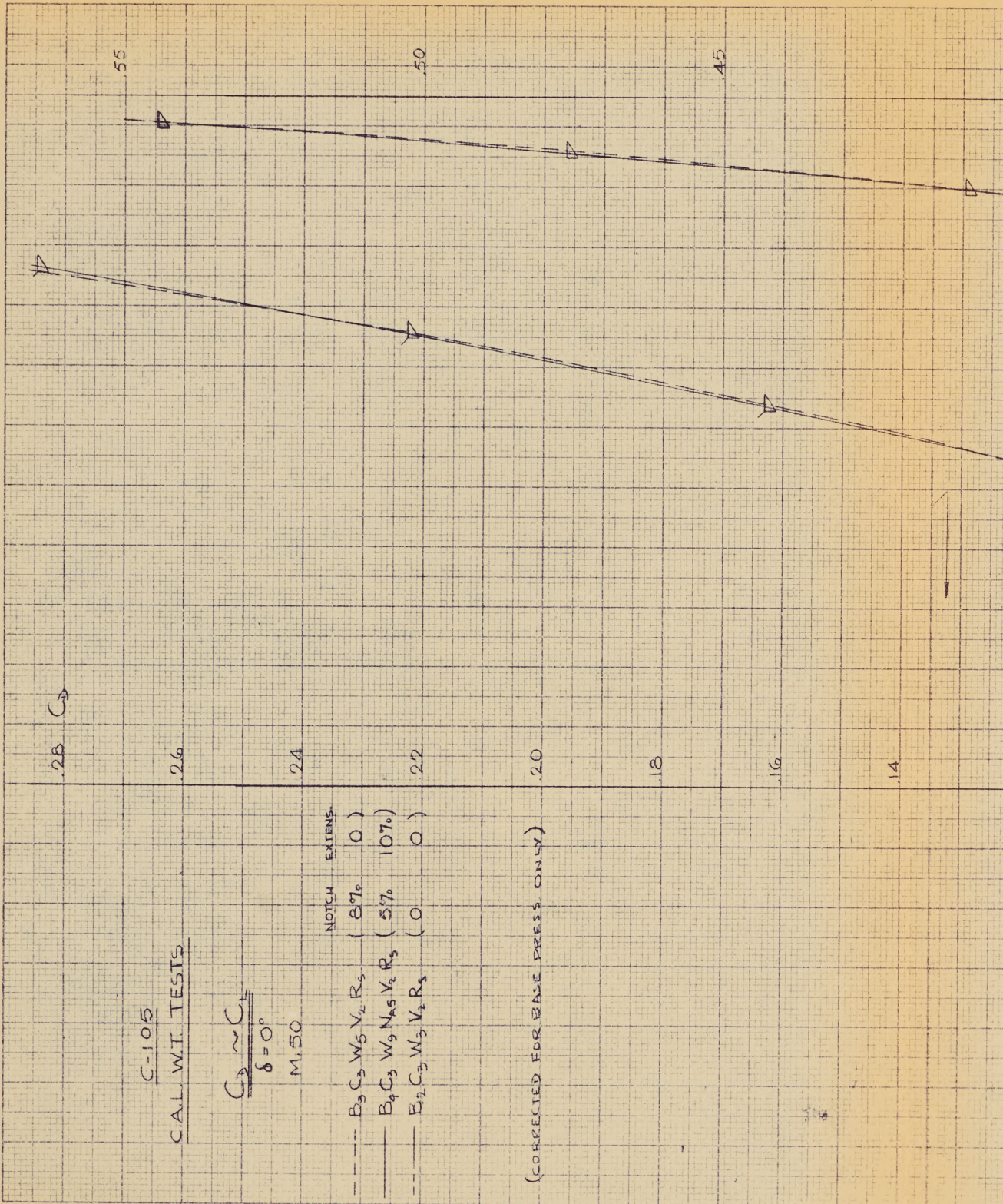
$\delta = 0^\circ$

M. 50

NOTCH EXTENS.

- B₃ C₃ W₅ V₂ R₅ (87% 0)
- B₄ C₃ W₉ N₄₅ V₂ R₅ (57% 107%)
- B₂ C₃ W₃ V₂ R₅ (0 0)

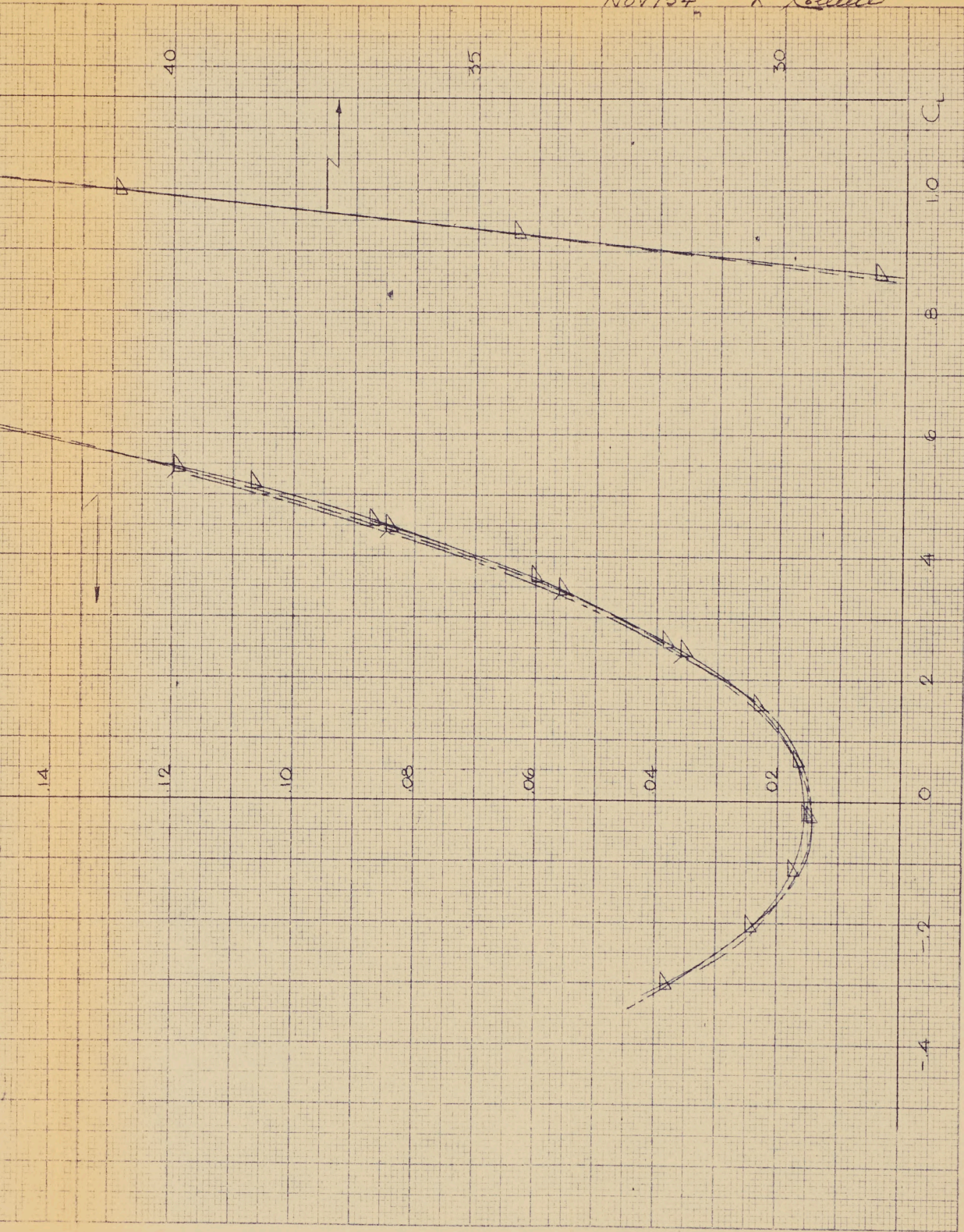
(CORRECTED FOR BALE PRESS ONLY)



