

DATA MANAGEMENT COPY # 3 CR-103156  
CIRCULATE & RETURN DMS-DR-1010

—SPACE SHUTTLE—

ILRV STRAIGHT WING ORBITER  
(MODEL 130C)  
LONGITUDINAL AND LATERAL STATIC  
STABILITY CHARACTERISTICS DURING  
CONFIGURATION BUILD-UP;  
HORIZONTAL TAIL CONTROL  
EFFECTIVENESS

NAR LOW-SPEED WIND TUNNEL

WIND TUNNEL TEST RESULTS  
DATA REPORT

AUGUST 1970

N71-35113

FACILITY FORM 602

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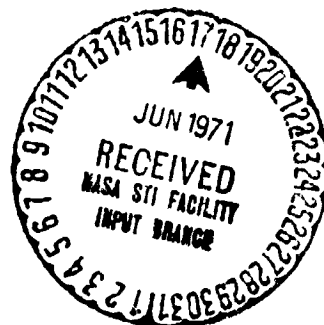
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SADSAC SPACE SHUTTLE  
AEROTHERMODYNAMIC  
DATA MANAGEMENT SYSTEM

SPACE DIVISION



CHRYSLER  
CORPORATION



REPORT NUMBER: DMS-DR-1010

PUBLISHED: August, 1970

SPACE SHUTTLE  
WIND TUNNEL TEST  
DATA REPORT

TEST FACILITY: NAR - Low Speed Wind Tunnel: Test #629

CONFIGURATION: ILRV Straight Wing Orbiter (Model 130C)

MODEL SCALE: .0076

TEST PURPOSE: Longitudinal & Lateral Static Stability Characteristics During  
Configuration Build-up; Horizontal Tail Control Effectiveness

MACH NUMBER: 0.26

TESTS CONDUCTED BY:

North American Rockwell Corporation

TEST CONDUCTOR Robert Mennell

TEST DATE: 15 June 1970

(This report has been prepared by Chrysler Corporation Space Division, under a Data Management Contract to NASA. Chrysler assumes no responsibility for the data presented herein other than its display characteristics.)

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## SUMMARY

Low speed longitudinal, directional and lateral static stability characteristics of a straight wing version of the North American Rockwell ILRV orbiter have been determined at a Mach number of .26 and a Reynolds number of  $1.85 \times 10^6/\text{ft}$ . The tests were conducted on a .0076 scale model in the NAAL 7.75 x 11 foot low speed wind tunnel located at International Airport, Los Angeles, California during the middle of June, 1970.

Variables investigated included fuselage configuration, wing force and aft location, horizontal tail vertical position; horizontal tail deflections for control, and body build up.

Data were obtained over a nominal angle of attack range from  $-4^\circ$  to  $70^\circ$  at  $0^\circ$  sideslip angle and over a nominal sideslip angle range from  $-8^\circ$  to  $4^\circ$  at nominal values of  $0^\circ$ ,  $10^\circ$ ,  $20^\circ$  and  $60^\circ$  angle of attack. Horizontal tail deflections were  $0^\circ$ ,  $\pm 10^\circ$ ,  $\pm 20^\circ$ ,  $\pm 30^\circ$ ,  $-40^\circ$ ,  $-50^\circ$  for the entire tail and  $10^\circ/-10^\circ$ ,  $20^\circ/-20^\circ$  for the left and right halves respectively.

Addition of the wing to the body produces a departure from the general trend of total axial force coefficient variation with angle of attack. The departure is apparent throughout the low angle of attack range. The precise cause of this deviation is unknown. Inclusion of base pressure data could have possibly been helpful in isolating the cause of the axial force variance. Knowledge of the base conditions would be helpful in the event the variance is attributable to wake or vortex flow emanating from the wing or wing-body juncture interacting with the body or sting in the model base region.

## TEST CONDITIONS

[illegible]

BALANCE UTILIZED: TASK MK I-A 0.0

**CAPACITY:**

### ACCURACY:

**COEFFICIENT  
TOLERANCE:**

|    |       |
|----|-------|
| NF | 200"  |
| SF | 50"   |
| AF | 15"   |
| PM |       |
| YM |       |
| RM | 70" # |

$\pm 0.5\%$  RATED


$$\begin{array}{r} \pm 0.0035 \\ \pm 0.0002 \\ \pm 0.0004 \\ \pm 0.0003 \\ \pm 0.0002 \\ \pm 0.0002 \end{array}$$

COMMENTS: Data were measured with a six component internal strain gage balance, the output being recorded on magnetic tape and utilizing the NAAL Astrodata system reduced to coefficient form employing an IBM 360 computer. The normal test mode for the model was wings vertical as shown by Figure 3.

## DATA REDUCTION

Data were measured by the internal balance in the body axis system. Axial force was adjusted to correspond to a base and sting cavity pressure then transferred to the stability axis system and corrected for tunnel wall effects and model blockage. Wind tunnel wall interference corrections were applied to angle of attack,  $C_D$  and  $C_m$  using standard wall correction relationships. Dynamic pressure was corrected for blockage effects due to the model. Final body axis data were then computed from the corrected stability axis data. Data were reduced to coefficient form using the following reference values:

$$S_{ref} = \text{wing planform area} = 0.179 \text{ ft}^2$$

$$l_{ref} = \bar{c} = \text{wing mean aerodynamic chord} = 2.458 \text{ inches}$$

$$b = \text{wing span} = 11.339 \text{ inches}$$

The moment reference point (MRP) is located 9.132 inches aft of the model nose and 0.384 inches below the fuselage reference line (FRL), see Figure 2.

## CONFIGURATIONS INVESTIGATED

The following model components were investigated:

- B6 - Basic fuselage
- B7 - Modified B6 - chine radius changed
- W6 - Basic Wing; 7° dihedral, 4° incidence
- W8 - Basic Wing W6 moved aft 48.4 inches f/s.
- W9 - Basic Wing W6 moved aft 96.9 inches f/s.
- H12 - Basic Horizontal tail, mid position
- H13 - Basic Vertical tail,  $\frac{1}{2}$  vertical

Refer to the immediately following pages for dimensional data of each component. Figure 2 shows the general dimensions of the overall orbiter while Figure 3 depicts a typical tunnel installation. Component combinations tested are as follows:

|         |           |
|---------|-----------|
| B6      | B6H13V5   |
| B6W6    | B6W6H13V5 |
| B6W8    | B6W6H12V5 |
| B6W9    | B6W9H12V5 |
| B6W6H12 | B7        |
| B6W6H13 | B7W9      |
| B6W8H12 | B7W9H12   |
| B6W8H13 | B7W9H13   |
| B6W9H12 | B7W9H12V5 |
| B6W9H13 | B7W9H13V5 |

The only control deflection tested was the horizontal tail. The entire tail was deflected  $0^\circ$ ,  $\pm 10^\circ$ ,  $\pm 20^\circ$ ,  $\pm 30^\circ$ ,  $- 40^\circ$ ,  $- 50^\circ$  for elevator effect and the left and right halves of the horizontal tail were deflected  $20^\circ/-20^\circ$  and  $10^\circ/10^\circ$  for aileron effect. The Data Set Collation Sheet gives a complete run summary on the configurations investigated.

NASA GUN - RC9

MODEL COMPONENT: BODY - B6

GENERAL DESCRIPTION: BASIC FUSELAGE & STRAIGHT WING  
ORBITER

DRAWING NUMBER: S-870-2, -4, -10, -18, -20, -30, -51, -53

| <u>DIMENSIONS:</u>                          | <u>FULL-SCALE</u> | <u>MODEL SCALE</u> |
|---------------------------------------------|-------------------|--------------------|
| Length, <u>FT</u>                           | <u>172.33</u>     | <u>1.31</u>        |
| Max. Width, <u>IN.</u>                      | <u>310.00</u>     | <u>2.35</u>        |
| Max. Depth, <u>IN.</u>                      | <u>340.34</u>     | <u>2.57</u>        |
| Fineness Ratio                              | <u>6.037</u>      | <u>6.037</u>       |
| Area                                        |                   |                    |
| Max. Cross-Sectional, <u>ft<sup>2</sup></u> | <u>140.03</u>     | <u>0.037</u>       |
| Planform                                    | <u>          </u> | <u>          </u>  |
| Wetted                                      | <u>          </u> | <u>          </u>  |
| Base - <u>ft<sup>2</sup></u>                | <u>          </u> | <u>.00926</u>      |

NAIL 629 20114

MODEL COMPONENT: BODY - B7

GENERAL DESCRIPTION: Modified B6 - chine radius changed

DRAWING NUMBER:

S-875

DIMENSIONS:

FULL-SCALE

MODEL SCALE

Length,  $in$

172.33

1.31

Max. Width,  $in$

308.80

2.35

Max. Depth,  $in$

337.71

2.57

Fineness Ratio

10.22

6.282

Area

Max. Cross-Sectional,  $in^2$

590.99

0.034

Planform

\_\_\_\_\_

\_\_\_\_\_

Wetted

\_\_\_\_\_

\_\_\_\_\_

Base  $ft^2$

\_\_\_\_\_

.00926

MODEL COMPONENT: WING - WING

GENERAL DESCRIPTION: BASIC STRAIGHT WING

DRAWING NUMBER:

LINES DWD. 9992-1306  
S-870-6-7

DIMENSIONS:

FULL-SCALE

MODEL SCALE

TOTAL DATA

|                            |              |        |
|----------------------------|--------------|--------|
| Area                       |              |        |
| Planform, $FT^2$           | 3107.22      | 0.18   |
| Wetted                     |              |        |
| Span (equivalent), $FT$    | 104.15       | 0.94   |
| Aspect Ratio               | 4.961        | 4.961  |
| Rate of Taper              | 0.397        | 0.397  |
| Taper Ratio                | 0.333        | 0.333  |
| Dihedral Angle, degrees    | 7.000        | 7.000  |
| Incidence Angle, degrees   | 0.000        | 0.000  |
| Aerodynamic Twist, degrees | -4.000       | -4.000 |
| Toe-In Angle               |              |        |
| Cant Angle                 |              |        |
| Sweep Back Angles, degrees |              |        |
| Leading Edge               | 21.673       | 21.673 |
| Trailing Edge              | 0.000        | 0.000  |
| 0.25 Element Line          | 16.576       | 16.576 |
| Chords:                    |              |        |
| Root (Wing Sta. 0.0), $IN$ | 447.00       | 3.40   |
| Tip, (equivalent), $IN$    | 148.47       | 1.13   |
| MAC, inches                | 322.45       | 2.46   |
| Fus. Sta. of .25 MAC, $IN$ | 117.35       | 0.92   |
| W.P. of .25 MAC, $IN$      | -148.87      | -1.13  |
| Airfoil Section            |              |        |
| Root, EXPOSED              | NACA 0012-64 |        |
| Tip                        | NACA 0012-64 |        |

EXPOSED DATA

|                            |         |       |
|----------------------------|---------|-------|
| Area, $FT^2$               | 2205.92 | 0.13  |
| Span, (equivalent), $FT$   | 48.31   | 0.75  |
| Aspect Ratio               | 4.386   | 4.386 |
| Taper Ratio                | 0.387   | 0.387 |
| Chords                     |         |       |
| Root, $IN$                 | 385.25  | 2.93  |
| Tip (EQUIVALENT), $IN$     | 148.47  | 1.13  |
| MAC, $IN$                  | 254.42  | 2.17  |
| Fus. Sta. of .25 MAC, $IN$ | 120.67  | 0.94  |
| W.P. of .25 MAC, $IN$      | -137.09 | -1.04 |

LEADING EDGE CURVE

Area,  $FT^2$

44.47 0.00258

NACA 639-RC4

MODEL COMPONENT: WING - W6

GENERAL DESCRIPTION: BASIC WING W6 moved 2ft 48.4 inches

DRAWING NUMBER:

LINES DWG. 7992-1300  
5-870-6-7

DIMENSIONS:

FULL-SCALE

MODEL SCALE

TOTAL DATA

|                            |              |        |
|----------------------------|--------------|--------|
| Area                       |              |        |
| Planform, $FT^2$           | 3107.22      | 0.18   |
| Wetted                     |              |        |
| Span (equivalent), $FT$    | 124.15       | 0.74   |
| Aspect Ratio               | 4.961        | 4.961  |
| Rate of Taper              | 0.397        | 0.397  |
| Taper Ratio                | 0.333        | 0.333  |
| Diehedral Angle, degrees   | 7.000        | 7.000  |
| Incidence Angle, degrees   | 0.000        | 0.000  |
| Aerodynamic Twist, degrees | -4.000       | -4.000 |
| Toe-In Angle               |              |        |
| Cant Angle                 |              |        |
| Sweep Back Angles, degrees |              |        |
| Leading Edge               | 21.672       | 21.672 |
| Trailing Edge              | 0.000        | 0.000  |
| 0.25 Element Line          | 16.596       | 16.596 |
| Chords:                    |              |        |
| Root (Wing Sta. 0.0), $IN$ | 447.20       | 3.40   |
| Tip, (equivalent), $IN$    | 148.97       | 1.13   |
| MAC, inches                | 322.95       | 2.46   |
| Fus. Sta. of .25 MAC, $IN$ | 1220.34      | 9.29   |
| W.P. of .25 MAC, $IN$      | -148.87      | -1.13  |
| Airfoil Section            |              |        |
| Root                       | NACA 0012-64 |        |
| Tip                        | NACA 0012-64 |        |

EXPOSED DATA

|                            |         |       |
|----------------------------|---------|-------|
| Area, $FT^2$               | 2204.24 | 0.13  |
| Span, (equivalent), $FT$   | 98.31   | 0.75  |
| Aspect Ratio               | 4.385   | 4.385 |
| Taper Ratio                | 0.387   | 0.387 |
| Chords                     |         |       |
| Root, $IN$                 | 385.13  | 2.93  |
| Tip (EQUIVALENT), $IN$     | 148.97  | 1.13  |
| MAC, $IN$                  | 284.45  | 2.16  |
| Fus. Sta. of .25 MAC, $IN$ | 1244.21 | 9.51  |
| W.P. of .25 MAC, $IN$      | -137.06 | -1.04 |

LEADING EDGE CURF

|              |       |         |
|--------------|-------|---------|
| Area, $FT^2$ | 27.17 | 0.00157 |
|--------------|-------|---------|

NAAL 629 - RC 1

MODEL COMPONENT: W1116 - W9

GENERAL DESCRIPTION: BASIC Numb W6 moved aft 96.9 inches

DRAWING NUMBER:

LINES DWG. 9992-1300  
5-870-6-7

DIMENSIONS:

FULL-SCALE

MODEL SCALE

TOTAL DATA

|                            |                     |                |
|----------------------------|---------------------|----------------|
| Area                       |                     |                |
| Planform, $FT^2$           | <u>3107.22</u>      | <u>0.18</u>    |
| Wetted                     |                     |                |
| Span (equivalent), $FT$    | <u>124.15</u>       | <u>0.94</u>    |
| Aspect Ratio               | <u>4.961</u>        | <u>4.961</u>   |
| Rate of Taper              | <u>0.397</u>        | <u>0.397</u>   |
| Taper Ratio                | <u>0.333</u>        | <u>0.333</u>   |
| Dihedral Angle, degrees    | <u>2.000</u>        | <u>2.000</u>   |
| Incidence Angle, degrees   | <u>0.000</u>        | <u>0.000</u>   |
| Aerodynamic Twist, degrees | <u>-4.000</u>       | <u>-4.000</u>  |
| Toe-In Angle               |                     |                |
| Cant Angle                 |                     |                |
| Sweep Back Angles, degrees |                     |                |
| Leading Edge               | <u>21.672</u>       | <u>21.672</u>  |
| Trailing Edge              | <u>0.000</u>        | <u>0.000</u>   |
| 0.25 Element Line          | <u>111.576</u>      | <u>111.576</u> |
| Chords:                    |                     |                |
| Root (Wing Sta. 0.0), $IN$ | <u>447.20</u>       | <u>3.40</u>    |
| Tip, (equivalent), $IN$    | <u>148.97</u>       | <u>1.13</u>    |
| MAC, inches                | <u>322.95</u>       | <u>2.46</u>    |
| Fus. Sta. of .25 MAC, $IN$ | <u>1268.83</u>      | <u>9.66</u>    |
| W.P. of .25 MAC, $IN$      | <u>-148.87</u>      | <u>-1.13</u>   |
| Airfoil Section            |                     |                |
| Root                       | <u>NACA 0012-64</u> |                |
| Tip                        | <u>NACA 0012-64</u> |                |

EXPOSED DATA

|                            |                |              |
|----------------------------|----------------|--------------|
| Area, $FT^2$               | <u>2204.21</u> | <u>0.13</u>  |
| Span, (equivalent), $FT$   | <u>98.31</u>   | <u>0.75</u>  |
| Aspect Ratio               | <u>4.385</u>   | <u>4.385</u> |
| Taper Ratio                | <u>0.387</u>   | <u>0.387</u> |
| Chords                     |                |              |
| Root, $IN$                 | <u>385.13</u>  | <u>2.92</u>  |
| Tip (equivalent), $IN$     | <u>148.97</u>  | <u>1.13</u>  |
| MAC, $IN$                  | <u>284.45</u>  | <u>2.16</u>  |
| Fus. Sta. of .25 MAC, $IN$ | <u>1247.70</u> | <u>9.88</u>  |
| W.P. of .25 MAC, $IN$      | <u>-137.06</u> | <u>-1.04</u> |

LEADING EDGE LUFF

AREA,  $FT^2$

10

10.42

0.0000

NAAAL 629 - RC4

MODEL COMPONENT: HORIZONTAL TAIL - 412

GENERAL DESCRIPTION: \_\_\_\_\_

DRAWING NUMBER: \_\_\_\_\_

LINES DWG 1992-1306

S-871; S-876-1, -2

DIMENSIONS:

FULL-SCALE

MODEL SCALE

TOTAL DATA

|                            |           |        |
|----------------------------|-----------|--------|
| Area                       |           |        |
| Planform, $FT^2$           | 1815.34   | 0.11   |
| Wetted                     |           |        |
| Span (equivalent), $FT$    | 79.48     | 0.60   |
| Aspect Ratio               | 3.480     | 3.480  |
| Rate of Taper              | 0.712     | 0.712  |
| Taper Ratio                | 0.228     | 0.228  |
| Dihedral Angle, degrees    | 7.000     | 7.000  |
| Incidence Angle, degrees   | 0.000     | 0.000  |
| Aerodynamic Twist, degrees | 0.000     | 0.000  |
| Toe-In Angle               |           |        |
| Cant Angle                 |           |        |
| Sweep Back Angles, degrees |           |        |
| Leading Edge               | 39.789    | 39.789 |
| Trailing Edge              | 6.897     | 6.897  |
| 0.25 Element Line          | 33.220    | 33.220 |
| Chords: <u>HORIZ</u>       |           |        |
| Root (Wing Sta. 0.0), $IN$ | 443.05    | 3.37   |
| Tip, (equivalent), $IN$    | 101.02    | 0.77   |
| MAC, inches                | 307.87    | 2.34   |
| Fus. Sta. of .25 MAC, $IN$ | 1840.46   | 14.01  |
| W.P. of .25 MAC, $IN$      | 4.12      | 0.03   |
| Airfoil Section            |           |        |
| Root                       | NACA 0012 | -6.4   |
| Tip                        | NACA 0012 | -6.4   |

EXPOSED DATA

|                            |         |       |
|----------------------------|---------|-------|
| Area, $FT^2$               | 974.61  | 0.06  |
| Span, (equivalent), $FT$   | 53.64   | 0.41  |
| Aspect Ratio               | 2.952   | 2.952 |
| Taper Ratio                | 0.304   | 0.304 |
| Chords                     |         |       |
| Root, $IN$                 | 331.84  | 2.53  |
| Tip (EQUIVALENT), $IN$     | 101.02  | 0.77  |
| MAC, $IN$                  | 236.94  | 1.80  |
| Fus. Sta. of .25 MAC, $IN$ | 1406.37 | 14.51 |
| W.P. of .25 MAC, $IN$      | 116.26  | 0.12  |

# NAA-629 ~ RC4

MODEL COMPONENT: HORIZONTAL TAIL - H 13

GENERAL DESCRIPTION: \_\_\_\_\_

DRAWING NUMBER: \_\_\_\_\_

LINES DWG. 9992-1300  
S-871; S-876-7-8

DIMENSIONS:

FULL-SCALE

MODEL SCALE

## TOTAL DATA

|                            |              |        |
|----------------------------|--------------|--------|
| Area                       |              |        |
| Planform, $ft^2$           | 1815.95      | 0.11   |
| Wetted                     |              |        |
| Span (equivalent), $ft$    | 79.55        | 0.61   |
| Aspect Ratio               | 3.485        | 3.485  |
| Rate of Taper              | 0.712        | 0.712  |
| Taper Ratio                | 0.227        | 0.227  |
| Diehedral Angle, degrees   | 2.000        | 2.000  |
| Incidence Angle, degrees   | 0.000        | 0.000  |
| Aerodynamic Twist, degrees | 0.000        | 0.000  |
| Toe-In Angle               |              |        |
| Cant Angle                 |              |        |
| Sweep Back Angles, degrees |              |        |
| Leading Edge               | 44.786       | 44.786 |
| Trailing Edge              | 15.677       | 15.677 |
| 0.25 Element Line          | 39.166       | 39.166 |
| Chords: <u>NACA 0012</u>   |              |        |
| Root (Wing Sta. 0.0), $in$ | 443.05       | 3.37   |
| Tip, (equivalent), $in$    | 100.71       | 0.77   |
| MAC, inches                | 307.80       | 2.34   |
| Fus. Sta. of .25 MAC, $in$ | 1846.60      | 14.05  |
| W.P. of .25 MAC, $in$      | -103.62      | -0.79  |
| Airfoil Section            |              |        |
| Root                       | NACA 0012-64 |        |
| Tip                        | NACA 0012-64 |        |

## EXPOSED DATA

|                            |         |       |
|----------------------------|---------|-------|
| Area, $ft^2$               | 975.22  | 0.06  |
| Span, (equivalent), $ft$   | 53.71   | 0.41  |
| Aspect Ratio               | 2.958   | 2.958 |
| Taper Ratio                | 0.303   | 0.303 |
| Chords                     |         |       |
| Root, $in$                 | 331.84  | 2.53  |
| Tip (equivalent), $in$     | 100.71  | 0.77  |
| MAC, $in$                  | 236.86  | 1.86  |
| Fus. Sta. of .25 MAC, $in$ | 1427.70 | 14.07 |
| W.P. of .25 MAC, $in$      | -91.48  | -0.70 |

NAAL 629 ~ RC4

MODEL COMPONENT: VERTICAL TAIL - V5

GENERAL DESCRIPTION: \_\_\_\_\_

DRAWING NUMBER: LINES DWG 9992-1300  
S-871; S-876-13

DIMENSIONS:

FULL-SCALE

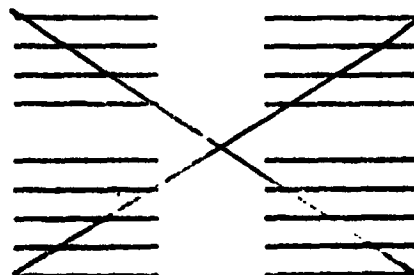
MODEL SCALE

TOTAL DATA

|                            |                     |               |
|----------------------------|---------------------|---------------|
| Area                       |                     |               |
| Planform, $FT^2$           | <u>693.84</u>       | <u>0.04</u>   |
| Wetted                     |                     |               |
| Span (equivalent), $FT$    | <u>32.13</u>        | <u>0.24</u>   |
| Aspect Ratio               | <u>1.488</u>        | <u>1.488</u>  |
| Rate of Taper              | <u>0.721</u>        | <u>0.721</u>  |
| Taper Ratio                | <u>0.302</u>        | <u>0.302</u>  |
| Diehedral Angle, degrees   | <u>    </u>         | <u>    </u>   |
| Incidence Angle, degrees   | <u>    </u>         | <u>    </u>   |
| Aerodynamic Twist, degrees | <u>    </u>         | <u>    </u>   |
| Toe-In Angle               | <u>0.000</u>        | <u>0.000</u>  |
| Cant Angle                 | <u>0.000</u>        | <u>0.000</u>  |
| Sweep Back Angles, degrees |                     |               |
| Leading Edge               | <u>43.250</u>       | <u>43.250</u> |
| Trailing Edge              | <u>12.417</u>       | <u>12.417</u> |
| 0.25 Element Line          | <u>37.255</u>       | <u>37.255</u> |
| Chords: (W.P. 154.40)      |                     |               |
| Root (Wing Sta. 0-0), $IN$ | <u>398.03</u>       | <u>3.029</u>  |
| Tip, (equivalent), $IN$    | <u>120.19</u>       | <u>0.915</u>  |
| MAC, inches                | <u>283.94</u>       | <u>2.161</u>  |
| Fus. Sta. of .25 MAC, $IN$ | <u>193.90</u>       | <u>14.702</u> |
| W.P. of .25 MAC, $IN$      | <u>312.75</u>       | <u>2.380</u>  |
| Airfoil Section            |                     |               |
| Root (W.P. 154.40)         | <u>NACA 0015-64</u> |               |
| Tip (W.P. 541.39)          | <u>NACA 0010-64</u> |               |

EXPOSED DATA

Area,  $FT^2$   
Span, (equivalent)  
Aspect Ratio  
Taper Ratio  
Chords  
    Root  
    Tip  
    MAC  
    Fus. Sta. of .25 MAC  
    W.P. of .25 MAC



TEST NAAL-629 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

| DATA SET IDENTIFIER | CONFIGURATION | SCHED.   |         | CONTROL DEFLECTION |  | NO. OF RUNS | MACH NUMBERS |    |  |  |  |  |  |  |  |  |
|---------------------|---------------|----------|---------|--------------------|--|-------------|--------------|----|--|--|--|--|--|--|--|--|
|                     |               | $\alpha$ | $\beta$ |                    |  |             | 26           | 1  |  |  |  |  |  |  |  |  |
| KC4001              | B6            | A        | 0       |                    |  |             |              |    |  |  |  |  |  |  |  |  |
| A 030               |               | A        | 0       |                    |  |             |              | 1  |  |  |  |  |  |  |  |  |
| 002                 |               | 0        | B       |                    |  |             |              | 30 |  |  |  |  |  |  |  |  |
| 084                 |               | 0        | B       |                    |  |             |              | 2  |  |  |  |  |  |  |  |  |
| 085                 |               | 10       | B       |                    |  |             |              | 84 |  |  |  |  |  |  |  |  |
| 003                 |               | 20       | B       |                    |  |             |              | 85 |  |  |  |  |  |  |  |  |
| 086                 |               | 20       | B       |                    |  |             |              | 3  |  |  |  |  |  |  |  |  |
| 004                 |               | 60       | B       |                    |  |             |              | 86 |  |  |  |  |  |  |  |  |
| 087                 |               | 60       | B       |                    |  |             |              | 4  |  |  |  |  |  |  |  |  |
| 034                 |               | 60       | B       |                    |  |             |              | 87 |  |  |  |  |  |  |  |  |
| 005                 | B6W6          | A        | 0       |                    |  |             |              | 34 |  |  |  |  |  |  |  |  |
| 063                 |               | A        | 0       |                    |  |             |              | 5  |  |  |  |  |  |  |  |  |
| 017                 |               | 0        | B       |                    |  |             |              | 63 |  |  |  |  |  |  |  |  |
| 064                 |               | 10       |         |                    |  |             |              | 17 |  |  |  |  |  |  |  |  |
| 008                 |               | 20       |         |                    |  |             |              | 64 |  |  |  |  |  |  |  |  |
| 006                 |               | 60       |         |                    |  |             |              | 8  |  |  |  |  |  |  |  |  |
| 007                 |               | 60       |         |                    |  |             |              | 6  |  |  |  |  |  |  |  |  |
| 024                 | B6W8          | A        | 0       |                    |  |             |              | 7  |  |  |  |  |  |  |  |  |
| 025                 | B6W9          | A        | 0       |                    |  |             |              | 24 |  |  |  |  |  |  |  |  |
|                     |               |          |         |                    |  |             |              | 25 |  |  |  |  |  |  |  |  |

COEFFICIENTS:

1 7 13 19 25 31 37 43 49 55 61

CL CDF ICNM CN CAFOREICWN CSL CY CNM/ANL/D

A) -4  $\Delta Z$  20; 20  $\Delta S$  70

B) -8, -6, -4, -2, 0, 2, 4

C) -15  $\Delta Z$  5, 10, 15, 20, 25, 30

$\alpha$  or  $\beta$   
SCHEDULES

NDV

TEST NAAL 629 DATA SET COLLATION SHEET

☐ PRETEST  
☒ POSTTEST

| DATA SET IDENTIFIER | CONFIGURATION | SCHD.    |         |          | CONTROL DEFLECTION |            |         | NO. OF RUNS | MACH NUMBERS |          |         |          |           |       |       |       |            |       |
|---------------------|---------------|----------|---------|----------|--------------------|------------|---------|-------------|--------------|----------|---------|----------|-----------|-------|-------|-------|------------|-------|
|                     |               | $\alpha$ | $\beta$ | $\gamma$ | $\delta$           | $\epsilon$ | $\zeta$ |             | $\eta$       | $\theta$ | $\iota$ | $\kappa$ | $\lambda$ | $\mu$ | $\nu$ | $\xi$ | $\omicron$ | $\pi$ |
| RC4035              | B6W6H12       | A        | 0       | 0        | 0                  | 0          | 0       |             | 35           |          |         |          |           |       |       |       |            |       |
| 059                 |               | 0        | B       | 1        | 1                  |            |         |             | 59           |          |         |          |           |       |       |       |            |       |
| 060                 |               | 10       | B       |          |                    |            |         |             | 60           |          |         |          |           |       |       |       |            |       |
| 061                 |               | 20       | B       |          |                    |            |         |             | 61           |          |         |          |           |       |       |       |            |       |
| 062                 |               | 40       | B       |          |                    |            |         |             | 62           |          |         |          |           |       |       |       |            |       |
| 009                 | B6W6H13       | A        | 0       |          |                    |            |         |             | 9            |          |         |          |           |       |       |       |            |       |
| 079                 |               | A        | 0       |          |                    |            |         |             | 79           |          |         |          |           |       |       |       |            |       |
| 012                 |               | 2        | B       |          |                    |            |         |             | 12           |          |         |          |           |       |       |       |            |       |
| 080                 |               | 10       | B       |          |                    |            |         |             | 80           |          |         |          |           |       |       |       |            |       |
| 011                 |               | 20       | B       |          |                    |            |         |             | 11           |          |         |          |           |       |       |       |            |       |
| 010                 |               | 60       | B       |          |                    |            |         |             | 10           |          |         |          |           |       |       |       |            |       |
| 028                 | B6W8H12       | A        | 0       |          |                    |            |         |             | 28           |          |         |          |           |       |       |       |            |       |
| 029                 | B6W8H13       | A        | 0       |          |                    |            |         |             | 29           |          |         |          |           |       |       |       |            |       |
| 027                 | B6W9H12       | A        | 0       |          |                    |            |         |             | 27           |          |         |          |           |       |       |       |            |       |
| 120                 | B6W9H12       | C        | 0       |          |                    |            |         |             | 120          |          |         |          |           |       |       |       |            |       |
| 026                 | B6W9H13       | A        | 0       |          |                    |            |         |             | 26           |          |         |          |           |       |       |       |            |       |
| 081                 | B6H13V5       | A        | 0       |          | 0                  | 0          |         |             | 81           |          |         |          |           |       |       |       |            |       |
| 082                 |               | A        | 0       | 10       | 10                 |            |         |             | 82           |          |         |          |           |       |       |       |            |       |
| RC4083              |               | A        | 0       | -10      | -10                |            |         |             | 83           |          |         |          |           |       |       |       |            |       |



$\alpha$  or  $\beta$  \_\_\_\_\_  
 SCHEDULES \_\_\_\_\_  
 NDV \_\_\_\_\_  
 SHEET 2 of 6

TEST NAAL 629 DATA SET COLLATION SHEET

☐ PRETEST  
☒ POSTTEST

| DATA SET IDENTIFIER | CONFIGURATION | SCHD.    |         | CONTROL DEFLECTION |            | NO. OF RUNS | MACH NUMBERS |  |  |  |  |  |  |  |  |  |
|---------------------|---------------|----------|---------|--------------------|------------|-------------|--------------|--|--|--|--|--|--|--|--|--|
|                     |               | $\alpha$ | $\beta$ | $\delta$           | $\delta_H$ |             | .21          |  |  |  |  |  |  |  |  |  |
| RC4013              | B6W6H13V5     | A        | 0       | 0                  | 0          |             | 13           |  |  |  |  |  |  |  |  |  |
| A 016               |               | 0        | B       |                    |            |             | 16           |  |  |  |  |  |  |  |  |  |
| 015                 |               | 20       |         |                    |            |             | 15           |  |  |  |  |  |  |  |  |  |
| 014                 |               | 60       |         |                    |            |             | 14           |  |  |  |  |  |  |  |  |  |
| 065                 |               | A        | 0       | -50                | -50        |             | 65           |  |  |  |  |  |  |  |  |  |
| 066                 |               | 0        | B       |                    |            |             | 66           |  |  |  |  |  |  |  |  |  |
| 067                 |               | 10       |         |                    |            |             | 67           |  |  |  |  |  |  |  |  |  |
| 068                 |               | 20       |         |                    |            |             | 68           |  |  |  |  |  |  |  |  |  |
| 069                 |               | 60       |         |                    |            |             | 69           |  |  |  |  |  |  |  |  |  |
| 070                 |               | A        | 0       | -40                | -40        |             | 70           |  |  |  |  |  |  |  |  |  |
| 071                 |               |          |         | -30                | -30        |             | 71           |  |  |  |  |  |  |  |  |  |
| 072                 |               |          |         | -20                | -20        |             | 72           |  |  |  |  |  |  |  |  |  |
| 074                 |               |          |         | -10                | -10        |             | 74           |  |  |  |  |  |  |  |  |  |
| 076                 |               |          |         | 10                 | 10         |             | 76           |  |  |  |  |  |  |  |  |  |
| 077                 |               |          |         | 20                 | 20         |             | 77           |  |  |  |  |  |  |  |  |  |
| 078                 |               |          |         | 30                 | 30         |             | 78           |  |  |  |  |  |  |  |  |  |
| 073                 |               |          |         | 20                 | -20        |             | 73           |  |  |  |  |  |  |  |  |  |
| 075                 |               |          |         | 10                 | -10        |             | 75           |  |  |  |  |  |  |  |  |  |
| 053                 | B6W6H12V5     | A        | 0       | 20                 | -20        |             | 53           |  |  |  |  |  |  |  |  |  |
| RC4055              | B6W6H12V5     | A        | 0       | 10                 | -10        |             | 55           |  |  |  |  |  |  |  |  |  |

16

|   |   |    |    |    |    |    |    |    |    |    |
|---|---|----|----|----|----|----|----|----|----|----|
| 1 | 7 | 13 | 19 | 25 | 31 | 37 | 43 | 49 | 55 | 61 |
|---|---|----|----|----|----|----|----|----|----|----|

COEFFICIENTS:

$\alpha$  or  $\beta$  SCHEDULES \_\_\_\_\_  
NOV \_\_\_\_\_  
SHEET 3 of 6

TEST NAAL 629 DATA SET COLLATION SHEET

☐ PRETEST  
☒ POSTTEST

| DATA SET IDENTIFIER | CONFIGURATION | SCHD.    |         | CONTROL DEFLECTION |          | NO. of RUNS | MACH NUMBERS |    |    |    |    |    |    |    |    |    |
|---------------------|---------------|----------|---------|--------------------|----------|-------------|--------------|----|----|----|----|----|----|----|----|----|
|                     |               | $\alpha$ | $\beta$ | $\zeta$            | $\delta$ |             | .26          | 40 | 42 | 43 | 44 | 41 | 45 | 46 | 47 | 48 |
| RC4040              | B6N6H12V5     | A        | 0       | 0                  | 0        |             |              |    |    |    |    |    |    |    |    |    |
| 042                 |               | 0        | B       |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 043                 |               | 10       |         |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 044                 |               | 20       |         |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 041                 |               | 60       |         |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 045                 |               | A        | 0       | -50                | -50      |             |              |    |    |    |    |    |    |    |    |    |
| 046                 |               | 0        | B       |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 047                 |               | 10       |         |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 048                 |               | 20       |         |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 049                 |               | 60       |         |                    |          |             |              |    |    |    |    |    |    |    |    |    |
| 050                 |               | A        | 0       | -40                | -40      |             |              |    |    |    |    |    |    |    |    |    |
| 051                 |               |          |         | -30                | -30      |             |              |    |    |    |    |    |    |    |    |    |
| 052                 |               |          |         | -20                | -20      |             |              |    |    |    |    |    |    |    |    |    |
| 054                 |               |          |         | -10                | -10      |             |              |    |    |    |    |    |    |    |    |    |
| 056                 |               |          |         | 10                 | 10       |             |              |    |    |    |    |    |    |    |    |    |
| 057                 |               |          |         | 20                 | 20       |             |              |    |    |    |    |    |    |    |    |    |
| 058                 |               |          |         | 30                 | 30       |             |              |    |    |    |    |    |    |    |    |    |
| 118                 | B6N9H12V5     | C        | 0       | 0                  | 0        |             |              |    |    |    |    |    |    |    |    |    |
| 119                 |               | 20       | B       | 0                  | 0        |             |              |    |    |    |    |    |    |    |    |    |
| RC4121              |               | 6        | B       | 0                  | 0        |             |              |    |    |    |    |    |    |    |    |    |
|                     |               | 7        |         | 13                 |          |             | 25           | 31 | 37 | 43 | 49 | 55 | 61 |    |    |    |

COEFFICIENTS:

$\alpha$  or  $\beta$   
 SCHEDULES

NDV

SHEET 4 of 6

TEST NAAL 629 DATA SET COLLATION SHEET

☐ PRETEST  
☒ POSTTEST

| DATA SET IDENTIFIER | CONFIGURATION | SCHD.    |         | CONTROL DEFLECTION |              | NO. OF RUNS | MACH NUMBERS |  |  |  |  |  |  |  |  |  |
|---------------------|---------------|----------|---------|--------------------|--------------|-------------|--------------|--|--|--|--|--|--|--|--|--|
|                     |               | $\alpha$ | $\beta$ | $\zeta_H$          | $\zeta_{H2}$ |             |              |  |  |  |  |  |  |  |  |  |
| RC4088              | B7            | A        | 0       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 089                 | ↓             | 0        | B       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 090                 | ↓             | 10       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 091                 | ↓             | 20       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 092                 | ↓             | 60       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 093                 | B7W9          | A        | 0       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 094                 | ↓             | 0        | B       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 095                 | ↓             | 10       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 096                 | ↓             | 20       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 097                 | ↓             | 60       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 098                 | B7W9H12       | A        | 0       | 0                  | 0            |             |              |  |  |  |  |  |  |  |  |  |
| 099                 | ↓             | 0        | B       | ↓                  | ↓            |             |              |  |  |  |  |  |  |  |  |  |
| 100                 | ↓             | 10       | ↓       | ↓                  | ↓            |             |              |  |  |  |  |  |  |  |  |  |
| 101                 | ↓             | 20       | ↓       | ↓                  | ↓            |             |              |  |  |  |  |  |  |  |  |  |
| 102                 | ↓             | 60       | ↓       | ↓                  | ↓            |             |              |  |  |  |  |  |  |  |  |  |
| 113                 | B7W9H13       | A        | 0       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 114                 | ↓             | 0        | B       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 115                 | ↓             | 10       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 116                 | ↓             | 20       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| 117                 | ↓             | 60       | ↓       | —                  | —            |             |              |  |  |  |  |  |  |  |  |  |
| RC4117              |               |          |         |                    |              |             |              |  |  |  |  |  |  |  |  |  |

COEFFICIENTS:

$\alpha$  or  $\beta$   
SCHEDULES

SHEET 5 of 6

NDV

# TEST NAAL 629 DATA SET COLLATION SHEET

☐ PRETEST

☒ POSTTEST

| DATA SET IDENTIFIER | CONFIGURATION | SCHD. |   |   | CONTROL DEFLECTION |     |     | NO. OF RUNS | MACH NUMBERS |    |    |    |    |    |    |  |  |  |
|---------------------|---------------|-------|---|---|--------------------|-----|-----|-------------|--------------|----|----|----|----|----|----|--|--|--|
|                     |               | a     | b | c | Sum                | Sum | Sum |             | 24           | 31 | 37 | 43 | 49 | 55 | 61 |  |  |  |
| RC4103              | B7W9H12Y5     | A     | 0 | 0 | 0                  | 0   | 0   |             | 103          |    |    |    |    |    |    |  |  |  |
| 104                 |               | 0     | B |   |                    |     |     |             | 104          |    |    |    |    |    |    |  |  |  |
| 105                 |               | 10    |   |   |                    |     |     |             | 105          |    |    |    |    |    |    |  |  |  |
| 106                 |               | 20    |   |   |                    |     |     |             | 106          |    |    |    |    |    |    |  |  |  |
| 107                 |               | 60    |   |   |                    |     |     |             | 107          |    |    |    |    |    |    |  |  |  |
| 108                 | B7W9H13Y5     | A     | 0 |   |                    |     |     |             | 108          |    |    |    |    |    |    |  |  |  |
| 109                 |               | 0     | B |   |                    |     |     |             | 109          |    |    |    |    |    |    |  |  |  |
| 110                 |               | 10    |   |   |                    |     |     |             | 110          |    |    |    |    |    |    |  |  |  |
| 111                 |               | 20    |   |   |                    |     |     |             | 111          |    |    |    |    |    |    |  |  |  |
| RC4112              |               | 60    |   |   |                    |     |     |             | 112          |    |    |    |    |    |    |  |  |  |

CORRECTIONS:

a of b  
SCHEMULES

NOV

SHEET 6 of 6

## TEST FACILITY DESCRIPTION

The North American Rockwell Aerodynamics Laboratory (NAAL) 7.75 x 11 foot Wind Tunnel (located at the International Airport, Los Angeles, California) is a continuous flow, closed circuit single return type tunnel, capable of speeds up to 220 miles per hour. The test section is vented to atmospheric pressure and is 7.75 feet high by 11 feet wide by 12 feet in length. Power is supplied by a 1250 horsepower nacelle mounted synchronous motor driving a 19 foot seven blade laminated birch propeller. The airspeed is controlled by varying the degree of coupling between the motor and propeller by means of a magnetic clutch. A damping screen and honeycomb section have been installed in the settling chamber upstream from the contraction cone (ratio 7.53 to 1) to minimize turbulence in the test section. The NAAL Wind Tunnel has been in operation since June 1943 and calibrations are available over a wide range of test conditions.

Tests may be conducted using a variety of mounting systems, e.g., a single strut, double strut, sting strut, reflection plane, cable suspension, and two dimensional wall. Aerodynamic data may be measured by a planar type external balance system or sting mounted internal balances. Instrumentation is available for recording 24 channels of force data on strip chart recorders and for photographically recording multiple pressures on manometer boards. These data are rapidly reduced and plotted by automatic data processing equipment. Additional information about this facility is presented in the Users Manual for the North American Aviation, Inc., NAAL 7.75 x 11 foot Wind Tunnel (NA-60-1346).

## NOMENCLATURE

| <u>SYMBOL</u> | <u>SADSAC<br/>SYMBOL</u> | <u>DEFINITION</u>                                                                  |
|---------------|--------------------------|------------------------------------------------------------------------------------|
| $A_b$         |                          | base area; $m^2$ , $ft^2$ , $in^2$                                                 |
| $a$           |                          | speed of sound; $m/sec$ , $ft/sec$                                                 |
| AR            | ASPECT                   | aspect ratio, $b^2/S$                                                              |
| $b$           | REFB                     | wing span or reference span; $m$ , $ft$ , $in$                                     |
| $c$           |                          | wing chord; $m$ , $ft$ , $in$                                                      |
| $\bar{c}$     |                          | wing mean aerodynamic chord or reference chord; $m$ , $ft$ , $in$                  |
| c. g.         |                          | center of gravity                                                                  |
| C. P.         |                          | center of pressure                                                                 |
| $C_A$         | CATOTL                   | axial force coefficient, $F_A/q S_{ref}$                                           |
| $C_{A_b}$     | CABASE                   | base axial force coefficient, $[(p_\infty - p_b)/q] (A_b/S_{ref})$                 |
| $C_{A_f}$     | CAFORE                   | forebody axial force coefficient, $C_A - C_{A_b}$                                  |
| $C_D$         | CDTOTL                   | drag force coefficient in the wind axis system, $F_D/q S_{ref}$                    |
| $C_D'$        | CD                       | drag force coefficient in the stability axis system, $F_D'/q S_{ref}$              |
| $C_L$         | CL                       | lift force coefficient (stability or wing axis) $F_L/q S_{ref}$                    |
| $C_{l_r}$     | CRL                      | rolling moment coefficient in body axis system, $M_{x_r}/q S_{ref} b$              |
| $C_{l_{r,s}}$ | CSL                      | rolling moment coefficient in the stability axis system, $M_{x_{r,s}}/q S_{ref} b$ |
| $C_{l_{r,w}}$ | CWL                      | rolling moment coefficient in the wind axis system, $M_{x_{r,w}}/q S_{ref} b$      |

# **NOMENCLATURE (Continued)**

| <b><u>SYMBOL</u></b> | <b><u>SADSAC<br/>SYMBOL</u></b> | <b><u>DEFINITION</u></b>                                                         |
|----------------------|---------------------------------|----------------------------------------------------------------------------------|
| $C_m$                | CNM                             | pitching moment coefficient in the body axis system, $M_y/q S_{ref} l_{ref}$     |
| $C_{m,s}$            | CNM                             | pitching moment coefficient in the stability axis system, $C_{m,s} = C_m$        |
| $C_{m,w}$            | CWM                             | pitching moment coefficient in the wind axis system, $M_{y,w}/q S_{ref} l_{ref}$ |
| $C_N$                | CN                              | normal force coefficient in the body axis system, $F_N/q S_{ref}$                |
| $C_n$                | CYM                             | yawing moment coefficient in the body axis system, $M_z/q S_{ref} b$             |
| $C_{n,s}$            | CWN                             | yawing moment coefficient in the stability axis system, $C_{n,s} = C_n$          |
| $C_{n,w}$            | CWN                             | yawing moment coefficient in the wind axis system, $M_{z,w}/q S_{ref} b$         |
| $C_p$                | CP                              | pressure coefficient, $(p - p_\infty)/q$                                         |
| $C_y$                | CY                              | side force coefficient (body or stability axis system), $F_y/q S_{ref}$          |
| $F_A$                |                                 | axial force; N, lb                                                               |
| $F_D$                |                                 | drag force in wind axis system; N, lb                                            |
| $F'_D$               |                                 | drag force in the stability axis system; N, lb                                   |
| $F_L$                |                                 | lift force (stability or wind axis system); N, lb                                |
| $F_N$                |                                 | normal force; N, lb                                                              |
| $F_Y$                |                                 | side force; N, lb                                                                |
| $l_{ref}$            | REFL                            | reference length ; m, ft, in                                                     |
| $L/D$                | L/D                             | lift-to-drag ratio, $C_L/C_D$                                                    |
| $M$                  | MACH                            | Mach number                                                                      |

# NOMENCLATURE (Continued)

| <u>SYMBOL</u> | <u>SADSAC<br/>SYMBOL</u> | <u>DEFINITION</u>                                                     |
|---------------|--------------------------|-----------------------------------------------------------------------|
| MRP           | MRP                      | abbreviation for moment reference point                               |
| $M_x$         |                          | rolling moment in the body axis system;<br>N-m, ft-lb                 |
| $M_{x,s}$     |                          | rolling moment in the stability axis system;<br>N-m, ft-lb            |
| $M_{x,w}$     |                          | rolling moment in the wind axis system;<br>N-m, ft-lb                 |
| $M_y$         |                          | pitching moment in the body (or stability)<br>axis system; N-m, ft-lb |
| $M_{y,w}$     |                          | pitching moment in the wind axis system;<br>N-m, ft-lb                |
| $M_z$         |                          | yawing moment in the body axis system;<br>N-m, ft-lb                  |
| $M_{z,w}$     |                          | yawing moment in the wind axis system;<br>N-m, ft-lb                  |
| p             |                          | static pressure; N/m <sup>2</sup> ; psi                               |
| P             |                          | total pressure; N/m <sup>2</sup> ; psi                                |
| q             | Q(PSI)<br>Q(PSF)         | dynamic pressure; N/m <sup>2</sup> , psi, psf                         |
| RN/L          | RN/L                     | Reynold's number per unit length; million/ft.                         |
| S             |                          | characteristic area; m <sup>2</sup> , ft <sup>2</sup>                 |
| $S_{ref}$     | REFS                     | reference area; m <sup>2</sup> , ft <sup>2</sup>                      |
| T             |                          | temperature; °K, °C, °R, °F                                           |
| V             |                          | speed of vehicle relative to surrounding<br>atmosphere; m/sec, ft/sec |

# **NOMENCLATURE (Continued)**

| <b><u>SYMBOL</u></b> | <b><u>SADSAC<br/>SYMBOL</u></b> | <b><u>DEFINITION</u></b>                                                                                                                                                                                                                                                        |
|----------------------|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\bar{V}$            |                                 | velocity of vehicle relative to surrounding atmosphere; m/sec, ft/sec                                                                                                                                                                                                           |
| $\alpha$             | <b>ALPHA</b>                    | angle of attack, angle between the projection of the wind $X_w$ -axis on the body X, Z - plane and the body X-axis; deg                                                                                                                                                         |
| $\beta$              | <b>BETA</b>                     | sideslip angle, angle between the wind $X_w$ -axis and the projection of this axis on the body X-Z-plane; deg                                                                                                                                                                   |
| $\gamma$             |                                 | ratio of specific heats                                                                                                                                                                                                                                                         |
| $\Gamma$             | <b>DIHDRL</b>                   | wing dihedral angle; deg                                                                                                                                                                                                                                                        |
| $\delta$             |                                 | control surface deflection angle; deg<br>positive deflections are:<br>aileron - left aileron trailing edge down<br>elevator - trailing edge down<br>rudder - trailing edge to the left<br>flap - trailing edge down<br>tab - trailing edge down with respect to control surface |
| $\rho$               |                                 | air density; $K_g/m^3$ , slugs/ft <sup>3</sup>                                                                                                                                                                                                                                  |
| $\theta$             |                                 | pitch angle, angle of rotation about the body Y-axis, positive when the positive Z-axis is rotated toward the positive X-axis; deg                                                                                                                                              |
| $\phi$               | <b>PHI</b>                      | roll angle, angle of rotation about the body X-axis, positive when the positive Y-axis is rotated toward the positive Z-axis; deg                                                                                                                                               |
| $\psi$               | <b>PSI</b>                      | yaw angle, angle of rotation about the body Z-axis, positive when the positive X-axis is rotated toward the positive Y-axis; deg                                                                                                                                                |

**NOMENCLATURE (Continued)**

**SUBSCRIPTS**

**DEFINITION**

|            |                                  |
|------------|----------------------------------|
| <b>a</b>   | <b>aileron</b>                   |
| <b>b</b>   | <b>base</b>                      |
| <b>c</b>   | <b>canard</b>                    |
| <b>e</b>   | <b>elevator or elevon</b>        |
| <b>f</b>   | <b>flap</b>                      |
| <b>r</b>   | <b>rudder or ruddervator</b>     |
| <b>s</b>   | <b>stability axis system</b>     |
| <b>t</b>   | <b>tail, or total conditions</b> |
| <b>w</b>   | <b>wind axis system</b>          |
| <b>ref</b> | <b>reference conditions</b>      |

FIGURES

- Notes:
1. Positive directions of force coefficients  
moment coefficients, and angles are  
indicated by arrows.
  2. For clarity, origins of wind and stability  
axes have been displaced from the center  
of gravity.

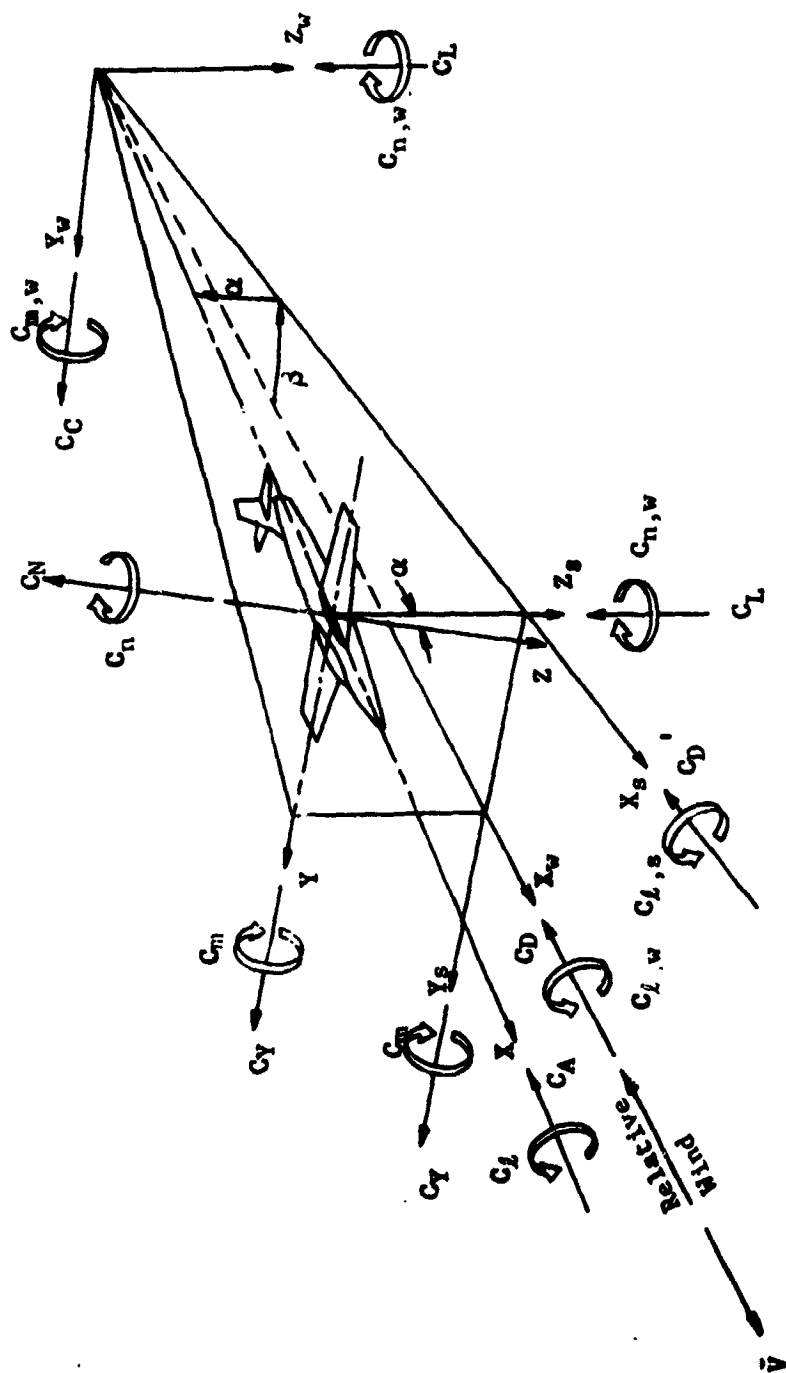
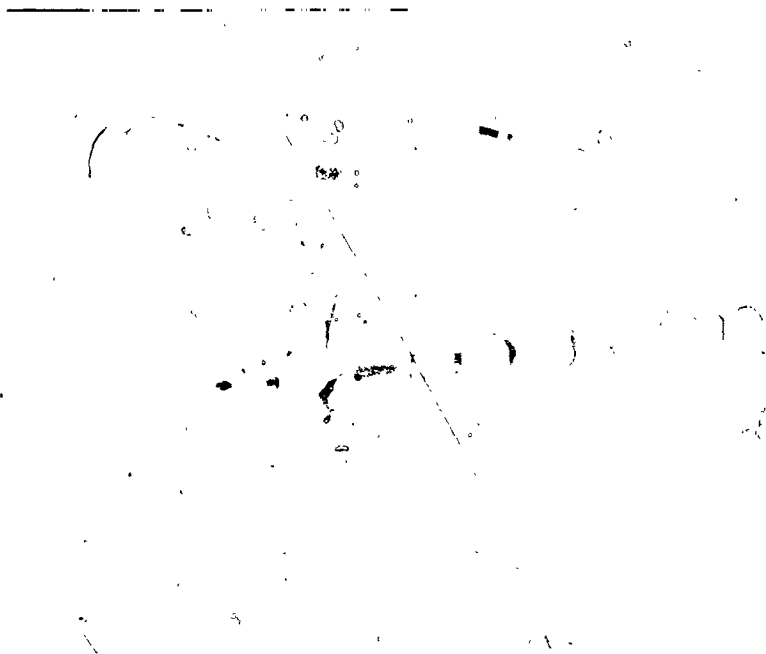


Figure 1. Axis systems, showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle





**a) Top, Front View, B6W6 H12V5 Configuration**



**b) Bottom, Front View, B7W9 Configuration**

**FIGURE 3. TYPICAL TUNNEL INSTALLATION PHOTOGRAPHS**

DATA DISPLAY INDEX

I. Multiple, Dependent Variable vs. Angle of Attack

A) Dependent Variables - CL, CN, CNM, SCG-SL, CAFORE, CDF, L/D

| <u>PLOT TITLES AND DATASET IDENTIFIERS</u>                                                                                                                                                 | <u>DATA BEGINS<br/>ON PLOT PAGE</u> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| COMPONENT BUILDUP-LOW TAIL CONFIGURATION<br>RC4001 RC4005 RC4009 RC4013                                                                                                                    | 1                                   |
| COMPONENT BUILDUP-MID TAIL CONFIGURATION<br>RC4030 RC4063 RC4035 RC4040                                                                                                                    | 7                                   |
| COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS<br>RC4088 RC4093 RC4113 RC4108                                                                                                           | 14                                  |
| COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS<br>RC4088 RC4093 RC4098 RC4103                                                                                                           | 21                                  |
| WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED<br>RC4030 RC4063 RC4024 RC4025                                                                                                          | 28                                  |
| WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION<br>RC4035 RC4028 RC4027 RC4063                                                                                                      | 35                                  |
| WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION<br>RC4079 RC4029 RC4026 RC4063                                                                                                      | 42                                  |
| WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION<br>RC4081 RC4082 RC4083                                                                                                         | 49                                  |
| HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION<br>RC4063 RC4079 RC4013 RC4076 RC4074<br>RC4063 RC4013 RC4074 RC4076 RC4077 RC4078<br>RC4063 RC4013 RC4072 RC4071 RC4070 RC4065 | 56<br>63<br>70                      |
| HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION<br>RC4063 RC4035 RC4040 RC4054 RC4056<br>RC4063 RC4040 RC4054 RC4056 RC4057 RC4058<br>RC4063 RC4040 RC4052 RC4051 RC4050 RC4045 | 77<br>84<br>91                      |
| EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS<br>RC4001 RC4030<br>RC4005 RC4063<br>RC4009 RC4079                                                                          | 98<br>105<br>112                    |
| ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION<br>RC4040 RC4055 RC4053                                                                                                                    | 119                                 |
| ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION<br>RC4013 RC4075 RC4073                                                                                                                    | 126                                 |
| EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS<br>RC4027 RC4120 RC4118                                                                                                       | 133                                 |

B) Dependent Variables - CY, CSL, CWN

| <u>PLOT TITLES AND DATASET IDENTIFIERS</u>                    |             |                            |                 | <u>DATA BEGINS<br/>ON PLOT PAGE</u> |
|---------------------------------------------------------------|-------------|----------------------------|-----------------|-------------------------------------|
| COMPONENT                                                     | BUILDUP-LOW | TAIL CONFIGURATION         | ALFA=0 DEGREES  |                                     |
| RC4002                                                        | RC4012      | RC4017                     | RC4016          | 140                                 |
| COMPONENT                                                     | BUILDUP-LOW | TAIL CONFIGURATION         | ALFA=20 DEGREES |                                     |
| RC4003                                                        | RC4008      | RC4011                     | RC4015          | 143                                 |
| COMPONENT                                                     | BUILDUP-LOW | TAIL CONFIGURATION         | ALFA=60 DEGREES |                                     |
| RC4004                                                        | RC4007      | RC4010                     | RC4014          | 146                                 |
| EFFECT OF                                                     | STING DIA   | ON STATIC AERODYNAMIC CHAR | ALFA=0 DEGREES  |                                     |
| RC4002                                                        | RC4084      |                            |                 | 149                                 |
| EFFECT OF                                                     | STING DIA   | ON STATIC AERODYNAMIC CHAR | ALFA=20 DEGREES |                                     |
| RC4003                                                        | RC4086      |                            |                 | 152                                 |
| EFFECT OF                                                     | STING DIA   | ON STATIC AERODYNAMIC CHAR | ALFA=60 DEGREES |                                     |
| RC4004                                                        | RC4087      |                            |                 | 155                                 |
| STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE |             |                            |                 |                                     |
| RC4084                                                        | RC4085      | RC4086                     | RC4087          | 158                                 |
| RC4017                                                        | RC4064      | RC4008                     | RC4007          | 161                                 |
| RC4059                                                        | RC4060      | RC4061                     | RC4062          | 164                                 |
| RC4041                                                        | RC4042      | RC4043                     | RC4044          | 167                                 |
| RC4046                                                        | RC4047      | RC4048                     | RC4049          | 170                                 |
| RC4089                                                        | RC4090      | RC4091                     | RC4092          | 173                                 |
| RC4094                                                        | RC4095      | RC4096                     | RC4097          | 176                                 |
| RC4114                                                        | RC4115      | RC4116                     | RC4117          | 179                                 |
| RC4109                                                        | RC4110      | RC4111                     | RC4112          | 182                                 |
| RC4099                                                        | RC4100      | RC4101                     | RC4102          | 185                                 |
| RC4104                                                        | RC4105      | RC4106                     | RC4107          | 188                                 |
| RC4044                                                        | RC4119      |                            |                 | 192                                 |
| RC4041                                                        | RC4121      |                            |                 | 195                                 |

II. Multiple, Dependent Variable Crossplots

Dependent Variables - CDF vs. CL, CNM vs CL

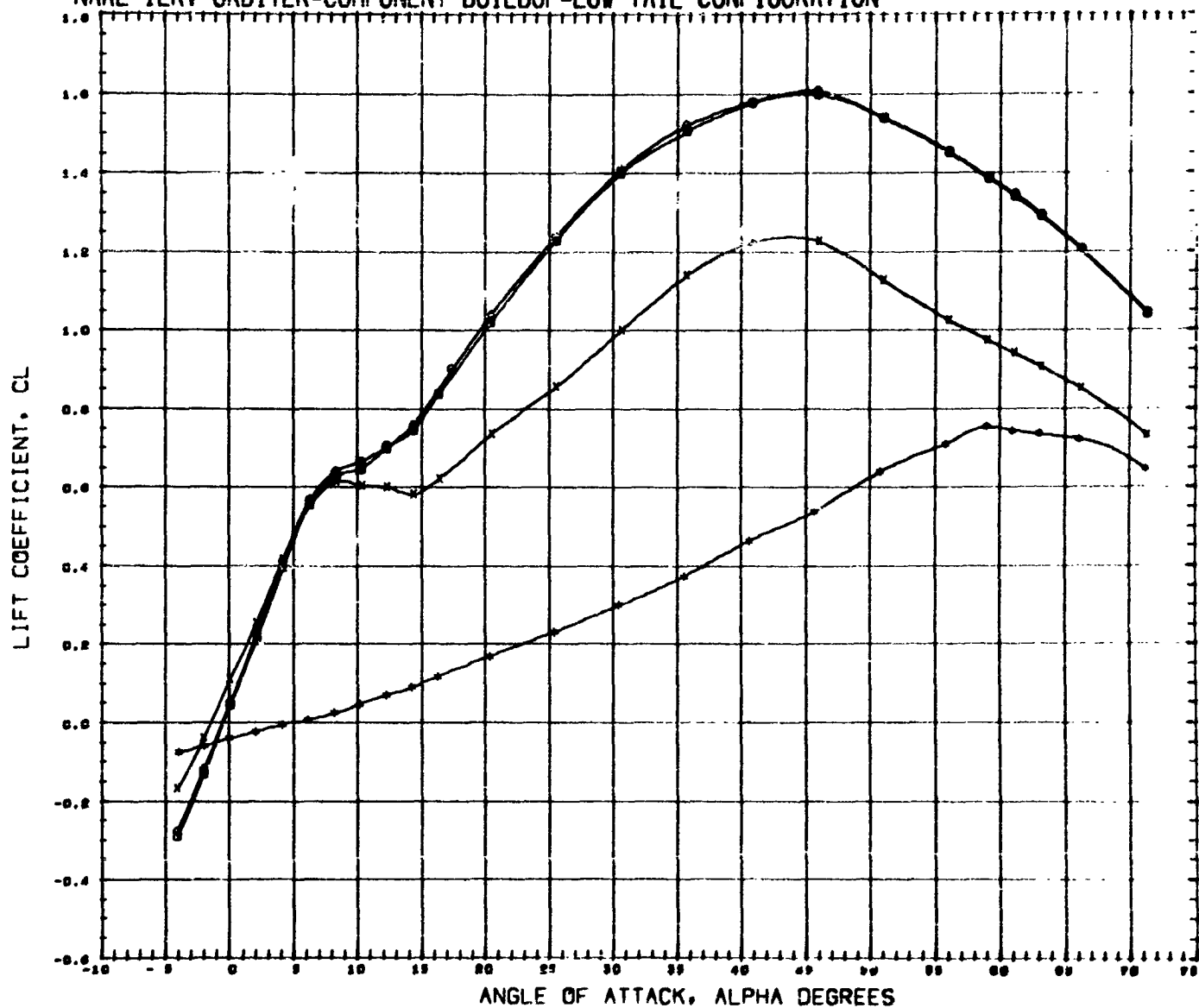
| <u>PLOT TITLES AND DATASET IDENTIFIERS</u> |             |                    |        | <u>DATA BEGINS<br/>ON PLOT PAGE</u> |
|--------------------------------------------|-------------|--------------------|--------|-------------------------------------|
| COMPONENT                                  | BUILDUP-LOW | TAIL CONFIGURATION |        |                                     |
| RC4001                                     | RC4005      | RC4009             | RC4013 | 198                                 |
| COMPONENT                                  | BUILDUP-MID | TAIL CONFIGURATION |        |                                     |
| RC4030                                     | RC4063      | RC4035             | RC4040 | 200                                 |

II. Multiple, Dependent Variable Crossplots (continued)

| PLOT TITLES AND DATASET IDENTIFIERS                            |        |        |        |        | DATA BEGINS<br>ON PLOT PAGE |     |
|----------------------------------------------------------------|--------|--------|--------|--------|-----------------------------|-----|
| COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS              |        |        |        |        |                             |     |
| RC4088                                                         | RC4093 | RC4113 | RC4108 |        | 202                         |     |
| COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS              |        |        |        |        |                             |     |
| RC4088                                                         | RC4093 | RC4098 | RC4103 |        | 204                         |     |
| WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED             |        |        |        |        |                             |     |
| RC4030                                                         | RC4063 | RC4024 | RC4025 |        | 206                         |     |
| WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION         |        |        |        |        |                             |     |
| RC4035                                                         | RC4028 | RC4027 | RC4063 |        | 208                         |     |
| WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION         |        |        |        |        |                             |     |
| RC4079                                                         | RC4029 | RC4026 | RC4063 |        | 210                         |     |
| WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION     |        |        |        |        |                             |     |
| RC4081                                                         | RC4082 | RC4083 |        |        | 212                         |     |
| HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION     |        |        |        |        |                             |     |
| RC4063                                                         | RC4079 | RC4013 | RC4076 | RC4074 | 214                         |     |
| RC4063                                                         | RC4013 | RC4074 | RC4076 | RC4077 | RC4078                      | 216 |
| RC4063                                                         | RC4013 | RC4072 | RC4071 | RC4070 | RC4065                      | 218 |
| HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION     |        |        |        |        |                             |     |
| RC4063                                                         | RC4035 | RC4040 | RC4054 | RC4056 |                             | 220 |
| RC4063                                                         | RC4040 | RC4054 | RC4056 | RC4057 | RC4058                      | 222 |
| RC4063                                                         | RC4040 | RC4052 | RC4051 | RC4050 | RC4045                      | 224 |
| EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS |        |        |        |        |                             |     |
| RC4001                                                         | RC4030 |        |        |        |                             | 226 |
| RC4005                                                         | RC4063 |        |        |        |                             | 228 |
| RC4009                                                         | RC4079 |        |        |        |                             | 230 |
| ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION                |        |        |        |        |                             |     |
| RC4040                                                         | RC4055 | RC4053 |        |        |                             | 232 |
| ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION                |        |        |        |        |                             |     |
| RC4013                                                         | RC4075 | RC4073 |        |        |                             | 234 |
| EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS   |        |        |        |        |                             |     |
| RC4027                                                         | RC4120 | RC4118 |        |        |                             | 236 |

DATA

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION

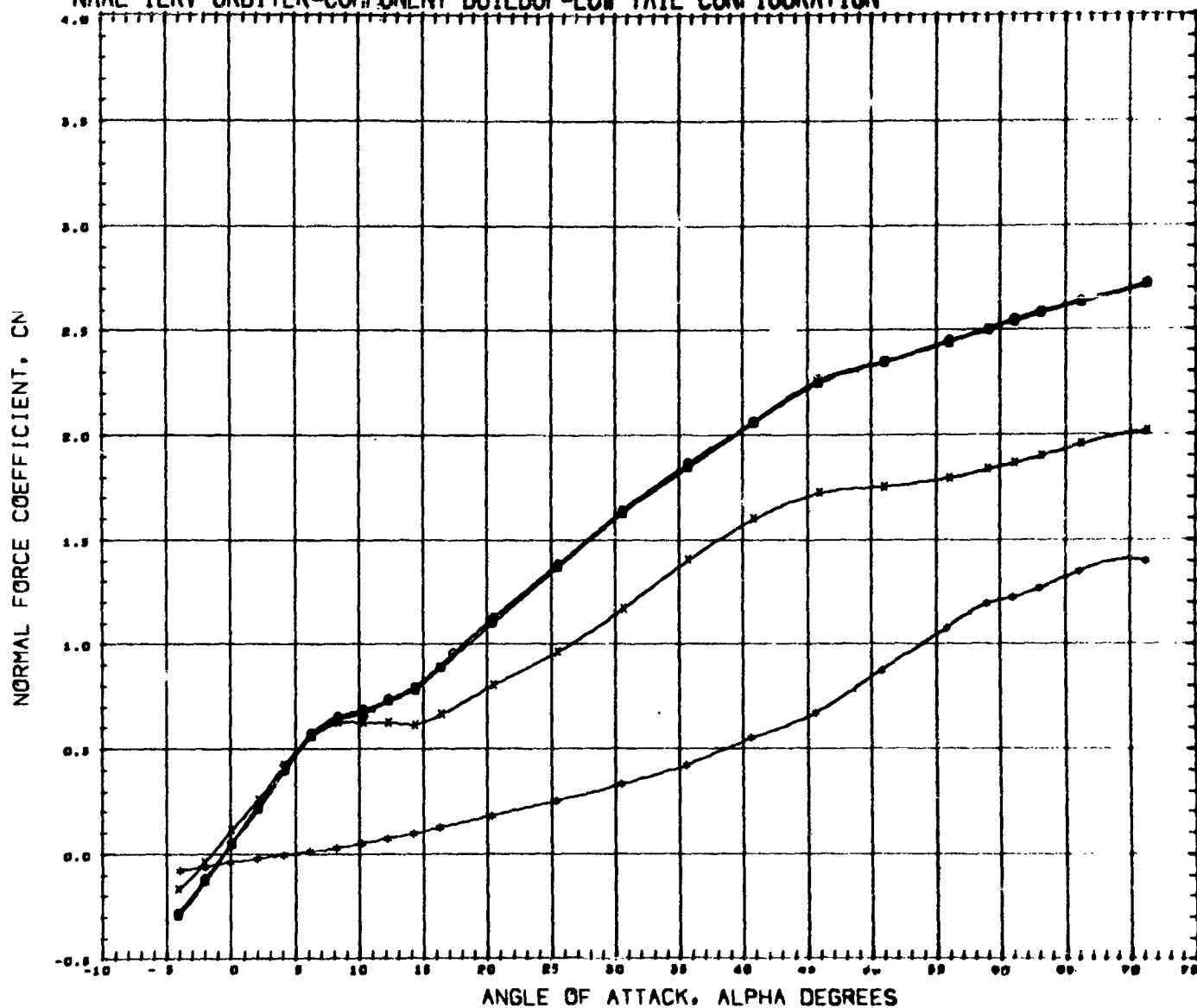


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4001) | 11 AUG 70 | 0.250 |
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4002) | 11 AUG 70 |       |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       |
| ●      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4013) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.700000E-01     |
| REFL 1.573700E-01     |
| REFD 1.153000E-01     |
| ENRP 0.158000E-01     |
| ENRP 0.000000E-01     |
| ENRP -2.040000E-01    |
| SCALE 7.010000E-01    |

REFERENCE FILE NAAL 020 NA-70-351

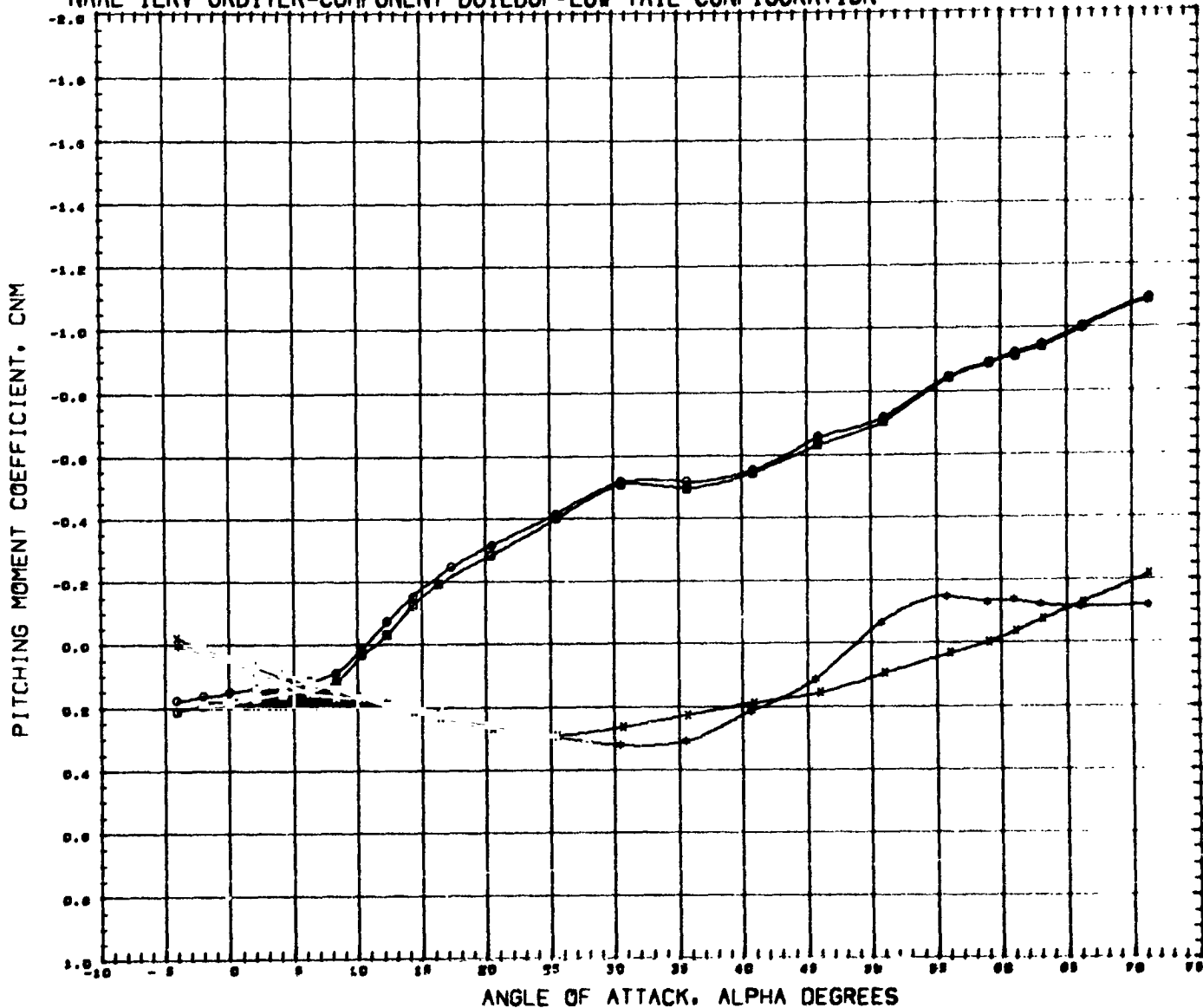
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4001   | 11 AUG 70 | 0.250 | REFS 1.70000X10-01 60.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 |       | REFL 1.07370X10-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4009   | 11 AUG 70 |       | REFS 1.33300X10-00 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4013   | 11 AUG 70 |       | WREF 0.33200X10-00 INCHES  |
|        |                                 |          |           |       | YREF 0.00000X10-01 INCHES  |
|        |                                 |          |           |       | ZREF -3.04000X10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

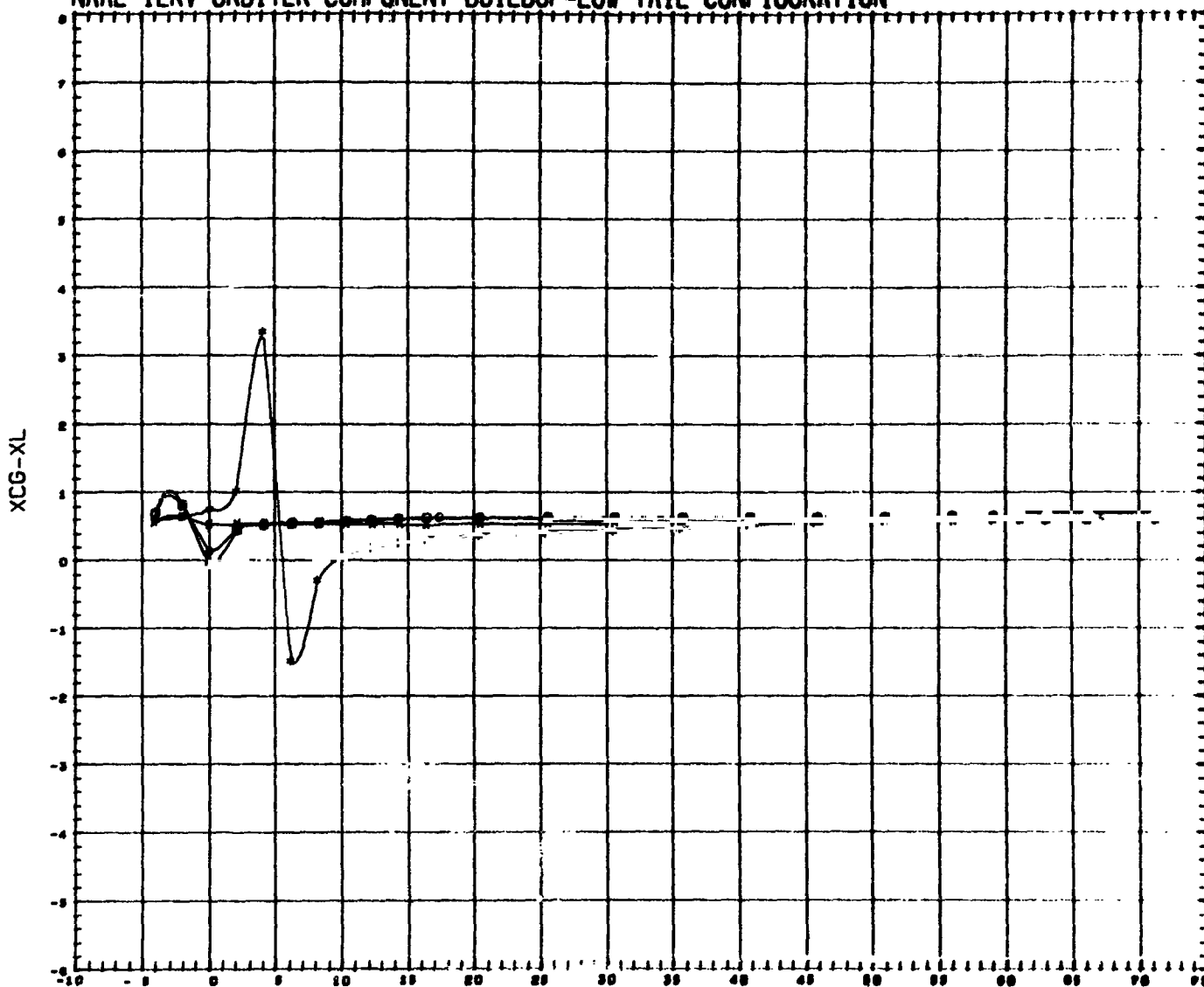
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | SS           | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|--------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | SS           | (RC4001) | 11 AUG 70 | 0.850 | REFS 1.700000E-01 SS-PT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS        | (RC4003) | 11 AUG 70 |       | REFL 1.973700E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS N13    | (RC4000) | 11 AUG 70 |       | REFD 1.133000E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS N13 V5 | (RC4013) | 11 AUG 70 |       | INRP 0.132000E-00 INCHES  |
|        |                                 |              |          |           |       | YNRP 0.000000E-01 INCHES  |
|        |                                 |              |          |           |       | ZNRP -3.040000E-02 INCHES |
|        |                                 |              |          |           |       | SCALE 7.010000E-02 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION



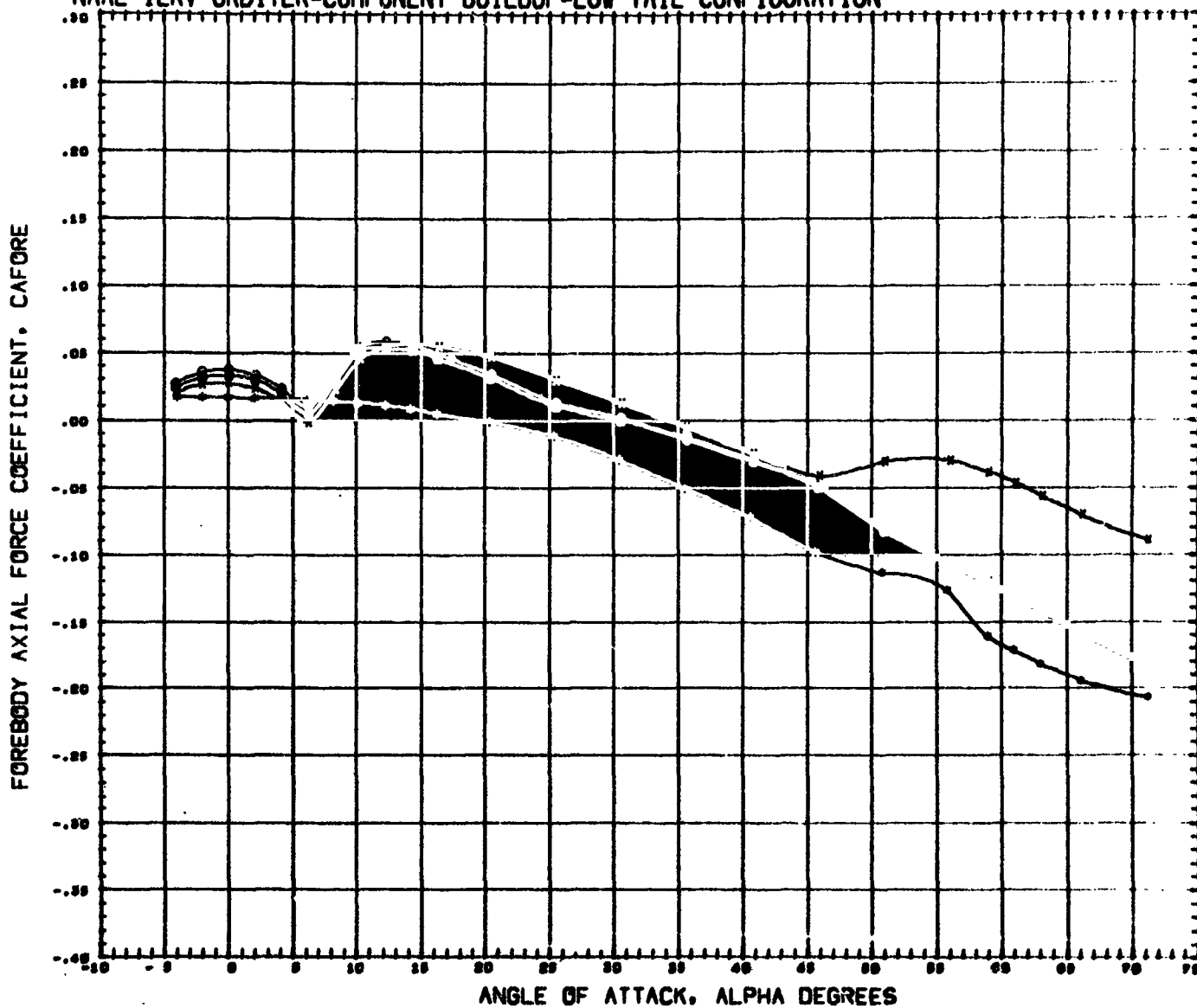
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4001) | 11 AUG 70 | 0.250 |
| (RC4003) | 11 AUG 70 |       |
| (RC4000) | 11 AUG 70 |       |
| (RC4013) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.700000E-01     |
| REFL 1.573700E-01     |
| REFD 1.133000E-00     |
| YMRP 0.132000E-00     |
| YMRP 0.000000E-01     |
| ZMRP -3.040000E-03    |
| SCALE 7.010000E-03    |

