

QC 40
Avro
C-105
P/AD/51

QC X
Avro
CF105
P-AD-51

(14)

FILE IN VAULT

C-105

P/Aero Data/51

UNCLASSIFIED
LATERAL STABILITY DERIVATIVES

ANALYZED IN LEVEL FLIGHT

WING NOTCHED AND EXTENDED

COPY 6

April 1955



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Canada

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et de génie mécanique

TO

DATE

Report no.: QCX - AVRO - CF105 - P-AD-51

has been downgraded to: _____
 de-classified

by (Name): Michel W. Drapeau

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

Date: Dec. 7, 1992

Signature



UNCLASSIFIED

A. V ROE CANADA LIMITED
MALTON - ONTARIO

TECHNICAL DEPARTMENT (Aircraft)

AIRCRAFT:

REPORT No. P/AERO DATA/51

FILE No

NO OF SHEETS: _____

TITLE:

C-105

ANALYZED

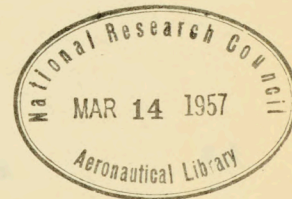
LATERAL STABILITY DERIVATIVES

IN LEVEL FLIGHT

WING NOTCHED AND EXTENDED

UNCLASSIFIED
NON CLASSIFIED

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



PREPARED BY _____ DATE April 1955
CHECKED BY _____ DATE _____
SUPERVISED BY _____ DATE _____
APPROVED BY _____ DATE _____

ISSUE No	REVISION No	REVISED BY	APPROVED BY	DATE	REMARKS

45126

12422320



AVRO AIRCRAFT LIMITED

TECHNICAL DEPARTMENT (Aircraft)

REPORT No. P/AERO DATA/51

SHEET No. _____

PREPARED BY _____

DATE _____

CHECKED BY _____

DATE _____

AIRCRAFT: _____

**UNCLASSIFIED
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INDEX

C-105

LATERAL STABILITY DERIVATIVES

IN LEVEL FLIGHT

	<u>Section</u>		
1. <u>Rollon Derivatives and Hinge Moments</u>			
$C_{l\delta a}$ *	1.1		
$C_{N\delta a}$	1.2		
$C_{y\delta a}$	1.3		
$C_{h\delta}$ *	1.4		
C_{nq}	1.5		
$C_{n\delta}$	1.6		
2. <u>Rudder Derivatives and Hinge Moments</u>			
	<u>$\beta < 3^\circ$</u> <u>$\beta > 3^\circ$</u>		
$C_{N\delta_r}$ ($\delta_R < 10^\circ$)	2.1.1	2.1.2	2.1
($\delta_R > 10^\circ$)	2.1.3	2.1.4 *	
$C_{l\delta_r}$ ($\delta_R < 10^\circ$)	2.2.1) 2.2.2	2.2
($\delta_R > 10^\circ$)	2.2.3		
$C_{y\delta_r}$ ($\delta_R < 10^\circ$)	2.3.1	2.3.2	2.3
($\delta_R > 10^\circ$)	2.3.3 *	2.3.4 *	
$C_{n\beta}$ *			2.4
$C_{n\delta}$ *			2.5

* Derivative independent of Angle of Attack.



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DATE _____

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DATE _____

3. Sideslip Derivatives

	$\beta < 3^\circ$	$\beta > 3^\circ$	
$C_{N\beta}$	3.1.1	3.1.2	3.1
$C_{l\beta}$		3.2.1	3.2
$C_{y\beta}$	3.3.1	3.3.2 *	3.3

UNCLASSIFIED
NON CLASSIFIE4. Yawing Derivatives

	$\beta < 3^\circ$	$\beta > 3^\circ$	
C_{N_r}	4.1.1	4.1.2	4.1
C_{l_r}	4.2.1	4.2.2	4.2
C_{y_r}	4.3.1	4.3.2	4.3

5. Rolling Derivatives

	$\beta < 3^\circ$	$\beta > 3^\circ$	
C_{N_p}	5.1.1	5.1.1	5.1
C_{l_p} *		5.2.1 *	5.2
C_{y_p}	5.3.1	5.3.1	5.3

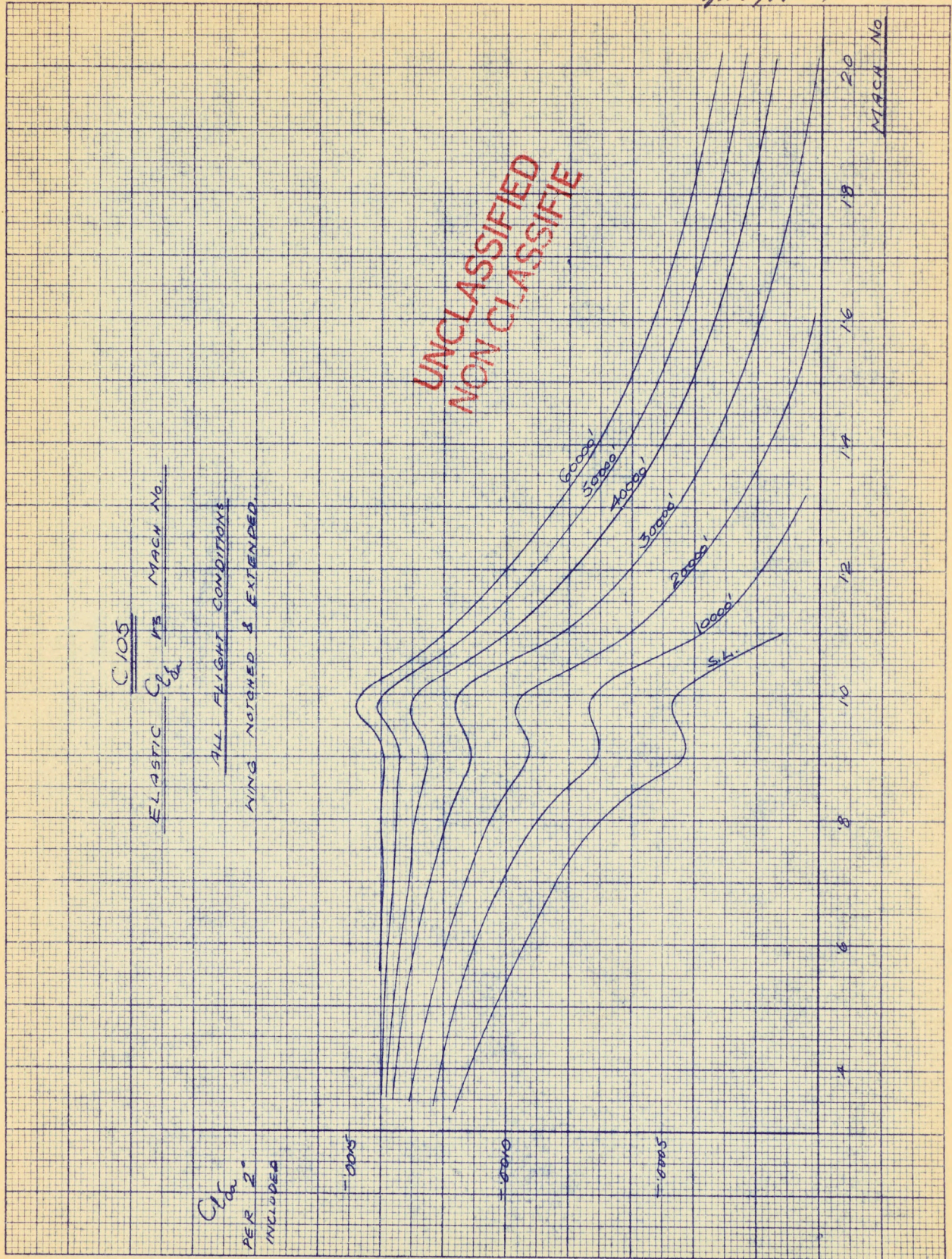
* Derivatives independent of Angle of Attack

P/AD/51

1.1

~~P/STAB/71 13-3-3.~~

April 15 Kinakhsul



C105
ELASTIC C_{105} vs MACH No.

ALL FLIGHT CONDITIONS
AVING NOTCHED & EXTENDED.