Nov/54, R. Lettelle

P/W/T/52

3.1



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P/W/T/52

1 Nov 1954

P/W/T/52

C.A. Ford

4-1

C-105

C_y

C.A.L. Wind Tunnel Tests

Oct. 1954

C_y vs β

$\alpha = 2.1^\circ$

$\delta_e = \delta_a = \delta_r = 0$

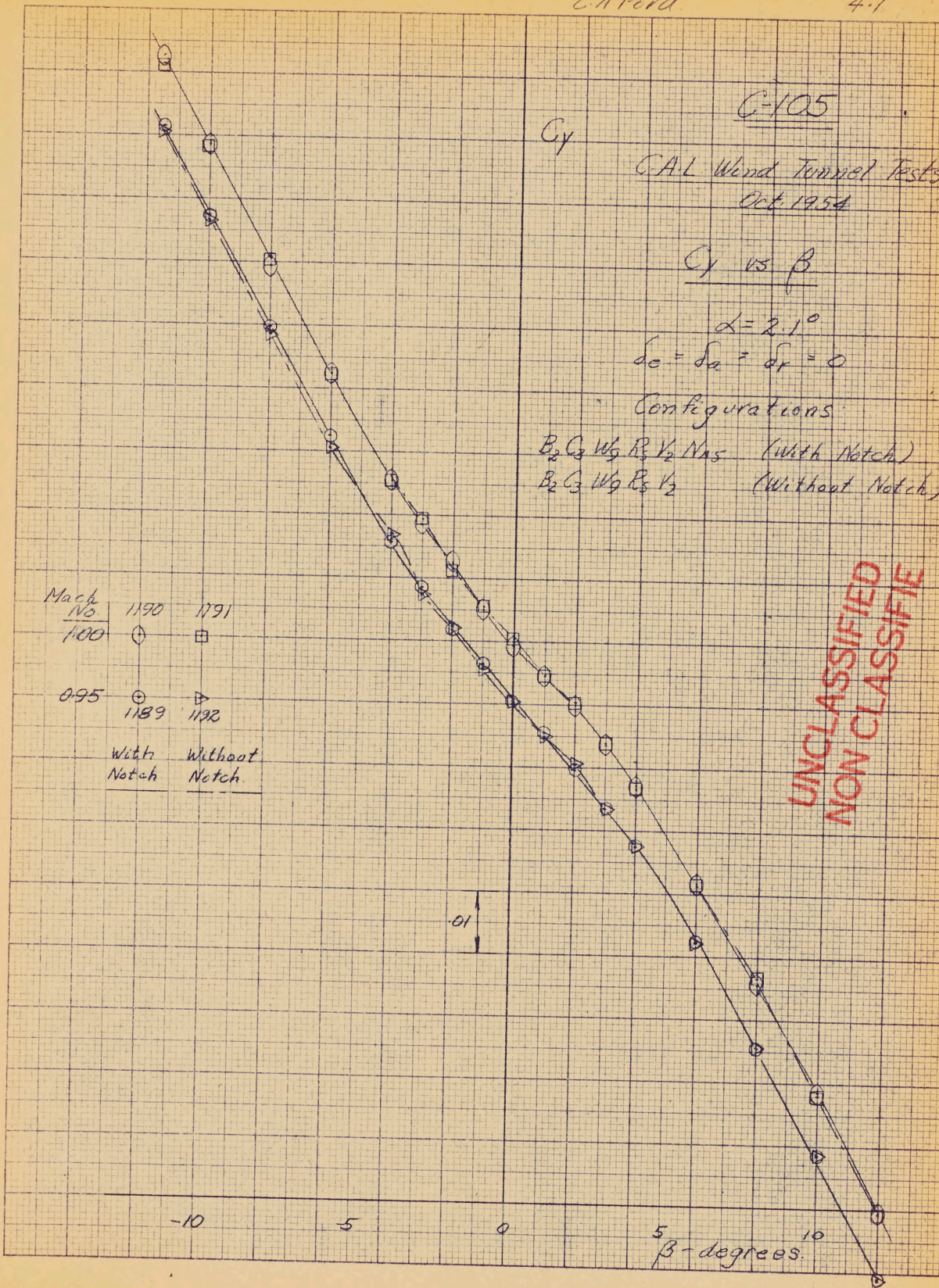
Configurations:

$B_2 C_3 W_9 R_5 V_2 N_{AS}$ (With Notch)

$B_2 C_3 W_9 R_5 V_2$ (Without Notch)

| | | |
|----------|------------|---------------|
| Mach No. | 1190 | 1191 |
| 1.00 | ○ | □ |
| 0.95 | ⊕ | ▷ |
| | 1189 | 1192 |
| | With Notch | Without Notch |

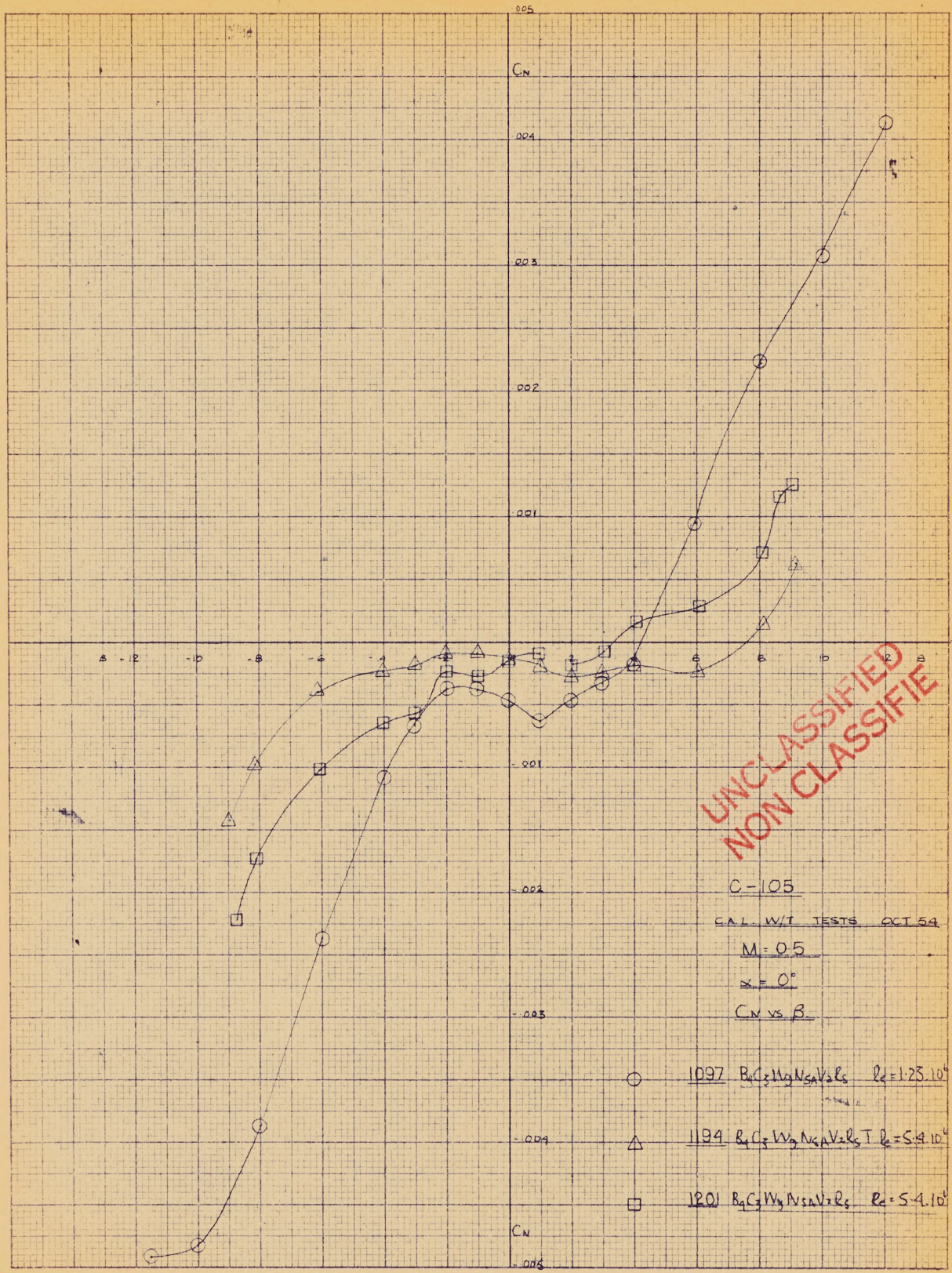
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P/W/T/52

5-1-1

10 X 10 TO THE 1/2 INCH 359-12
KEUFFEL & ESSER CO. MADE IN U.S.A.



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C-105

CAL. W/T TESTS OCT 54

M = 0.5

$\alpha = 0^\circ$

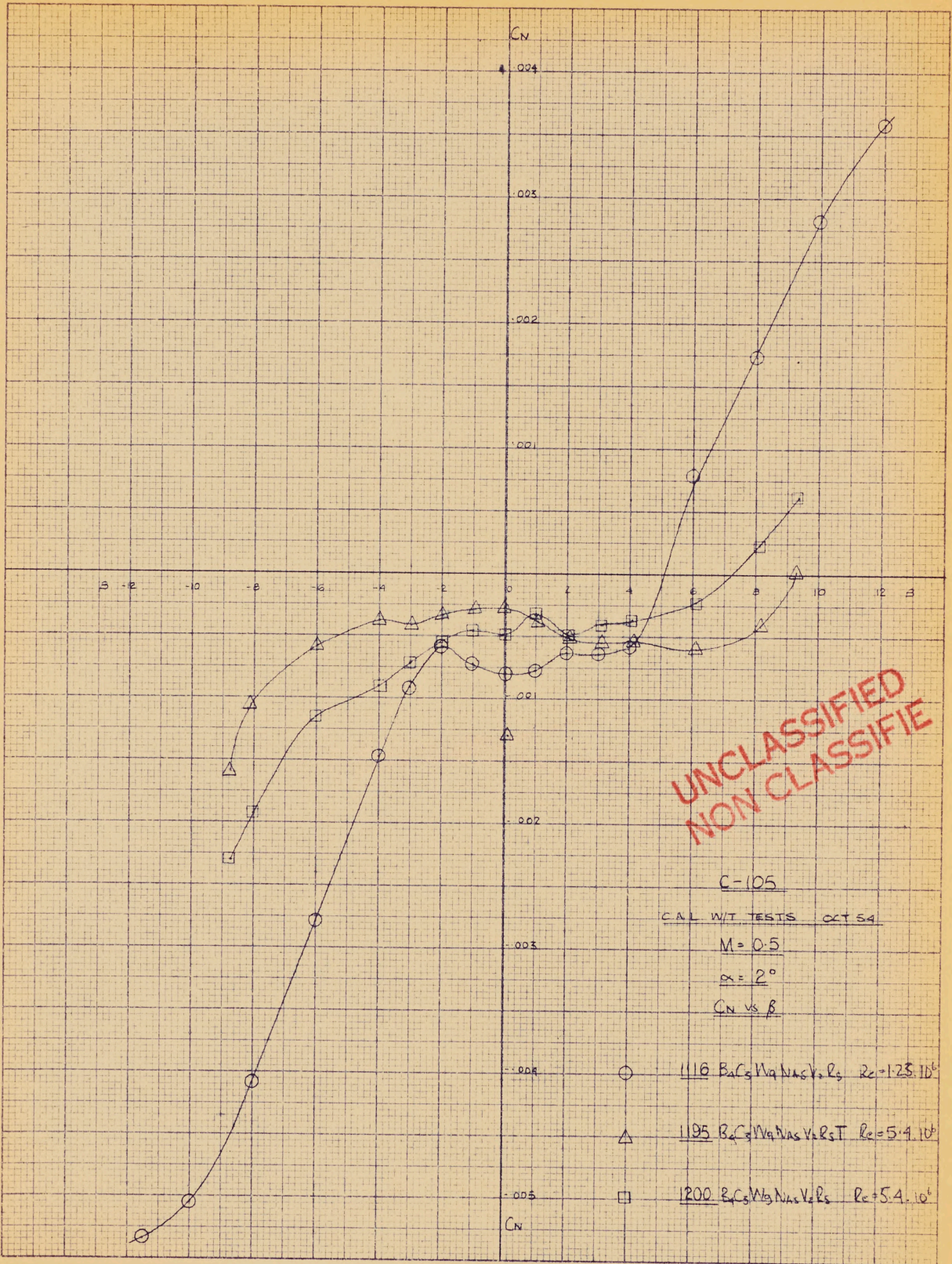
C_N vs β

- 1097 $B_1 C_2 W_3 N_4 V_5 R_6$ $R_6 = 1.25 \cdot 10^4$
- △ 1194 $B_1 C_2 W_3 N_4 V_5 T R_6$ $R_6 = 5.4 \cdot 10^4$
- 1201 $B_1 C_2 W_3 N_4 V_5 R_6$ $R_6 = 5.4 \cdot 10^4$