REFERENCE FILE NAAL 020 NA-70-351

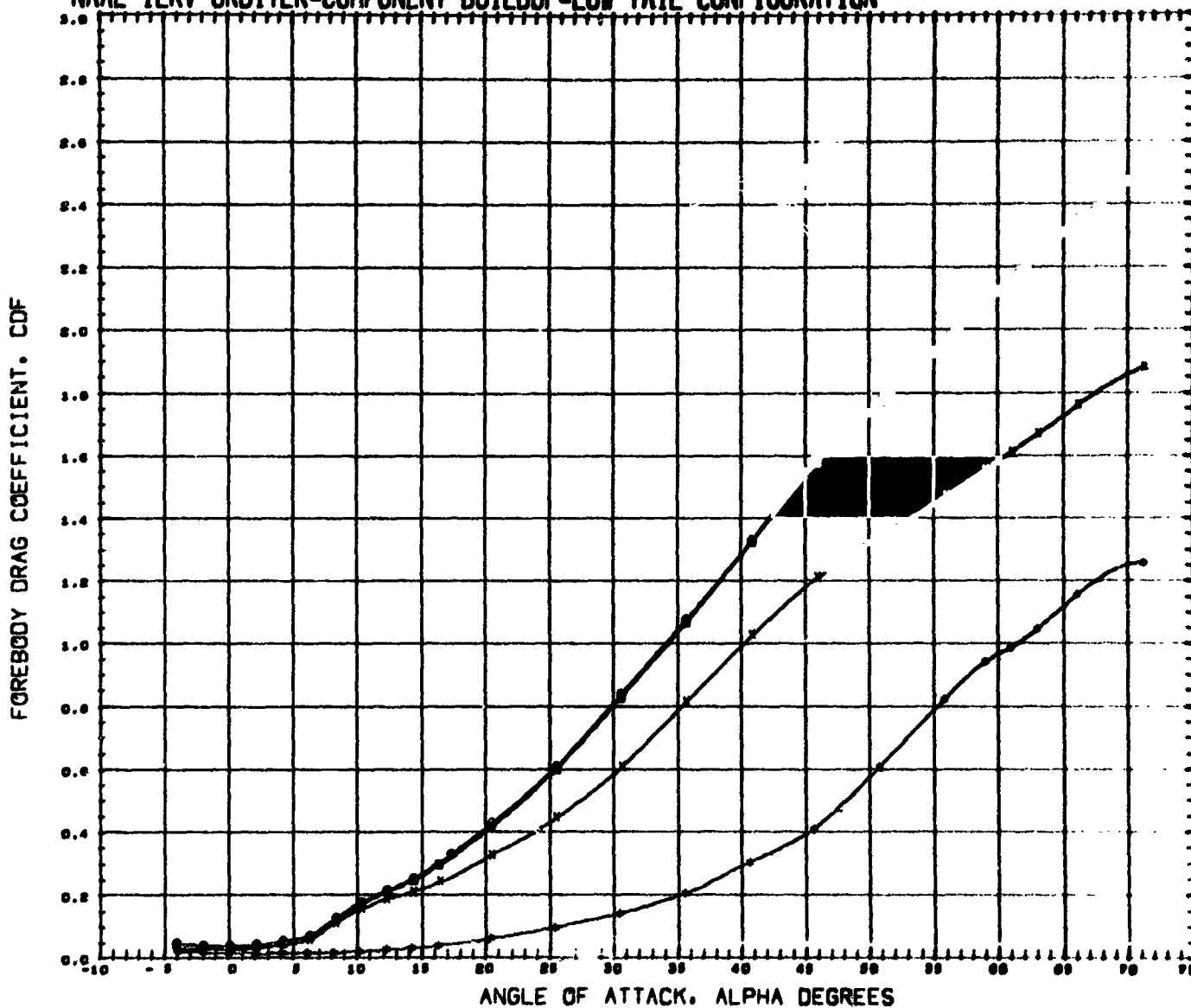
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | NACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|--------------|--------------------|-------|---------------------------|
| •      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0        | (RC4001) 11 AUG 70 | 0.200 | REFD 1.700000E-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0        | (RC4005) 11 AUG 70 |       | REFL 1.87370E-01 INCHES   |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H13    | (RC4009) 11 AUG 70 |       | REFD 1.133000E-01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H13 V1 | (RC4013) 11 AUG 70 |       | ENRP 0.132000E-01 INCHES  |
|        |                                 |              |                    |       | YNRP 0.000000E-01 INCHES  |
|        |                                 |              |                    |       | ZNRP -1.000000E-01 INCHES |
|        |                                 |              |                    |       | SCALE 1.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-381

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION

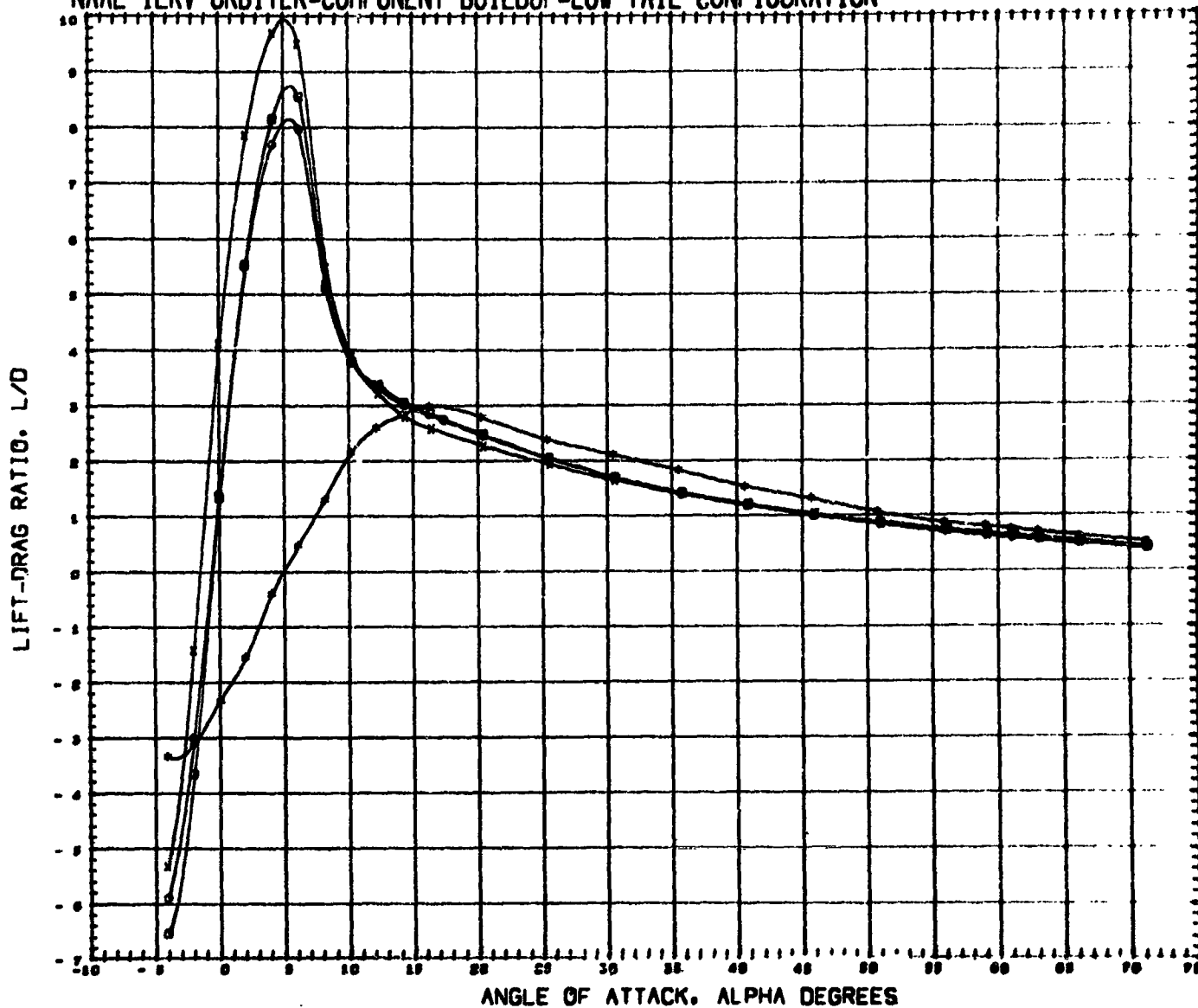


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4001) | 11 AUG 70 | 9.850 | REFS 1.70000E10-01 80.FT.  |
| x      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4002) | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| □      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       | REFD 1.13300E10-01 INCHES  |
| ○      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4004) | 11 AUG 70 |       | VHRP 0.13300E10-01 INCHES  |
|        |                                 | (RC4005) | 11 AUG 70 |       | VHRP 0.00000E10-01 INCHES  |
|        |                                 | (RC4006) | 11 AUG 70 |       | ZHRP -3.04000E10-01 INCHES |
|        |                                 | (RC4007) | 11 AUG 70 |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-391

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | SS           | DATA SET | DATE      | NACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|----------|-----------|-------|--------------------------|
| .      | NAAL 020 SSV-ILRV STRAIGHT WING | SS           | (RC4005) | 11 AUG 70 | 0.890 | REF 1.700000E-01 SS.FY.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | SS W6        | (RC4006) | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | SS W6 N13    | (RC4007) | 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | SS W6 N13 V6 | (RC4013) | 11 AUG 70 |       | RMSP 0.13300E-01 INCHES  |
|        |                                 |              |          |           |       | TMSP 0.00000E-01 INCHES  |
|        |                                 |              |          |           |       | RMSP -3.04000E-01 INCHES |
|        |                                 |              |          |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

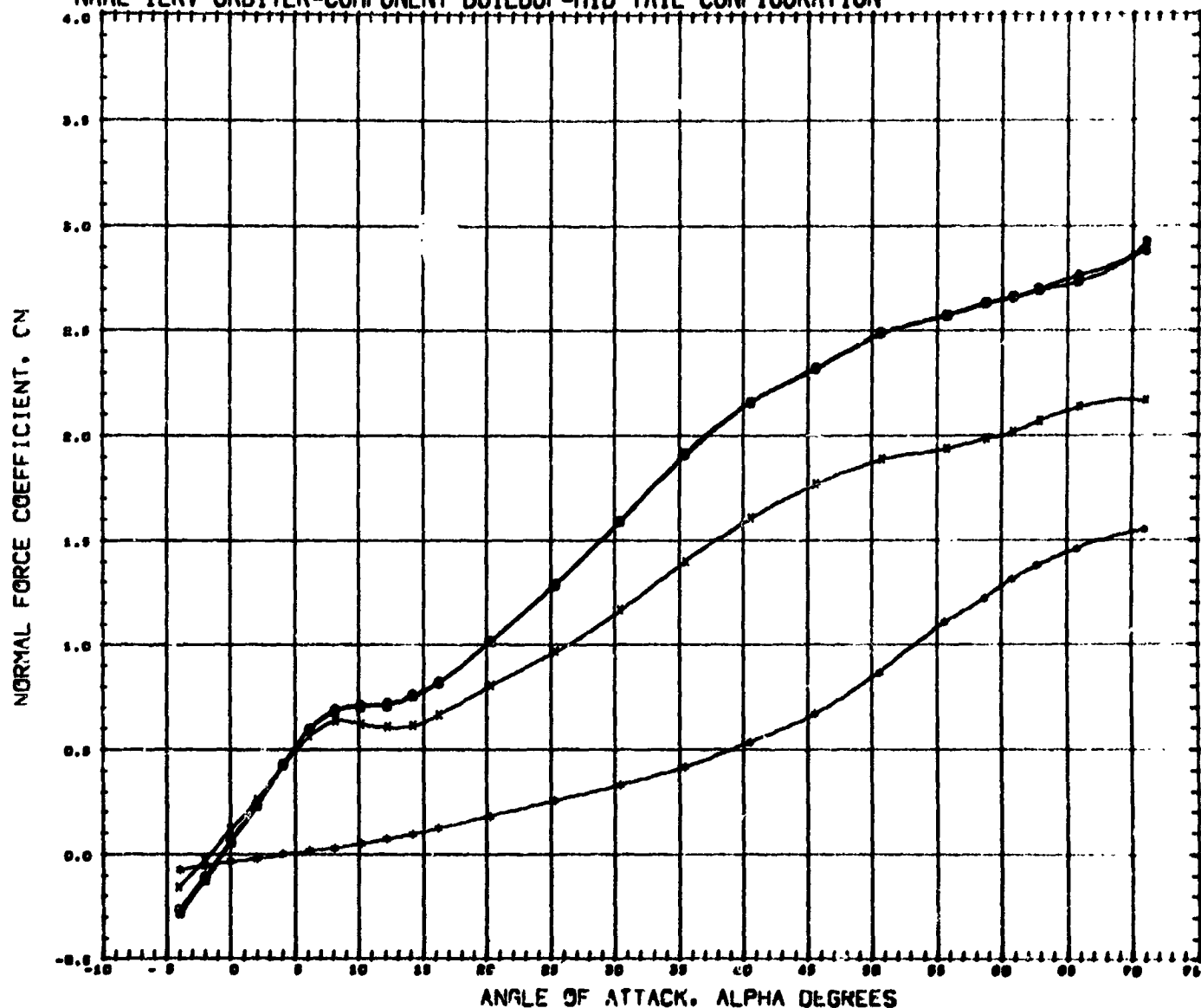
# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.250 | REFL 1.74000E-01 80.FT.  |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4035) | 11 AUG 70 |       | REFL 1.13300E-00 INCHES  |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 |       | REFL 0.13800E-00 INCHES  |
|        |                                 |          |           |       | REFL 0.00000E-01 INCHES  |
|        |                                 |          |           |       | REFL -3.04000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION

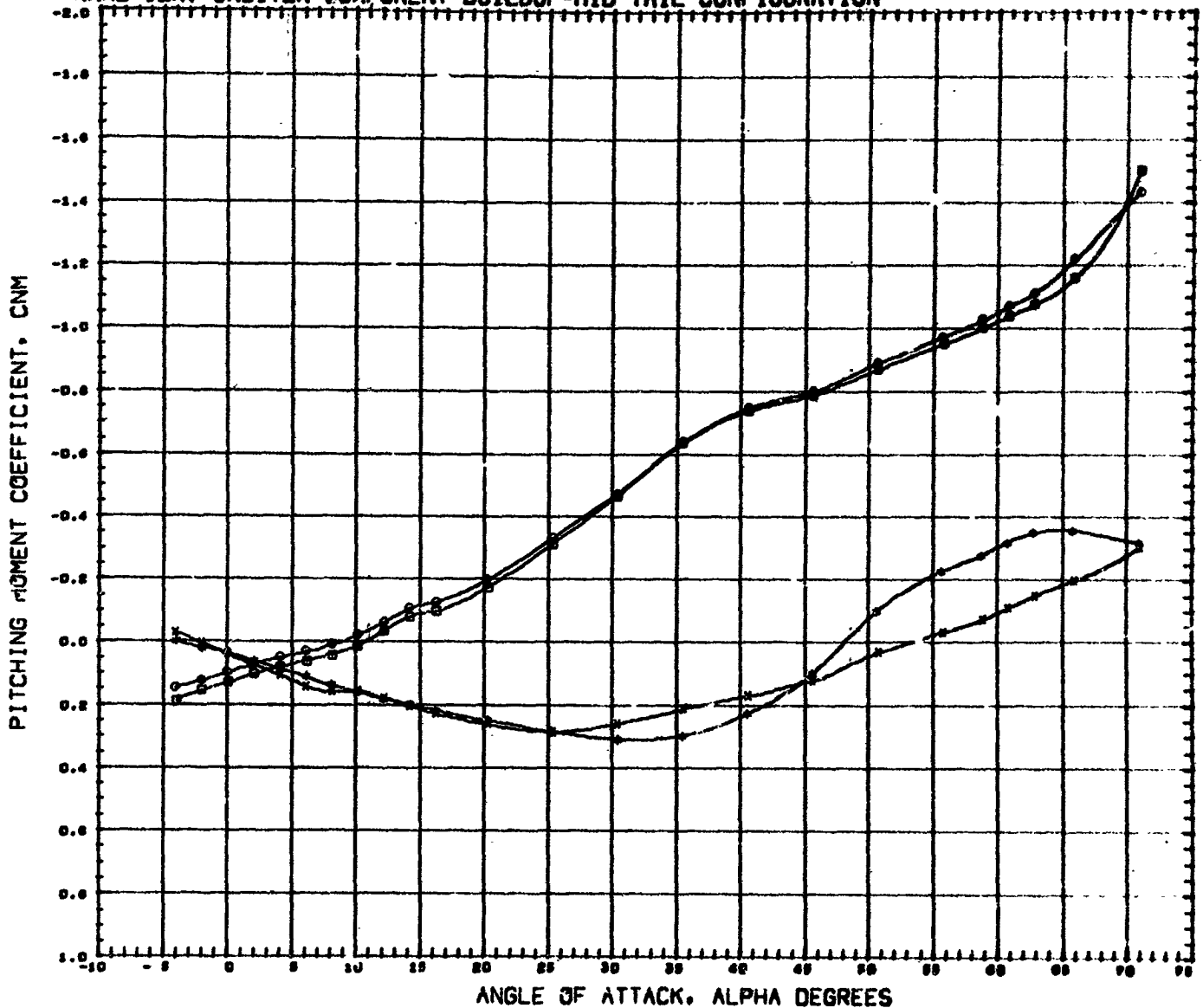


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.800 | REF 1.700000E-01 00.00   |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4031) | 11 AUG 70 |       | REF 1.975000E-01 INCHES  |
| u      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4032) | 11 AUG 70 |       | REF 1.133000E-01 INCHES  |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 |       | REF 0.130000E-01 INCHES  |
|        |                                 |          |           |       | REF 0.000000E-01 INCHES  |
|        |                                 |          |           |       | REF -3.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE |

REFERENCE FILE

NAAL 020 NA-70-391

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.250 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC-035) | 11 AUG 70 |       |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 |       |

REFERENCE FILE NAAL 020 NA-70-351

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFS                  | 1.70000010-01 80.FT.  |
| REFL                  | 1.57500010-01 INCHES  |
| REFD                  | 1.13500010-01 INCHES  |
| ENRP                  | 0.13500010-01 INCHES  |
| ENRP                  | 0.00000010-01 INCHES  |
| ENRP                  | -2.04000010-01 INCHES |
| SCALE                 | 7.01000010 SCALE      |

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION

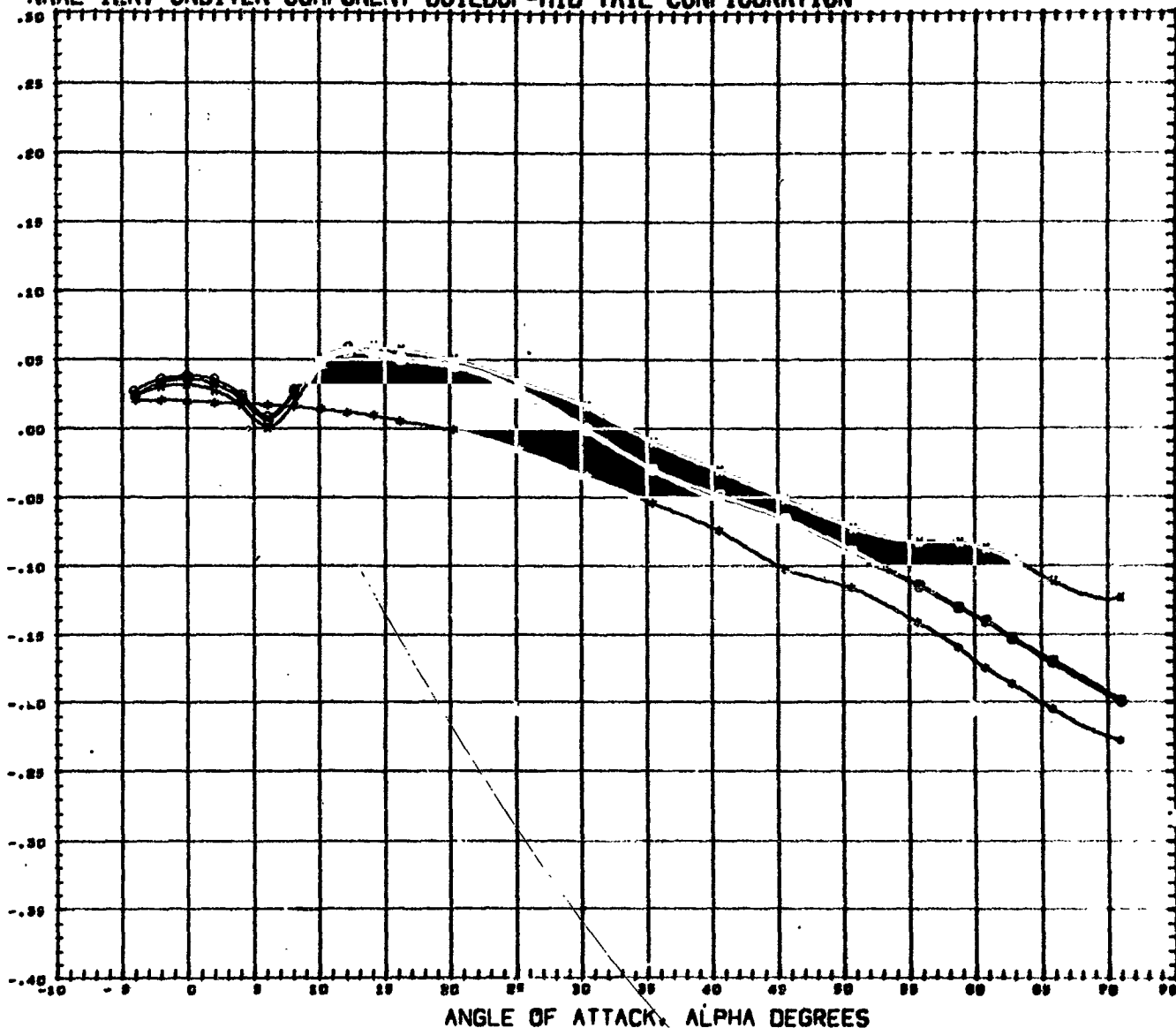


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC403D   | 11 AUG 70 | 0.800 | REFS 1.700000E-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4063   | 11 AUG 70 |       | REFL 1.973700E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4035   | 11 AUG 70 |       | REFS 1.133000E-00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040   | 11 AUG 70 |       | YMRP 0.130000E-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                 |          |           |       | ZMRP -2.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION

FOREBODY AXIAL FORCE COEFFICIENT, CAFORE



| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING |

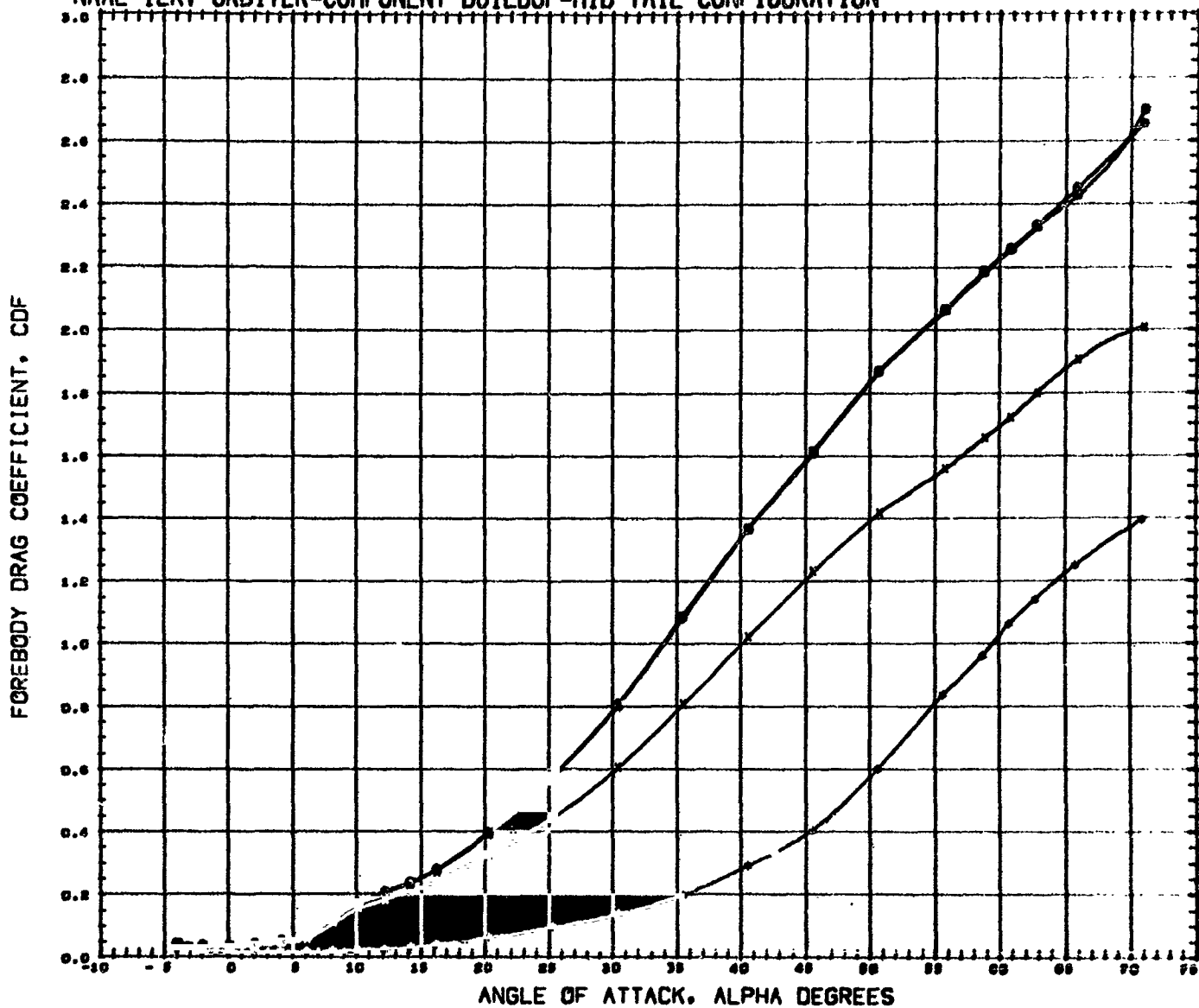
ANGLE OF ATTACK, ALPHA DEGREES

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4030) | 11 AUG 70 | 0.850 |
| (RC4063) | 11 AUG 70 |       |
| (RC4035) | 11 AUG 70 |       |
| (RC4040) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                     |
|-----------------------|---------------------|
| REFS                  | 1.700000E-01 INCHES |
| REFL                  | 1.97370E-01 INCHES  |
| REFD                  | 1.13300E-01 INCHES  |
| YNP                   | 0.13200E-01 INCHES  |
| YNP                   | 0.00000E-01 INCHES  |
| YNP                   | -3.04000E-01 INCHES |
| SCALE                 | 7.01000E-01 SCALE   |

REFERENCE FILE NAAL 020 NA-70-391

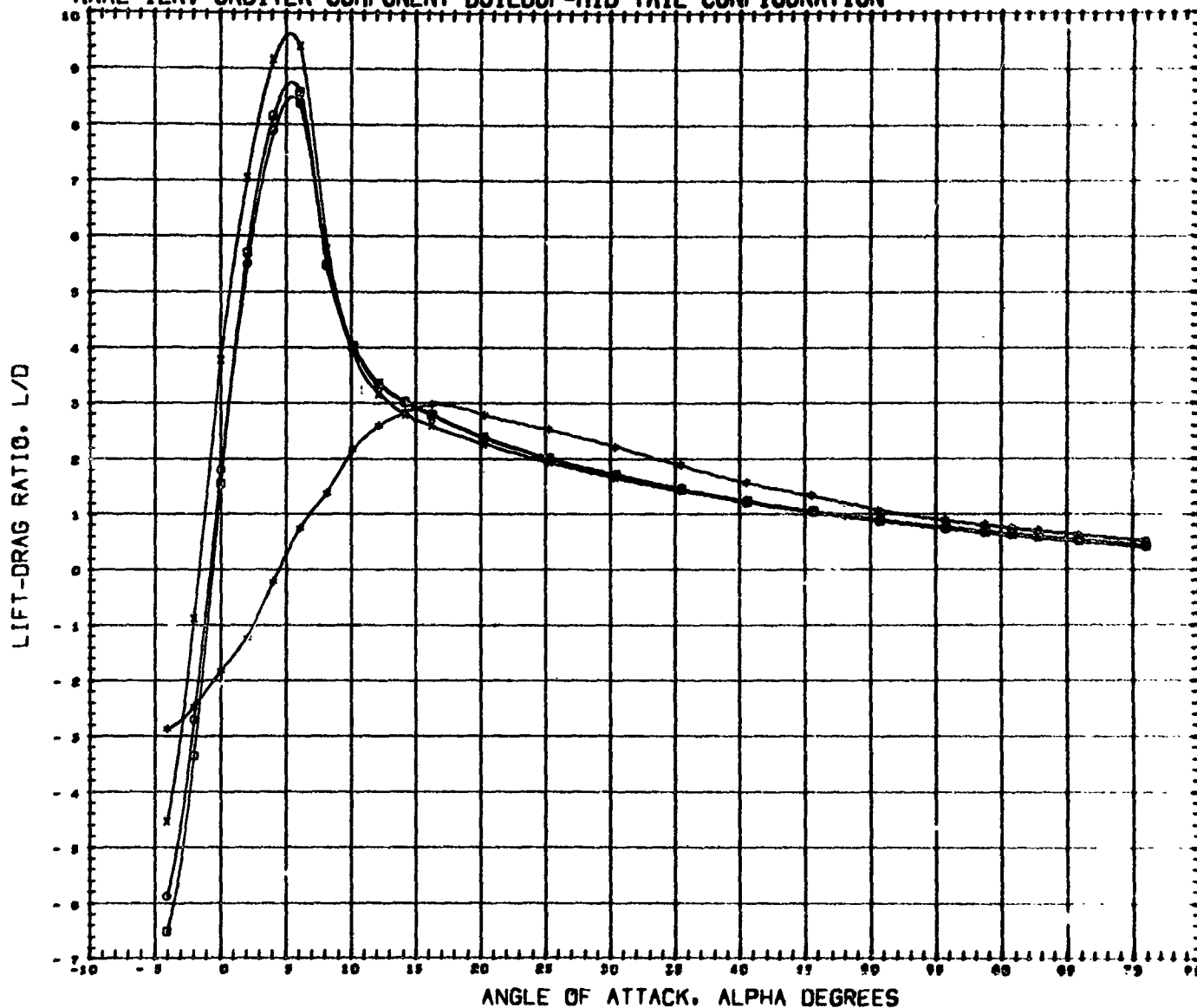
# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4030   | 11 AUG 70 | 0.250 | REFS 1.700000E-01 60.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4031   | 11 AUG 70 |       | REFL 1.973700E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4032   | 11 AUG 70 |       | REFS 1.133000E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040   | 11 AUG 70 |       | ENRP 0.132000E-01 INCHES  |
|        |                                 |          |           |       | VNRP 0.000000E-01 IN. H2O |
|        |                                 |          |           |       | ZNRP -3.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION

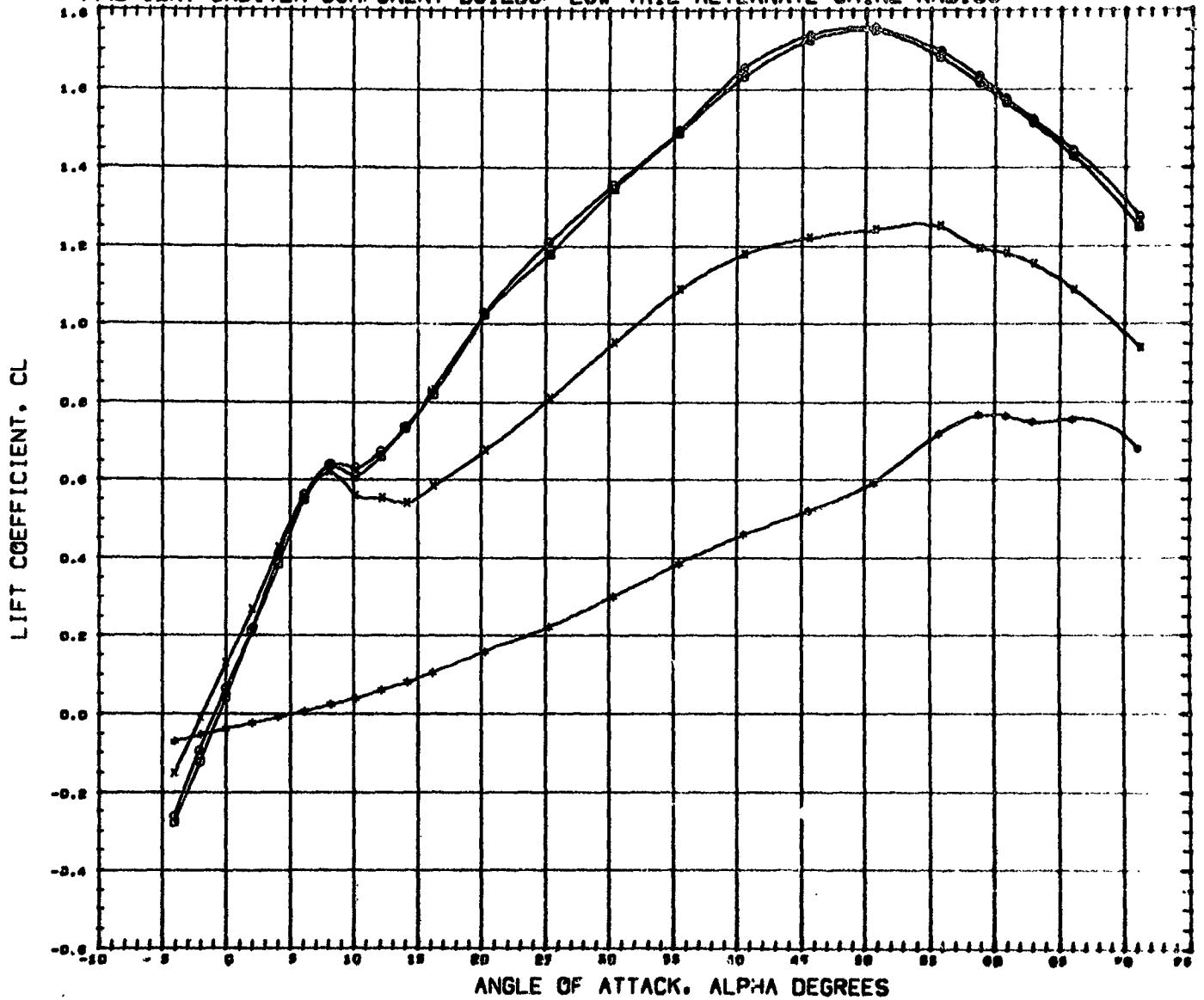


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4030   | 11 AUG 70 | 0.850 | REFS 1.70000X10-01 60.71.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4031   | 11 AUG 70 |       | REFL 1.97370X10-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4032   | 11 AUG 70 |       | REFD 1.13300X10-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040   | 11 AUG 70 |       | YMRP 0.13200X10-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000X10-01 INCHES  |
|        |                                 |          |           |       | ZMRP -3.04000X10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000X10-03 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-391

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS

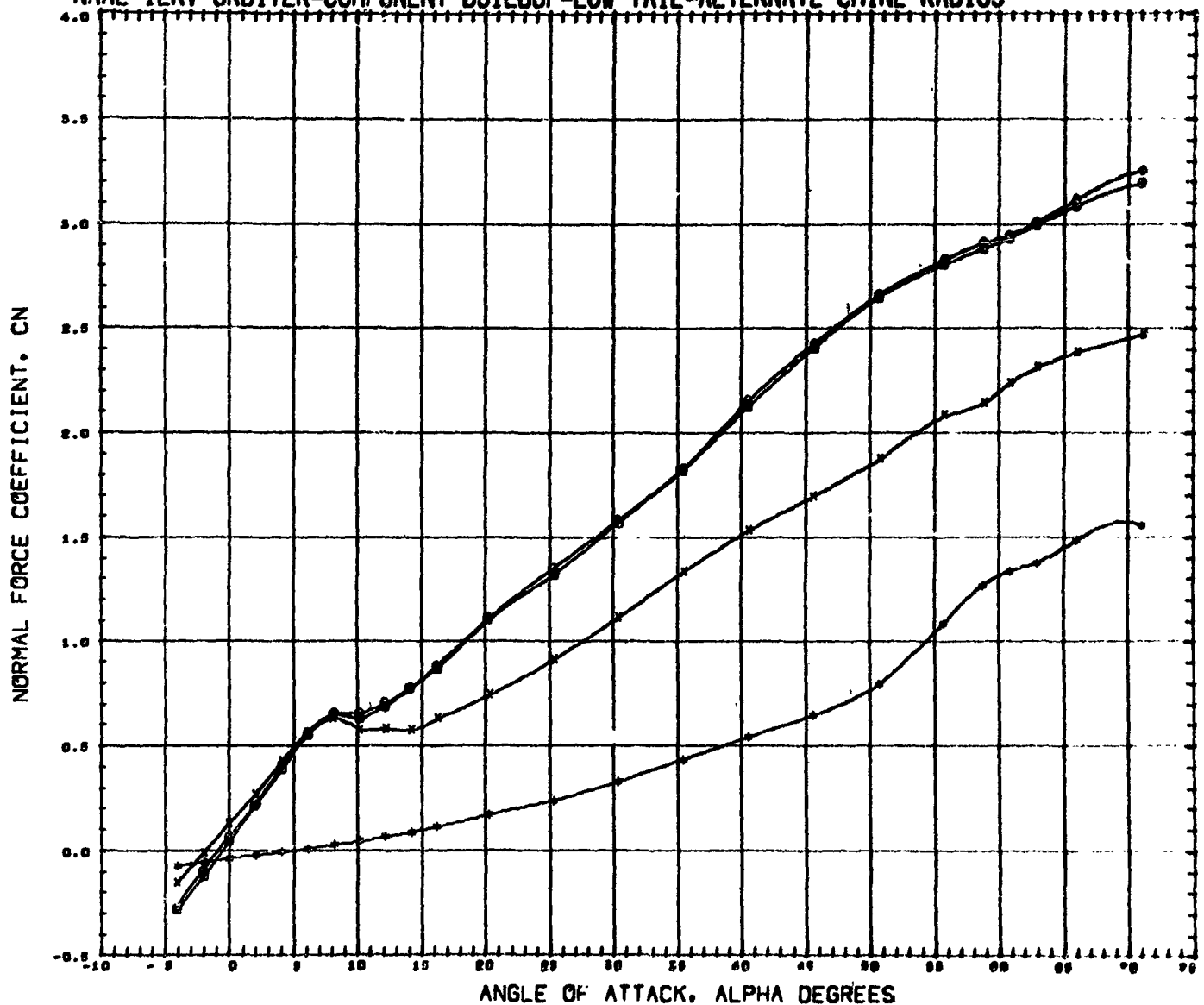


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| ●      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4000) | 12 AUG 70 | 0.850 |
| ×      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4113) | 12 AUG 70 |       |
| ◇      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4100) | 11 AUG 70 |       |

REFERENCE FILE NAAL 020 NA-70-351

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E-01 80.FT.  |
| REFL                  | 1.970000E-01 INCHES  |
| REFD                  | 1.130000E-00 INCHES  |
| ENRP                  | 0.130000E-00 INCHES  |
| VNRP                  | 0.000000E-01 INCHES  |
| ENRP                  | -3.040000E-01 INCHES |
| SCALE                 | 7.010000E-01 SCALE   |

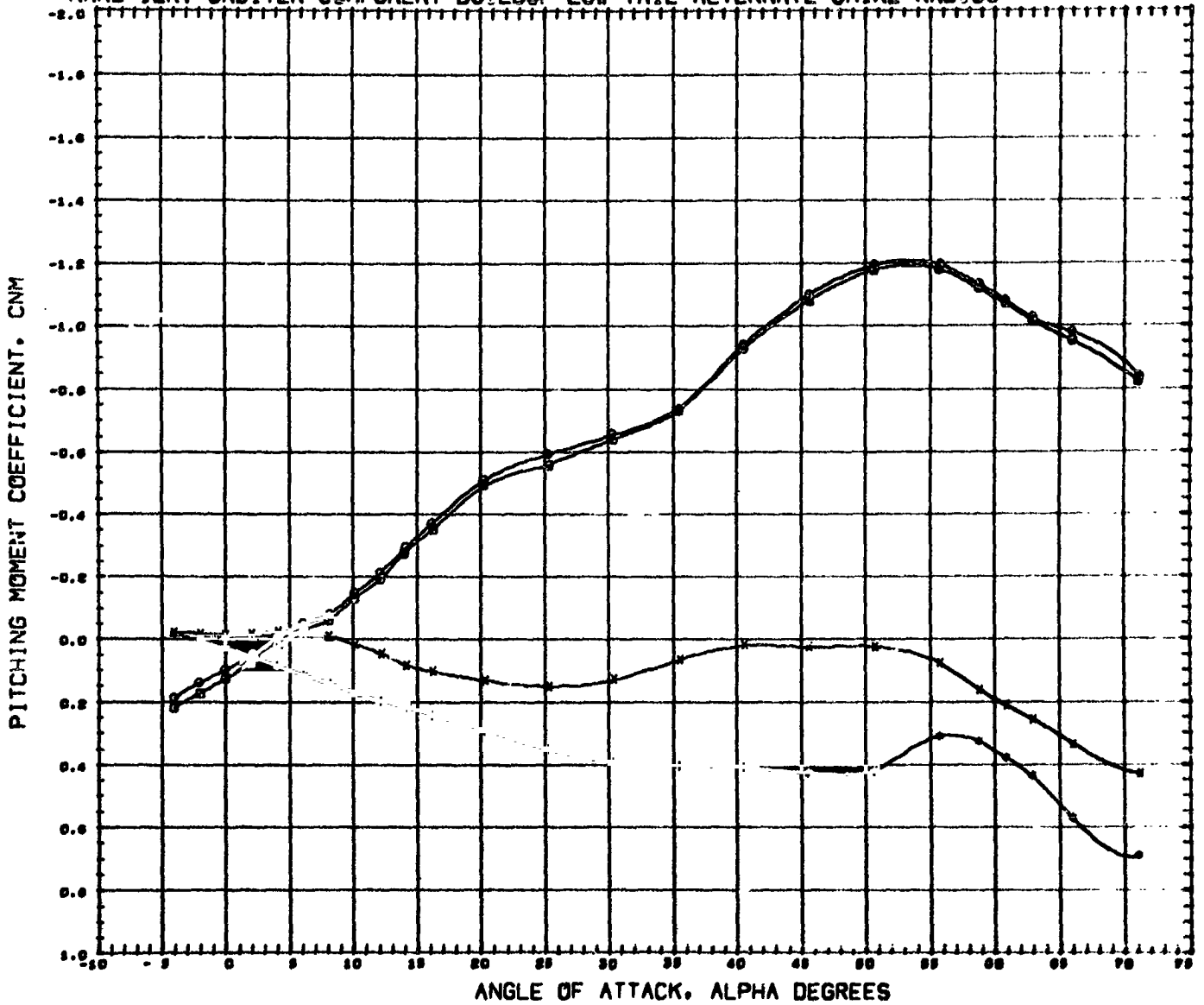
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|--------------|--------------------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B7           | (RC4000) 12 AUG 70 | D.290 | REFS 1.700000E-01 INCHES  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | B7 W9        | (RC4003) 11 AUG 70 |       | REFL 1.973700E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | B7 W9 M13    | (RC4113) 12 AUG 70 |       | REFD 1.133000E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | B7 W9 M13 V5 | (RC4100) 11 AUG 70 |       | INBP 0.133000E-01 INCHES  |
|        |                                 |              |                    |       | INRP 0.000000E-01 INCHES  |
|        |                                 |              |                    |       | INRP -3.040000E-01 INCHES |
|        |                                 |              |                    |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-331

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4000   | 12 AUG 70 | 0.250 | REFD 1.70000010-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4001   | 11 AUG 70 |       | REFL 1.07370010-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4113   | 12 AUG 70 |       | REFD 1.25300010-00 INCHES  |
| ◇      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4100   | 11 AUG 70 |       | YMRP 0.10000010-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |          |           |       | YMRP -0.00000010-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

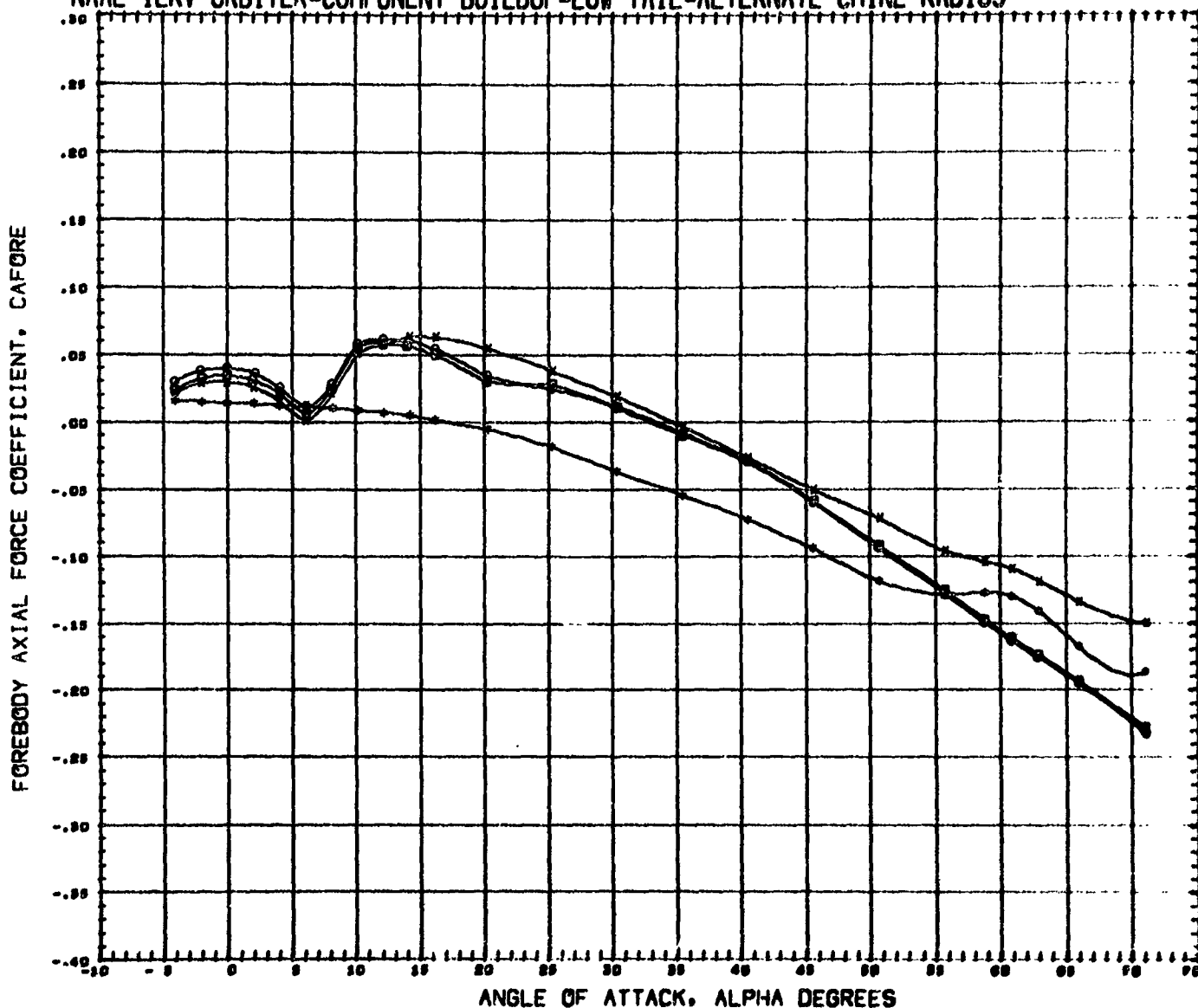
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| 0      | NAAL 020 SSV-ILRV STRAIGHT WING | 07           | 12 AUG 70 | 0.250 | REFD 1.70000010-01 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0        | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 H13    | 12 AUG 70 |       | REFD 1.13200010-00 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 H13 V5 | 11 AUG 70 |       | XMRP 0.12200010-00 INCHES  |
|        |                                 |              |           |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |              |           |       | ZMRP -3.04000010-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS



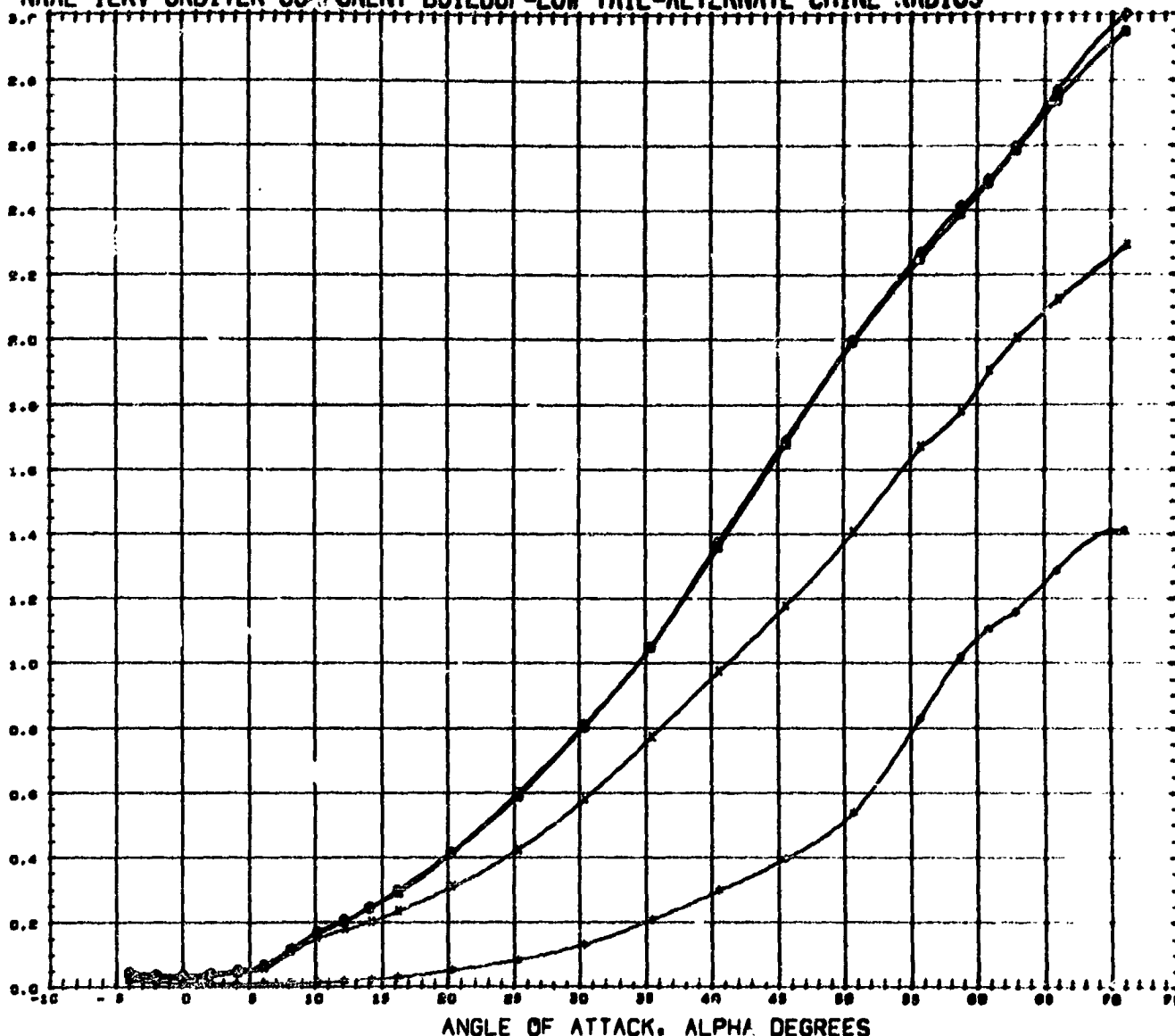
| SYMBOL | CONFIGURATION DESCRIPTION                   | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------------------|----------|-----------|-------|----------------------------|
| X      | NAAL 020 SSV-ILRV STRAIGHT WING BY          | (RC4082) | 12 AUG 70 | 0.650 | REFS 1.70000010-01 88.FT.  |
| K      | NAAL 020 SSV-ILRV STRAIGHT WING BY W        | (RC4083) | 11 AUG 70 |       | REFL 1.07370010-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING BY W N13    | (RC4113) | 12 AUG 70 |       | REFD 1.13300010-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING BY W N13 VS | (RC4100) | 11 AUG 70 |       | ENRP 0.13300010-00 INCHES  |
|        |                                             |          |           |       | ENRP 0.00000010-01 INCHES  |
|        |                                             |          |           |       | ENRP -3.04000010-01 INCHES |
|        |                                             |          |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-591

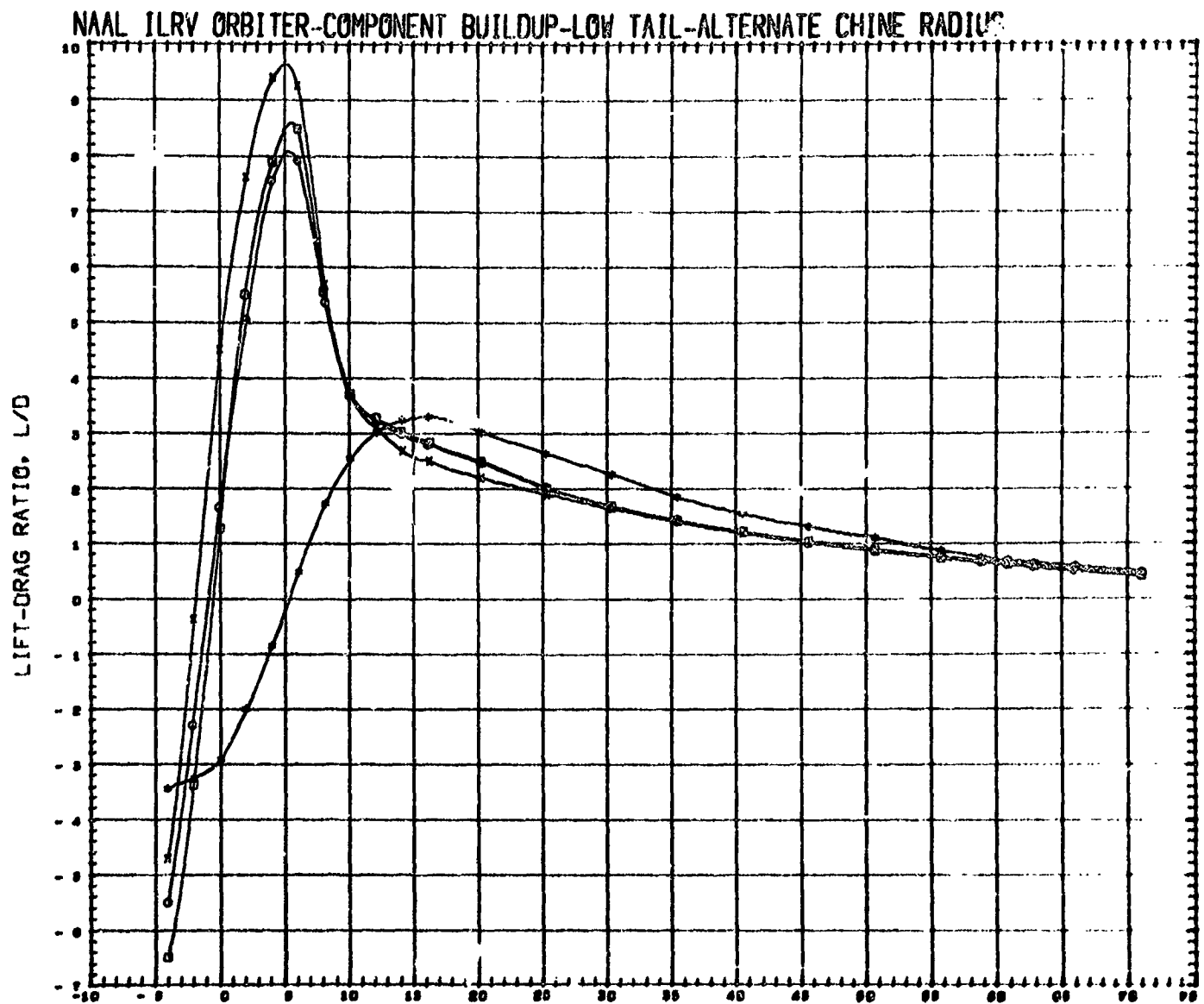
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS

FOREBODY DRAG COEFFICIENT, CDF



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION     |
|--------|---------------------------------|--------------|----------|-----------|---------------------------|
| •      | NAAL 020 JV-ILRV STRAIGHT WING  | 07           | (RC4000) | 12 AUG 70 | 0.640                     |
| ×      | NAAL 020 USV-ILRV STRAIGHT WING | 07 W0        | (RC4003) | 11 AUG 70 | REFD 1.700000E-01 00.77.  |
| □      | NAAL 020 LSV-ILRV STRAIGHT WING | 07 W0 N13    | (RC4115) | 11 AUG 70 | REFD 1.073700E-01 INCHES  |
| ◊      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 N13 V5 | (RC4100) | 11 AUG 70 | REFD 1.130000E-00 INCHES  |
|        |                                 |              |          |           | YMRP 0.130000E-00 INCHES  |
|        |                                 |              |          |           | YMRP 0.000000E-01 INCHES  |
|        |                                 |              |          |           | ZMRP -3.040000E-01 INCHES |
|        |                                 |              |          |           | SCALE 7.010000E-03 SCALE  |

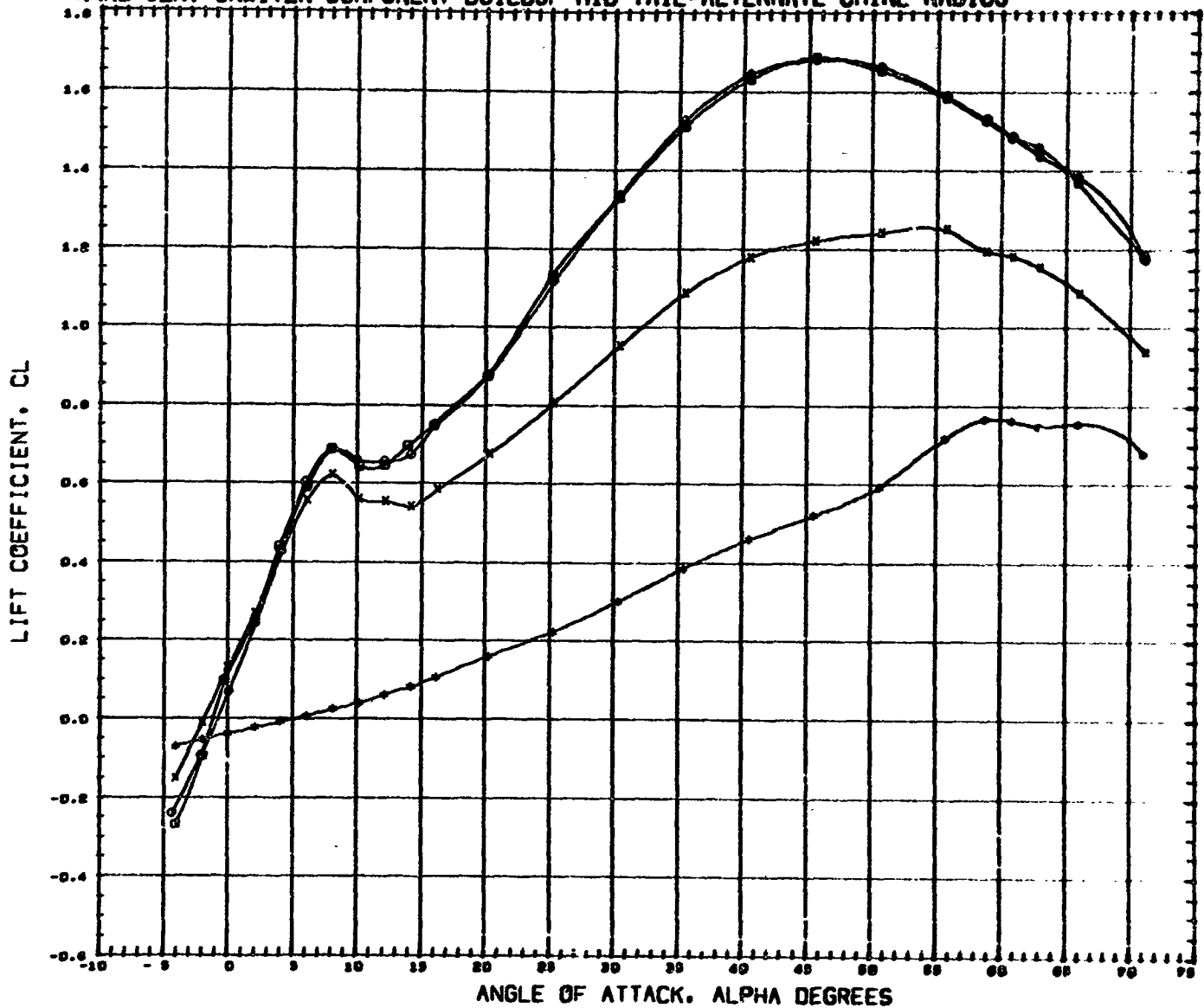
REFERENCE FILE NAAL 020 NA-70-351



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | NACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| ●      | NAAL 020 BBV-ILRV STRAIGHT WING | (RC4004) | 12 AUG 70 | 0.250 | REFS 1.70000E10-01 56.71.  |
| ×      | NAAL 020 BBV-ILRV STRAIGHT WING | (RC4002) | 11 AUG 70 |       | REFL 1.87370E10-01 INCHES  |
| ■      | NAAL 020 BBV-ILRV STRAIGHT WING | (RC4113) | 12 AUG 70 |       | REFD 1.13340E10-00 INCHES  |
| ◆      | NAAL 020 BBV-ILRV STRAIGHT WING | (RC4108) | 11 AUG 70 |       | INRP 0.13300E10-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000E10-01 INCHES  |
|        |                                 |          |           |       | ZMRP -5.04000E10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E10 SCALE     |

REFERENCE FILE NAAL 020 NA-70-331

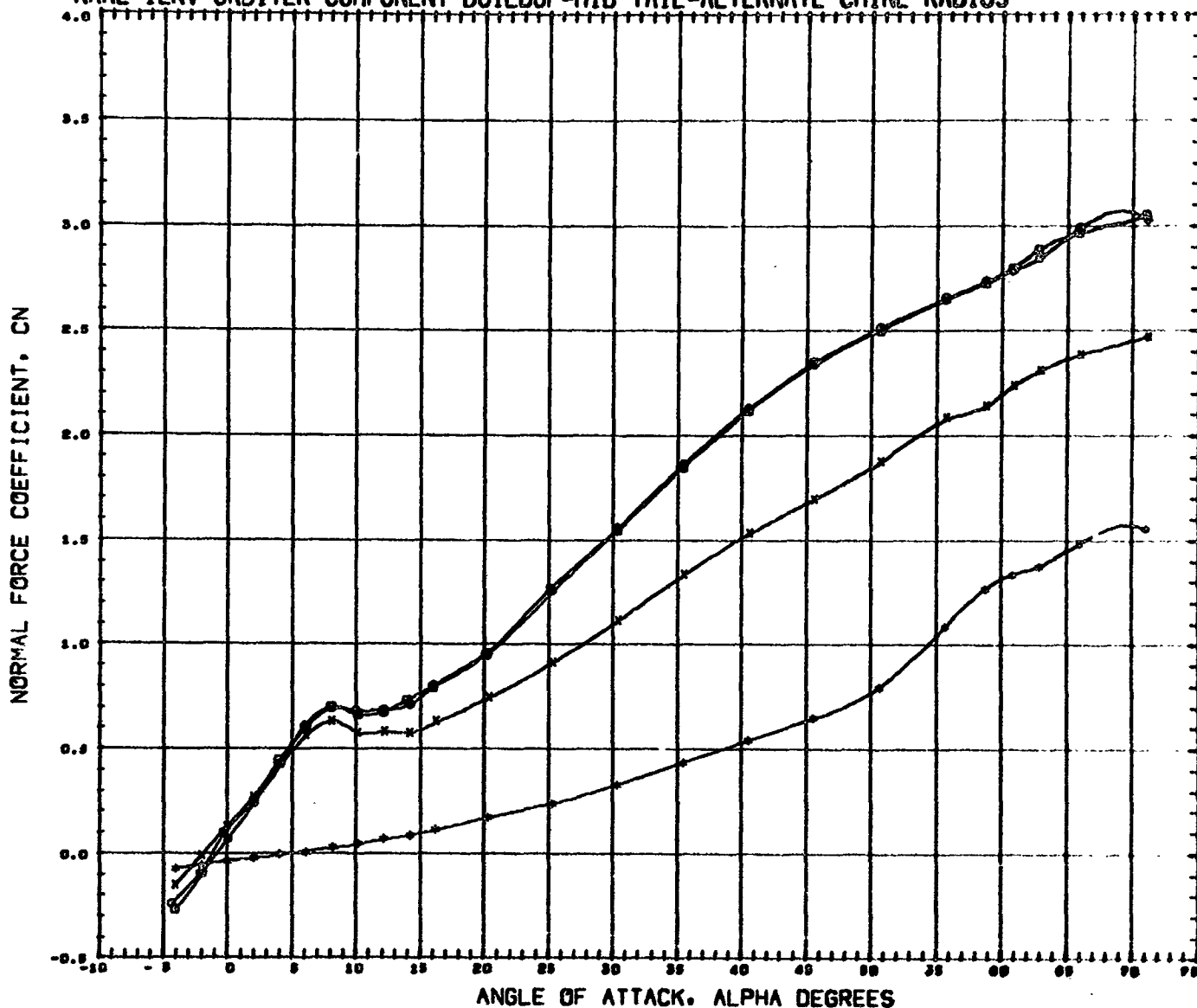
# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4000   | 12 AUG 70 | 0.250 | REFD 1.700000E-01 00.FT. |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4001   | 11 AUG 70 |       | REFL 1.975700E-01 INCHES |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4002   | 11 AUG 70 |       | REFD 1.100000E-01 INCHES |
| ◇      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4103   | 11 AUG 70 |       | REFD 0.100000E-01 INCHES |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS

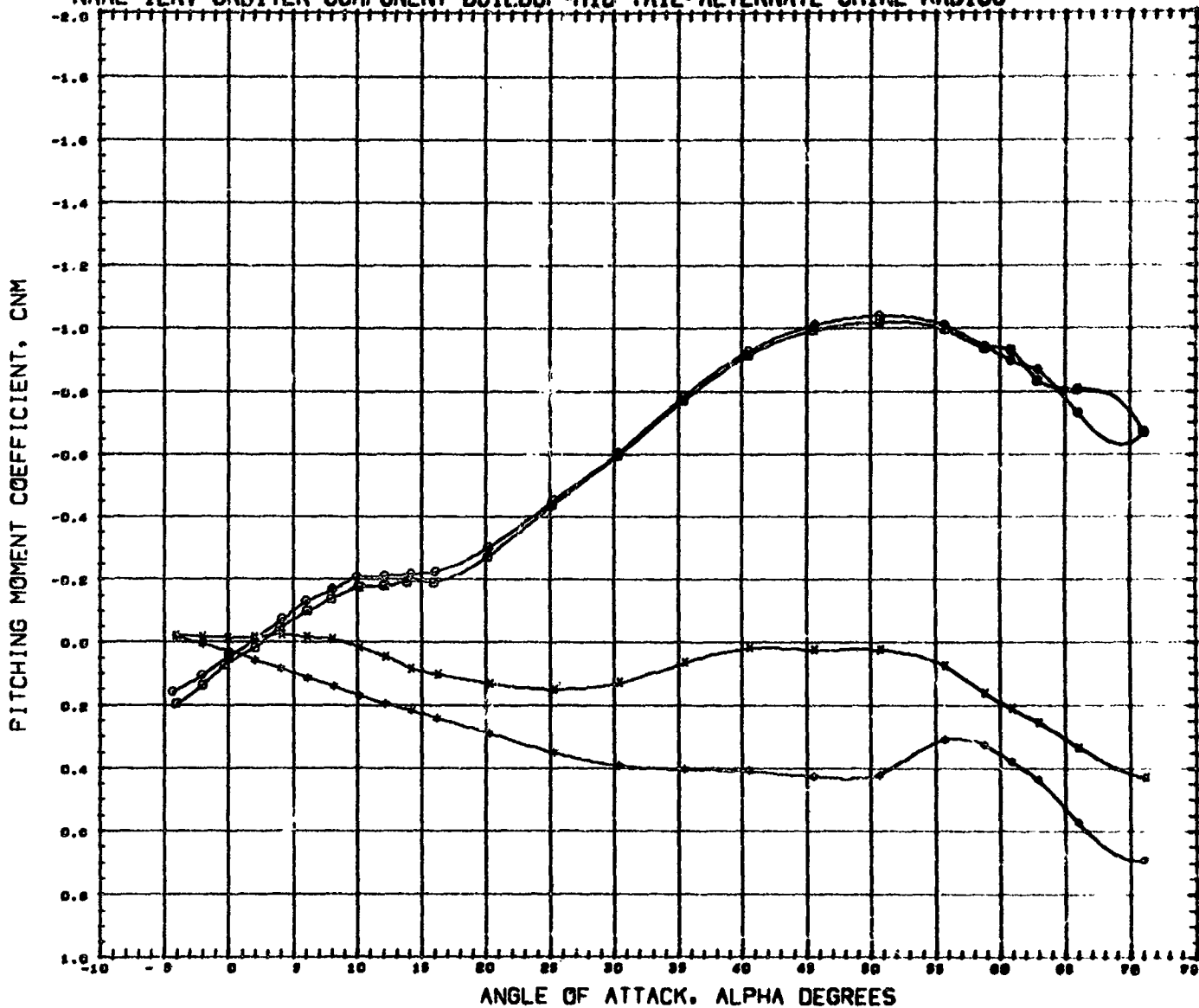


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4088) | 12 AUG 70 | 0.850 | REFD 1.70000E+01 INCHES  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4089) | 11 AUG 70 |       | REFL 1.07370E+01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4090) | 11 AUG 70 |       | REFD 1.13300E+01 INCHES  |
|        | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4100) | 11 AUG 70 |       | KNRP 0.13800E+01 INCHES  |
|        |                                 |          |           |       | YNRP 0.00000E+00 INCHES  |
|        |                                 |          |           |       | ZNRP -0.04000E+00 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E+00 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS



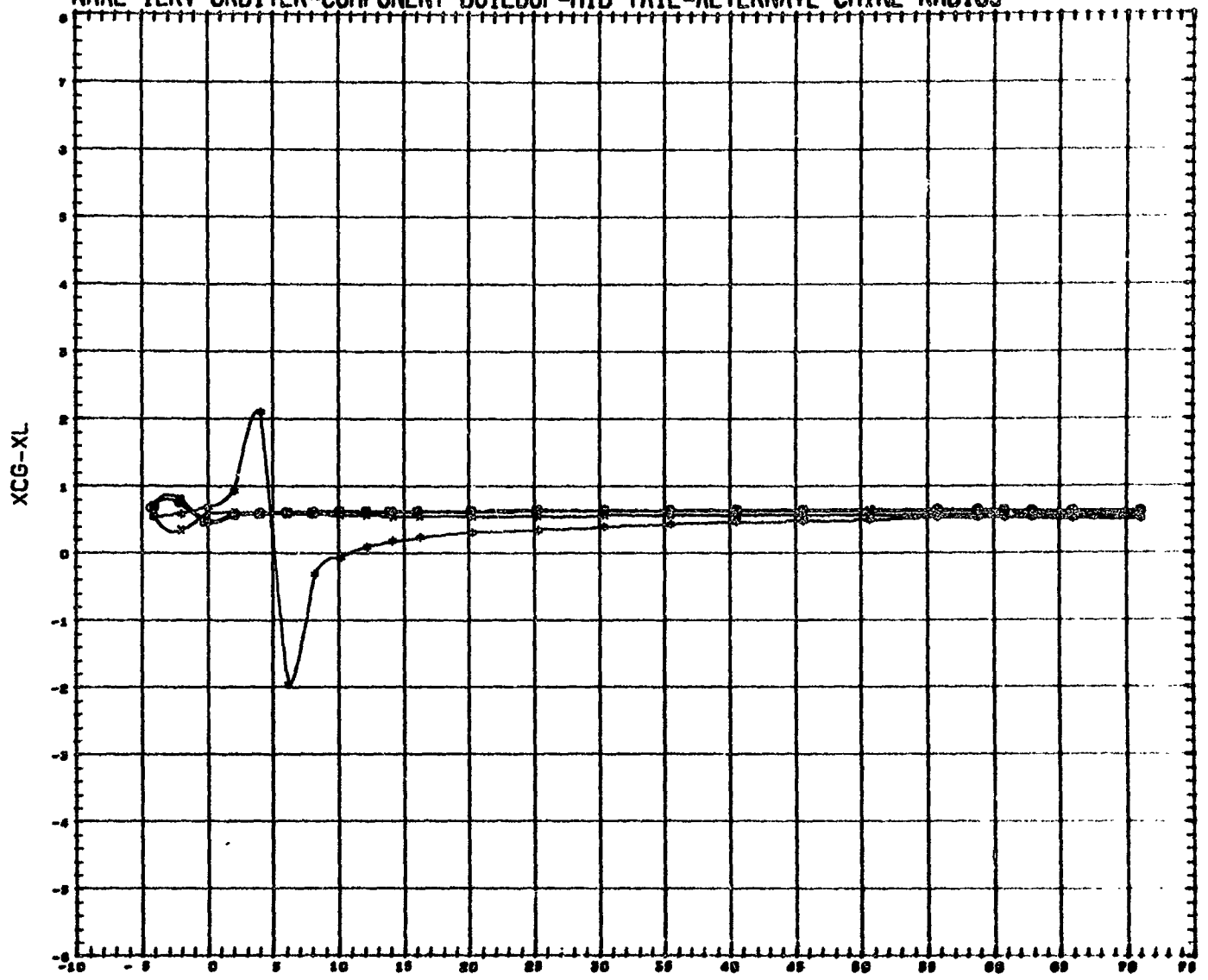
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING |
| ○      | NAAL 029 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4008) | 12 AUG 70 | 0.250 |
| (RC4003) | 11 AUG 70 |       |
| (RC4008) | 11 AUG 70 |       |
| (RC4103) | 11 AUG 70 |       |

| REFERENCE INFORMATION     |
|---------------------------|
| REF1 1.700000E+01 03.FT.  |
| REF2 1.073700E+01 INCHES  |
| REF3 1.132000E+00 INCHES  |
| INRP 0.170000E+00 INCHES  |
| YMRP 0.000000E+00 INCHES  |
| ZMRP -3.040000E+00 INCHES |
| SCALE 7.010000E+00 SCALE  |

REFERENCE FILE NAAL 029 NA-70-391

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS

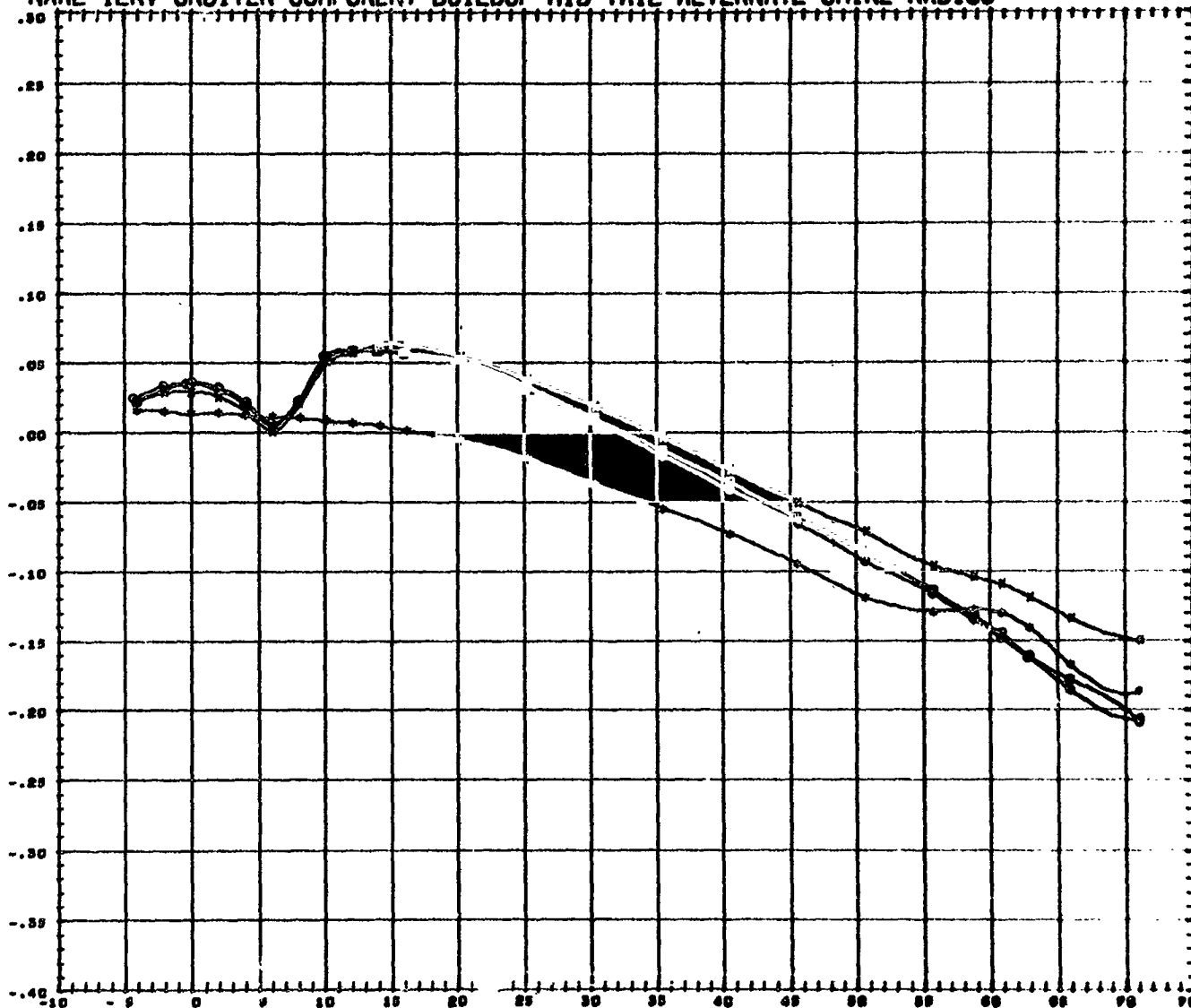


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|----------|-----------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | BT           | (RC4000) | 12 AUG 70 | 0.890                      |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | BT W0        | (RC4003) | 11 AUG 70 | REF0 1.70000X10-01 80.FT.  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | BT W0 H12    | (RC4000) | 11 AUG 70 | REF1 1.97370X10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | BT W0 H12 V5 | (RC4303) | 11 AUG 70 | REF2 1.19390X10-00 INCHES  |
|        |                                 |              |          |           | YMRP 0.19500X10-00 INCHES  |
|        |                                 |              |          |           | YMRP 0.00000X10-01 INCHES  |
|        |                                 |              |          |           | ZMRP -3.60000X10-01 INCHES |
|        |                                 |              |          |           | SCALE 7.61000X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS

FOREBODY AXIAL FORCE COEFFICIENT, CAFORE



ANGLE OF ATTACK, ALPHA DEGREES

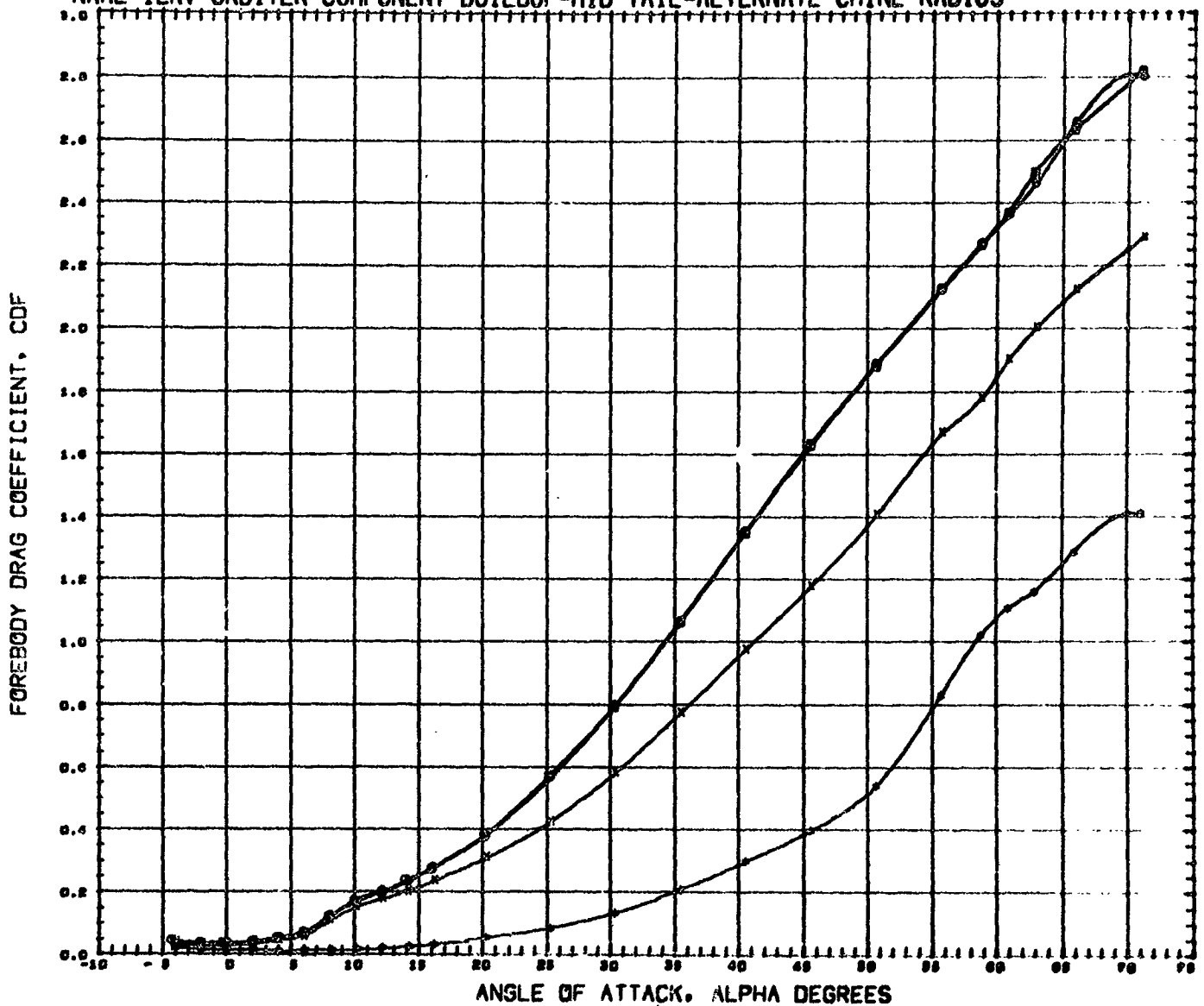
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| A      | NAAL 629 SSV-ILRV STRAIGHT WING | BY (RC4000)           | 12 AUG 70 | 0.250 |
| X      | NAAL 629 SSV-ILRV STRAIGHT WING | BY U0 (RC4003)        | 11 AUG 70 |       |
| Q      | NAAL 629 SSV-ILRV STRAIGHT WING | BY W0 H12 (RC4000)    | 11 AUG 70 |       |
| O      | NAAL 629 SSV-ILRV STRAIGHT WING | BY W0 H12 V5 (RC4103) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 629 NA-70-391

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFS                  | 1.70000010-01 66.FT.  |
| REFL                  | 1.97570010-01 INCHES  |
| REFD                  | 1.13000010-01 INCHES  |
| VMRP                  | 0.10000010-00 INCHES  |
| VMRP                  | 0.00000010-00 INCHES  |
| VMRP                  | -3.00000010-01 INCHES |
| SCALE                 | 7.01000010-01 SCALE   |

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS

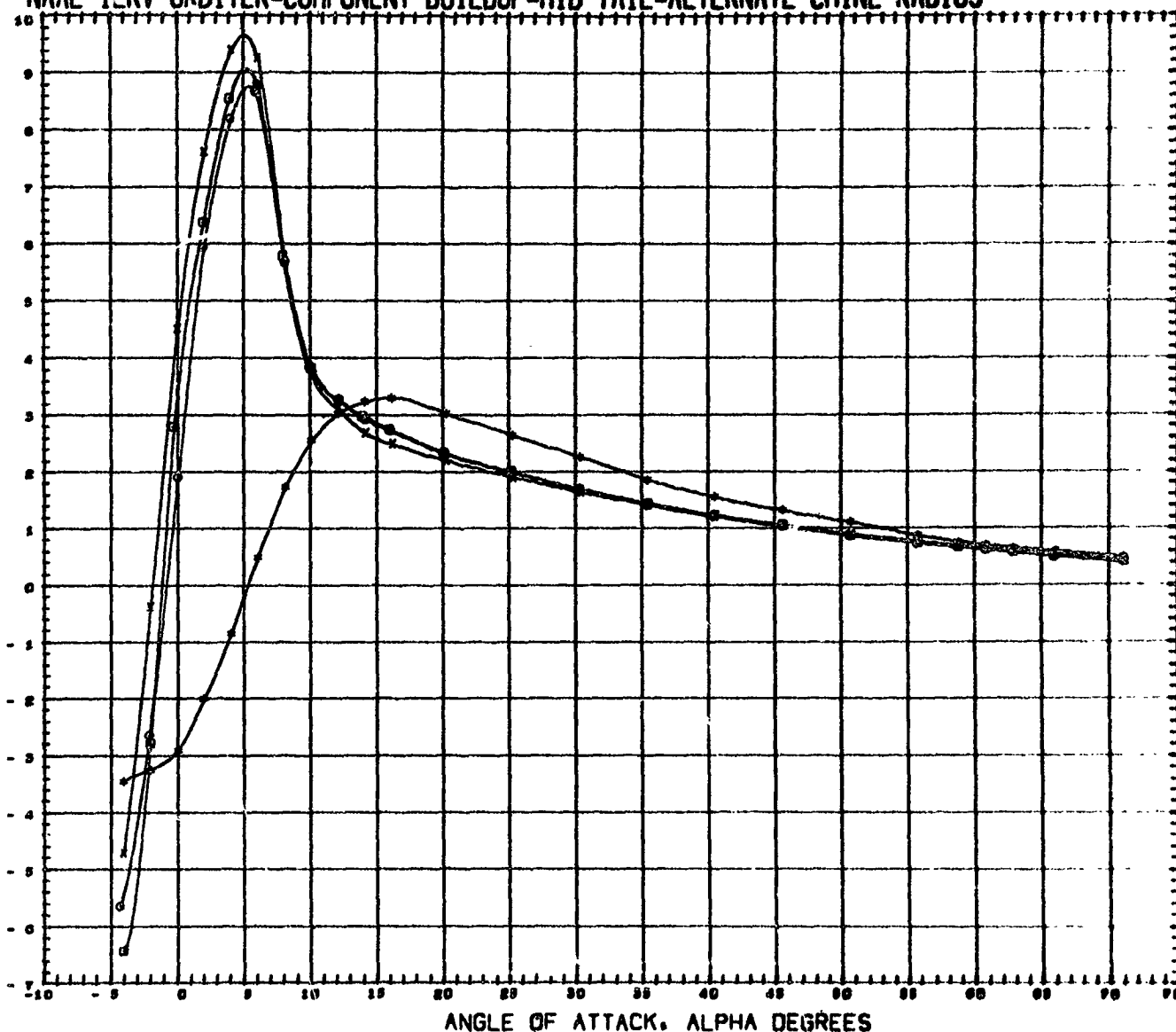


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 07           | 12 AUG 70 | 0.890 | REFS 1.70000010-01 90.07.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W9        | 11 AUG 70 |       | REFL 1.07370010-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W9 H12    | 11 AUG 70 |       | REFS 1.13300010-02 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W9 H12 V5 | 11 AUG 70 |       | ZMRP 0.13000010-02 INCHES  |
|        |                                 |              |           |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |              |           |       | ZMRP -3.04000010-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS

LIFT-DRAG RATIO, L/D



| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| x      | NAAL 029 SSV-ILRV STRAIGHT WING |
| *      | NAAL 029 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |

ANGLE OF ATTACK, ALPHA DEGREES

| DATA SET | DATE      | NACH  |
|----------|-----------|-------|
| (RC4000) | 12 AUG 70 | 0.230 |
| (RC4003) | 11 AUG 70 |       |
| (RC4000) | 11 AUG 70 |       |
| (RC4103) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000X10-01    |
| REFL 1.97370X10-01    |
| RE.0 1.13300X10-01    |
| TRF 0.10000X10-00     |
| TRF 0.00000X10-01     |
| TRF -3.00000X10-01    |
| SCALE 7.01000X10-01   |

REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED



| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 00V-ILRV STRAIGHT WING 00    | (RC4030) | 11 AUG 70 | 0.050 | REFS 1.700000E-01 00.FT.  |
| x      | NAAL 020 00V-ILRV STRAIGHT WING 00 W0 | (RC4043) | 11 AUG 70 |       | REFL 1.975700E-01 INCHES  |
| o      | NAAL 020 00V-ILRV STRAIGHT WING 00 W0 | (RC4024) | 11 AUG 70 |       | REFS 1.133000E-01 INCHES  |
| o      | NAAL 020 00V-ILRV STRAIGHT WING 00 W0 | (RC4029) | 11 AUG 70 |       | YMRP 0.130000E-01 INCHES  |
|        |                                       |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                       |          |           |       | ZMRP -3.040000E-01 INCHES |
|        |                                       |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-551



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.250 | REFS 1.70000E10-01 88 FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4033) | 11 AUG 70 |       | REFL 1.57570E10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4024) | 11 AUG 70 |       | REFS 1.13300E10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4025) | 11 AUG 70 |       | ENRP 0.13300E10-00 INCHES  |
|        |                                 |          |           |       | VNRP 0.00000E10-01 INCHES  |
|        |                                 |          |           |       | ENRP -3.04000E10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E10 SCALE     |

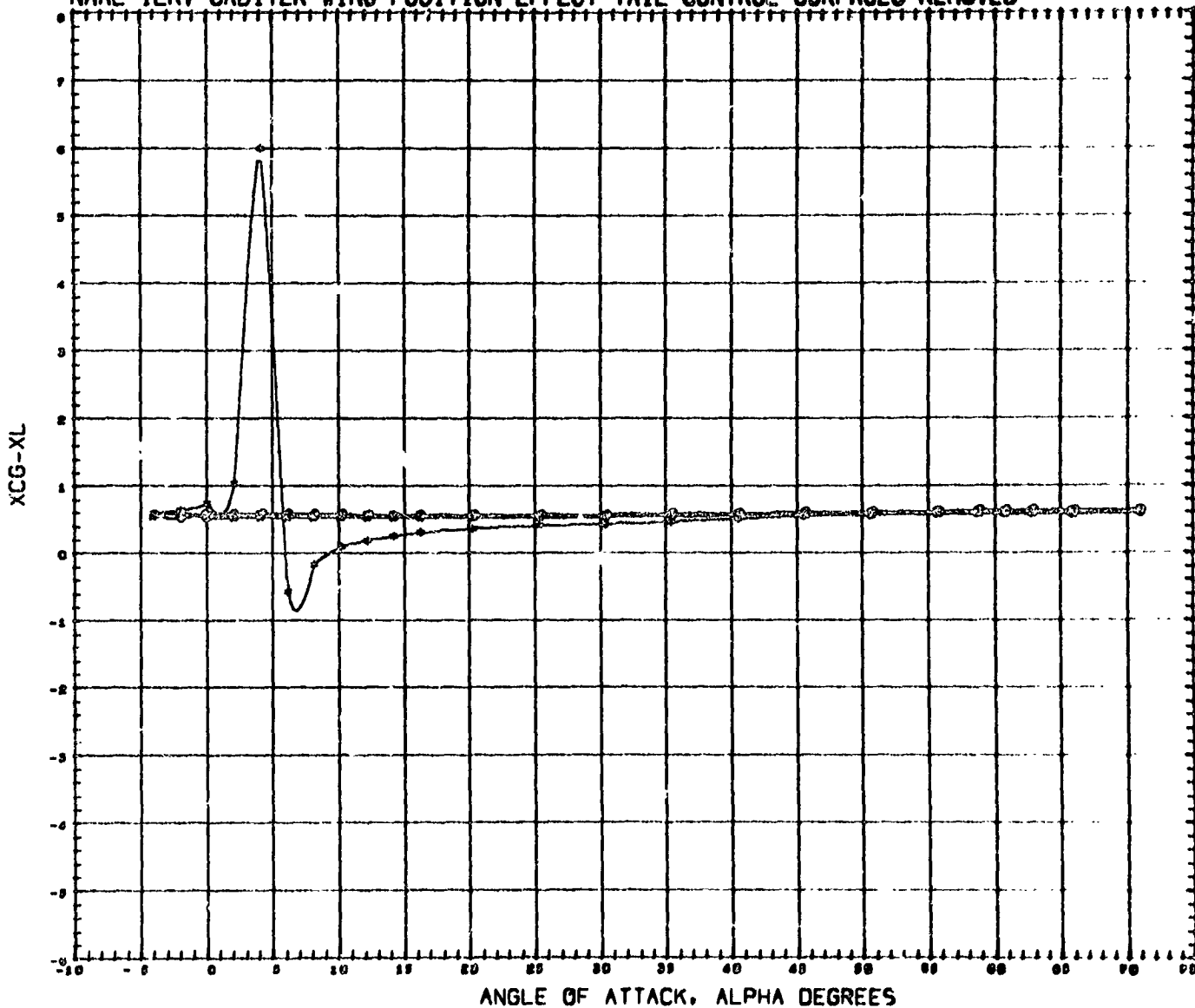
REFERENCE FILE NAAL 020 NA-70-351

THE TEST ORBITER WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED

ANGLE OF ATTACK, ALPHA DEGREES

REFERENCE FILE                      NAAL 629 NA-70-551

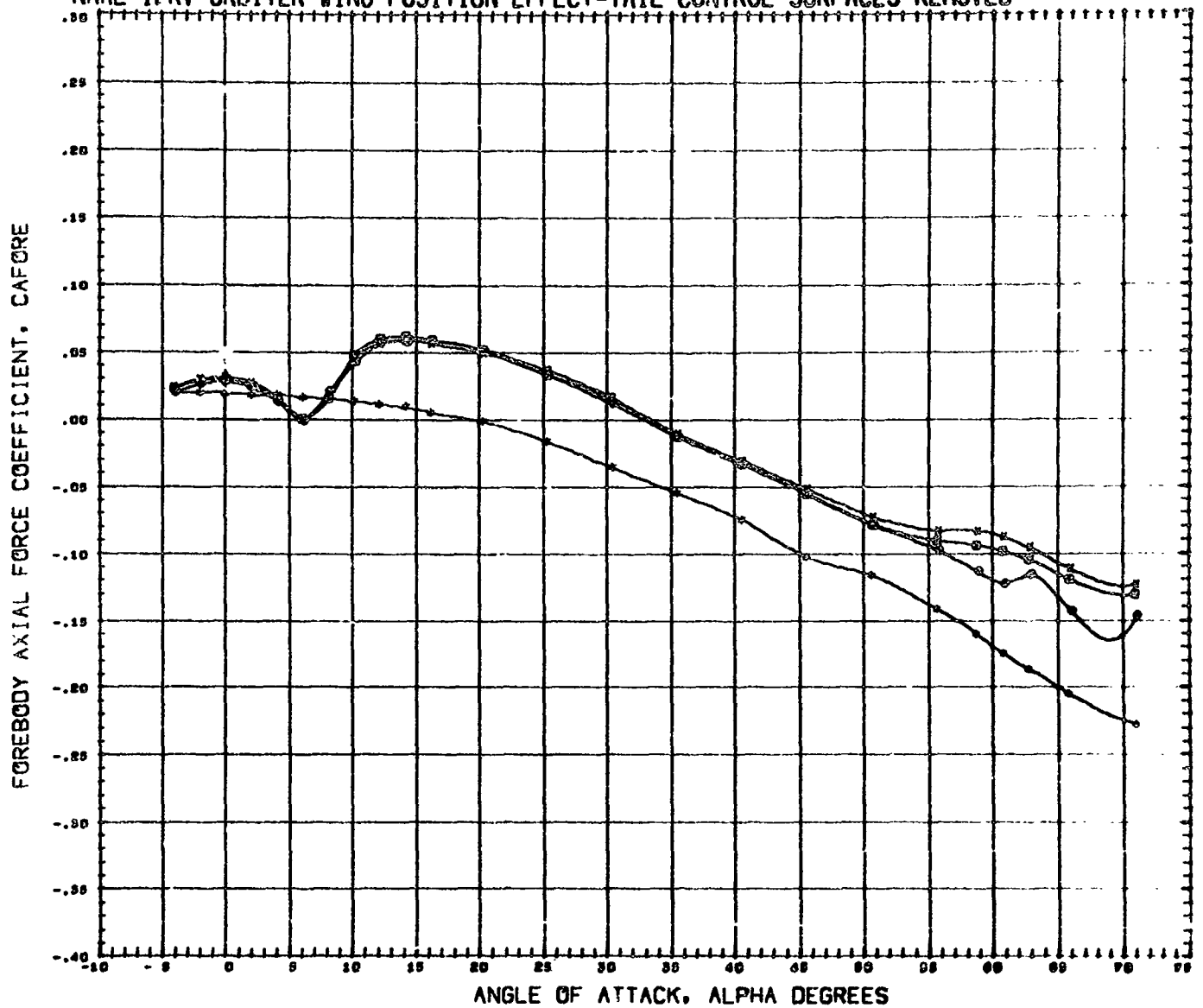
# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | NACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.290 | REFS 1.700000E-01 80.PY. |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       | REFL 1.870700E-01 INCHES |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4004) | 11 AUG 70 |       | REFS 1.100000E-00 INCHES |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4005) | 11 AUG 70 |       | INMP 0.100000E-00 INCHES |
|        |                                 |          |           |       | YMP 0.000000E-01 INCHES  |
|        |                                 |          |           |       | ZMP -3.000000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED

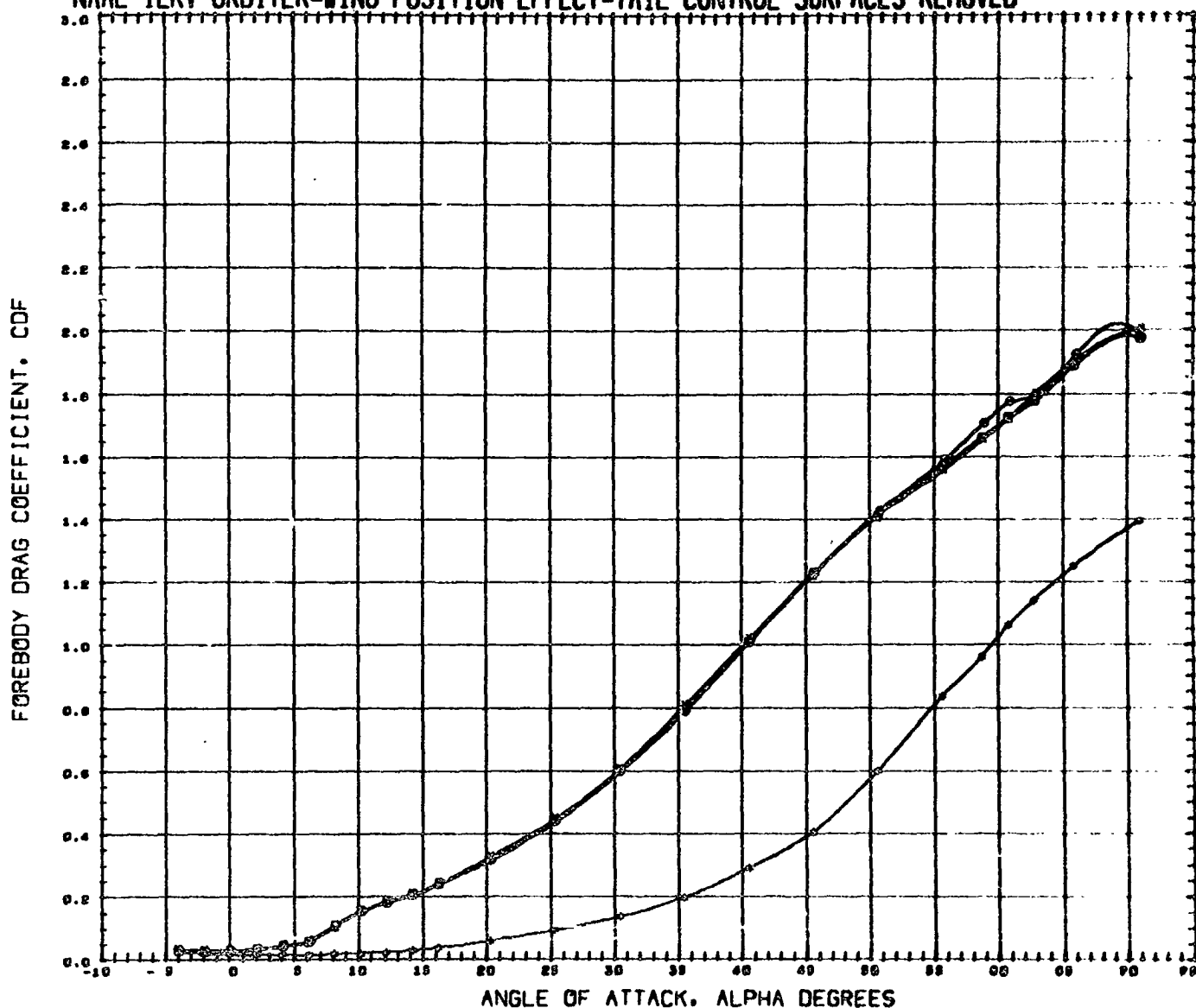


| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 629 SSV-ILRV STRAIGHT WING 86    | (RC4030) | 11 AUG 70 | 0.290 | REFD 1.70000010-01 80.71.  |
| x      | NAAL 629 SSV-ILRV STRAIGHT WING 86 W8 | (RC4063) | 11 AUG 70 |       | REFL 1.87370010-01 INCH26  |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING 86 W8 | (RC4081) | 11 AUG 70 |       | REFD 1.13100010-01 INCH26  |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING 86 W9 | (RC4025) | 11 AUG 70 |       | INQP 0.10200010-01 INCH26  |
|        |                                       |          |           |       | INQP 0.00000010-01 INCH26  |
|        |                                       |          |           |       | INRP -3.04000010-01 INCH26 |
|        |                                       |          |           |       | SCALE 7.61000010 SCALE     |

REFERENCE FILE NAAL 629 NA-70-331

173

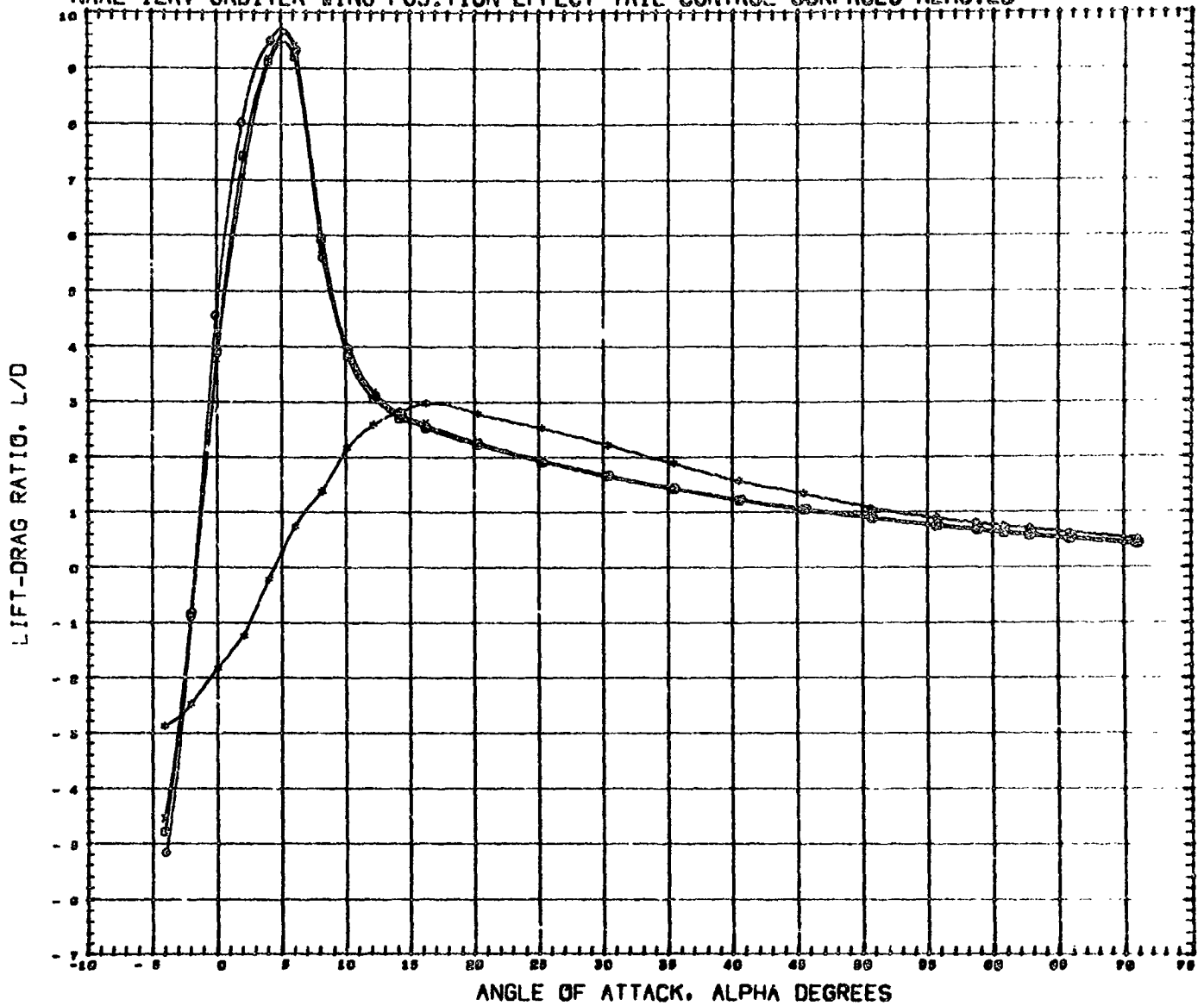
# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.850 | REFS 1.900000E-01 00.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       | REFL 1.673700E-01 INCHES  |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4024) | 11 AUG 70 |       | REFD 1.133900E-00 INCHES  |
| ○      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4025) | 11 AUG 70 |       | ENRP 0.132000E-00 INCHES  |
|        |                                 |          |           |       | YNRP 0.000000E-01 INCHES  |
|        |                                 |          |           |       | ZNRP -3.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

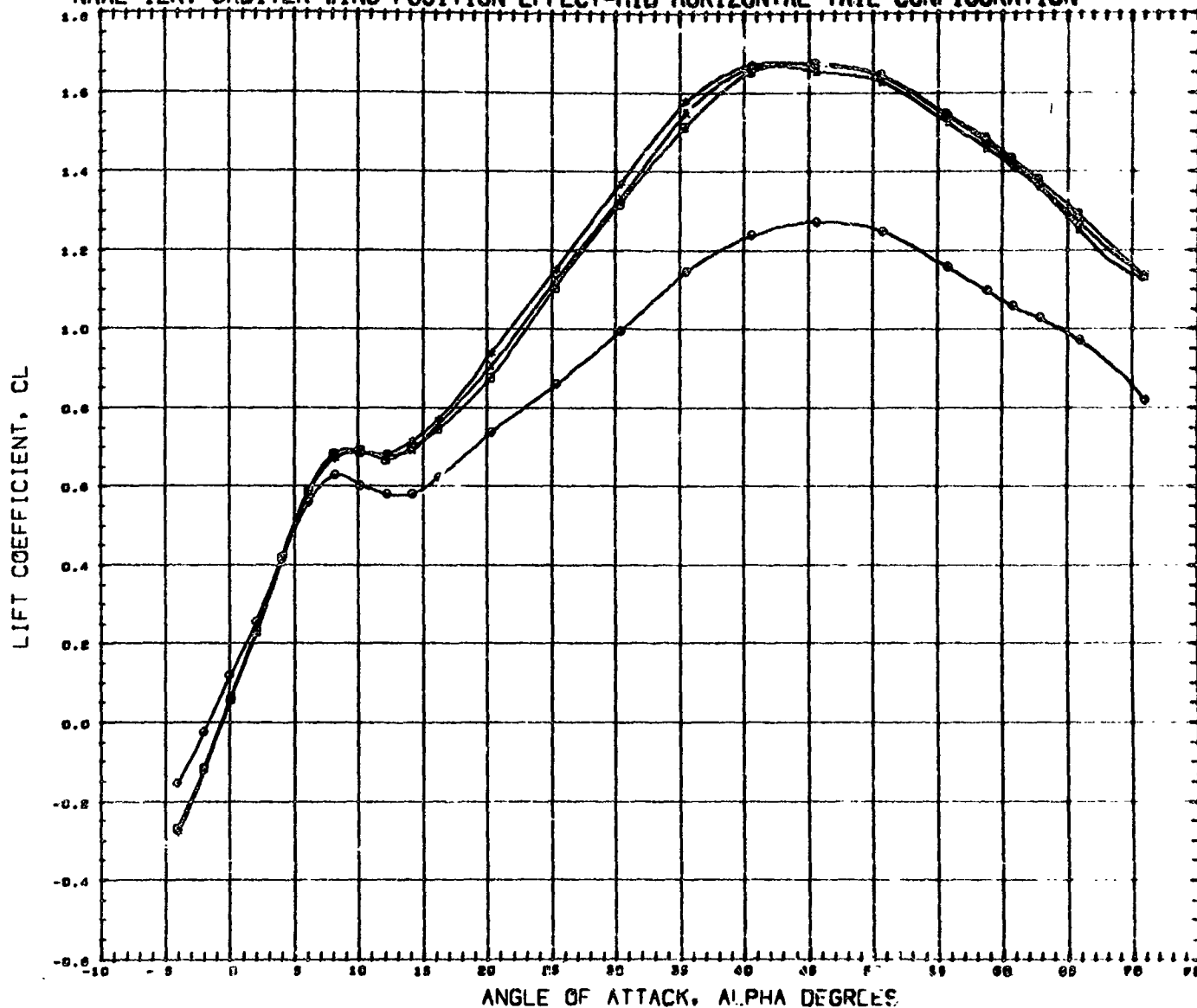
# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED



| SYMBOL | CONFIGURATION DESCRIPTION       | BO    | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-------|----------|-----------|-------|----------------------------|
| *      | NAAL 029 OSV-ILRV STRAIGHT WING | BO    | (RC4030) | 11 AUG 70 | 0.836 | REFS 1.70000E10-01 60.77.  |
| x      | NAAL 026 OSV-ILRV STRAIGHT WING | BO MB | (RC4083) | 11 AUG 70 |       | REFL 1.07370E10-01 INCHES  |
| o      | NAAL 020 OSV-ILRV STRAIGHT WING | BO MB | (RC4084) | 11 AUG 70 |       | REFD 1.13300E10-00 10:000  |
| o      | NAAL 020 OSV-ILRV STRAIGHT WING | BO MB | (RC4085) | 11 AUG 70 |       | ENRP 0.13200E10-00 INCHES  |
|        |                                 |       |          |           |       | YNRP 0.00000E10-01 INCHES  |
|        |                                 |       |          |           |       | ZNRP -2.04000E10-01 INCHES |
|        |                                 |       |          |           |       | SCALE 7.01000E10 SCALE     |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



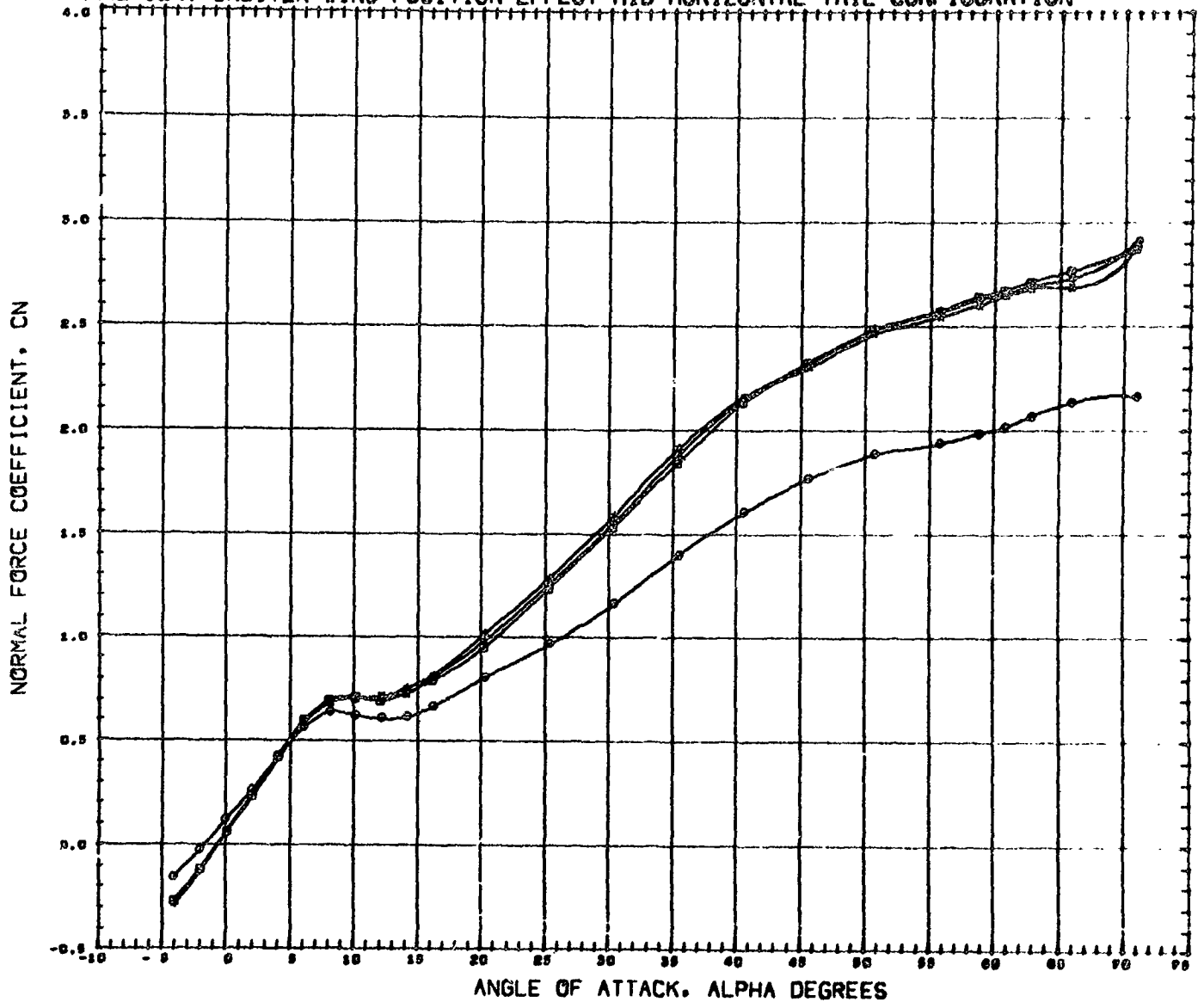
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4033) | 11 AUG 70 | 0.290 |
| (RC4020) | 11 AUG 70 |       |
| (RC4027) | 11 AUG 70 |       |
| (RC4003) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000E10-01    |
| REFL 1.37370E10-01    |
| REFD 1.13300E10-00    |
| INRP 0.13200E10-00    |
| YNRP 0.00000E10-00    |
| ZNRP -3.04000E10-01   |
| SCALE 7.01000E10-01   |

REFERENCE FILE NAAL 020 NA-70-351

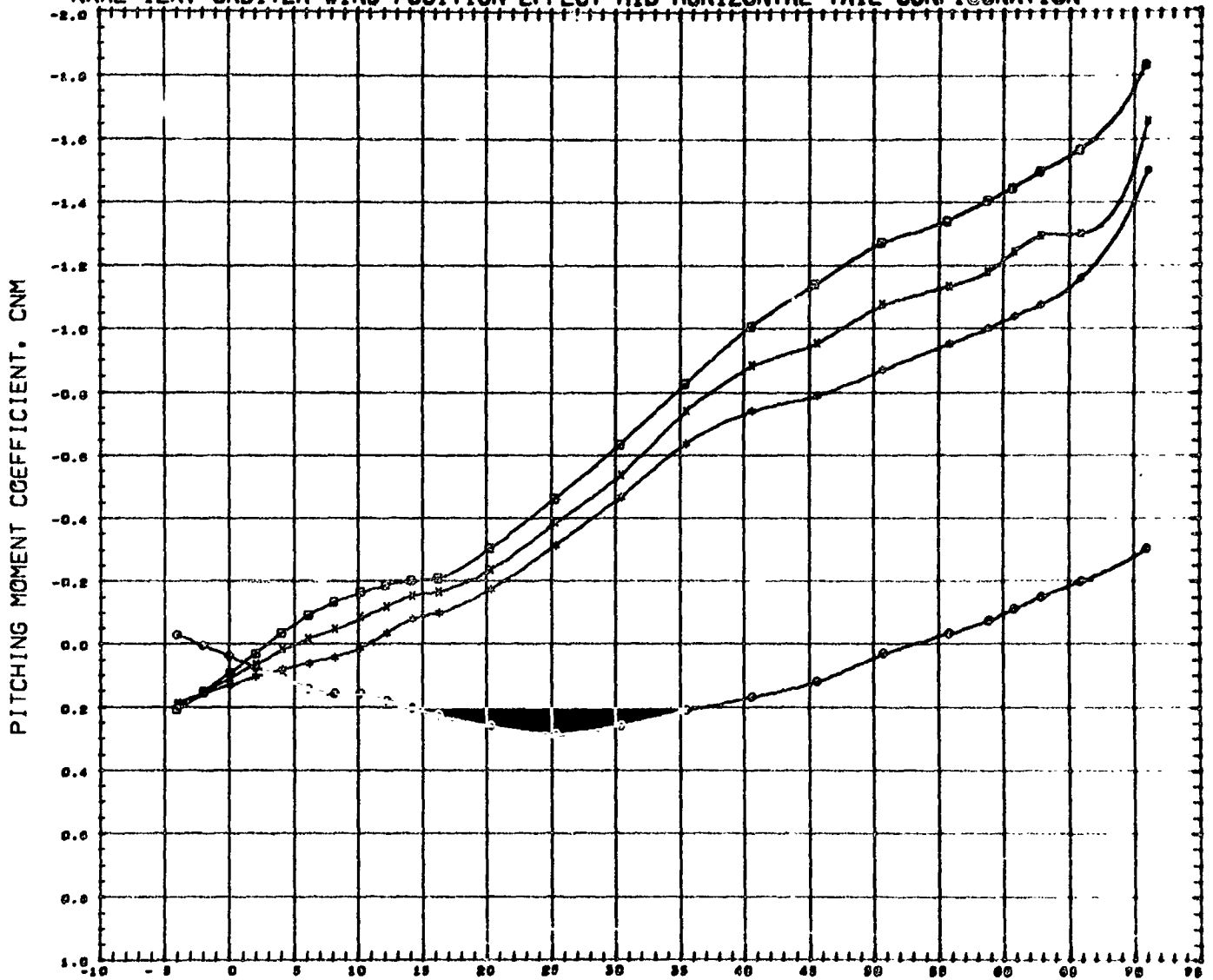
# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|-------------------------------------------|----------|-----------|-------|--------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6 N12 | (RC4035) | 11 AUG 70 | 0.850 | REFS 1.70000E-01 SQ.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6 N12 | (RC4026) | 11 AUG 70 |       | REFL 1.07370E-01 INCHES  |
| B      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6 N12 | (RC4027) | 11 AUG 70 |       | REFB 1.13300E-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6     | (RC4005) | 11 AUG 70 |       | XMRP 0.13800E-01 INCHES  |
|        |                                           |          |           |       | YMRP 0.00000E-01 INCHES  |
|        |                                           |          |           |       | ZMRP -3.04000E-01 INCHES |
|        |                                           |          |           |       | SCALE 7.01000E-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION

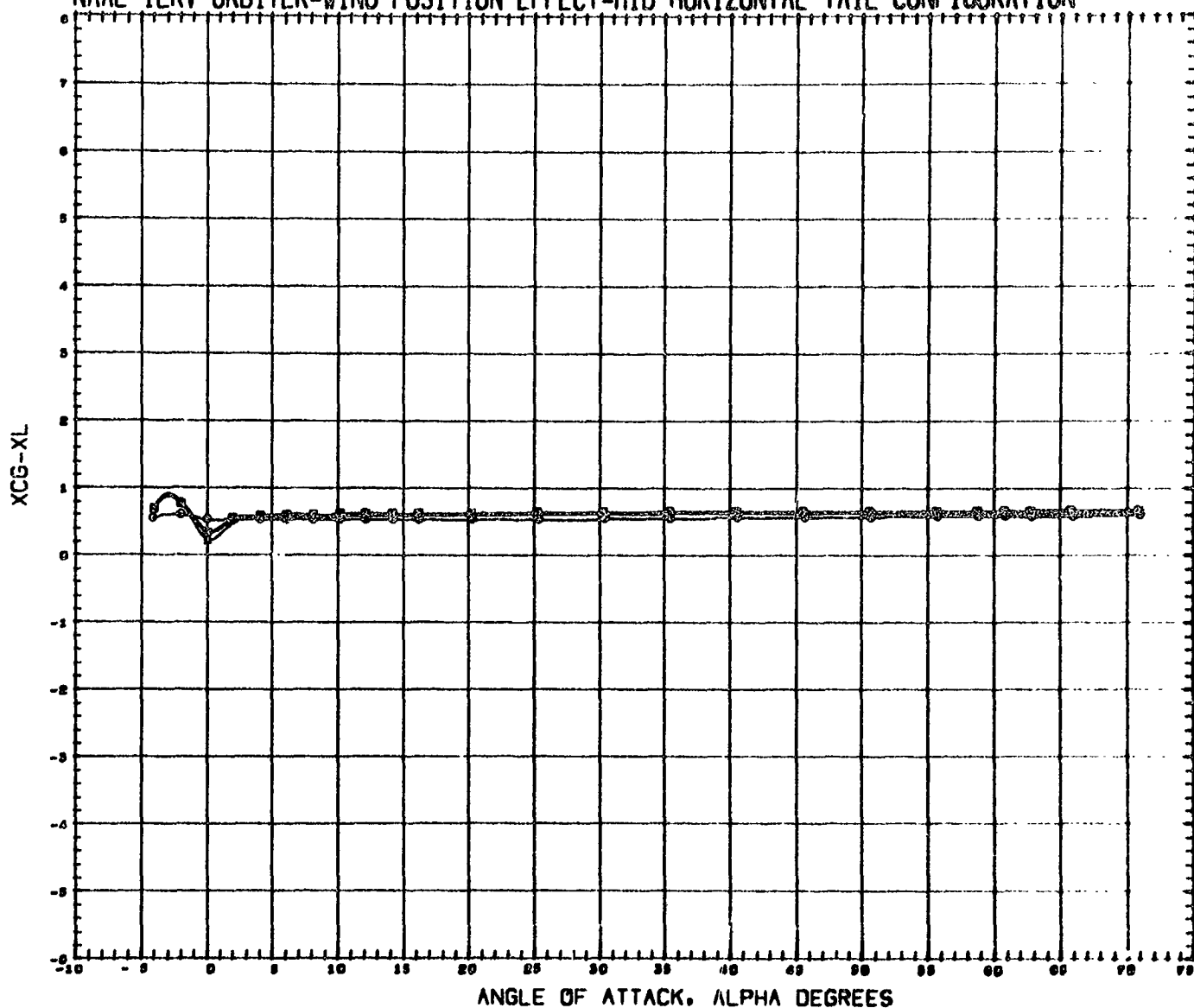


ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | NACH  | REFERENCE INFORMATION                  |
|--------|-------------------------------------------|----------|-----------|-------|----------------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W0 H12 | (RC4035) | 11 AUG 70 | 0.850 | REFS 1.70000X10 <sup>-01</sup> 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W8 H12 | (RC4020) | 11 AUG 70 |       | REFL 1.97378X10 <sup>-01</sup> INCHES  |
| g      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W9 H12 | (RC4027) | 11 AUG 70 |       | REFS 1.13308X10 <sup>-01</sup> INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W6     | (RC4003) | 11 AUG 70 |       | ENRP 0.13000X10 <sup>-00</sup> INCHES  |
|        |                                           |          |           |       | ENRP 0.00000X10 <sup>-00</sup> INCHES  |
|        |                                           |          |           |       | ENRP -3.84000X10 <sup>-01</sup> INCHES |
|        |                                           |          |           |       | SCALE 7.01000X10 <sup>-01</sup> SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



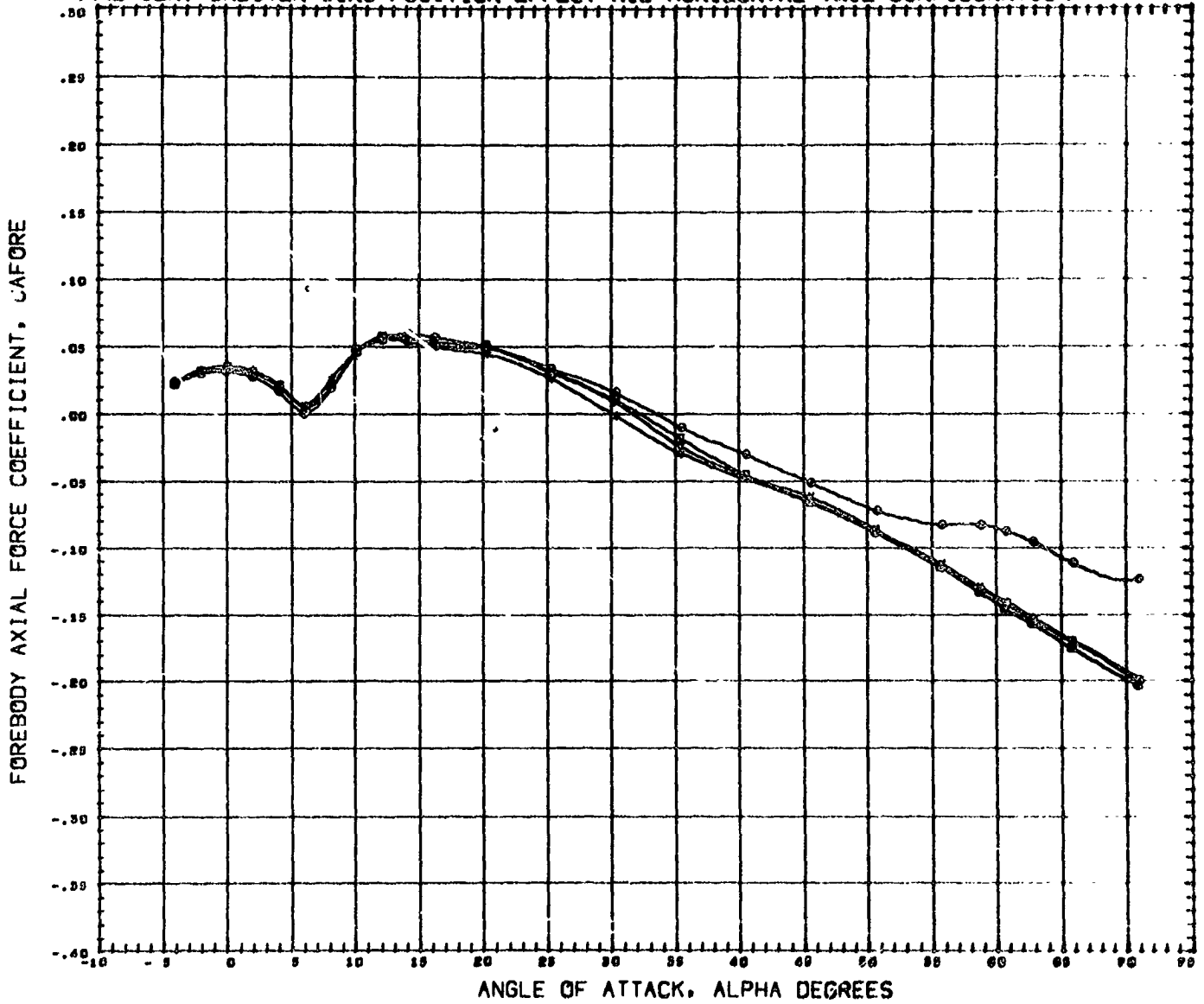
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|-----------|----------|-----------|-----------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H12 | (RC4035) | 11 AUG 70 | 0.259                 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H12 | (RC4080) | 11 AUG 70 |                       |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H12 | (RC4027) | 11 AUG 70 |                       |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0     | (RC4063) | 11 AUG 70 |                       |

REFERENCE FILE

NAAL 020 NA-70-351

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000X10-01    |
| REFL 1.97570X10-01    |
| REFD 1.13800X10-00    |
| WHRP 0.13200X10-00    |
| VHRP 0.00000X10-01    |
| ZHRP -3.04000X10-01   |
| SCALE 7.61000X10-02   |

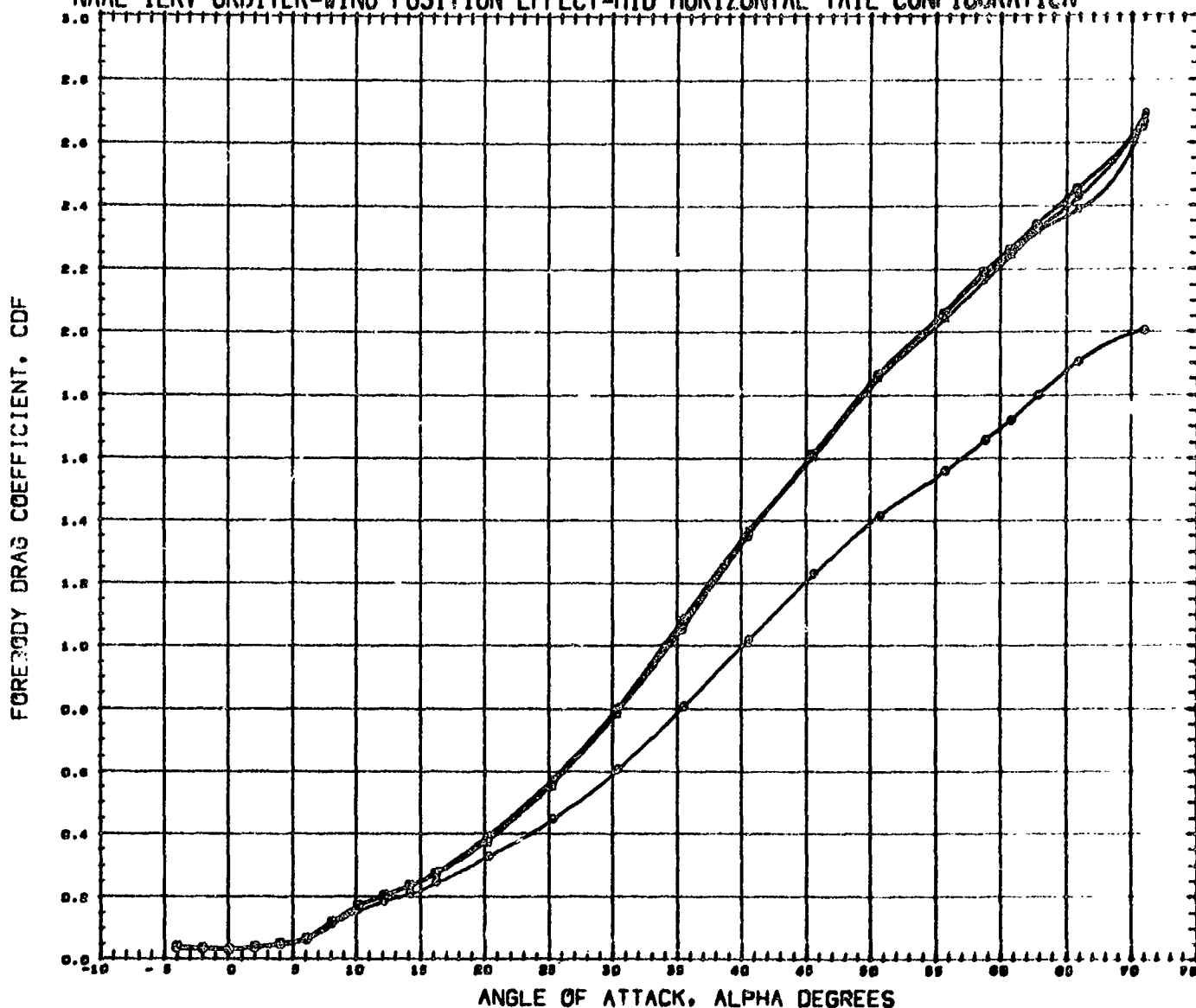
# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | MACH  | REFERENCE INFORMATION       |
|--------|-------------------------------------------|----------|-----------|-------|-----------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING 80 W8 M12 | (RC4035) | 11 AUG 70 | 0.250 | REF A 1.70000E10-01 80.971  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING 80 W8 M12 | (RC4020) | 11 AUG 70 |       | REF L 1.87370E10-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING 80 W8 M12 | (RC4027) | 11 AUG 70 |       | REF B 1.15800E10-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING 80 W8     | (RC4063) | 11 AUG 70 |       | REF C 0.15800E10-00 INCHES  |
|        |                                           |          |           |       | REF D 0.00500E10-01 INCHES  |
|        |                                           |          |           |       | REF E -2.84000E10-01 INCHES |
|        |                                           |          |           |       | SCALE 7.01000E10 SCALE      |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION

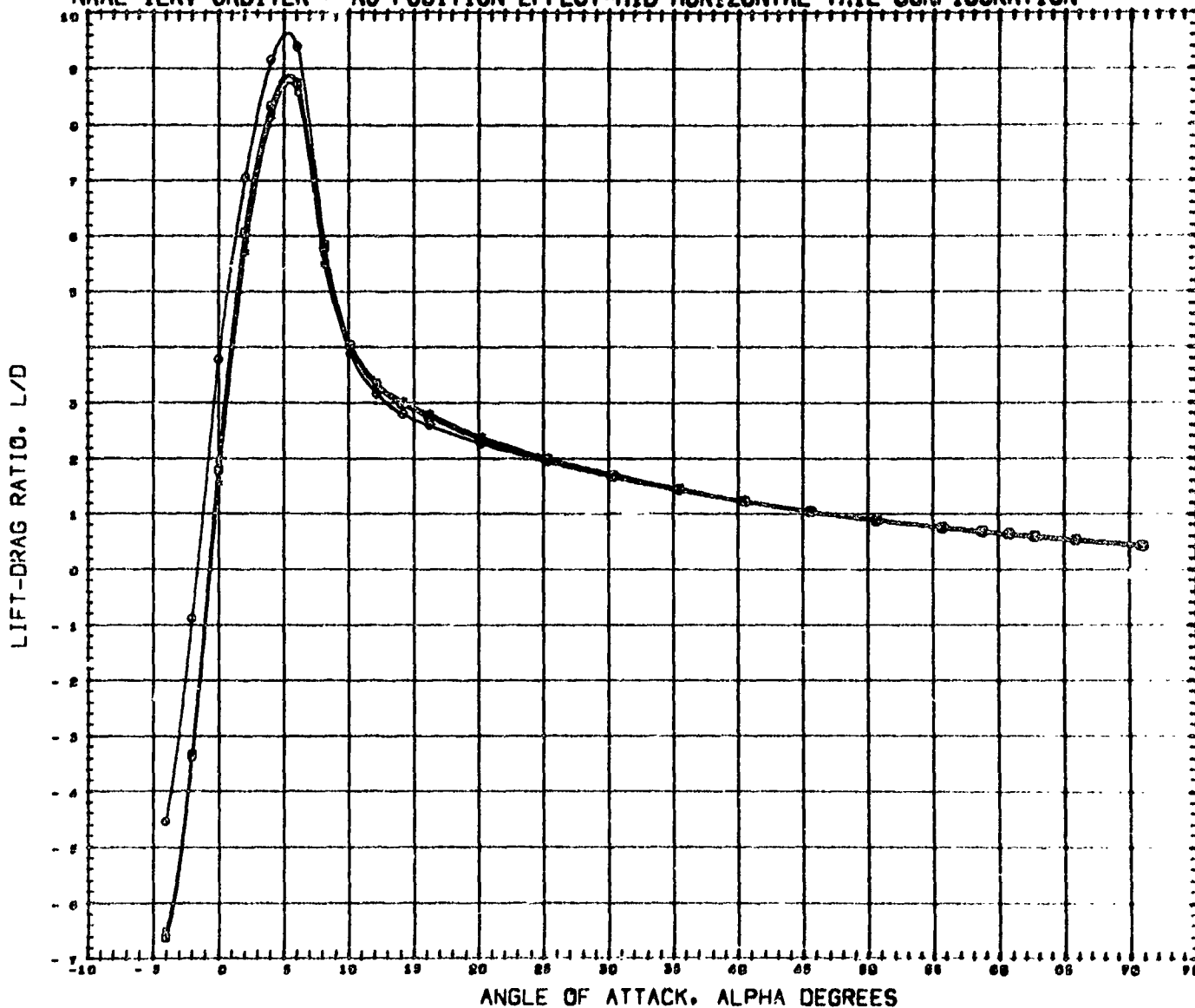


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| O      | NAAL 020 BSV-ILRV STRAIGHT WING | IRC4035  | 31 AUG 70 | 0.250 | REFS 1.70000E10-01 88.FT.  |
| X      | NAAL 020 BSV-ILRV STRAIGHT WING | IRC4020  | 31 AUG 70 |       | REFL 1.57376E10-01 INCHES  |
| Q      | NAAL 020 BSV-ILRV STRAIGHT WING | IRC4027  | 31 AUG 70 |       | REFD 1.13300E10-00 INCHES  |
| O      | NAAL 020 BSV-ILRV STRAIGHT WING | IRC4063  | 31 AUG 70 |       | ENRP 0.13300E10-00 INCHES  |
|        |                                 |          |           |       | YNRP 0.00000E10-01 INCHES  |
|        |                                 |          |           |       | ZNRP -3.00000E10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E10-00 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-251

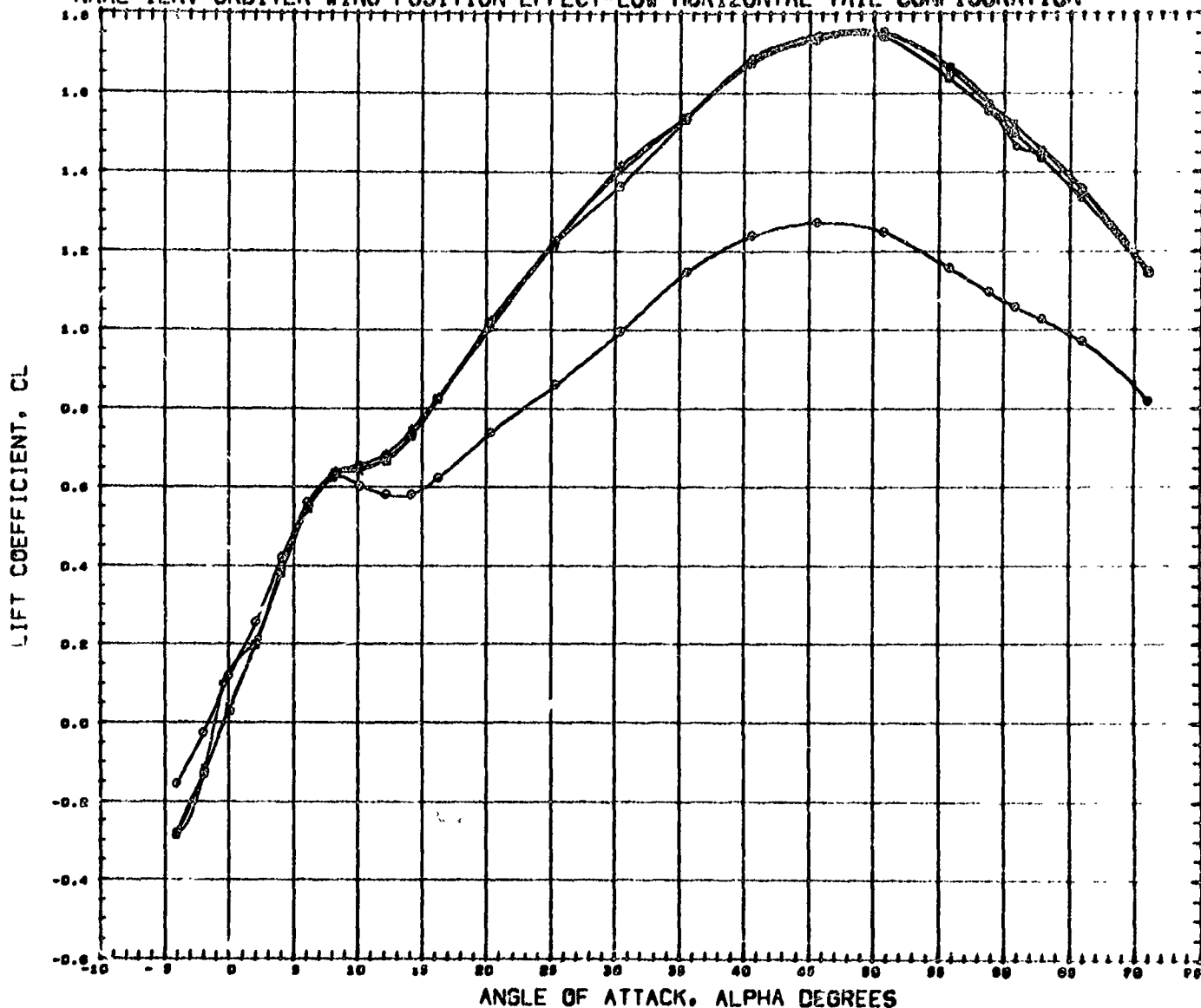
# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION         |
|--------|---------------------------------|----------|-----------|-------|-------------------------------|
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4035) | 11 AUG 70 | 0.250 | REFS 1.700000E+01 00.01 00.01 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4020) | 11 AUG 70 |       | REFL 1.973700E+01 100020      |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4027) | 11 AUG 70 |       | REFD 1.133000E+00 100020      |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       | YMRP 0.133000E+00 100020      |
|        |                                 |          |           |       | YMRP 0.000000E+00 100020      |
|        |                                 |          |           |       | ZMRP -3.040000E-01 100020     |
|        |                                 |          |           |       | SCALE 7.010000E+00 00 SCALE   |

REFERENCE FILE NAAL 020 NA-70-331

# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION

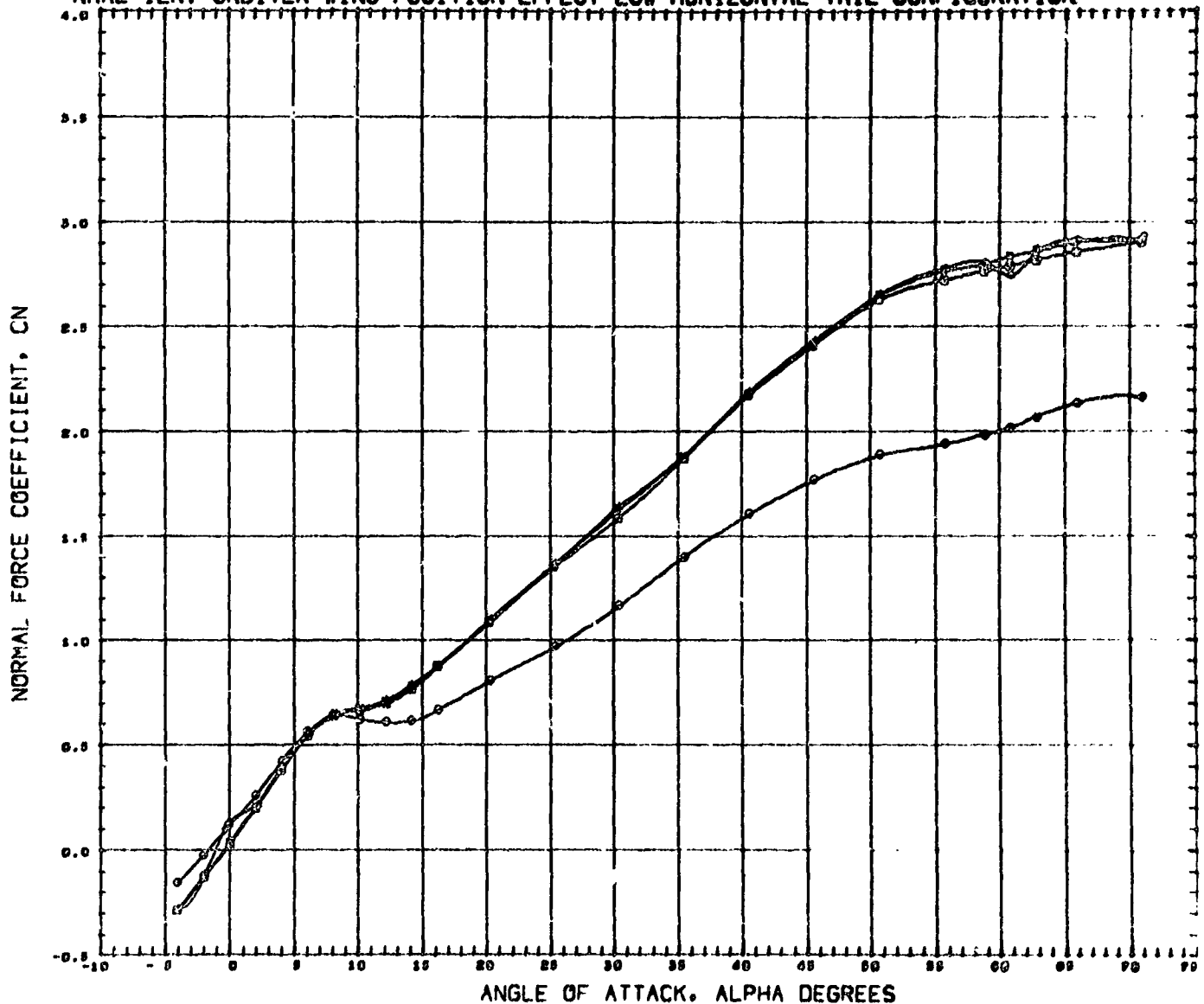


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | NACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| S      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4079) | 11 AUG 70 | 0.299 | REFS 1.79000010-01 00.77   |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4080) | 11 AUG 70 |       | REFL 1.87370010-01 INCH20  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4086) | 11 AUG 70 |       | REFD 1.13300010-01 INCH20  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4083) | 11 AUG 70 |       | YNRP 0.00000010-00 INCH20  |
|        |                                 |          |           |       | YNRP -3.04000010-01 INCH20 |
|        |                                 |          |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

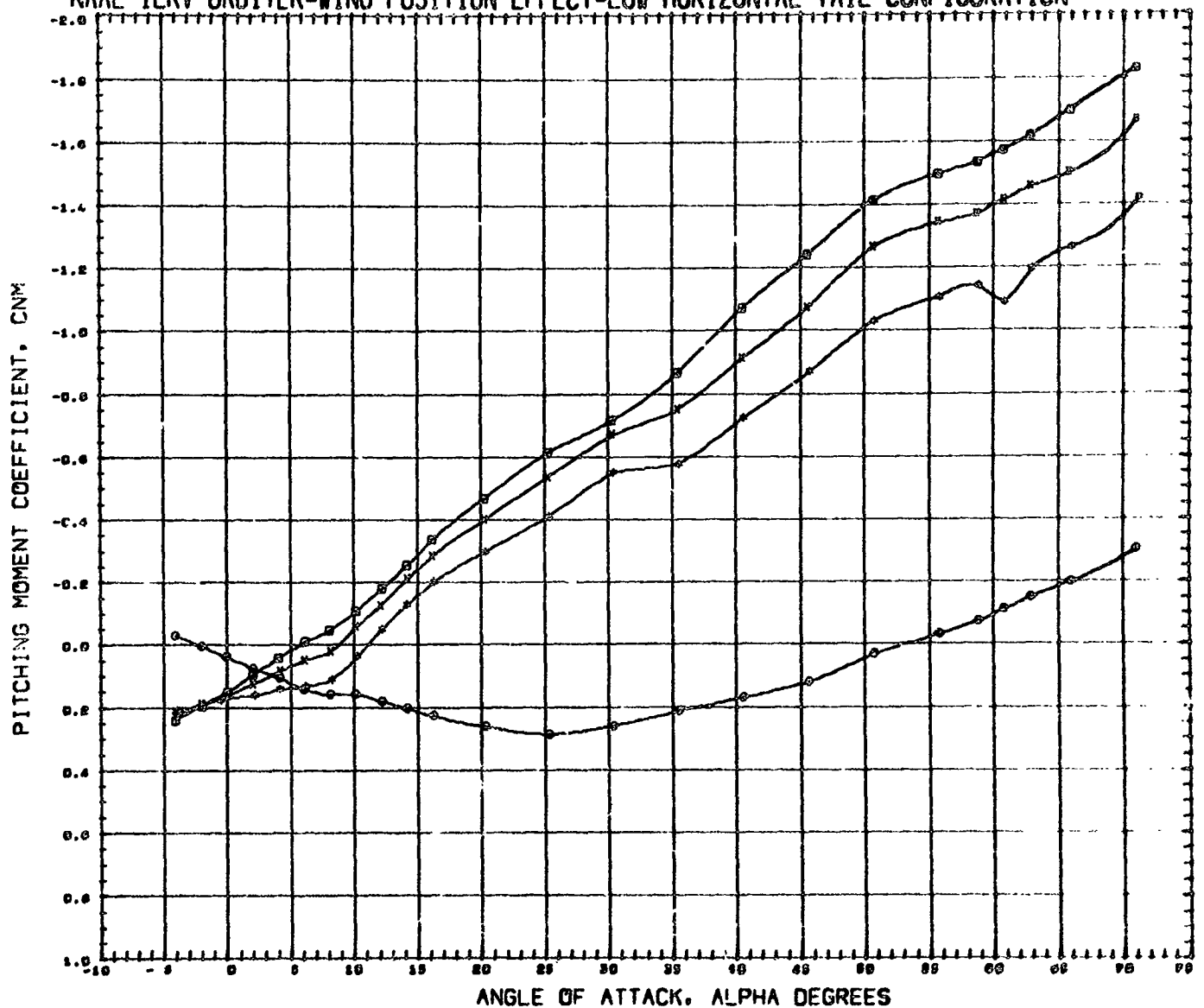
# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL                            | CONFIGURATION DESCRIPTION |          |               | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION |                     |        |
|-----------------------------------|---------------------------|----------|---------------|-----------|----------|-----------|-----------------------|---------------------|--------|
| +                                 | NAAL 020                  | OSV-ILRV | STRAIGHT WING | 88 W6 H13 | (RC4078) | 11 AUG 70 | 0.250                 | REFD 1.90000010-01  | 80.FT. |
| x                                 | NAAL 020                  | OSV-ILRV | STRAIGHT WING | 88 W6 H13 | (RC4080) | 11 AUG 70 |                       | REFL 1.87500010-01  | INCHES |
| □                                 | NAAL 020                  | OSV-ILRV | STRAIGHT WING | 88 W6 H13 | (RC4086) | 11 AUG 70 |                       | REFD 1.85000010-01  | INCHES |
| ○                                 | NAAL 020                  | OSV-ILRV | STRAIGHT WING | 88 W6     | (RC4083) | 11 AUG 70 |                       | WHRP 0.00000010-00  | INCHES |
|                                   |                           |          |               |           |          |           |                       | YHRP 0.00000010-01  | INCHES |
|                                   |                           |          |               |           |          |           |                       | ZHRP 0.00000010-01  | INCHES |
|                                   |                           |          |               |           |          |           |                       | SCALE 7.01000010-01 | SCALE  |
| REFERENCE FILE NAAL 020 NA-7C-351 |                           |          |               |           |          |           |                       |                     |        |

REFERENCE FILE NAAL 020 NA-7C-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION

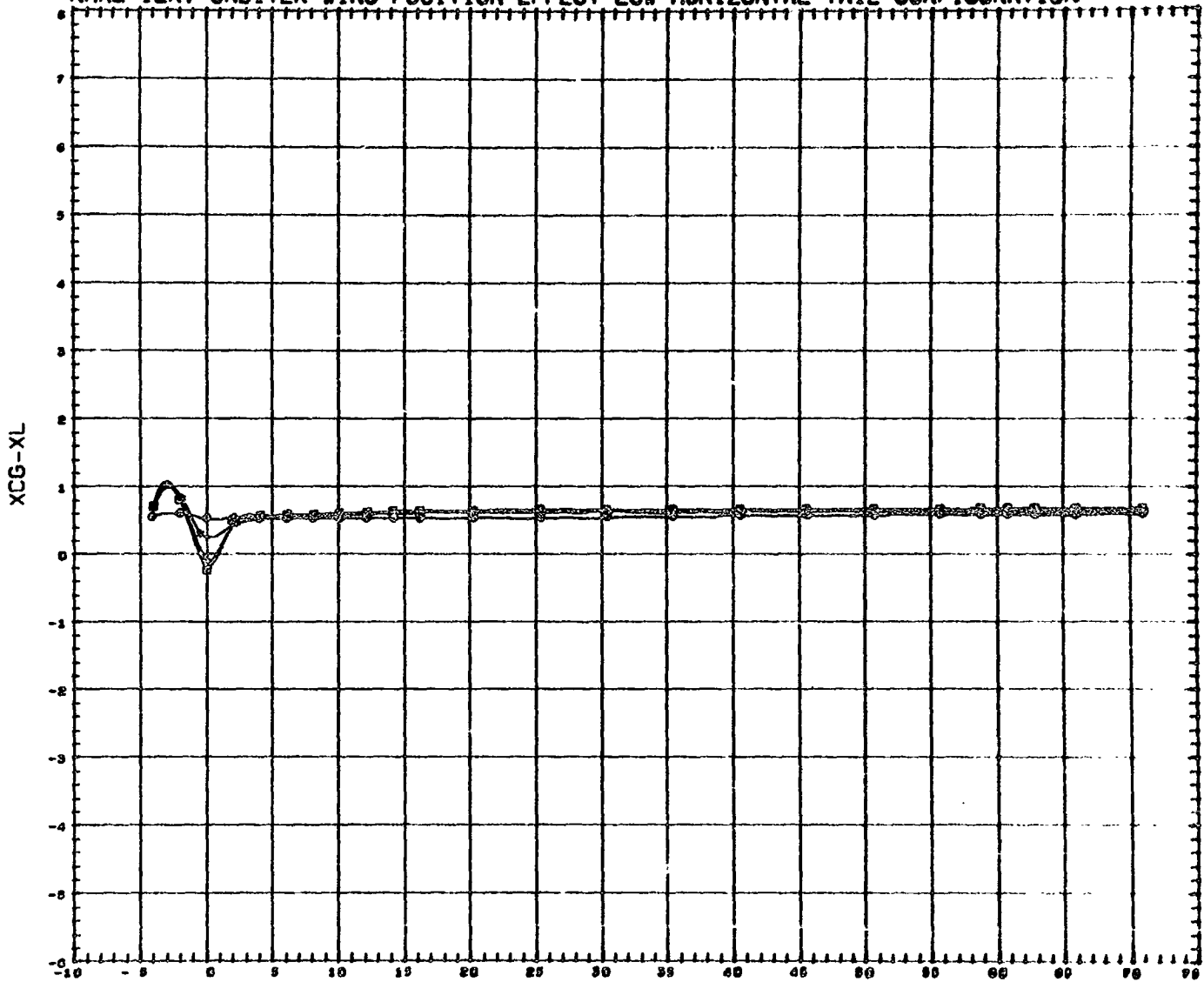


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 88 W0 N13 | 11 AUG 70 | 0.250 | REF0 1.70000110-01 00.77.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 88 W0 N13 | 11 AUG 70 |       | REF1 1.07070110-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 88 W0 N13 | 11 AUG 70 |       | REF2 1.13000110-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 88 W0     | 11 AUG 70 |       | REF3 0.13000110-01 INCHES  |
|        |                                 |           |           |       | REF4 0.00000110-01 INCHES  |
|        |                                 |           |           |       | REF5 -3.04000110-01 INCHES |
|        |                                 |           |           |       | SCALE 7.01000110-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION

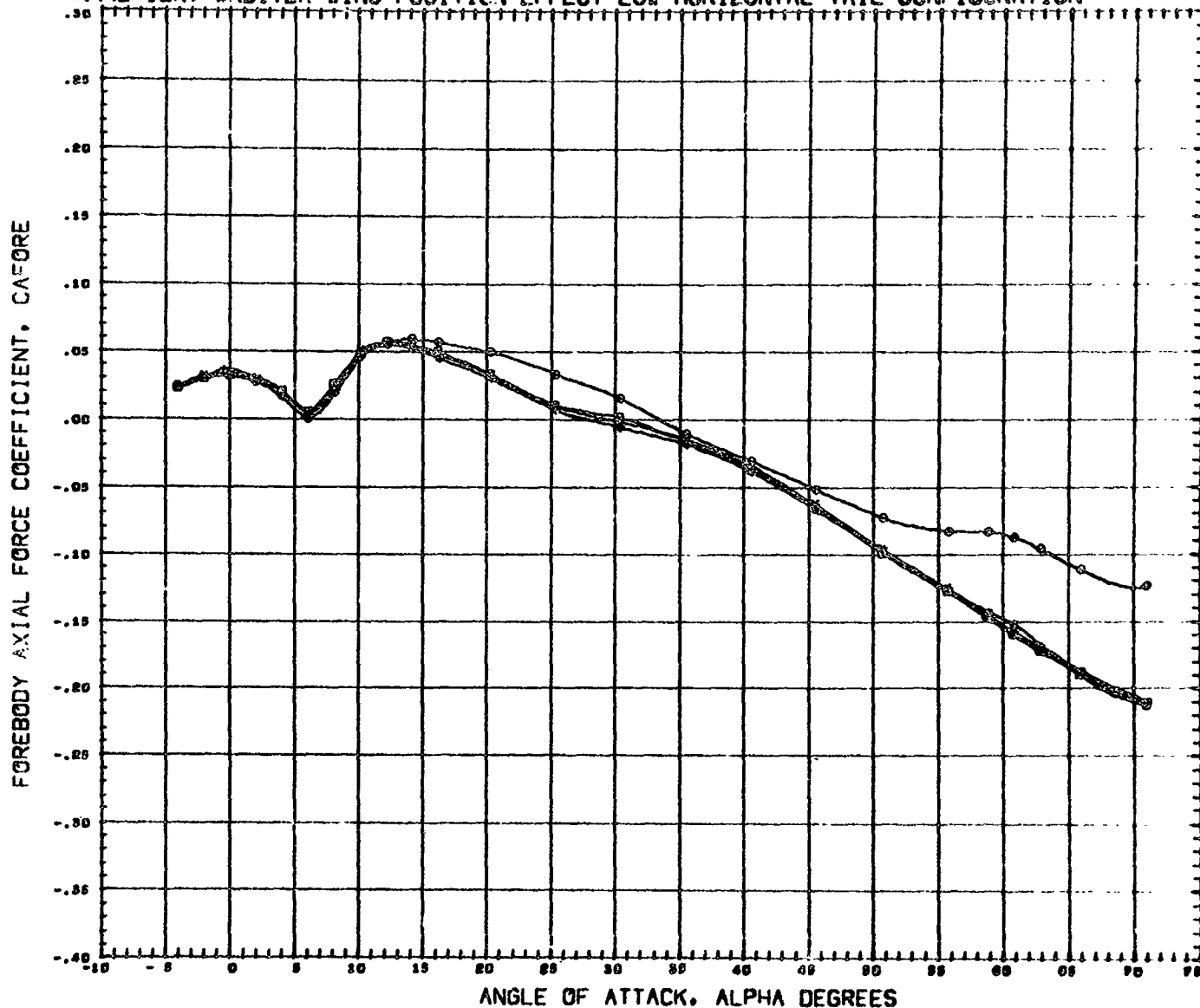


ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|-----------|----------|-----------|-----------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W6 H13 | (RC4070) | 11 AUG 70 | 0.250                 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 H13 | (RC4080) | 11 AUG 70 |                       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W9 H13 | (RC4090) | 11 AUG 70 |                       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W5     | (RC4003) | 11 AUG 70 |                       |

REFERENCE FILE NAAL 029 NA-70-531

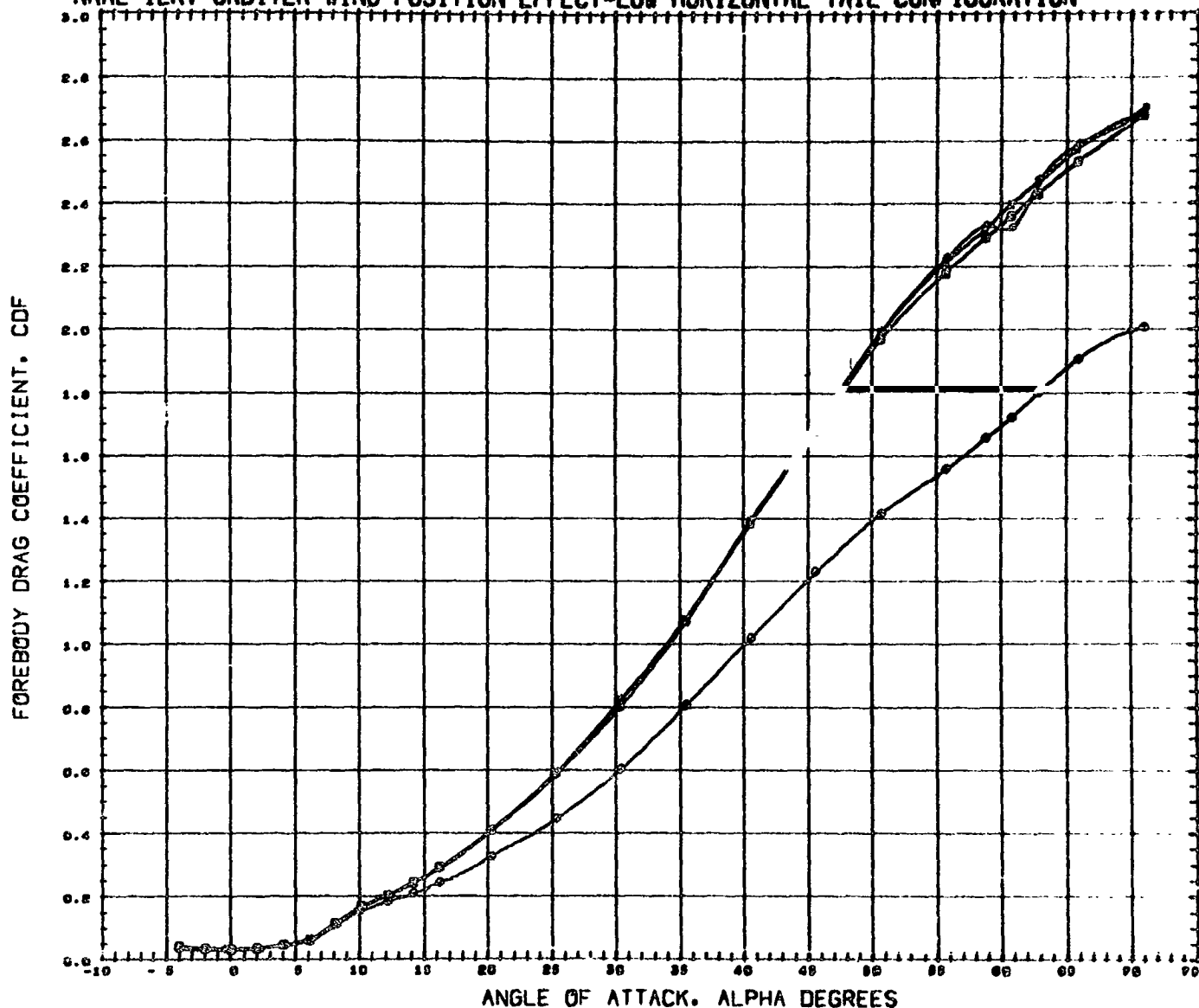
# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | SS MG | H13 | DATA SET | DATE      | NACH  | REFERENCE INFORMATION                  |
|--------|---------------------------------|-------|-----|----------|-----------|-------|----------------------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | SS MG | H13 | (RC4070) | 11 AUG 70 | 0.290 | REF0 1.70000X10 <sup>-01</sup> 86.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | SS MG | H13 | (RC4020) | 11 AUG 70 |       | REF1 1.97370X10 <sup>-01</sup> INCHES  |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING | SS MG | H13 | (RC4020) | 11 AUG 70 |       | REF2 1.13800X10 <sup>-00</sup> INCHES  |
| ○      | NAAL 029 SSV-ILRV STRAIGHT WING | SS MG |     | (RC4083) | 11 AUG 70 |       | KNRP 0.13800X10 <sup>-00</sup> INCHES  |
|        |                                 |       |     |          |           |       | YNRP 0.00000X10 <sup>-01</sup> INCHES  |
|        |                                 |       |     |          |           |       | ZMRP -3.04000X10 <sup>-01</sup> INCHES |
|        |                                 |       |     |          |           |       | SCALE 7.01000X10 <sup>-01</sup> SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

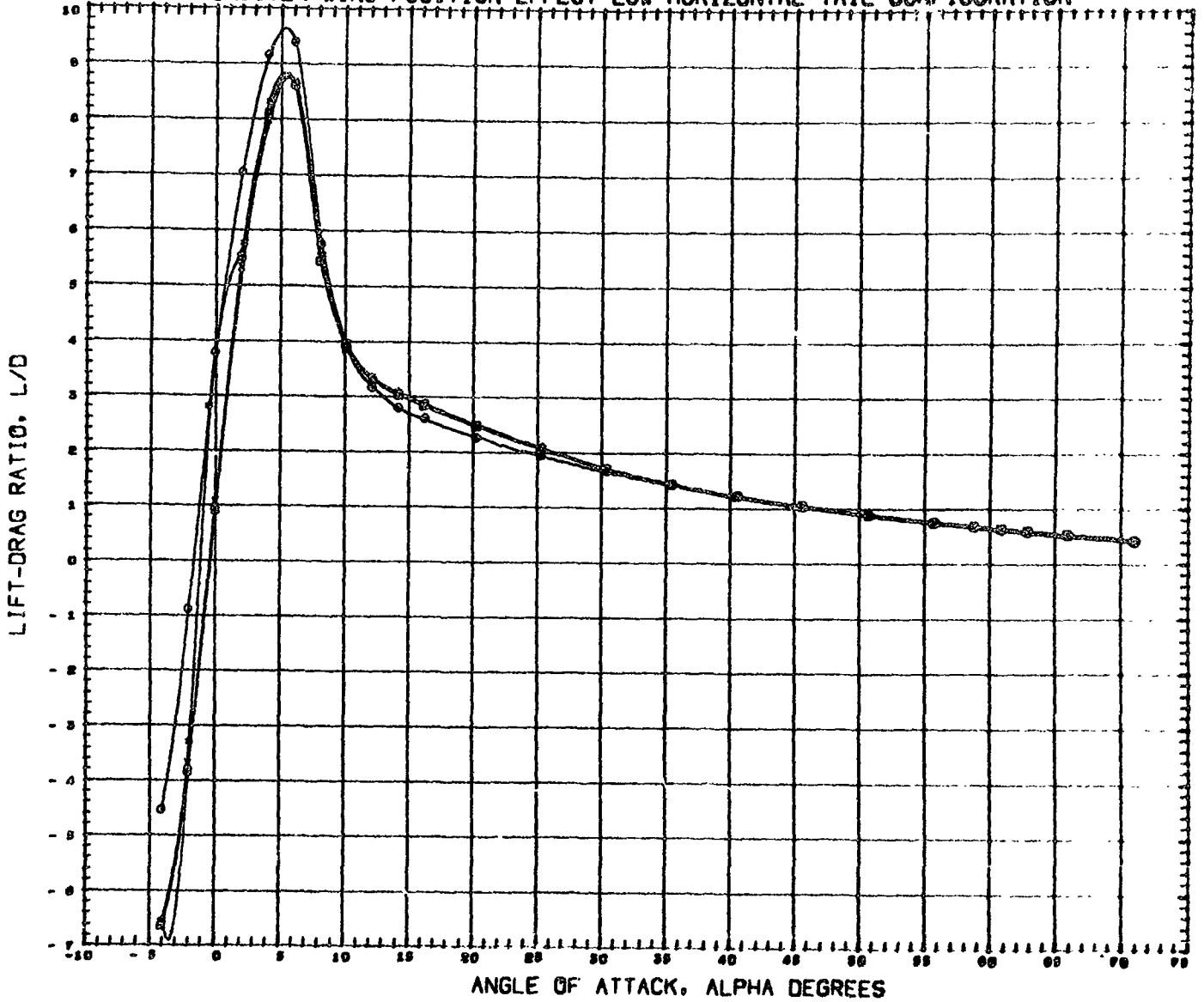
# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| #      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4070   | 11 AUG 70 | 0.250 | REFS 1.70000010-01 80.77.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4080   | 11 AUG 70 |       | REFL 1.07370010-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4086   | 11 AUG 70 |       | REFS 1.13300010-00 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4083   | 11 AUG 70 |       | REFS 0.13300010-00 INCHES  |
|        |                                 |          |           |       | REFS 0.00000010-01 INCHES  |
|        |                                 |          |           |       | REFS -3.04000010-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000010-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION

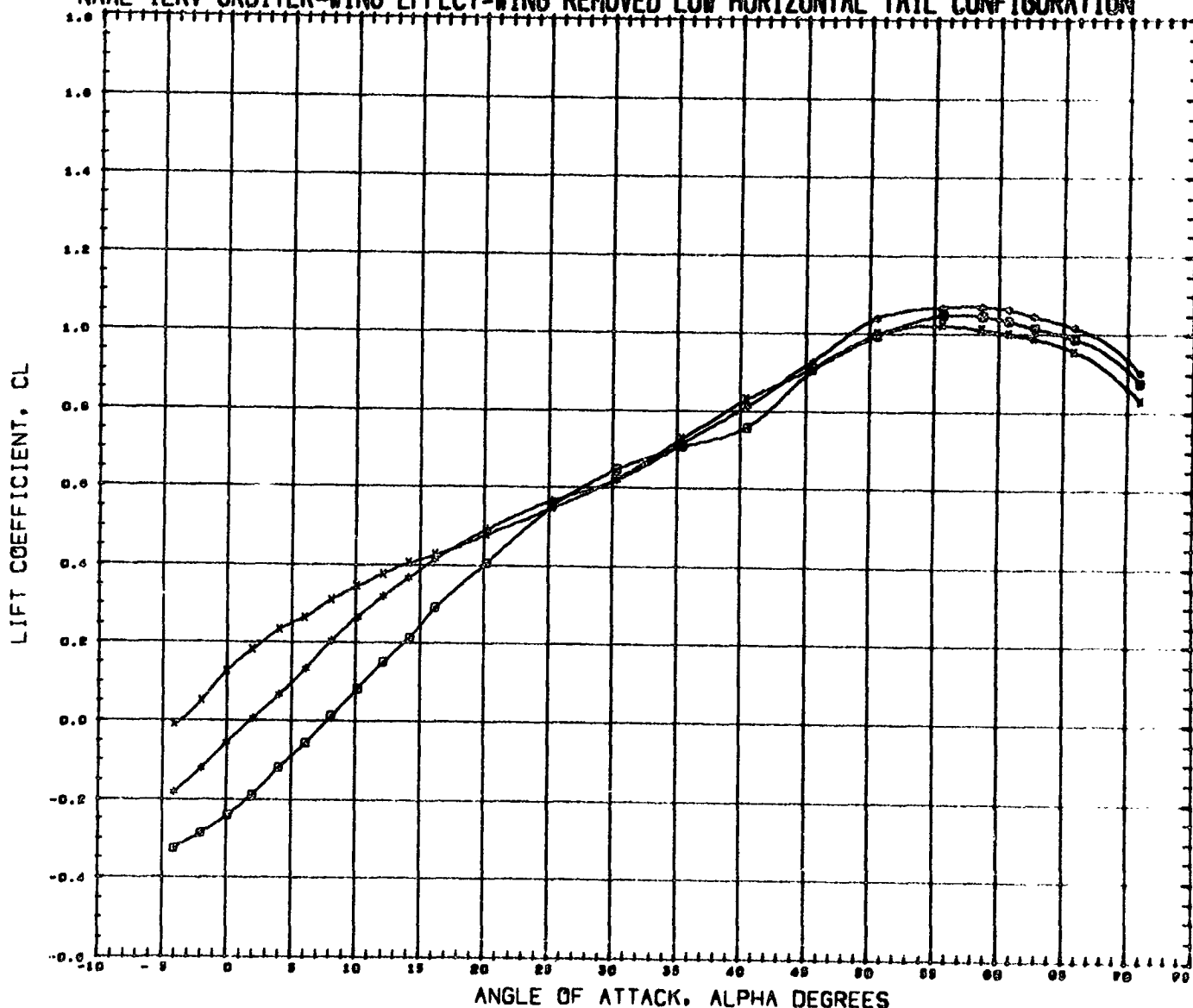


| SYMBOL | CONFIGURATION DESCRIPTION       | BC WS H13 | DATA SET | DATE      | MACH  |
|--------|---------------------------------|-----------|----------|-----------|-------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | BC WS H13 | (RC4079) | 11 AUG 70 | 0.250 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | BC WS H13 | (RC4080) | 11 AUG 70 |       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | BC WS H13 | (RC4081) | 11 AUG 70 |       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | BC WS     | (RC4082) | 11 AUG 70 |       |

REFERENCE FILE NAAL 029 NA-70-331

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFS                  | 1.700000E-01  | 00.FT. |
| REFL                  | 1.973700E-01  | INCHES |
| REFD                  | 1.153000E-01  | INCHES |
| ENRP                  | 9.132000E-02  | INCHES |
| ENRP                  | 0.000000E-02  | INCHES |
| ENRP                  | -3.040000E-01 | INCHES |
| SCALE                 | 7.010000E-01  | SCALE  |

# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



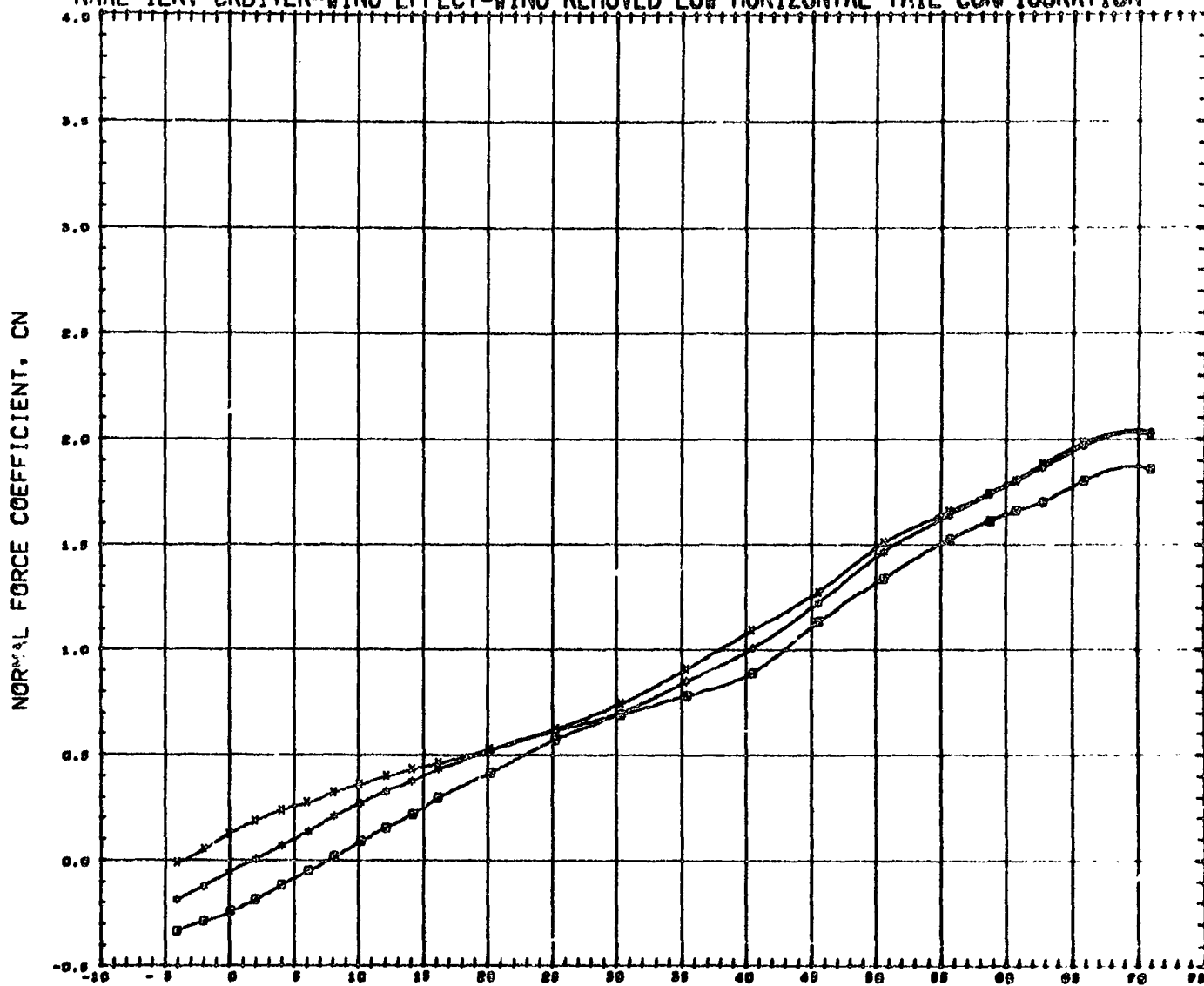
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|-----------|----------|-----------|-----------------------|
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 M13 V5 | (RC4001) | 12 AUG 70 | 0.290                 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 M13 V5 | (RC4002) | 11 AUG 70 |                       |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 M13 V5 | (RC4003) | 11 AUG 70 |                       |

|       |                |        |
|-------|----------------|--------|
| REFS  | 1.70000X10-01  | 60.FT. |
| REFL  | 1.91370X10-01  | INCHES |
| REFD  | 1.13300X10-00  | INCHES |
| ENRP  | 0.13300X10-00  | INCHES |
| YNRP  | 0.00000X10-01  | INCHES |
| ZNRP  | -3.00000X10-03 | INCHES |
| SCALE | 7.01000X10     | SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



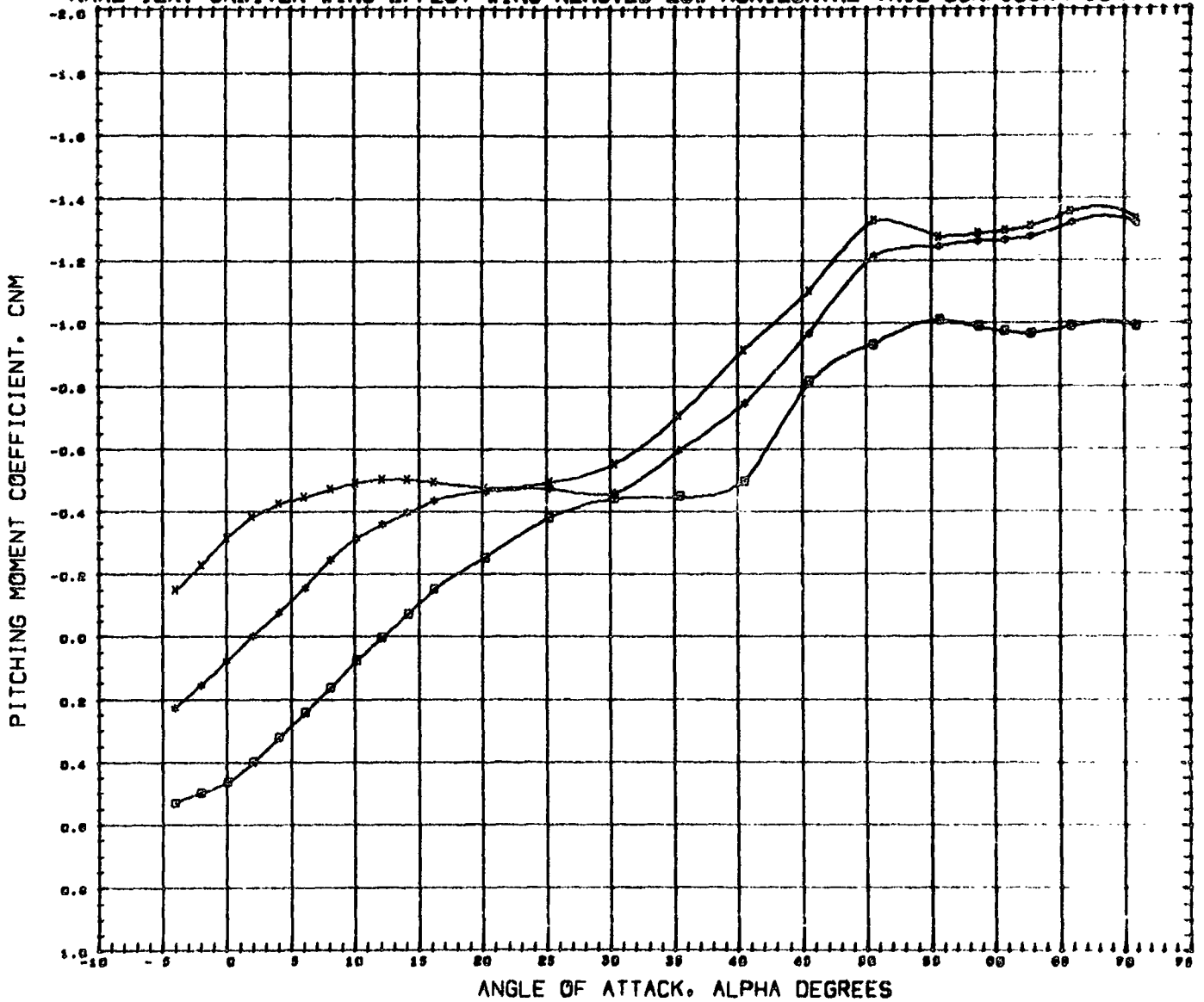
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|-----------|----------|-----------|-----------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 H13 V5 | (RC4001) | 12 AUG 70 | 0.250                 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 H13 V5 | (RC4002) | 11 AUG 70 |                       |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 H13 V5 | (RC4003) | 11 AUG 70 |                       |

|       |                |        |
|-------|----------------|--------|
| REFS  | 1.70000E10-01  | 80.77. |
| REFL  | 1.57370E10-01  | INCHES |
| REFS  | 1.13300E10-00  | INCHES |
| YMRP  | 0.13300E10-00  | INCHES |
| YMRP  | 0.00000E10-01  | INCHES |
| ZMRP  | -5.04000E10-01 | INCHES |
| SCALE | 7.01000E10     | SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

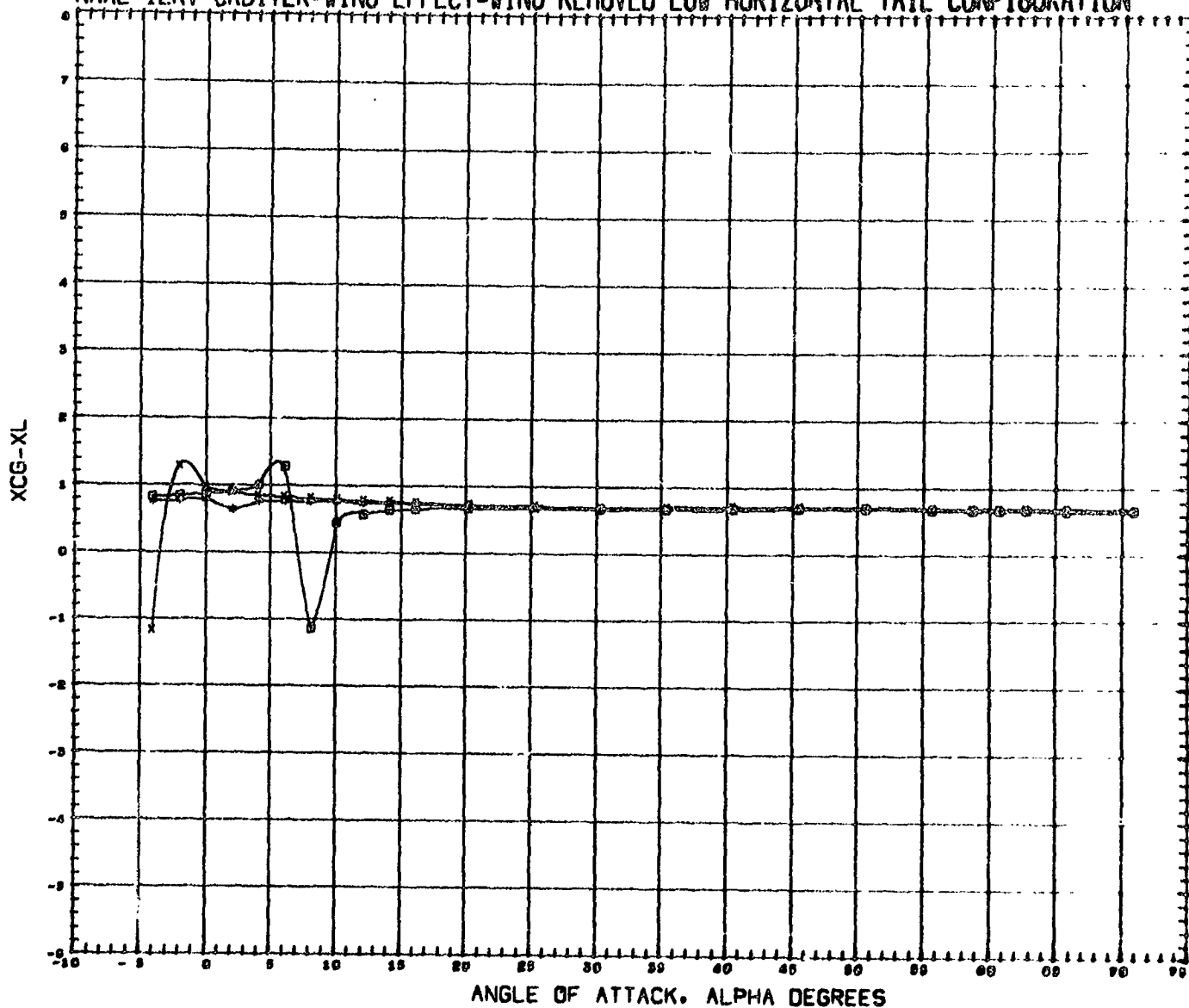
# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE               | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|-----------|--------------------|-------|---------------------------|
| x      | NAAL 020 88V-ILRV STRAIGHT WING | 08 H13 V5 | (RC4001) 12 AUG 70 | 0.850 | REFD 1.700000E-01 INCHES  |
| x      | NAAL 020 88V-ILRV STRAIGHT WING | 08 H13 V5 | (RC4002) 11 AUG 70 |       | REFL 1.073700E-01 INCHES  |
| o      | NAAL 020 88V-ILRV STRAIGHT WING | 08 H13 V5 | (RC4003) 11 AUG 70 |       | REFD 1.133000E-01 INCHES  |
|        |                                 |           |                    |       | INRP 0.133000E-01 INCHES  |
|        |                                 |           |                    |       | INRP 0.000000E-01 INCHES  |
|        |                                 |           |                    |       | INRP -0.040000E-01 INCHES |
|        |                                 |           |                    |       | SCALE 7.610000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-331

# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



SYMBOL CONFIGURATION DESCRIPTION

# NAAL 020 SSV-ILRV STRAIGHT WING  
X NAAL 020 SSV-ILRV STRAIGHT WING  
O NAAL 020 SSV-ILRV STRAIGHT WING

86 M13 V5  
86 M13 V5  
86 M13 V5

DATA SET

DATE

MACH

(RC4001) 12 AUG 70  
(RC4002) 12 AUG 70  
(RC4003) 12 AUG 70

0.299

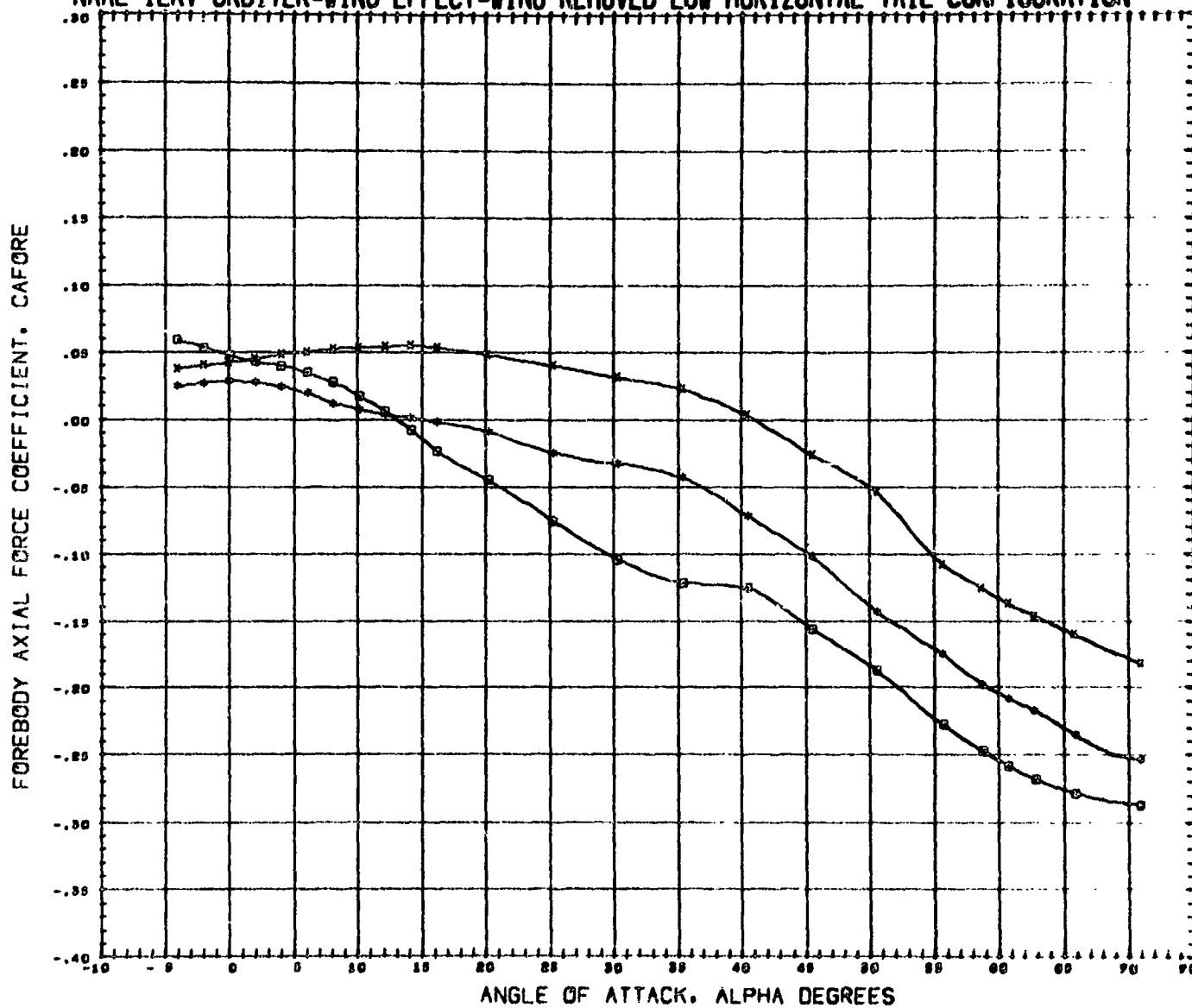
REFERENCE INFORMATION

REFD 1.700000E-01 SO.FT.  
REFL 1.972000E-01 INCHES  
REFB 1.132000E-01 INCHES  
XWRP 9.132000E-01 INCHES  
YWRP 0.000000E+00 INCHES  
ZWRP -3.840000E-01 INCHES  
SCALE 7.610000E-01 SCALE

REFERENCE FILE

NAAL 020 NA-70-391

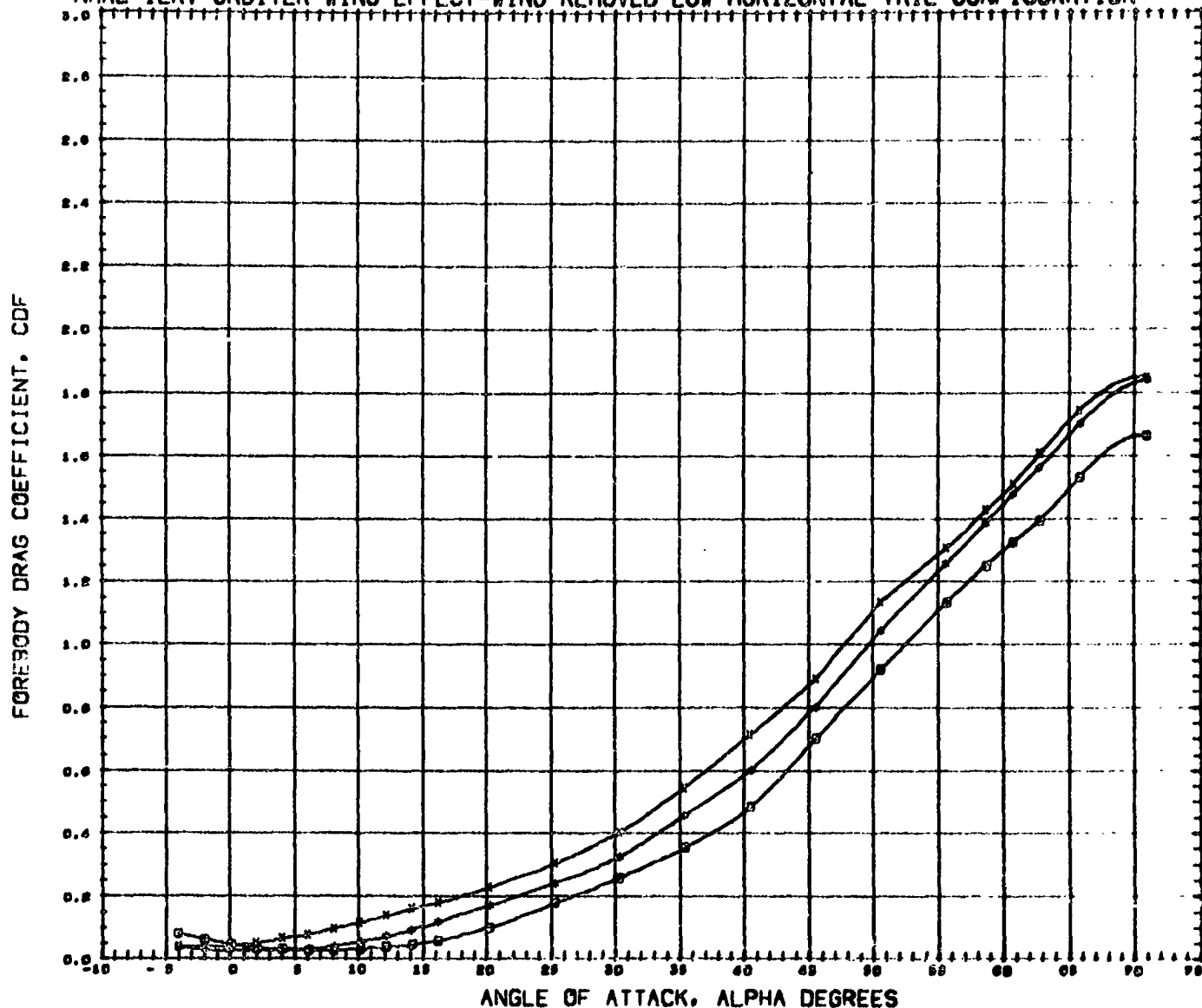
# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE               | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|-----------|--------------------|-------|--------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 H13 V5 | (RC4001) 12 AUG 70 | 0.890 | REFS 1.70000E+01 80 FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 H13 V5 | (RC4002) 11 AUG 70 |       | REFL 1.07370E+01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 H13 V5 | (RC4003) 11 AUG 70 |       | REFD 1.13500E+00 INCHES  |
|        |                                 |           |                    |       | INRP 0.13800E+00 INCHES  |
|        |                                 |           |                    |       | YMRP 0.00000E+00 INCHES  |
|        |                                 |           |                    |       | ZMRP -3.04000E+01 INCHES |
|        |                                 |           |                    |       | SCALE 7.01000E+00 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



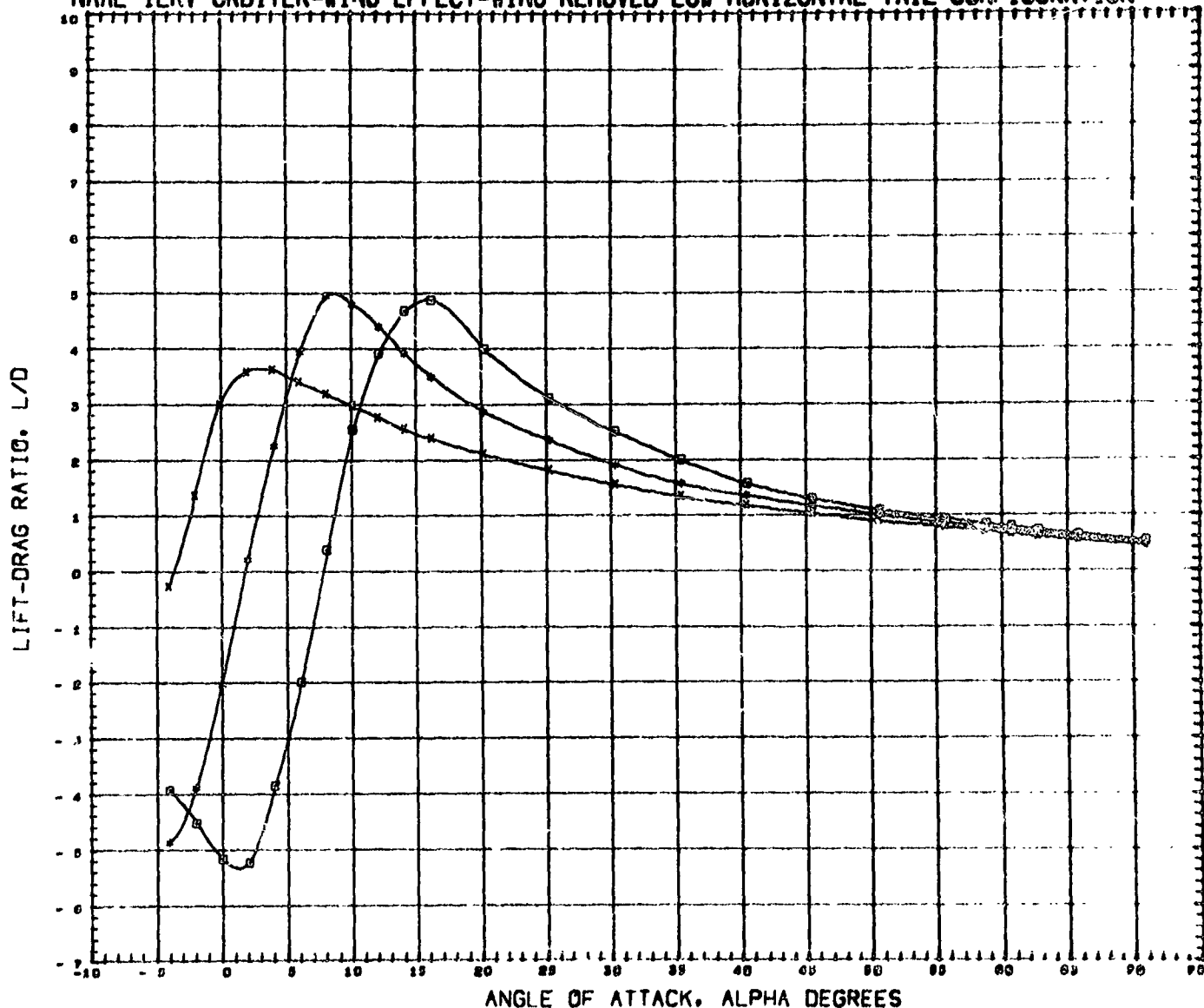
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  |
|--------|---------------------------------|--------------------|-----------|-------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 H13 V5 (RC4001) | 12 AUG 70 | 0.250 |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 H13 V5 (RC4002) | 11 AUG 70 |       |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 H13 V5 (RC4003) | 11 AUG 70 |       |

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REF1                  | 1.700000E-01  | 80.77. |
| REF2                  | 1.073700E-01  | INCHES |
| REF3                  | 1.133000E-01  | INCHES |
| REF4                  | 0.130000E-01  | INCHES |
| REF5                  | 0.000000E-01  | INCHES |
| REF6                  | -0.000000E-01 | INCHES |
| REF7                  | 0.000000E-01  | INCHES |
| REF8                  | 0.000000E-01  | INCHES |
| REF9                  | 0.000000E-01  | INCHES |
| REF10                 | 0.000000E-01  | INCHES |
| REF11                 | 0.000000E-01  | INCHES |
| REF12                 | 0.000000E-01  | INCHES |
| REF13                 | 0.000000E-01  | INCHES |
| REF14                 | 0.000000E-01  | INCHES |
| REF15                 | 0.000000E-01  | INCHES |
| REF16                 | 0.000000E-01  | INCHES |
| REF17                 | 0.000000E-01  | INCHES |
| REF18                 | 0.000000E-01  | INCHES |
| REF19                 | 0.000000E-01  | INCHES |
| REF20                 | 0.000000E-01  | INCHES |
| REF21                 | 0.000000E-01  | INCHES |
| REF22                 | 0.000000E-01  | INCHES |
| REF23                 | 0.000000E-01  | INCHES |
| REF24                 | 0.000000E-01  | INCHES |
| REF25                 | 0.000000E-01  | INCHES |
| REF26                 | 0.000000E-01  | INCHES |
| REF27                 | 0.000000E-01  | INCHES |
| REF28                 | 0.000000E-01  | INCHES |
| REF29                 | 0.000000E-01  | INCHES |
| REF30                 | 0.000000E-01  | INCHES |
| REF31                 | 0.000000E-01  | INCHES |
| REF32                 | 0.000000E-01  | INCHES |
| REF33                 | 0.000000E-01  | INCHES |
| REF34                 | 0.000000E-01  | INCHES |
| REF35                 | 0.000000E-01  | INCHES |
| REF36                 | 0.000000E-01  | INCHES |
| REF37                 | 0.000000E-01  | INCHES |
| REF38                 | 0.000000E-01  | INCHES |
| REF39                 | 0.000000E-01  | INCHES |
| REF40                 | 0.000000E-01  | INCHES |
| REF41                 | 0.000000E-01  | INCHES |
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| REF45                 | 0.000000E-01  | INCHES |
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| REF51                 | 0.000000E-01  | INCHES |
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| REF54                 | 0.000000E-01  | INCHES |
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| REF57                 | 0.000000E-01  | INCHES |
| REF58                 | 0.000000E-01  | INCHES |
| REF59                 | 0.000000E-01  | INCHES |
| REF60                 | 0.000000E-01  | INCHES |
| REF61                 | 0.000000E-01  | INCHES |
| REF62                 | 0.000000E-01  | INCHES |
| REF63                 | 0.000000E-01  | INCHES |
| REF64                 | 0.000000E-01  | INCHES |
| REF65                 | 0.000000E-01  | INCHES |
| REF66                 | 0.000000E-01  | INCHES |
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| REF68                 | 0.000000E-01  | INCHES |
| REF69                 | 0.000000E-01  | INCHES |
| REF70                 | 0.000000E-01  | INCHES |
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| REF72                 | 0.000000E-01  | INCHES |
| REF73                 | 0.000000E-01  | INCHES |
| REF74                 | 0.000000E-01  | INCHES |
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| REF76                 | 0.000000E-01  | INCHES |
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| REF79                 | 0.000000E-01  | INCHES |
| REF80                 | 0.000000E-01  | INCHES |
| REF81                 | 0.000000E-01  | INCHES |
| REF82                 | 0.000000E-01  | INCHES |
| REF83                 | 0.000000E-01  | INCHES |
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| REF85                 | 0.000000E-01  | INCHES |
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| REF87                 | 0.000000E-01  | INCHES |
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REFERENCE FILE

NAAL 020 NA-70-531

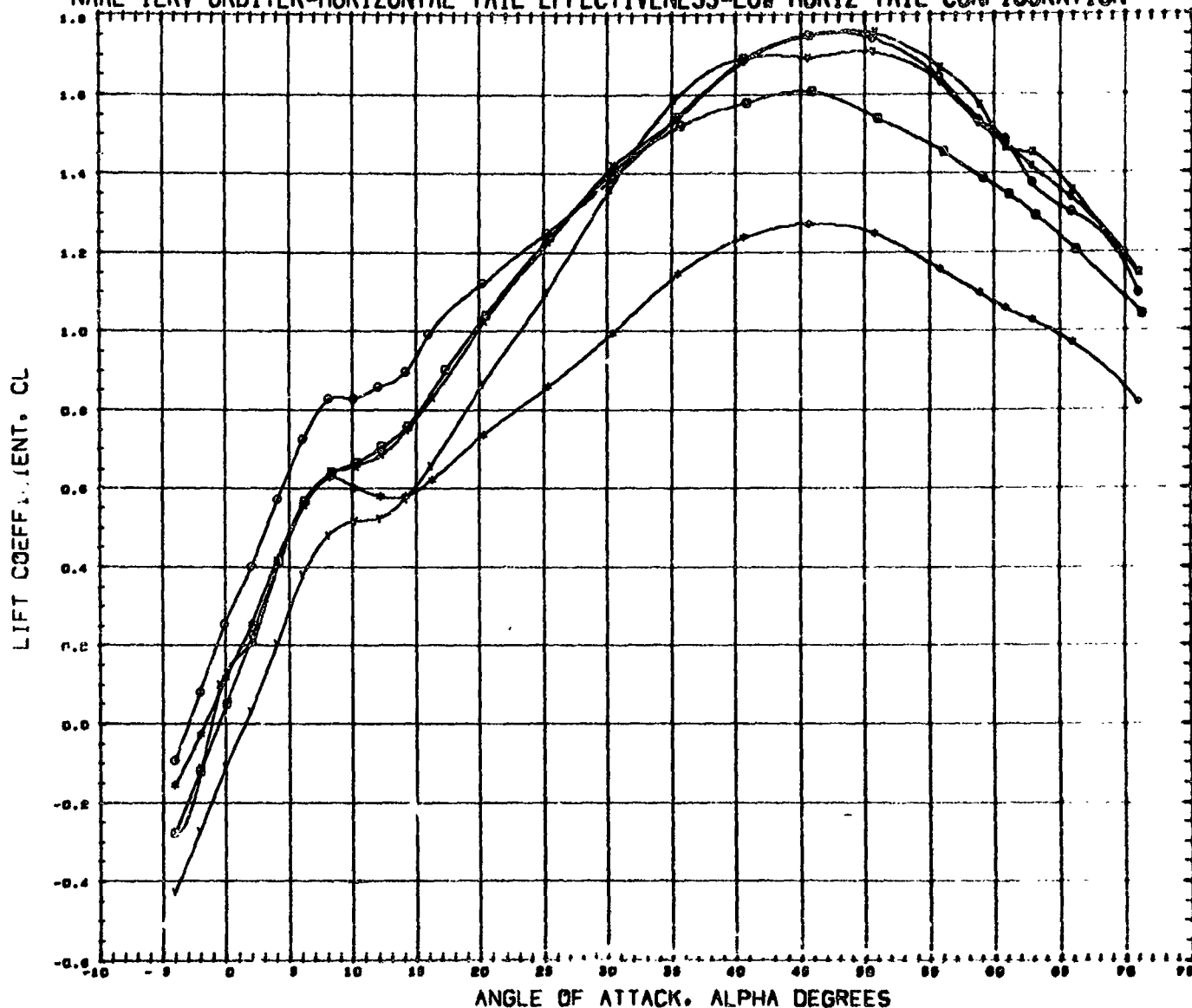
# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION |                        | DATA SET           | DATE     | MACH      | REFERENCE INFORMATION |                          |
|--------|---------------------------|------------------------|--------------------|----------|-----------|-----------------------|--------------------------|
| +      | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 M13 V5          | (RC4001) | 12 AUG 70 | 0.890                 | REFD 1.70000E+01 SS.PV.  |
| x      | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 M13 V5          | (RC4002) | 11 AUG 70 |                       | REFL 1.57370E+01 INCHES  |
| u      | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 M13 V5          | (RC4003) | 11 AUG 70 |                       | REFD 1.13300E+00 INCHES  |
|        |                           |                        |                    |          |           |                       | XMPP 0.13800E+00 INCHES  |
|        |                           |                        |                    |          |           |                       | YMPP 0.00000E+00 INCHES  |
|        |                           |                        |                    |          |           |                       | ZMRP -3.00000E+01 INCHES |
|        |                           |                        |                    |          |           |                       | SCALE 7.01000E+01 SCALE  |
|        | REFERENCE FILE            |                        | NAAL 020 NA-70-391 |          |           |                       |                          |

REFERENCE FILE NAAL 020 NA-70-391

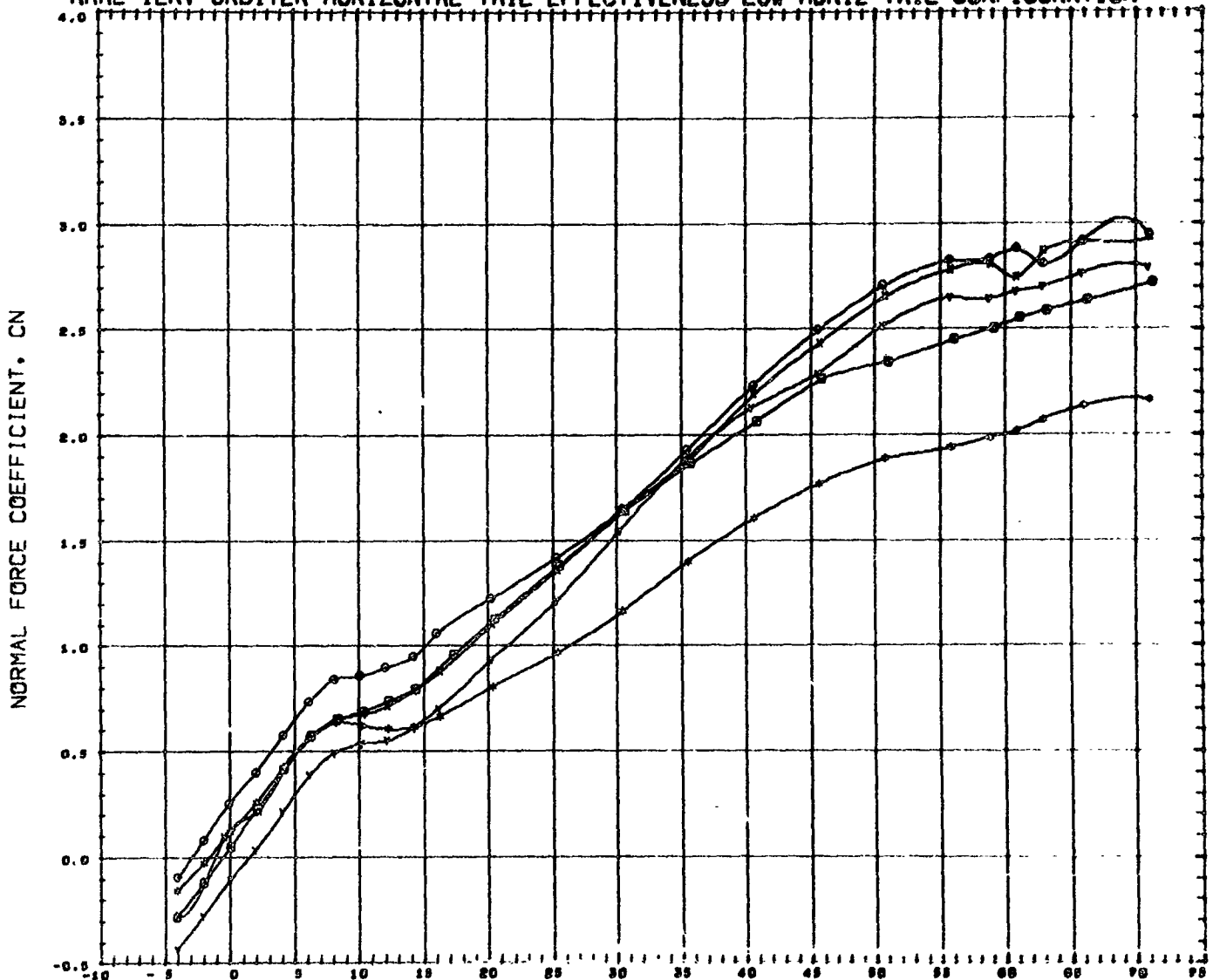
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 (RC4063)        | 11 AUG 70 | 0.250 | REFD 1.70000010-01 88.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H13 (RC4070)    | 11 AUG 70 |       | REFL 1.07570010-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H13 V3 (RC4013) | 11 AUG 70 |       | REFD 1.13300010-00 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H13 V3 (RC4076) | 11 AUG 70 |       | YMRP 0.13000010-00 INCHES  |
| V      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H13 V3 (RC4074) | 11 AUG 70 |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |                       |           |       | YMRP -3.04000010-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

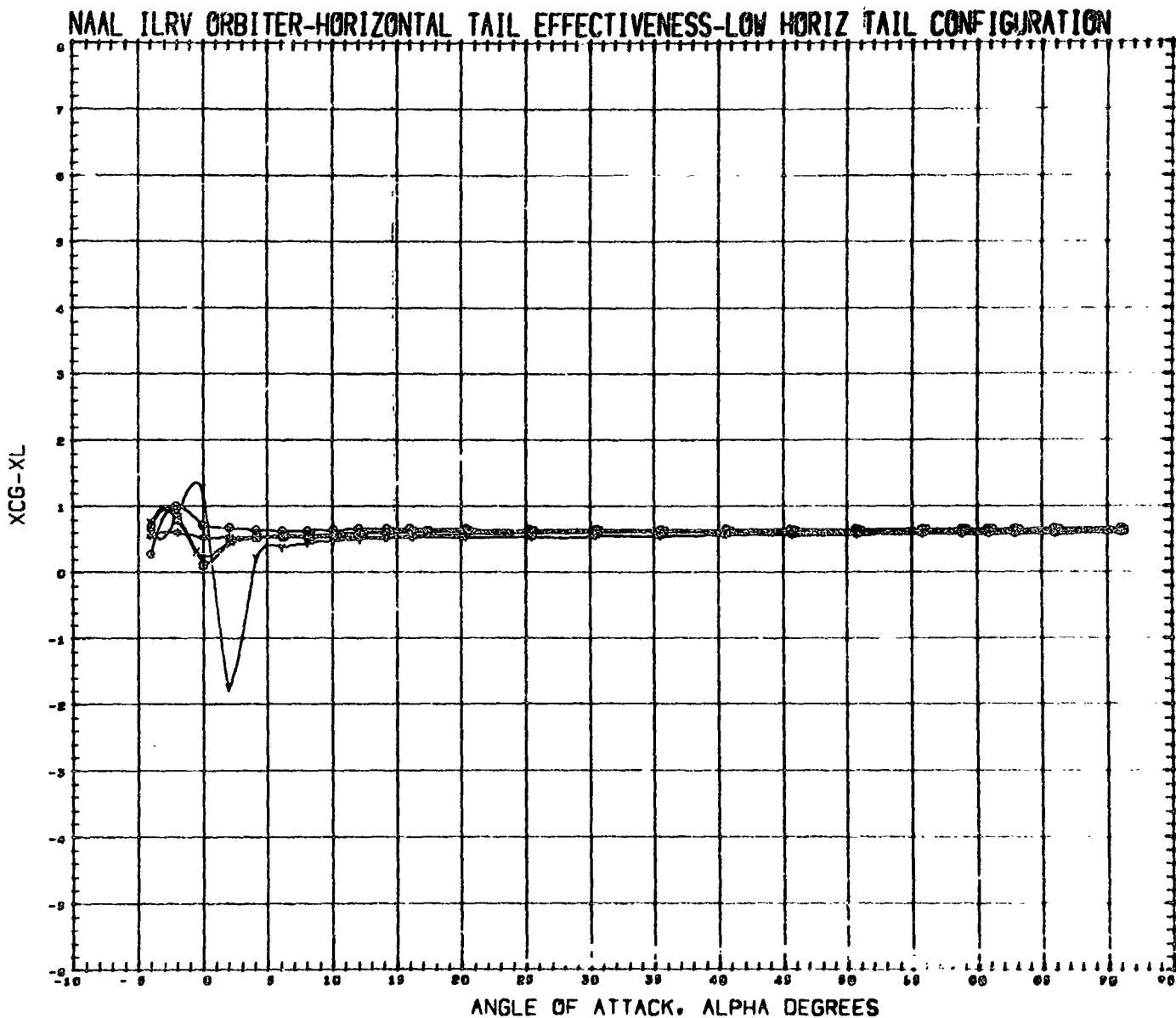
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W8        | 11 AUG 70 | 0.250 | REFS 1.70000E10-01 80.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W8 H13    | 11 AUG 70 |       | REFL 1.87370E10-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 | 11 AUG 70 |       | REFD 1.13300E10-00 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 | 11 AUG 70 |       | YMHP 0.12000E10-00 INCHES  |
| △      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 | 11 AUG 70 |       | YMHP 0.00000E10-01 INCHES  |
|        |                                 |              |           |       | YMHP -3.04000E10-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-393

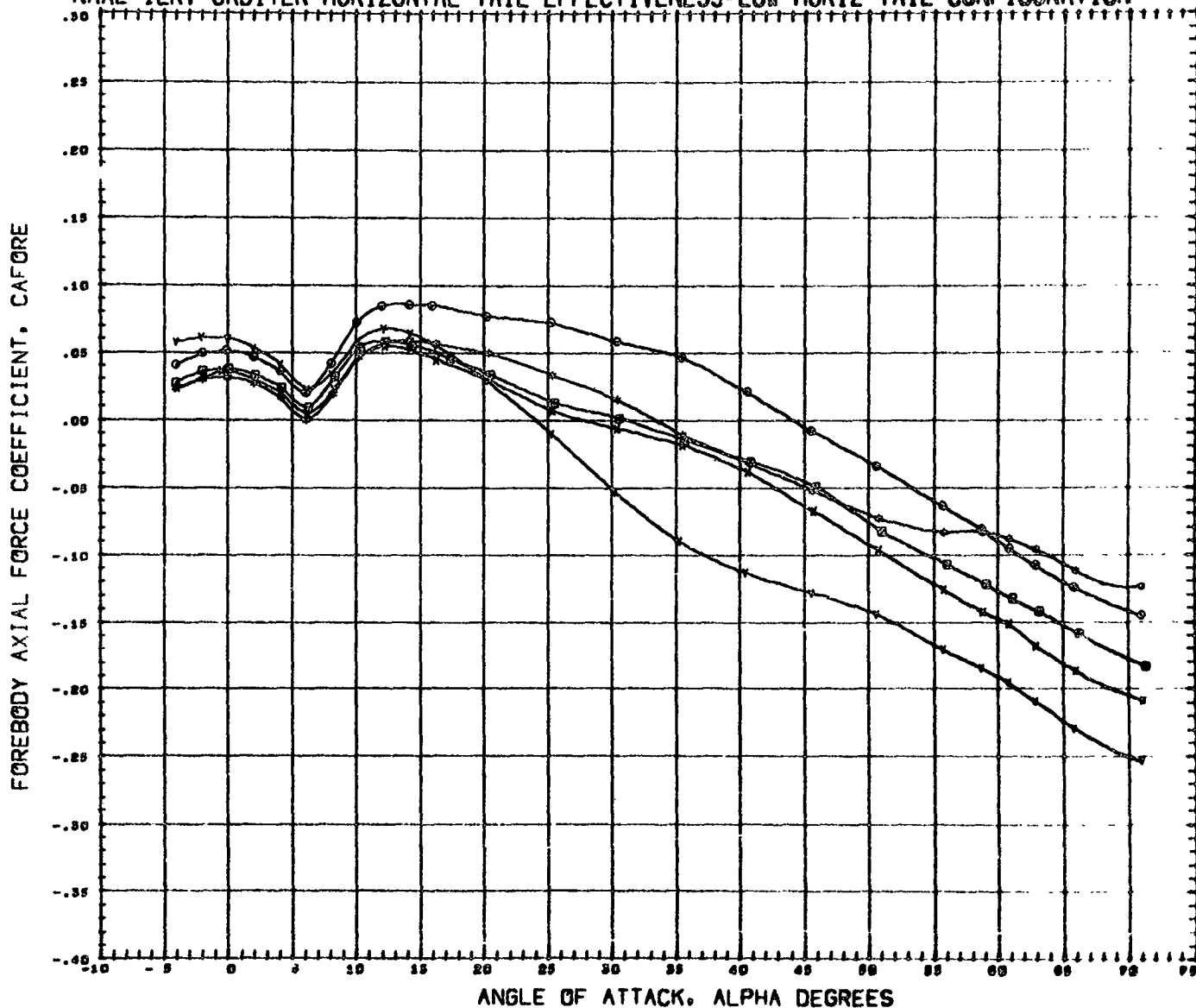
| SYMBOL | CONFIGURATION DESCRIPTION         |          |          |      |              |  | DATA SET | DATE      | NACH  | REFERENCE INFORMATION |                            |        |
|--------|-----------------------------------|----------|----------|------|--------------|--|----------|-----------|-------|-----------------------|----------------------------|--------|
| A      | NAAL 02D                          | SSV-ILRV | STRAIGHT | WING | 06 W8        |  | (RC4083) | 11 AUG 70 | 0.259 | REFS                  | 1.70000X10 <sup>-01</sup>  | 60.FT. |
| X      | NAAL 02D                          | SSV-ILRV | STRAIGHT | WING | 06 W8 H13    |  | (RC4079) | 11 AUG 70 |       | REFL                  | 1.87370X10 <sup>-01</sup>  | INCHES |
| G      | NAAL 02D                          | SSV-ILRV | STRAIGHT | WING | 06 W8 H13 V5 |  | (RC4013) | 11 AUG 70 |       | REFS                  | 1.13300X10 <sup>-01</sup>  | INCHES |
| O      | NAAL 02D                          | SSV-ILRV | STRAIGHT | WING | 06 W8 H13 V5 |  | (RC4076) | 11 AUG 70 |       | MRP                   | 0.13800X10 <sup>-01</sup>  | INCHES |
| V      | NAAL 02D                          | SSV-ILRV | STRAIGHT | WING | 06 W8 H13 V5 |  | (RC4074) | 11 AUG 70 |       | VMR                   | 0.00000X10 <sup>-01</sup>  | INCHES |
|        |                                   |          |          |      |              |  |          |           |       | ZMRP                  | -3.04000X10 <sup>-01</sup> | INCHES |
|        |                                   |          |          |      |              |  |          |           |       | SCALE                 | 7.01000X10 <sup>-01</sup>  | SCALE  |
|        | REFERENCE FILE NAAL 02D NA-70-351 |          |          |      |              |  |          |           |       |                       |                            |        |



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 (RC4063)        | 11 AUG 70 | 0.250 | REFS 1.70000X10-01 60.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 (RC4070)    | 11 AUG 70 |       | REFL 1.97370X10-01 INCHES  |
| @      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 (RC4013) | 11 AUG 70 |       | REFS 1.13300X10-00 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 (RC4076) | 11 AUG 70 |       | XMRP 0.13800X10-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 (RC4074) | 11 AUG 70 |       | YMRP 0.00000X10-00 INCHES  |
|        |                                 |                       |           |       | ZMRP -3.04000X10-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000X10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

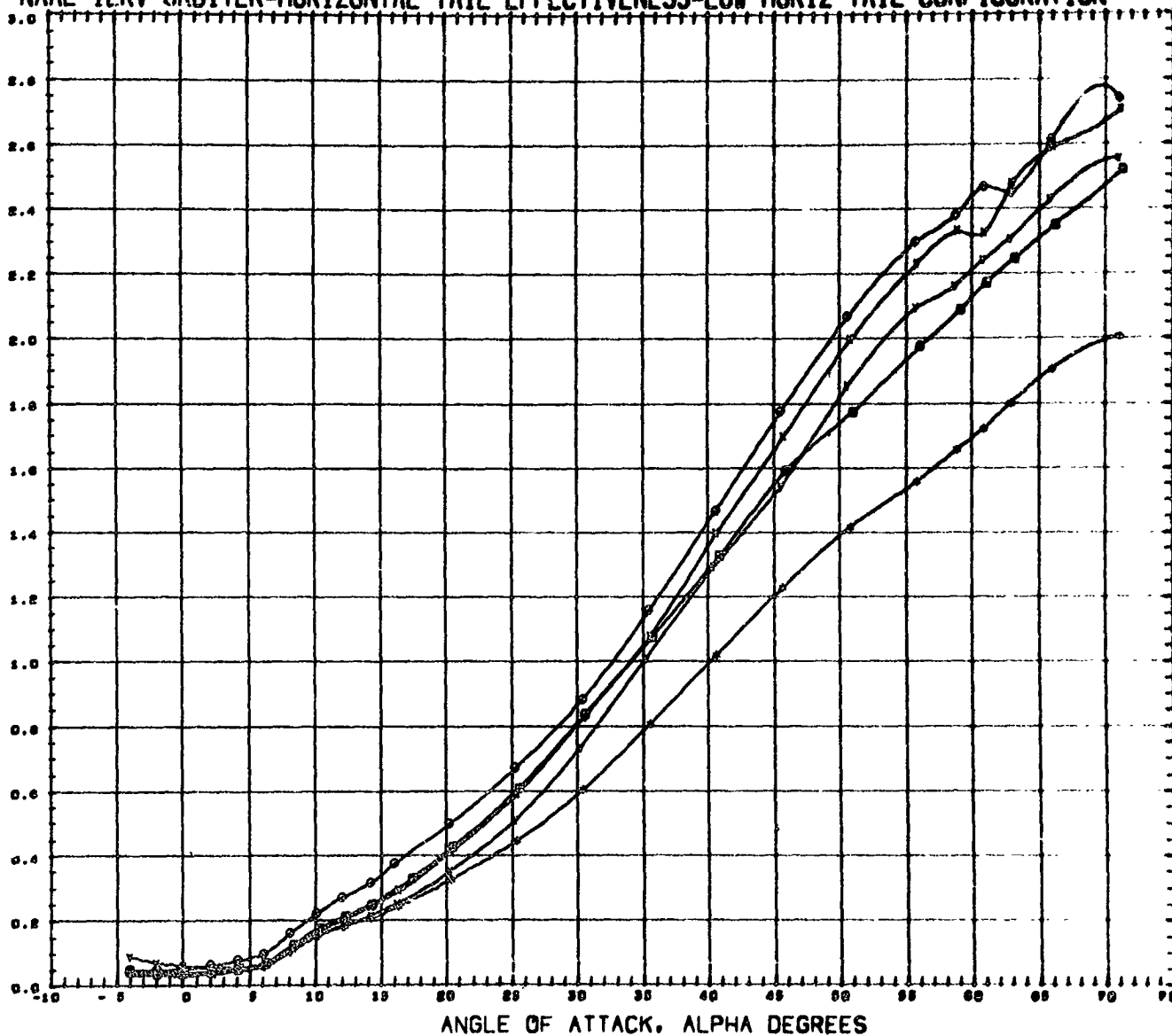


| SYMBOL                            | CONFIGURATION DESCRIPTION |          |               | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION |       |                |        |
|-----------------------------------|---------------------------|----------|---------------|--------------|----------|-----------|-----------------------|-------|----------------|--------|
| *                                 | NAAL 020                  | SSV-ILRV | STRAIGHT WING | 06 W0        | (RC4003) | 11 AUG 70 | 0.850                 | REFS  | 1.70000010.01  | SQ.FT. |
| x                                 | NAAL 020                  | SSV-ILRV | STRAIGHT WING | 06 W0 N13    | (RC4070) | 11 AUG 70 |                       | REFL  | 1.57370010.01  | INCHES |
| o                                 | NAAL 020                  | SSV-ILRV | STRAIGHT WING | 06 W0 N13 V5 | (RC4013) | 11 AUG 70 |                       | REFS  | 1.15300010.00  | INCHES |
| o                                 | NAAL 020                  | SSV-ILRV | STRAIGHT WING | 06 W0 N13 V5 | (RC4076) | 11 AUG 70 |                       | ZMRP  | 0.15000010.00  | INCHES |
| v                                 | NAAL 020                  | SSV-ILRV | STRAIGHT WING | 06 W0 N13 V5 | (RC4074) | 11 AUG 70 |                       | ZMRP  | 0.00000010.00  | INCHES |
|                                   |                           |          |               |              |          |           |                       | ZMRP  | -3.00000010.01 | INCHES |
|                                   |                           |          |               |              |          |           |                       | SCALE | 7.01000010.01  | SCALE  |
| REFERENCE FILE NAAL 020 NA-70-351 |                           |          |               |              |          |           |                       |       |                |        |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

FOREBODY DRAG COEFFICIENT, CDF

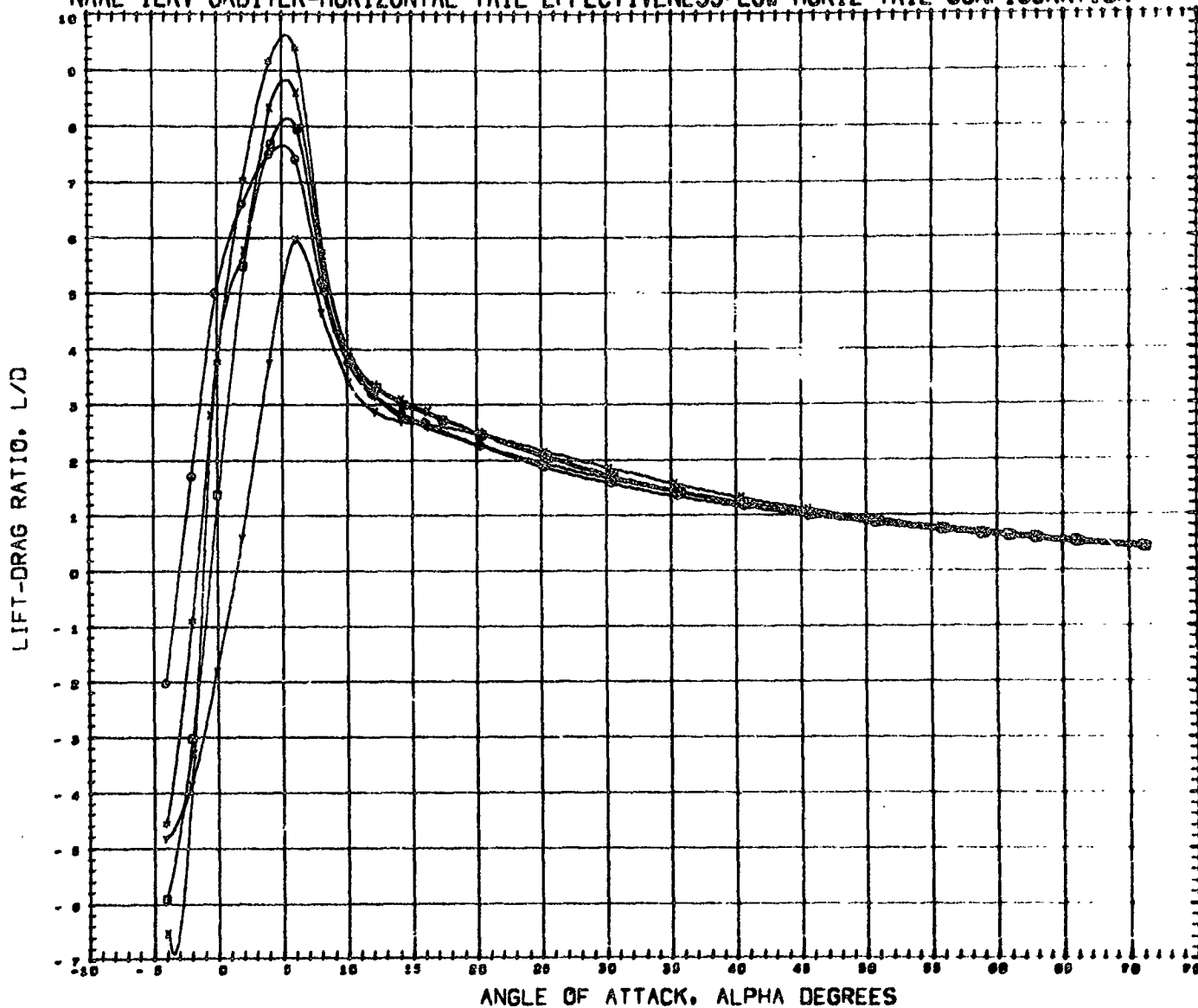


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | NALM  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS        | 11 AUG 70 | 0.250 | REFD 1.70000E10-01 SQ.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13    | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13 V5 | 11 AUG 70 |       | REFD 1.13300E10-01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13 V5 | 11 AUG 70 |       | VMHP 0.13200E10-00 INCHES  |
| △      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13 V5 | 11 AUG 70 |       | VMHP 0.00000E10-01 INCHES  |
|        |                                 |              |           |       | ZMHP -3.94000E10-03 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E10 SCALE     |

REFERENCE FILE

NAAL 020 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

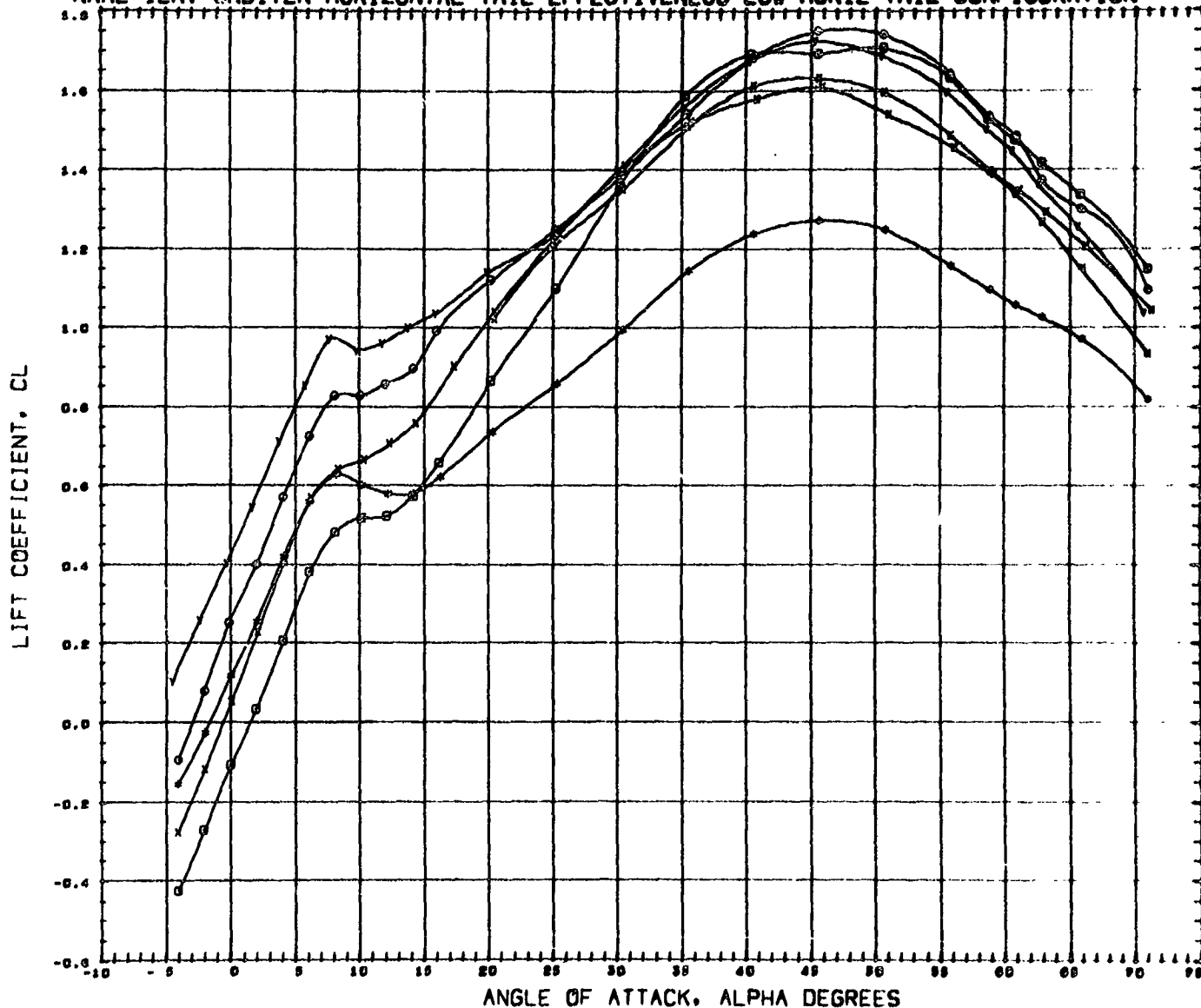


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  |
|--------|---------------------------------|--------------|-----------|-------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6        | 11 AUG 70 | 0.250 |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6 H13    | 11 AUG 70 |       |
| Q      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       |
| Q      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       |
| V      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       |

REFERENCE FILE NAAL 020 NA-70-391

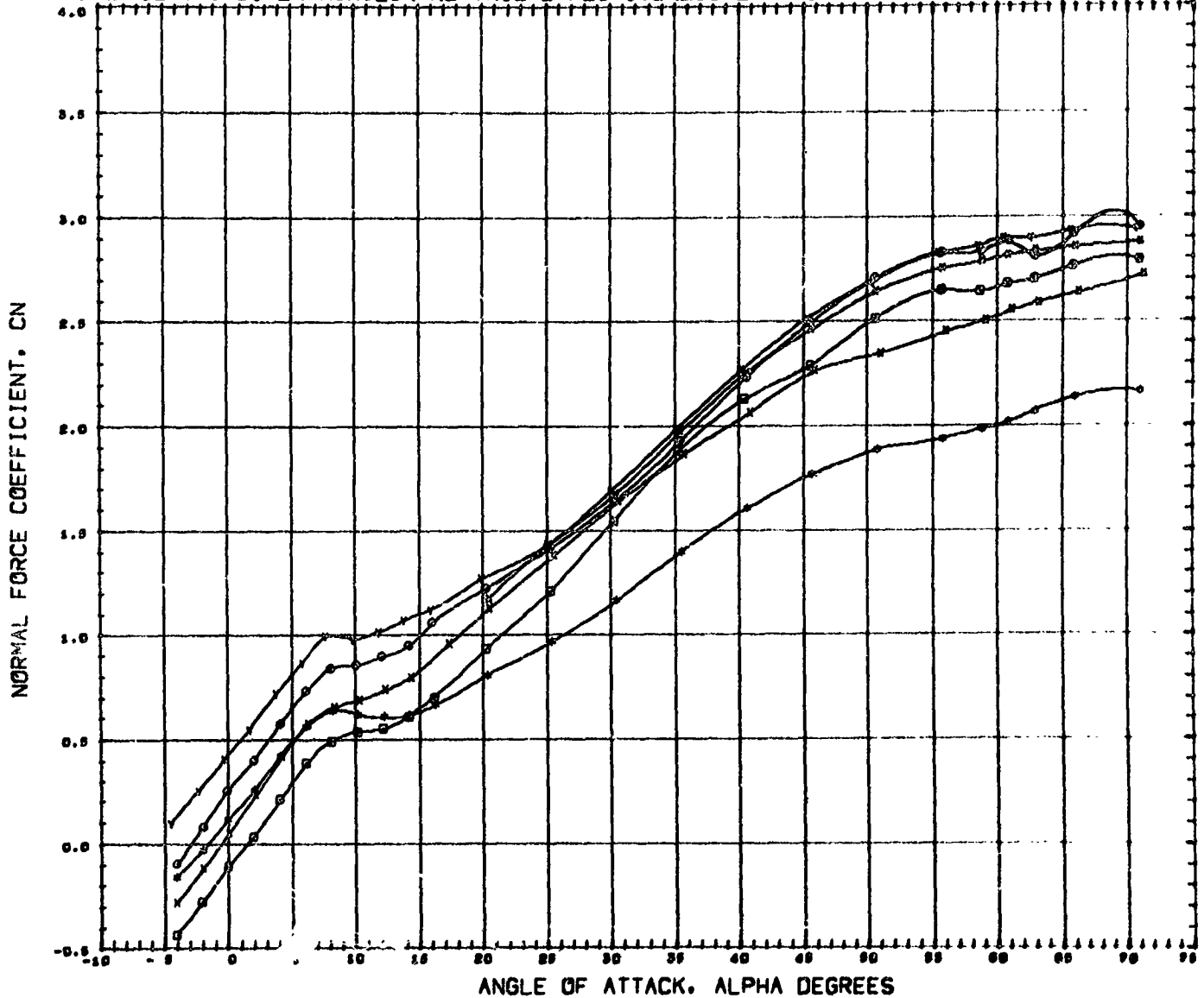
| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E-01 00.FT.  |
| REFL                  | 1.073700E-01 INCHES  |
| REFS                  | 1.133000E-01 INCHES  |
| ENRP                  | 0.130000E-00 INCHES  |
| VNRP                  | 0.000000E-01 INCHES  |
| ZNRP                  | -3.000000E-01 INCHES |
| SCALE                 | 7.010000E-01 SCALE   |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL                            | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|-----------------------------------|---------------------------------|----------|-----------|-------|--------------------------|
| 0                                 | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 | 0.250 | REFS 1.70000E+01 80.71.  |
| X                                 | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4013) | 11 AUG 70 |       | REFL 1.57370E+01 INCHES  |
| Q                                 | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4074) | 11 AUG 70 |       | REFS 1.13300E+01 INCHES  |
| Q                                 | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4070) | 11 AUG 70 |       | XMRP 0.13200E+01 INCHES  |
| Y                                 | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4077) | 11 AUG 70 |       | YMRP 0.00000E+01 INCHES  |
| X                                 | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4076) | 11 AUG 70 |       | ZMRP -3.04000E+01 INCHES |
| REFERENCE FILE NAAL 020 NA-70-351 |                                 |          |           |       | SCALE 7.01000E+01 SCALE  |

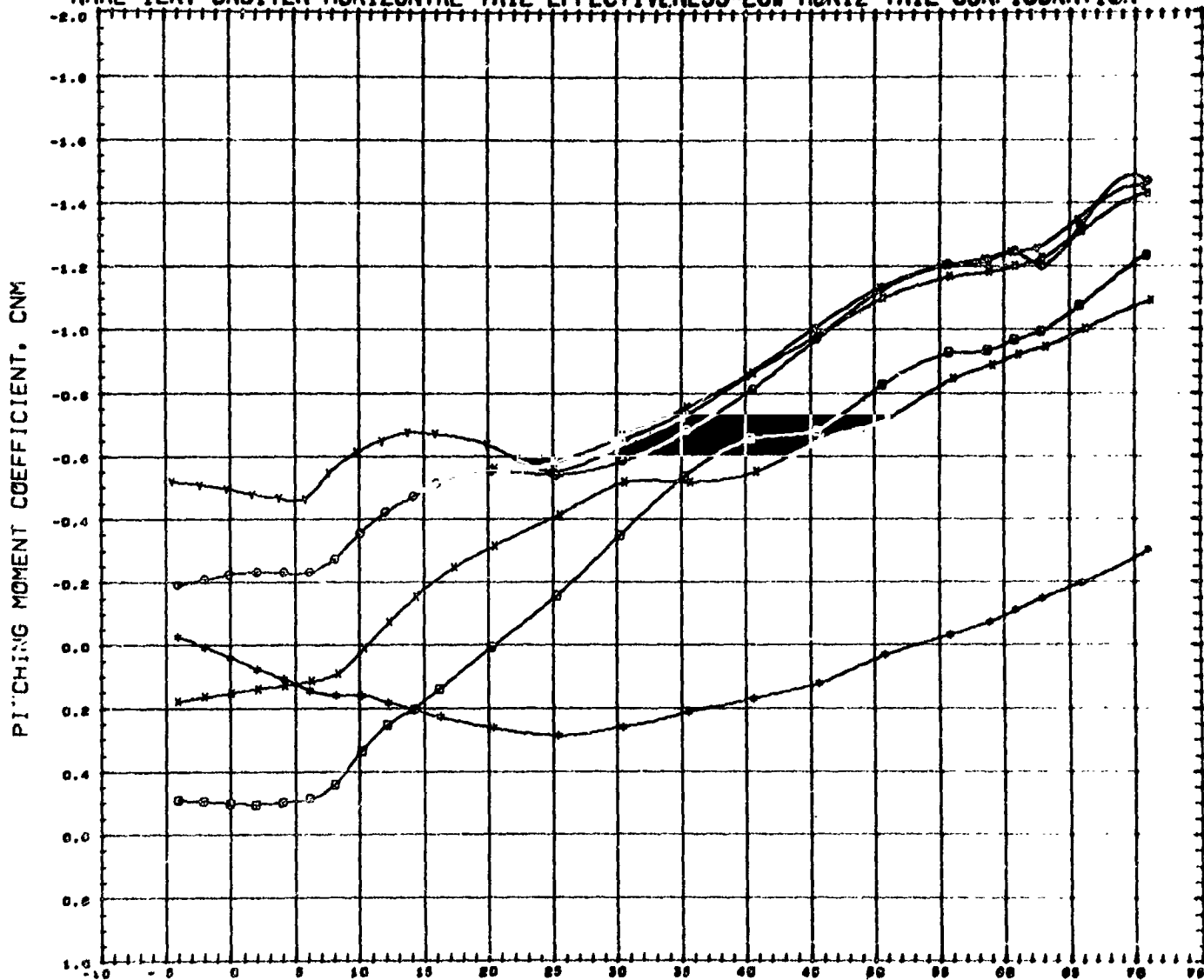
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| 0      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0        | 11 AUG 70 | 0.293 | REF0 1.70000010-01 00.FT.  |
| X      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5 | 11 AUG 70 |       | REF1 1.97370010-01 INCHES  |
| Q      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5 | 11 AUG 70 |       | REF2 1.13300010-01 INCHES  |
| O      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5 | 11 AUG 70 |       | REF3 0.13300010-00 INCHES  |
| Y      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5 | 11 AUG 70 |       | REF4 0.00000010-00 INCHES  |
| N      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5 | 11 AUG 70 |       | REF5 -0.04000010-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000010-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-331

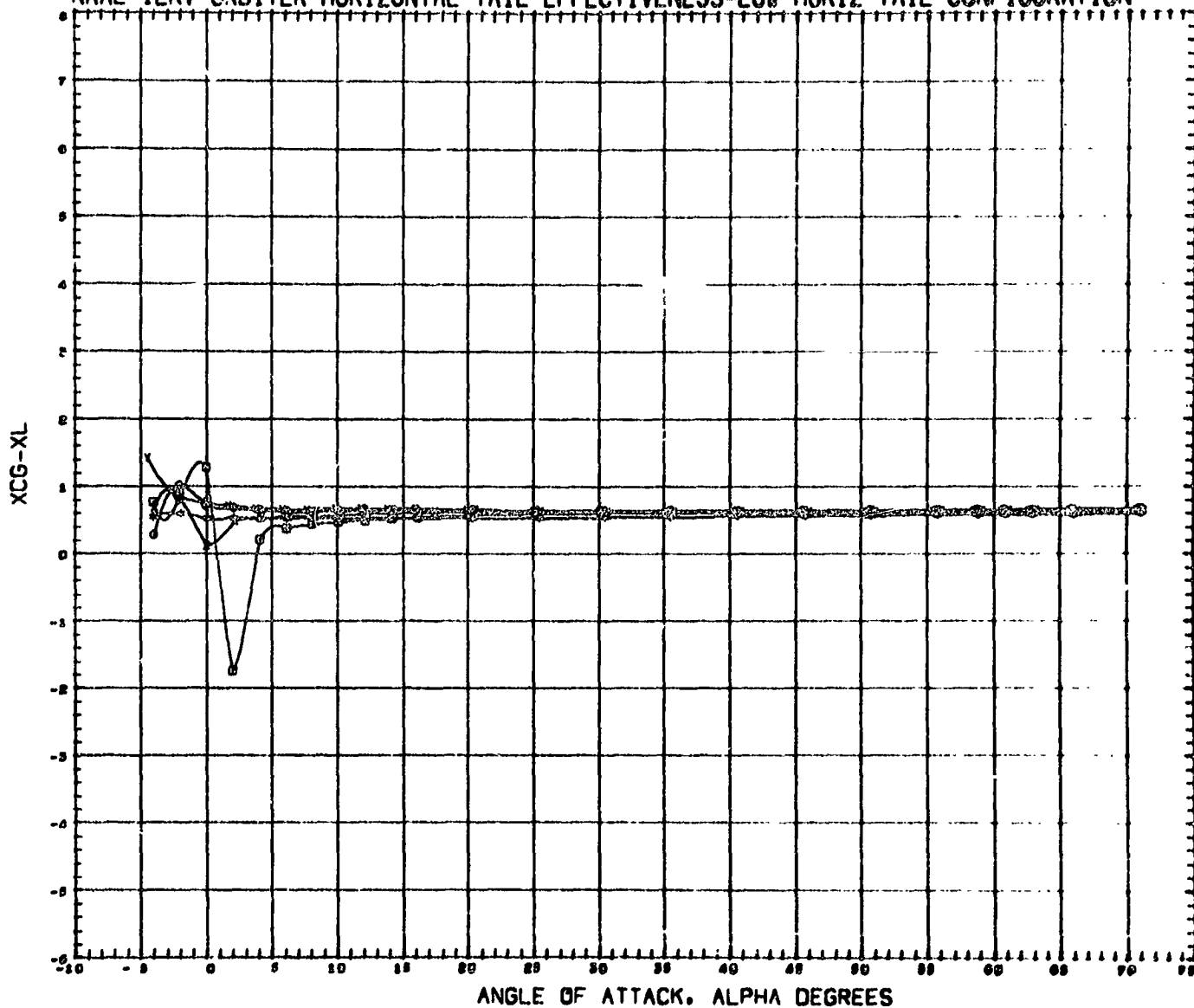
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------------|-----------|-------|----------------------------|
| *      | NAAL 020 05V-ILRV STRAIGHT WING | 86 W6              | 11 AUG 70 | 0.250 | REFS 1.70000E10-01 80.FT.  |
| x      | NAAL 020 05V-ILRV STRAIGHT WING | 86 W6 M13 V3       | 11 AUG 70 |       | REFL 1.07370E10-01 INCHES  |
| o      | NAAL 020 05V-ILRV STRAIGHT WING | 86 W6 M13 V5       | 11 AUG 70 |       | REFD 1.13300E10-00 INCHES  |
| o      | NAAL 020 05V-ILRV STRAIGHT WING | 86 W6 M13 V5       | 11 AUG 70 |       | XMRP 0.18000E10-00 INCHES  |
| y      | NAAL 020 05V-ILRV STRAIGHT WING | 86 W6 M13 V5       | 11 AUG 70 |       | YMRP 0.00000E10-00 INCHES  |
| x      | NAAL 020 05V-ILRV STRAIGHT WING | 86 W6 M13 V5       | 11 AUG 70 |       | ZMRP -3.04000E10-01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-PD-331 |           |       | SCALE 7.01000E10 SCALE     |

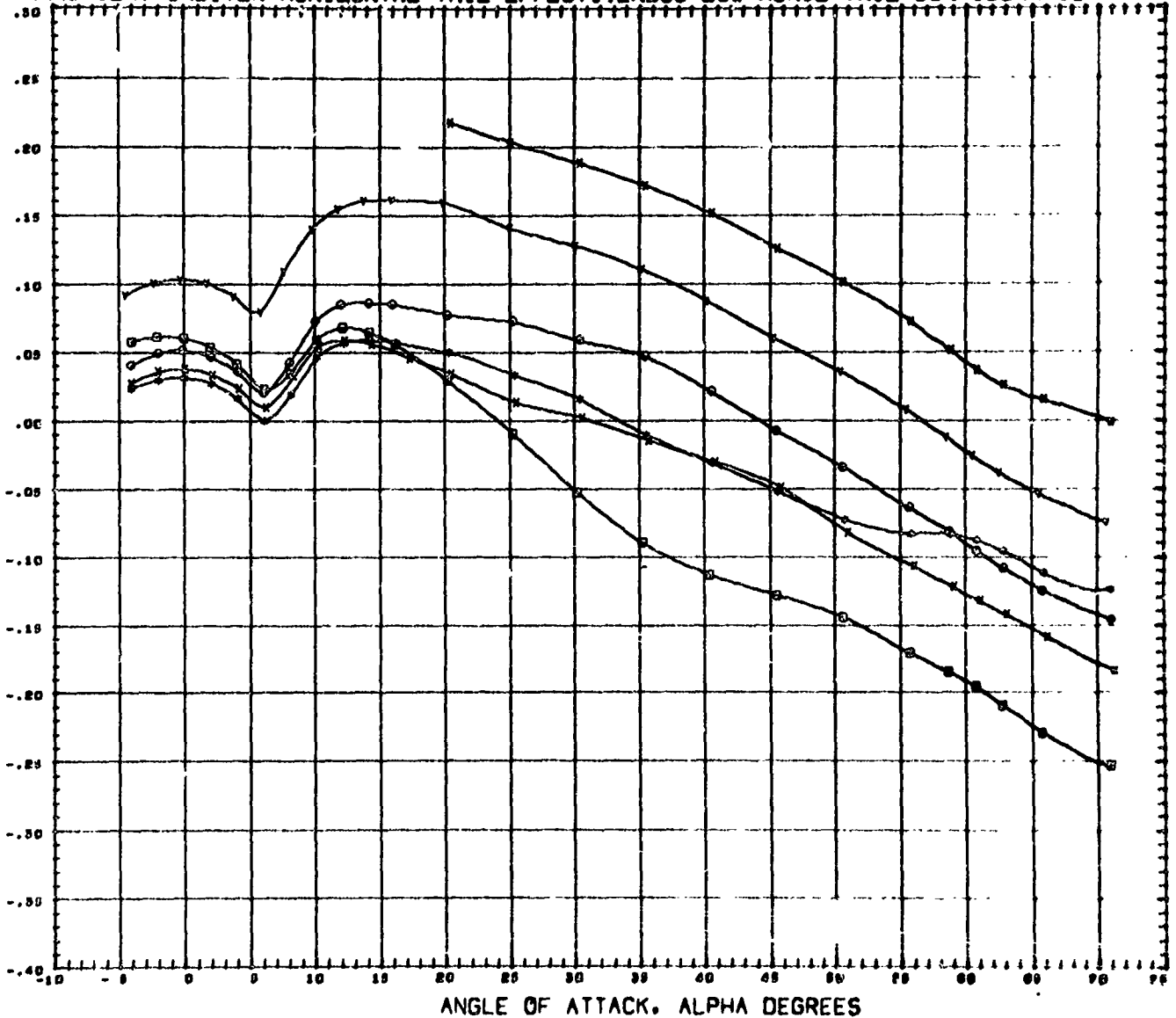
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------------|-----------|-------|--------------------------|
| *      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0              | 11 AUG 70 | 0.250 | REFD 1.70000E+01 INCHES  |
| X      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5       | 11 AUG 70 |       | REFL 0.07370E+01 INCHES  |
| Q      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5       | 11 AUG 70 |       | REFD 1.13700E+01 INCHES  |
| O      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5       | 11 AUG 70 |       | INRP 0.12200E+01 INCHES  |
| V      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5       | 11 AUG 70 |       | INRP 0.00000E+01 INCHES  |
| K      | NAAL 020 00V-ILRV STRAIGHT WING | 00 W0 N13 V5       | 11 AUG 70 |       | INRP -0.00000E+01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-39; |           |       | SCALE 7.01000E+01 SCALE  |

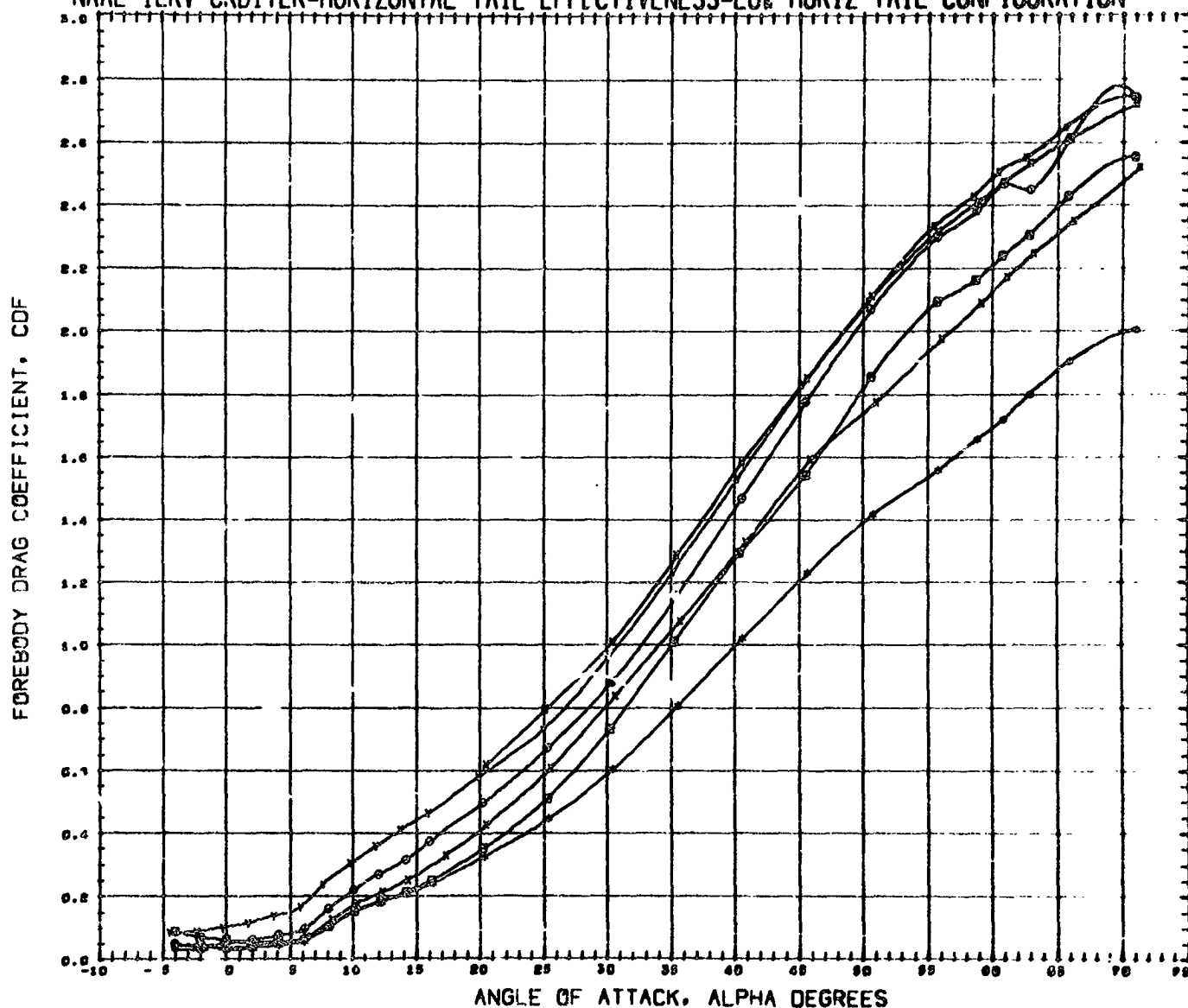
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

FOREBODY AXIAL FORCE COEFFICIENT, C<sub>AF</sub>O<sub>R</sub>E



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6              | 11 AUG 70 | 0.250 | REFD 1.70000E10-01 80. FT. |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | 11 AUG 70 |       | REFD 1.13300E10-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | 11 AUG 70 |       | ENRP 0.18800E10-00 INCHES  |
| V      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | 11 AUG 70 |       | ENRP 0.00000E10-01 INCHES  |
| H      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | 11 AUG 70 |       | ENRP -3.84000E10-01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-351 |           |       | SCALE 7.01000E10-01 SCALE  |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