C_{105}
PER 2°
INCLUDED

-0005

-0010

-0015

UNCLASSIFIED
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MACH No

C-105

Critica vs Mach No

Elastic

level Flight

Wing Notched and Extended

0.003

0.002

Critica

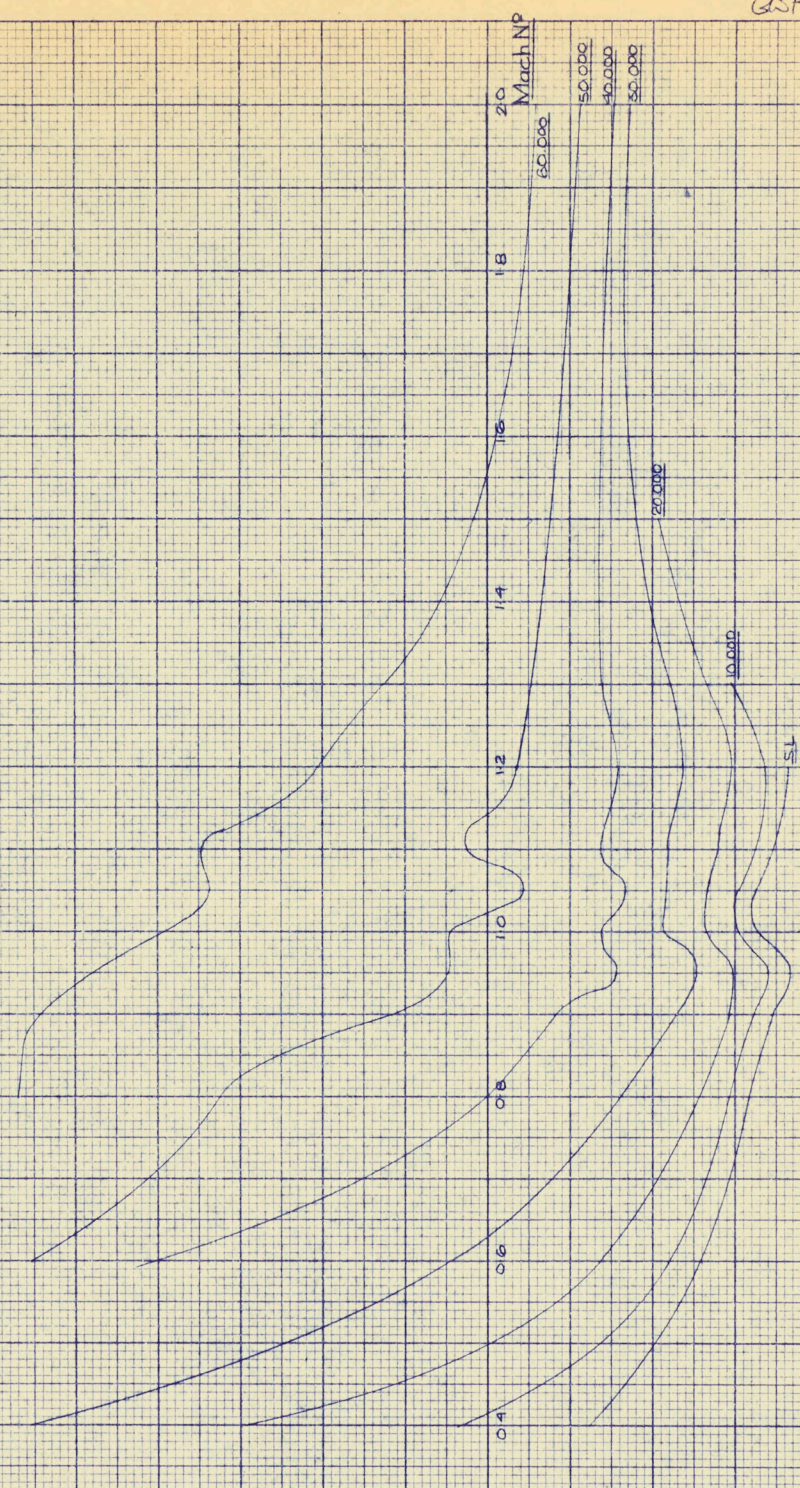
per degree incl

0.001

0

-0.001

-0.002

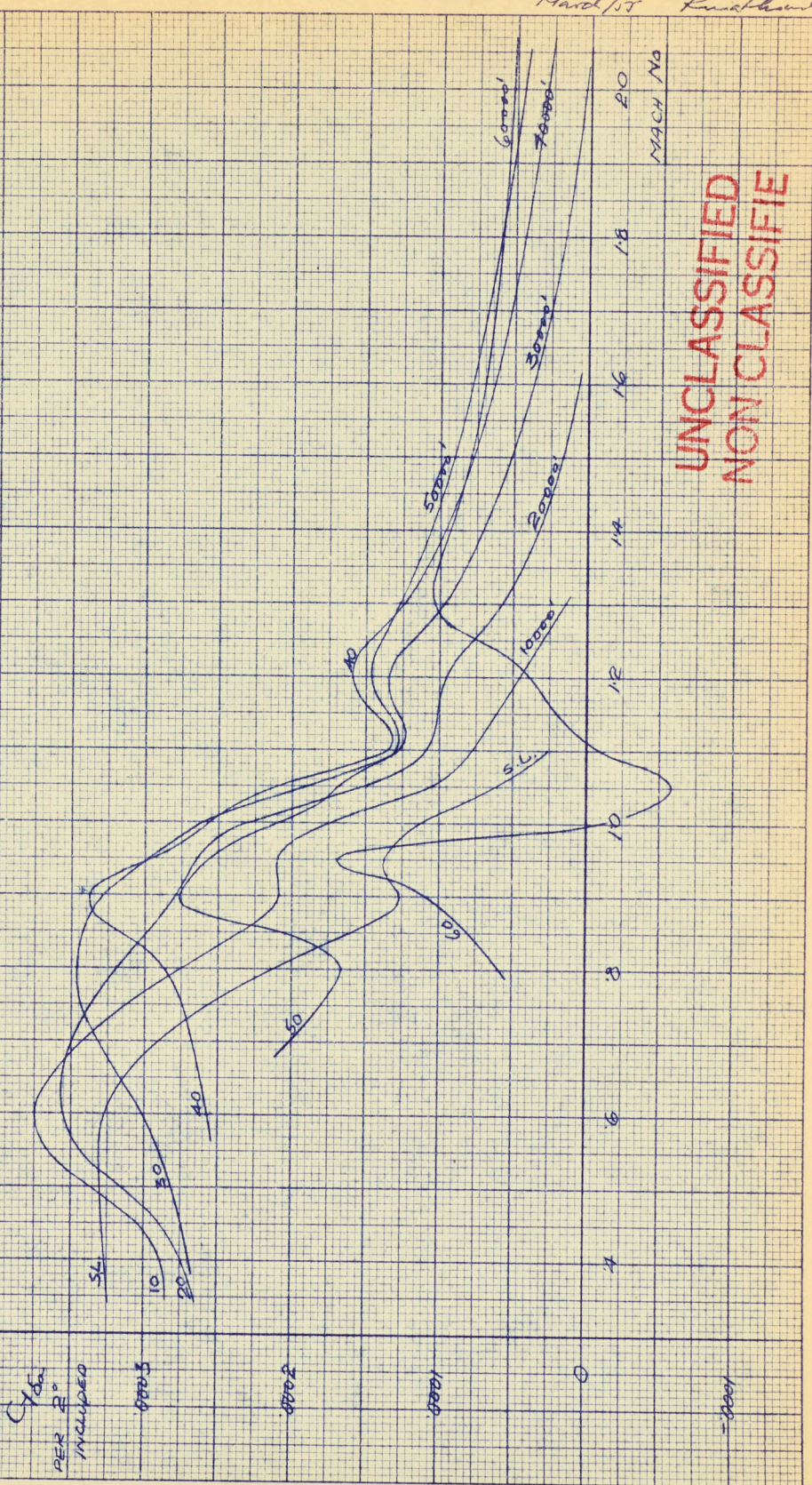


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P/AD151 1.3

P/550223/91 13-2-4
Hard/PT Knutson

C105
ELASTIC CYCLE VS MACH NO
IN LEVEL FLIGHT
WINGS NOTCHED & EXTENDED



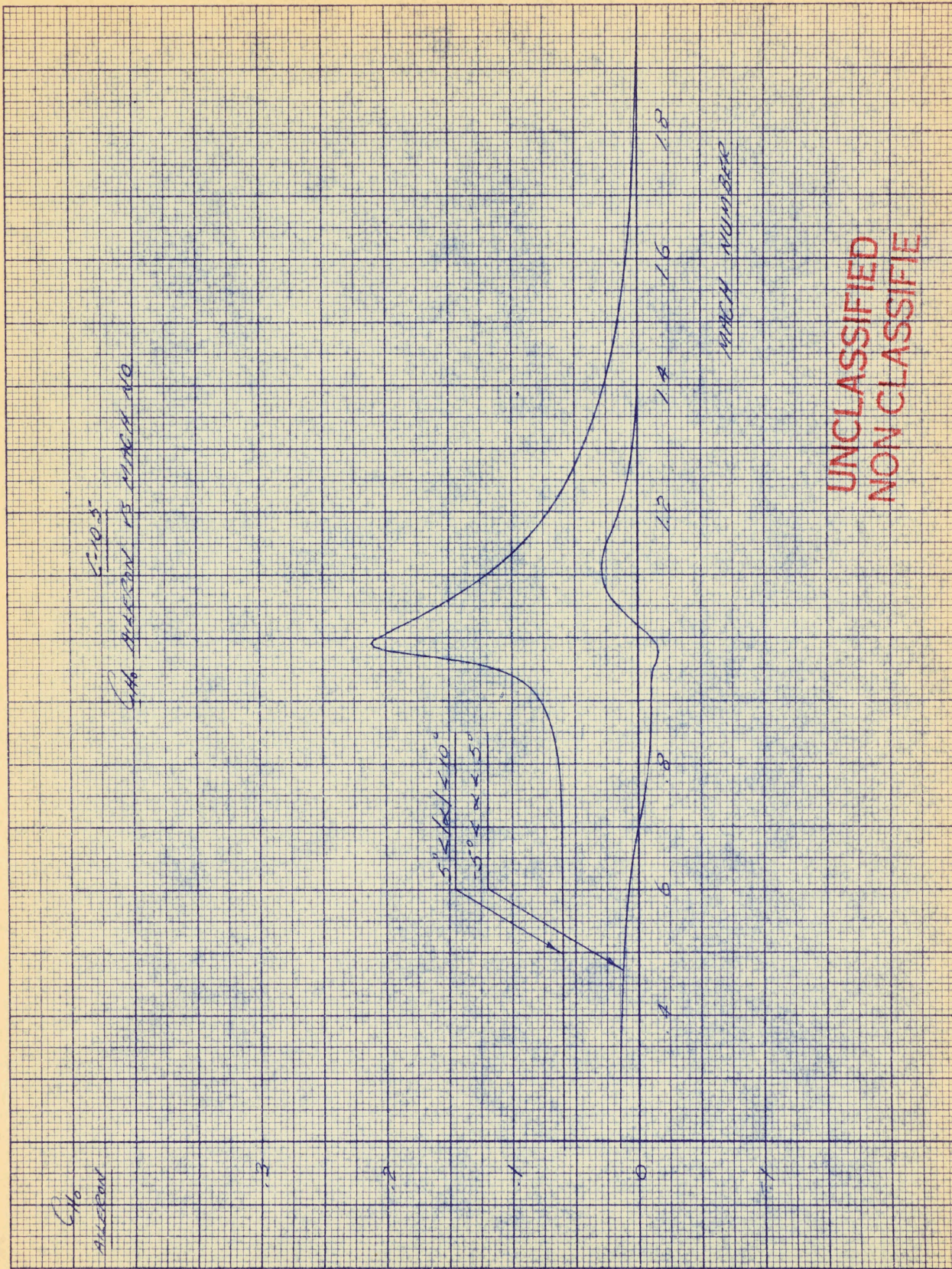
UNCLASSIFIED
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DIADISI 1.7