C_N

-0.05

10 X 10 TO THE 1/2 INCH 359-12
KLUFFEL & ESSER CO. MADE IN U.S.A.



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C-105

CAL W/T TESTS OCT 54

M = 0.5

alpha = 2°

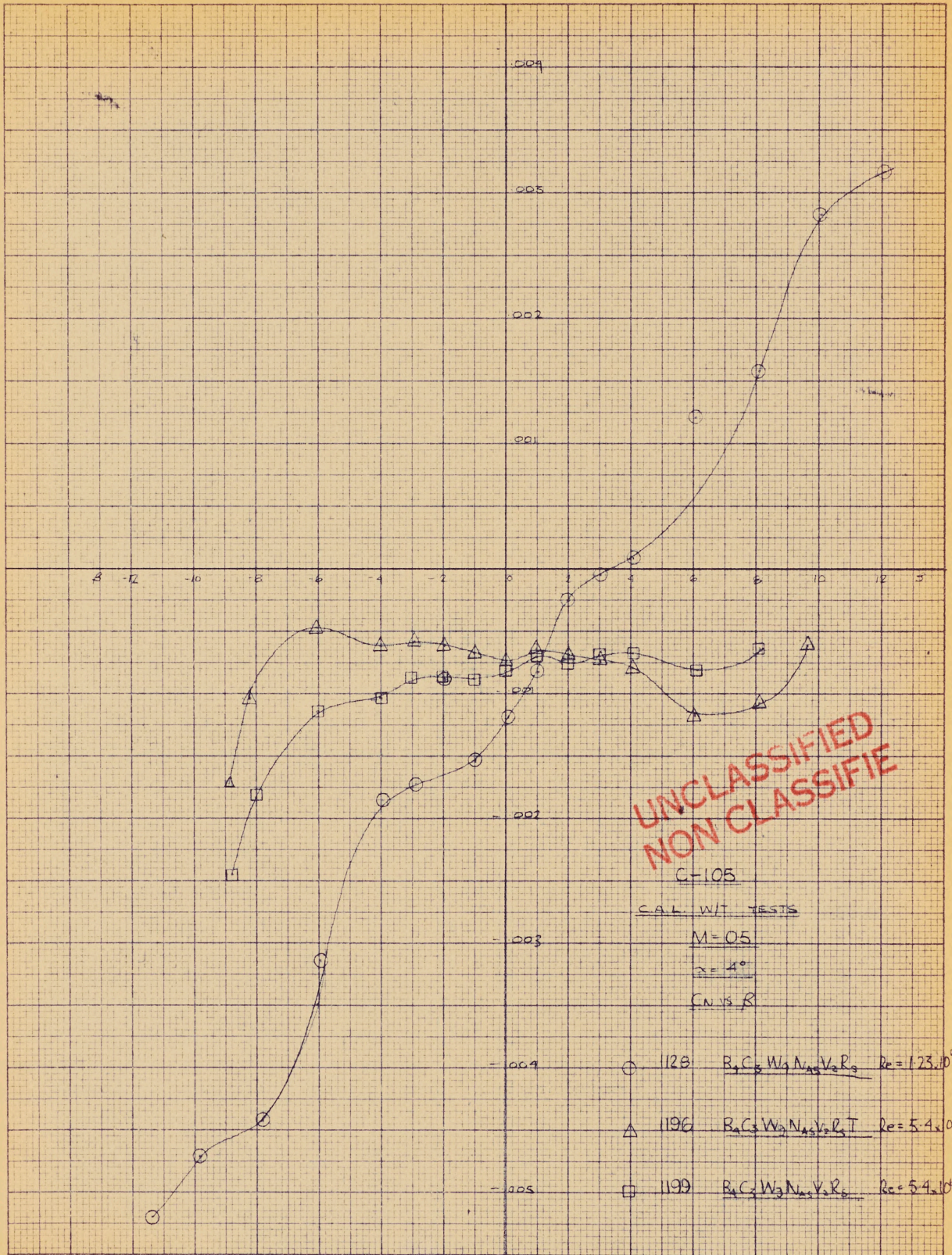
CN vs beta

○ 116 B₂C₅W₃N₄S₂V₂R₃ Re = 1.25 · 10⁶

△ 1195 B₂C₅W₃N₄S₂V₂R₃T Re = 5.4 · 10⁶

□ 1200 B₂C₅W₃N₄S₂V₂R₃ Re = 5.4 · 10⁶

10 X 10 TO THE 1/2 INCH 359-12
KEUFFEL & ESSER CO. MADE IN U.S.A.



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G=105


CAL. W/T TESTS

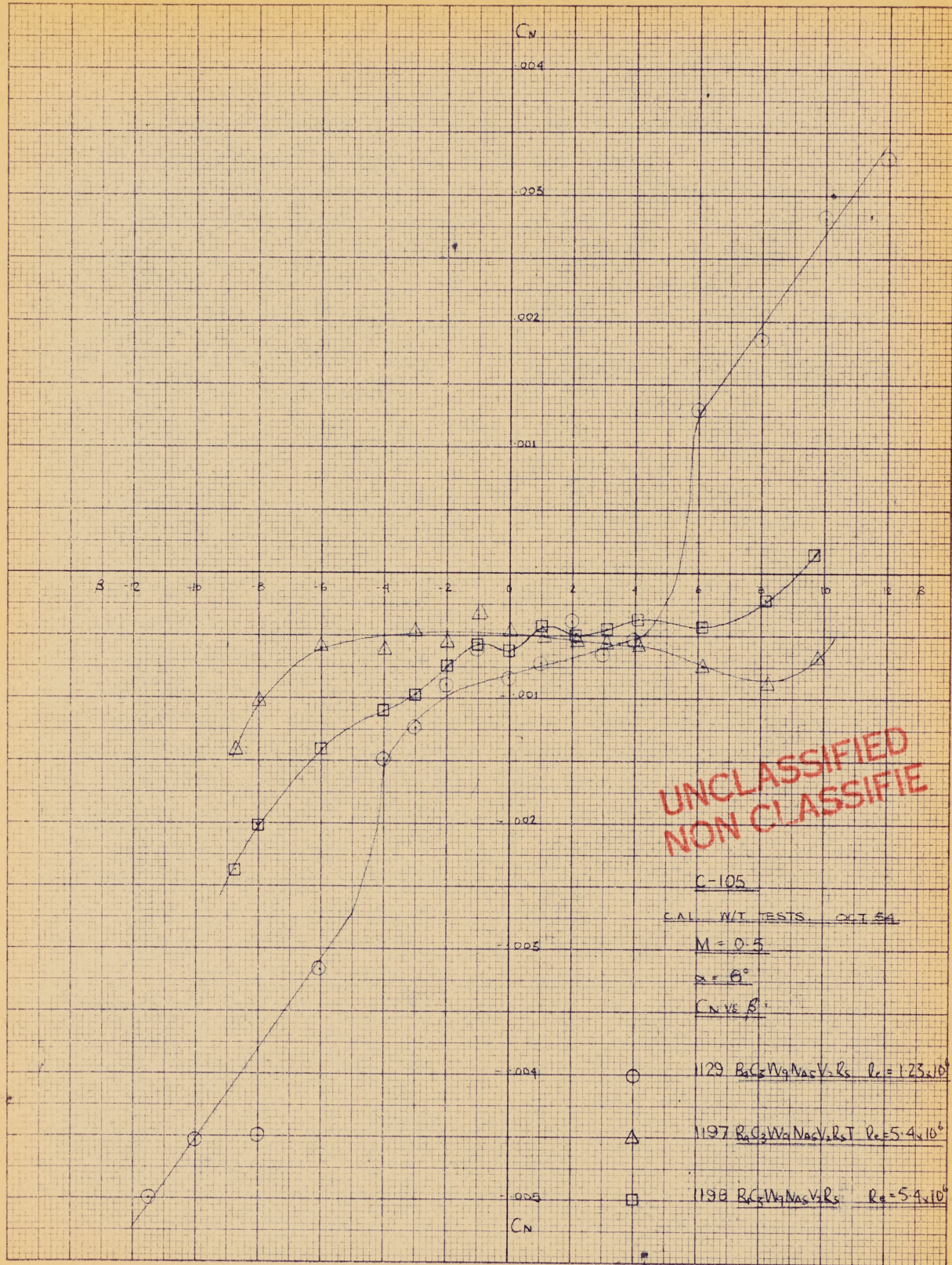
M=05

$\alpha = 4^\circ$

CN vs R

- ⊕ 128 $B_1 C_3 W_3 N_{40} V_2 R_5$ $Re = 1.23 \cdot 10^4$
- △ 1196 $B_1 C_3 W_3 N_{40} V_2 R_5 T$ $Re = 5.4 \cdot 10^4$
- 1199 $B_1 C_3 W_3 N_{40} V_2 R_5$ $Re = 5.4 \cdot 10^4$

10 X 10 TO THE 1/2 INCH 359-12
 KEUFFEL & ESSER CO. MADE IN U.S.A.




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CAL. W/T TESTS. OCT 54

M = 0.5

$\alpha = 6^\circ$

CN vs β

- 1129 $Re = 1.25 \times 10^6$
- △ 1197 $Re = 5.4 \times 10^6$
- 1198 $Re = 5.4 \times 10^6$

CN

C-105

C.A.L TESTS OCT '54

C_N

C_N vs β

008

$\alpha = 2^\circ$

M

RUN.