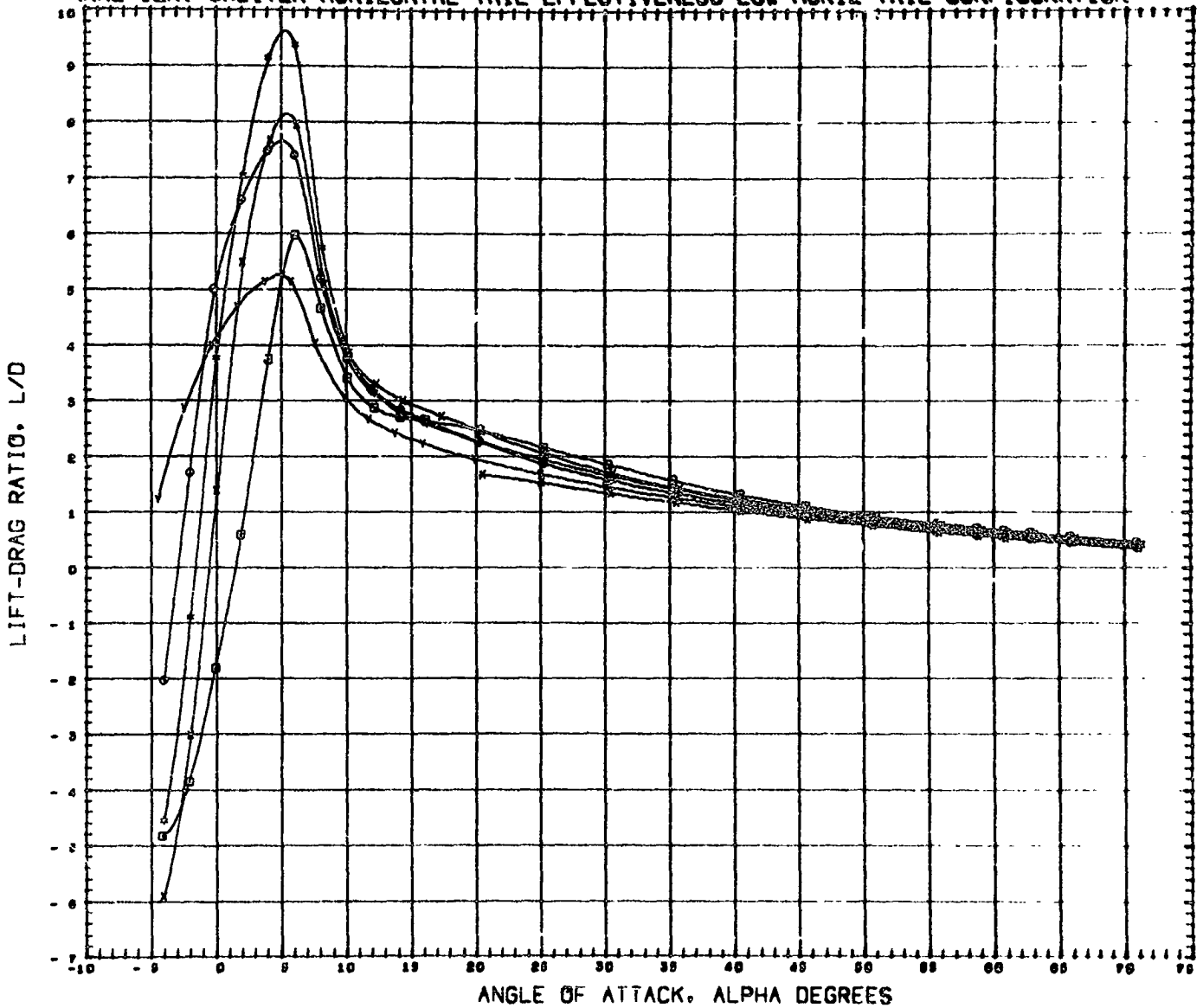


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6        | 11 AUG 70 | 0.250 | REFD 1.70000E+01 00.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 N13 V5 | 11 AUG 70 |       | REFL 1.57370E+01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 N13 V5 | 11 AUG 70 |       | REFD 1.13300E+01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 N13 V5 | 11 AUG 70 |       | YMFP 9.19200E+00 INCHES  |
| y      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 N13 V5 | 11 AUG 70 |       | YMFP 0.00000E+00 INCHES  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 N13 V5 | 11 AUG 70 |       | YMFP -3.04000E+01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE

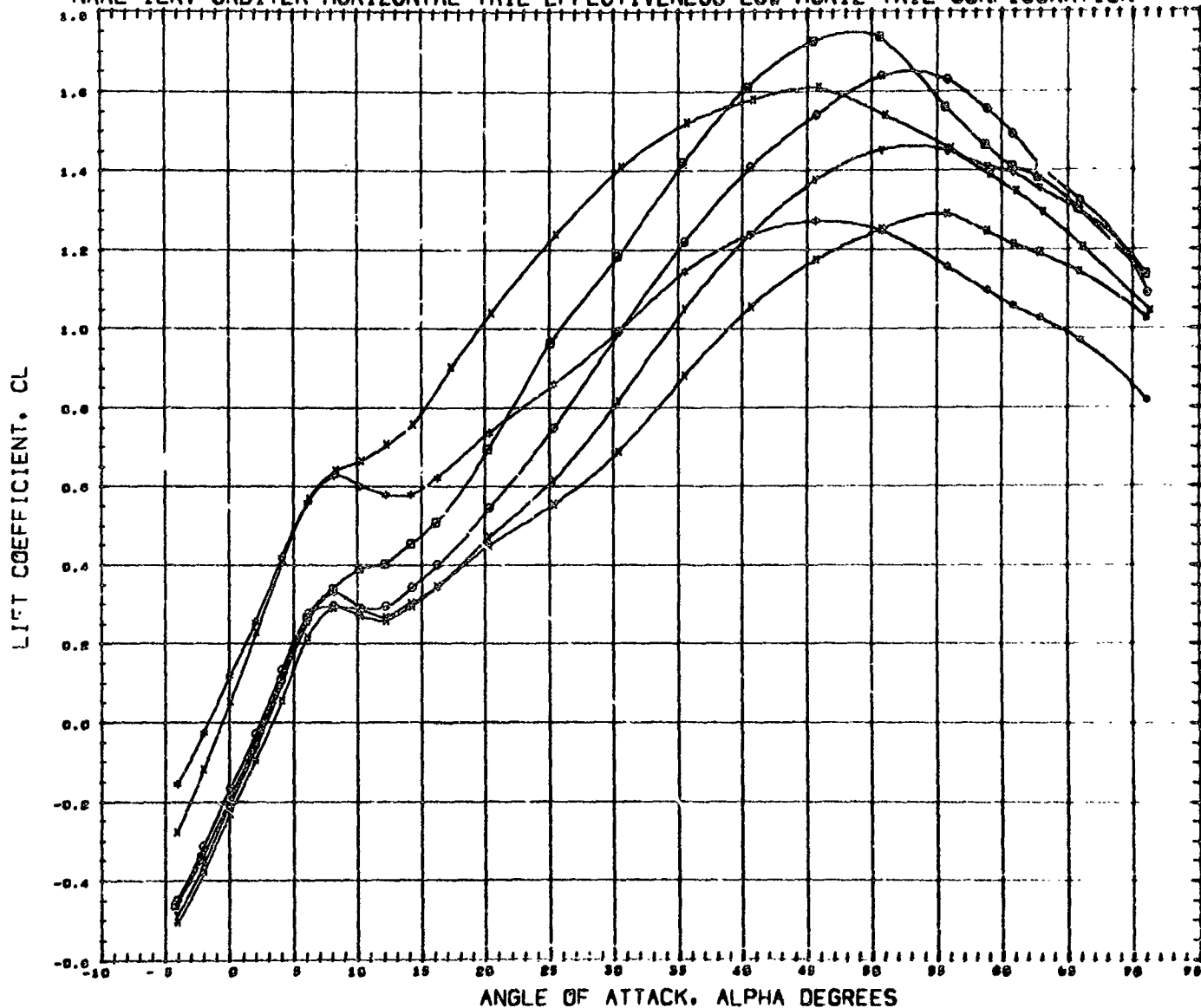
NAAL 029 NA-FE-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  | REFERENCE INFORMATION                  |
|--------|---------------------------------|--------------------|-----------|-------|----------------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6              | 11 AUG 70 | 0.250 | REFD 1.70000X10 <sup>-01</sup> 80. FT. |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5       | 11 AUG 70 |       | REFL 1.87370X10 <sup>-01</sup> INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5       | 11 AUG 70 |       | REFD 1.13390X10 <sup>-01</sup> INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5       | 11 AUG 70 |       | KNRP 0.13200X10 <sup>-01</sup> INCHES  |
| y      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5       | 11 AUG 70 |       | KNRP 0.00000X10 <sup>-01</sup> INCHES  |
| n      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5       | 11 AUG 70 |       | KNRP -3.84000X10 <sup>-01</sup> INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-391 |           |       | SCALE 7.91000X10 <sup>-01</sup> SCALE  |

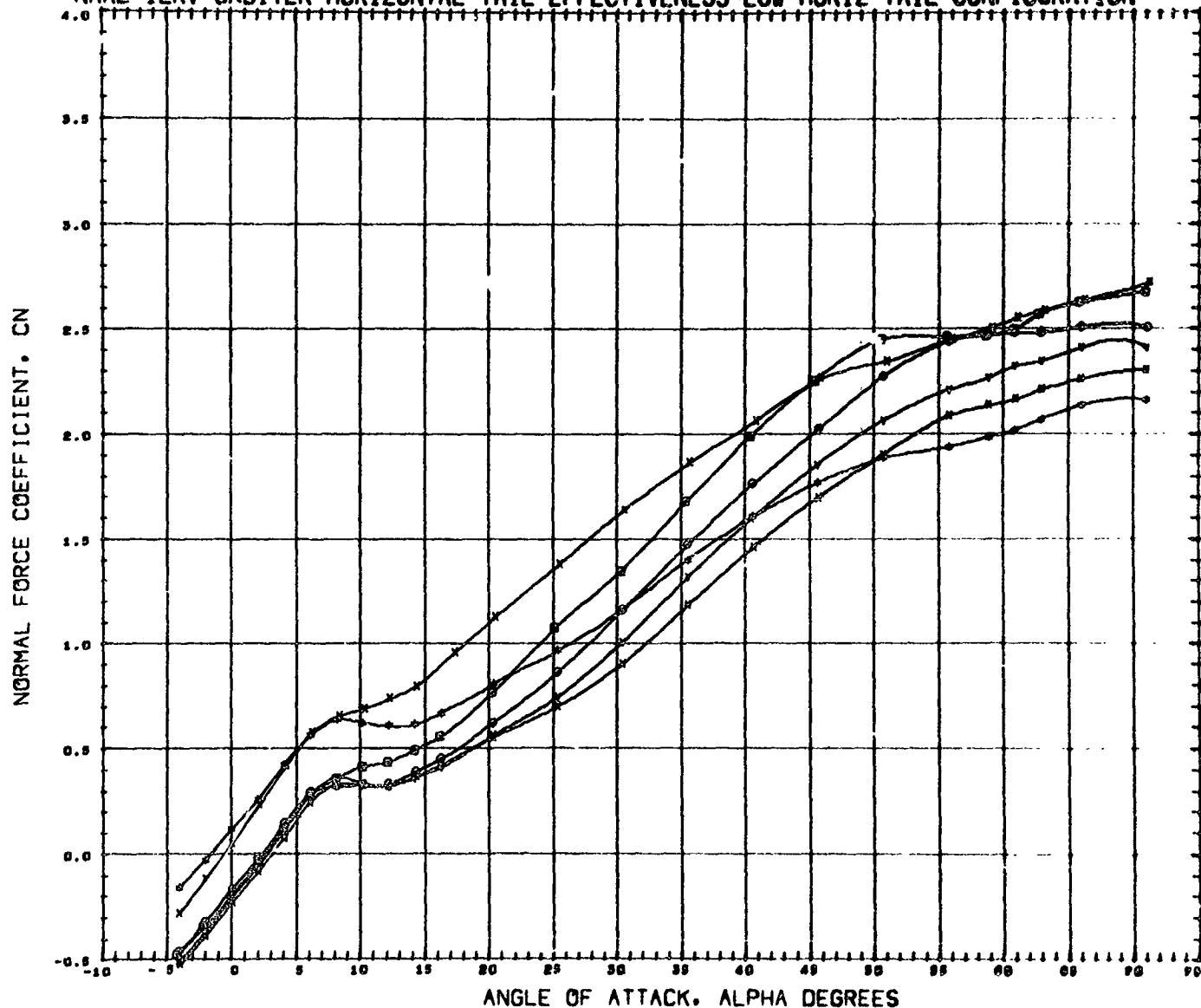
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 | 0.250 | REFS 1.70000E+01 00.71.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4013) | 11 AUG 70 |       | REFL 1.57070E+01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4072) | 11 AUG 70 |       | REFD 1.13300E+00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4071) | 11 AUG 70 |       | YMRP 0.13700E+00 INCHES  |
| y      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4070) | 11 AUG 70 |       | YMRP 0.00000E+00 INCHES  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4005) | 11 AUG 70 |       | ZMRP -5.04000E+01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

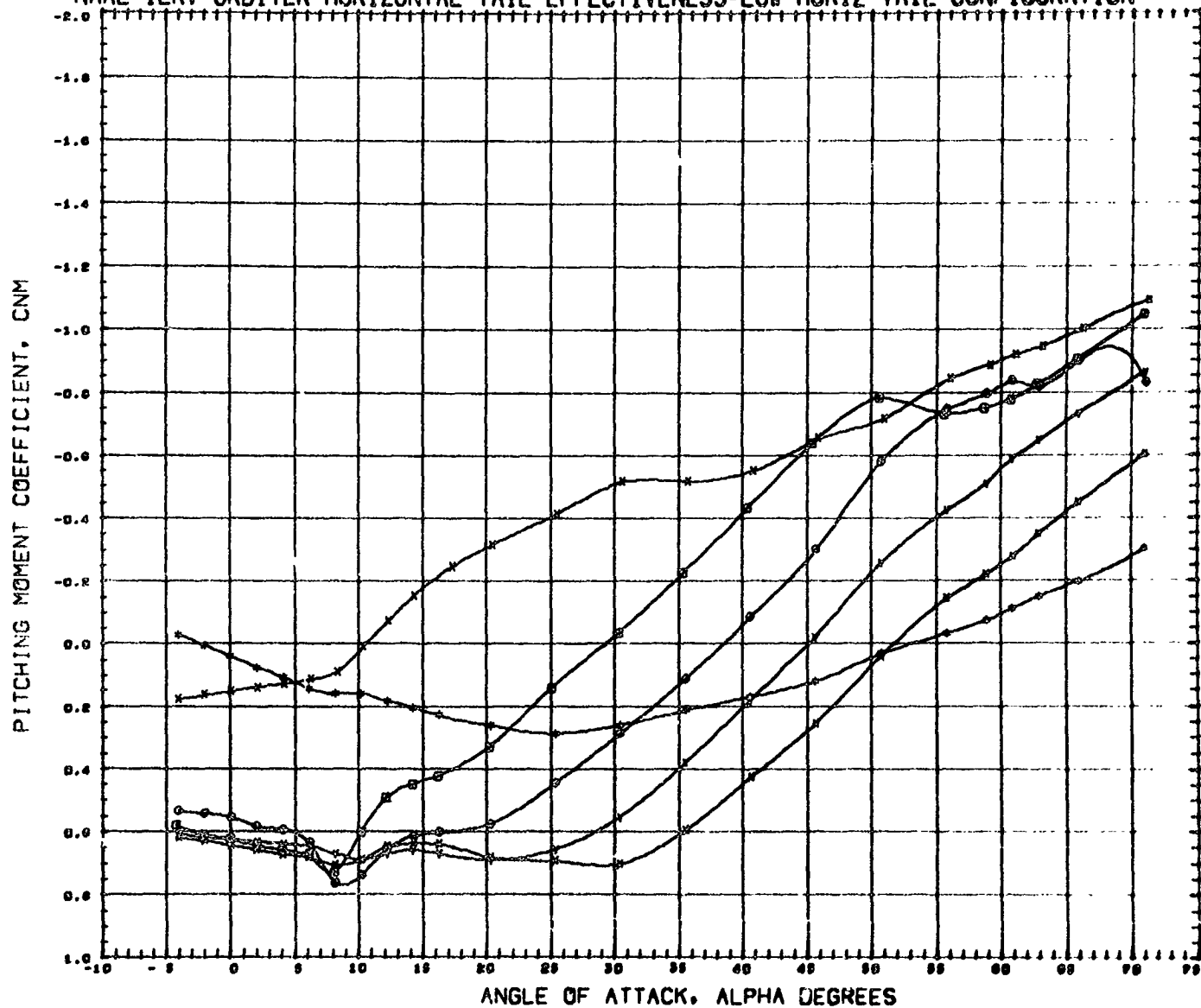


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| +      | NAAL 629 SSV-ILRV STRAIGHT WING | 88 W8        | 11 AUG 70 | 0.290 | REFD 1.70000E10-01 80.71.  |
| x      | NAAL 629 SSV-ILRV STRAIGHT WING | 88 W8 H13 V5 | 11 AUG 70 |       | REFL 1.07370E10-01 INCHES  |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING | 88 W8 H13 V5 | 11 AUG 70 |       | REFD 1.13200E10-01 INCHES  |
| y      | NAAL 629 SSV-ILRV STRAIGHT WING | 88 W8 H13 V5 | 11 AUG 70 |       | YMRP 0.13200E10-00 INCHES  |
|        | NAAL 629 SSV-ILRV STRAIGHT WING | 88 W8 H13 V5 | 11 AUG 70 |       | YMRP 0.00000E10-01 INCHES  |
|        | NAAL 629 SSV-ILRV STRAIGHT WING | 88 W8 H13 V5 | 11 AUG 70 |       | ZMRP -3.04000E10-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE

NAAL 629 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

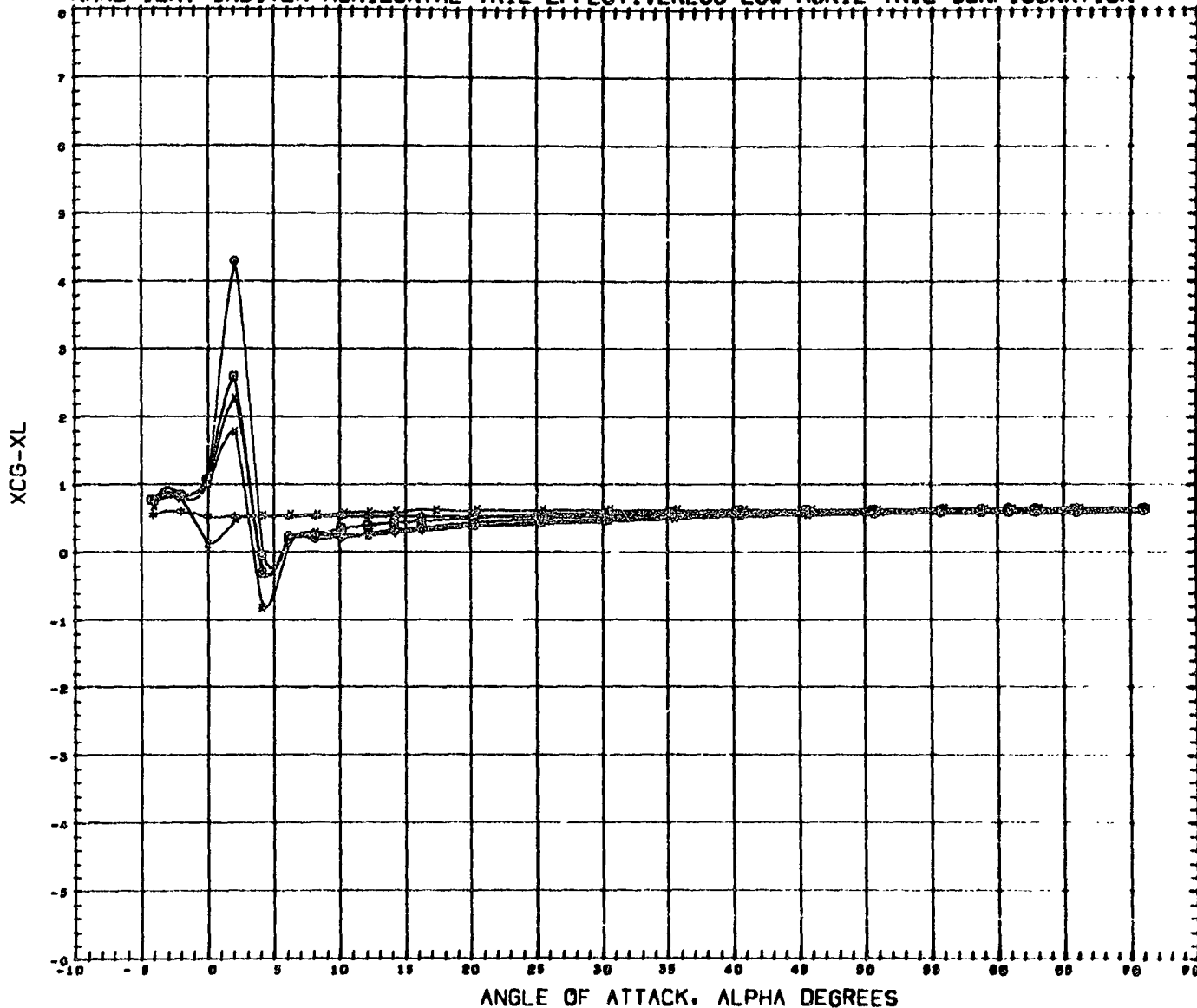


| SYMBOL | CONFIGURATION DESCRIPTION |          |            |      | DATA SET           | DATE     | MACH      | REFERENCE INFORMATION |       |                            |        |
|--------|---------------------------|----------|------------|------|--------------------|----------|-----------|-----------------------|-------|----------------------------|--------|
| *      | NAAL 020                  | SSV-ILRV | 3 STRAIGHT | WING | 86 WS              | (RC4003) | 11 AUG 70 | 0.250                 | REFS  | 1.70000X10 <sup>-01</sup>  | SQ.FT. |
| x      | NAAL 020                  | SSV-ILRV | 3 STRAIGHT | WING | 86 WS N13 V5       | (RC4013) | 11 AUG 70 |                       | REFL  | 1.57570X10 <sup>-01</sup>  | INCHES |
| o      | NAAL 020                  | SSV-ILRV | 3 STRAIGHT | WING | 86 WS N13 V5       | (RC4072) | 11 AUG 70 |                       | REFS  | 1.13350X10 <sup>-01</sup>  | INCHES |
| o      | NAAL 020                  | SSV-ILRV | 3 STRAIGHT | WING | 86 WS N13 V5       | (RC4071) | 11 AUG 70 |                       | ENRP  | 0.13800X10 <sup>-00</sup>  | INCHES |
| y      | NAAL 020                  | SSV-ILRV | 3 STRAIGHT | WING | 86 WS N13 V5       | (RC4070) | 11 AUG 70 |                       | YMRP  | 0.00000X10 <sup>-00</sup>  | INCHES |
| n      | NAAL 020                  | SSV-ILRV | 3 STRAIGHT | WING | 86 WS N13 V5       | (RC4005) | 11 AUG 70 |                       | ZMRP  | -3.00000X10 <sup>-01</sup> | INCHES |
|        |                           |          |            |      |                    |          |           |                       | SCALE | 7.01000X10 <sup>-01</sup>  | SCALE  |
|        | REFERENCE FILE            |          |            |      | NAAL 020 NA-PD-391 |          |           |                       |       |                            |        |

REFERENCE FILE

NAAL 020 NA-70-351

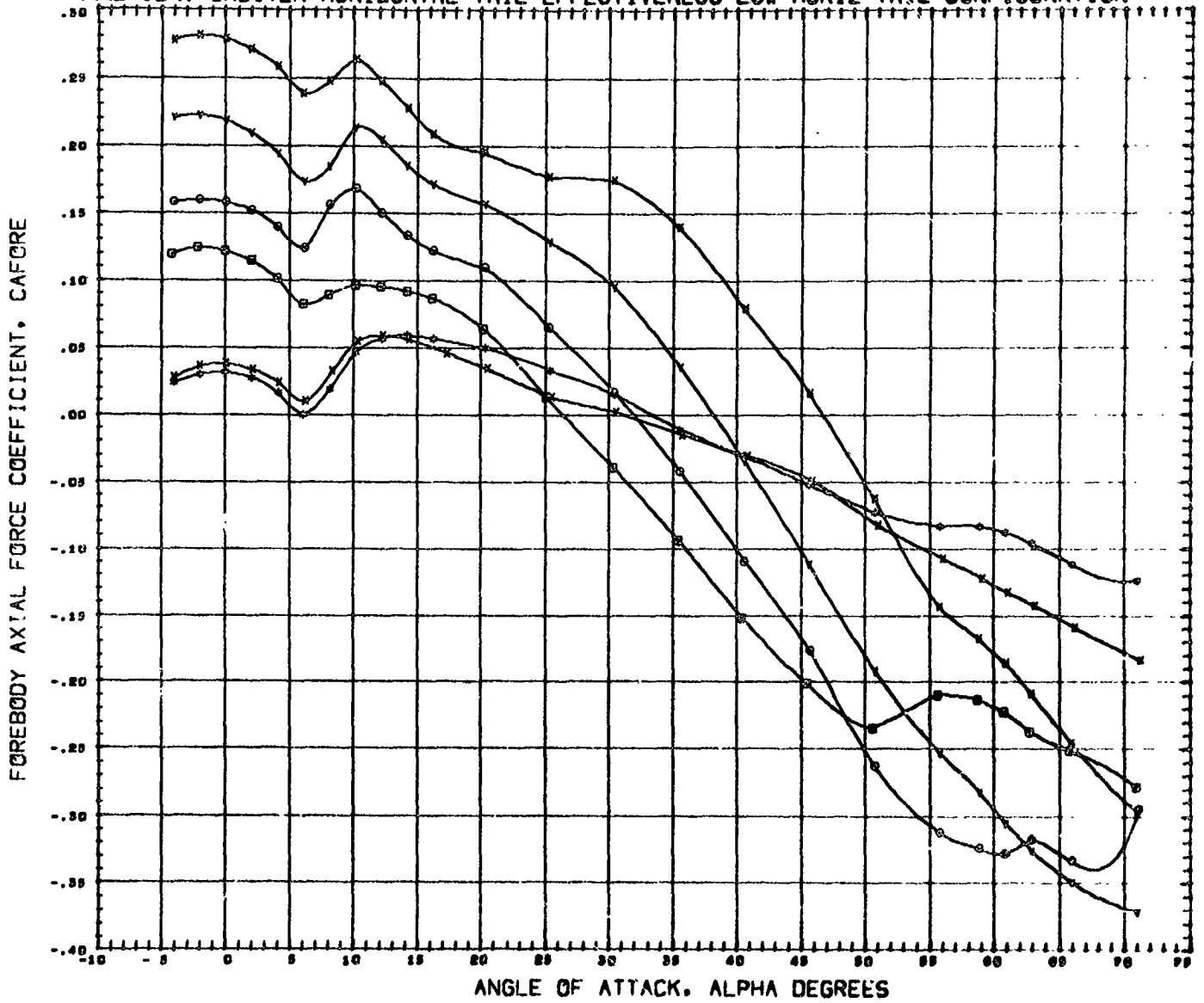
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6        | 11 AUG 70 | 0.290 | REFS 1.70000E10-01 BG.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5 | 11 AUG 70 |       | REFL 1.87370E10-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5 | 11 AUG 70 |       | REFC 1.12200E10-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5 | 11 AUG 70 |       | INRP 9.13000E10-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5 | 11 AUG 70 |       | INRP 0.00000E10-01 INCHES  |
| H      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5 | 11 AUG 70 |       | INRP -3.04000E10-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

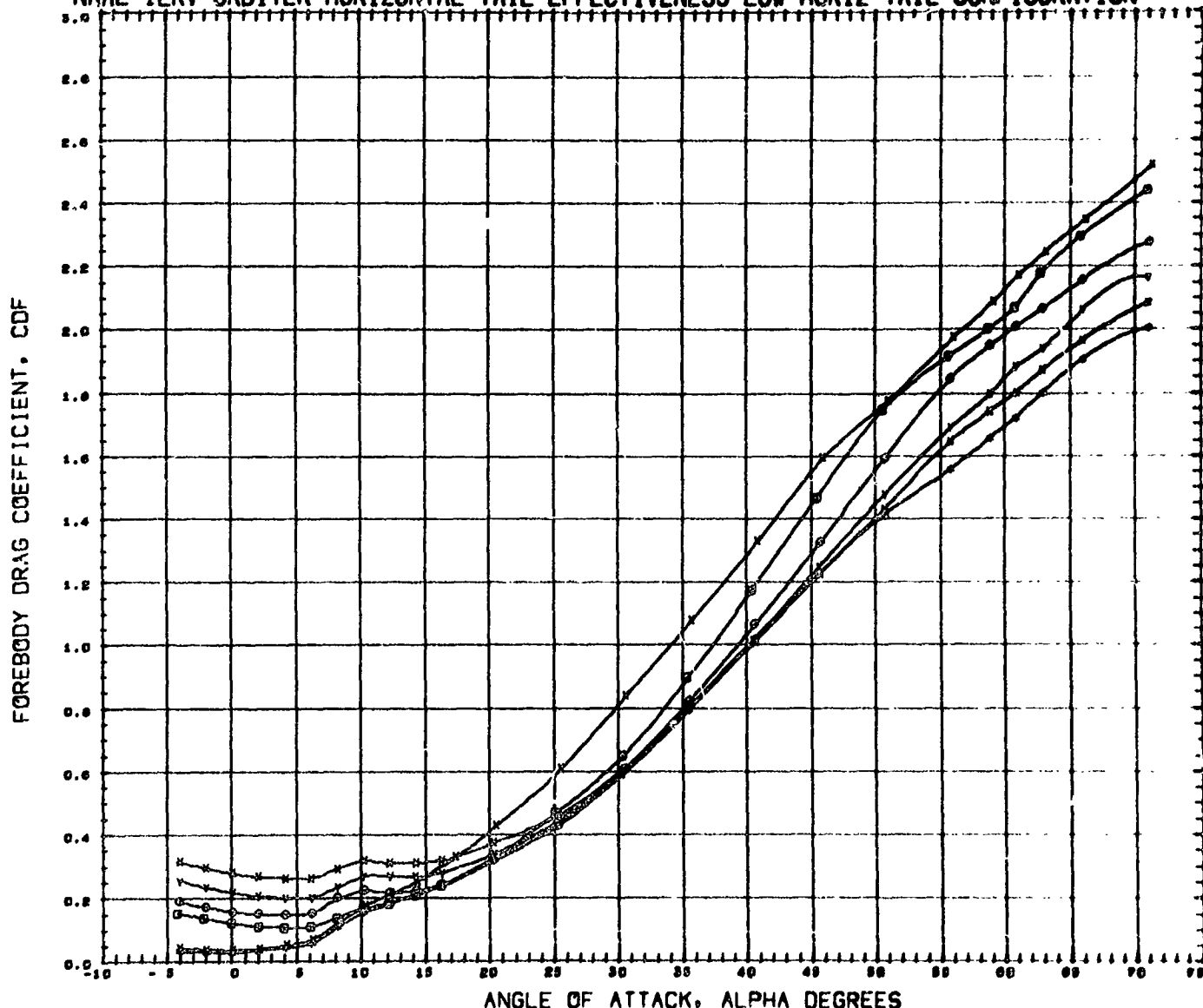
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 | 0.859 | REFD 1.70000010-01 1/8 FT. |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4013   | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4072   | 11 AUG 70 |       | REFD 1.13000010-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4071   | 11 AUG 70 |       | ENRP 0.13000010-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4070   | 11 AUG 70 |       | ENRP 0.00000010-01 INCHES  |
| H      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4009   | 11 AUG 70 |       | ENRP -3.04000010-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

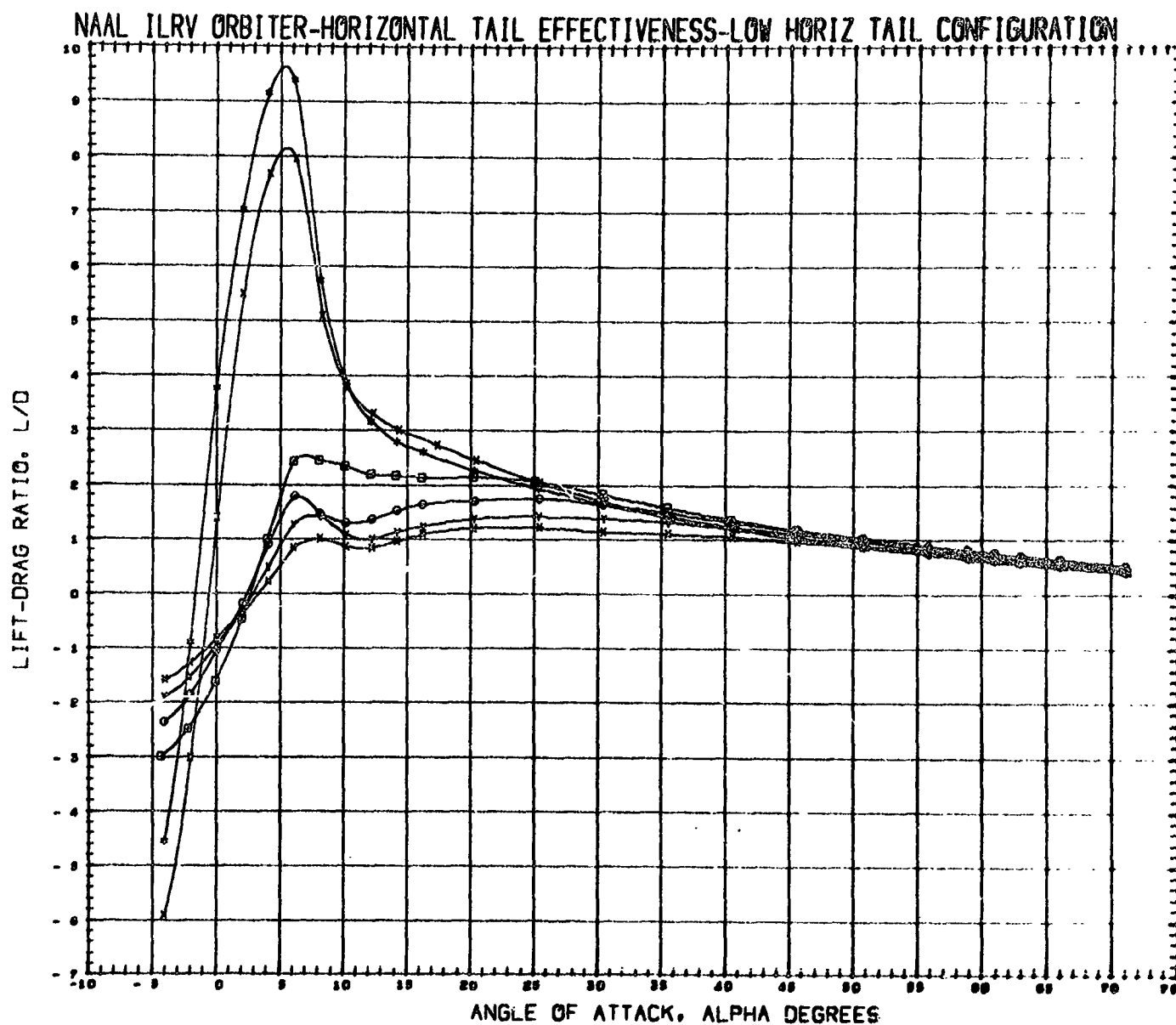
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 (RC4003)        | 11 AUG 70 | 0.250 | REFL 1.70000E10-01 50.71.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 (RC4013) | 11 AUG 70 |       | REFL 1.97375E10-01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 (RC4072) | 11 AUG 70 |       | REFD 1.13300E10-00 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 (RC4071) | 11 AUG 70 |       | XMRP 0.13200E10-00 INCHES  |
| y      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 (RC4070) | 11 AUG 70 |       | YMRP 0.00000E10-01 INCHES  |
| h      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W8 H13 V5 (RC4059) | 11 AUG 70 |       | ZMRP -3.04000E10-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE

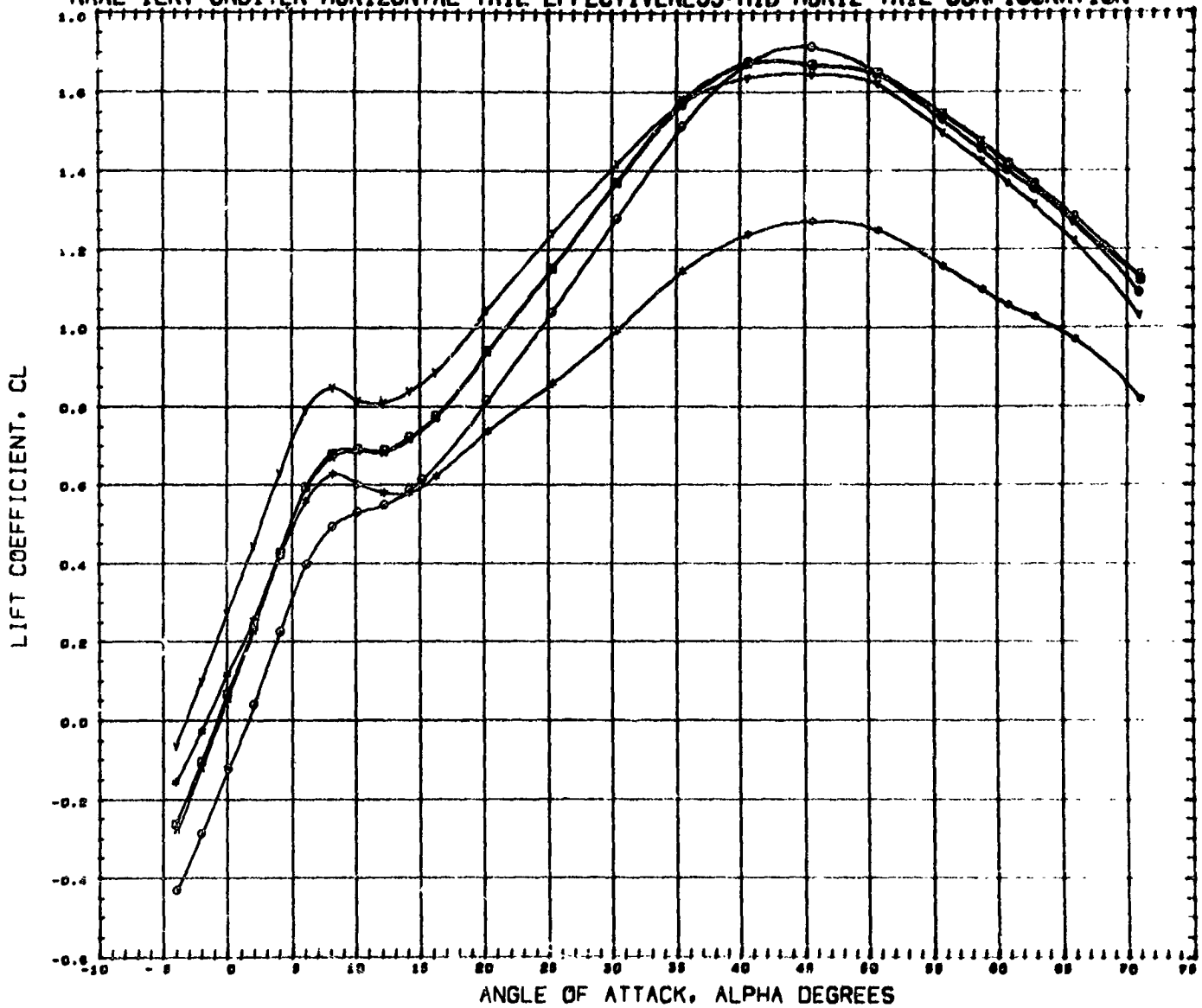
NAAL 029 NA-70-191



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6        | 11 AUG 70 | 0.250 | REFS 1.70000E-01 00.71.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       | REFB 1.13300E-00 INCHES  |
| v      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       | ZMRP 0.13200E-00 INCHES  |
| k      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 H13 V5 | 11 AUG 70 |       | YMRP 0.00000E-01 INCHES  |
|        |                                 |              |           |       | ZMRP -3.04000E-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

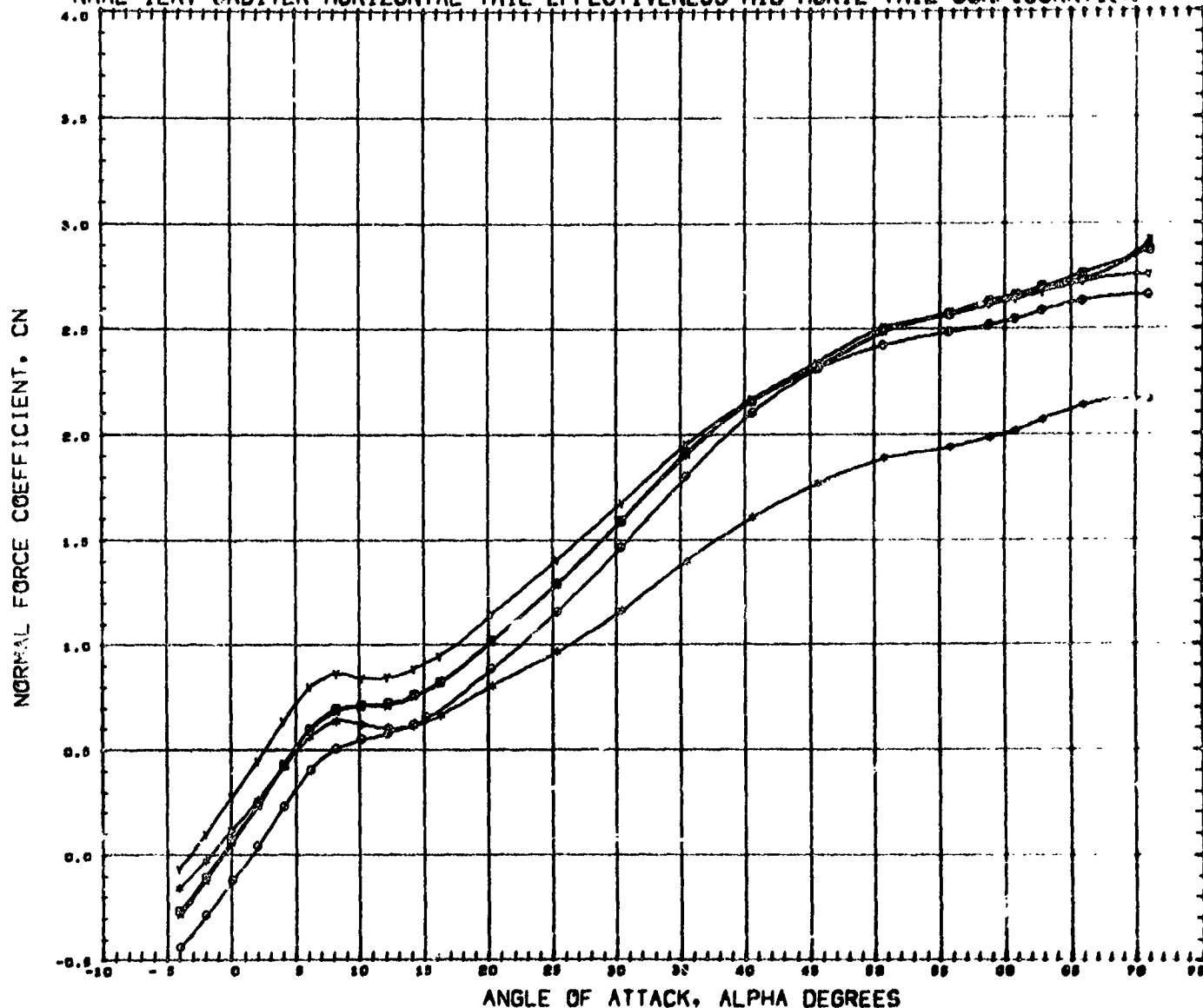
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | NACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 | 0.029 | REFS 1.70000E-01 INCHES  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4033   | 11 AUG 70 |       | REFL 1.07370E-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040   | 11 AUG 70 |       | REFD 1.15300E-01 INCHES  |
| V      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4054   | 11 AUG 70 |       | ENRP 0.15200E-01 INCHES  |
|        |                                 | RC4059   | 11 AUG 70 |       | YHRP 0.00000E-01 INCHES  |
|        |                                 |          |           |       | ZHRP -3.04000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01300E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

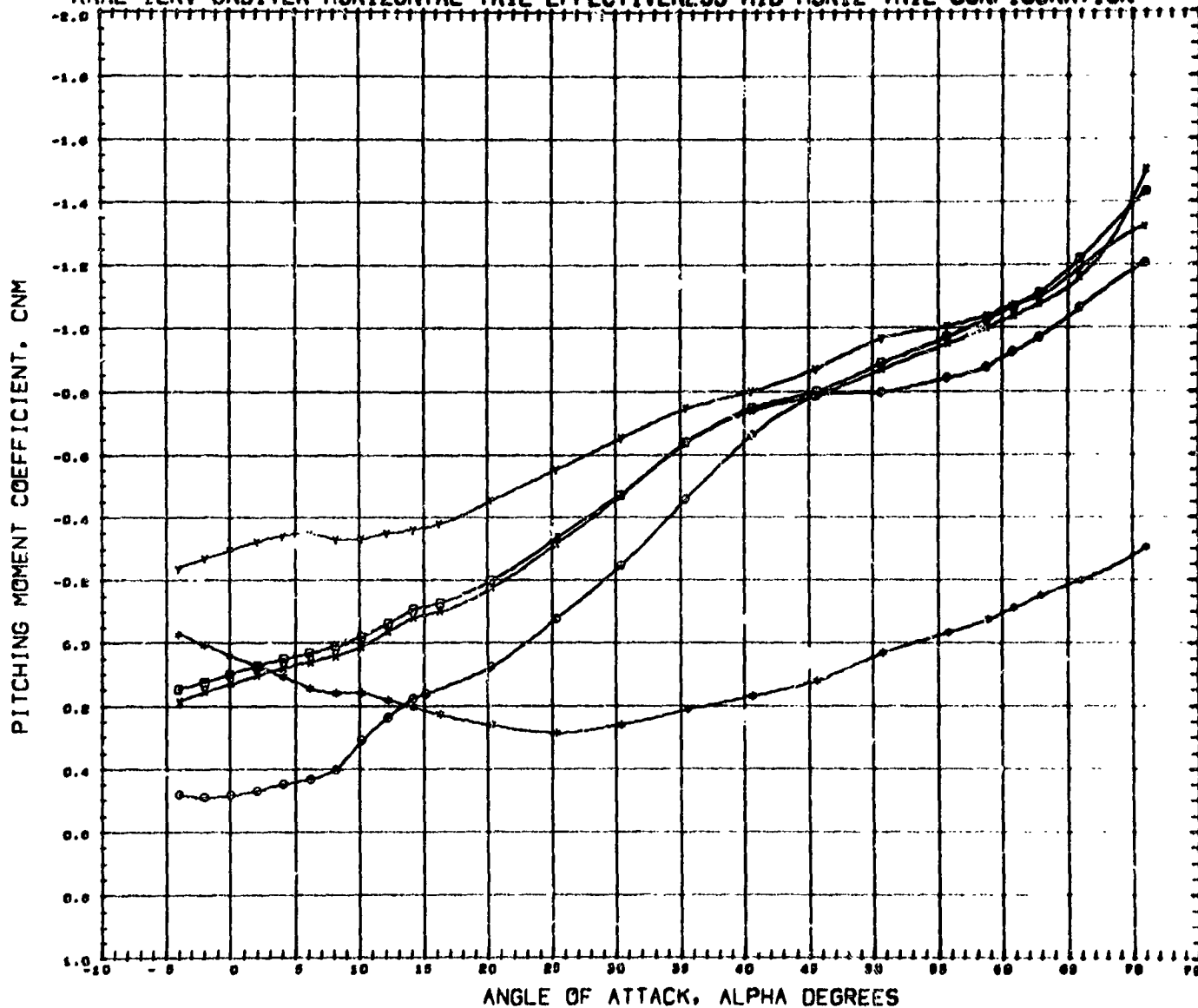
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | 00 M0        | 11 AUG 70 | 0.890 | REFS 1.700000E-01 00.FT. |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | 00 M0 M12    | 11 AUG 70 |       | REFL 1.57370E-01 INCHES  |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | 00 M0 M12 V5 | 11 AUG 70 |       | REFB 1.13300E-01 INCHES  |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | 70 M0 M12 V5 | 11 AUG 70 |       | INRP 0.13000E-01 INCHES  |
| y      | NAAL 020 BSV-ILRV STRAIGHT WING | 00 M0 M12 V5 | 11 AUG 70 |       | INRP 0.00000E-01 INCHES  |
|        |                                 |              |           |       | INRP -3.00000E-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-551

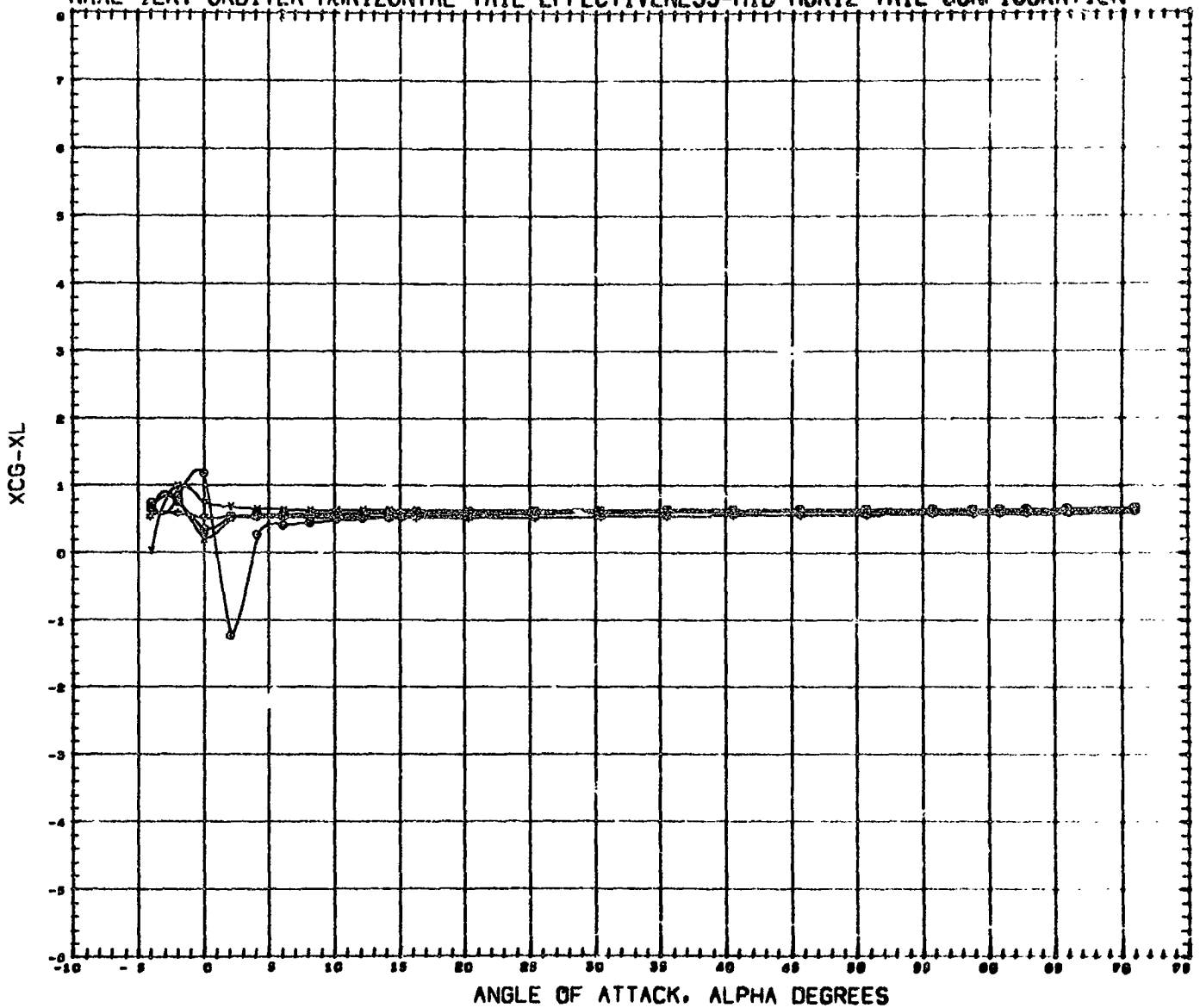
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL         | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|----------------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *              | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 (RC4003)        | 11 AUG 70 | G.259 | REF 1.70000010-01 30. FT.  |
| +              | NAAL 021 SSV-ILRV STRAIGHT WING | 06 W6 N12 (RC4035)    | 11 AUG 70 |       | REF 1.87370010-01 INCHES   |
| Δ              | NAAL 022 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5 (RC4040) | 11 AUG 70 |       | REF 1.13530010-01 INCHES   |
| ○              | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5 (RC4034) | 11 AUG 70 |       | YMRP 0.13200010-00 INCHES  |
| ▽              | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5 (RC4030) | 11 AUG 70 |       | YMRP 0.00800010-00 INCHES  |
|                |                                 |                       |           |       | ZMRP -0.04000010-01 INCHES |
|                |                                 |                       |           |       | SCALE 1.01600010-03 SCALE  |
| REFERENCE FILE |                                 | NAAL 020 NA-70-331    |           |       |                            |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

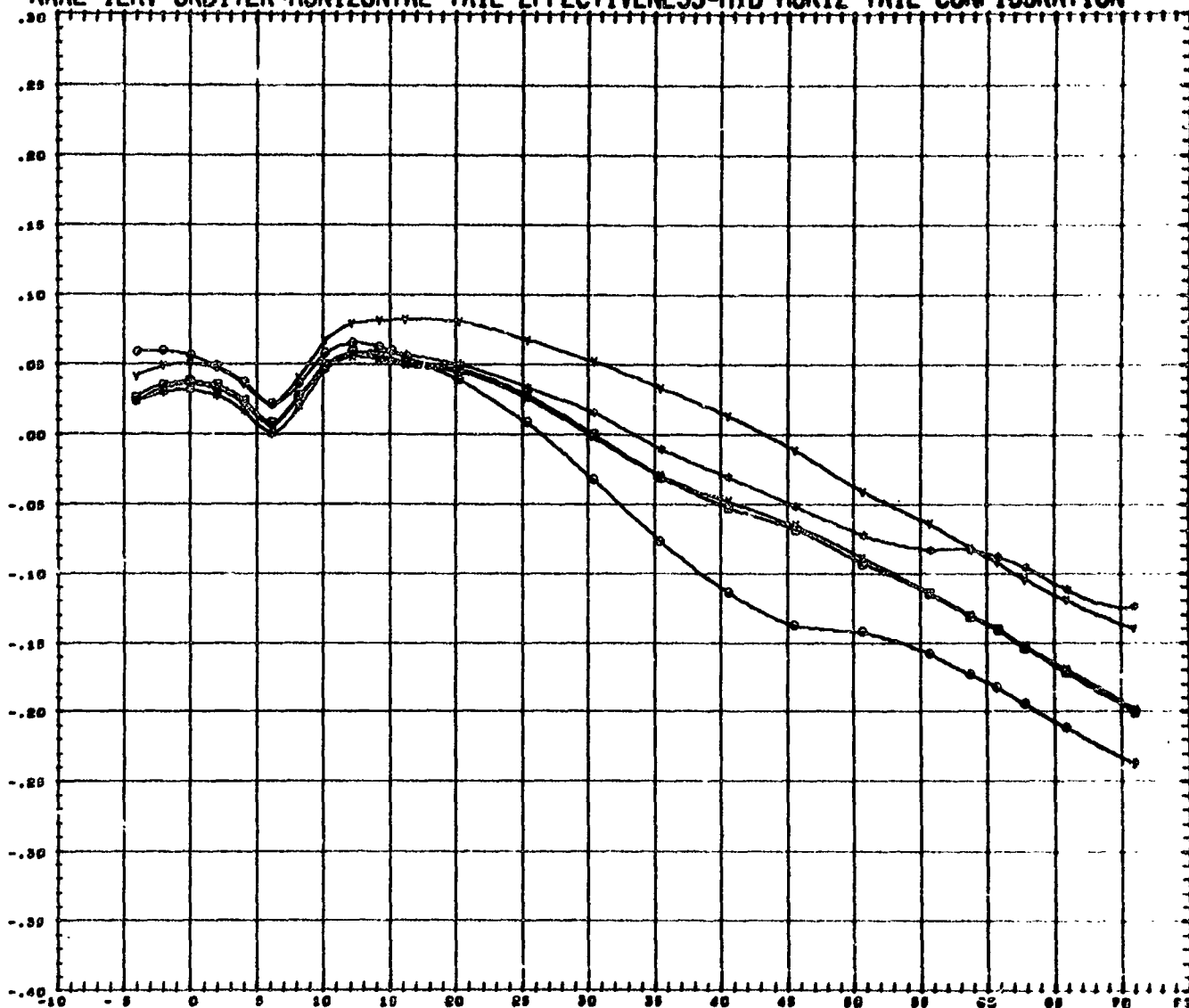


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 | 0.750 | PEFS 1.70000E+01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4035   | 11 AUG 70 |       | REFL 1.07376E+01 INCHES  |
| @      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040   | 11 AUG 70 |       | REFD 1.13300E+00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4034   | 11 AUG 70 |       | ENRP 0.13800E+00 INCHES  |
| v      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4036   | 11 AUG 70 |       | YMR 0.09000E+00 INCHES   |
|        |                                 |          |           |       | ZMRP -3.04000E+01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

FOREBODY AXIAL FORCE COEFFICIENT, CAFORE

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

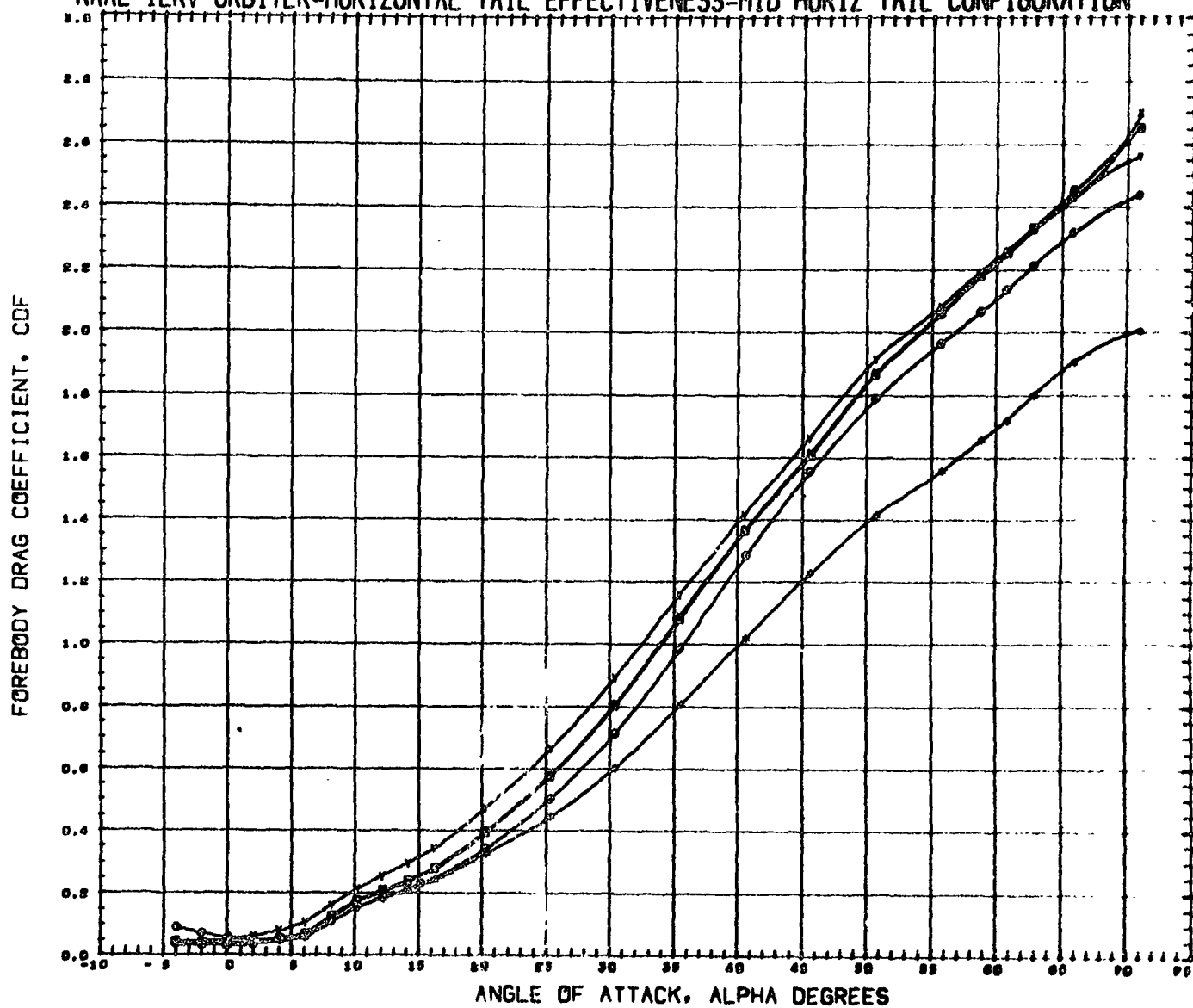


ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION                  |
|--------|---------------------------------|--------------|--------------------|-------|----------------------------------------|
| *      | NAAL 020 JSV-ILRV STRAIGHT WING | 06 W0        | (RC4063) 11 AUG 70 | 0.850 | REF0 1.70000X10 <sup>-01</sup> 88.FT.  |
| x      | NAAL 020 JSV-ILRV STRAIGHT WING | 06 W0 H12    | (RC4035) 11 AUG 70 |       | REF1 1.57370X10 <sup>-01</sup> INCHES  |
| o      | NAAL 020 JSV-ILRV STRAIGHT WING | 06 W0 H12 V5 | (RC4040) 11 AUG 70 |       | REF2 1.13300X10 <sup>-01</sup> INCHES  |
| Q      | NAAL 020 JSV-ILRV STRAIGHT WING | 06 W0 H12 V5 | (RC4054) 11 AUG 70 |       | INRP 0.13200X10 <sup>-01</sup> INCHES  |
| v      | NAAL 020 JSV-ILRV STRAIGHT WING | 06 W0 H12 V5 | (RC4054) 11 AUG 70 |       | INRP 0.00000X10 <sup>-01</sup> INCHES  |
|        |                                 |              |                    |       | INRP -3.04000X10 <sup>-01</sup> INCHES |
|        |                                 |              |                    |       | SCALE 7.01000X10 <sup>-01</sup> SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

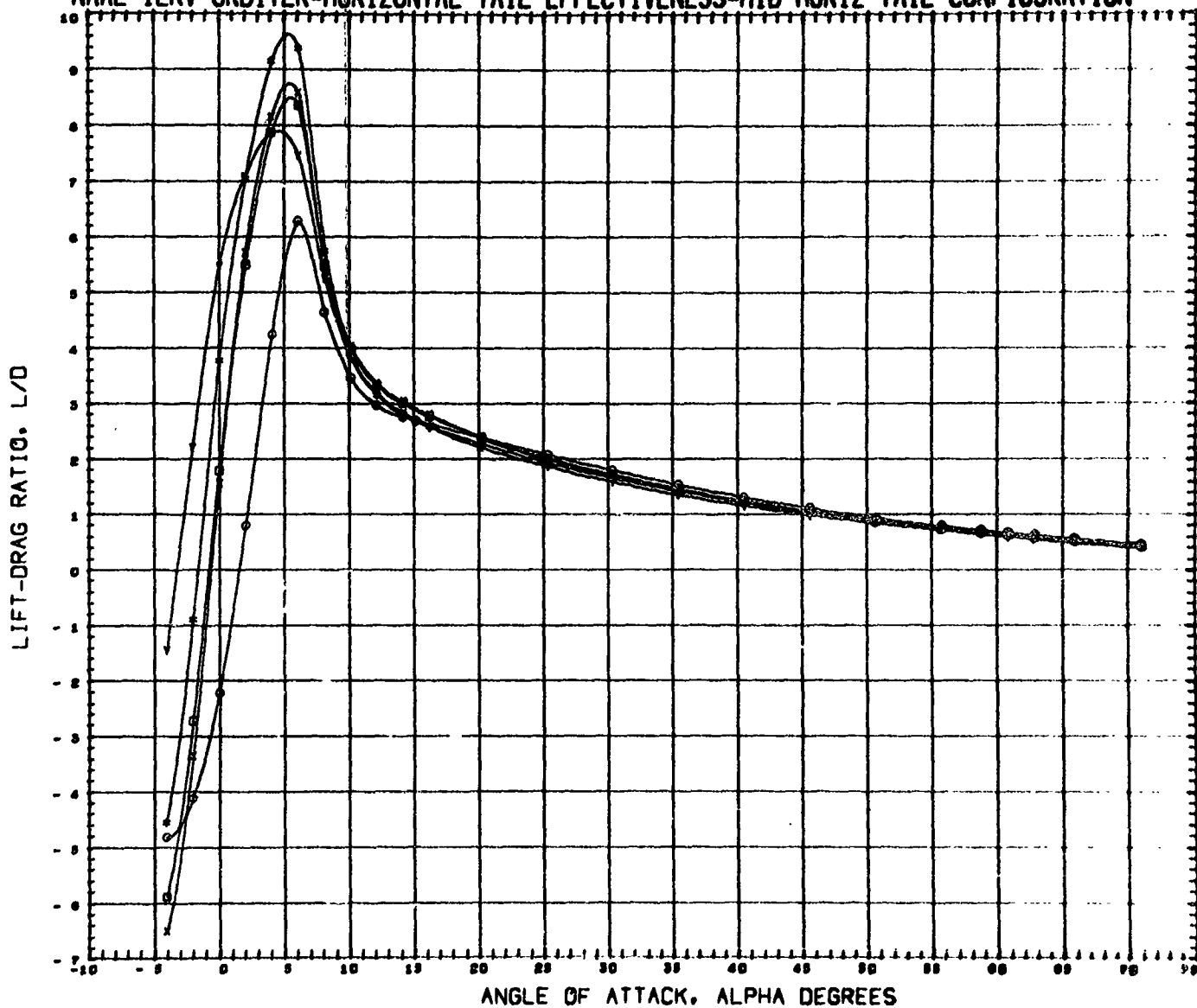
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | SS WS        | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|----------|-----------|-------|--------------------------|
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS H12    | (RC4003) | 11 AUG 70 | 0.290 | REFS 1.70000E-01 SQ.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS H12    | (RC4035) | 11 AUG 70 |       | REFL 1.57370E-01 INCHES  |
| B      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS H12 V5 | (RC4040) | 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS H12 V5 | (RC4034) | 11 AUG 70 |       | ENRP 0.13300E-01 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WS H12 V5 | (RC4036) | 11 AUG 70 |       | YNRP 0.00000E-01 INCHES  |
|        |                                 |              |          |           |       | ZNRP -5.04000E-01 INCHES |
|        |                                 |              |          |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

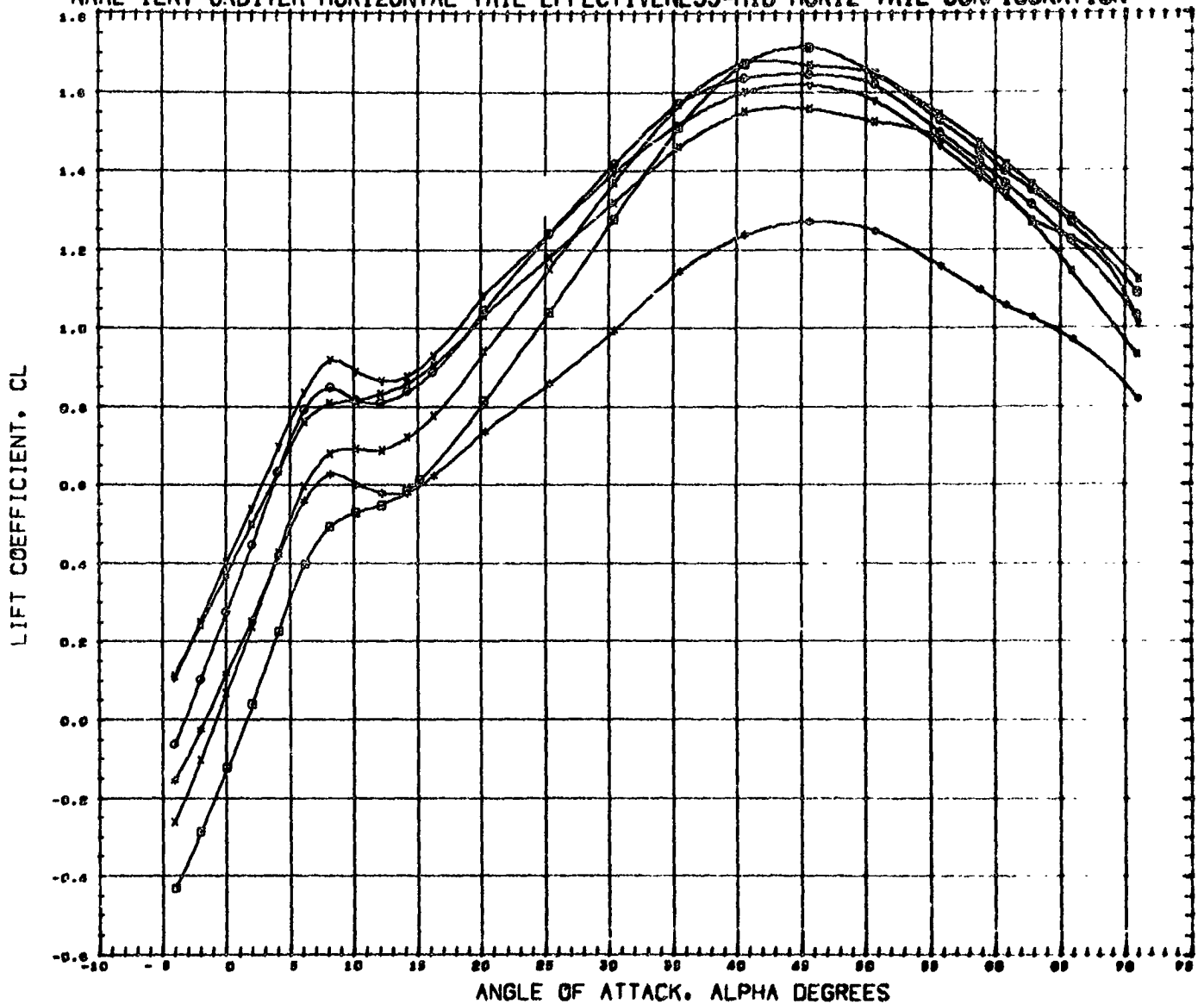
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL         | CONFIGURATION DESCRIPTION |                        | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION |                       |
|----------------|---------------------------|------------------------|--------------|----------|-----------|-----------------------|-----------------------|
|                |                           |                        |              |          | 0.250     |                       |                       |
| *              | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 W6        | (RC4083) | 11 AUG 70 | REFS                  | 1.70000E10-01 88.FY.  |
| x              | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 W6 M12    | (RC4033) | 11 AUG 70 | REPL                  | 1.97370E10-01 INCHES  |
| o              | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 W6 M12 V5 | (RC4040) | 11 AUG 70 | REFS                  | 1.13300E10-00 INCHES  |
| o              | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 W6 M12 V5 | (RC4034) | 11 AUG 70 | KMRP                  | 0.13200E10-00 INCHES  |
| y              | NAAL 020                  | SSV-ILRV STRAIGHT WING | 06 W6 M12 V5 | (RC4036) | 11 AUG 70 | YMRP                  | 0.00000E10-01 INCHES  |
|                |                           |                        |              |          |           | ZMRP                  | -3.84000E10-01 INCHES |
|                |                           |                        |              |          |           | SCALE                 | 7.61000E10-03 SCALE   |
| REFERENCE FILE |                           | NAAL 020 NA-70-351     |              |          |           |                       |                       |

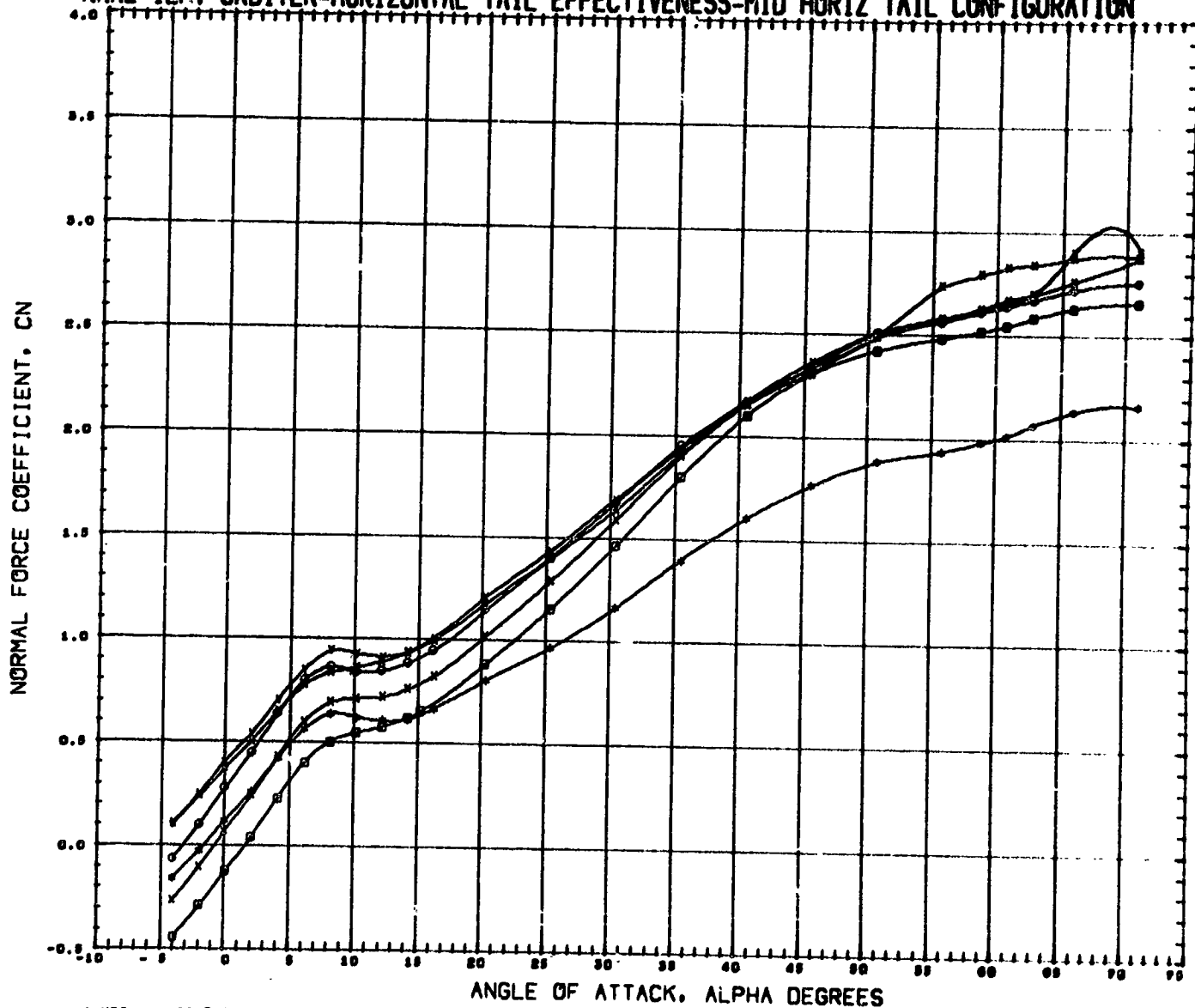
REFERENCE FILE NAAL 029 NA-70-391

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL         | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | HACH  | REFERENCE INFORMATION     |
|----------------|---------------------------------|--------------------|-----------|-------|---------------------------|
| *              | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0              | 11 AUG 70 | 0.250 | REFS 1.700000E-01 00.97.  |
| x              | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | REFL 1.073700E-01 INCHES  |
| o              | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | REFS 1.130000E-01 INCHES  |
| o              | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | INHP 0.132000E-00 INCHES  |
| y              | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | THNP 0.000000E-00 INCHES  |
| n              | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | THNP -2.040000E-01 INCHES |
|                |                                 |                    |           |       | SCALE 1.010000E-01 SCALE  |
| REFERENCE FILE |                                 | NAAL 020 NA-70-351 |           |       |                           |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

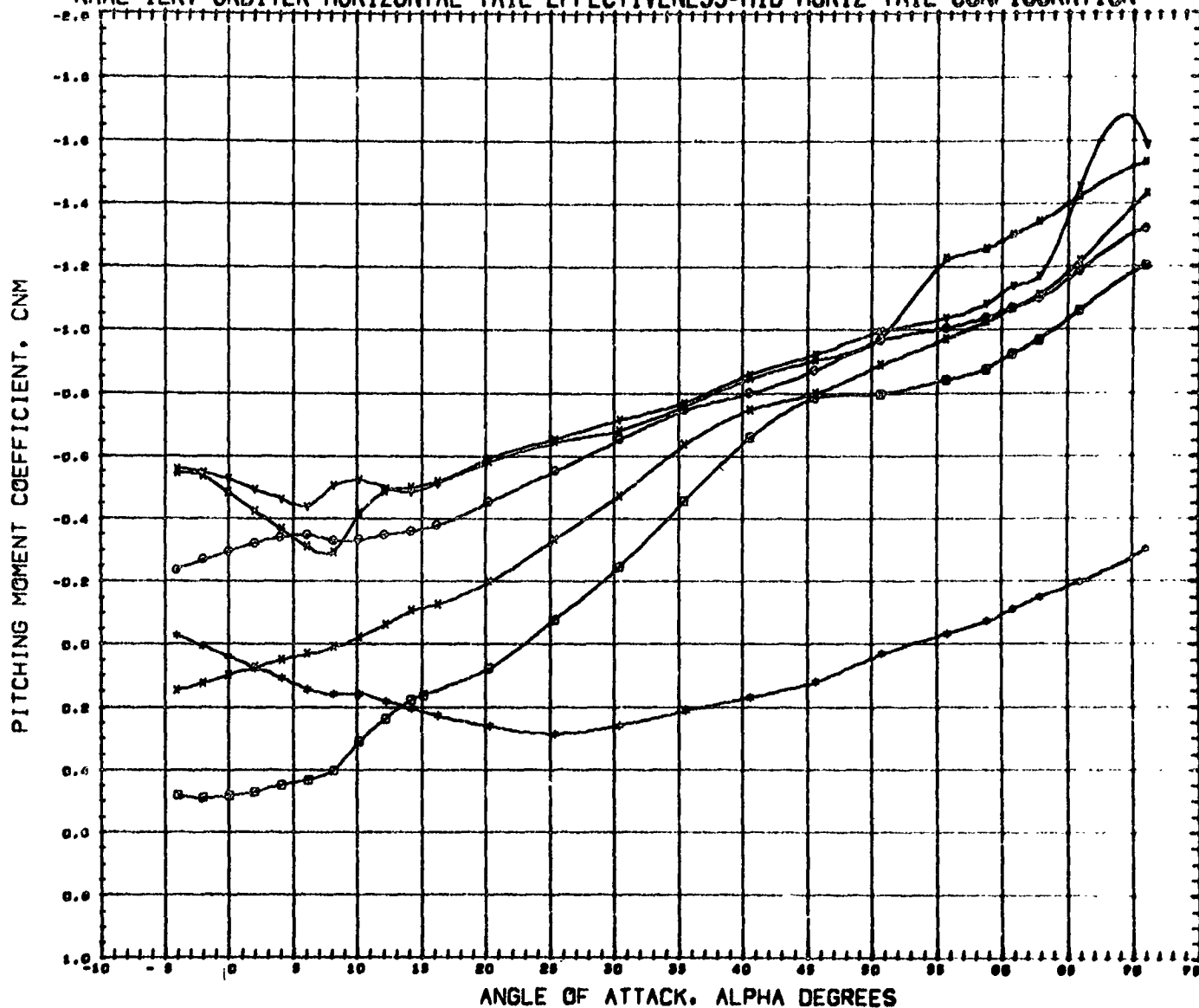


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS        | 11 AUG 70 | 0.250 | REFS 1.70000E-01 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| 0      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | REFS 1.13300E-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | ENRP 0.13200E-00 INCHES  |
| V      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | VMRP 0.00000E-00 INCHES  |
| N      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | ZMRP -3.04000E-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E-03 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

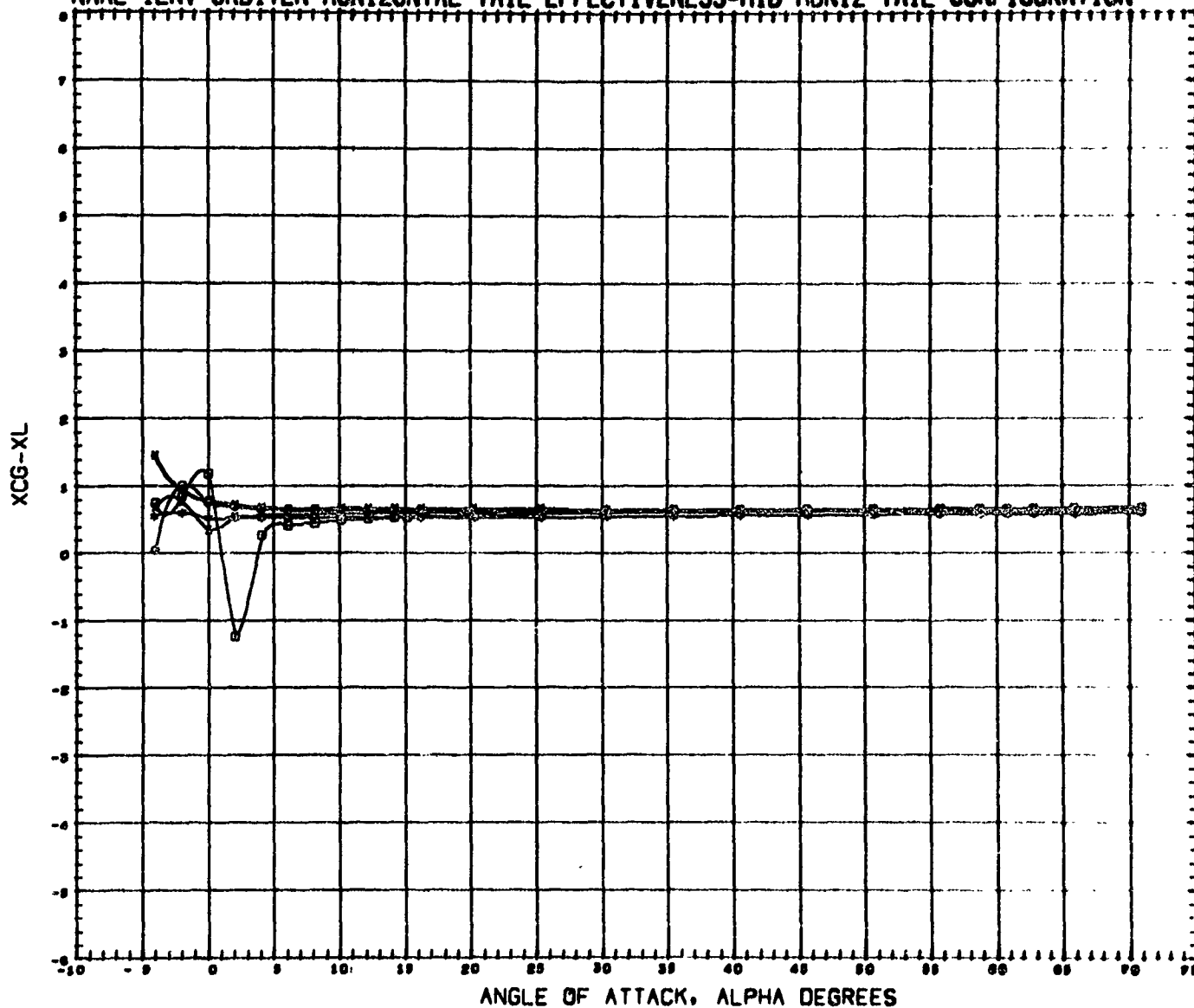
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 WS        | 11 AUG 70 | 0.250 | REFS 1.70000010-01 60 FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 WS N12 VS | 11 AUG 70 |       | REFL 1.57370010-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 WS N12 VS | 11 AUG 70 |       | REFS 1.13300010-01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 WS N12 VS | 11 AUG 70 |       | KNRP 0.13000010-00 INCHES  |
| ◇      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 WS N12 VS | 11 AUG 70 |       | YNRP 0.00000010-00 INCHES  |
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | 08 WS N12 VS | 11 AUG 70 |       | YNRP -3.04000010-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000010-01 SCALE  |

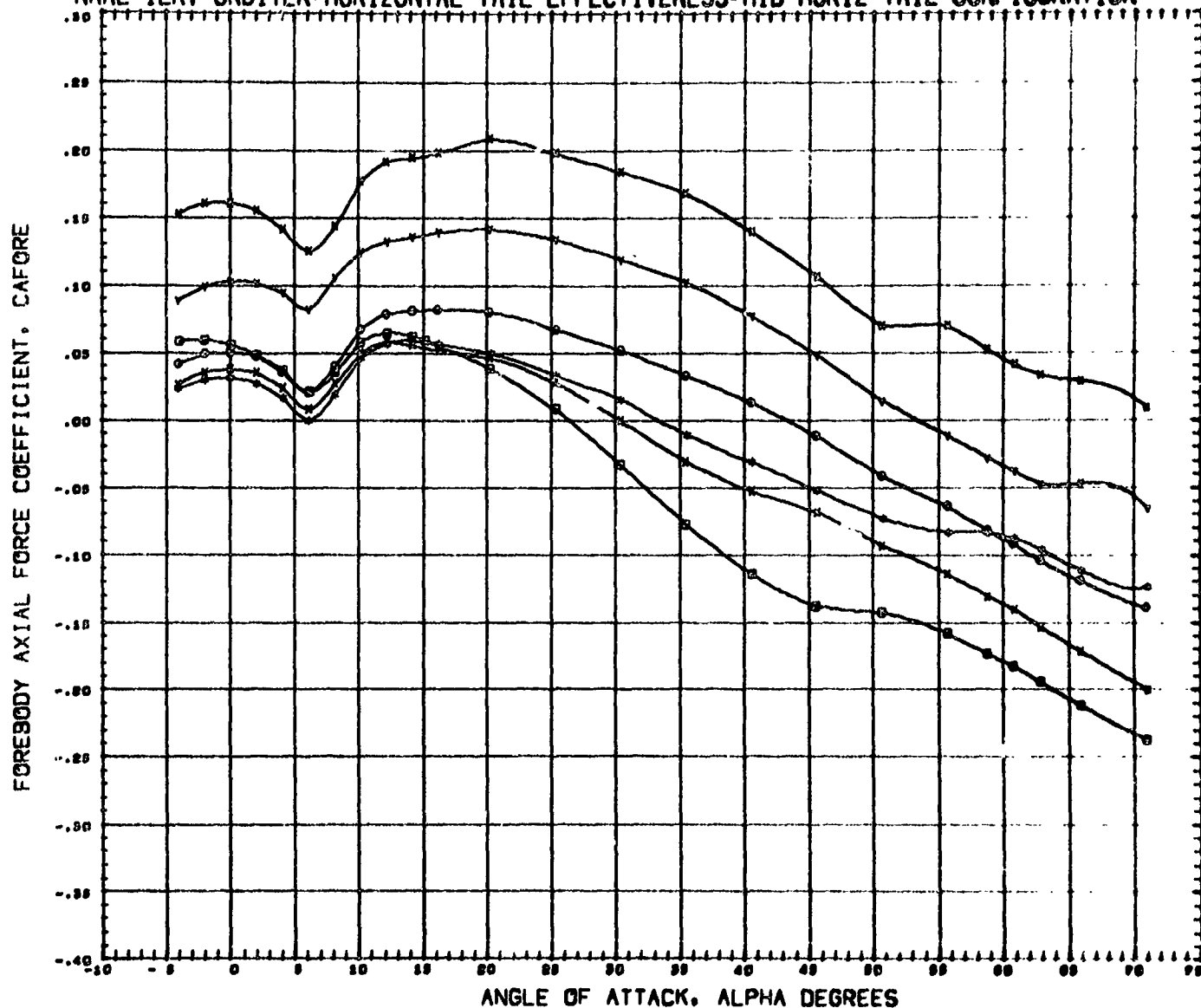
REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