~~LA. R/ACRS DATA 1.72~~

APR. 55

CLARK

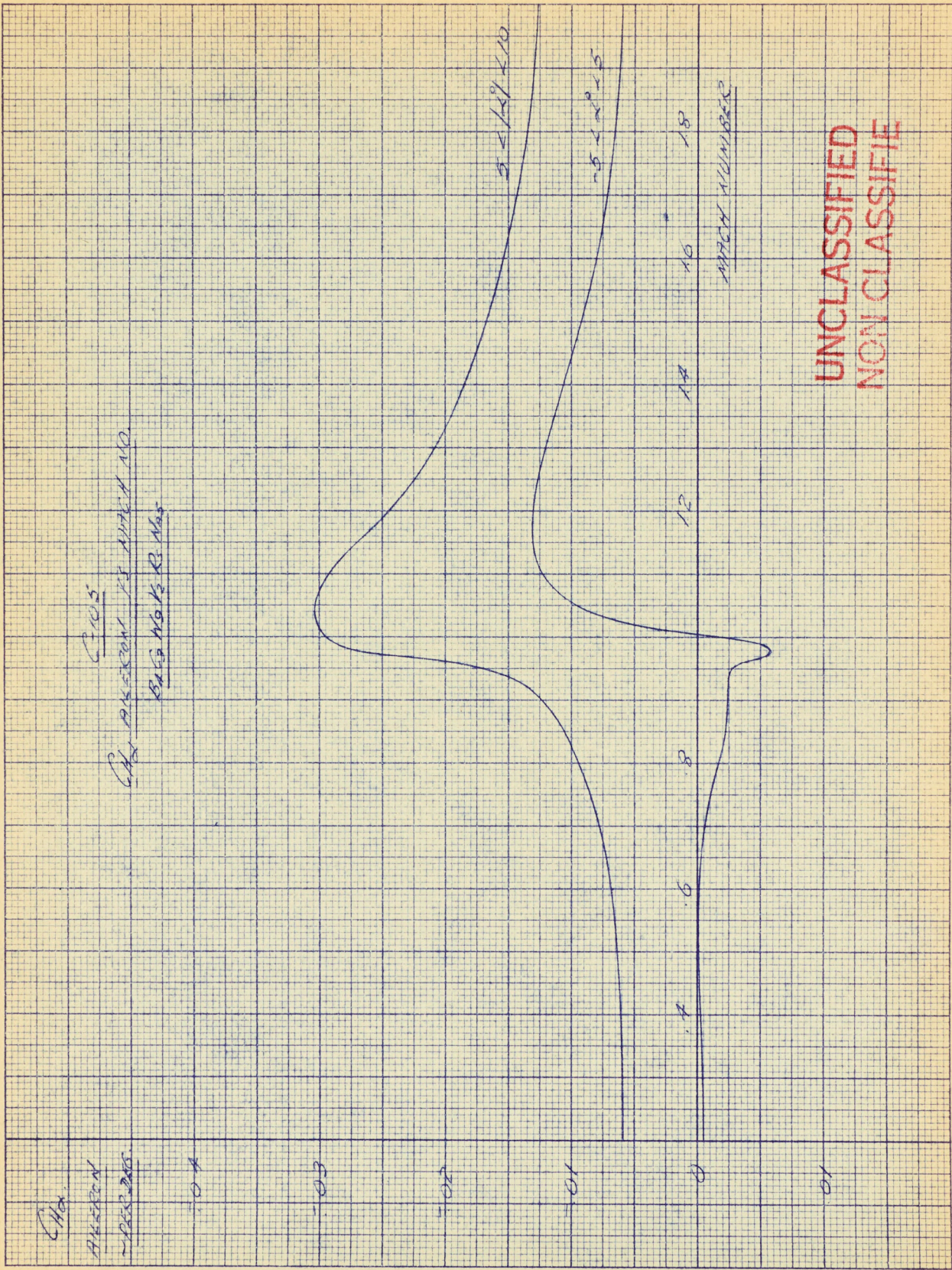


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P/A D/51

1.5
JUN 55

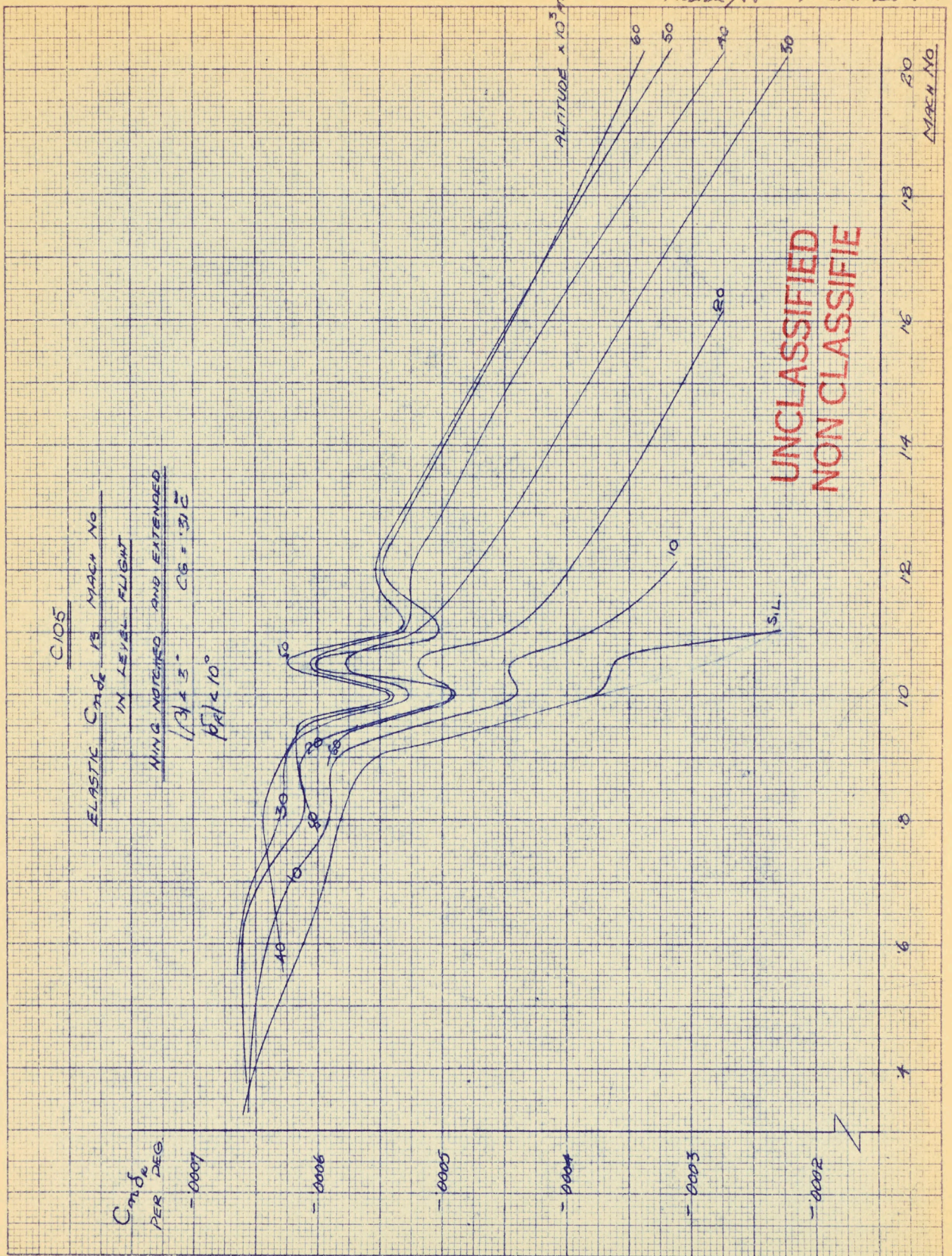
~~Handwritten notes~~
CHECK



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NON CLASSIFIE

P/A/D/S/I 2.1.1

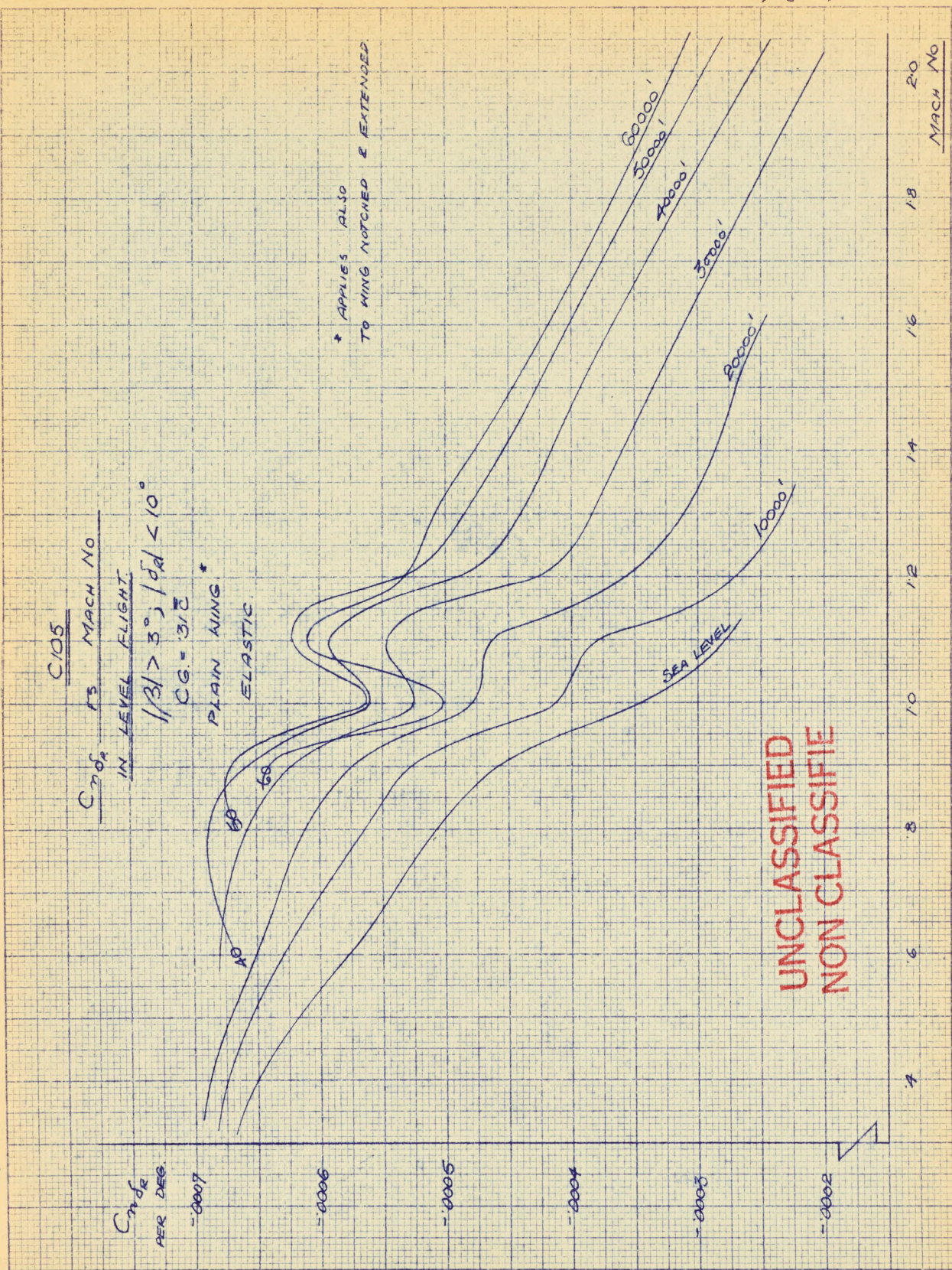
~~P/STAB/71~~ ~~71.2~~
March/55 Knuthson L.