95 \odot 717 $W_3 B_2 C_3 V_2 R_5$

EFFECT OF NOSE MODIFICATION

94 \triangle 1211 $W_3 B_4 C_3 V_2 R_5$

NO EXTENSION, NO NOTCHES.

006

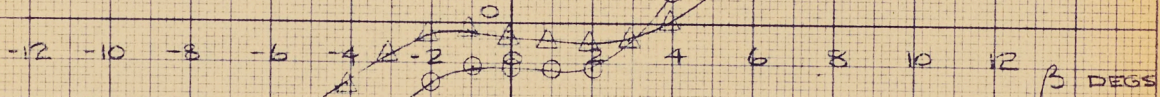
004

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002

'OLD' NOSE

'NEW' NOSE



$3^\circ < |\beta| < 10^\circ$

NOSE

$C_{N\beta} / \text{DEG}$

B_2

\odot

0.000535

B_4

\triangle

0.000492

-0.006

-0.004

-0.002

C-105

C.A.L. TESTS OCT. '54.

C_N

C_N vs β

$M = .95$

$\alpha = 2^\circ$

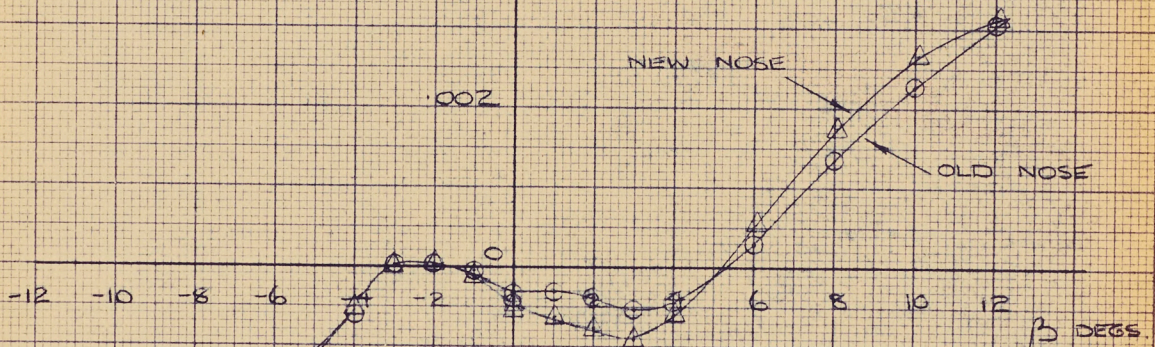
○ 1189 $B_2 W_9 N_{A5} C_3 V_2 R_5$

△ 1113 $B_4 W_9 N_{A5} C_3 V_2 R_5$

EFFECT OF NOSE MODIFICATION

10% EXTENSION, 5% NOTCH

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$3^\circ < |\beta| < 10^\circ$

NOSE

C_N/DEG

B_2 ○ .000515

B_4 △ .000575

C-105

C.A.I.L. TESTS OCT. '54

C_N

C_N vs β

.008

$M = .95$

○ 717 $W_3 B_2 C_2 V_2 R_5$

$\alpha = 2^\circ$

△ 1192 $W_9 B_2 C_3 V_2 R_5$

.006

EFFECT OF 10% EXTENSION

'OLD' NOSE.

.004

.002

NO EXTENSIONS

10% EXTENSIONS

-12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 β DEGS.

-.002

-.004

-.006

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C-105

C.A.L. TESTS OCT. '54

C_N

C_N vs β

M RUN. .008

$\alpha = 2^\circ$

.94 ○ 1211 B₄W₃C₃V₂R₅

EFFECT OF 10% EXTENSION
WITH 5% NOTCH.

.95 △ 1113 B₄W₉N₁₅C₃V₂R₅

.006

NEW NOSE

M = .95

.004

.002

NO NOTCH
NO EXTENSION

10% EXTENSION 5% NOTCH

-12 -10 -8 -6 -4 -2 2 4 6 8 10 12 β DEGS

-.002

-.006

-.008

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C.A.L. TESTS OCT '54

C_N vs β

$\alpha = 2^\circ$

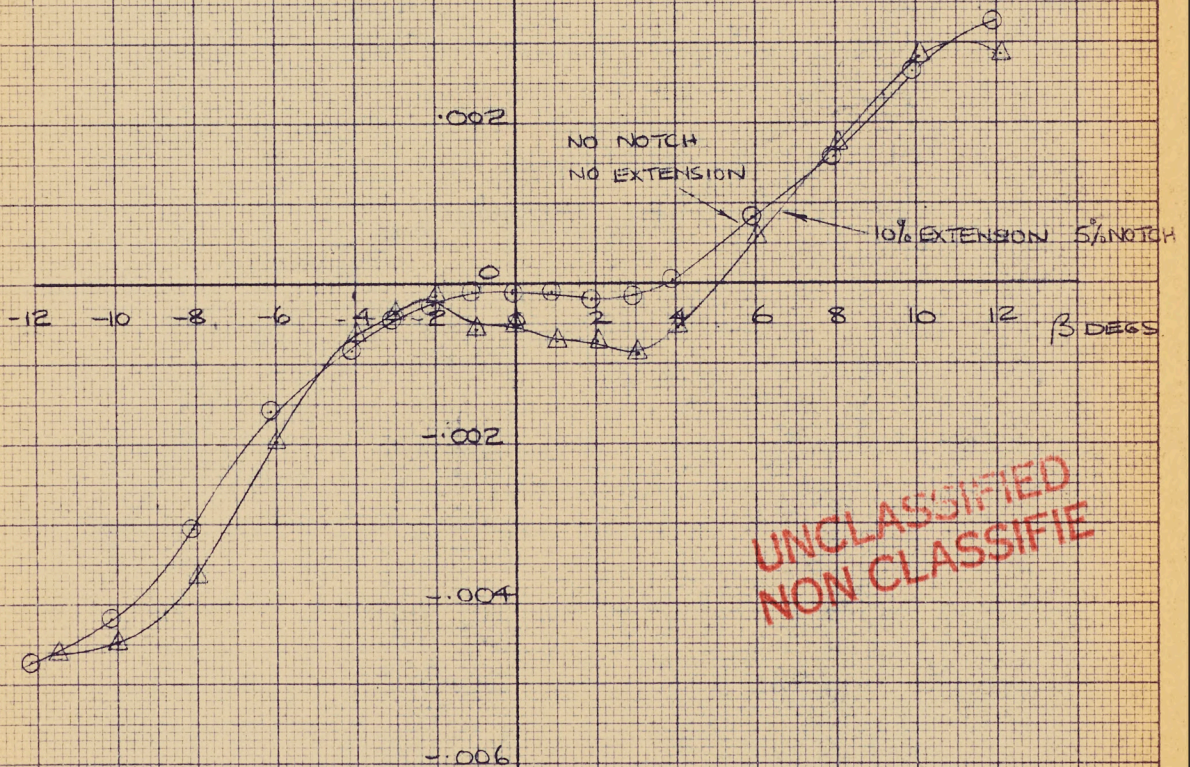
| M | RUN | Configuration | C_N |
|----|---------------|------------------------------|-------|
| 90 | 0 1213 | $B_4 W_3 C_3 V_2 R_5$ | .008 |
| 90 | Δ 1114 | $B_4 W_9 N_{A5} C_3 V_2 R_5$ | .006 |

EFFECT OF 10% EXTENSION

WITH 5% NOTCH.

NEW NOSE

M = 90



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C-105.