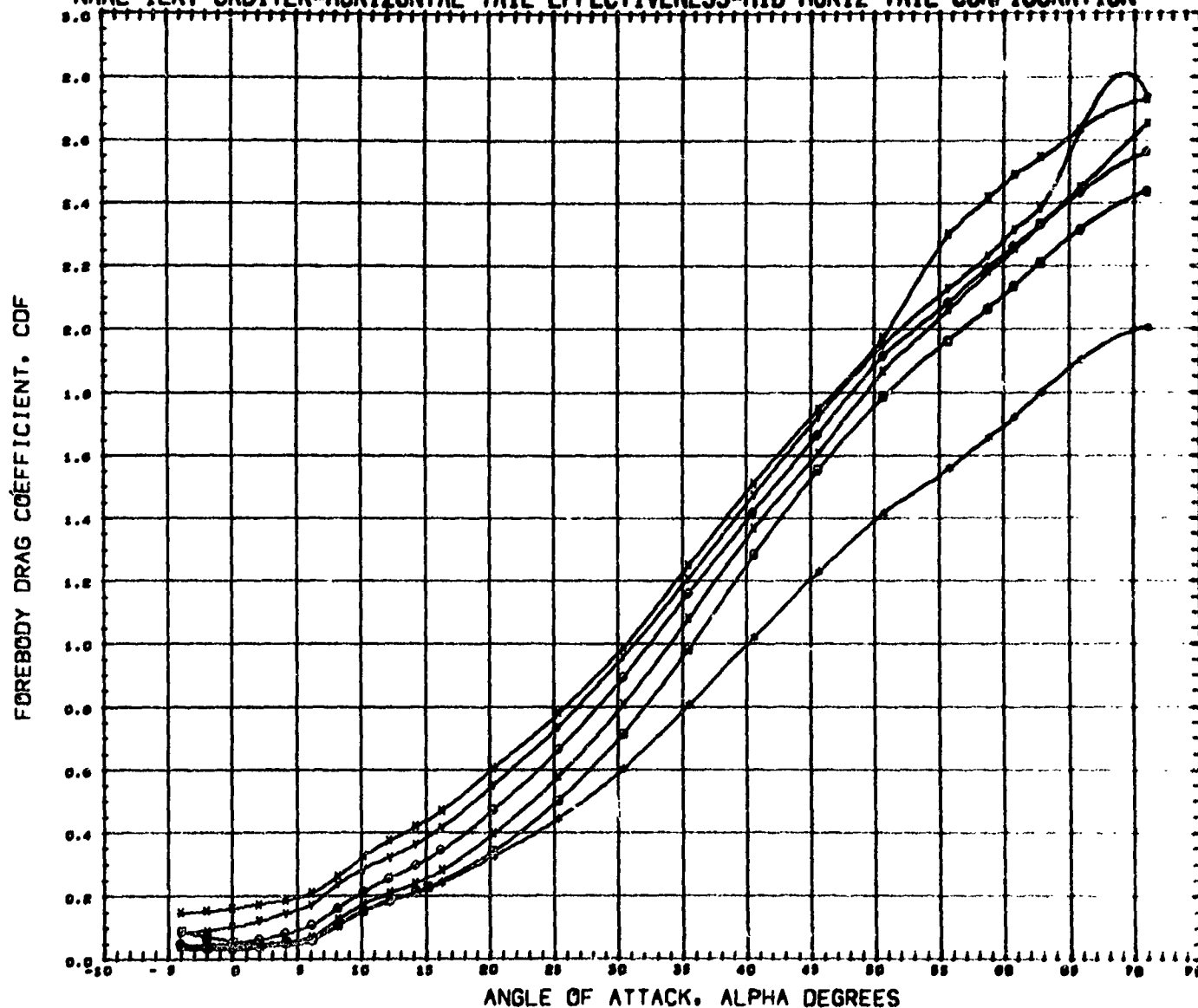
| SYMBOL                            | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION                                                                                                                                                                                                                                                                        |
|-----------------------------------|---------------------------------|--------------|----------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0        | (RC4003) | 11 AUG 70 | 0.250                                                                                                                                                                                                                                                                                        |
| x                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 M12 V3 | (RC4040) | 11 AUG 70 |                                                                                                                                                                                                                                                                                              |
| o                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 M12 V3 | (RC4034) | 11 AUG 70 |                                                                                                                                                                                                                                                                                              |
| o                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 M12 V3 | (RC4036) | 11 AUG 70 |                                                                                                                                                                                                                                                                                              |
| y                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 M12 V3 | (RC4037) | 11 AUG 70 |                                                                                                                                                                                                                                                                                              |
| n                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 M12 V3 | (RC4038) | 11 AUG 70 |                                                                                                                                                                                                                                                                                              |
| REFERENCE FILE NAAL 020 NA-70-591 |                                 |              |          |           | REFS 1.70000X10 <sup>-01</sup> 00.FT.<br>REFL 1.07370X10 <sup>-01</sup> INCHES<br>REFS 1.13300X10 <sup>-01</sup> INCHES<br>YMRP 0.13800X10 <sup>-00</sup> INCHES<br>YMRP 0.00000X10 <sup>-00</sup> INCHES<br>ZMRP -3.04000X10 <sup>-01</sup> INCHES<br>SCALE 7.01000X10 <sup>-03</sup> SCALE |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------------|-----------|-------|--------------------------|
| P      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0              | 11 AUG 70 | 0.250 | REFS 1.70000E-01 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | REFL 1.07370E-01 INCHES  |
| D      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | ENRP 0.13200E-01 INCHES  |
| V      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | YNRP 0.00000E-01 INCHES  |
| N      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N12 V5       | 11 AUG 70 |       | YNRP -3.04000E-01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-351 |           |       | SCALE 7.01000E-01 SCALE  |

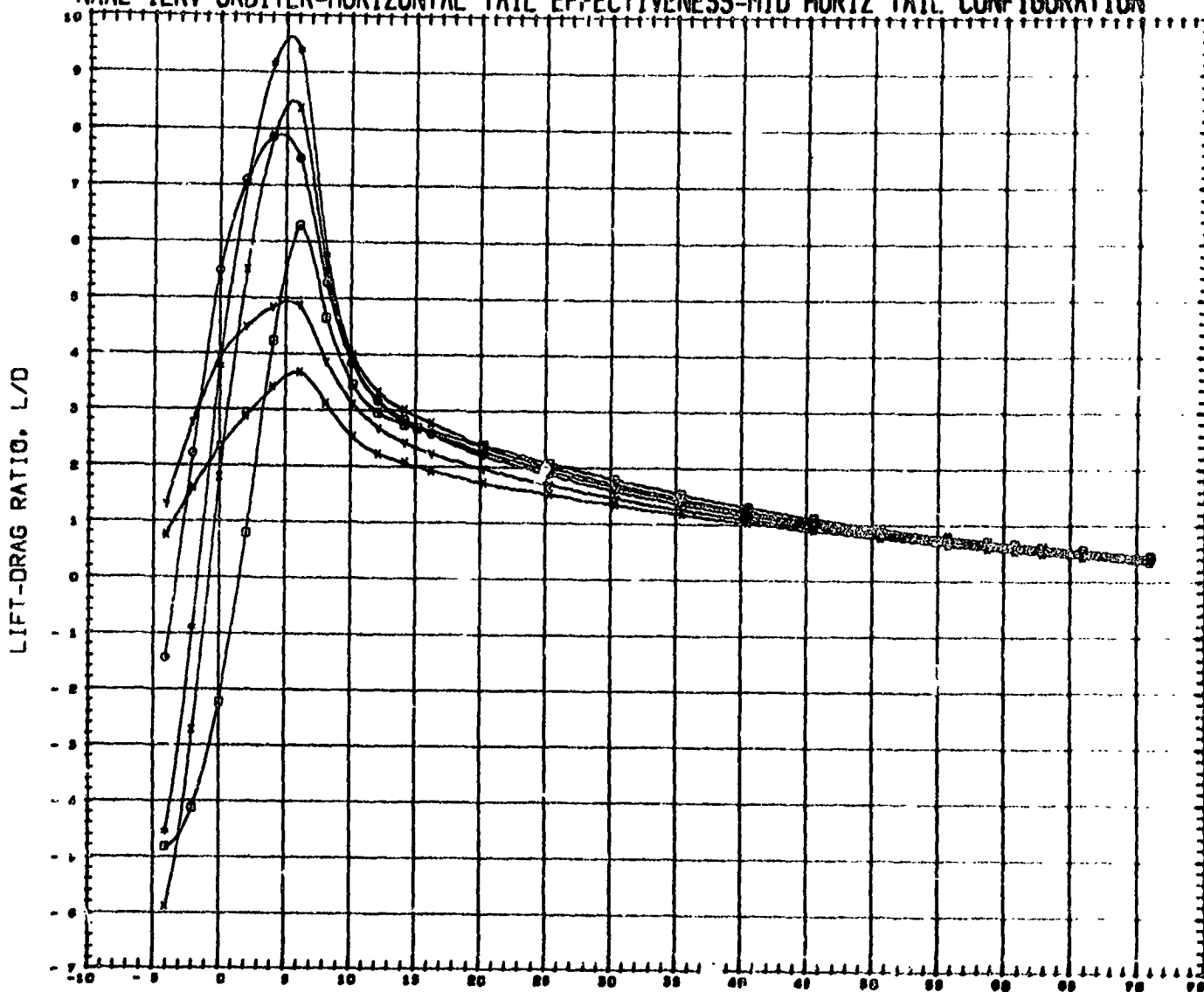
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|--------------|-----------|-------|---------------------------|
| +      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 WS        | 11 AUG 70 | 0.250 | REF 1.70000010-01 INCHES  |
| H      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | REF 1.97370010-01 INCHES  |
| Q      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | REF 1.13300010-00 INCHES  |
| O      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | YMRP 0.13000010-00 INCHES |
| V      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | YMRP 0.00000010-01 INCHES |
| N      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | 11 AUG 70 |       | ZMRP 3.04000010-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000010-01 SCALE |

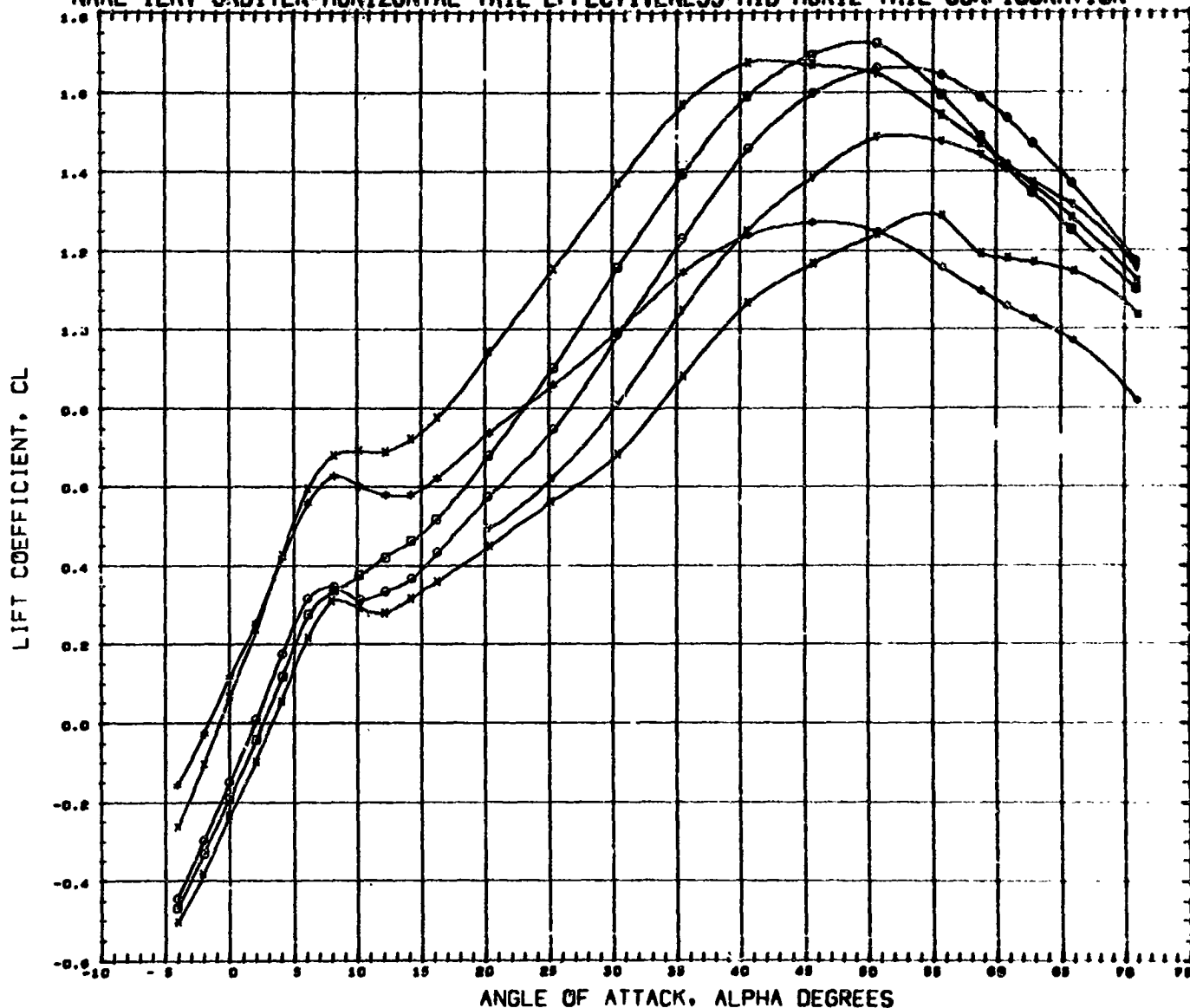
REFERENCE FILE NAAL 029 NA-70-551

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



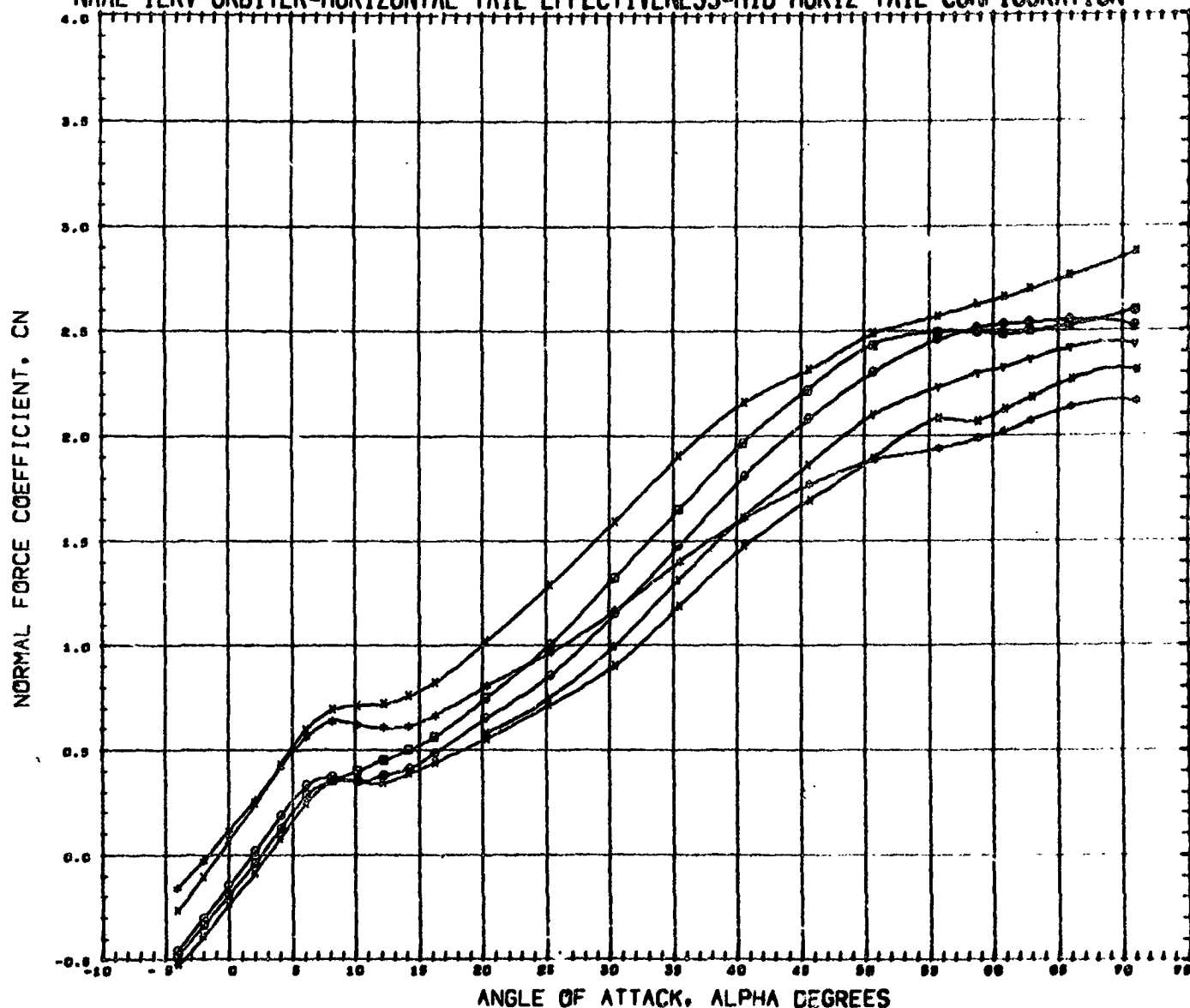
| SYMBOL                            | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION      |
|-----------------------------------|---------------------------------|--------------|--------------------|-------|----------------------------|
| O                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS        | (RC4003) 11 AUG 70 | 0.250 | REF0 1.70000E10-01 00.FT.  |
| X                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | (RC4040) 11 AUG 70 |       | REF1 1.97570E10-01 INCHES  |
| Q                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | (RC4054) 11 AUG 70 |       | REF2 1.33000E10-00 INCHES  |
| O                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | (RC4056) 11 AUG 70 |       | REF3 0.13000E10-00 INCHES  |
| V                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | (RC4057) 11 AUG 70 |       | REF4 0.00000E10-01 INCHES  |
| N                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H12 V5 | (RC4050) 11 AUG 70 |       | REF5 -3.04000E10-01 INCHES |
| REFERENCE FILE NAAL 020 NA-79-351 |                                 |              |                    |       | SCALE 7.01000E10-01 SCALE  |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET          | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-------------------|-----------|-------|----------------------------|
| P      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6             | 11 AUG 70 | 0.250 | REFS 1.70000E10-01 50.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5      | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5      | 11 AUG 70 |       | REFS 1.13300E10-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5      | 11 AUG 70 |       | ENRP 0.13200E10-01 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5      | 11 AUG 70 |       | VNRP 0.00000E10-01 INCHES  |
| N      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 N12 V5      | 11 AUG 70 |       | ZNRP -3.04000E10-01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-35 |           |       | SCALE 7.01000E10 SCALE     |

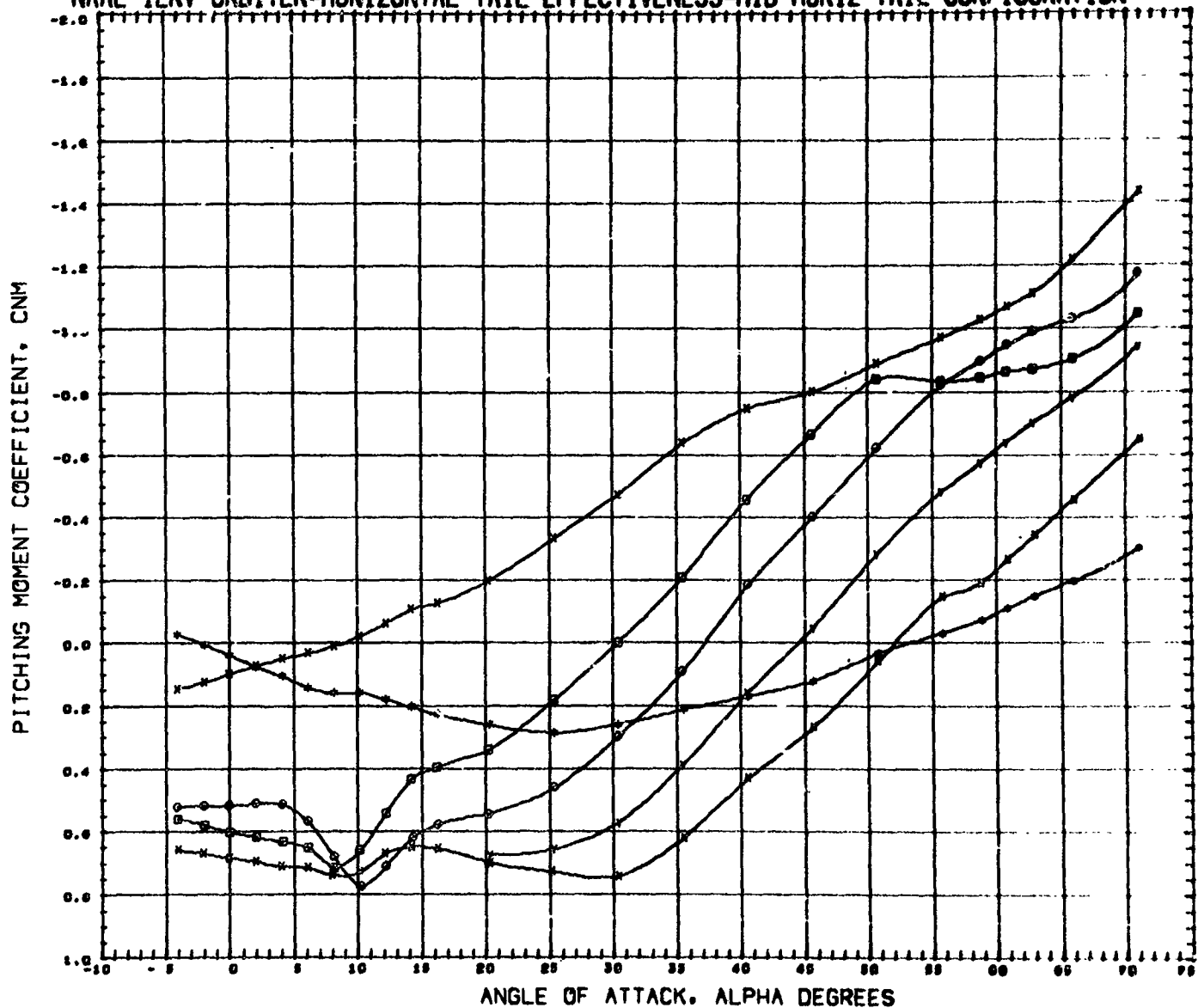
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 05 WS        | 11 AUG 70 | C.270 | REFS 1.70000E10-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS N12 V5 | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS N12 V5 | 11 AUG 70 |       | REFL 1.33300E10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS N12 V5 | 11 AUG 70 |       | KNRP 0.33000E10-00 INCHES  |
| v      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS N12 V5 | 11 AUG 70 |       | KNRP 0.00000E10-00 INCHES  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS N12 V5 | 11 AUG 70 |       | KNRP -3.04000E10-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

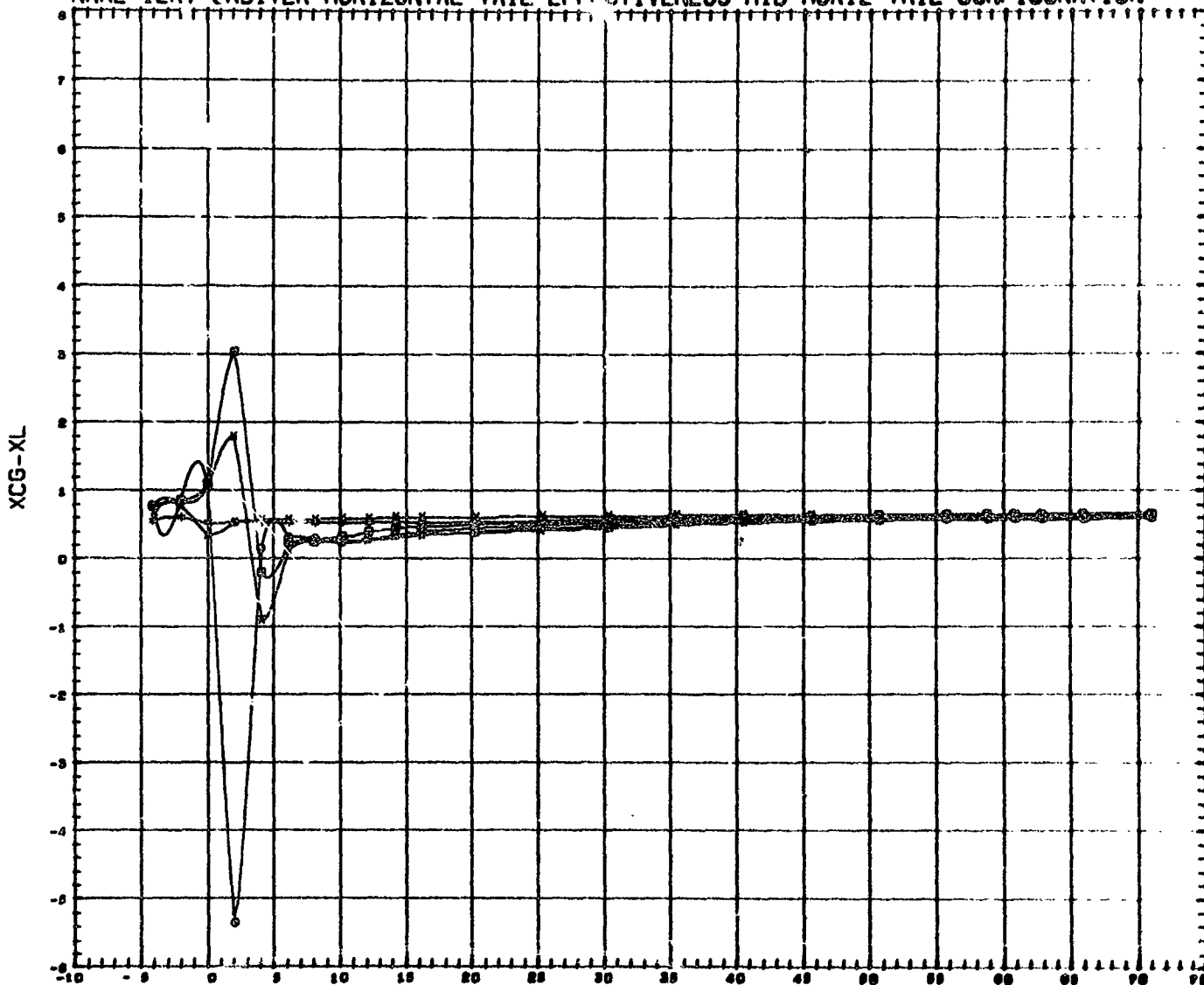
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|--------------------|-------|----------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | BC W8        | (RC4003) 11 AUG 70 | 0.859 | REFS 1.70000X10-01 88.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | BC W8 H12 V5 | (RC4040) 11 AUG 70 |       | REFL 1.97376X10-01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | BC W8 H12 V5 | (RC4052) 11 AUG 70 |       | REFS 1.13300X10-00 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | BC W8 H12 V5 | (RC4051) 11 AUG 70 |       | INRP 0.13800X10-00 INCHES  |
| y      | NAAL 029 SSV-ILRV STRAIGHT WING | BC W8 H12 V5 | (RC4050) 11 AUG 70 |       | YMRP 0.00000X10-01 INCHES  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | BC W8 H12 V5 | (RC4045) 11 AUG 70 |       | ZMRP -3.04000X10-01 INCHES |
|        |                                 |              |                    |       | SCALE 7.01000X10-01 SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | REF   | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4083             | 11 AUG 70 | 0.250 | REFD 1.70000010-01 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040             | 11 AUG 70 |       | REFL 1.07370010-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4052             | 11 AUG 70 |       | REFD 1.13300010-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4051             | 11 AUG 70 |       | ENRP 2.13300010-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4050             | 11 AUG 70 |       | ENRP 0.25000010-01 INCHES  |
| N      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4049             | 11 AUG 70 |       | ENRP -3.04300010-01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-351 |           |       | SCALE 7.01000010-01 SCALE  |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

FOREBODY AXIAL FORCE COEFFICIENT, CAFORE

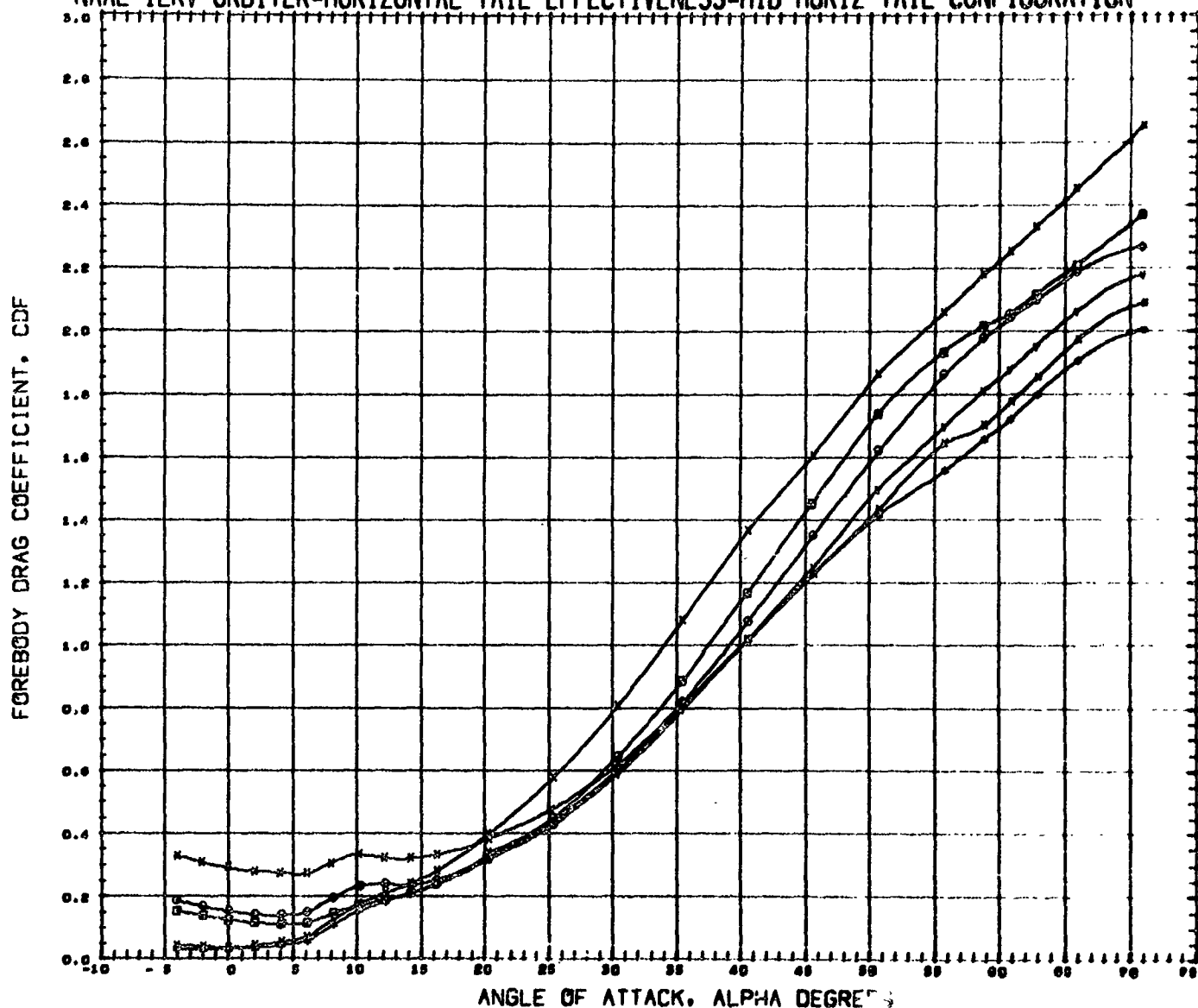


ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| #      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 | 0.250 | REFS 1.70000E+01 80.FT.  |
| X      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 |       | REFL 1.07370E+01 INCHES  |
| O      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4032) | 11 AUG 70 |       | REFD 1.13900E+00 INCHES  |
| Y      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4031) | 11 AUG 70 |       | ZMRP 0.13200E+00 INCHES  |
| K      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 |       | ZMRP 0.00000E+00 INCHES  |
|        |                                 | (RC4043) | 11 AUG 70 |       | ZMRP -3.04000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

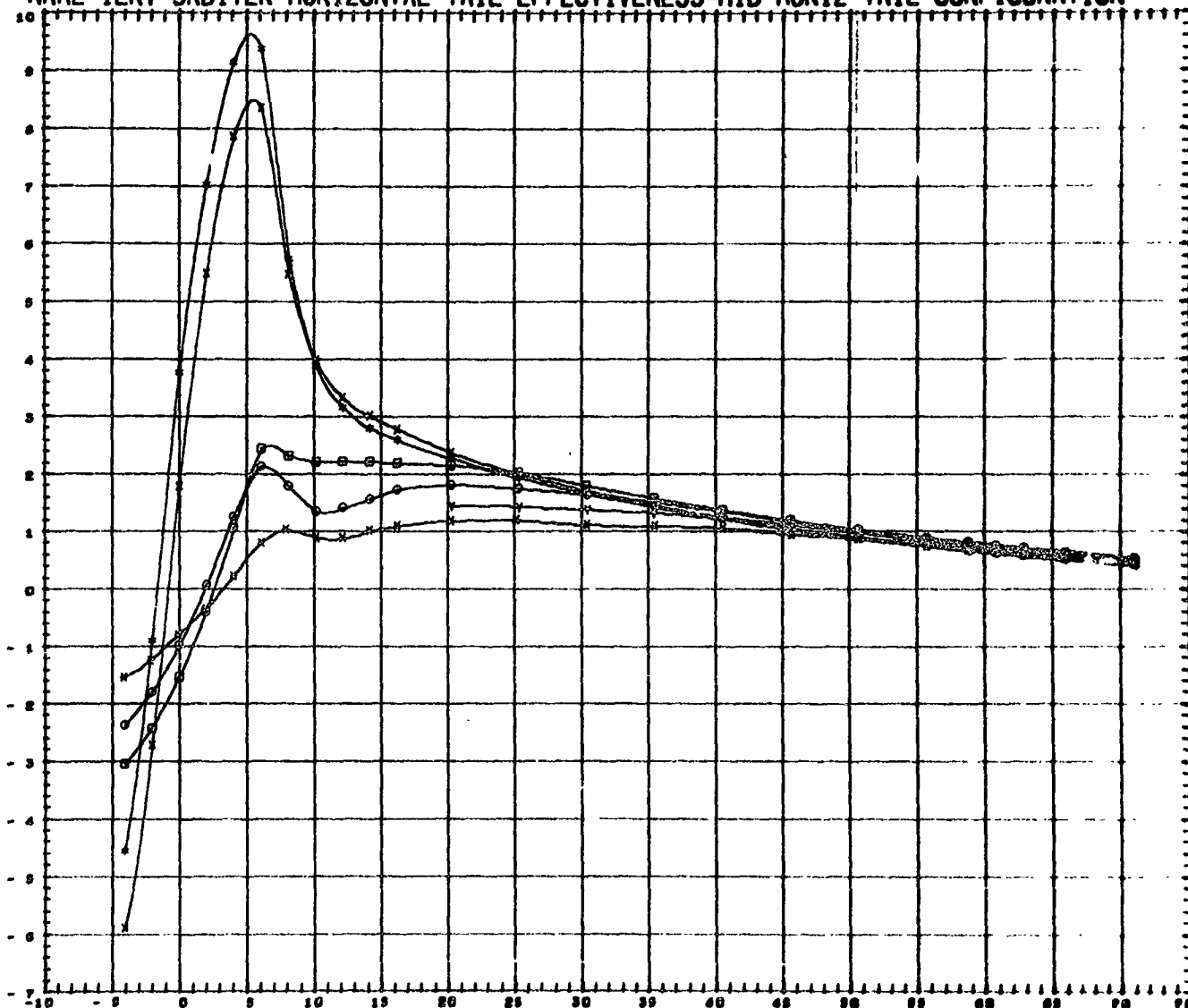
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL                            | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION      |
|-----------------------------------|---------------------------------|--------------|--------------------|-------|----------------------------|
| ●                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0        | (RC4003) 11 AUG 70 | 0.250 | REF0 1.70000010-01 80.FT.  |
| ×                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 | (RC4040) 11 AUG 70 |       | REF1 1.57370010-01 INCHES  |
| ◻                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 | (RC4032) 11 AUG 70 |       | REF2 1.15300010-01 INCHES  |
| ◊                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 | (RC4031) 11 AUG 70 |       | REF3 0.13200010-00 INCHES  |
| △                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 | (RC4030) 11 AUG 70 |       | REF4 0.00000010-00 INCHES  |
| ▽                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 | (RC4030) 11 AUG 70 |       | REF5 -0.04000010-01 INCHES |
| ◊                                 | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 | (RC4049) 11 AUG 70 |       | REF6 7.01000010-01 SCALE   |
| REFERENCE FILE NAAL 020 NA-70-351 |                                 |              |                    |       |                            |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

LIFT-DRAG RATIO, L/D

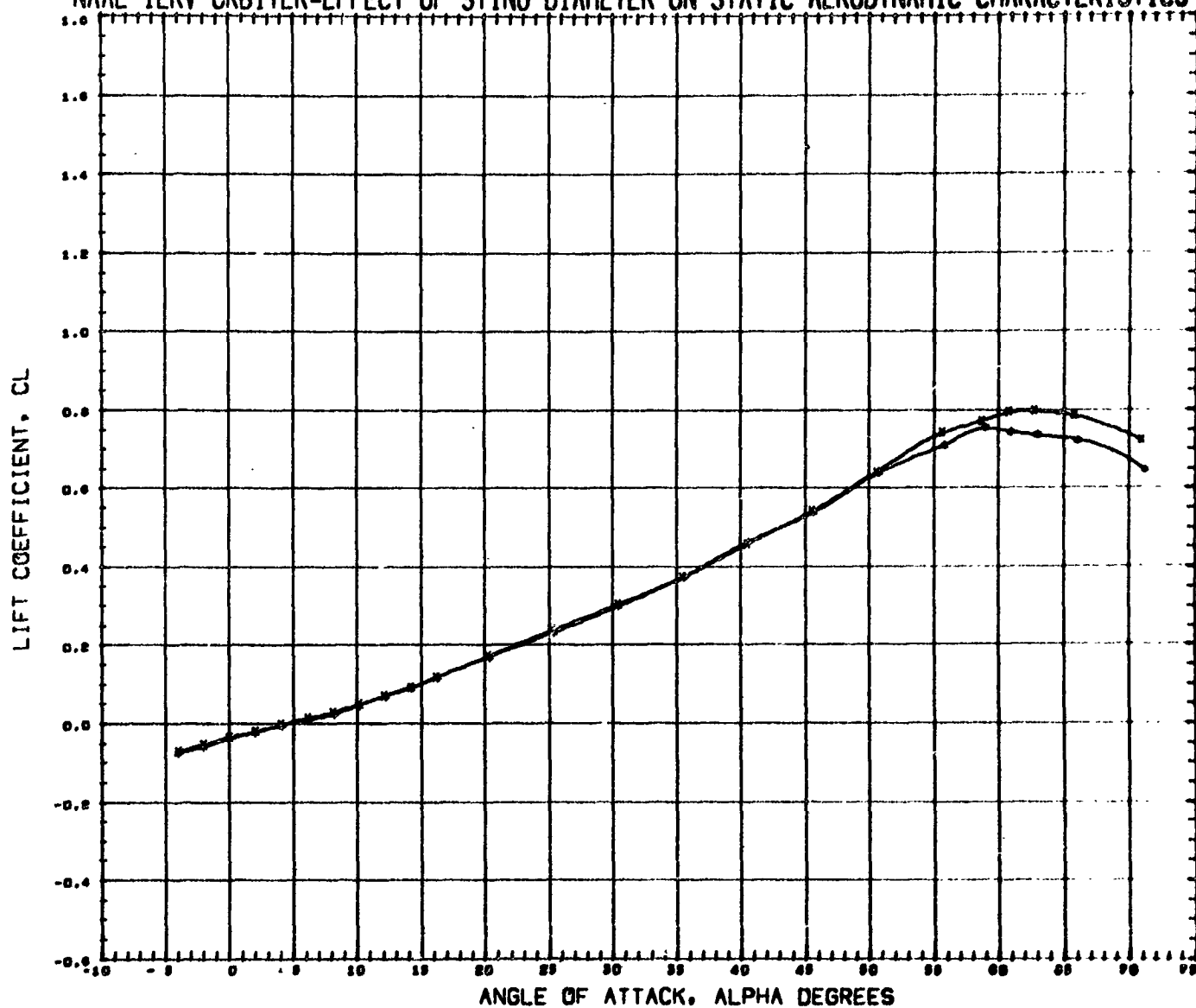


ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION | DESCRIPTION            | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------|------------------------|-----------------------|-----------|-------|--------------------------|
| #      | NAAL 629      | SSV-ILRV STRAIGHT WING | 86 W6 (RC4005)        | 11 AUG 70 | 0.899 | REFS 1.70000E-01 SQ.FT.  |
| X      | NAAL 629      | SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4040) | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| Q      | NAAL 629      | SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4032) | 11 AUG 70 |       | REFS 1.13300E+00 INCHES  |
| O      | NAAL 629      | SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4031) | 11 AUG 70 |       | KMRP 0.13000E+00 INCHES  |
| Y      | NAAL 629      | SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4030) | 11 AUG 70 |       | VMRP 0.00000E-01 INCHES  |
| K      | NAAL 629      | SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4045) | 11 AUG 70 |       | ZMRP -3.00000E-03 INCHES |
|        |               |                        |                       |           |       | SCALE 7.01000E-03 SCALE  |

REFERENCE FILE NAAL 629 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

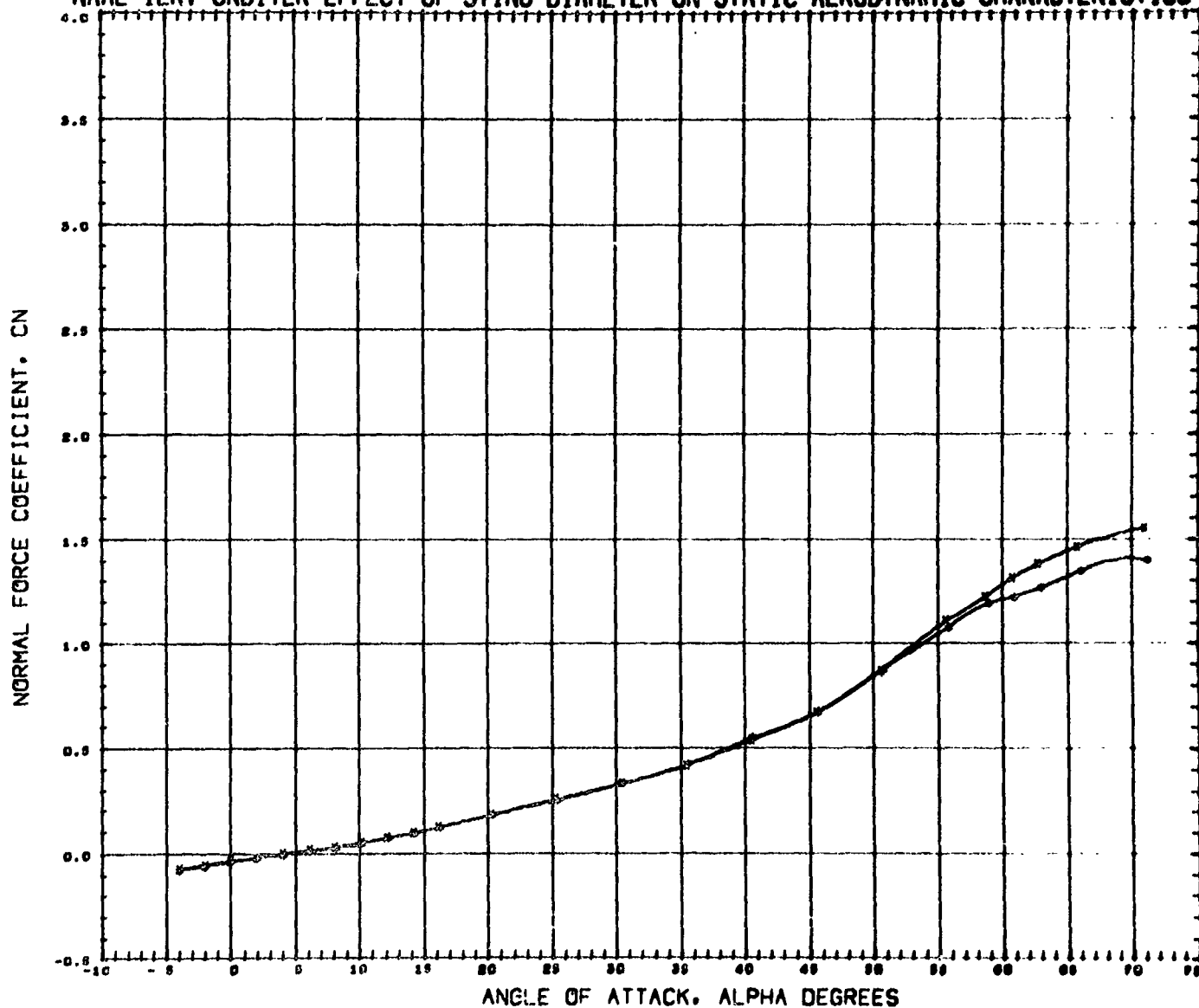


| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  |
|--------|------------------------------------|----------|-----------|-------|
| x      | NAAL 029 SSV-ILRV STRAIGHT WING 36 | (RC4001) | 11 AUG 70 | 0.250 |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING 48 | (RC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REF0                  | 1.70000010-01 36. FT. |
| REF1                  | 1.97370010-01 INCHES  |
| REF2                  | 1.13300010-01 INCHES  |
| REF3                  | 0.13000010-00 INCHES  |
| REF4                  | 0.00000010-00 INCHES  |
| REF5                  | -0.00000010-01 INCHES |
| REF6                  | 0.00000010-01 INCHES  |
| REF7                  | 0.00000010-01 INCHES  |
| REF8                  | 0.00000010-01 INCHES  |
| REF9                  | 0.00000010-01 INCHES  |
| REF10                 | 0.00000010-01 INCHES  |
| REF11                 | 0.00000010-01 INCHES  |
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| REF16                 | 0.00000010-01 INCHES  |
| REF17                 | 0.00000010-01 INCHES  |
| REF18                 | 0.00000010-01 INCHES  |
| REF19                 | 0.00000010-01 INCHES  |
| REF20                 | 0.00000010-01 INCHES  |
| REF21                 | 0.00000010-01 INCHES  |
| REF22                 | 0.00000010-01 INCHES  |
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| REF31                 | 0.00000010-01 INCHES  |
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| REF33                 | 0.00000010-01 INCHES  |
| REF34                 | 0.00000010-01 INCHES  |
| REF35                 | 0.00000010-01 INCHES  |
| REF36                 | 0.00000010-01 INCHES  |
| REF37                 | 0.00000010-01 INCHES  |
| REF38                 | 0.00000010-01 INCHES  |
| REF39                 | 0.00000010-01 INCHES  |
| REF40                 | 0.00000010-01 INCHES  |
| REF41                 | 0.00000010-01 INCHES  |
| REF42                 | 0.00000010-01 INCHES  |
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| REF45                 | 0.00000010-01 INCHES  |
| REF46                 | 0.00000010-01 INCHES  |
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| REF49                 | 0.00000010-01 INCHES  |
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| REF99                 | 0.00000010-01 INCHES  |
| REF100                | 0.00000010-01 INCHES  |

REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



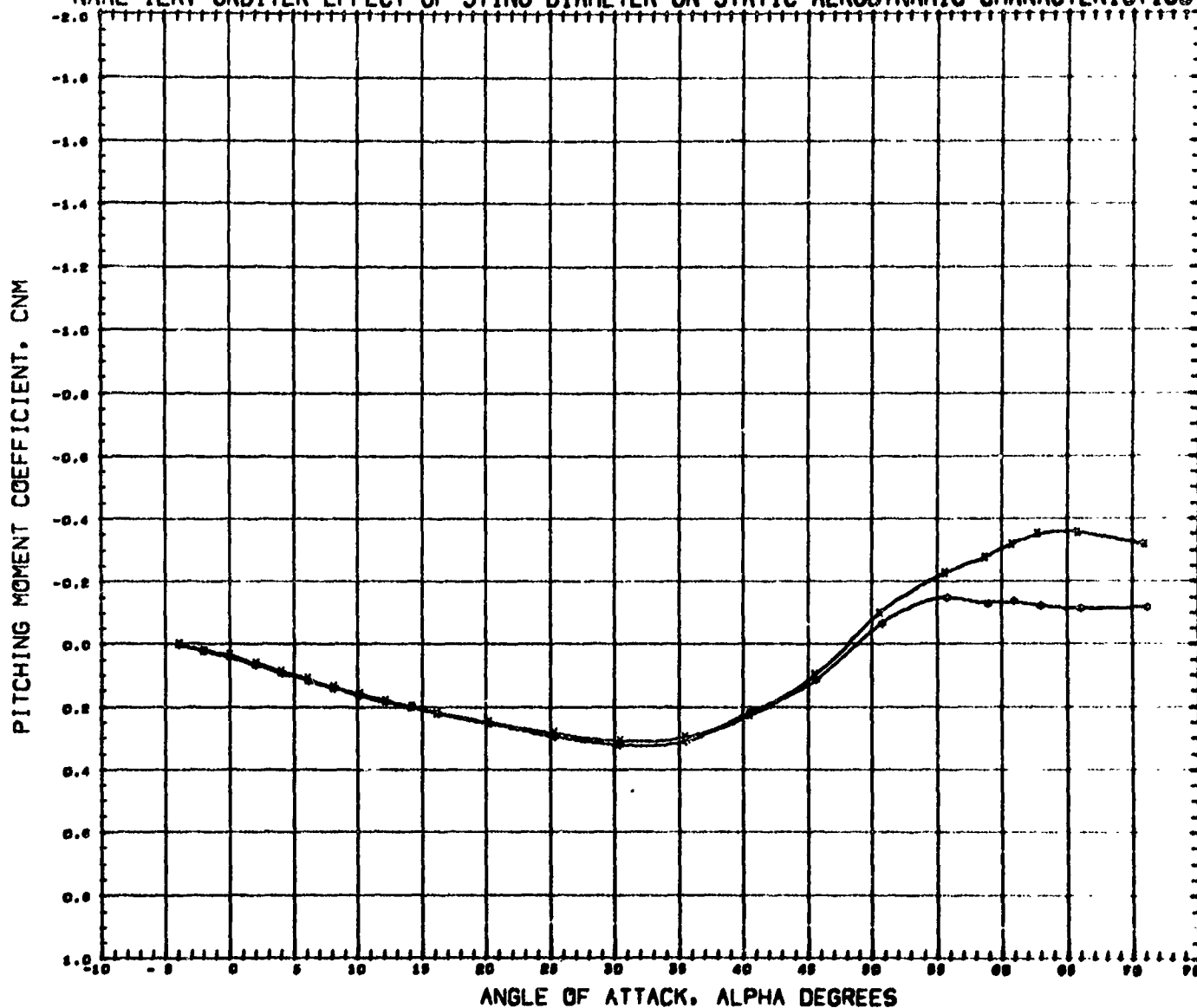
| SYMBOL | CONFIGURATION DESCRIPTION       | SS |
|--------|---------------------------------|----|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | 86 |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | 86 |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4001) | 11 AUG 70 | 0.290 |
| (RC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REF0                  | 1.70000X10-01  | 86.FT. |
| REF1                  | 1.97370X10-01  | INCHES |
| REF2                  | 1.15300X10-00  | INCHES |
| ZMRP                  | 0.15200X10-00  | INCHES |
| ZMRP                  | 0.00000X10-00  | INCHES |
| ZMRP                  | -0.04000X10-01 | INCHES |
| SCALE                 | 7.01000X10-03  | SCALE  |

REFERENCE FILE NAAL 020 NA-70-331

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

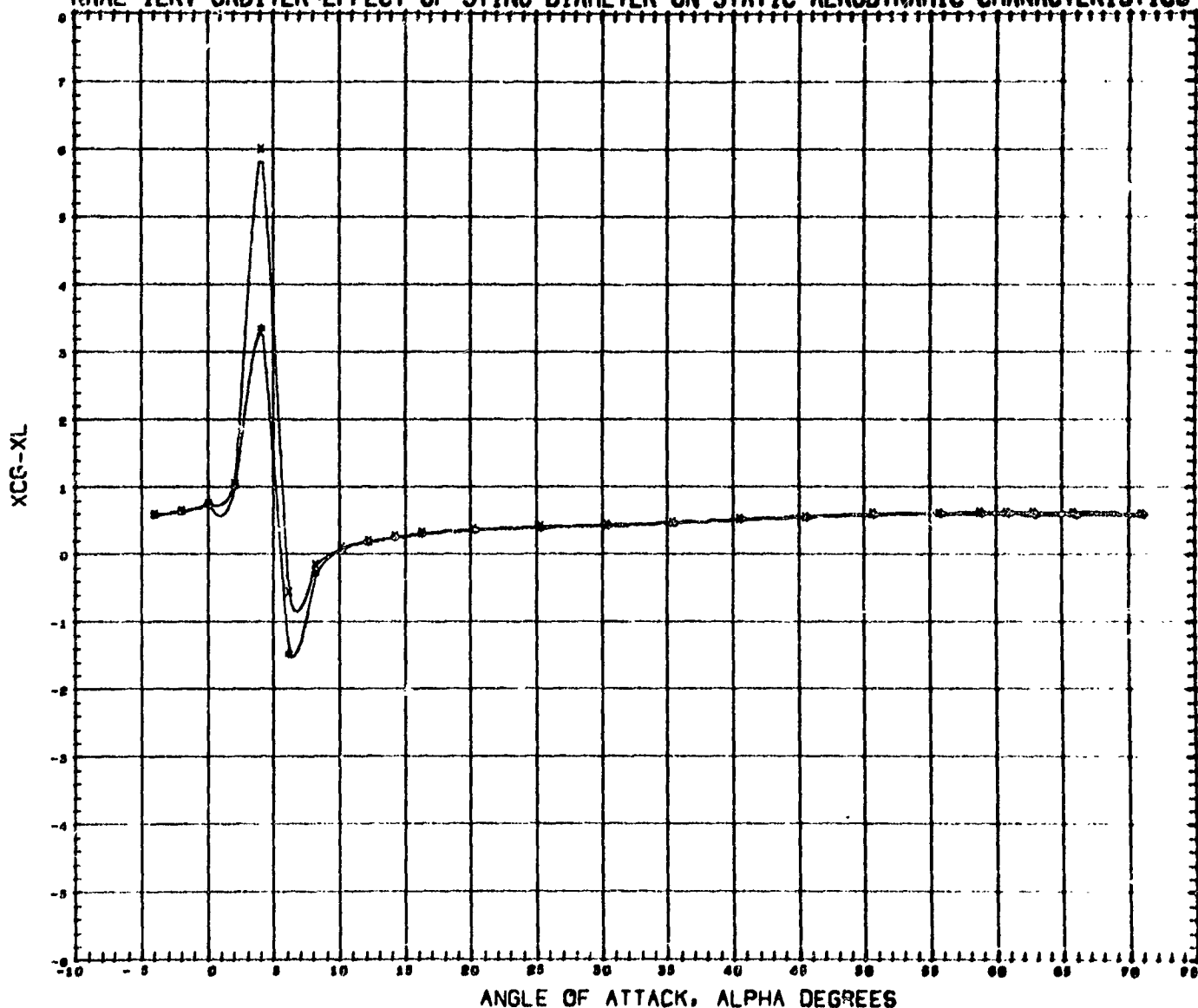


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | RC4001   | 11 AUG 70 | 0.290 | REFS 1.70000E-01 80.71.  |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | RC4030   | 11 AUG 70 |       | REFL 1.57370E-01 INCHES  |
|        |                                 |          |           |       | REFS 1.13300E-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.13000E-00 INCHES  |
|        |                                 |          |           |       | YMRP 3.00000E-01 INCHES  |
|        |                                 |          |           |       | ZMRP -3.00000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE

NAAL 020 HA-70-391

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



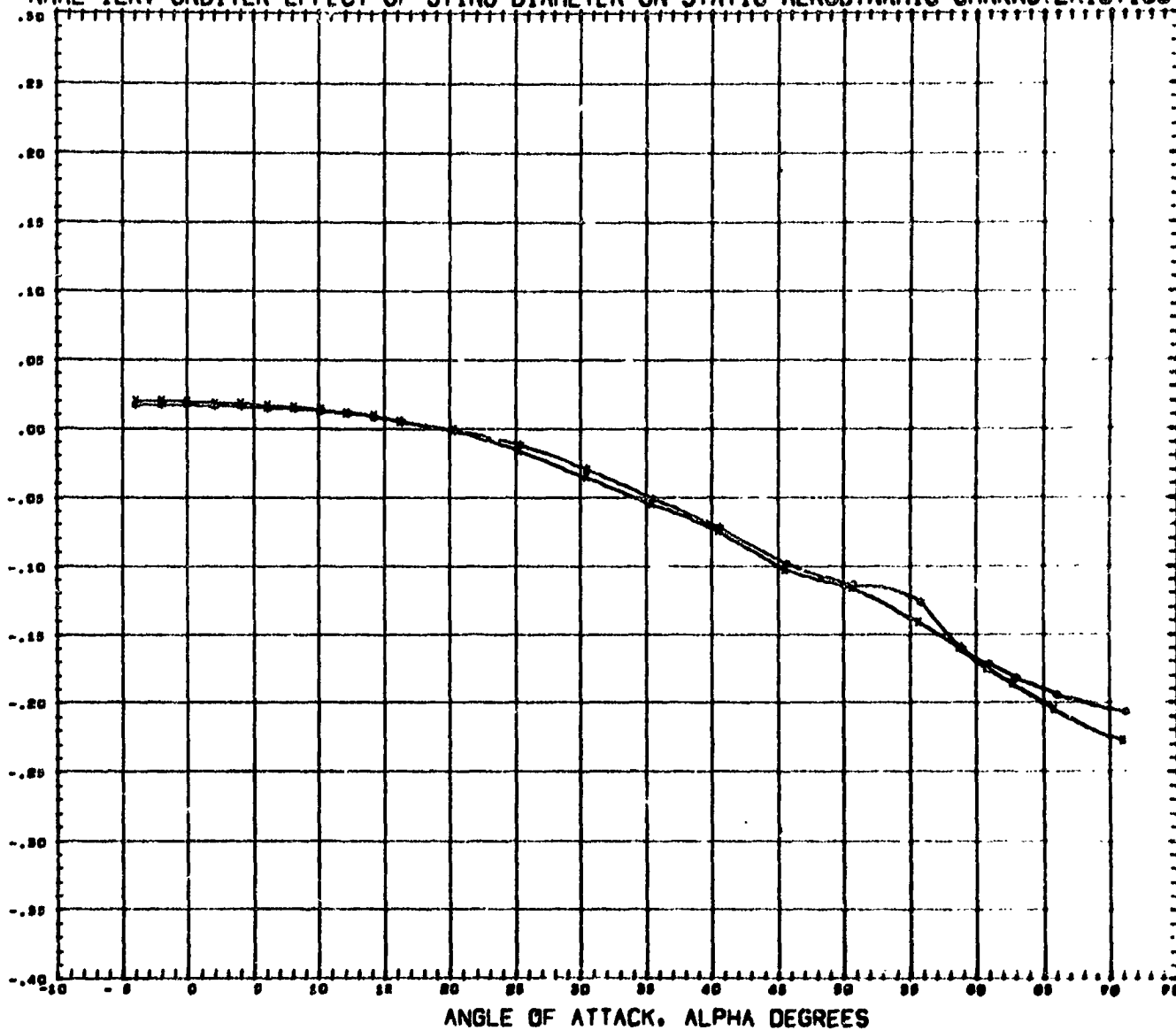
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| x      | NAAL 022 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4001) | 11 AUG 70 | 0.290 |
| (RC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E+01 INCHES  |
| REFL                  | 1.073700E+01 INCHES  |
| REFB                  | 1.133000E+01 INCHES  |
| YMRP                  | 0.132000E+00 INCHES  |
| YMRP                  | 0.000000E+00 INCHES  |
| ZMRP                  | -3.040000E-01 INCHES |
| SCALE                 | 7.010000E-03 SCALE   |