P/AD/51 2.1.2

~~P/STAB/68 13-17~~

Feb 1/55 Kuzhambur



P/AD/51 2.1.3 P/stab/71
GWT 121.3

C-105

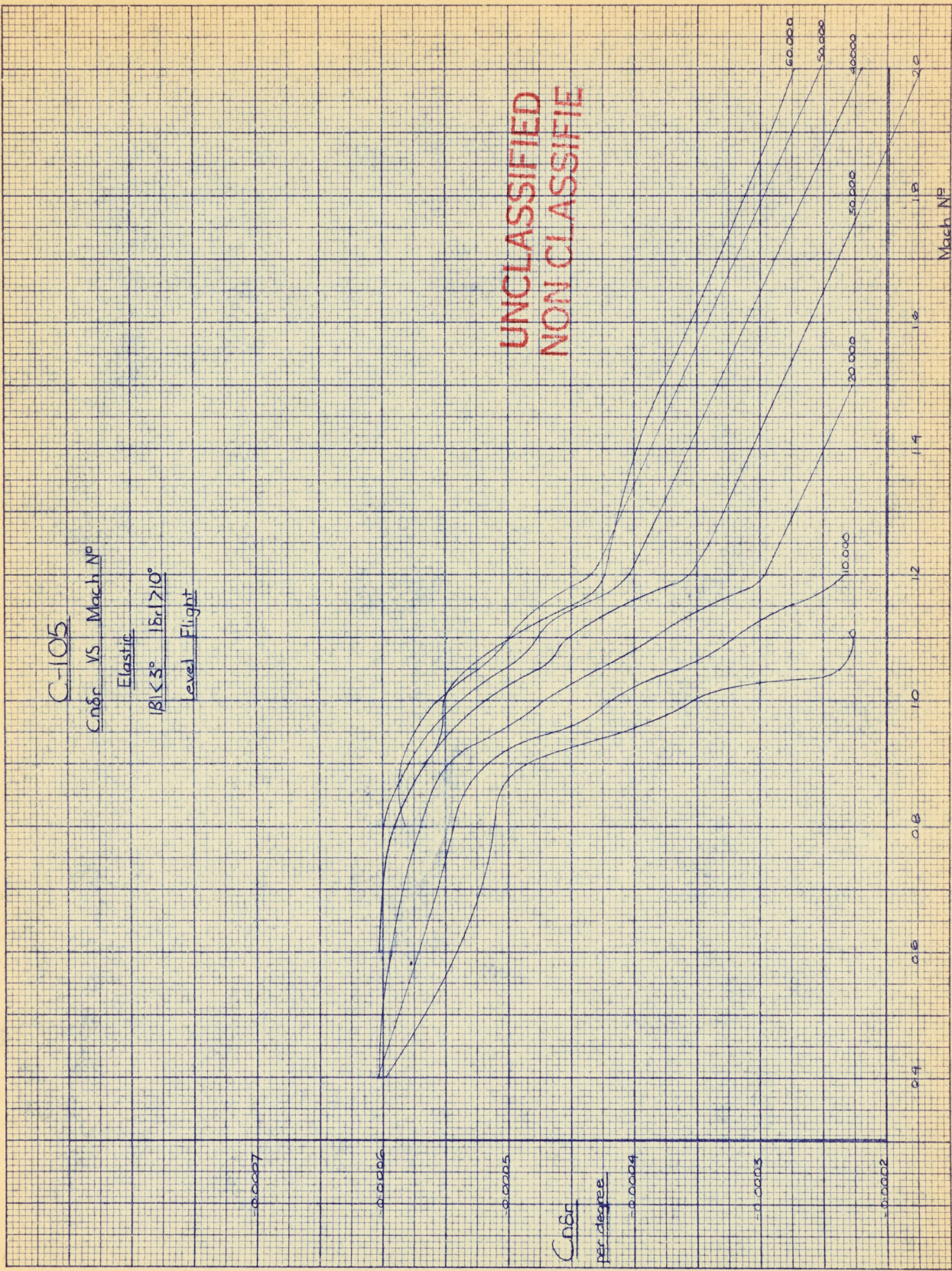
Cnδr VS Mach N°

Elastic

β < 3° 15, > 10°

Level Flight

UNCLASSIFIED
NON CLASSIFIE



Cnδr
per degree

Mach N°

P/A/D/51 2.1.4

P/Stab/71

GWSH

1233

C-105

$C_{n\delta}$ vs Mach No

Elastic

$\beta \geq 3^\circ$ $18.1 > 10^\circ$

All Flight Conditions

UNCLASSIFIED
NON CLASSIFIE

-0.0007

-0.0006

-0.0005

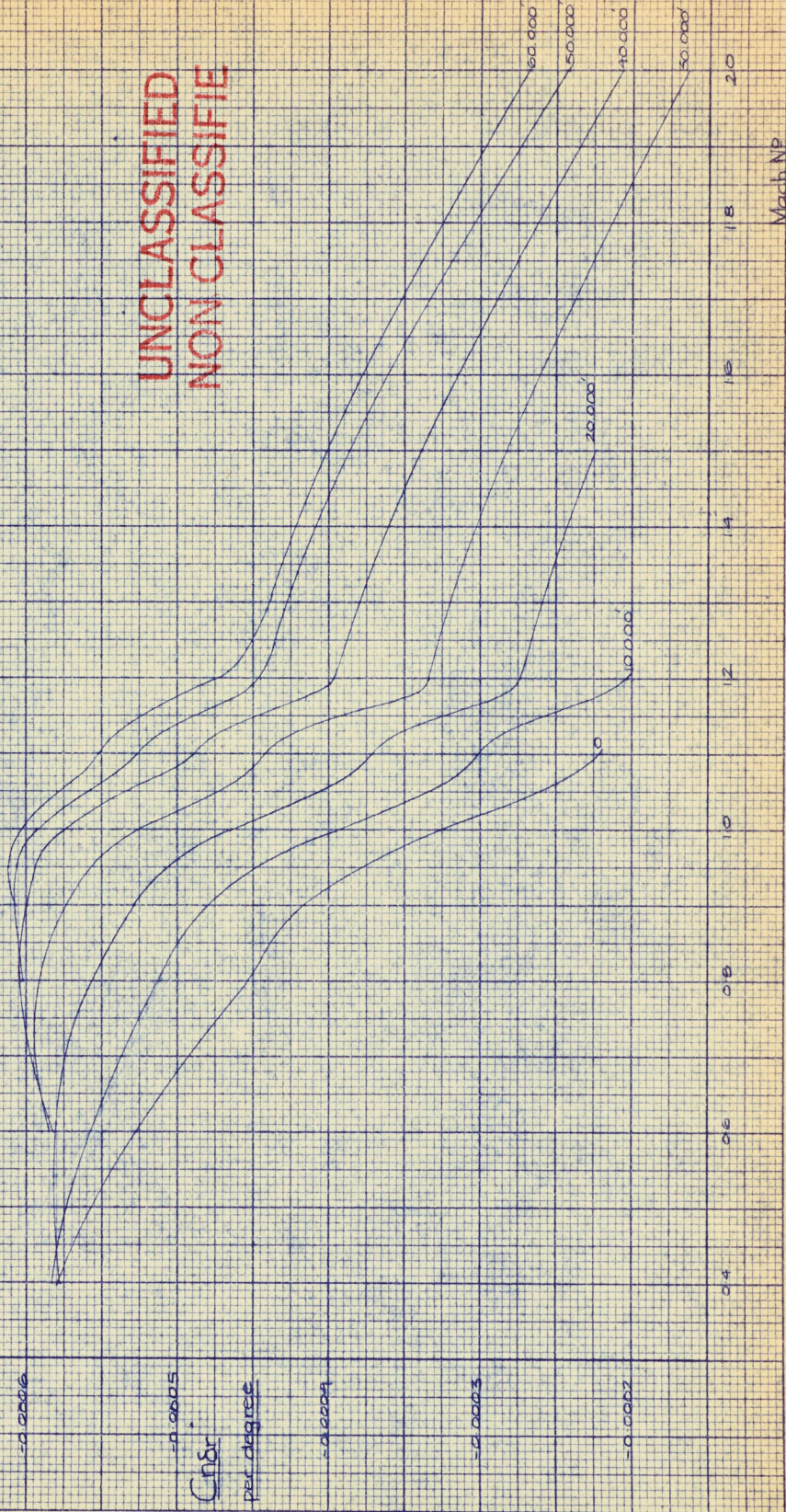
$C_{n\delta}$

per degree

-0.0004

-0.0003

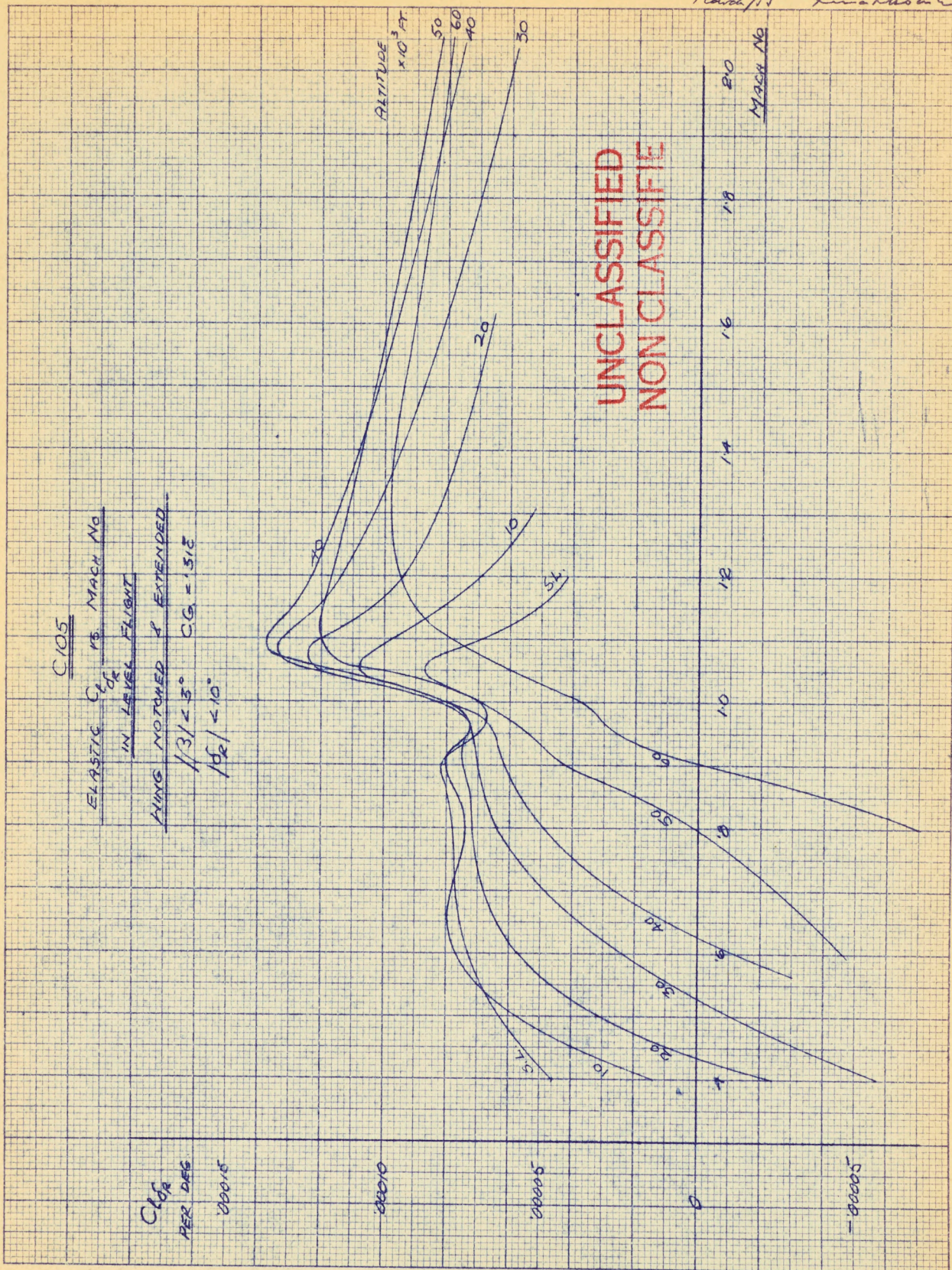
-0.0002



Mach NP

P/AD/51 2.2.1

~~P/STAB/71 1.8.~~
 March/15 Kuvakhseni



C105

ELASTIC CDR IN LEVEL FLIGHT

WING MOTIONED & EXTENDED

$\beta/\alpha < 3^\circ$ CG = 1.5 IE

$\beta/\alpha < 10^\circ$

UNCLASSIFIED
 NON CLASSIFIE

CDR PER DEG

00015

00010

00005

0

-00000-

PAD/51 2.2.2

SMT. 15.5. P/STA13/68

MARCH 1955

J. Papis.

C 105

B₂C₃W₃ V₃R₅

C_L vs MACH NO

1/3 / > 3°

FULL δ RANGE

AERONAUTIC AIRCRAFT, LEVEL FLIGHT.

C_L
PER DEG.

00012
00010
00008
00006
00004
00002
0
00002
00004
00006

SL.
10
20
30

40
50
60

SL.

10,000'

20,000'

30,000'
40,000'
50,000'
60,000'

MACH NO.
2.0

1.8

1.6

1.4

1.2

1.0

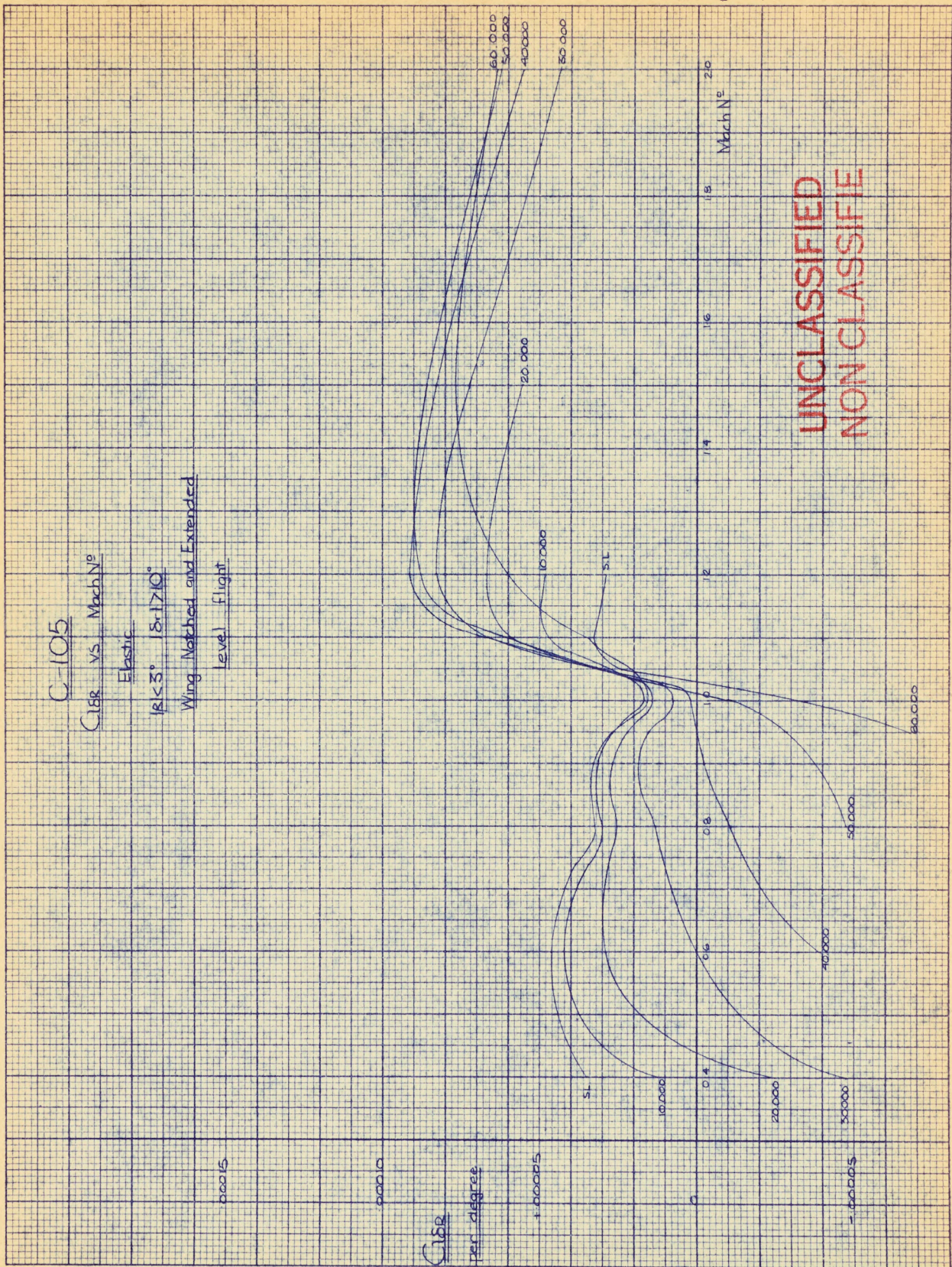
.8

.6

UNCLASSIFIED
NON CLASSIFIE

P/A D/51 2.2.3

P/Std/771
EASH



P/A0/51 2.3.1

P/STAS/71 11.6.
Hard / J Kuatkuachi

C105

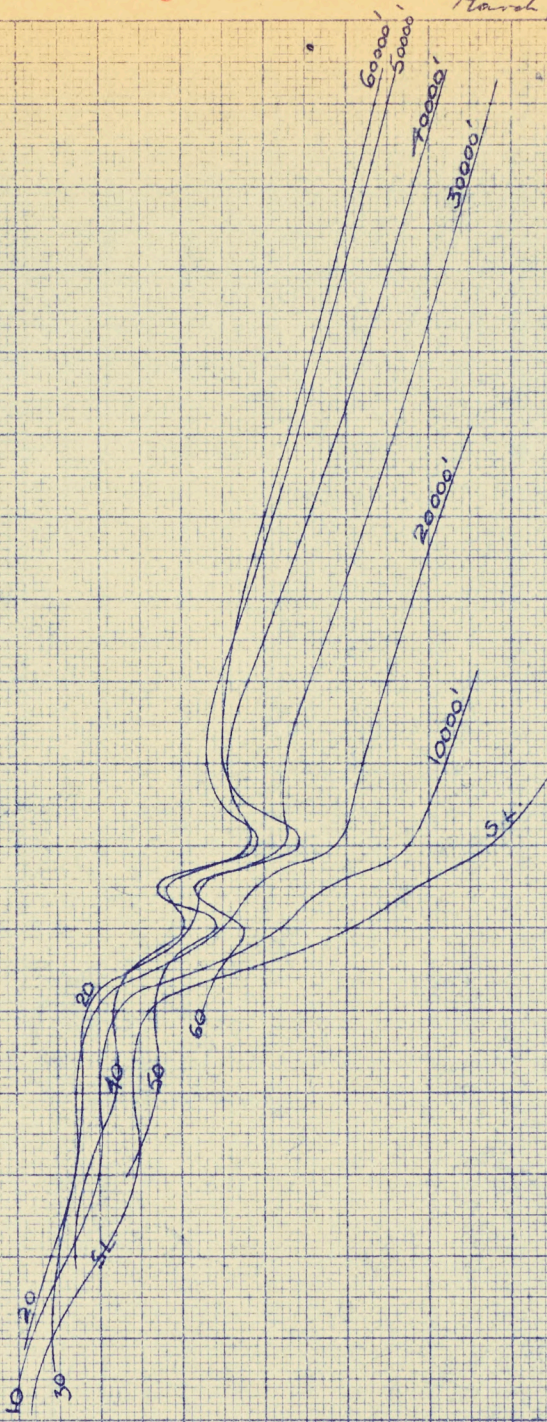
ELASTIC C_{Y_0} VS MACH No
IN LEVEL FLIGHT

WING NOTCHED AND EXTENDED

$| \beta | < 3^\circ$ C.G. = .31C

$| \alpha_d | < 10^\circ$

C_{Y_0}
PER DEG



UNCLASSIFIED
NON CLASSIFIE

MACH No

18

16

14

12

10

8

6

4

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18

16

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18

16

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4

P/AD/51 2.3.2 15.9. P/STAB/68. FEB. 1955 T. Pajus.

C105

CONF. $B_4 C_3 W_3 V_3 R_3$

$C_{Y_{\alpha}}$ vs MACH NO.