C.A.L. TESTS OCT. 54

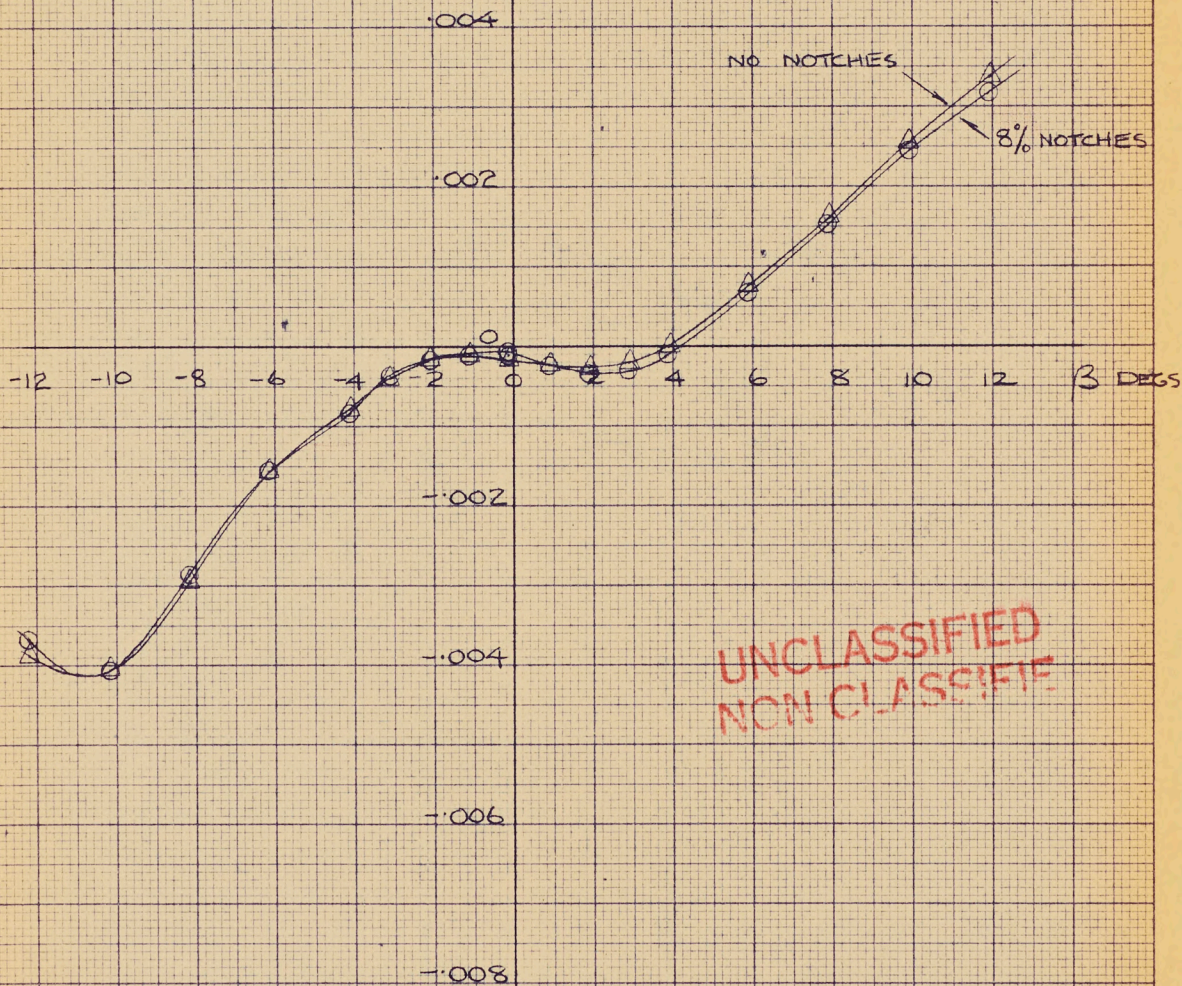
C_N vs β

$M = .94$

$\alpha = 2^\circ$

O 1210 $W_3 B_4 N_{A_0} C_3 V_2 R_5$
 A 1211 $W_3 B_4 C_3 V_2 R_5$

EFFECT OF 8% NOTCHES
'NEW' NOSE



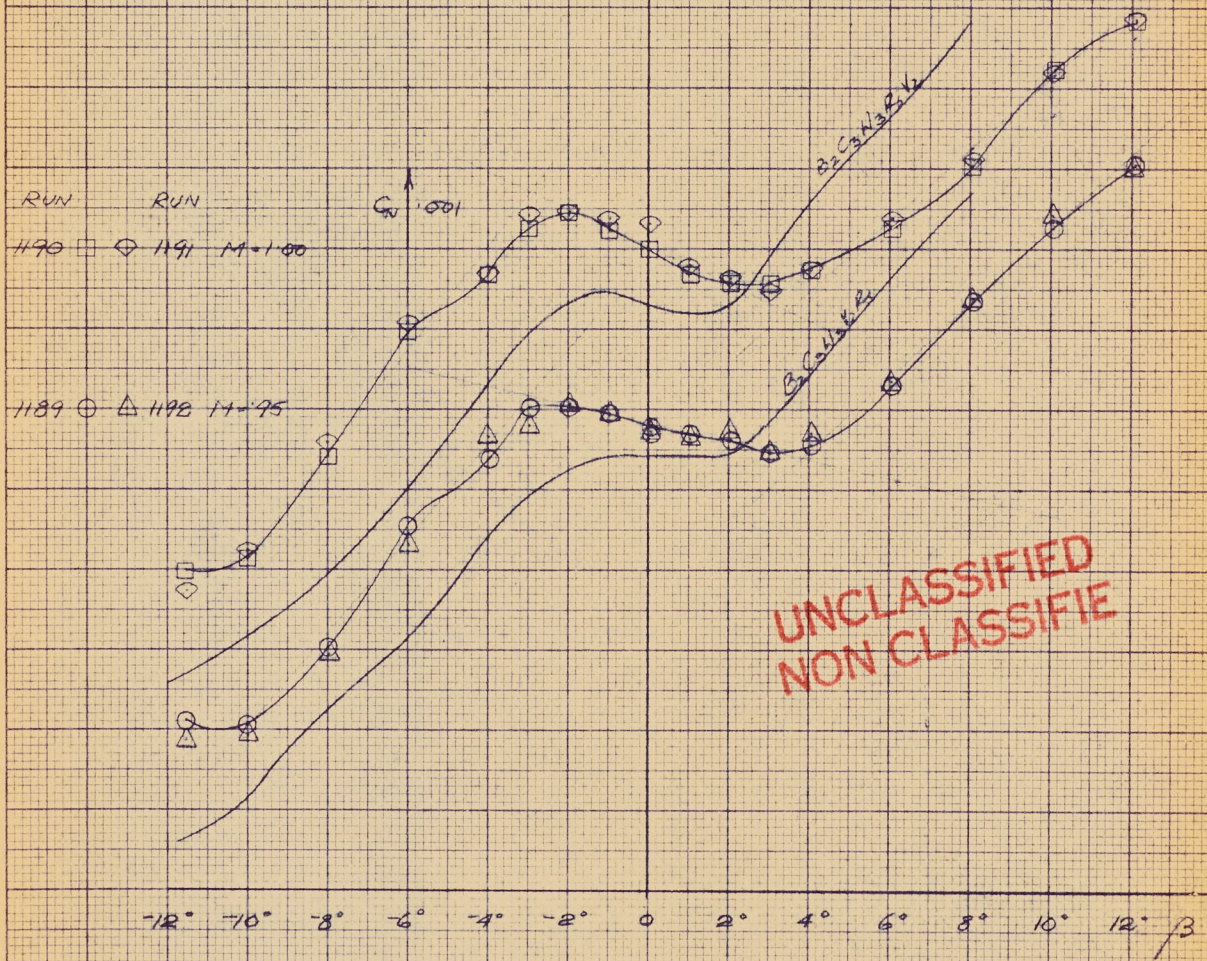
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C105
C.A.L. WIND TUNNEL TESTS OCT 52

C_N vs β

EFFECT OF NOTCH
α = 2°

- □ B₂C₃W₉R₃V₂N₄S
- △ ◇ B₂C₃K₉R₃K



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CAL. W.T. TESTS, JUNE 1954.

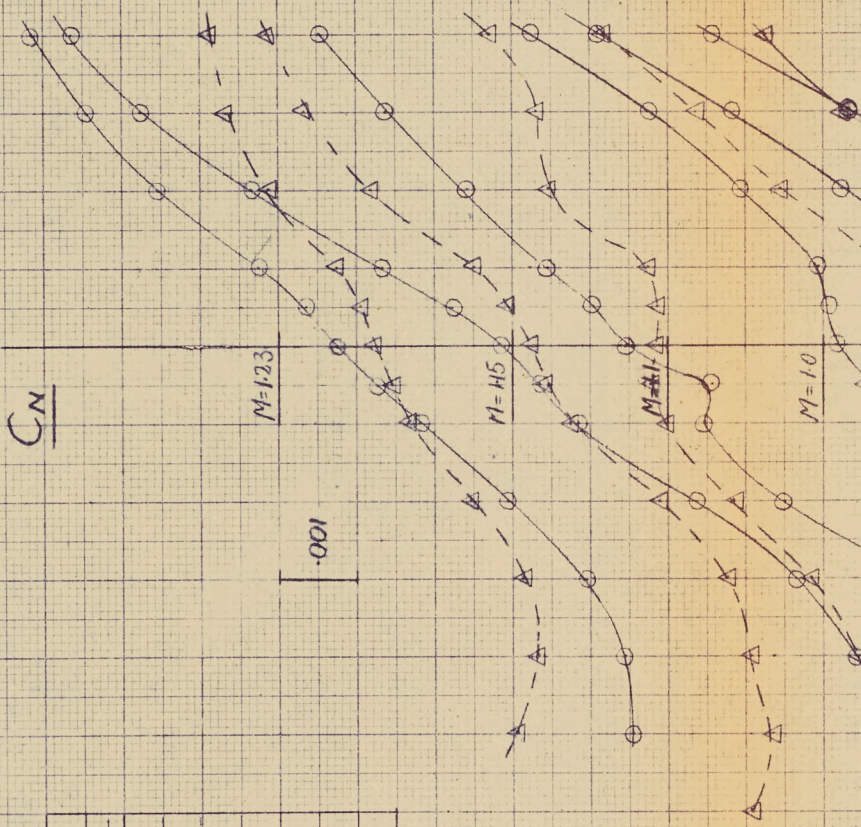
C_N vs. β

$\alpha = 2^\circ$

Δ — CONE $B_2 C_3 H_3 V_2 R_3$ (NEW CANOPY).
 \circ — " $B_2 C_3 H_3 V_2 R_3 F$ (PAIRED INTAKES).

C_N

| MACH NUMBER | CONE | PAIRED | RUN |
|-------------|----------|----------|-----|
| 1.23 | Δ | Δ | 918 |
| 1.15 | Δ | Δ | 917 |
| 1.10 | Δ | Δ | 916 |
| 1.0 | Δ | Δ | 915 |
| .9 | Δ | Δ | 914 |
| .7 | Δ | Δ | 913 |
| .5 | Δ | Δ | 912 |