REFERENCE FILE NAAL 029 NA-70-331

## FOREBODY AXIAL FORCE COEFFICIENT, CAFORE



| SYMBOL | CONFIGURATION DESCRIPTION |          |               |    | DATA SET | DATE      | NAME  |
|--------|---------------------------|----------|---------------|----|----------|-----------|-------|
| #      | NAAL 020                  | SSV-ILRV | STRAIGHT WING | DC | (RC4005) | 11 AUG 70 | 0.030 |
|        | NAAL 020                  | SSV-ILRV | STRAIGHT WING | DC | (RC4030) | 11 AUG 70 |       |

```

REFERENCE INFORMATION
REF# 1.70000010-01 50.71.
REF# 1.07370010-01 INC#20
REF# 1.13300010-00 INC#20
XMR# 0.13200010-00 INC#20
YMR# 0.00000010-00 INC#20
ZMR# -3.00000010-00 INC#20
SCALE 7.01220010-00 SCALE

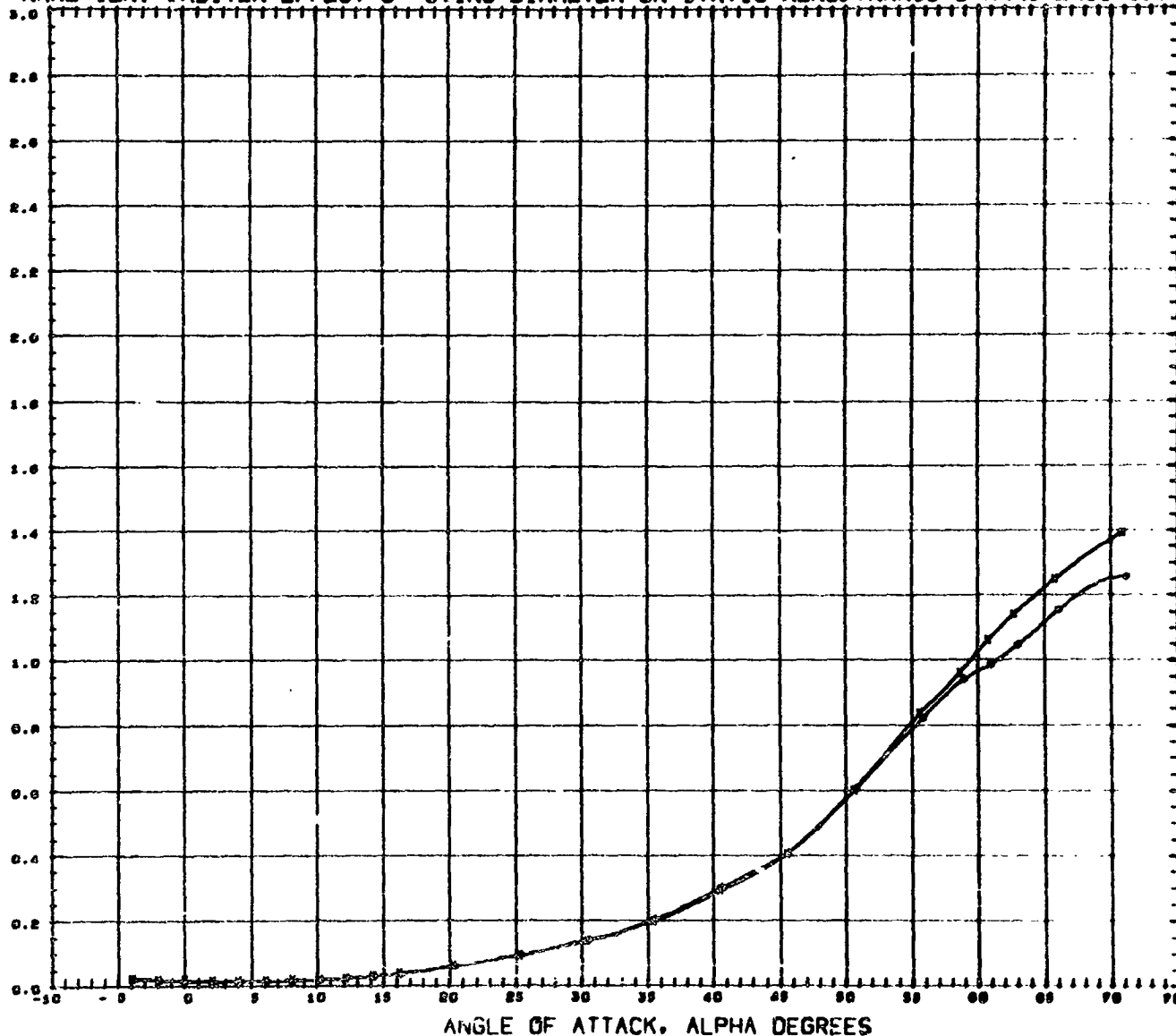
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**REFERENCE FILE**

NAAL 620 NA-70-331

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

FOREBODY DRAG COEFFICIENT, CDF



| SYMBOL | CONFIGURATION DESCRIPTION       | BO |
|--------|---------------------------------|----|
| .      | NAAL 029 SSV-ILRV STRAIGHT WING | BO |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | BO |

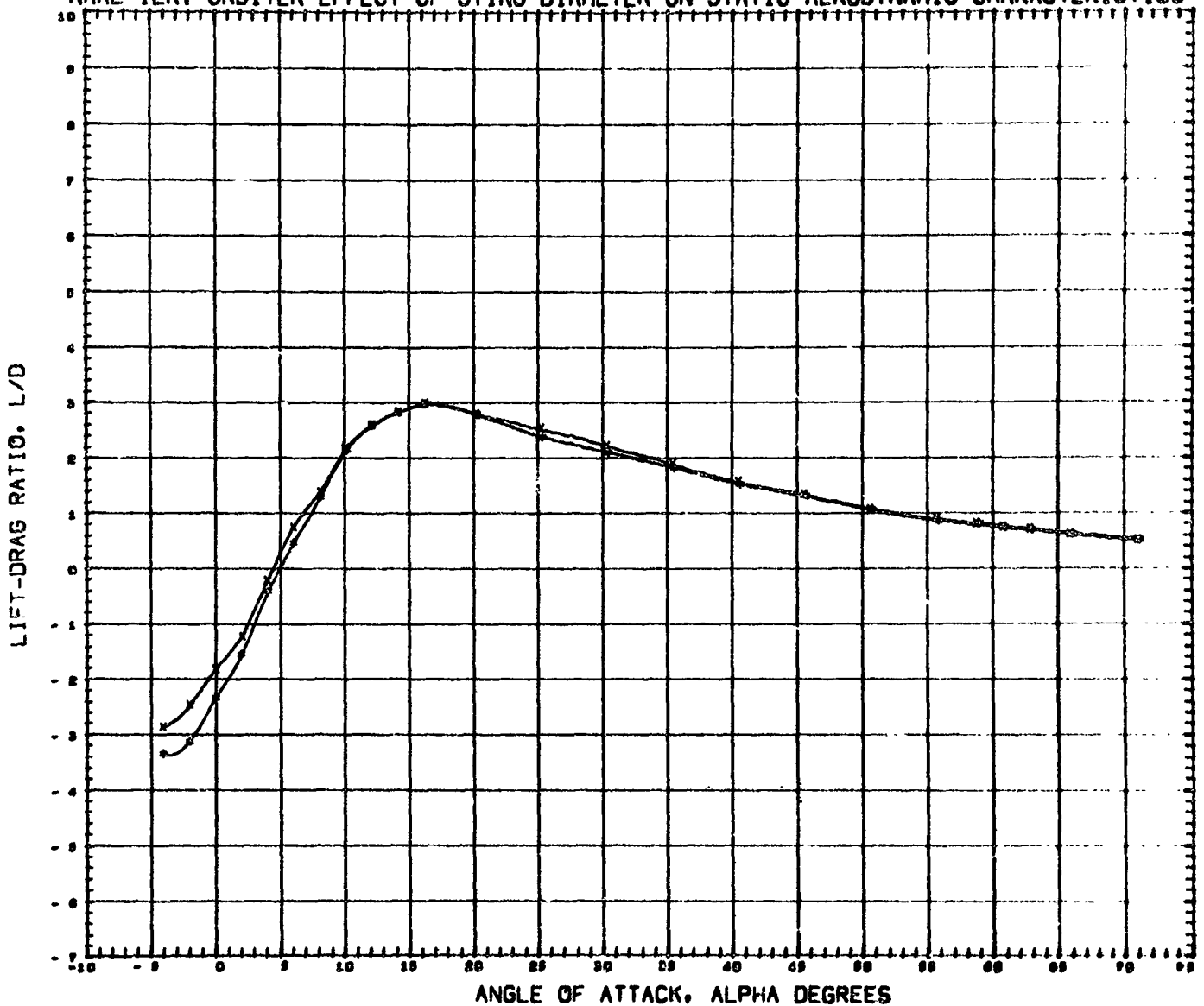
| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (PC4001) | 11 AUG 70 | 0.250 |
| (RC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |             |        |
|-----------------------|-------------|--------|
| REFL                  | 1.76000010  | 60.71  |
| REFL                  | 1.97570010  | INCHES |
| REFD                  | 1.13300010  | INCHES |
| YMRP                  | 0.13200010  | INCHES |
| YMRP                  | 0.00000010  | INCHES |
| ZMRP                  | -3.04000010 | INCHES |
| SCALE                 | 7.01000010  | SCALE  |

REFERENCE FILE

NAAL 029 NA-70-331

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



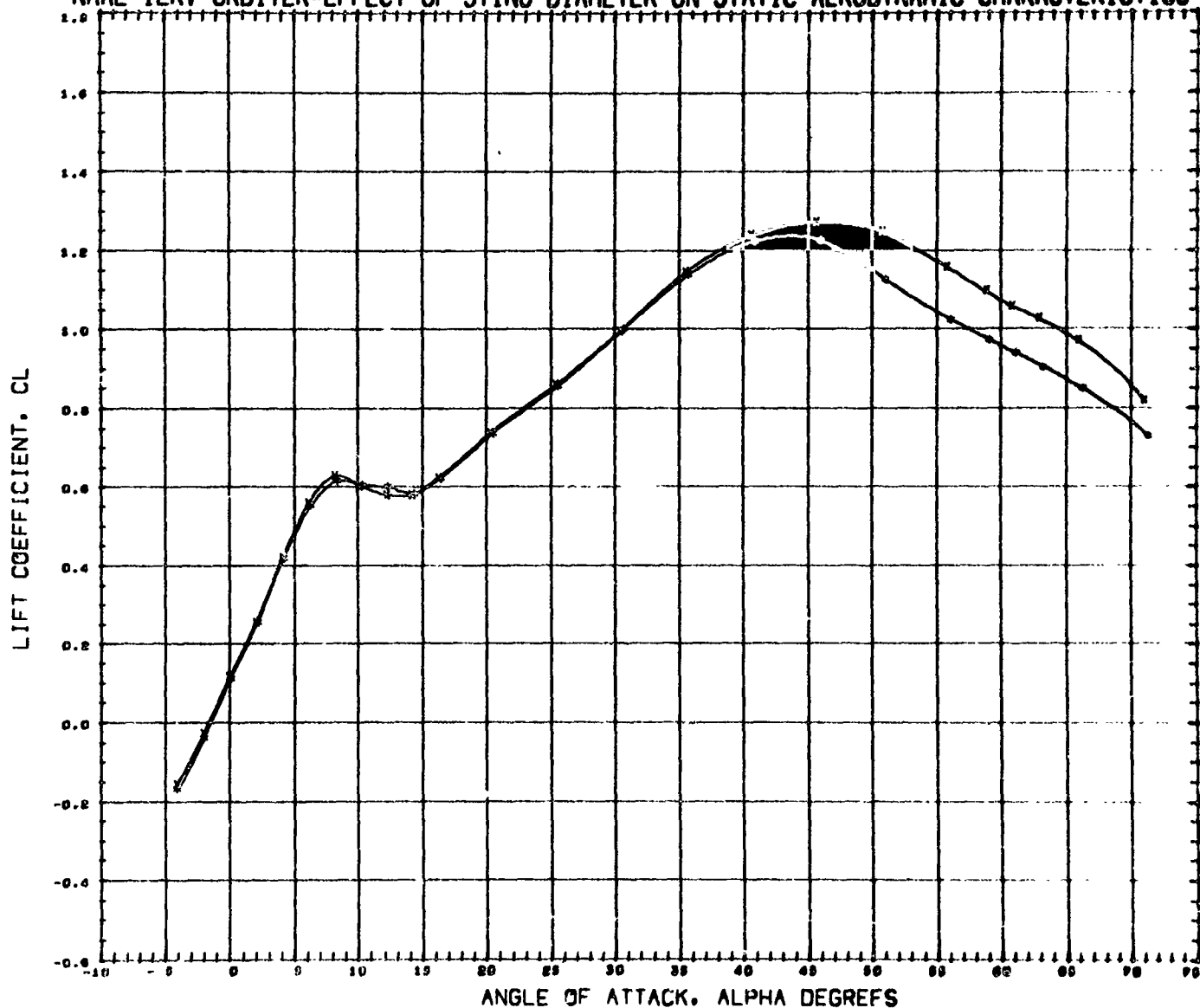
| SYMBOL | CONFIGURATION DESCRIPTION       | DS |
|--------|---------------------------------|----|
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | DS |
| .      | NAAL 029 SSV-ILRV STRAIGHT WING | DS |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4001) | 11 AUG 70 | 0.850 |
| (RC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                 |         |
|-----------------------|-----------------|---------|
| REFS                  | 1.79000x10^-01  | 00. FT. |
| REFL                  | 1.97370x10^-01  | INCHES  |
| REFD                  | 1.13300x10^-01  | INCHES  |
| ENRP                  | 0.13200x10^-00  | INCHES  |
| YMRP                  | 0.00000x10^-00  | INCHES  |
| ZMRP                  | -3.00000x10^-01 | INCHES  |
| SCALE                 | 7.61000x10^-03  | SCALE   |

REFERENCE FILE NAAL 029 NA-70-393

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



SYMBOL CONFIGURATION DESCRIPTION

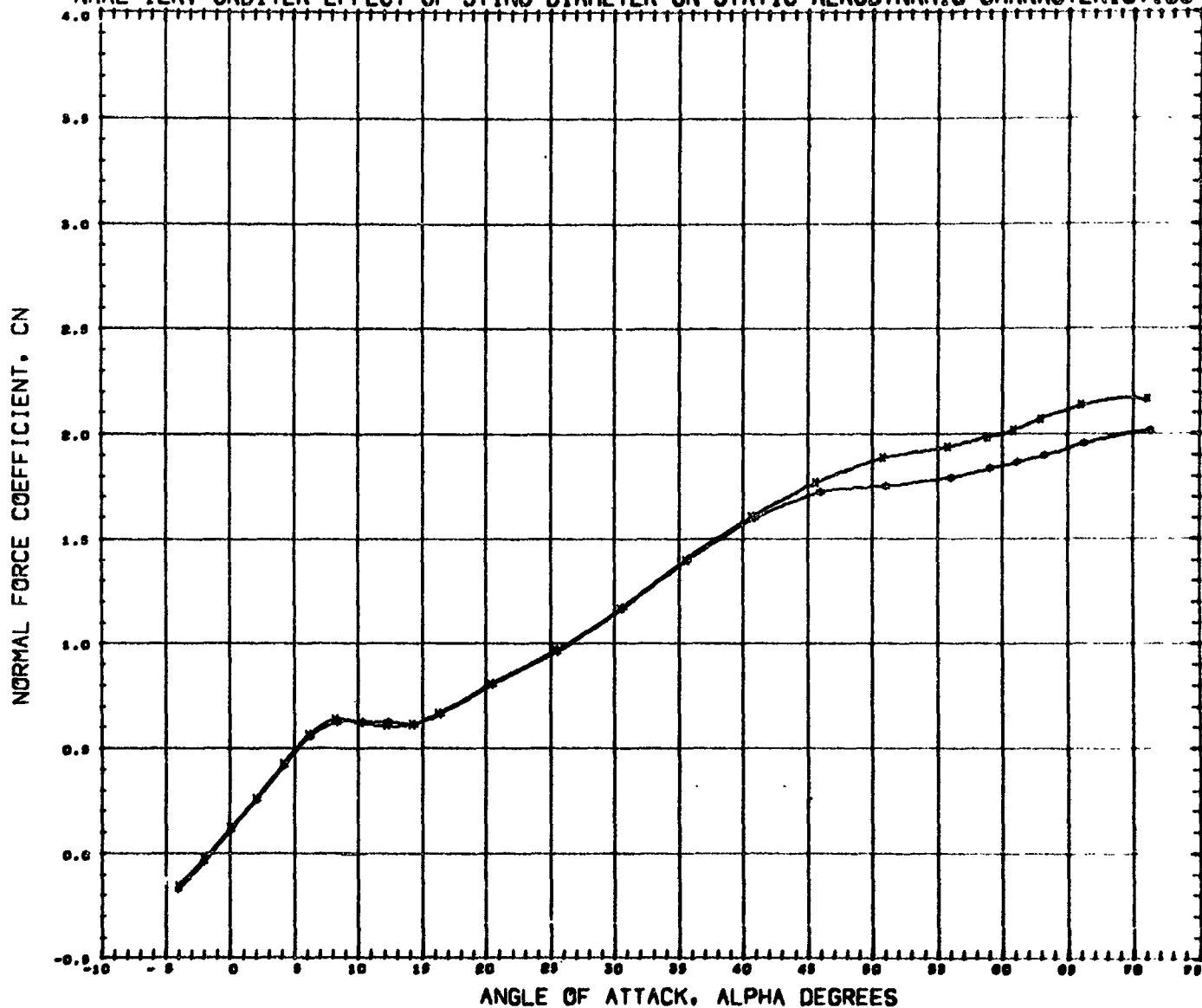
\* NAAL 029 SSV-ILRV STRAIGHT WING B6 W6  
X NAAL 029 SSV-ILRV STRAIGHT WING B6 W6

DATA SET DATE MACH  
(RC4005) 11 AUG 70 0.250  
(RC4005) 11 AUG 70

REFERENCE INFORMATION  
REFS 1.70000E10-01 60.FT.  
REFL 1.97370E10-01 INCHES  
REFD 1.13100E10-01 INCHES  
VIRP 0.13000E10-00 INCHES  
VIRP 0.00000E10-00 INCHES  
VIRP -5.00000E10-01 INCHES  
SCALE 7.01000E10 SCALE

REFERENCE FILE NAAL 029 NA-PD-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

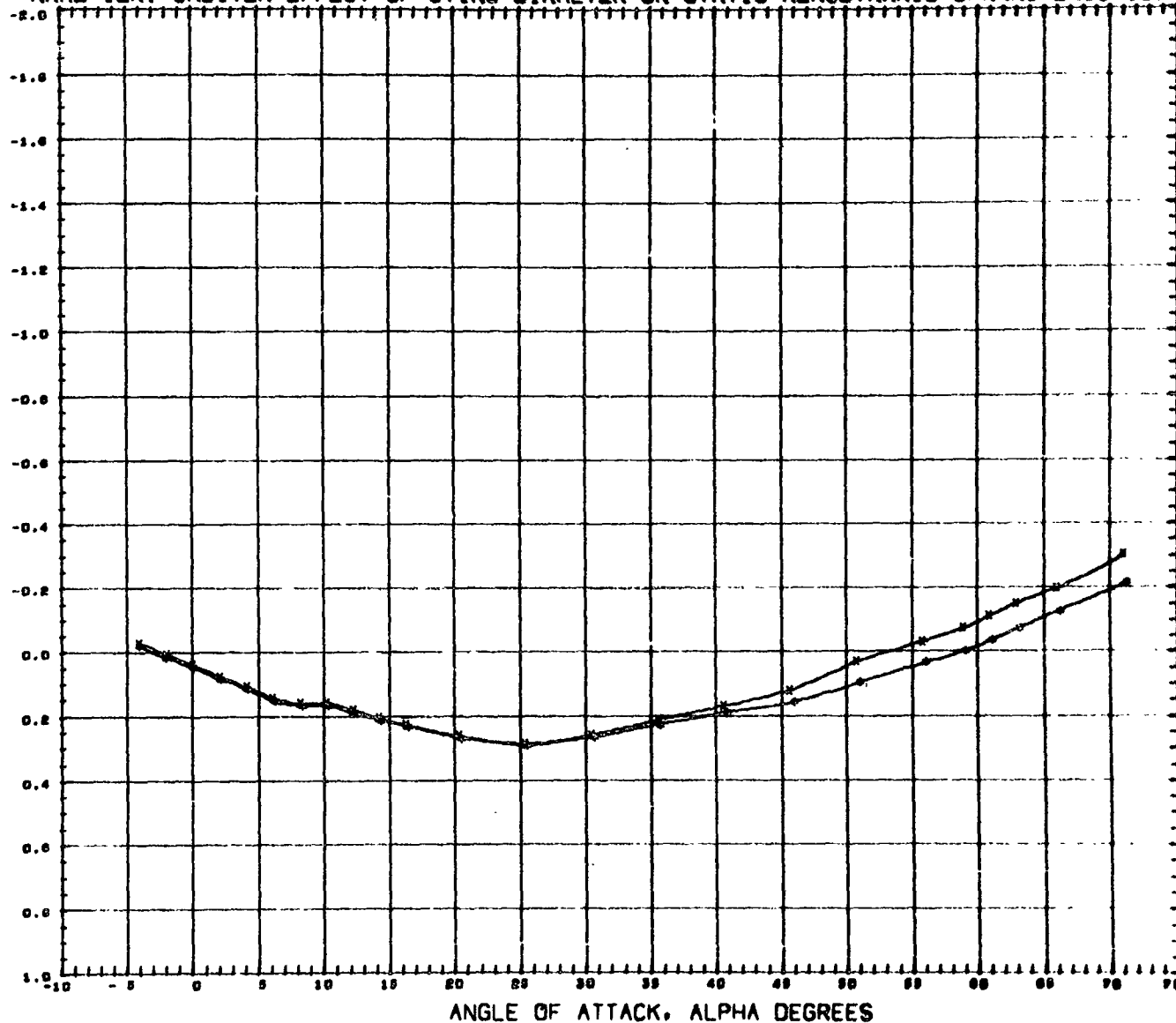


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4005   | 11 AUG 70 | 0.250 |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 | 0.250 |

REFERENCE FILE NAAL 020 NA-70-351

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFD                  | 1.70000E10-01 00.FT.  |
| REFL                  | 1.97570E10-01 INCHES  |
| REFD                  | 1.13500E10-00 INCHES  |
| ENRP                  | 0.13500E10-00 INCHES  |
| ENRP                  | 0.00000E10-01 INCHES  |
| ENRP                  | -3.04000E10-01 INCHES |
| SCALE                 | 7.01000E10-00 SCALE   |

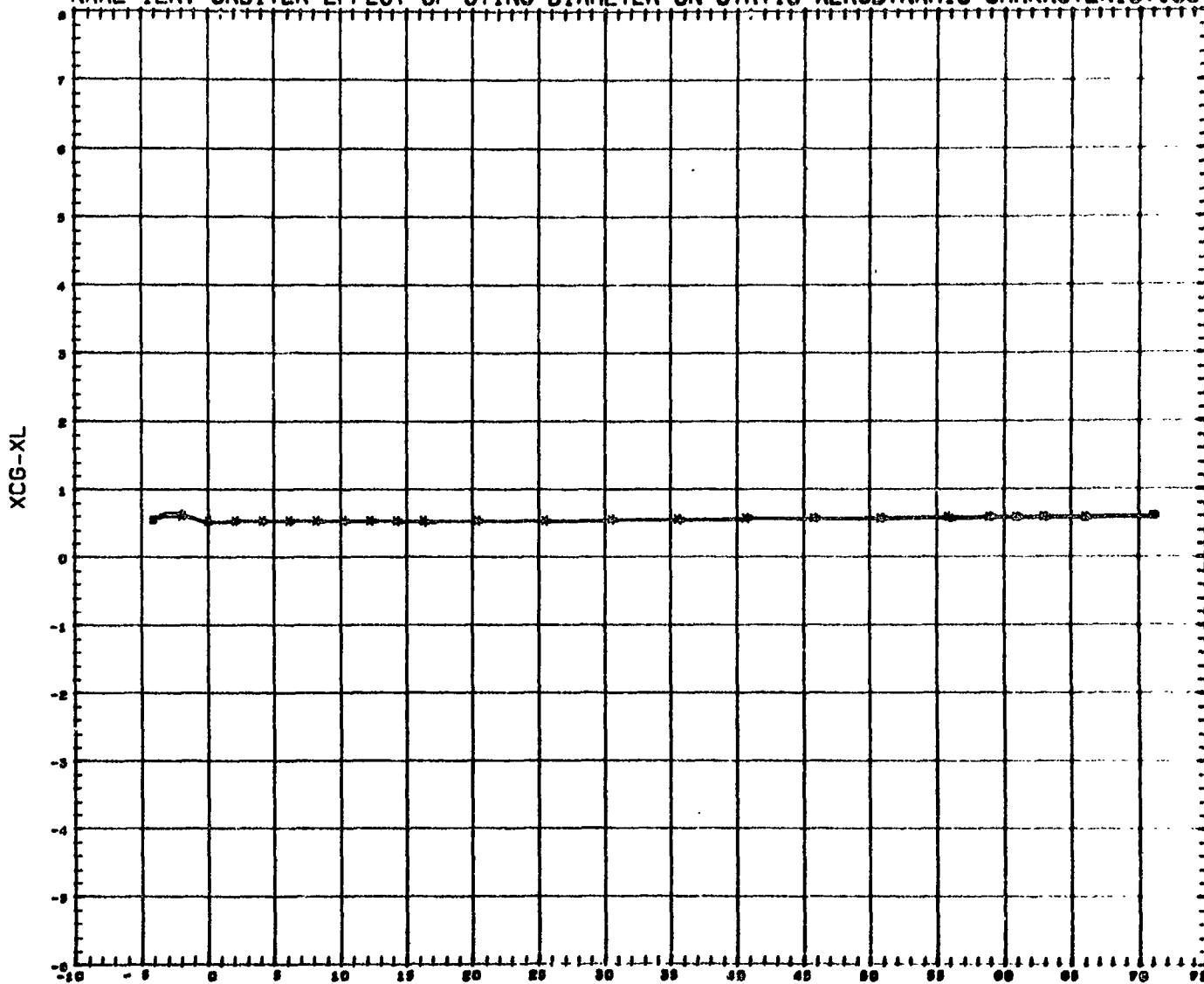
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| o      | NAAL 829 BSV-ILRV STRAIGHT WING | (RC4005) | 11 AUG 70 | 0.250 | REFS 1.90000E10 01 88.FT.  |
| x      | NAAL 829 BSV-ILRV STRAIGHT WING | (RC4003) | 11 AUG 70 |       | REFL 1.87570E10 01 INCHES  |
|        |                                 |          |           |       | REFS 1.13590E10 01 INCHES  |
|        |                                 |          |           |       | XMRP 0.13200E10 00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000E10 00 INCHES  |
|        |                                 |          |           |       | ZMRP -3.04000E10 01 INCHES |
|        |                                 |          |           |       | SCALE 7.21000E10 01 SCALE  |

REFERENCE FILE NAAL 829 NA-70-351

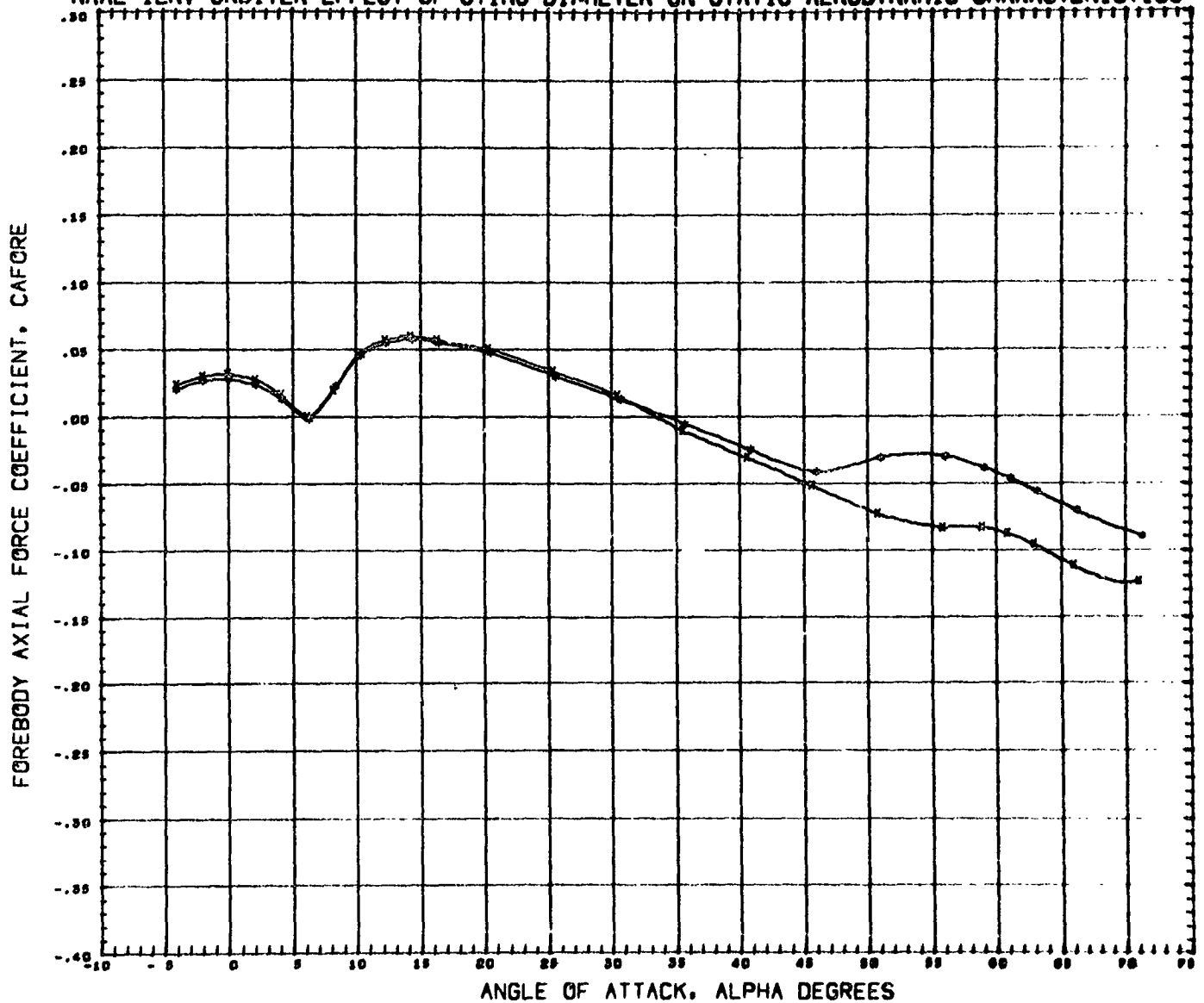
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 M6    | 11 AUG 70 | 0.250 | REFS 1.70000X10-01 60.77.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 M6    | 11 AUG 70 |       | REFL 1.97570X10-01 INCHES  |
|        |                                 |          |           |       | REFD 1.13300X10-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.13300X10-00 INCHES  |
|        |                                 |          |           |       | ZMRP 0.00000X10-01 INCHES  |
|        |                                 |          |           |       | ZMRP -3.00000X10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

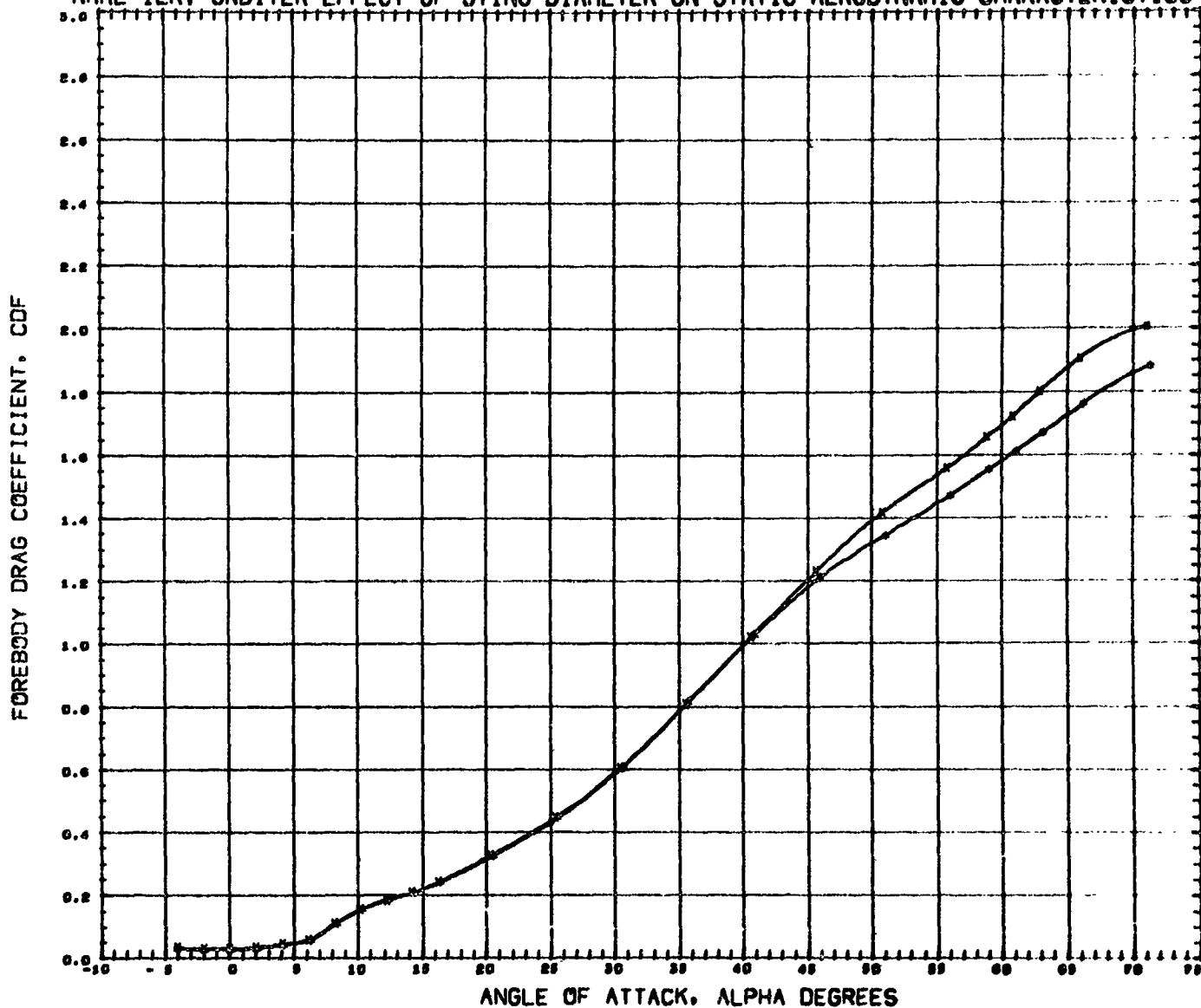


| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  |
|--------|---------------------------------------|----------|-----------|-------|
| *      | NAAL 629 BSV-ILRV STRAIGHT WING 86 W6 | (RC4005) | 11 AUG 70 | 0.299 |
| x      | NAAL 629 BSV-ILRV STRAIGHT WING 86 W6 | (RC4005) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                                   |
|-----------------------|-----------------------------------|
| REFS                  | 1.70000X10 <sup>-01</sup> 88.77   |
| REFL                  | 1.57370X10 <sup>-01</sup> INCHES  |
| REFD                  | 1.13300X10 <sup>-01</sup> INCHES  |
| YHFP                  | 0.13200X10 <sup>-00</sup> INCHES  |
| YHFP                  | 0.00000X10 <sup>-01</sup> INCHES  |
| ZHFP                  | -3.04000X10 <sup>-01</sup> INCHES |
| SCALE                 | 7.01000X10 <sup>-01</sup> SCALE   |

REFERENCE FILE NAAL 629 NA-70-351

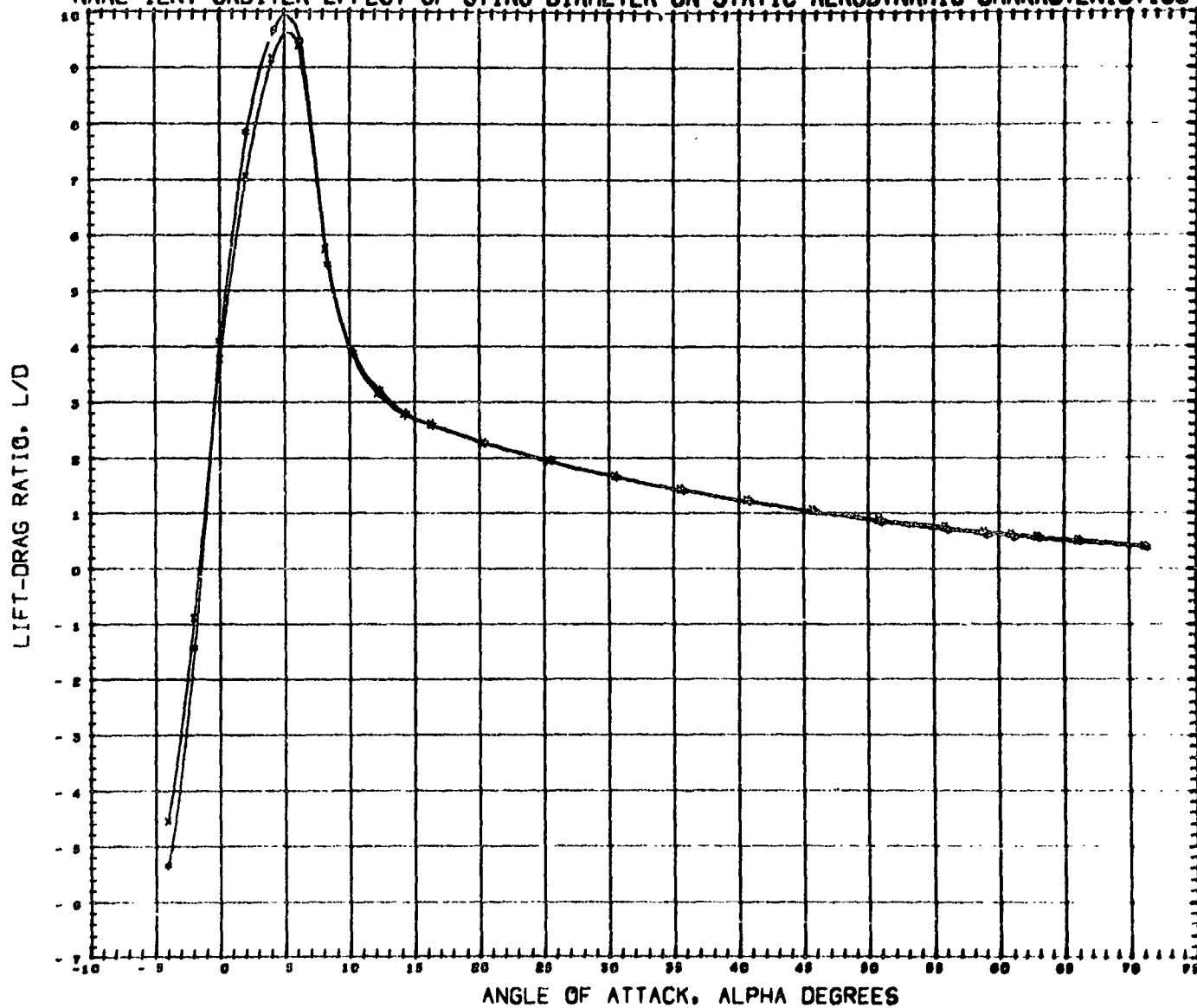
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 86 WS | (RC4005) | 11 AUG 70 | 0.859 | REFD 1.70000010-01 86.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING 86 WS | (RC4003) | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
|        |                                       |          |           |       | REFD 1.13300010-00 INCHES  |
|        |                                       |          |           |       | ENRP 0.13200010-00 INCHES  |
|        |                                       |          |           |       | VNRP 0.00000010-01 INCHES  |
|        |                                       |          |           |       | ENRP -0.04000010-01 INCHES |
|        |                                       |          |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

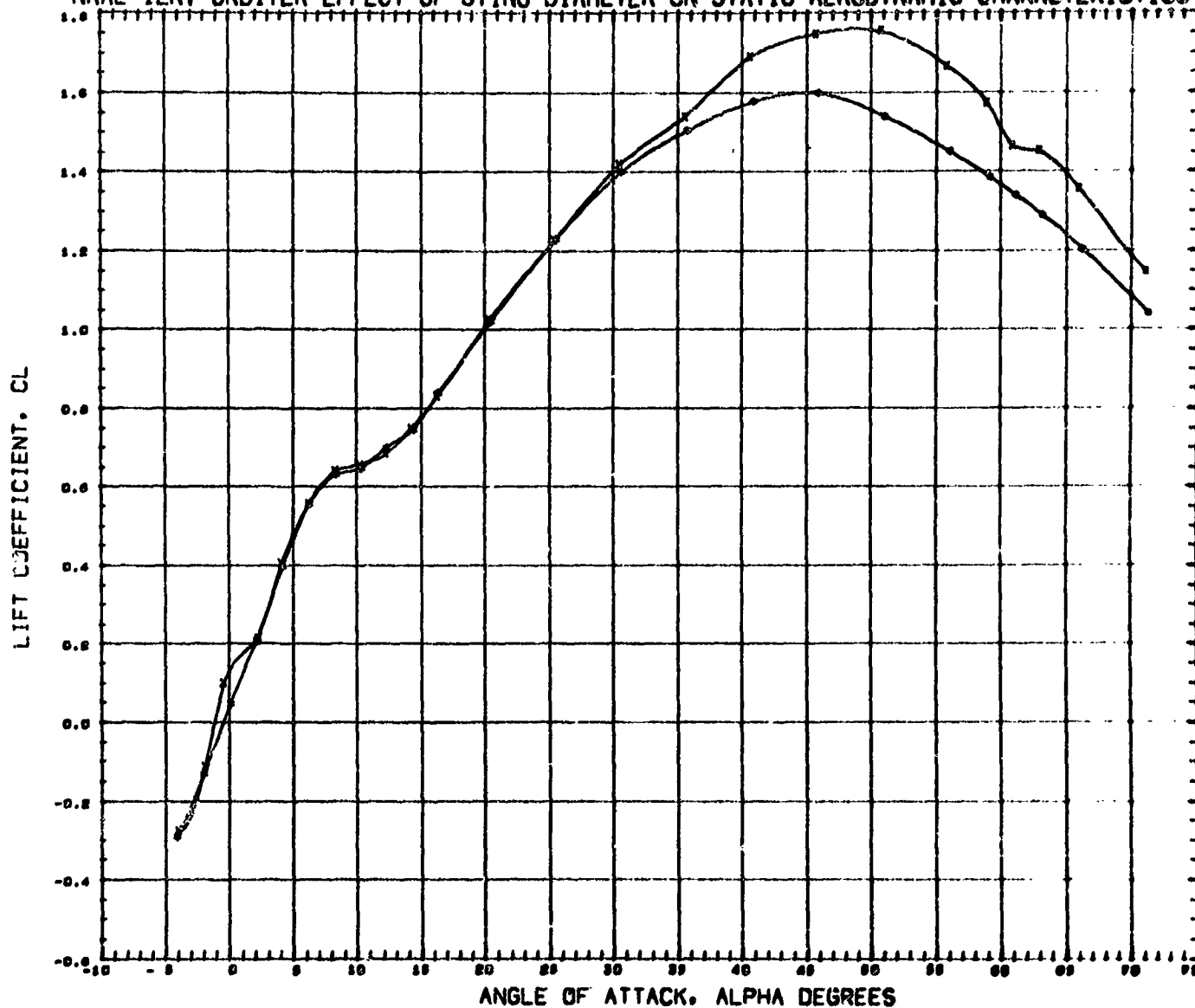
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION              | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|----------------------------------------|----------|-----------|-------|----------------------------|
| #      | NAAL 629 88V-ILRV STRAIGHT WING 66 (1) | (RC4005) | 11 AUG 70 | 0.859 | REFS 1.70000E10-01 66 FT.  |
| x      | NAAL 629 88V-ILRV STRAIGHT WING 66 W6  | (RC4005) | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
|        |                                        |          |           |       | REFD 1.13300E10-01 INCHES  |
|        |                                        |          |           |       | XWRP 0.13200E10-00 INCHES  |
|        |                                        |          |           |       | YWRP 0.00000E10-00 INCHES  |
|        |                                        |          |           |       | ZWRP -3.84000E10-01 INCHES |
|        |                                        |          |           |       | SCALE 7.81000E10-00 SCALE  |

REFERENCE FILE NAAL 629 NA-70-351

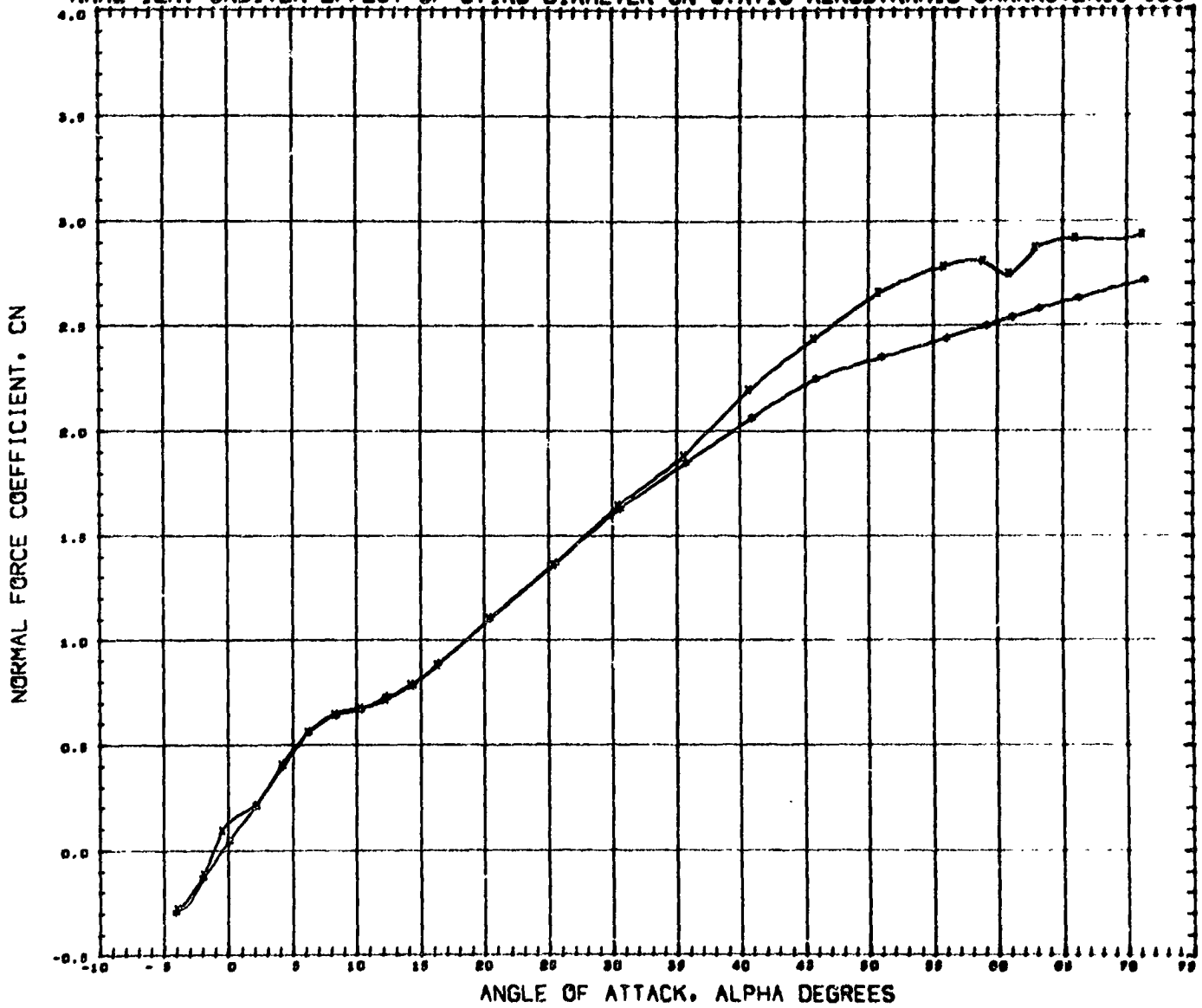
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| •      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4000) | 11 AUG 70 | 0.850 | REF1 1.700000E-01 50.71. |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4070) | 11 AUG 70 |       | REF2 1.07370E-01 INCHES  |
|        |                                 |          |           |       | REF3 1.13300E-01 INCHES  |
|        |                                 |          |           |       | REF4 0.10000E-01 INCHES  |
|        |                                 |          |           |       | REF5 0.00000E-01 INCHES  |
|        |                                 |          |           |       | REF6 -3.00000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.00000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



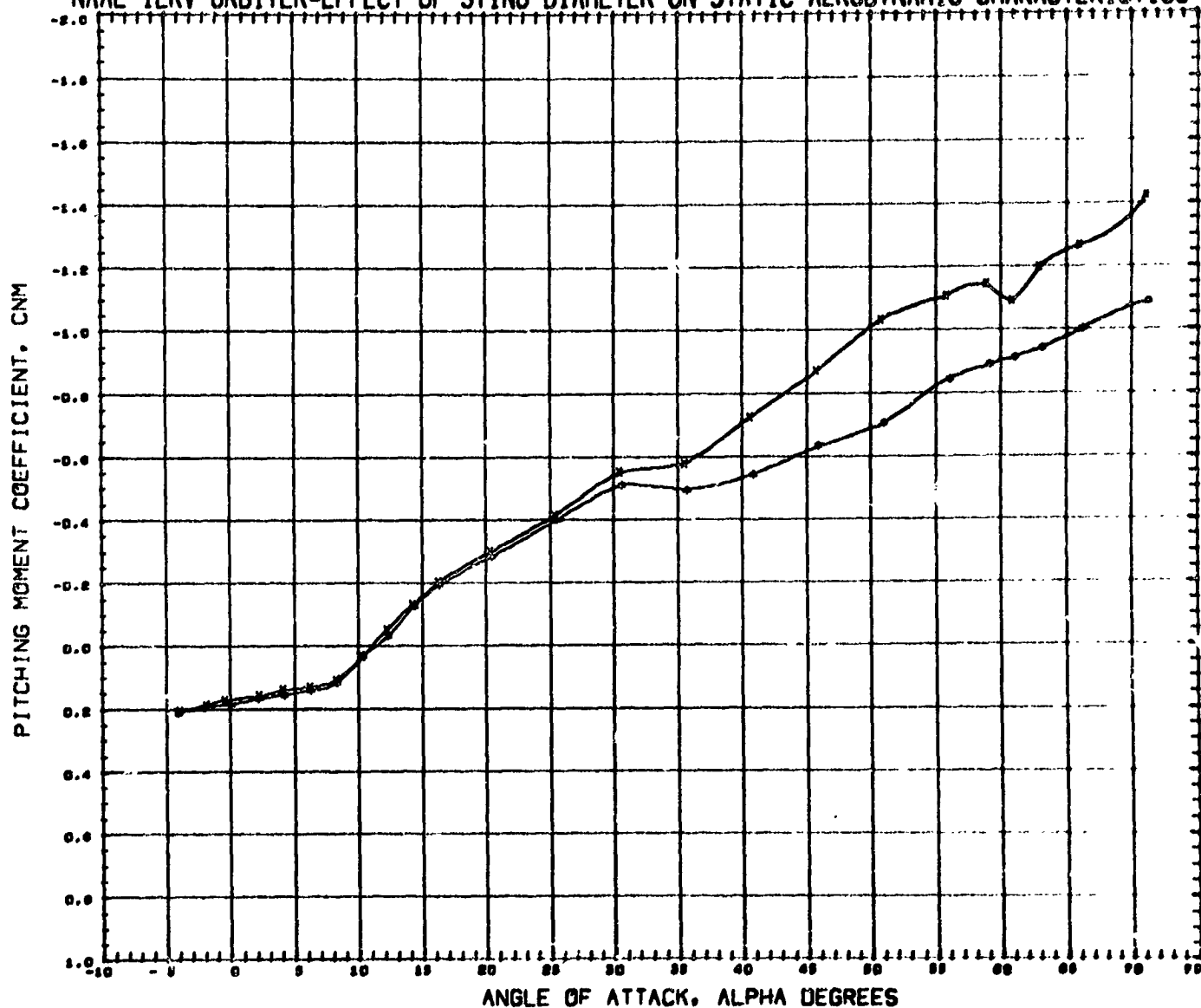
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| *      | NAAL 020 OSV-ILRV STRAIGHT WING | RC4000   | 11 AUG 70 | 0.290 |
| x      | NAAL 020 OSV-ILRV STRAIGHT WING | RC4070   | 11 AUG 70 |       |

REFERENCE FILE NAAL 020 NA-70-391

REFERENCE INFORMATION

|       |               |        |
|-------|---------------|--------|
| REFS  | 1.700000E-01  | 00 FT. |
| REFL  | 1.973700E-01  | INCHES |
| REFS  | 1.133000E-01  | INCHES |
| YMRP  | 0.132000E-00  | INCHES |
| YMRP  | 0.000000E-00  | INCHES |
| YMRP  | -3.040000E-01 | INCHES |
| SCALE | 7.010000E-01  | SCALE  |

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



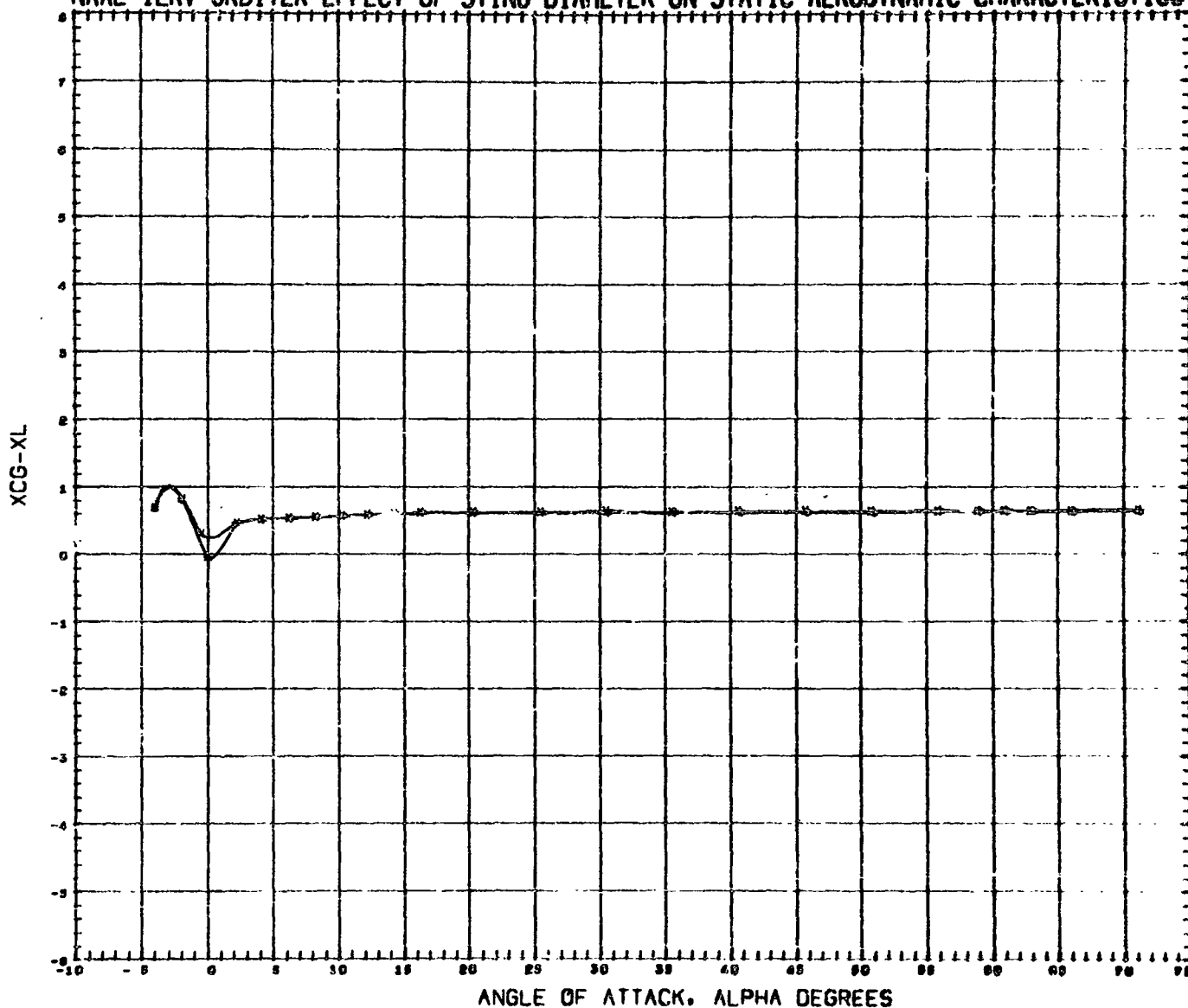
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      |       |
|--------|---------------------------------|-----------|----------|-----------|-------|
| *      | NAAL 020 00V-ILRV STRAIGHT WING | 06 W6 H12 | (RC4000) | 11 AUG 70 | 0.290 |
| x      | NAAL 020 00V-ILRV STRAIGHT WING | 06 W6 H13 | (RC4070) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-391

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFS                  | 1.700000E+01  | 00.FT. |
| REFL                  | 1.075700E+01  | INCHES |
| REFD                  | 1.133000E+00  | INCHES |
| ENRP                  | 0.133000E+00  | INCHES |
| VNRP                  | 0.000000E+00  | INCHES |
| ZNRP                  | -3.040000E-01 | INCHES |
| SCALE                 | 7.010000E+01  | SCALE  |

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

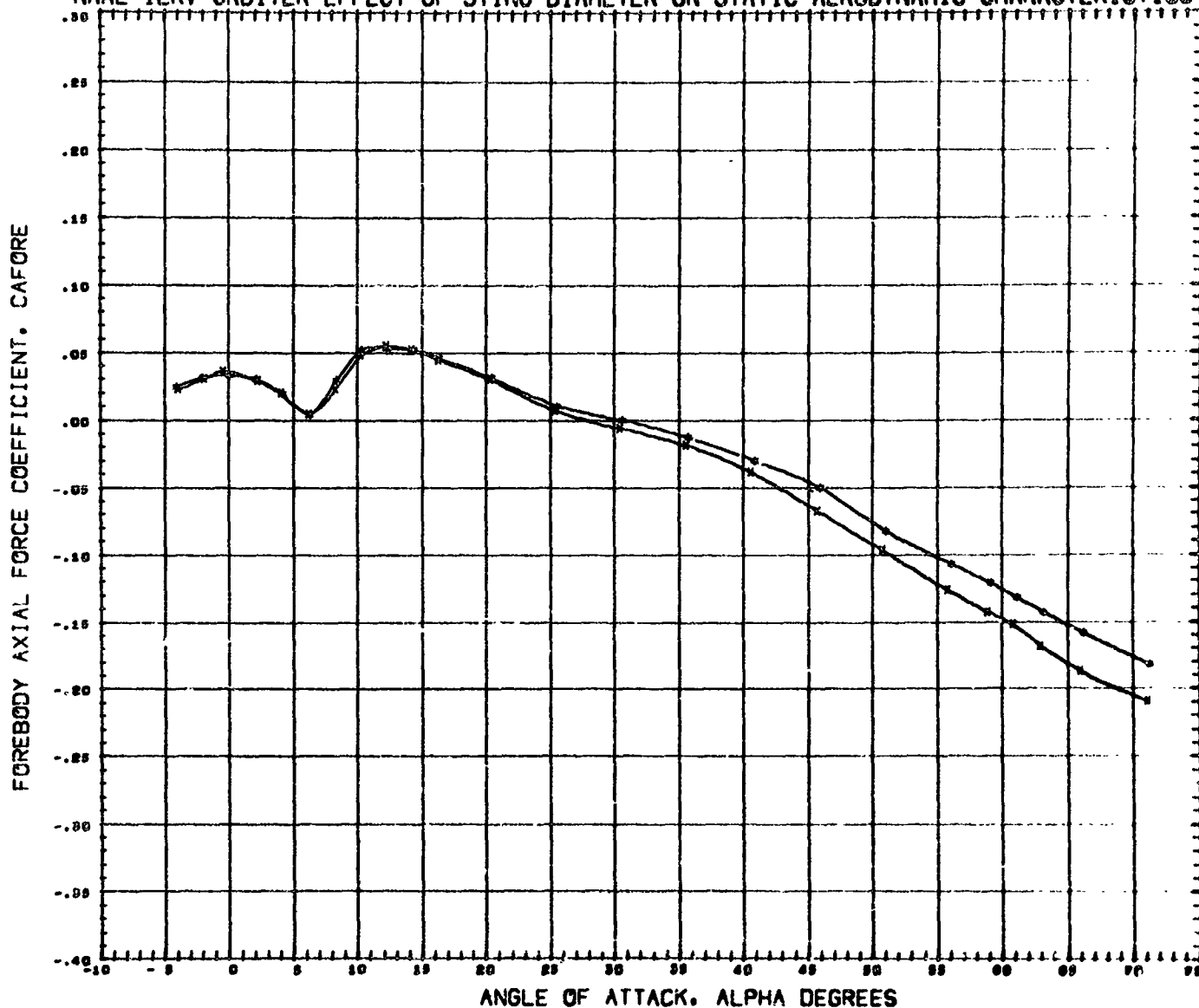


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE               | MACH  |
|--------|---------------------------------|-----------|--------------------|-------|
| #      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 H13 | (RC4000) 11 AUG 70 | 0.259 |
| X      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 H14 | (RC4070) 11 AUG 70 |       |

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E-01 80.FT.  |
| REFL                  | 1.973700E-01 INCHES  |
| REFD                  | 1.133000E-01 INCHES  |
| YNRP                  | 0.132000E-01 INCHES  |
| YNRP                  | 0.000000E-01 INCHES  |
| YNRP                  | -3.040000E-01 INCHES |
| SCALE                 | 7.010000E-01 SCALE   |

REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



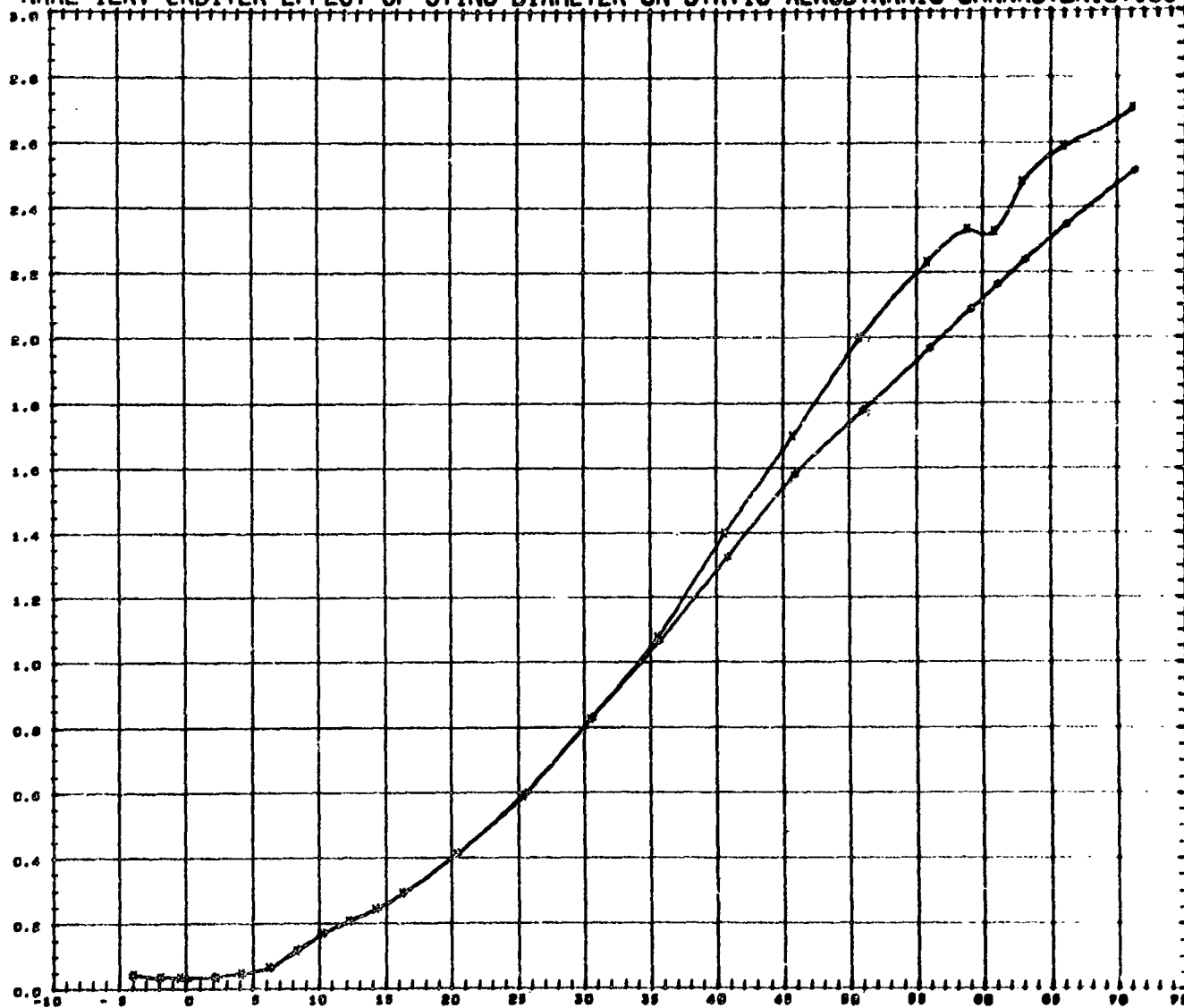
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4009) | 11 AUG 70 | 0.250 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4079) | 11 AUG 70 | 0.250 |

| REFERENCE INFORMATION |                     |
|-----------------------|---------------------|
| REF1                  | 1.70000E+01 INCHES  |
| REF2                  | 1.07370E+01 INCHES  |
| REF3                  | 1.13300E+01 INCHES  |
| REF4                  | 0.13200E+00 INCHES  |
| REF5                  | 0.00000E+00 INCHES  |
| REF6                  | -3.04000E-01 INCHES |
| REF7                  | 7.01000E+00 SCALE   |

REFERENCE FILE NAAL 029 NA-70-391

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

FOREBODY DRAG COEFFICIENT, CDF



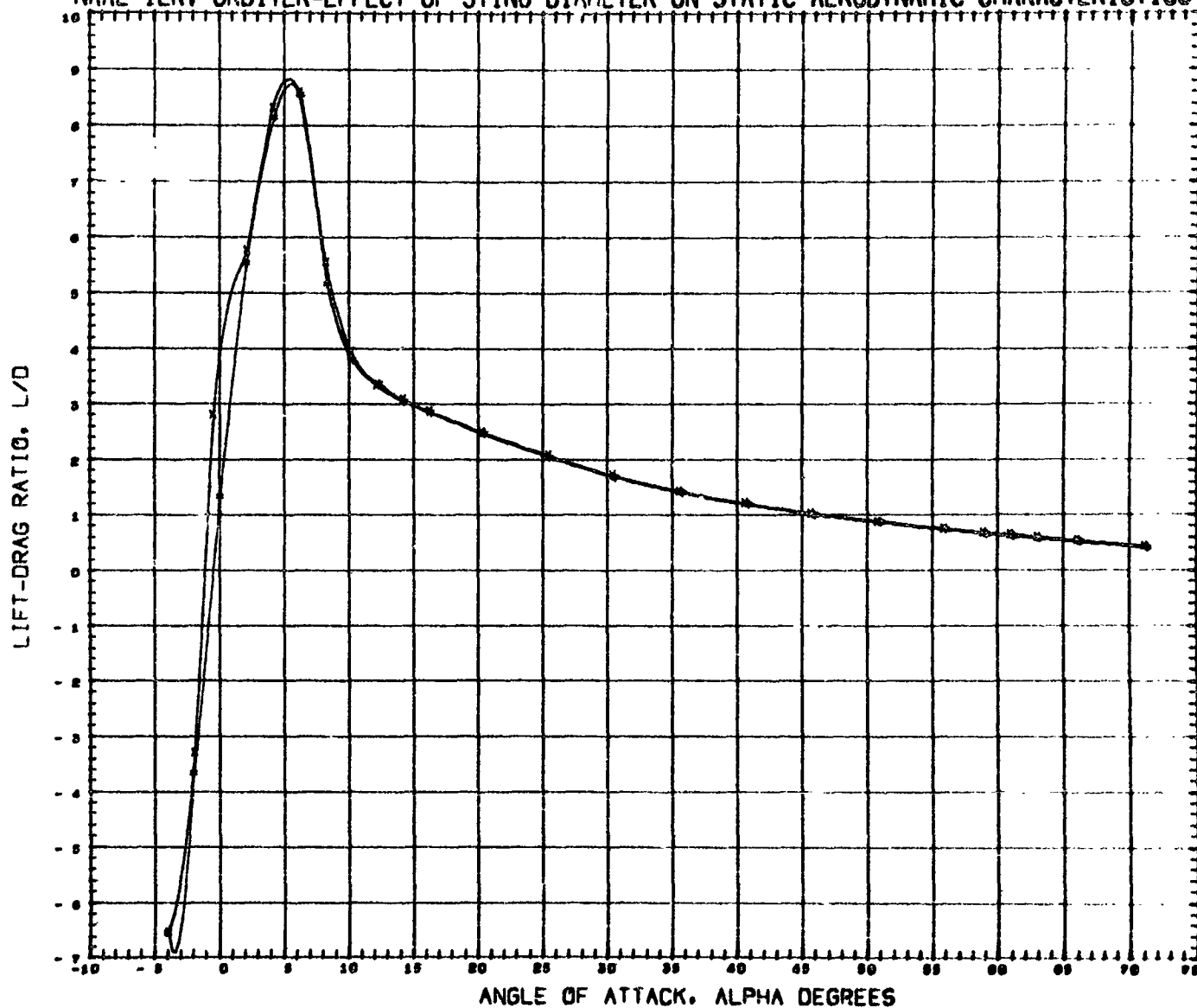
ANGLE OF ATTACK, ALPHA DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE      | MACH      |
|--------|---------------------------------|-----------|-----------|-----------|
| #      | NAAL 020 BSV-ILRV STRAIGHT WING | B6 W6 M13 | 11 AUG 70 | 0.250     |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | B6 W6 M13 | (RC4070)  | 11 AUG 70 |

REFERENCE FILE NAAL 020 NA-70-331

| REFERENCE INFORMATION |                     |
|-----------------------|---------------------|
| REFS                  | 1.70000E+01 00.FT.  |
| REFL                  | 1.07370E+01 INCHES  |
| REFD                  | 1.13390E+01 INCHES  |
| YMRP                  | 0.13200E+00 INCHES  |
| YMRP                  | 0.00000E+00 INCHES  |
| YMRP                  | -3.04000E-01 INCHES |
| SCALE                 | 7.01000E+01 SCALE   |

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS

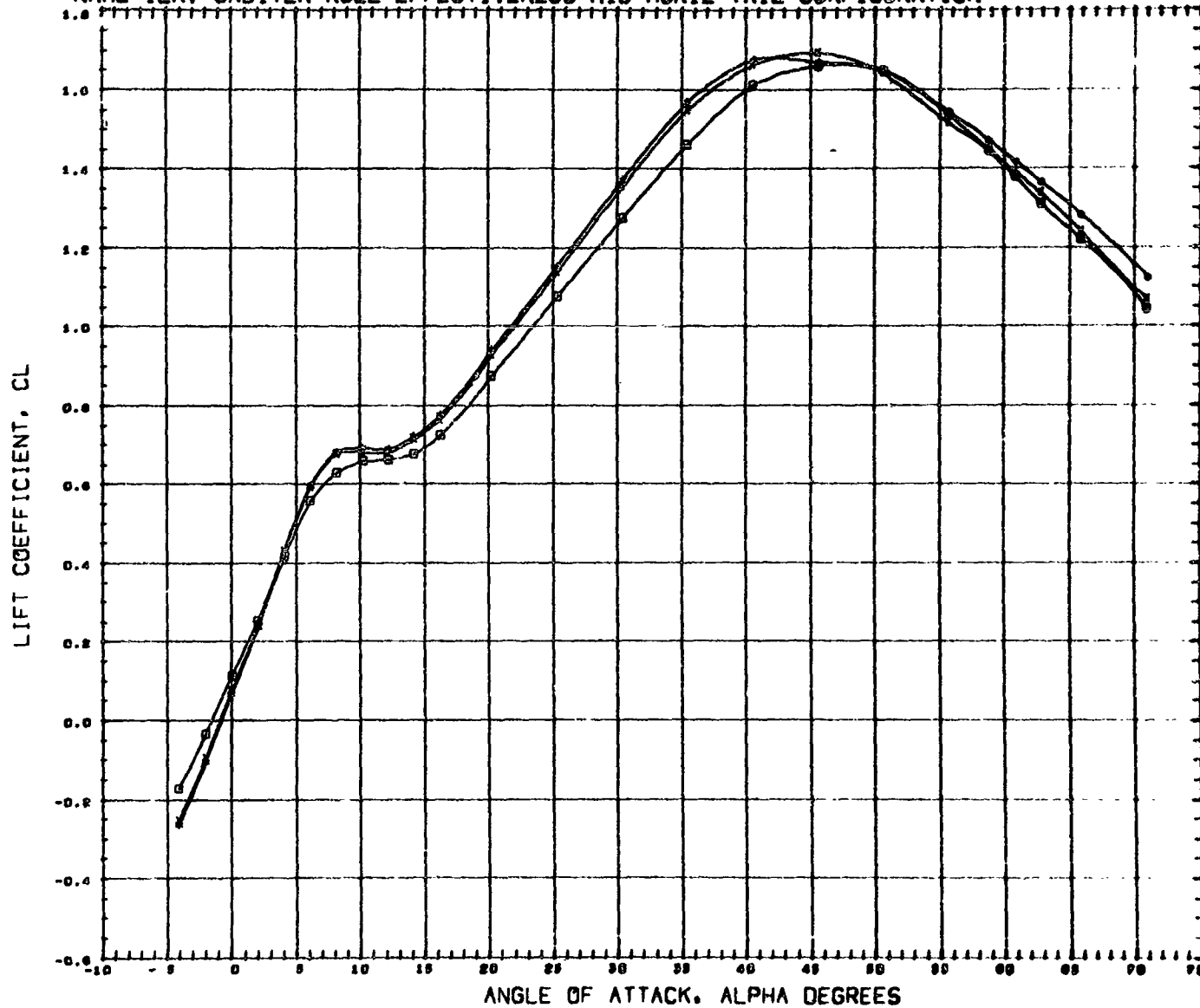


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4009) | 11 AUG 70 | 0.250 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4079) | 11 AUG 70 | 0.250 |

| REFERENCE INFORMATION |                                   |
|-----------------------|-----------------------------------|
| REFS                  | 1.70000X10 <sup>-01</sup> SQ.FT.  |
| REFL                  | 1.87370X10 <sup>-01</sup> INCHES  |
| REFD                  | 1.13300X10 <sup>-01</sup> INCHES  |
| SNRP                  | 0.13300X10 <sup>-00</sup> INCHES  |
| YNRP                  | 0.00000X10 <sup>-00</sup> INCHES  |
| ZNRP                  | -3.84000X10 <sup>-01</sup> INCHES |
| SCALE                 | 7.61000X10 <sup>-03</sup> SCALE   |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



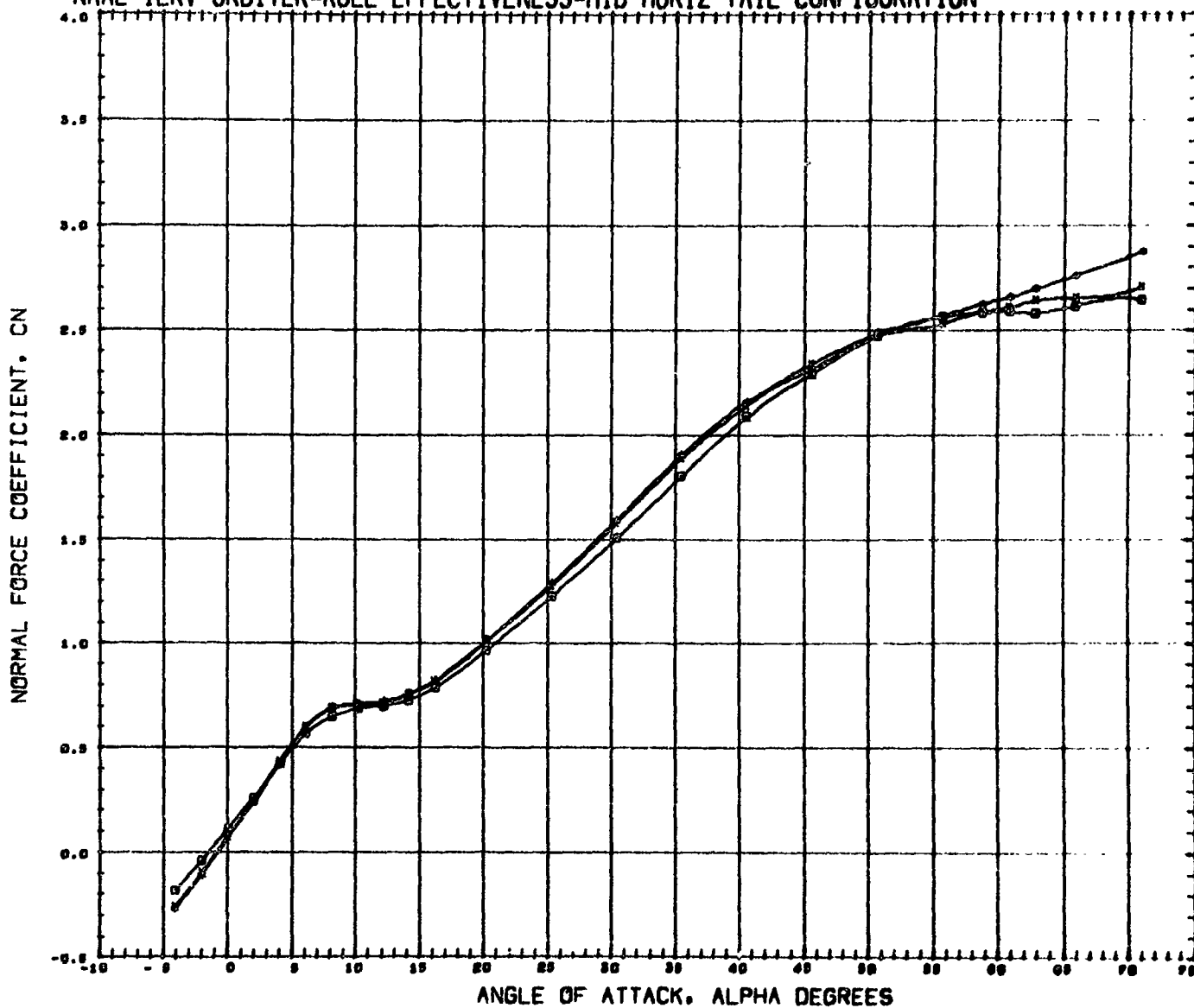
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 629 SSV-ILRV STRAIGHT WING | BS WS M12 V3 (RC4040) | 11 AUG 70 | 0.230 |
| x      | NAAL 620 SSV-ILRV STRAIGHT WING | BS WS M12 V3 (RC4035) | 11 AUG 70 |       |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING | BS WS M12 V3 (RC4033) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 629 NA-70-393

| REFERENCE INFORMATION |                         |
|-----------------------|-------------------------|
| REFS                  | 1.700000E-01 50.FT.     |
| REFL                  | 1.57370E10 0.01 INCHES  |
| REFD                  | 1.13300E10 0.01 INCHES  |
| YMRP                  | 0.13200E10 0.00 INCHES  |
| YMRP                  | 0.00000E10 0.00 INCHES  |
| ZMRP                  | -3.04000E10 0.01 INCHES |
| SCALE                 | 7.01000E10 0.01 SCALE   |

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



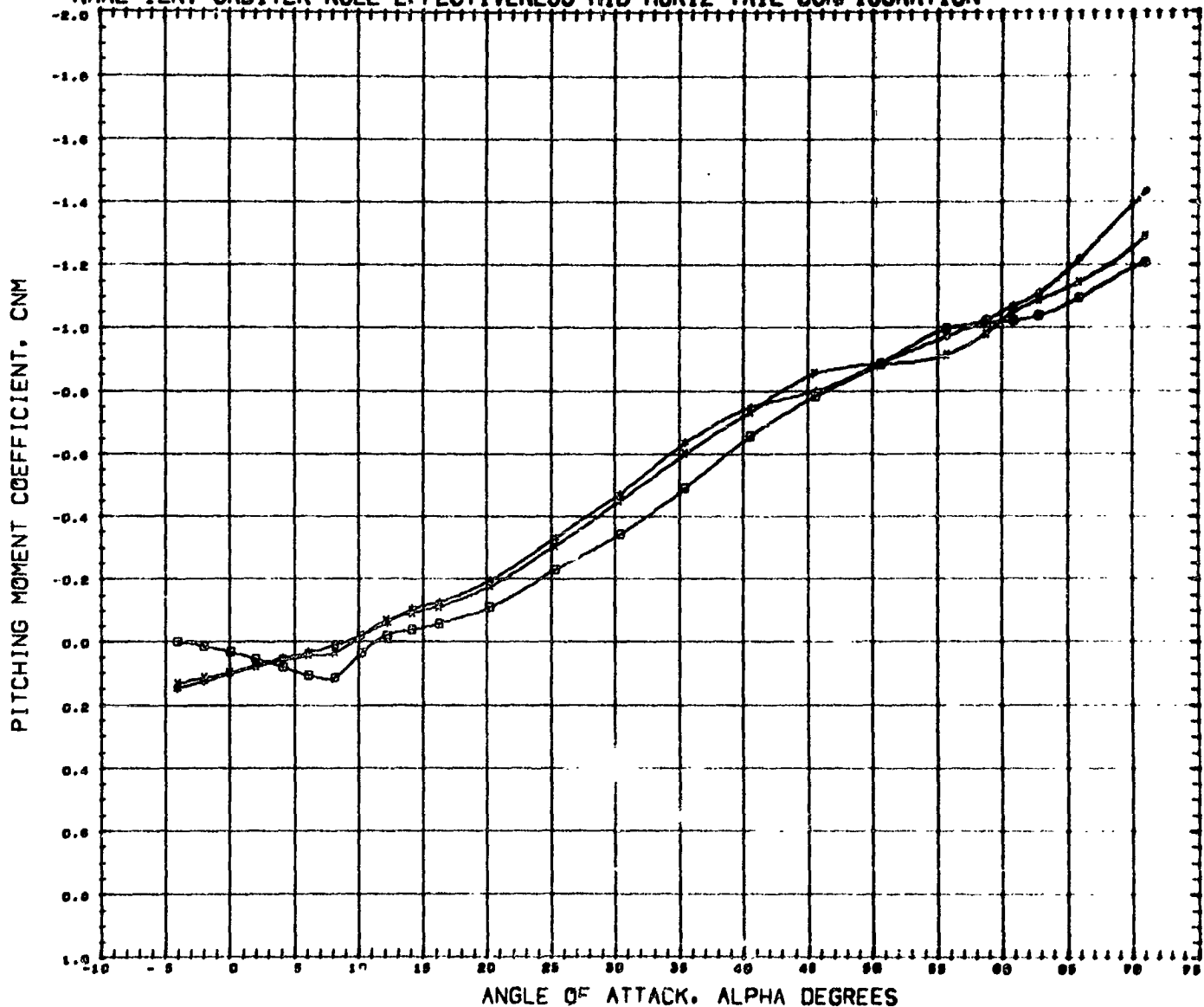
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4040) | 11 AUG 70 | 0.259 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4055) | 11 AUG 70 |       |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4053) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-351

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000X10-01  | CG.F1. |
| REFL                  | 1.97370X10-01  | INCHES |
| REFD                  | 1.13300X10-01  | INCHES |
| YMRP                  | 0.13200X10-00  | INCHES |
| YMRP                  | 0.00000X10-00  | INCHES |
| YMRP                  | -3.04000X10-01 | INCHES |
| SCALE                 | 7.01000X10-01  | SCALE  |

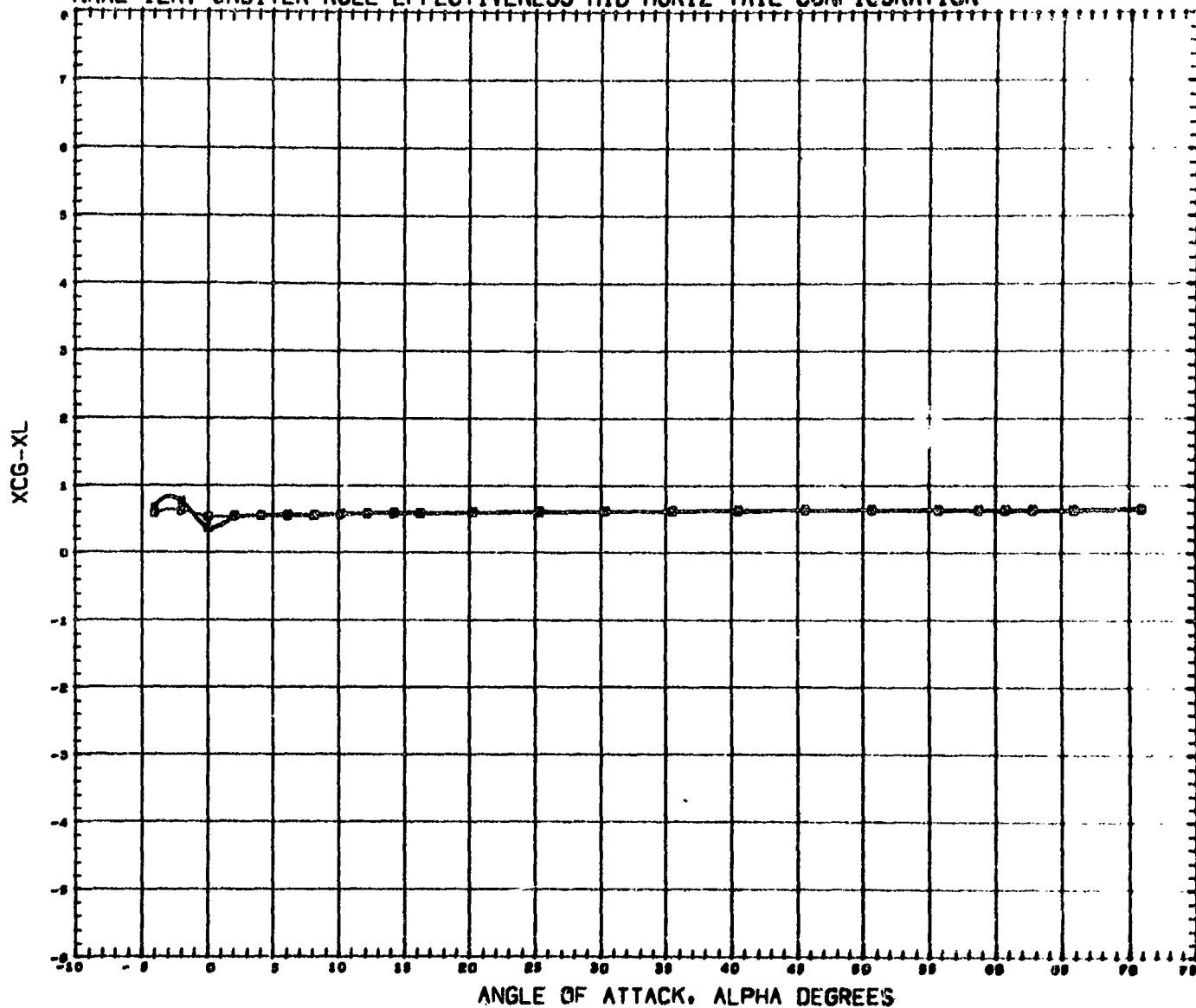
# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W3 M12 V3 (RC4040) | 11 AUG 70 | 0.299 | REFS 1.70000010-01 30. FT. |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 M12 V3 (RC4055) | 11 AUG 70 |       | REFL 1.57370010-01 INCHES  |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 M12 V3 (RC4093) | 11 AUG 70 |       | REFS 1.55000010-00 INCHES  |
|        |                                 |                       |           |       | YMRP 0.13200010-00 INCHES  |
|        |                                 |                       |           |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |                       |           |       | ZMRP -3.04000010-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000010-02 SCALE  |

REFERENCE FILE NAAL 029 NA-70-381

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 020 OSV-ILRV STRAIGHT WING | 06 W0 H12 V5 (RC4040) | 11 AUG 70 | 0.290 |
| x      | NAAL 020 OSV-ILRV STRAIGHT WING | 06 W0 H12 V5 (RC4055) | 11 AUG 70 |       |
| o      | NAAL 020 OSV-ILRV STRAIGHT WING | 06 W0 H12 V5 (RC4053) | 11 AUG 70 |       |

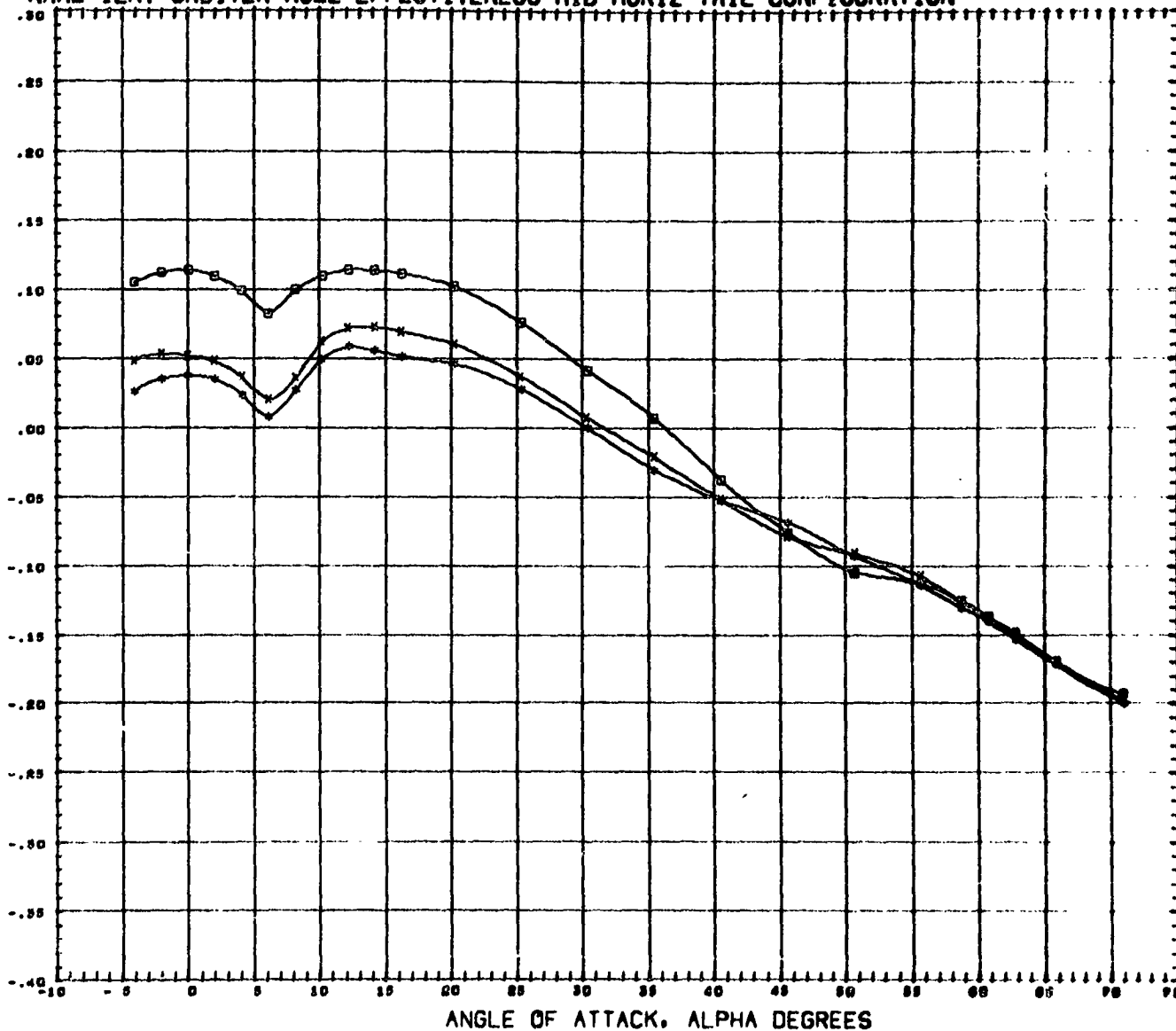
REFERENCE FILE

NAAL 020 NA-70-551

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFS                  | 1.700000E-01  | 00.71  |
| REFL                  | 1.075700E-01  | INCHES |
| REFD                  | 1.133000E-01  | INCHES |
| INRP                  | 0.132000E-00  | INCHES |
| INRP                  | 0.000000E-00  | INCHES |
| INRP                  | -9.040000E-01 | INCHES |
| SCALE                 | 7.010000E-03  | SCALE  |

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

FOREBODY AXIAL FORCE COEFFICIENT, CAFORE



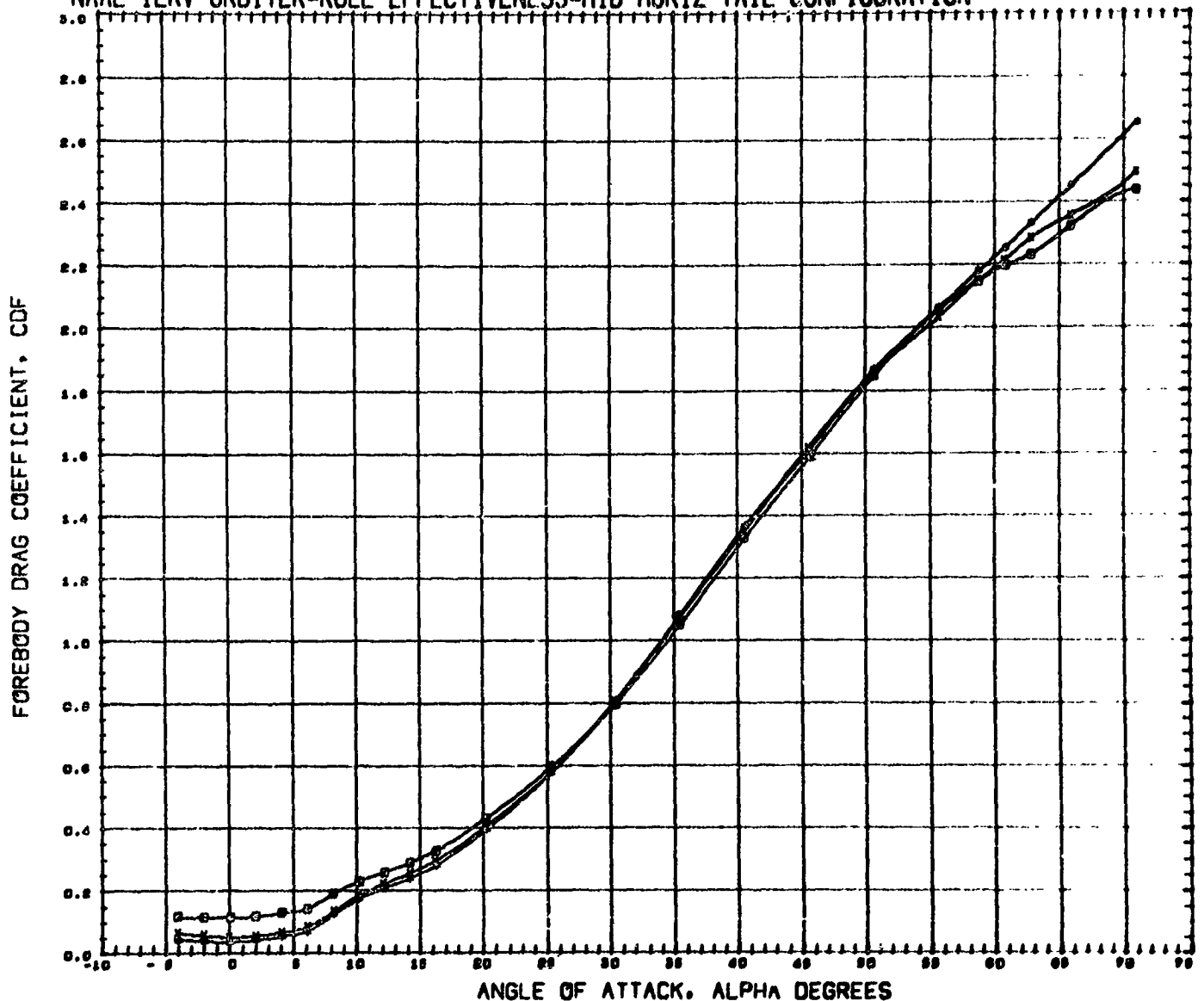
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H12 V5 (RC4040) | 11 AUG 70 | 0.250 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H12 V5 (RC4055) | 11 AUG 70 |       |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H12 V5 (RC4055) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-351

| REFERENCE INFORMATION      |
|----------------------------|
| REFS 1.70000010-01 00.FY.  |
| REFL 1.57370010-01 INCHES  |
| REFD 1.15500010-01 INCHES  |
| ENRP 0.15500010-00 INCHES  |
| YMRP 0.00000010-01 INCHES  |
| ZMRP -0.04000010-01 INCHES |
| SCALE 7.01000010-01 SCALE  |

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



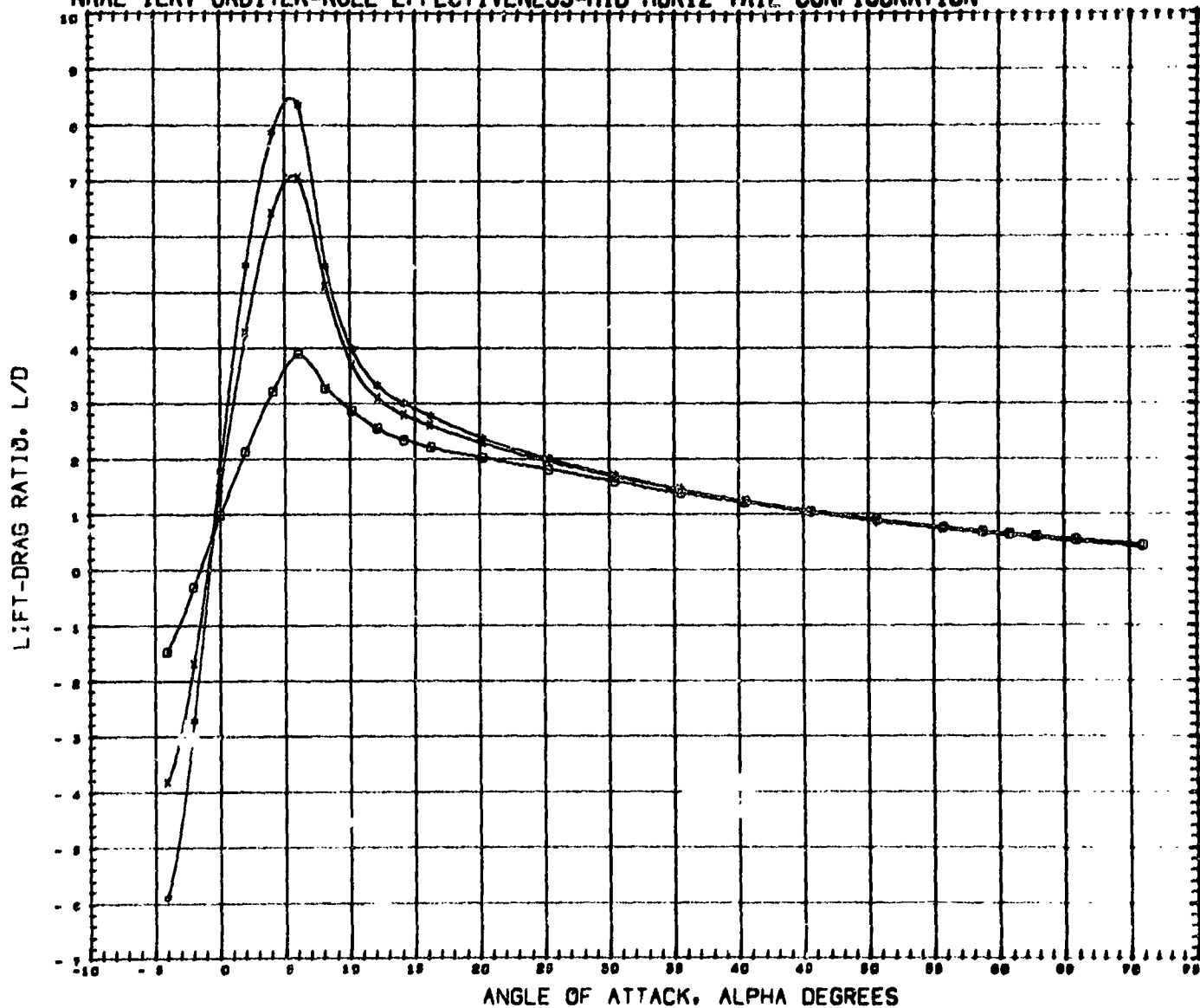
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA PT  | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| X      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 | 0.250 |
| O      | NAAL 020 88V-ILRV STRAIGHT WING | (RC4055) | 11 AUG 70 |       |
|        | NAAL 020 88V-ILRV STRAIGHT WING | (RC4073) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-351

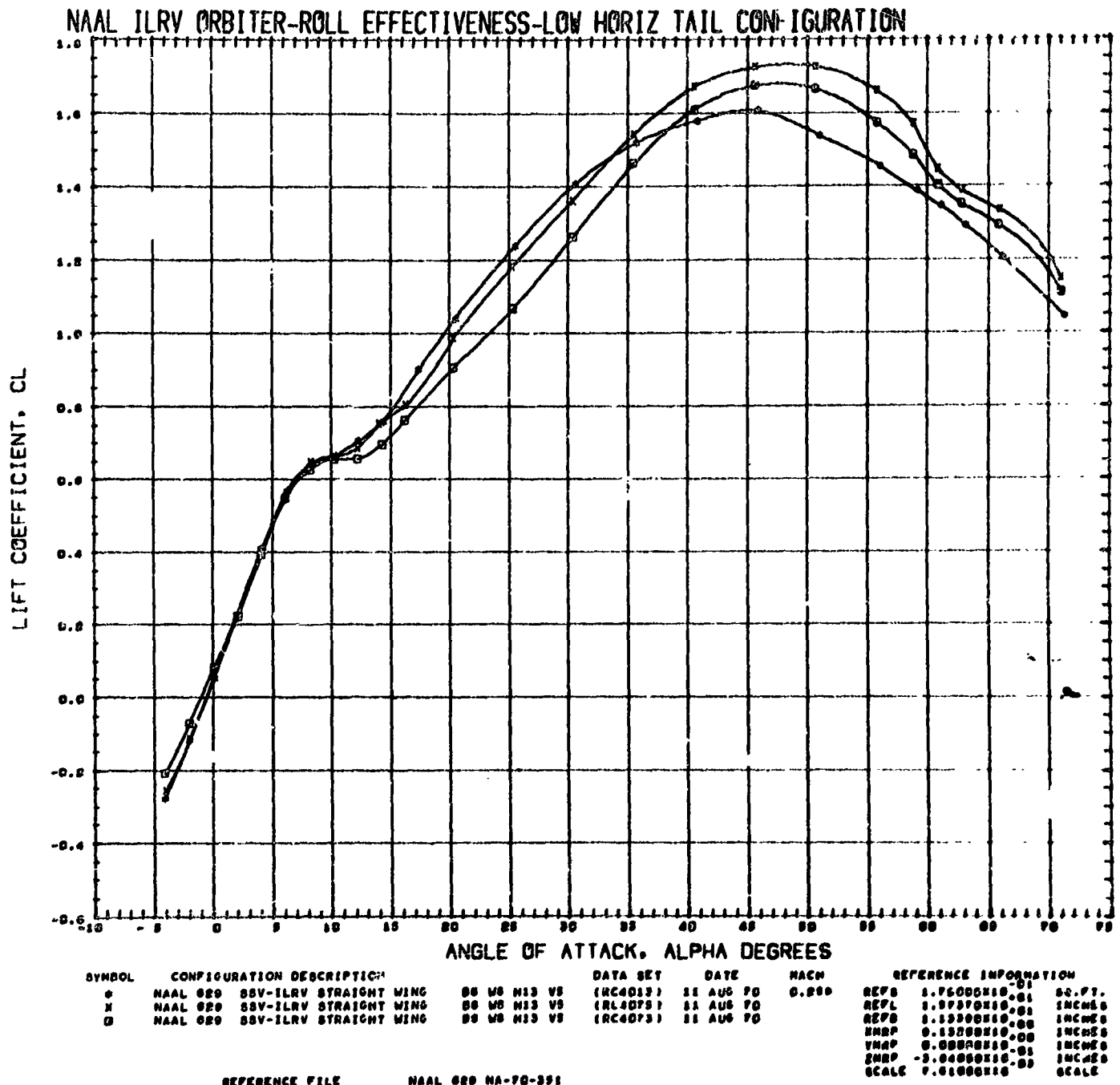
| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFS                  | 1.700E+10-01  | 00.71. |