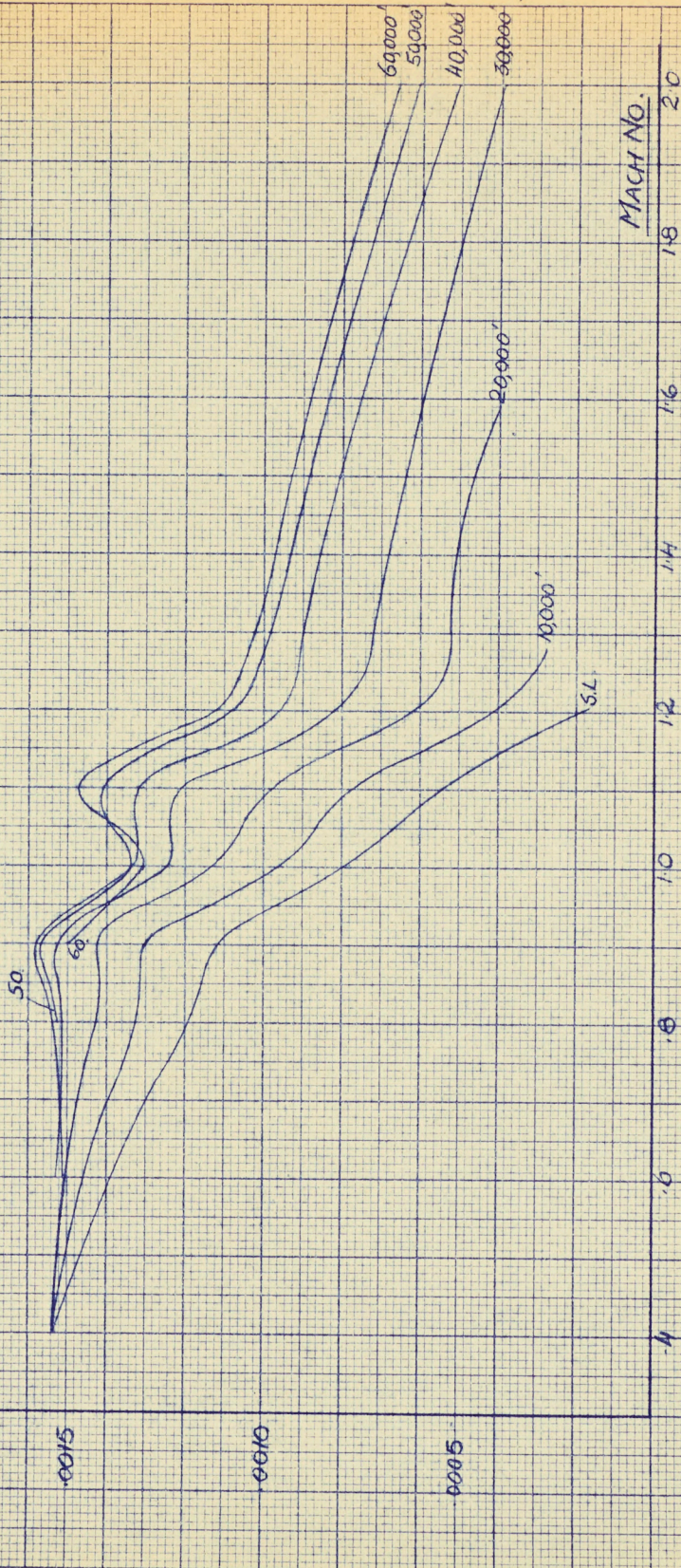
AEROELASTIC AIRCRAFT

LEVEL FLIGHT.

$\beta \approx 3$

$\delta r < 10^\circ$

$C_{Y_{\alpha}}(\beta)$
PER DEGREE



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P/AD/51 2.3.3

P/STAB/75
APRIL 55.

1-29
R.B.B.

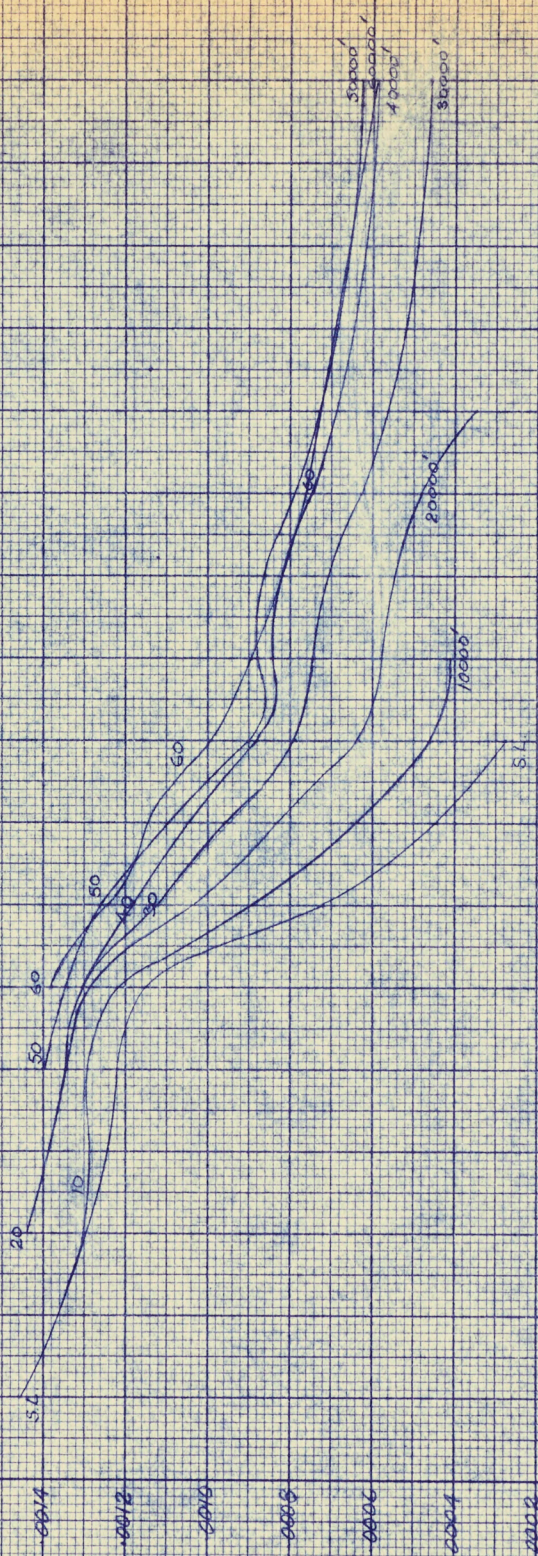
$C_{x_{stab}}$

vs MACH N°

FOR ALL FLIGHT CONDITIONS

$\beta < 3^\circ ; \delta T > 10^\circ$

$C_{x_{stab}}$



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P/A D/5-1 2,3,4 P/Stab 175 GSH 1.22.

C-105
C_{Yδ} vs Mach N°
Elastic

181 > 3° 18kl > 10°

Wing Notched and Extended
All flight Conditions

0.020

0.015

C_{Yδ}

per degree

0.010

0.005

0

60.000
50.000
40.000
30.000

20.000

10.000

20

18

16

14

12

10

08

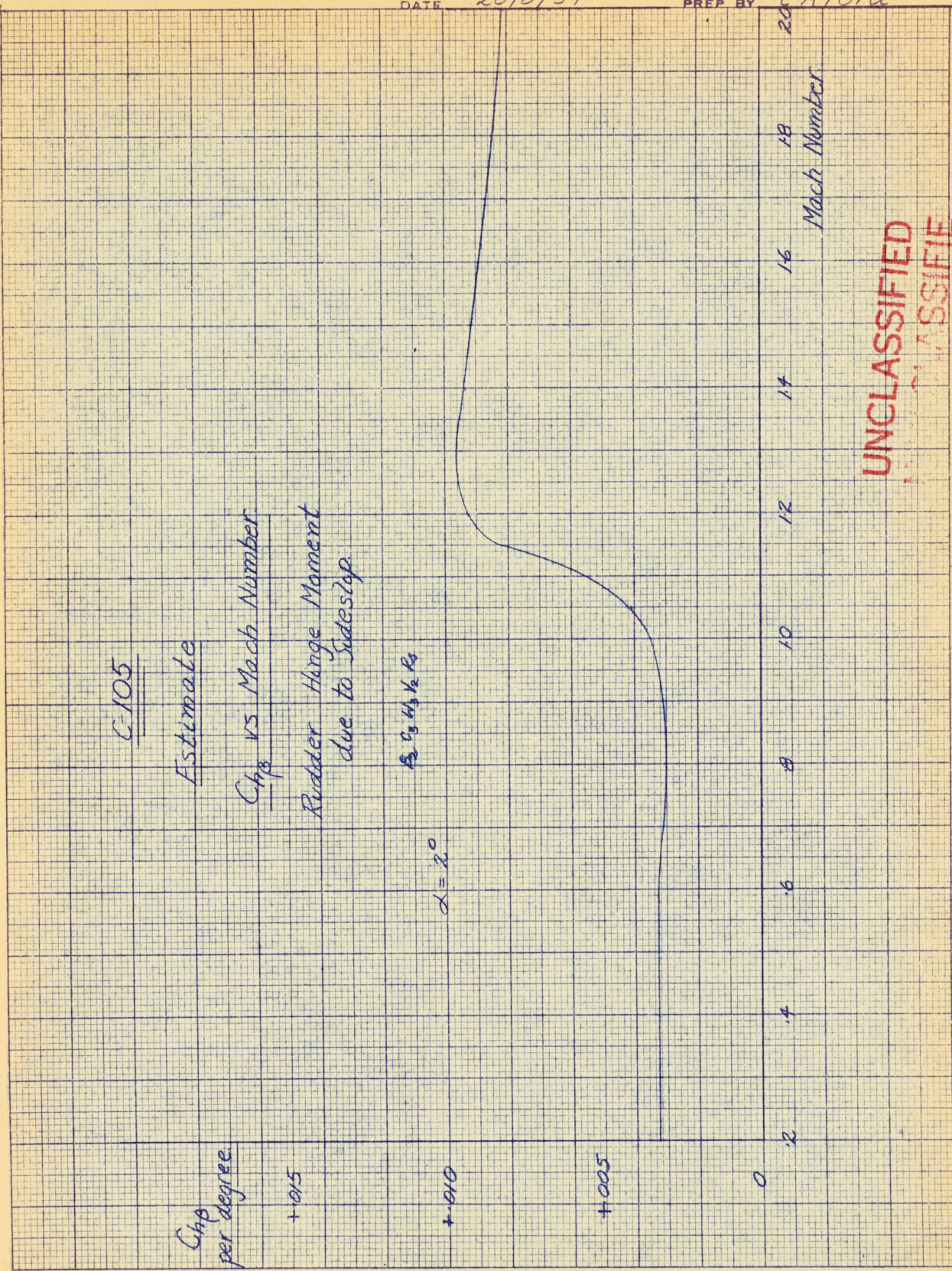
06

04

Mach N°

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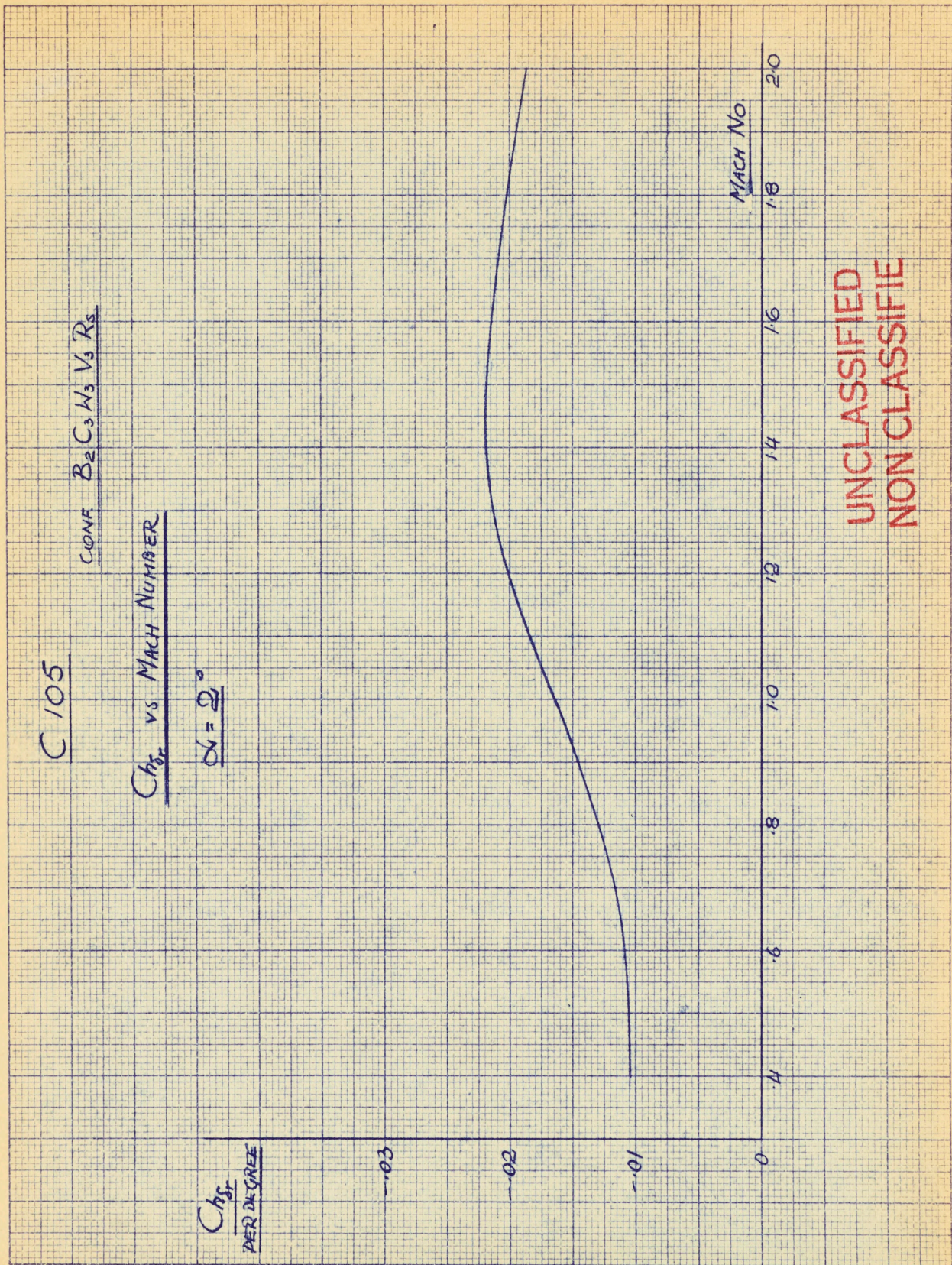
359-12 KEUFFEL & ESSER CO.
 10 X 10 TO INC 1/2 inch, 5th lines accented.
 MADE IN U.S.A.