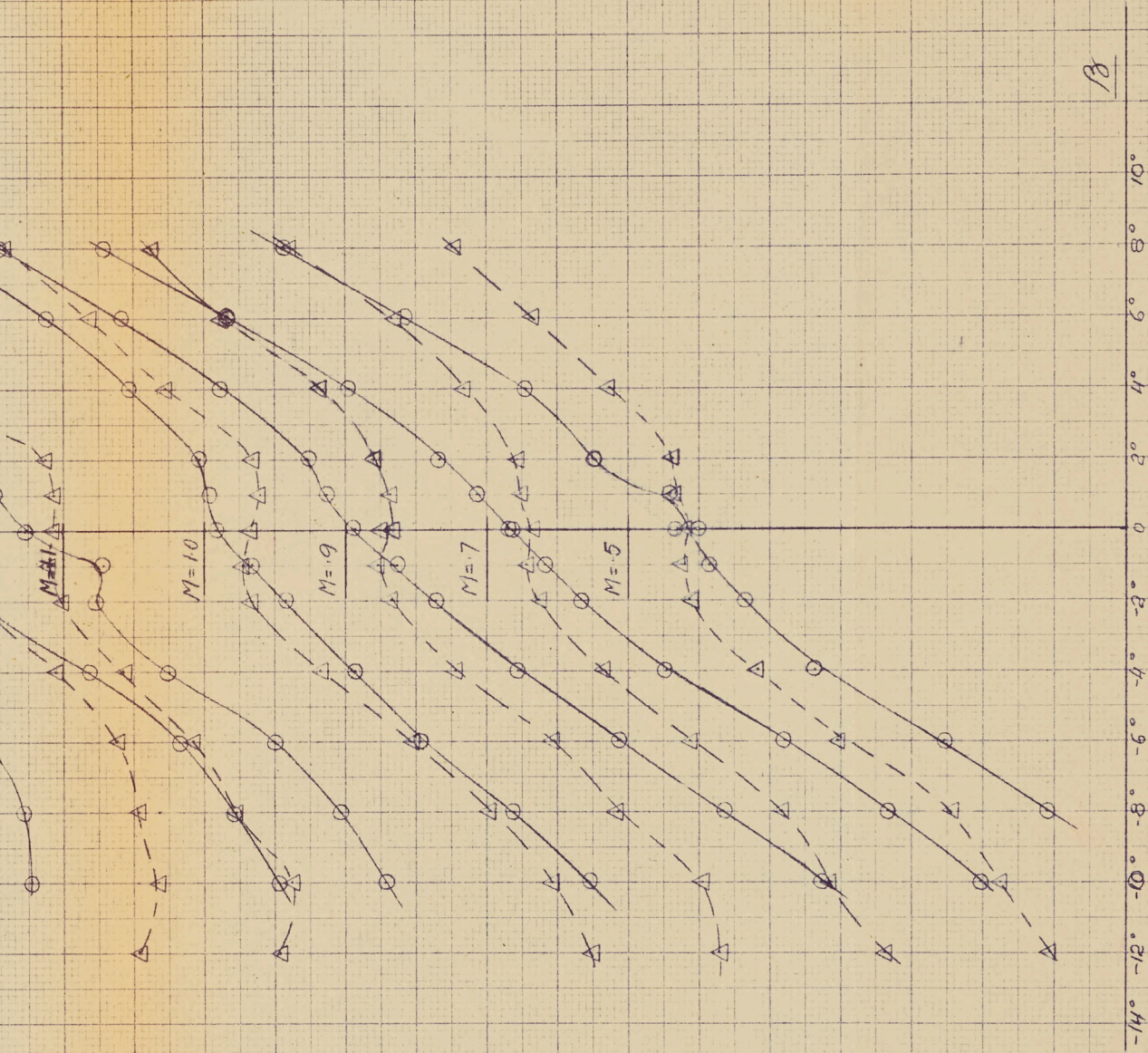


17/11/54

Dec. 1954

5-5

J. Papis



B

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NOT FOR CLASSIFICATION

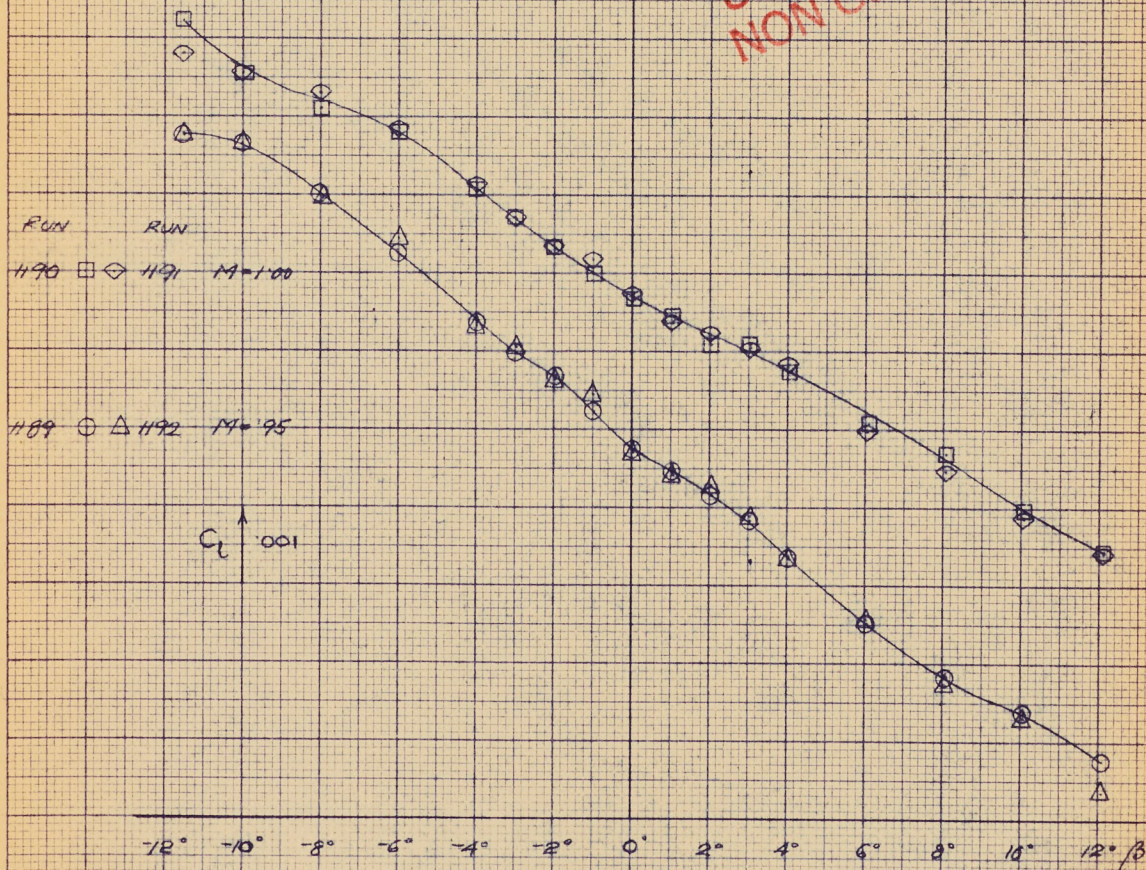
61 P/W 152
Oct/54 S. Knapkowski

C105
C.A.L. WIND TUNNEL TESTS OCT. 57
 C_L vs β

EFFECT OF NOTCH
 $\alpha = 2^\circ$

○ □ $B_2 C_3 H_9 R_3 Y_2 N_{45}$
△ ◇ $B_2 C_3 H_9 R_3 Y_2$

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C-105

C.A.L. Wind Tunnel Tests

Oct. 1954

C_{NF}

Reynolds Number Effect

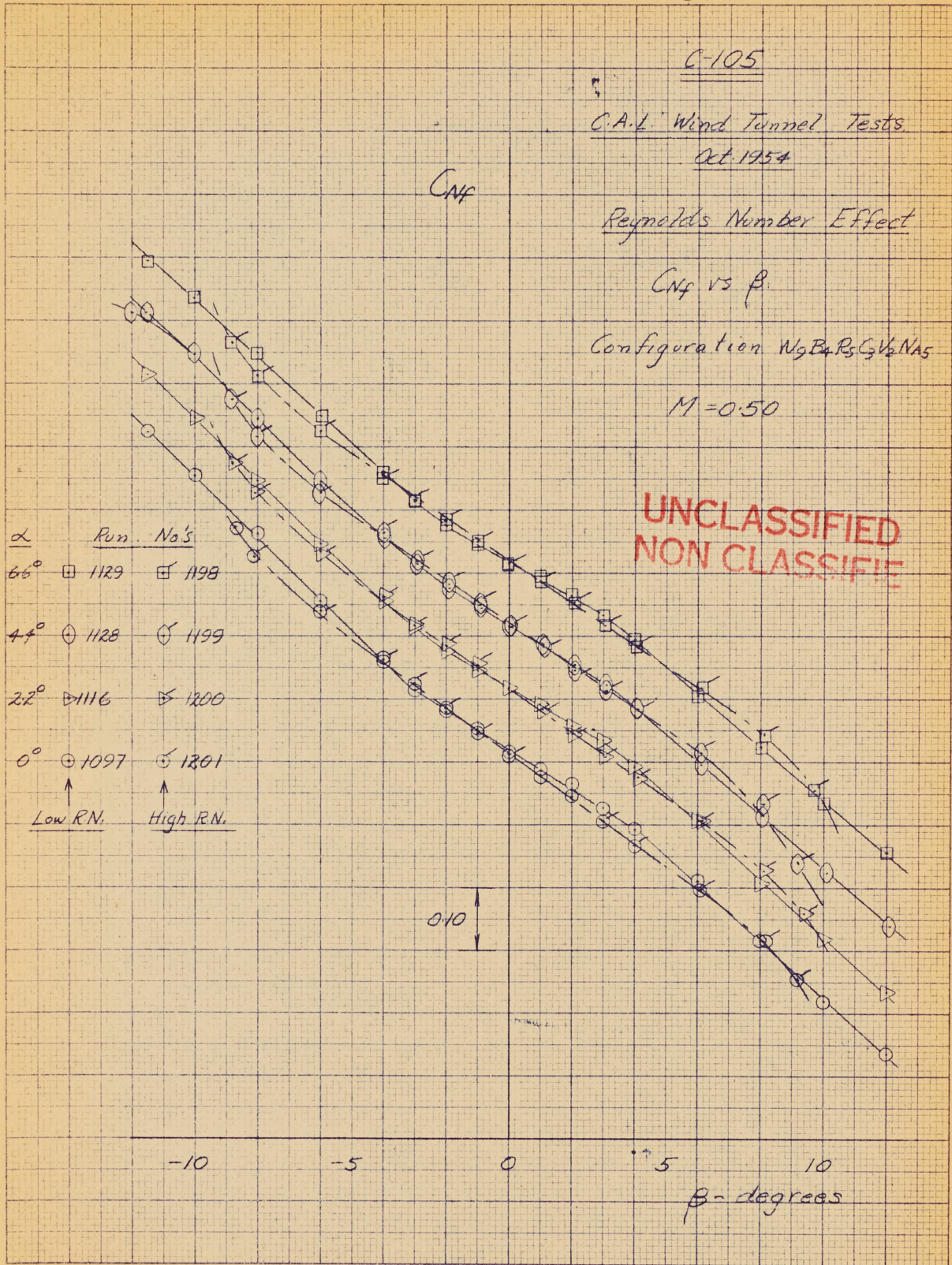
C_{NF} vs β

Configuration $W_5 B_4 R_5 C_3 V_2 N_{AS}$

$M = 0.50$

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| α | Run. No's | |
|-------------|-----------------------|-----------------------|
| 6.6° | \square 1129 | \square 1198 |
| 4.4° | \circ 1128 | \circ 1199 |
| 2.2° | \triangleright 1116 | \triangleright 1200 |
| 0° | \circ 1097 | \circ 1201 |
| | ↑ Low R.N. | ↑ High R.N. |