UNCLASSIFIED
 CONFIDENTIAL

P/AD/51 2.5

~~15.7.~~ P/STAB/68
Feb. 1955. T. Papis



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P/AD/51 3.1.1

~~P/ST/AS/1/1~~ 5.11
March/15 Kinoshita

C105
Comp 15 MACH No

IN LEVEL FLIGHT

1/3/25°

CG = 31%

WING NOTCHED & EXTENDED

ELASTIC FIN

Comp 3
PER DEG

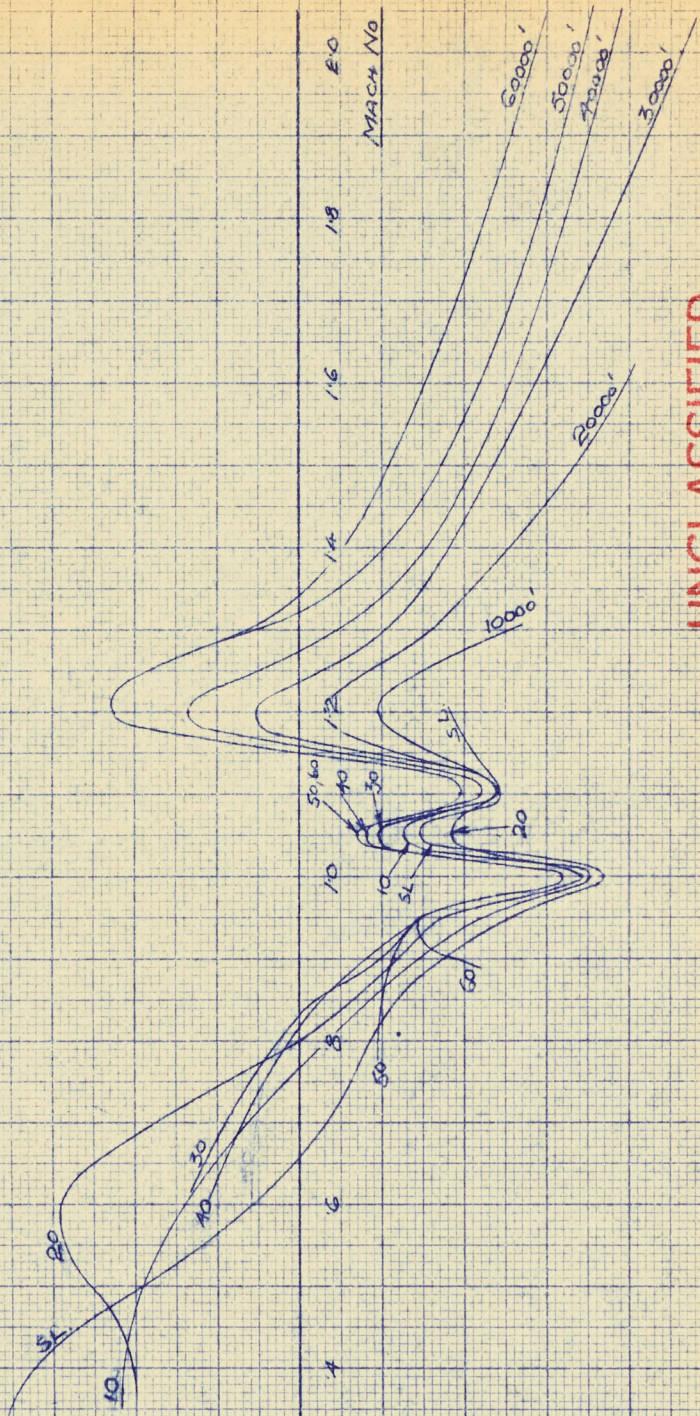
0004

0002

0

-0002

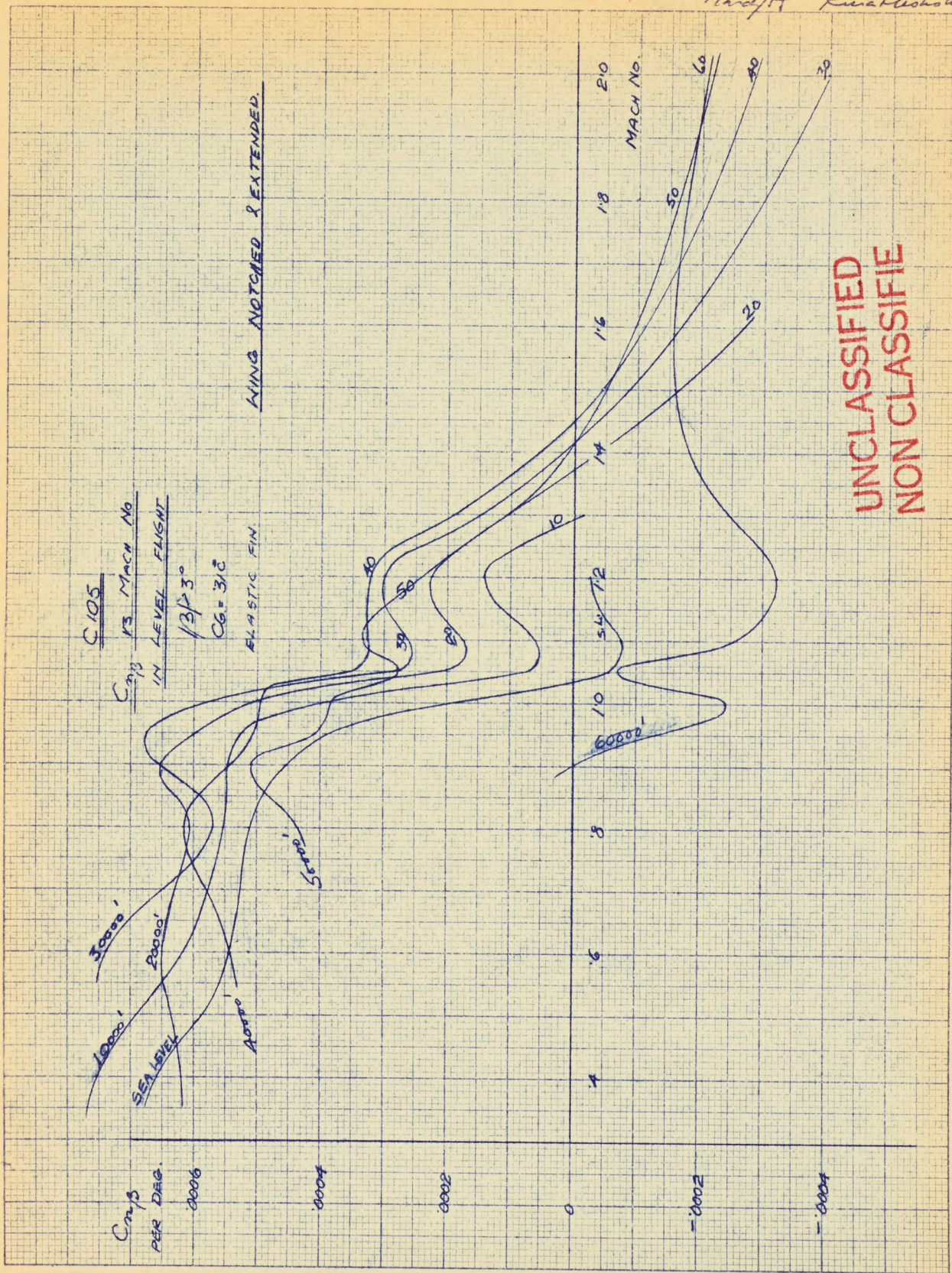
-0004



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P/AD/51 3.1.2

~~P/STARS/71~~ 10.9
Hand/ST Kwikleonski



C105
 Cap 13 Mach No
 IN LEVEL FLIGHT
 13/3°
 CG = 31.8

WING NOTCHED & EXTENDED.

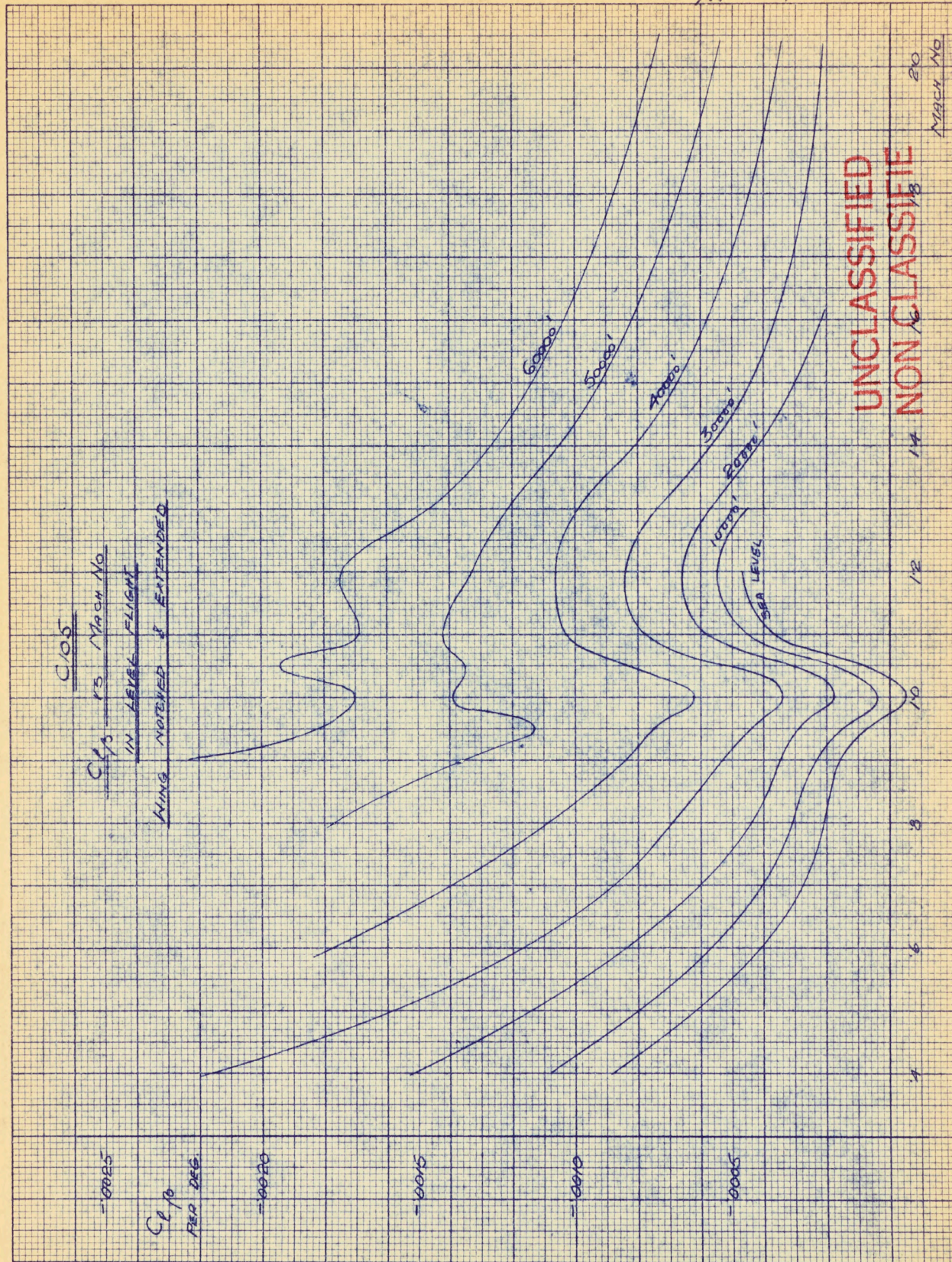
ELASTIC FIN.

UNCLASSIFIED
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PIAD/51 3.2.1

~~P/STAB/71~~ 2.2.

March/57 Knickhauke



C_L vs Mach No.
IN LEVEL FLIGHT
WING NOTCHED & EXTENDED

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20
MARCH NO

14

12

10

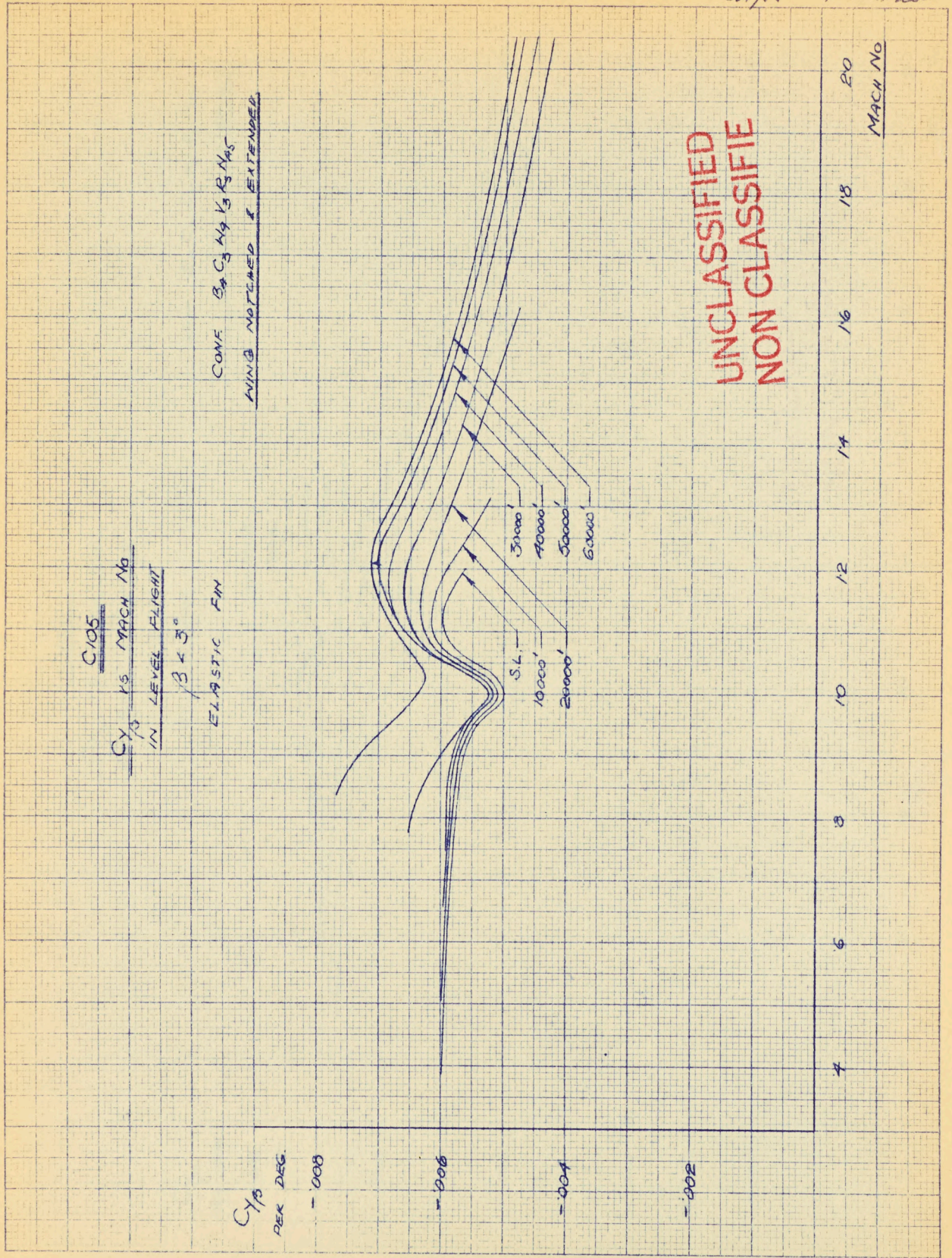
8

6

4

PIADISI 3.3.1

~~P/STAB 1/11~~ 6.5.
 Feb/15 Kuntzhausen



C105

$C_{Y\beta}$ vs MACH No
ALL FLIGHT CONDITIONS

$\beta > 3^\circ$

ELASTIC FIN.

CONF. B4 C3 K9 V3 R5 Naf
A/WING NOTCHED & EXTENDED.

$C_{Y\beta}$
PER DEG.

-010

-008

-006

-004

-002

ALTITUDE:

60000'

50000'

40000'

30000'

20000'

10000'

SEA LEVEL

4

6

8

10

12

14

16

18

20

MACH No

UNCLASSIFIED
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C-105

$C_{N\dot{\epsilon}}$ VS MACH NO

TAIL ELASTICS INCLUDED

NOTCHED & EXTENDED WING

$n = 1$ $|\beta| < 2^\circ$

C.G. AT 31% MAC

$C_{N\dot{\epsilon}}$
PER RADIAN

0

-.05

-.10

-.15

.4

.6

.8

1.0

1.2

1.4

1.6

1.8

2.0

MACH NO

SEA LEVEL

20000'

40000'

60000'

20000'

40000'

60000'

S.L.

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P/AD/51 A.1.1

P/Std/70
D-58

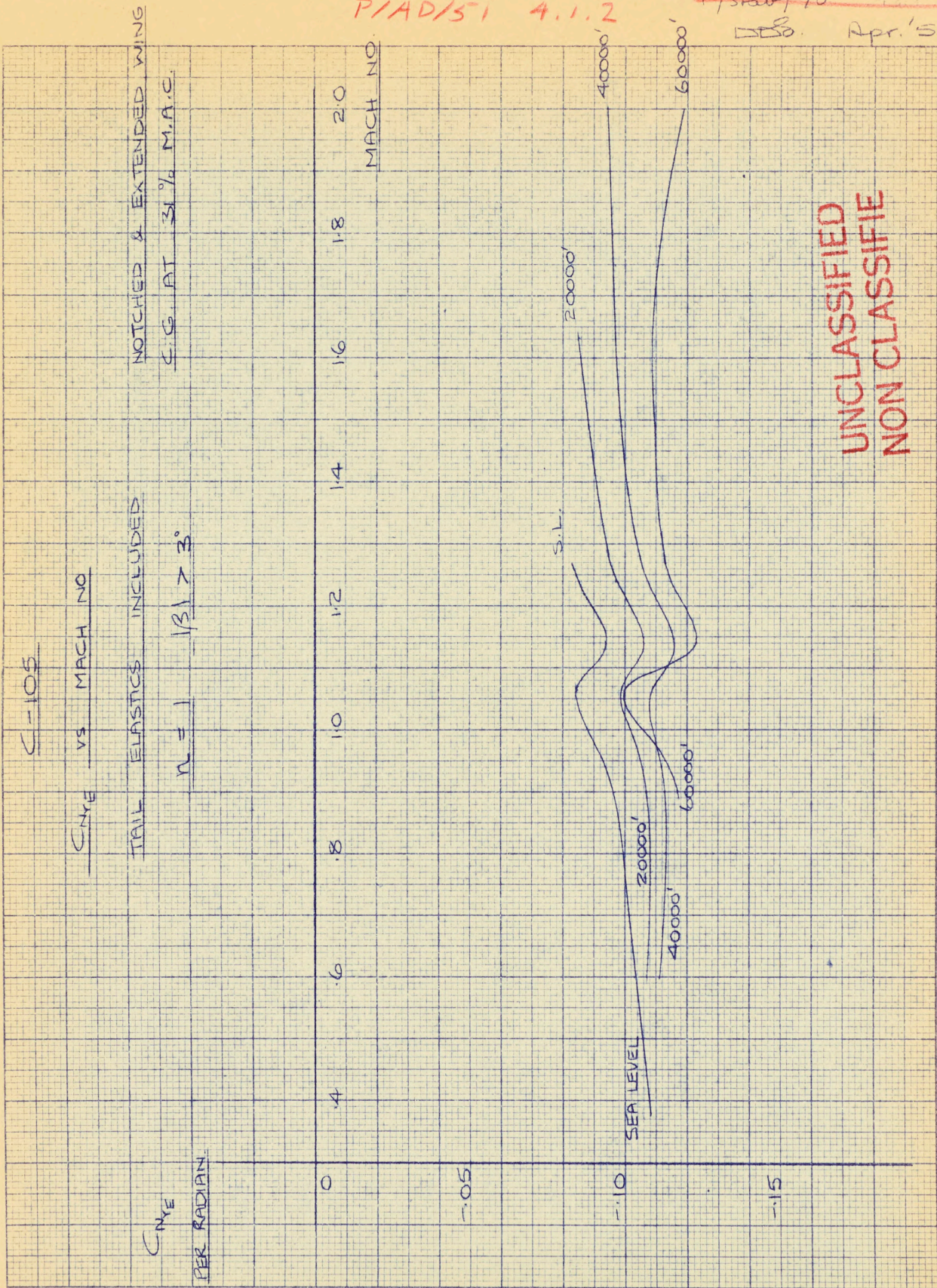
Apr '55

P/AD/51 4.1.2

P/Stab/70

DBB

Apr. '55



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P/A D/S 1 4.2.1

P/5 Feb/70

1988 Apr. 55

C-105

C_{Lye} VS MACH NO

NOTCHED &

EXTENDED WING

C.G. AT 31% M.A.C.

TAIL ELASTICS INCLUDED

$n = 1$ $\beta > 3^\circ$

C_{Lye}
PER RADIAN.

.07

.06

.05

.04

.03 SEA LEVEL

.02

.01

0

-.01

-.02

60000'

40000'

20000'

60000'

40000'

20000'

MACH NO.

1.8

1.6

1.4

1.2

1.0

.8

.6

.4

S.L.

UNCLASSIFIED
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PIAD/51 A.2.2

P/Stub/70

Apr. '55

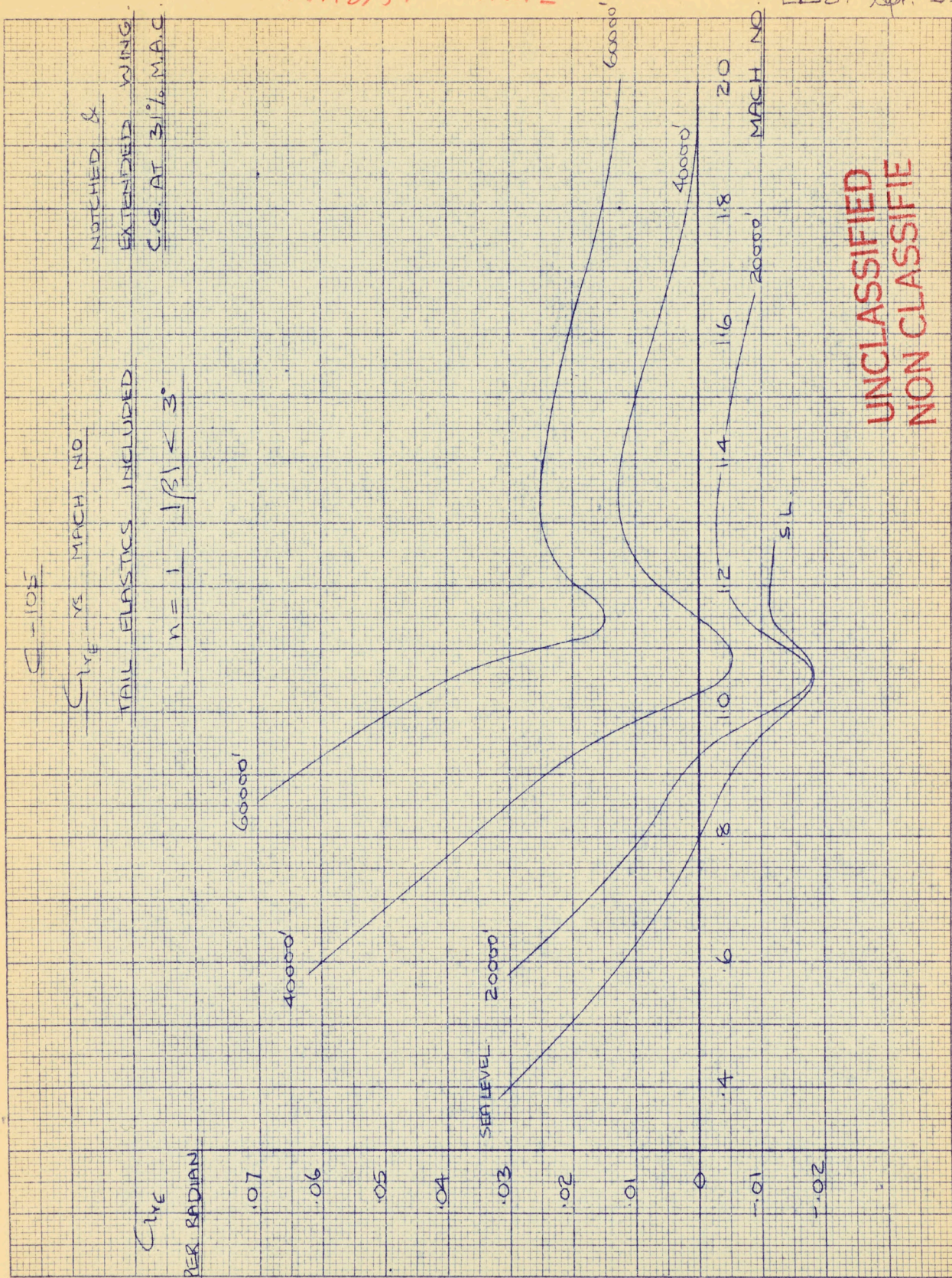
C-105

$C_{1/2}$ VS MACH NO

TAIL ELASTICS INCLUDED

$n = 1 \quad |\beta| < 3^\circ$

NOTCHED &
EXTENDED WING
C.G. AT 31% M.A.C.