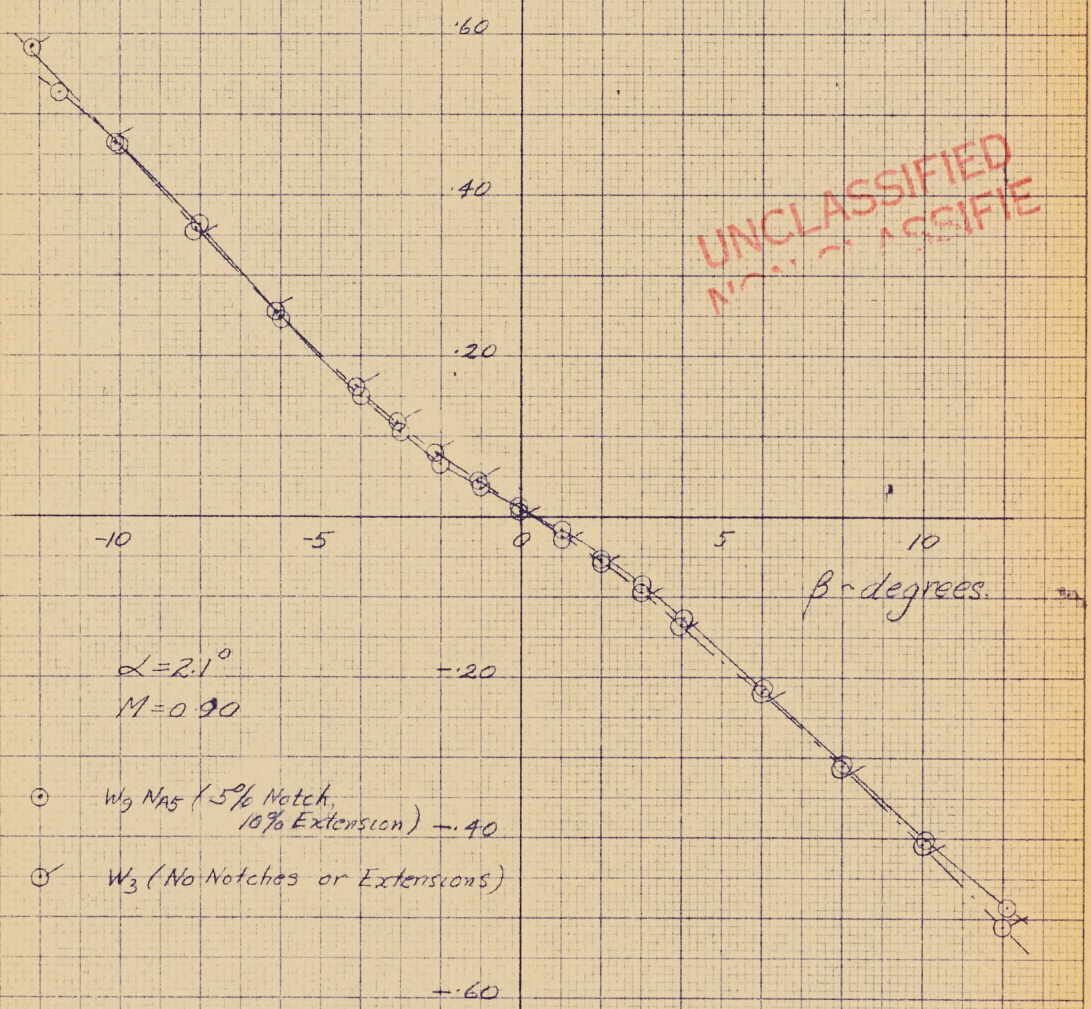


C-105

C.A.L. Wind Tunnel Tests
Oct. 1954

Effect of Wing Configuration
on C_{NF} vs β

C_{NF}



UNCLASSIFIED

$\alpha = 2.1^\circ$
 $M = 0.90$

- $W_9 NA5$ (5% Notch, 10% Extension) → .40
- W_3 (No Notches or Extensions)

C 105

CAL. WT. TESTS, JUNE (AND APRIL) 1954.