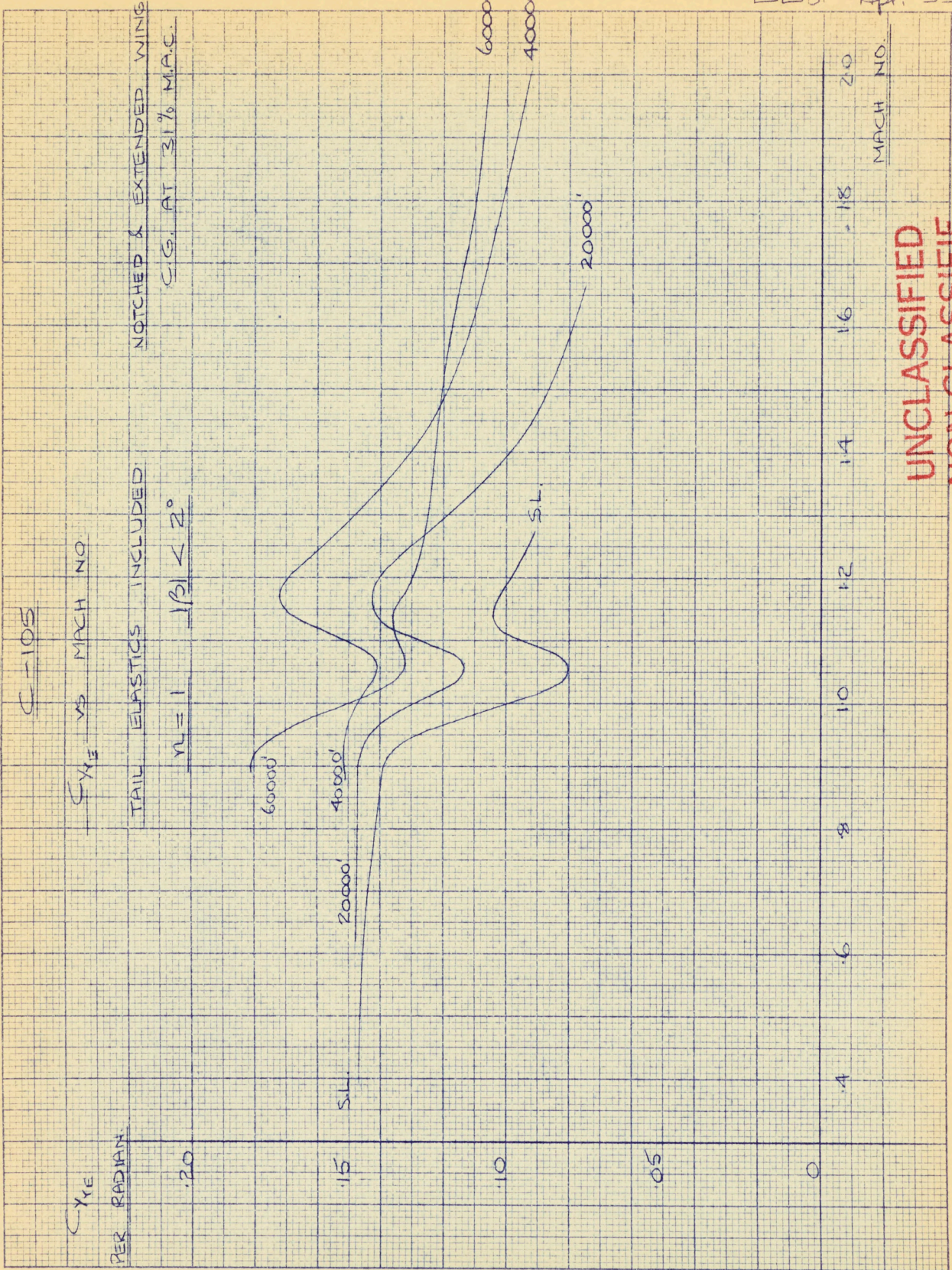
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NON CLASSIFIE

P/AD/51 4.3.1

P/Stat/70

LD²

Apr. '55

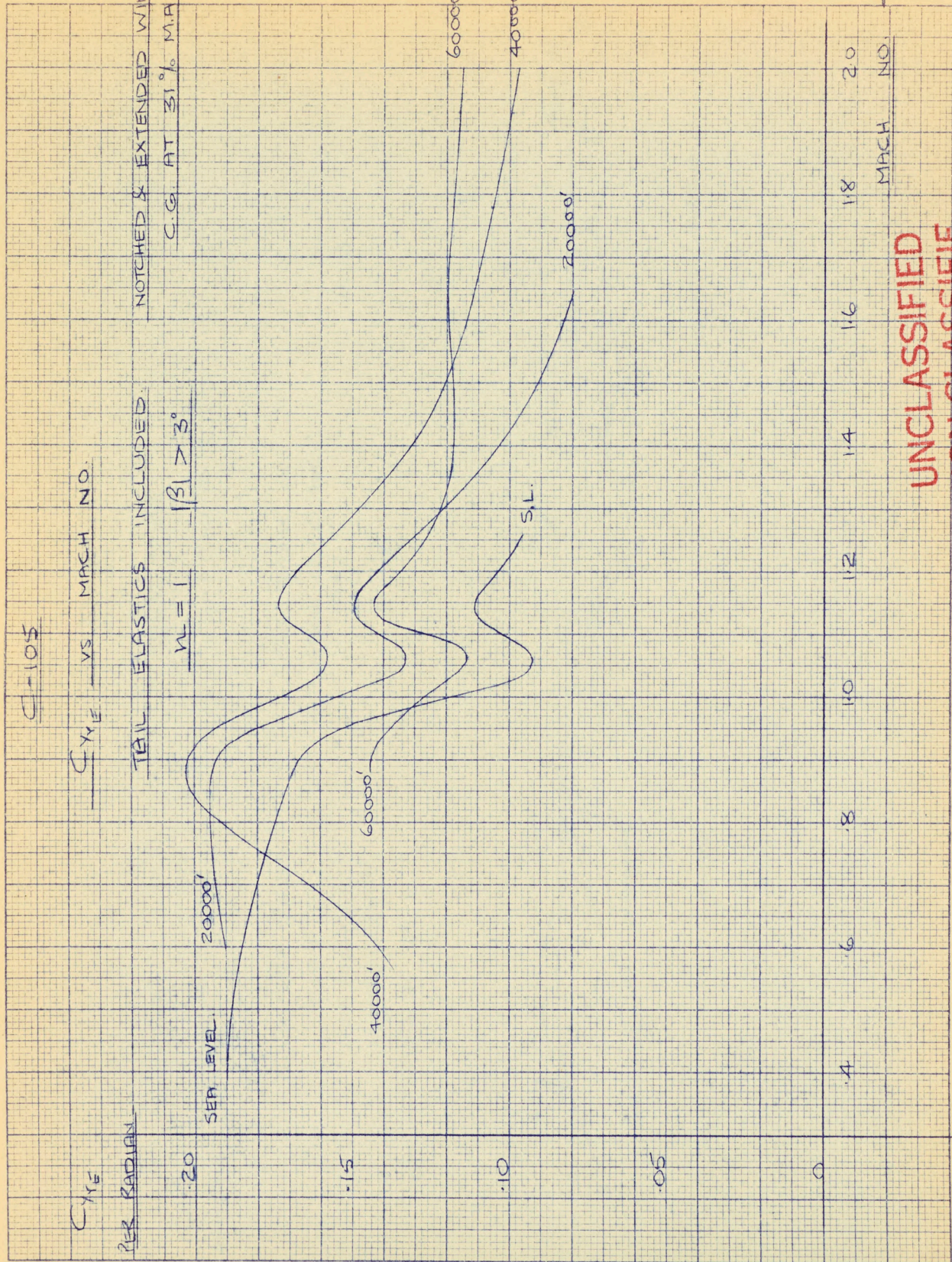


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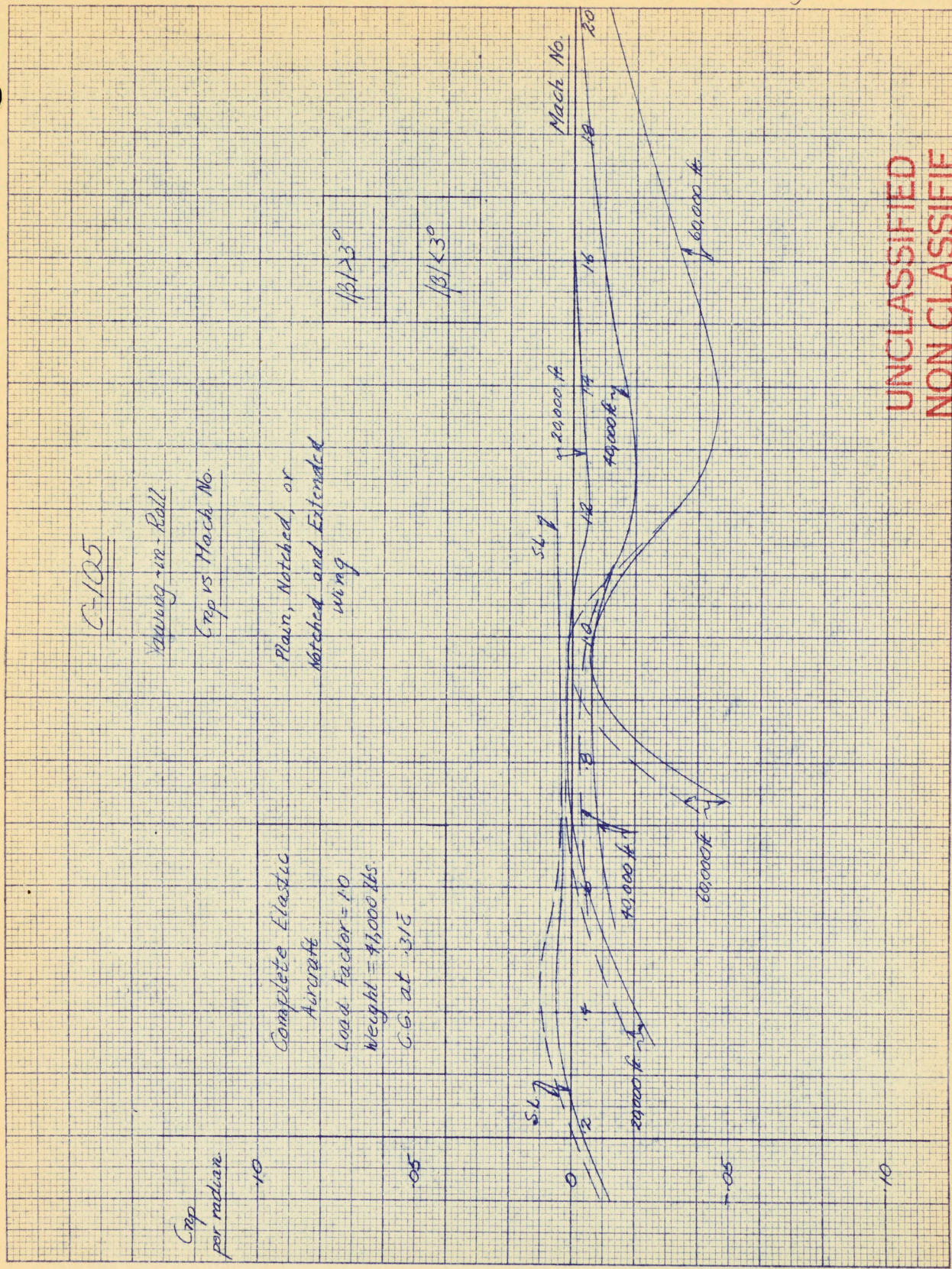
P/A D/5-1 A. 3. 2

P/S Study 70
LDBO.

Apr. 55



UNCLASSIFIED
NON CLASSIFIED



UNCLASSIFIED
NON CLASSIFIED

C-105

Damping in Roll

C_{Dp} vs Mach No.

Complete Elastic Aircraft
Notched and Extended wing.

C_{Dp}
per radian

20

15

10

05

Weight
C.G. Position
Load Factor } All

60,000 ft

50,000 ft

40,000 ft

30,000 ft

20,000 ft

10,000 ft

Sea level

12

14

16

18

20

22

24

26

28

30

UNCLASSIFIED
NON CLASSIFIED

Mach No.

P/AD/51, 5, 3, 1

~~11 Feb 58~~ 320
Feb 55 C.A. Ford.

C-105

Aeroelastic Side-force due to Rolling.

Cyp vs Mach No.

Plain, Notched, or Notched and Extended Wing.

Complete Aircraft
Load Factor = 1
Weight = 47,000 lbs
C.G. at 31.2

1B/K3°

1B/K3°

Wing W3
or W4 N15

Cyp
per radian

-30

-20

-10

0

60,000 ft

40,000 ft

20,000 ft

Sea Level

2

4

6

8

10

12

14

16

18

20

Mach No

UNCLASSIFIED
NON CLASSIFIE

OLD WORLD
353
MADE IN U.S.A.