C_{Mf} vs β

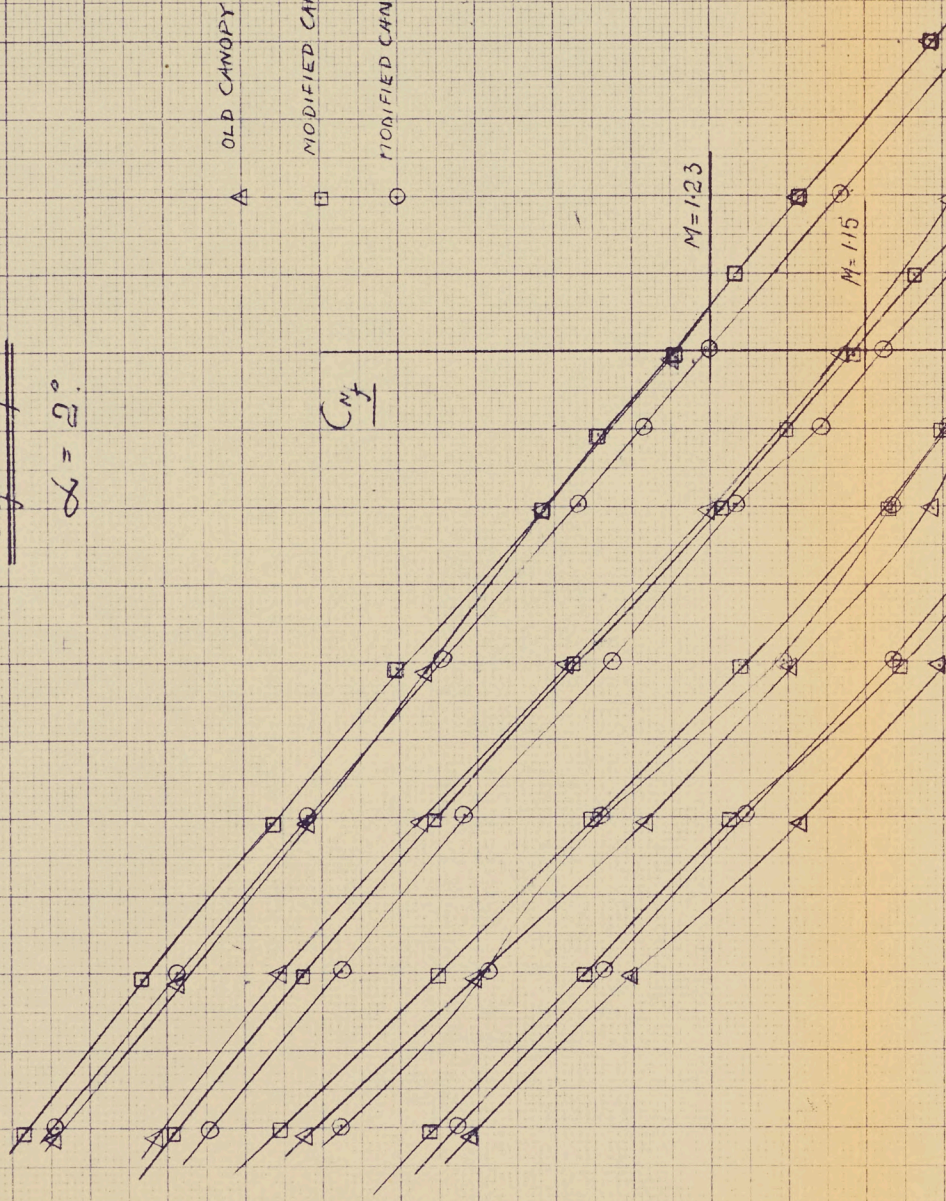
$\alpha = 2^\circ$

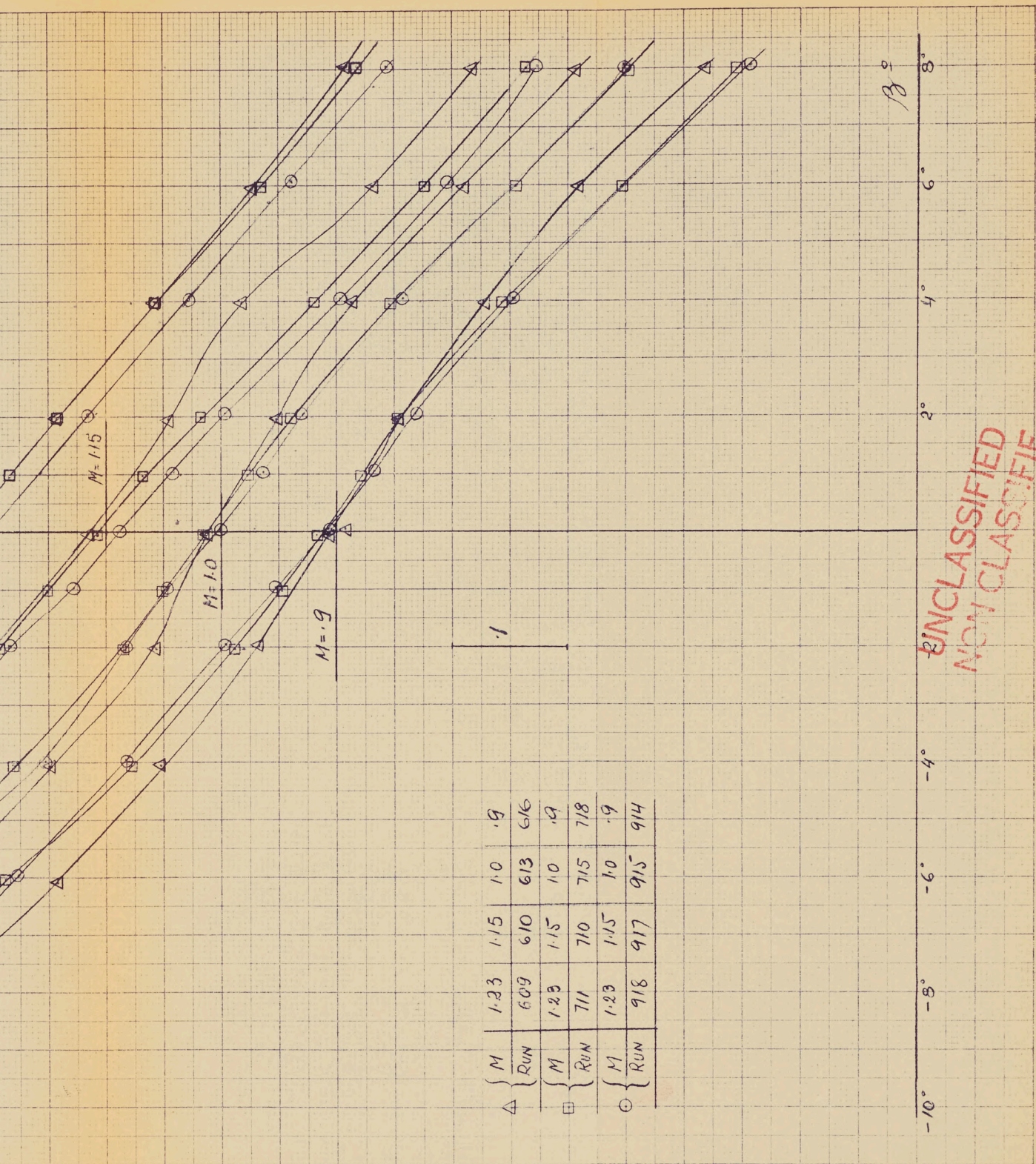
C_{Mf}

□ OLD CANOPY (W.T. APRIL 1954)

○ MODIFIED CANOPY (W.T. JUNE 1954)

△ MODIFIED CANOPY, RAISED INTAKES (---)





| | | | | | |
|-----------|-----|------|------|-----|-----|
| Δ | M | 1.23 | 1.15 | 1.0 | .9 |
| | Run | 609 | 610 | 613 | 616 |
| \square | M | 1.23 | 1.15 | 1.0 | .9 |
| | Run | 711 | 710 | 715 | 718 |
| \circ | M | 1.23 | 1.15 | 1.0 | .9 |
| | Run | 918 | 917 | 915 | 914 |

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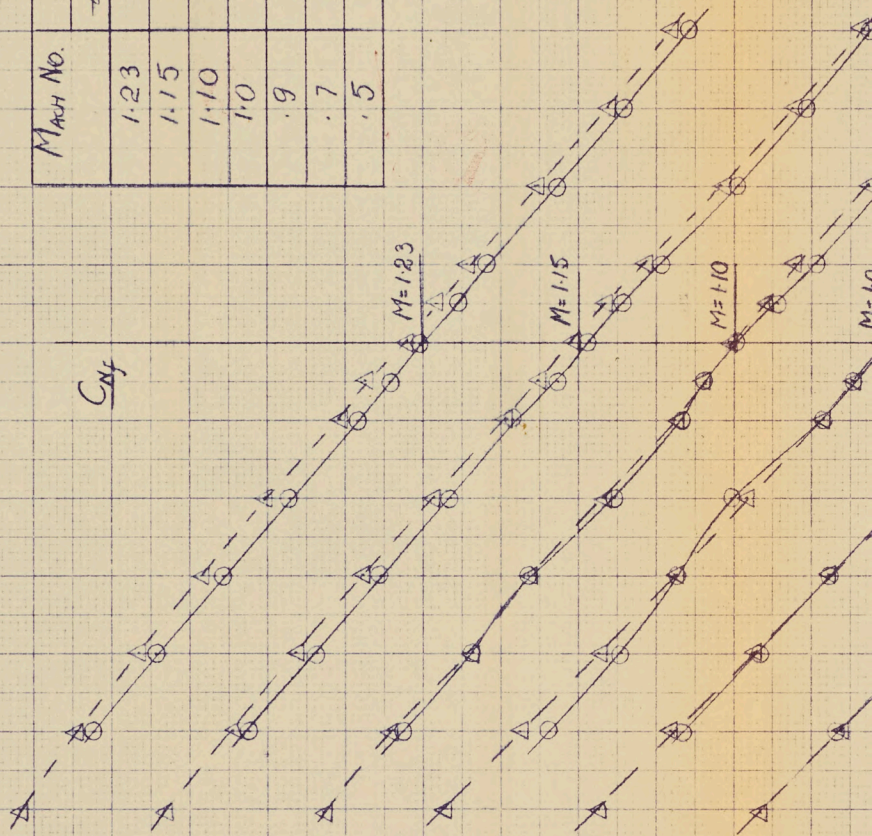
C105

CAL W.T. TESTS, JUNE 1954

C_N vs. β

$\alpha = 2^\circ$

NEW CANOPY Δ — Δ CONFIG: B₂C₃M₃V₂R₃
 FAIRED INTAKES \circ — \circ " B₂C₃M₃V₂R₃F



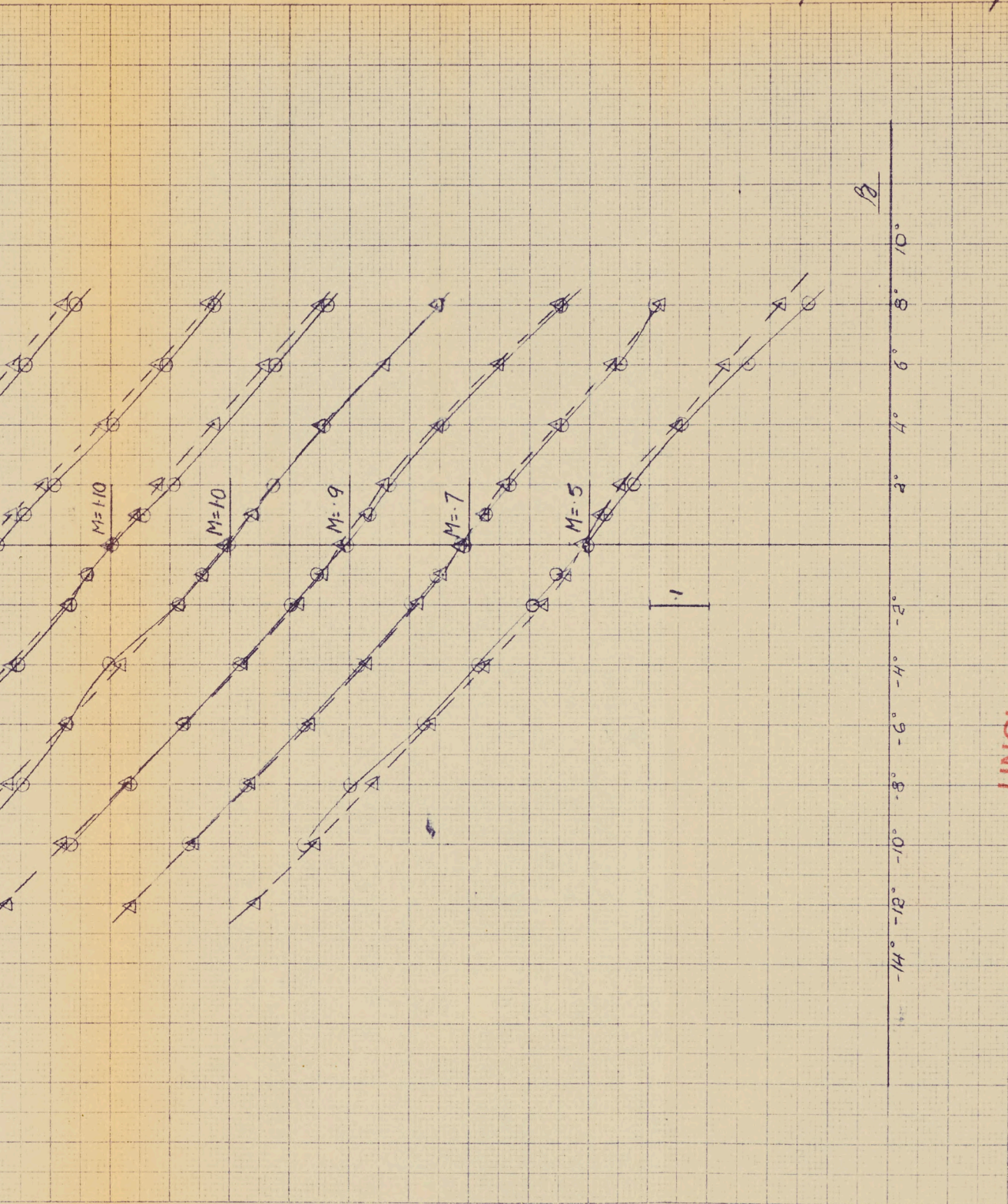
| Mach No. | RUN | |
|----------|---------------------|-------------------|
| | Δ — Δ | \circ — \circ |
| 1.23 | 711 | 918 |
| 1.15 | 710 | 917 |
| 1.10 | 712 | 916 |
| 1.0 | 715 | 915 |
| .9 | 718 | 914 |
| .7 | 720 | 913 |
| .5 | 721 | 912 |

PWT/52

7-3-2.

DEC. 1954

J. Papis.



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353
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