| REFL                  | 1.070E+10-01  | INCHES |
| REFD                  | 1.130E+10-01  | INCHES |
| YMRP                  | 0.100E+10-00  | INCHES |
| YMRP                  | 0.000E+10-01  | INCHES |
| YMRP                  | -0.040E+10-01 | INCHES |
| SCALE                 | 1.010E+10-01  | SCALE  |

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

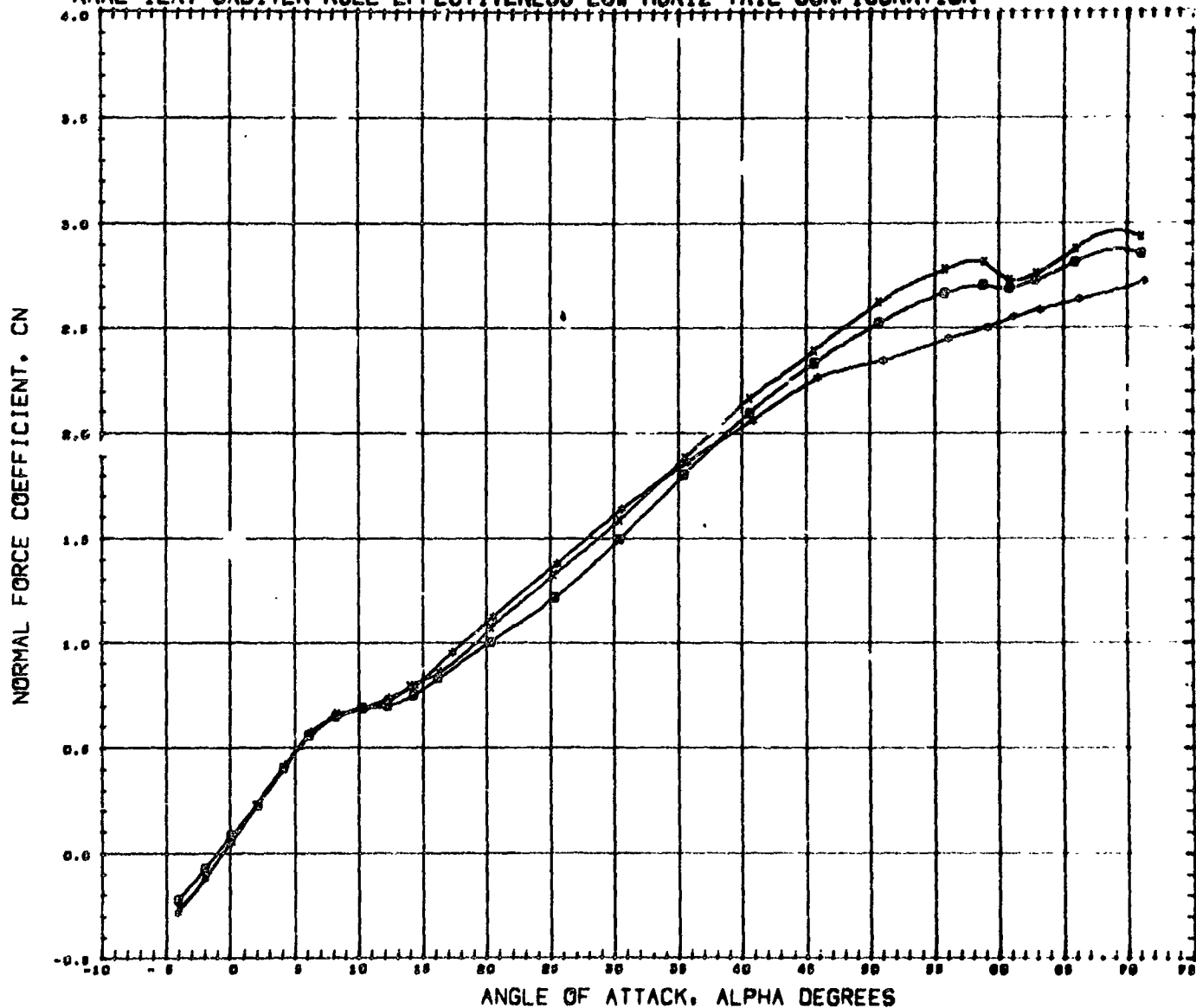


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 020 08V-ILRV STRAIGHT WING | 06 W0 M12 V5 | 11 AUG 70 | 0.850 | REFS 1.70000E+01 00.FT.  |
| x      | NAAL 020 08V-ILRV STRAIGHT WING | 06 W0 M12 V5 | 11 AUG 70 |       | REFL 1.07370E+01 INCHES  |
| o      | NAAL 020 08V-ILRV STRAIGHT WING | 06 W0 M12 V5 | 11 AUG 70 |       | REFD 1.13300E+01 INCHES  |
|        |                                 |              |           |       | INRP 0.13200E+00 INCHES  |
|        |                                 |              |           |       | YNRP 0.00000E+00 INCHES  |
|        |                                 |              |           |       | ZNRP -3.04000E-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E+00 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391



# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



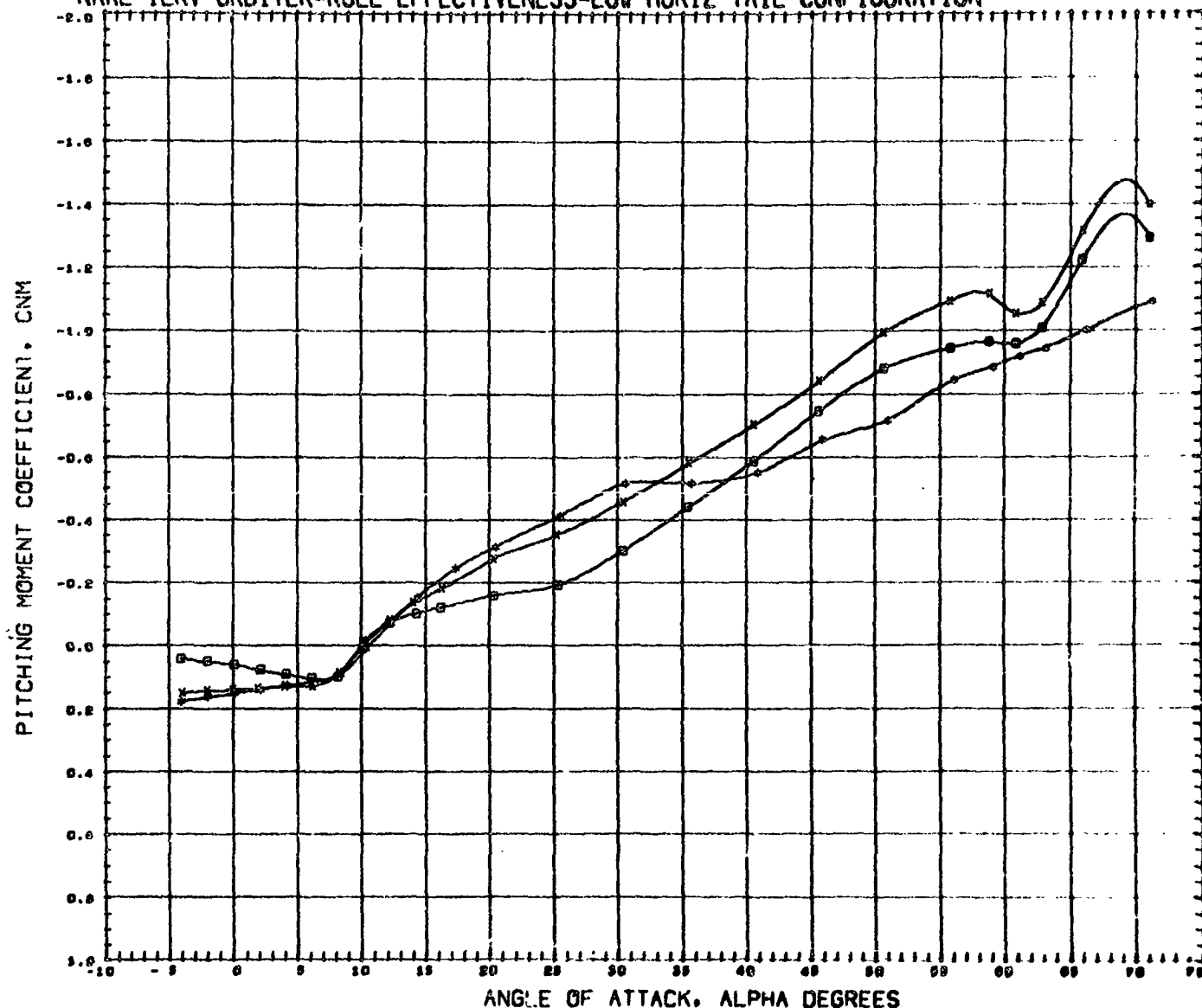
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| C      | NAAL 020 SSV-ILRV STRAIGHT WING |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING |
| D      | NAAL 020 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4013) | 11 AUG 70 | 0.250 |
| (RC4079) | 11 AUG 70 |       |
| (RC4072) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                        |
|-----------------------|------------------------|
| REFS                  | 1.70000E+01 01 60.FT.  |
| REFL                  | 1.07370E+01 01 INCHES  |
| REFD                  | 1.13300E+01 01 INCHES  |
| YMRP                  | 0.13200E+01 01 INCHES  |
| YMRP                  | 0.00000E+01 01 INCHES  |
| ZMRP                  | -3.04000E+01 01 INCHES |
| SCALE                 | 7.01000E+01 01 SCALE   |

REFERENCE FILE NAAL 020 NA-70-351

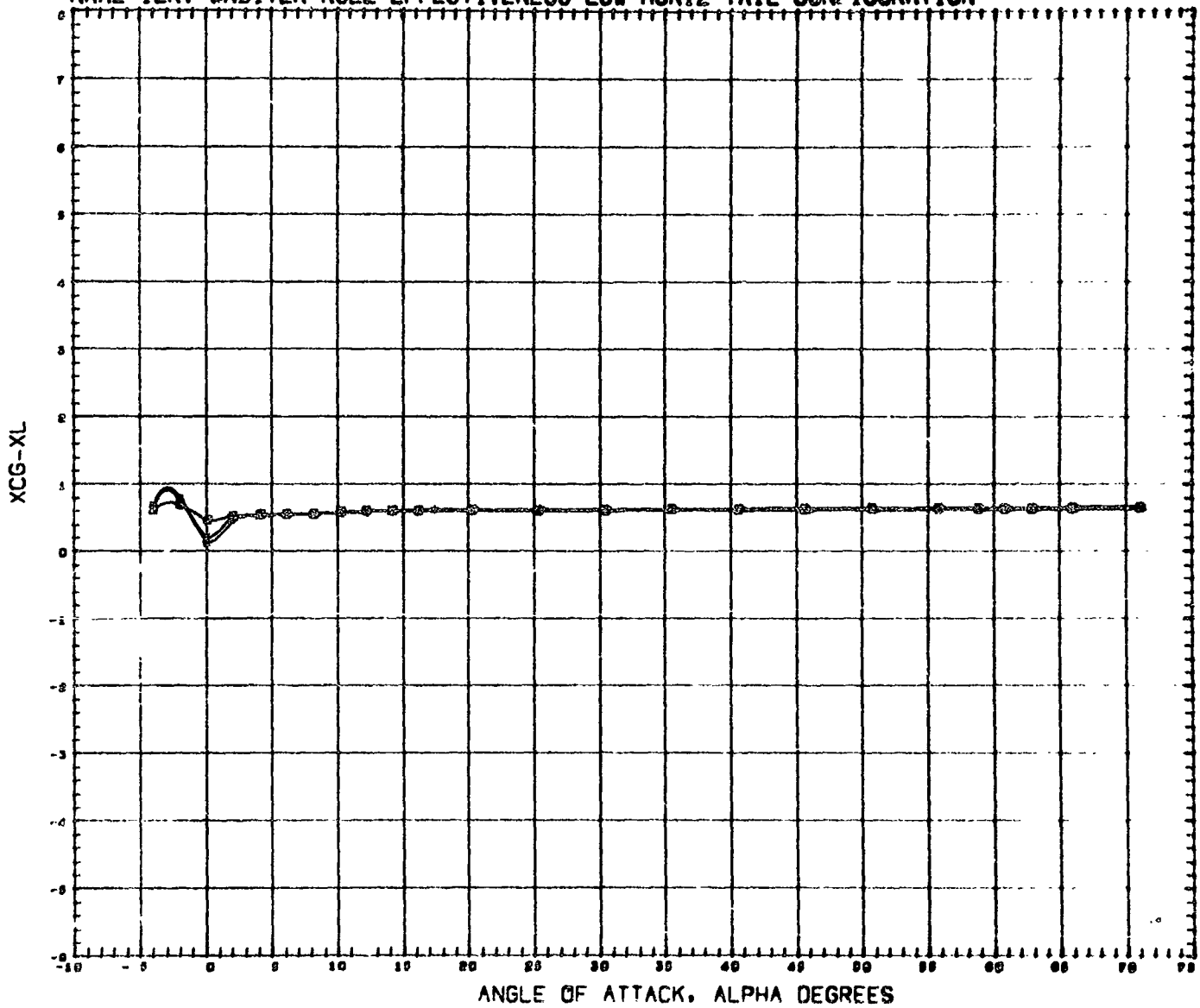
# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| •      | NAAL 020 BSV-ILRV STRAIGHT WING | 86 W6 M13 V5 (RC4013) | 11 AUG 70 | 0.850 | REFS 1.70000X10-01 86.77.  |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | 86 W6 M13 V5 (RC4075) | 11 AUG 70 |       | REFL 1.57370X10-01 INCHES  |
| □      | NAAL 020 BSV-ILRV STRAIGHT WING | 86 W6 M13 V5 (RC4073) | 11 AUG 70 |       | REFS 1.13390X10-00 INCHES  |
|        |                                 |                       |           |       | XREF 0.13800X10-00 INCHES  |
|        |                                 |                       |           |       | YREF 0.00000X10-01 INCHES  |
|        |                                 |                       |           |       | ZREF -3.04000X10-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01800X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

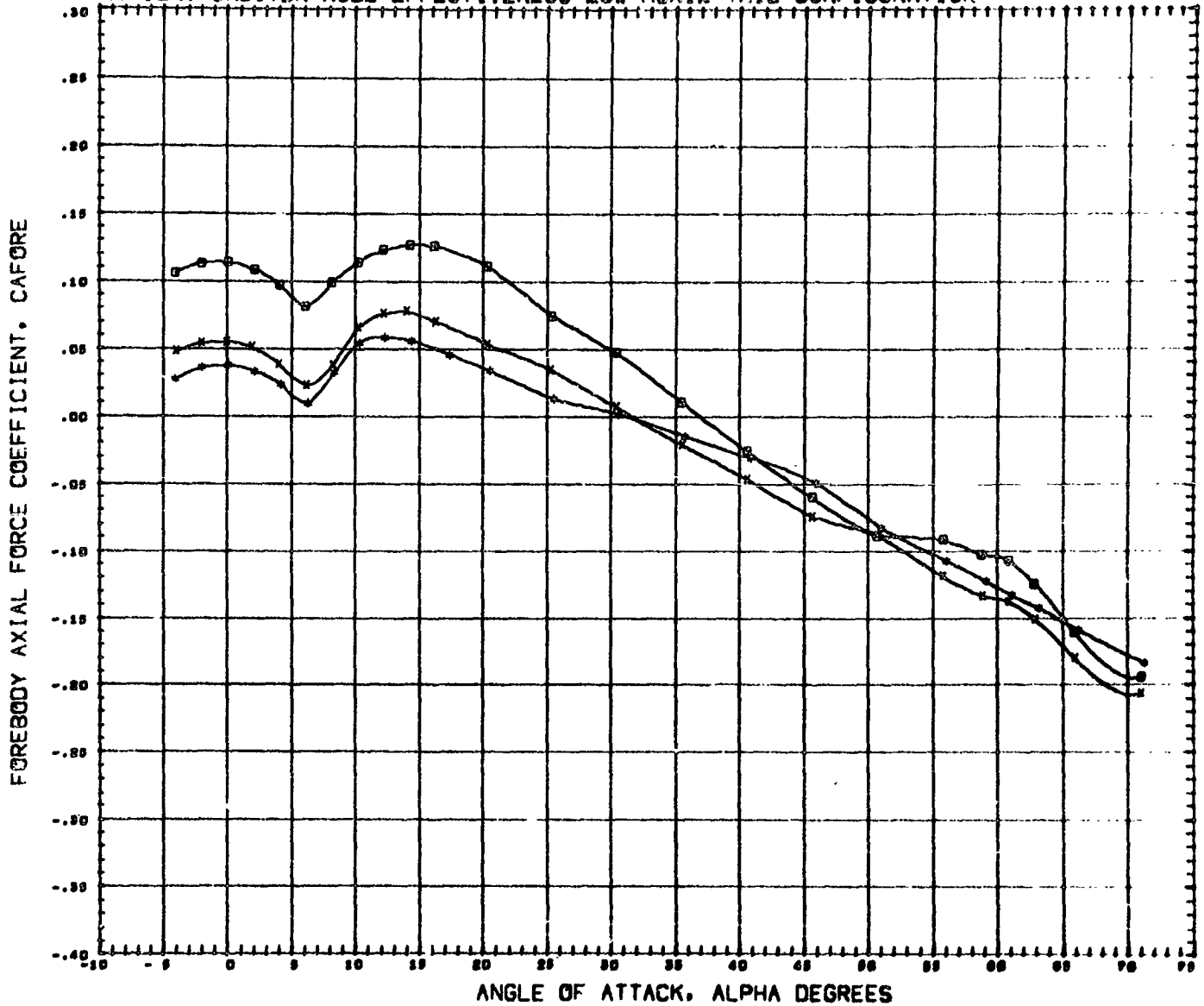
# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|----------|-----------|----------------------------|
| 2      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13 V3 | (RC4013) | 11 AUG 70 | 0.850                      |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13 V3 | (LC4075) | 11 AUG 70 | REFD 1.70000E10-01 88.71   |
| 3      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13 V3 | (RC4073) | 11 AUG 70 | REFL 1.97570E10-01 INCHES  |
|        |                                 |              |          |           | REFB 1.13300E10-00 INCHES  |
|        |                                 |              |          |           | YMRP 0.13200E10-00 INCHES  |
|        |                                 |              |          |           | YMRP 0.00000E10-01 INCHES  |
|        |                                 |              |          |           | ZMRP -3.04000E10-03 INCHES |
|        |                                 |              |          |           | SCALE 7.61000E10 SCALE     |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



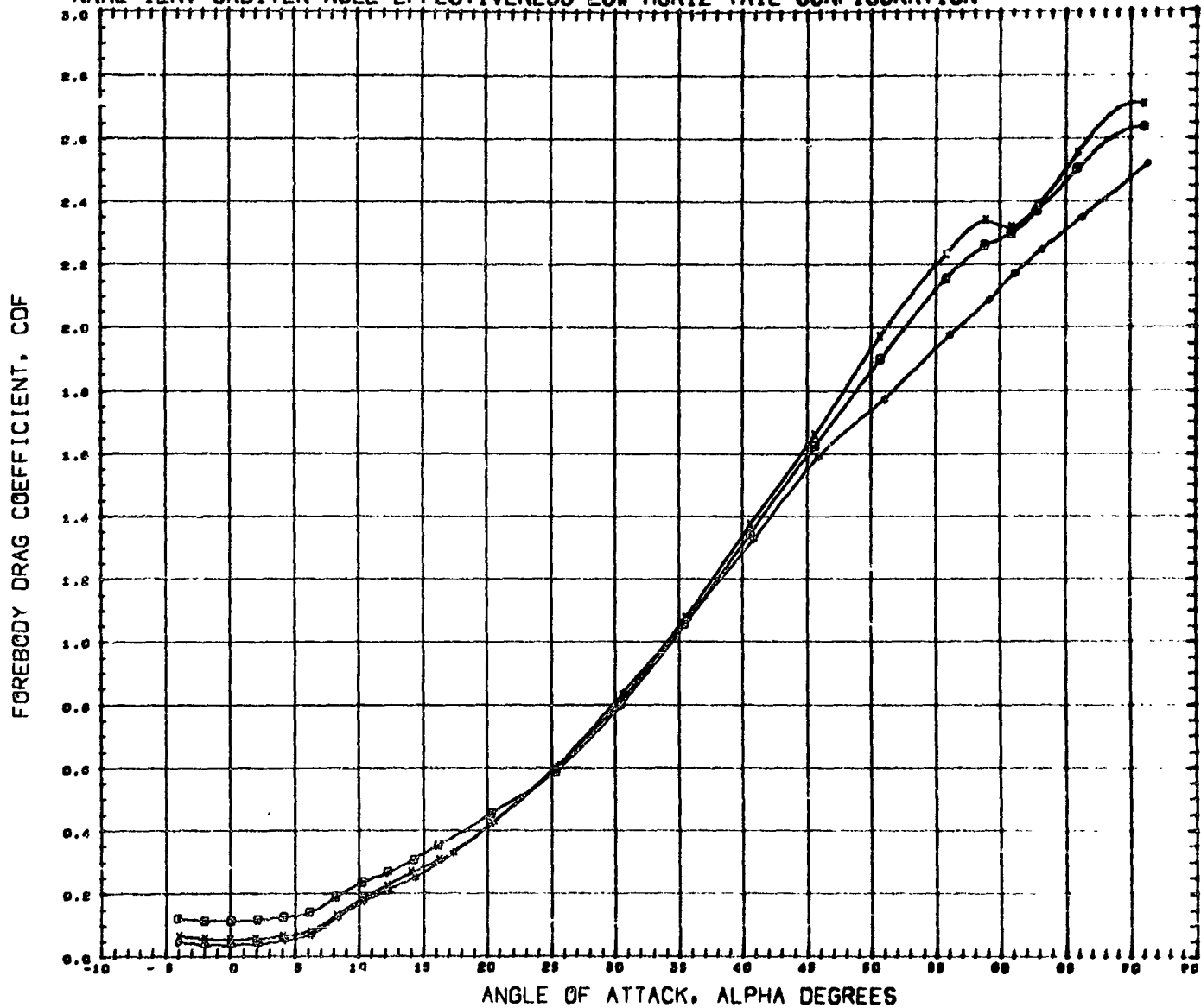
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| ●      | NAAL 020 OSV-ILRV STRAIGHT WING | 06 W8 N13 V5 (RC4013) | 11 AUG 70 | 0.850 |
| ×      | NAAL 020 OSV-ILRV STRAIGHT WING | 06 W8 N13 V5 (RC4073) | 11 AUG 70 |       |
| ■      | NAAL 020 OSV-ILRV STRAIGHT WING | 06 W8 N13 V5 (RC4073) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-351

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E-01 INCHES  |
| REFL                  | 1.873700E-01 INCHES  |
| REFD                  | 1.133000E-01 INCHES  |
| UNRP                  | 0.150000E-00 INCHES  |
| UNRP                  | 0.000000E-01 INCHES  |
| UNRP                  | -3.040000E-01 INCHES |
| SCALE                 | 7.010000E-01 SCALE   |

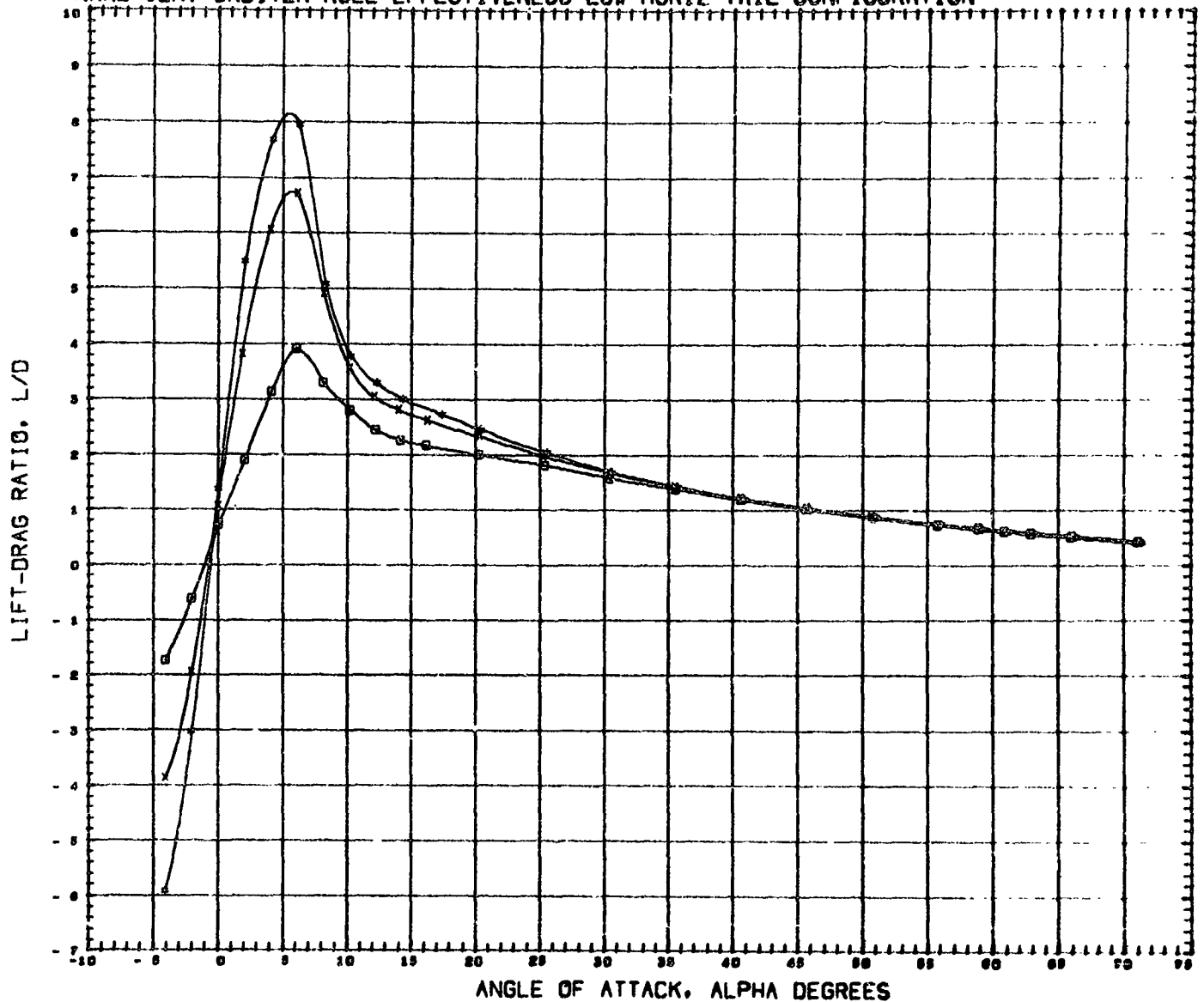
# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | NACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 (RC4013) | 11 AUG 70 | 0.289 | REFS 1.70000X10-01 60.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 (RC4075) | 11 AUG 70 |       | REFL 1.97370X10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 (RC4073) | 11 AUG 70 |       | REFS 1.13300X10-01 INCHES  |
|        |                                 |                       |           |       | XMRP 0.13800X10-00 INCHES  |
|        |                                 |                       |           |       | YMRP 0.00000X10-00 INCHES  |
|        |                                 |                       |           |       | ZMRP -3.04000X10-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000X10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



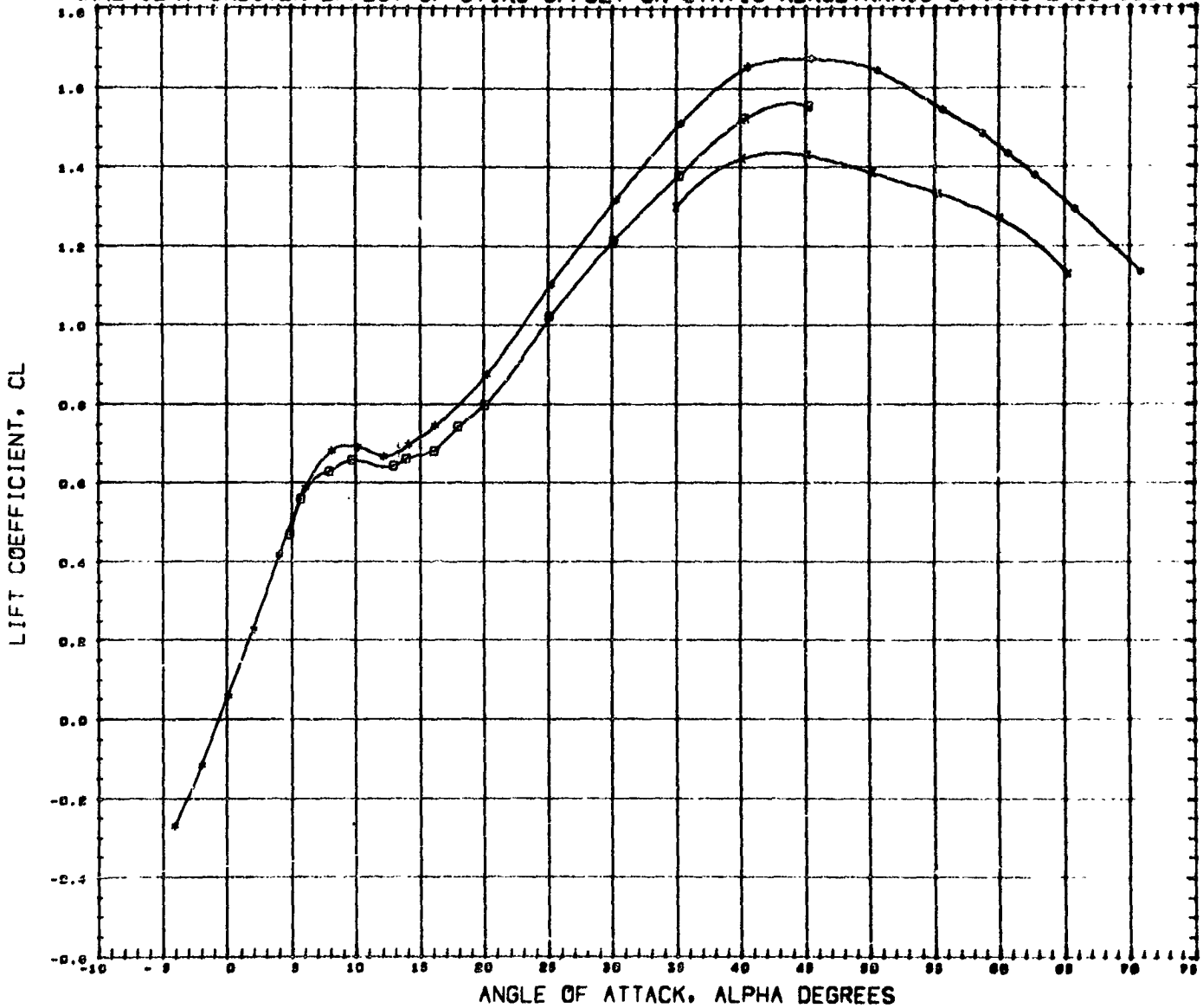
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| +      | NAAL 620 SSV-ILRV STRAIGHT WING | RC4013   | 11 AUG 70 | 0.250 |
| x      | NAAL 620 SSV-ILRV STRAIGHT WING | RC4075   | 11 AUG 70 |       |
| o      | NAAL 620 SSV-ILRV STRAIGHT WING | RC4073   | 11 AUG 70 |       |

REFERENCE FILE

NAAL 620 NA-70-351

| REFERENCE INFORMATION |                |
|-----------------------|----------------|
| REFS                  | 1.70000E10-01  |
| REFL                  | 1.97379E10-01  |
| REFD                  | 1.13300E10-00  |
| INRP                  | 6.13200E10-00  |
| YNRP                  | 0.00000E+00    |
| ZNRP                  | -3.04000E10-01 |
| SCALE                 | 7.1 000E10-01  |

# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS

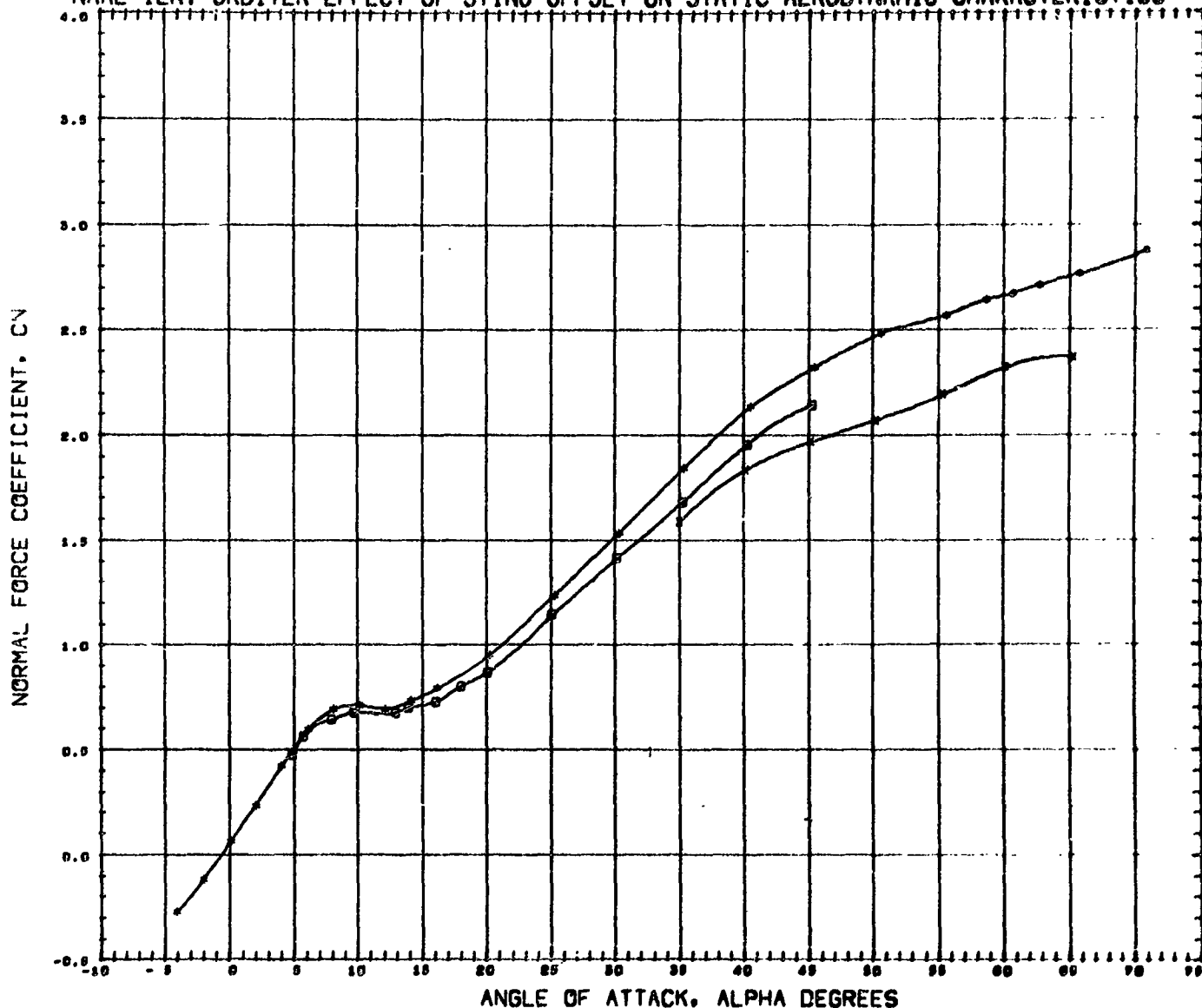


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4087) | 11 AUG 70 | 0.250 |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4120) | 11 AUG 70 |       |
| o      | NAAL 020 BSV-ILRV STRAIGHT WING | (RC4110) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                     |
|-----------------------|---------------------|
| REFD                  | 1.70000E+01 80.FT.  |
| REFL                  | 1.97500E+01 INCHES  |
| REFB                  | 1.13200E+01 INCHES  |
| YNRP                  | 0.13200E+01 INCHES  |
| YNRP                  | 0.00000E+01 INCHES  |
| YNRP                  | -3.04000E+01 INCHES |
| SCALE                 | 7.01000E+01 SCALE   |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS



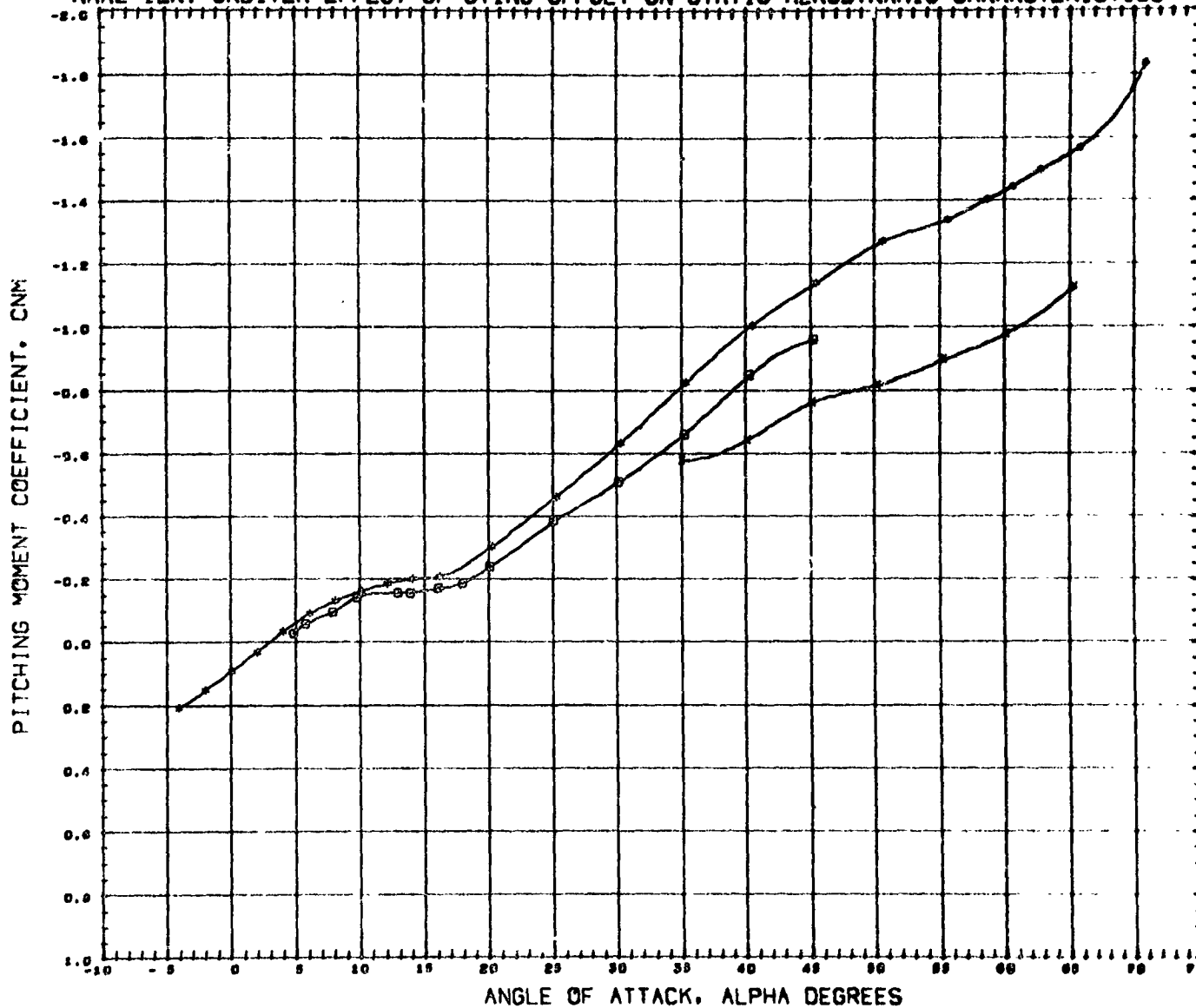
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W9 M12 (RC4027)    | 11 AUG 70 | 0.280 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W9 M12 (RC4120)    | 11 AUG 70 |       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W9 M12 V3 (RC4130) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 029 NA-70-391

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000X10-01  | 88.FY. |
| REFL                  | 1.57370X10-01  | INCHES |
| REFD                  | 1.13300X10-00  | INCHES |
| INRP                  | 0.13000X10-00  | INCHES |
| YNRP                  | 0.00000X10-01  | INCHES |
| ZNRP                  | -3.00000X10-01 | INCHES |
| SCALE                 | 7.01000X10-01  | SCALE  |

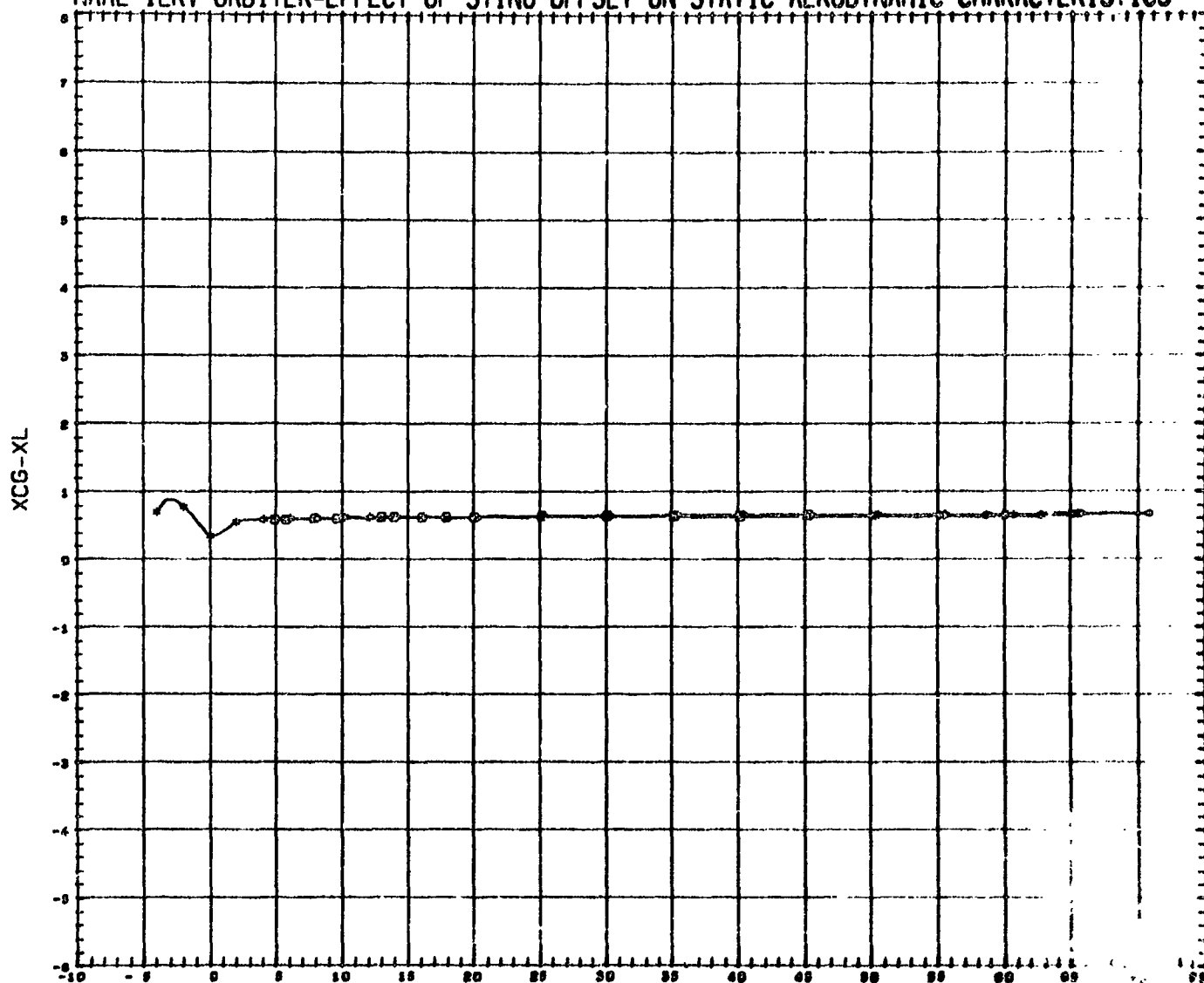
# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION                    | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|----------------------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W9 H12    | (RC4027) | 11 AUG 70 | 0.250 | REFD 1.700000E-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W9 H12    | (RC4120) | 11 AUG 70 |       | REFL 1.073700E-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W9 H12 V5 | (RC4116) | 11 AUG 70 |       | REFD 1.133000E-00 INCHES  |
|        |                                              |          |           |       | XMRP 0.132000E-00 INCHES  |
|        |                                              |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                              |          |           |       | ZMRP -3.040000E-01 INCHES |
|        |                                              |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | Q, %     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|--------------|----------|-----------|-----------------------|
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 86 W9 N12    | (RC4027) | 11 AUG 70 | 0.250                 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 86 W9 N12    | (RC4120) | 11 AUG 70 |                       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 86 W9 N12 Y9 | (RC4118) | 11 AUG 70 |                       |

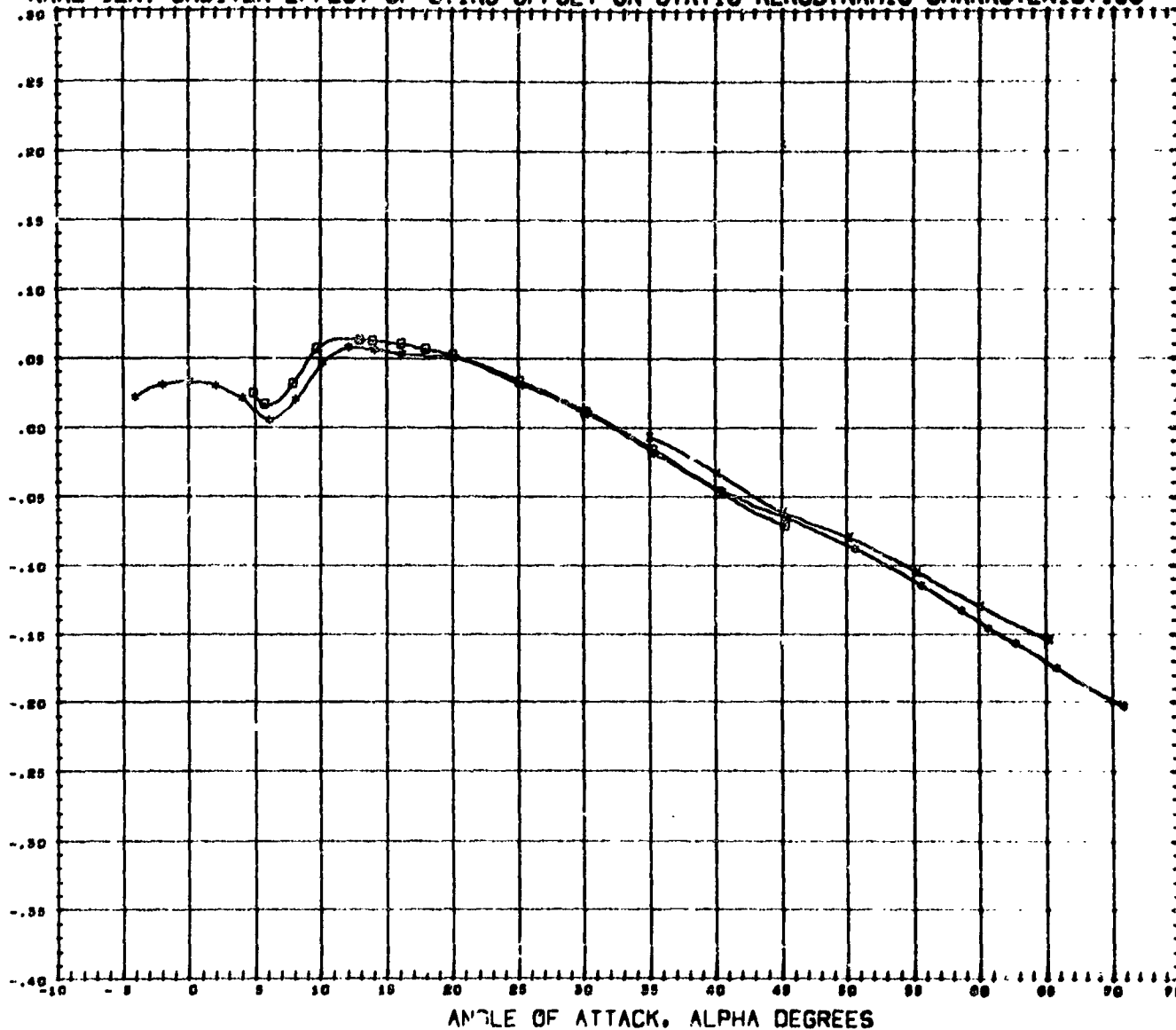
  

|       |               |        |
|-------|---------------|--------|
| REFS  | 1.700000E-01  | 00.71  |
| REFL  | 1.973700E-01  | INCHES |
| REFD  | 1.133000E-00  | INCHES |
| VMFP  | 0.132000E-00  | INCHES |
| VMFP  | 0.000000E-01  | INCHES |
| VMFP  | -3.000000E-01 | INCHES |
| SCALE | 7.010000E-01  | SCALE  |

REFERENCE FILE NAAL 029 NA-70-353

# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS

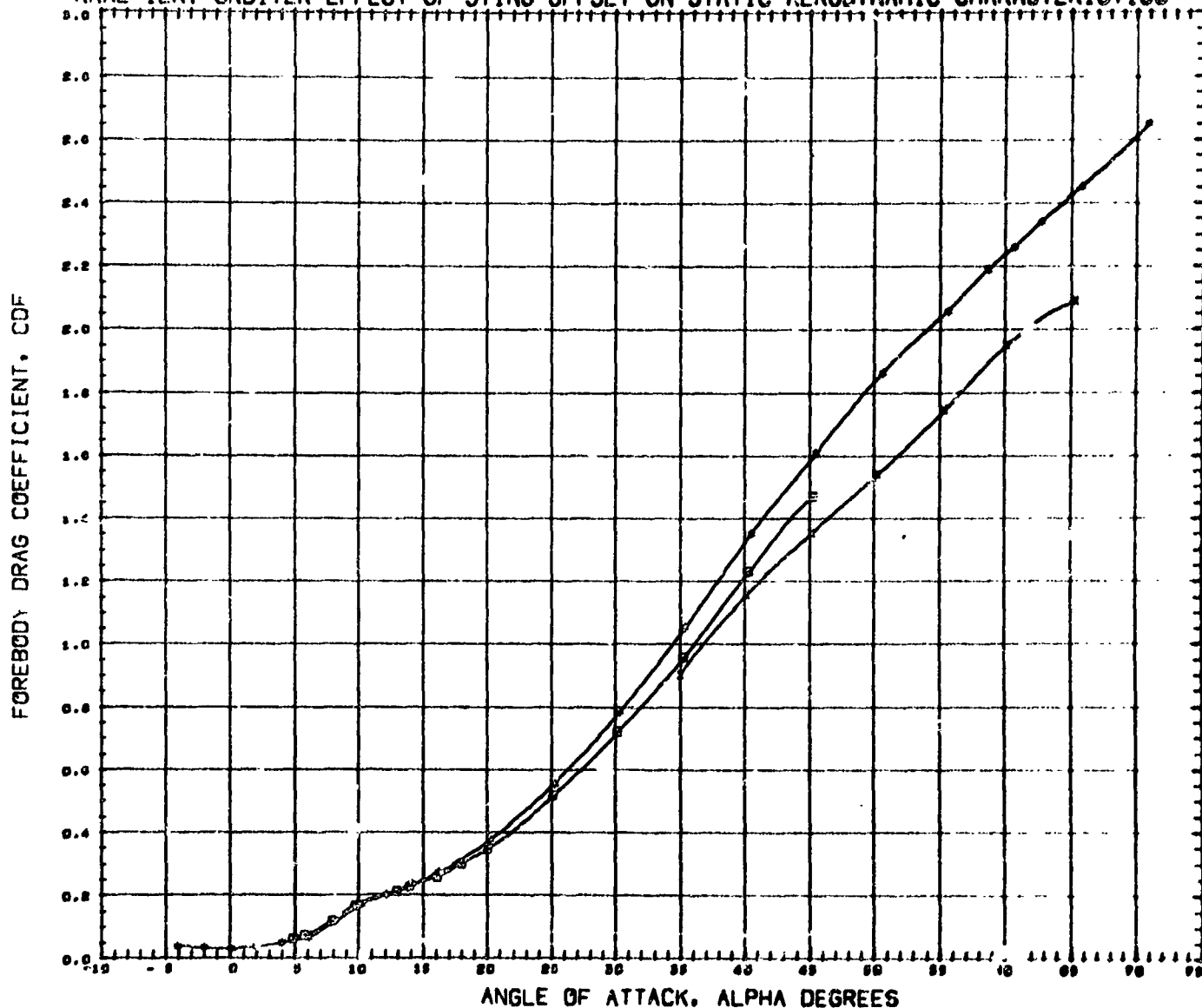
FOREBODY AXIAL FORCE COEFFICIENT, CAFORE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4027   | 11 AUG 70 | 0.250 | REFS 1.700000E-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4120   | 11 AUG 70 |       | REFL 1.073700E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4110   | 11 AUG 70 |       | REFS 1.133000E-01 INCHES  |
|        |                                 |          |           |       | HNRP 0.132000E-01 INCHES  |
|        |                                 |          |           |       | YNRP 0.000000E-01 INCHES  |
|        |                                 |          |           |       | ZNRP -3.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

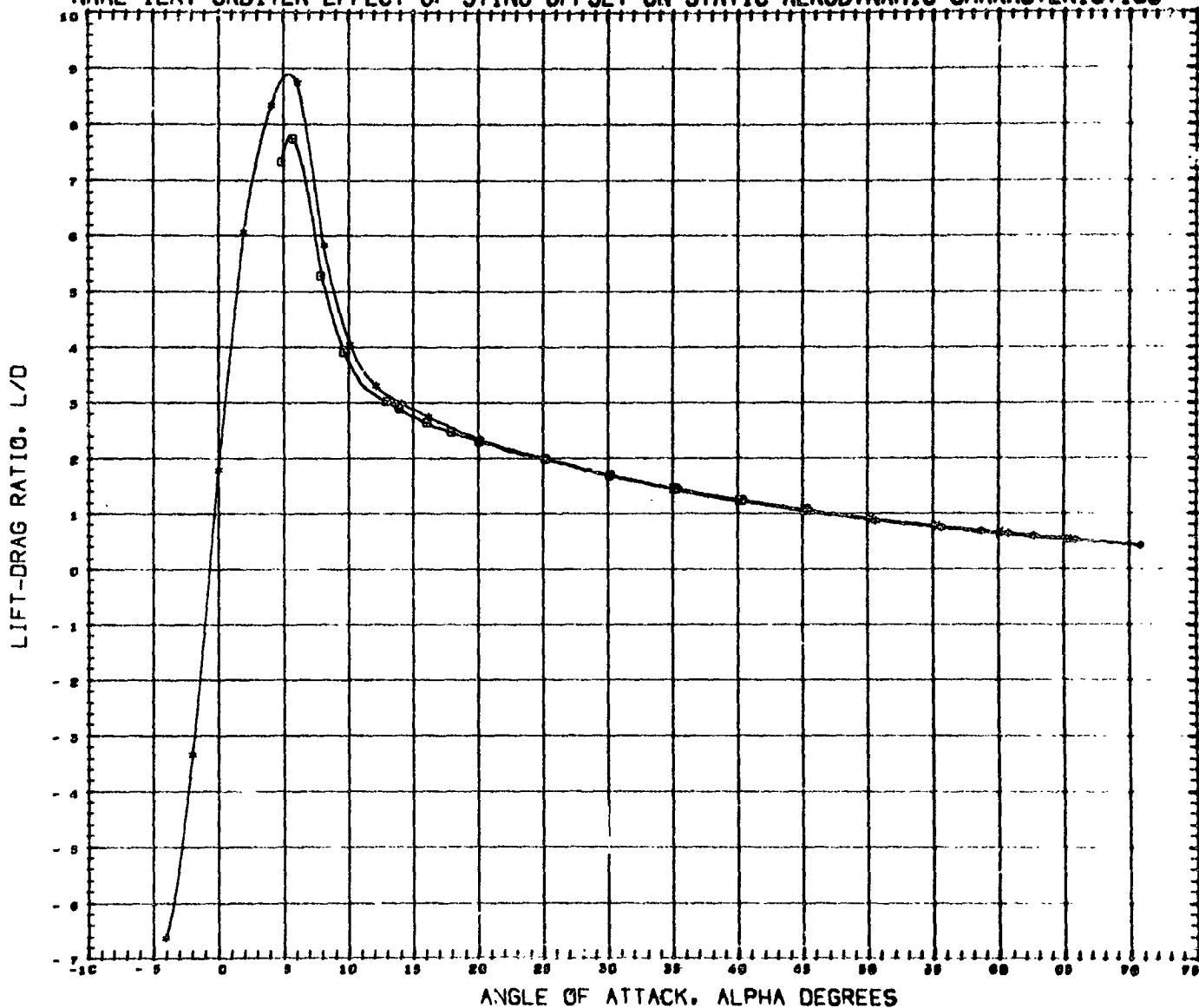
# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION       | SS WD MISE    | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|---------------|----------|-----------|-------|---------------------------|
| A      | NAAL 026 SSV-ILRV STRAIGHT WING | SS WD MISE    | (RC4027) | 11 AUG 70 | 0.250 | REFS 1.700000E-01 50.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WD MISE    | (RC4120) | 11 AUG 70 |       | REFL 1.075000E-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | SS WD MISE VS | (RC4110) | 11 AUG 70 |       | REFS 1.133000E-01 INCHES  |
|        |                                 |               |          |           |       | KMRP 0.133000E-01 INCHES  |
|        |                                 |               |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                 |               |          |           |       | ZMRP -3.049000E-01 INCHES |
|        |                                 |               |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING OFFSET ON STATIC AERODYNAMIC CHARACTERISTICS

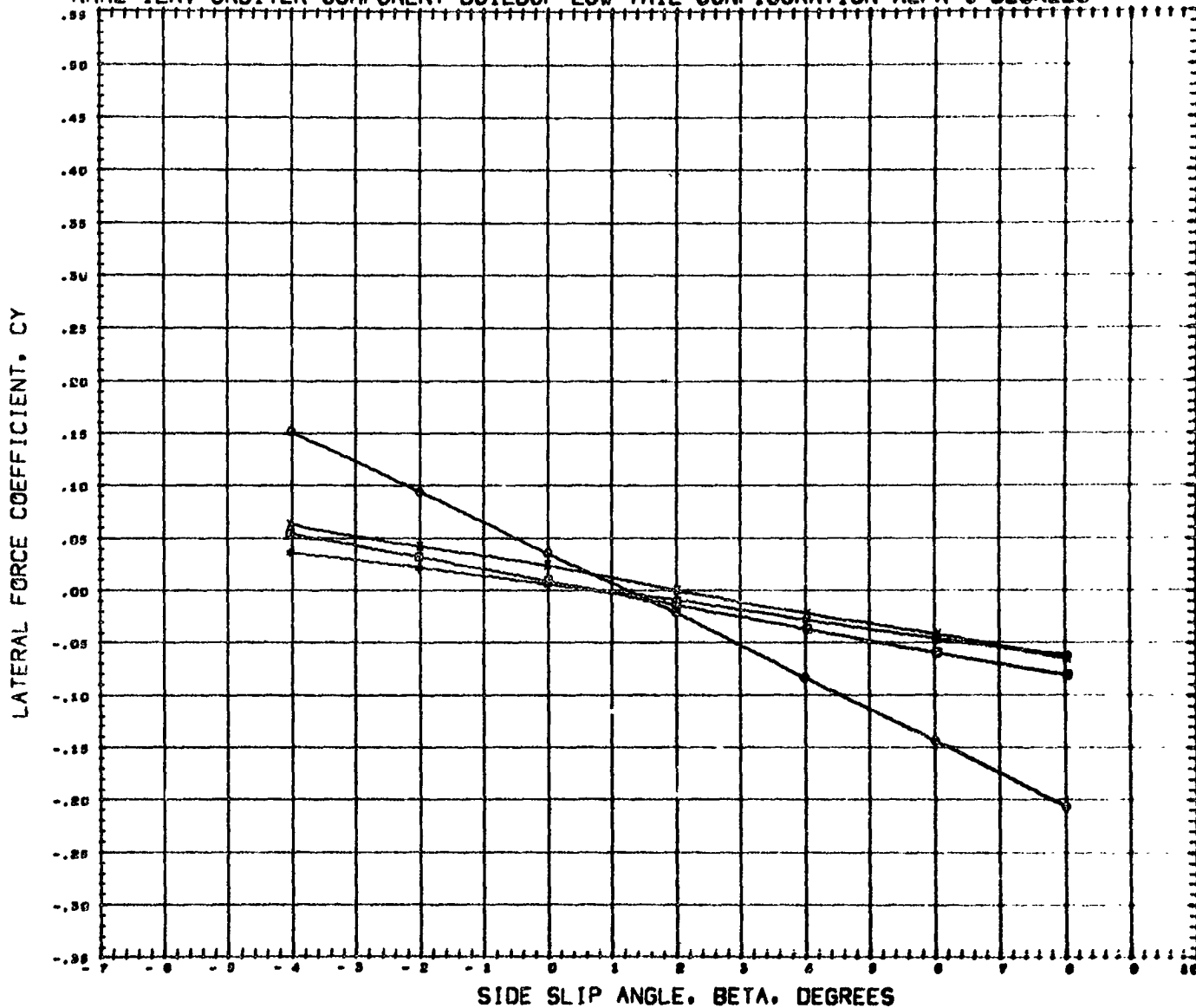


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 (RC4027)    | 11 AUG 70 | 0.250 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 (RC4120)    | 11 AUG 70 |       |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W0 M12 V5 (RC4110) | 11 AUG 70 |       |

REFERENCE FILE NAAL 020 NA-70-351

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E-01 00.FT.  |
| REFL                  | 1.973700E-01 INCHES  |
| REFS                  | 1.133000E-01 INCHES  |
| YNRP                  | 0.133000E-01 INCHES  |
| YNRP                  | 0.000000E-01 INCHES  |
| YNRP                  | -3.040000E-01 INCHES |
| SCALE                 | 7.610000E-01 SCALE   |

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=0 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|--------------|----------|-----------|-----------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 86           | (RC400E) | 11 AUG 70 | 0.859                 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W8 N13    | (RC401E) | 11 AUG 70 |                       |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W8        | (RC4017) | 11 AUG 70 |                       |
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W8 N13 V8 | (RC4016) | 11 AUG 70 |                       |
| .      | NAAL 020 SSV-ILRV STRAIGHT WING |              |          |           |                       |

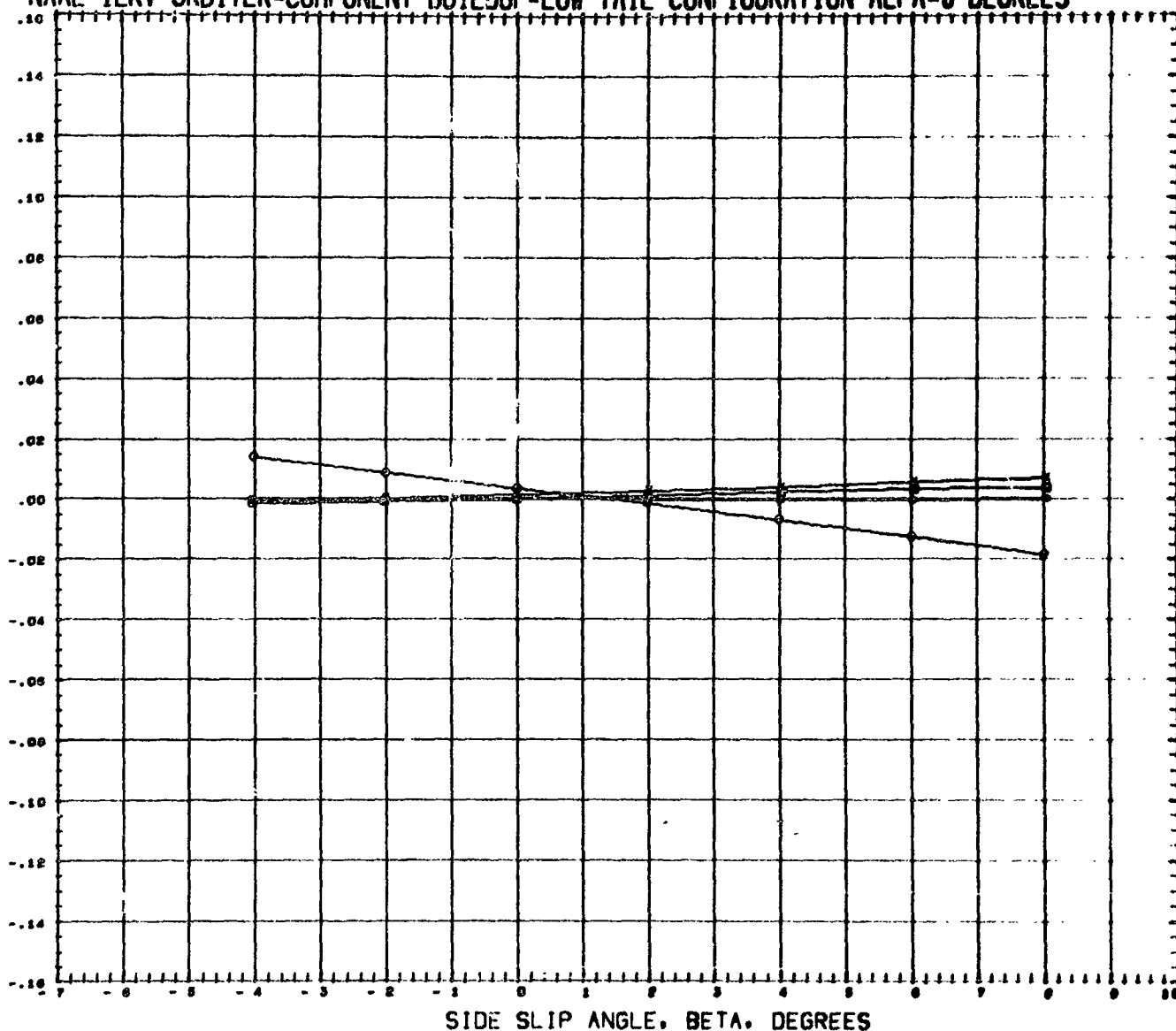
REFERENCE FILE

NAAL 020 NA-70-351

REF8 1.70000X10-01 80.FT.  
 REF1 1.97370X10-01 INCHES  
 REF2 1.13390X10-02 INCHES  
 ZMRP 0.13200X10-02 INCHES  
 YMRP 0.00000X10-01 INCHES  
 ZMRP -3.04000X10-01 INCHES  
 SCALE 7.01000X10-01 SCALE

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=0 DEGREES

ROLLING MOMENT COEFFICIENT, CSL



| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING |

DATA SET DATE MACH

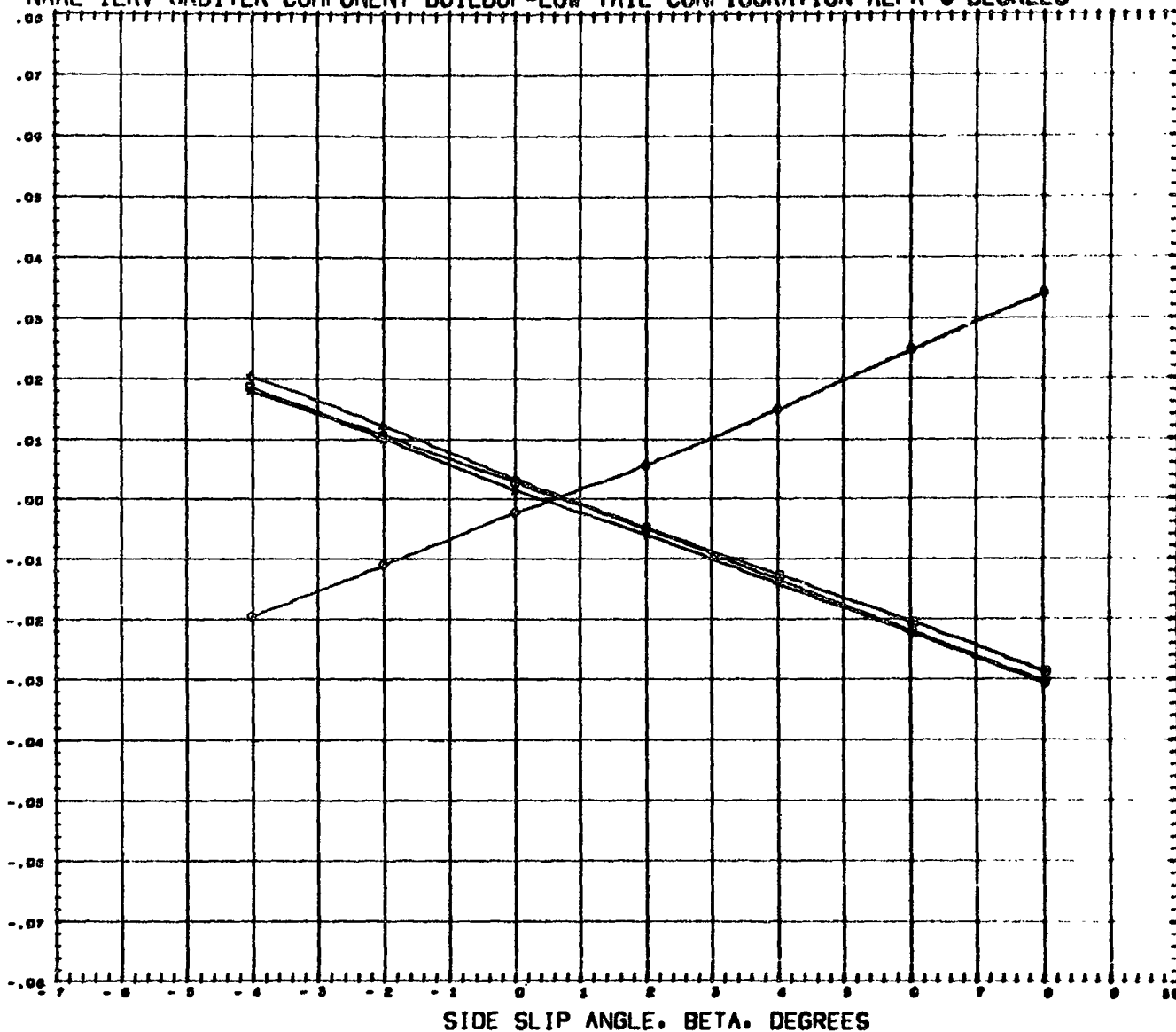
| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4002) | 11 AUG 70 | 0.250 |
| (RC4012) | 11 AUG 70 |       |
| (RC4017) | 11 AUG 70 |       |
| (RC4010) | 11 AUG 70 |       |

| REFERENCE INFORMATION     |
|---------------------------|
| REF0 1.700000E-01 50.FT.  |
| REF1 1.975700E-01 INCHES  |
| REF2 1.135000E-00 INCHES  |
| REF3 0.132000E-00 INCHES  |
| REF4 0.000000E-01 INCHES  |
| REF5 -3.040000E-01 INCHES |
| SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=0 DEGREES

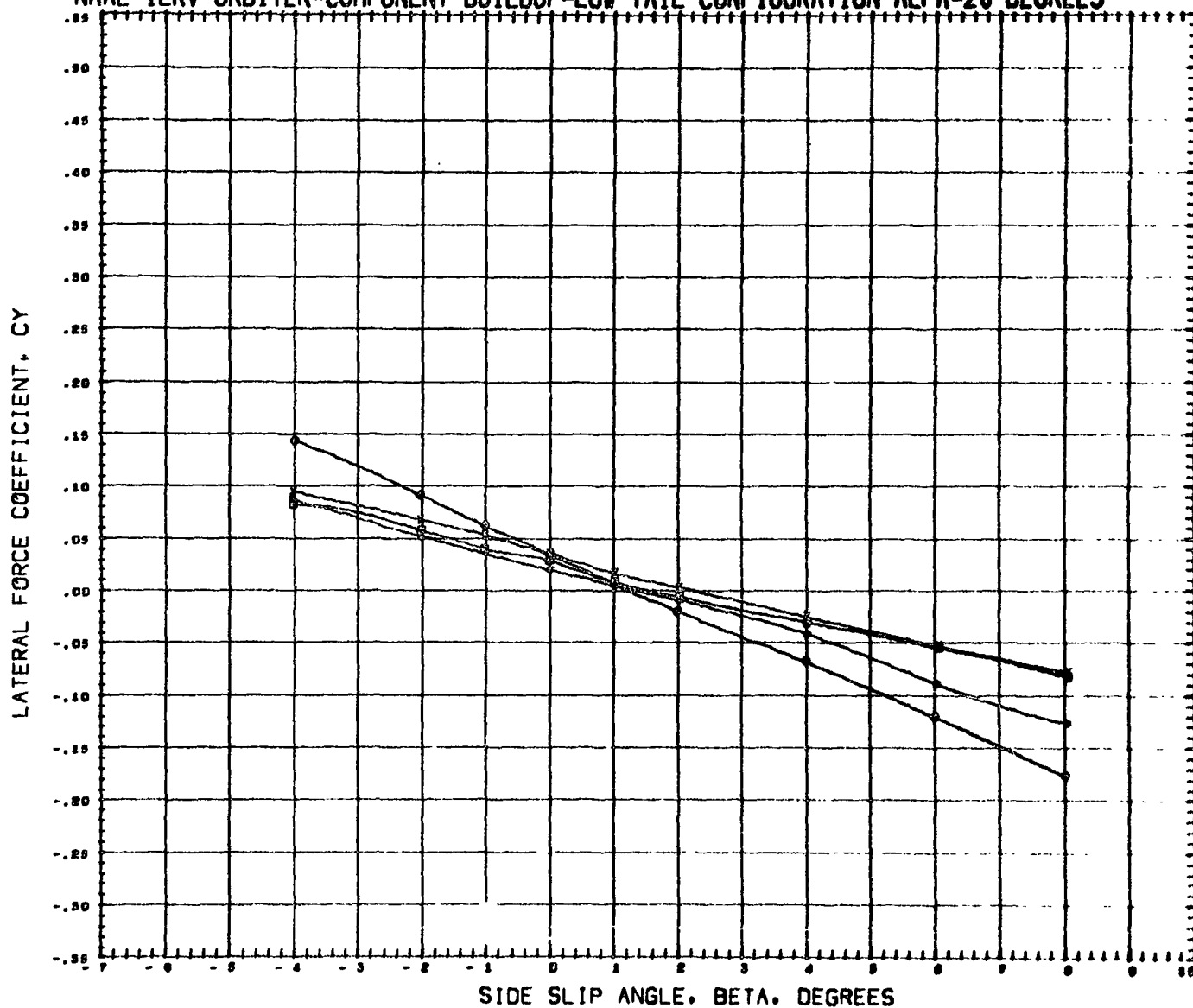
YAWING MOMENT COEFFICIENT, CWN



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | RC4002   | 11 AUG 70 | 0.259 | REFS 1.70000E10-01 SS.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | RC4012   | 11 AUG 70 |       | REFL 1.57370E10-01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | RC4017   | 11 AUG 70 |       | REFS 1.33300E10-00 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | RC4016   | 11 AUG 70 |       | KMRP 0.13200E10-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000E10-01 INCHES  |
|        |                                 |          |           |       | ZMRP -3.04000E10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

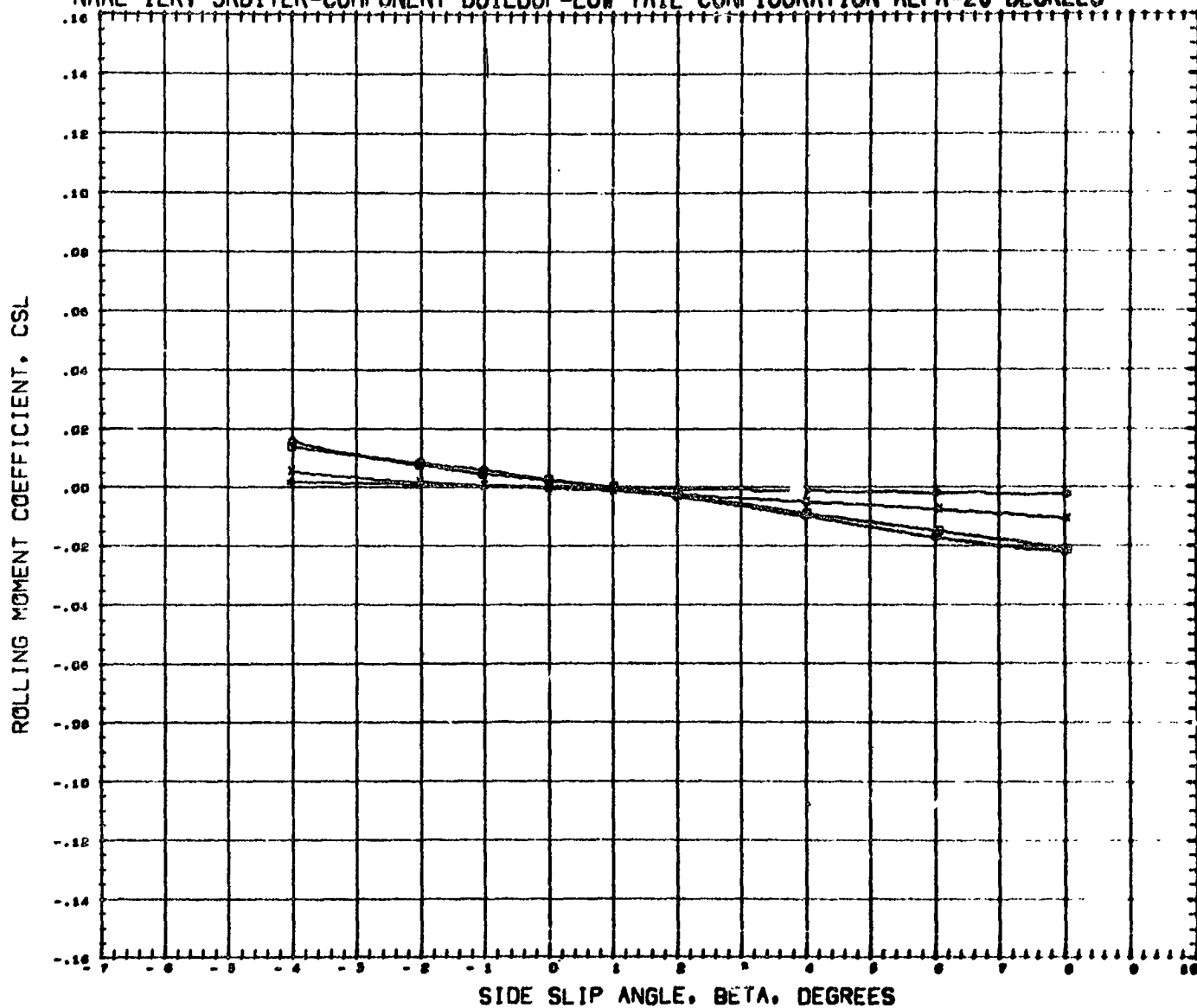
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=20 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|-----------------------|-----------|-------|--------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 (RC4003)           | 11 AUG 70 | 0.289 | REF0 1.70000E+01 00.71.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 (RC4000)        | 11 AUG 70 |       | REF1 1.97370E+01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 (RC4011)    | 11 AUG 70 |       | REF2 1.13300E+00 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5 (RC4015) | 11 AUG 70 |       | ENRP 0.13000E+00 INCHES  |
|        |                                 |                       |           |       | YNRP 0.00000E+00 INCHES  |
|        |                                 |                       |           |       | ZNRP -3.04000E+01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=20 DEGREES



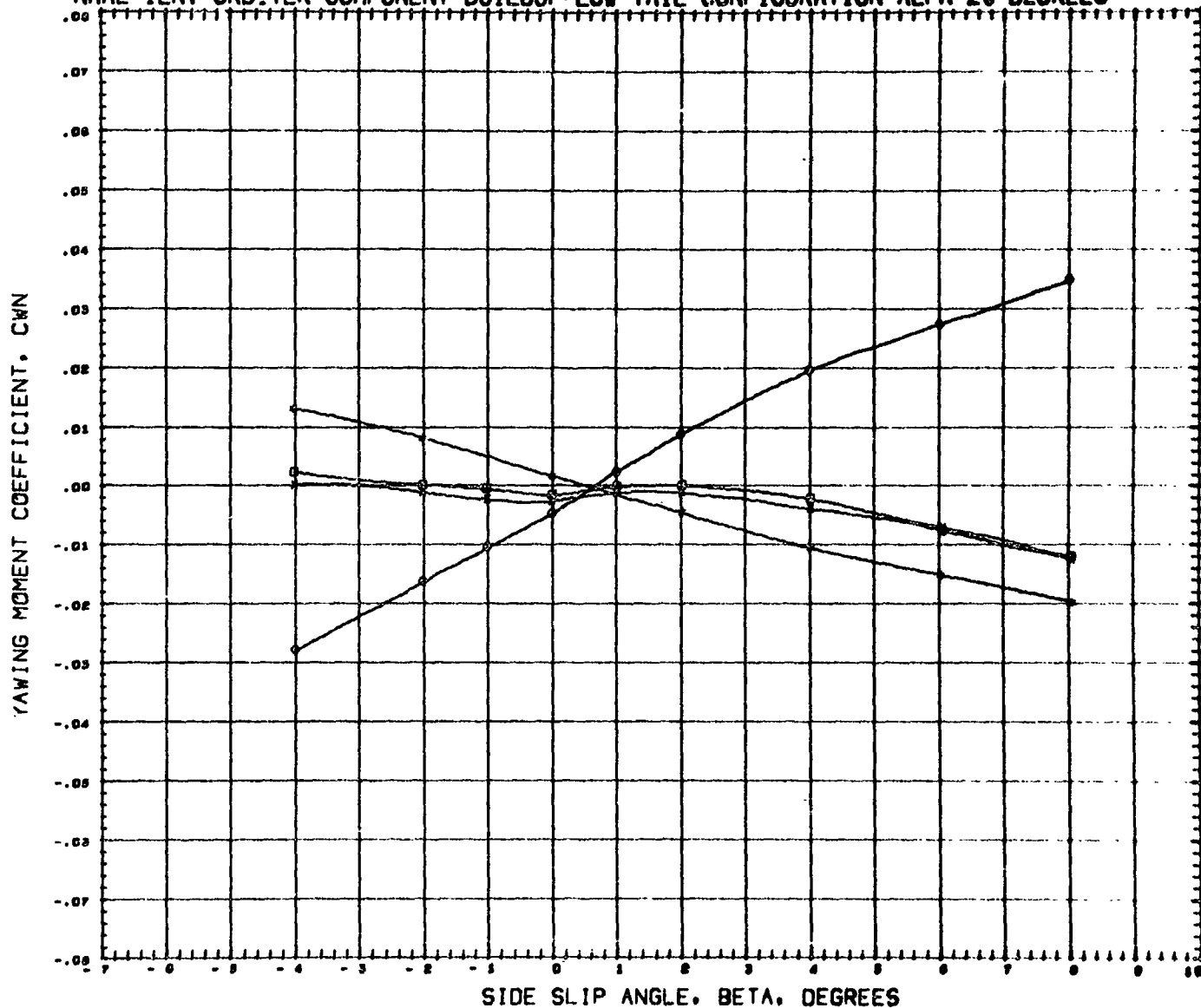
| SYMBOL | CONFIGURATION DESCRIPTION                    | DATA SET | DATE      | MACH  |
|--------|----------------------------------------------|----------|-----------|-------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING 86           | (RC4003) | 11 AUG 70 | 0.270 |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W8        | (RC4008) | 11 AUG 70 |       |
| B      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W8 M13    | (RC4011) | 11 AUG 70 |       |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W8 M13 V5 | (RC4015) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-351

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000010-01  | 88.77. |
| REFL                  | 1.07370010-01  | INCHES |
| REFD                  | 1.33300010-01  | INCHES |
| INRP                  | 0.33000010-00  | INCHES |
| INRP                  | 0.00000010-00  | INCHES |
| INRP                  | -3.04000010-01 | INCHES |
| SCALE                 | 7.01000010-03  | SCALE  |

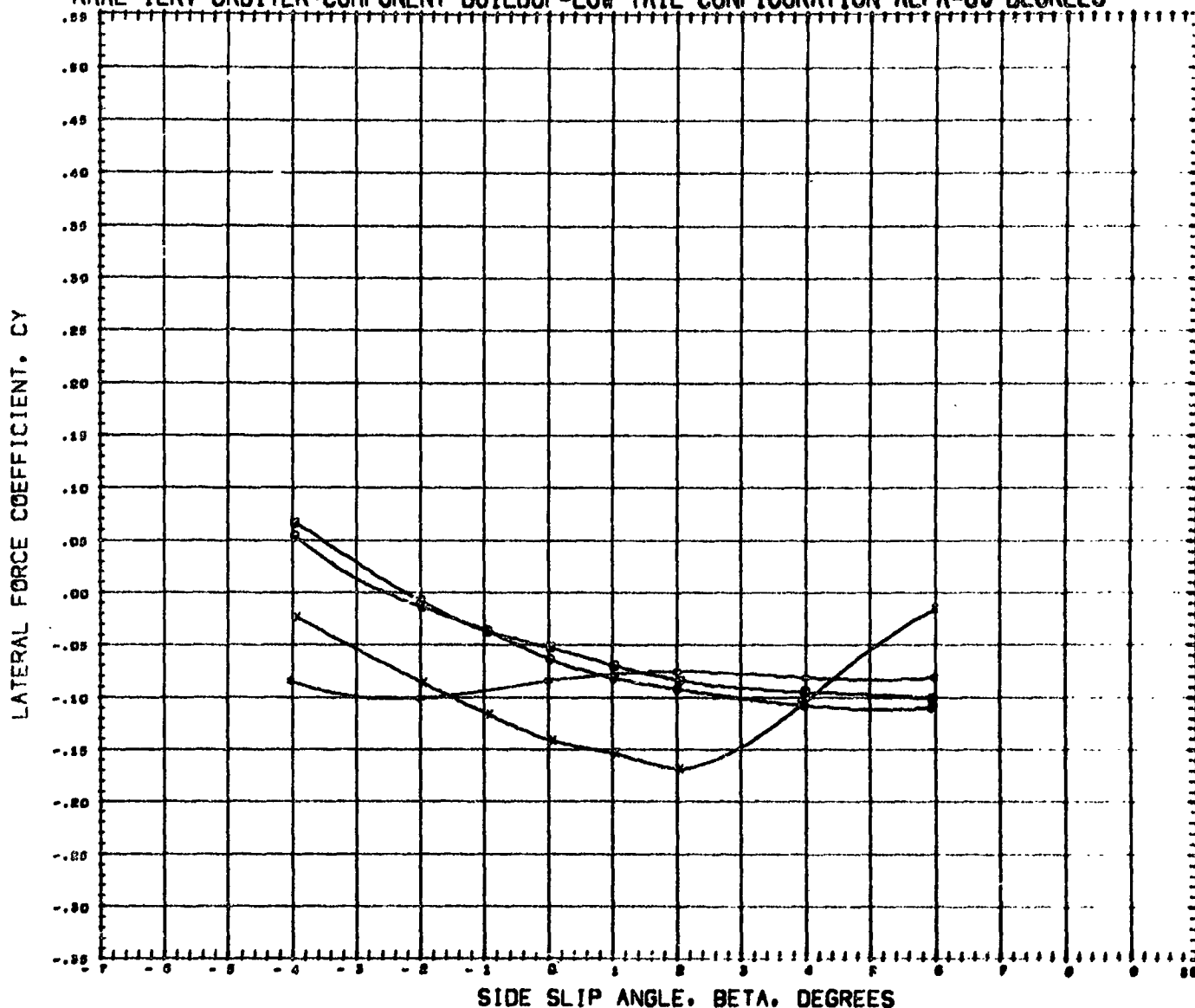
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=20 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6           | 11 AUG 70 | 0.250 | REF0 1.70000E10-01 88.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6        | 11 AUG 70 |       | REF1 1.97570E10-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H13    | 11 AUG 70 |       | REF2 1.13500E10-00 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 H13 V5 | 11 AUG 70 |       | KMRP 0.13000E10-00 INCHES  |
|        |                                 |              |           |       | YMRP 0.00000E10-01 INCHES  |
|        |                                 |              |           |       | ZMRP -3.04000E10-03 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

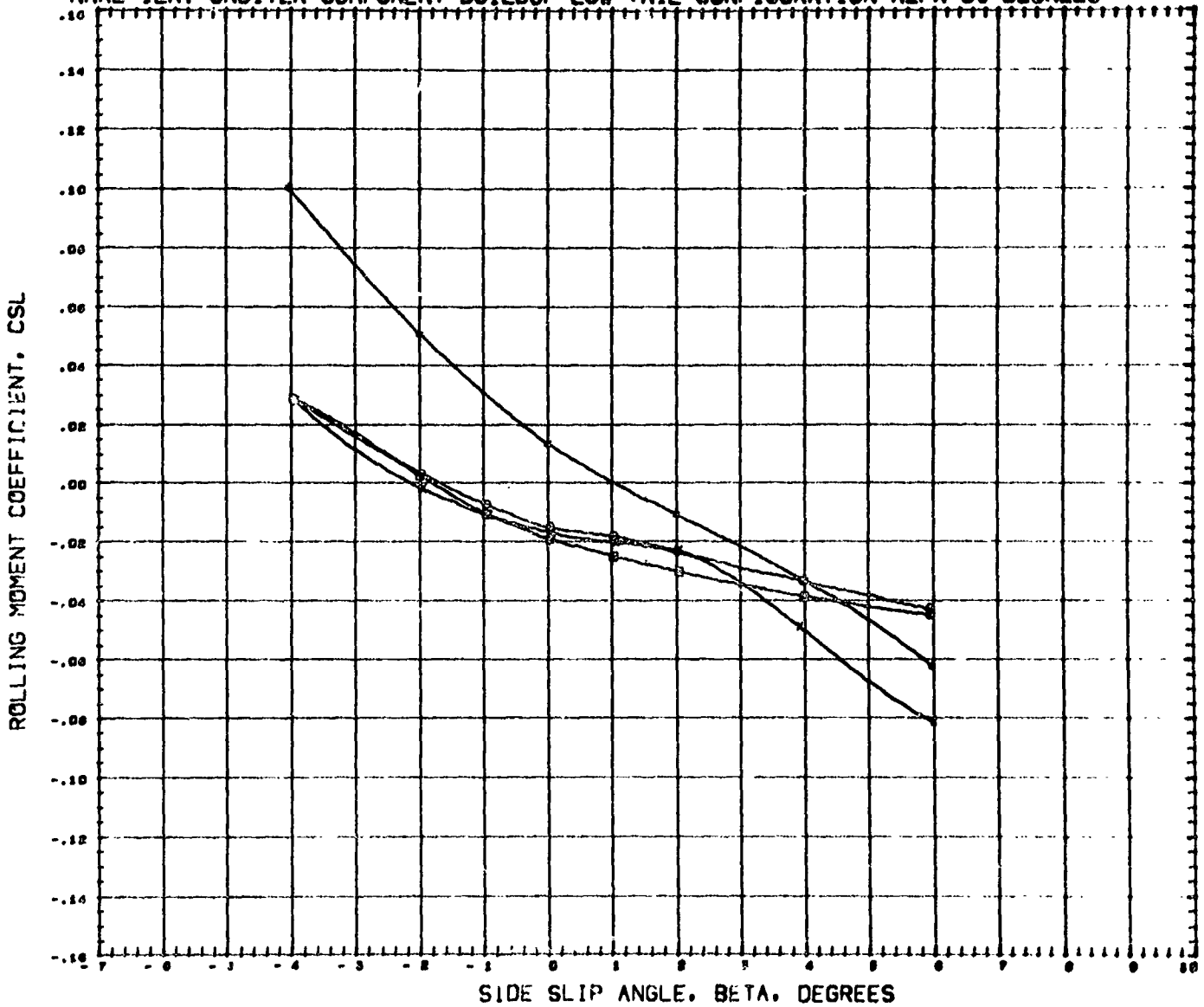
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=60 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 620 88V-ILRV STRAIGHT WING | 88           | 11 AUG 70 | 0.889 | REFS 1.70000E-01 88.71   |
| x      | NAAL 620 88V-ILRV STRAIGHT WING | 88 W6        | 11 AUG 70 |       | REFL 1.87370E-01 INCHES  |
| Q      | NAAL 620 88V-ILRV STRAIGHT WING | 88 W6 N13    | 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
| Q      | NAAL 620 88V-ILRV STRAIGHT WING | 88 W6 N13 V8 | 11 AUG 70 |       | FNRP 0.13300E-01 INCHES  |
|        |                                 |              |           |       | FNRP 0.00000E-01 INCHES  |
|        |                                 |              |           |       | FNRP -3.04000E-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 620 NA-70-351

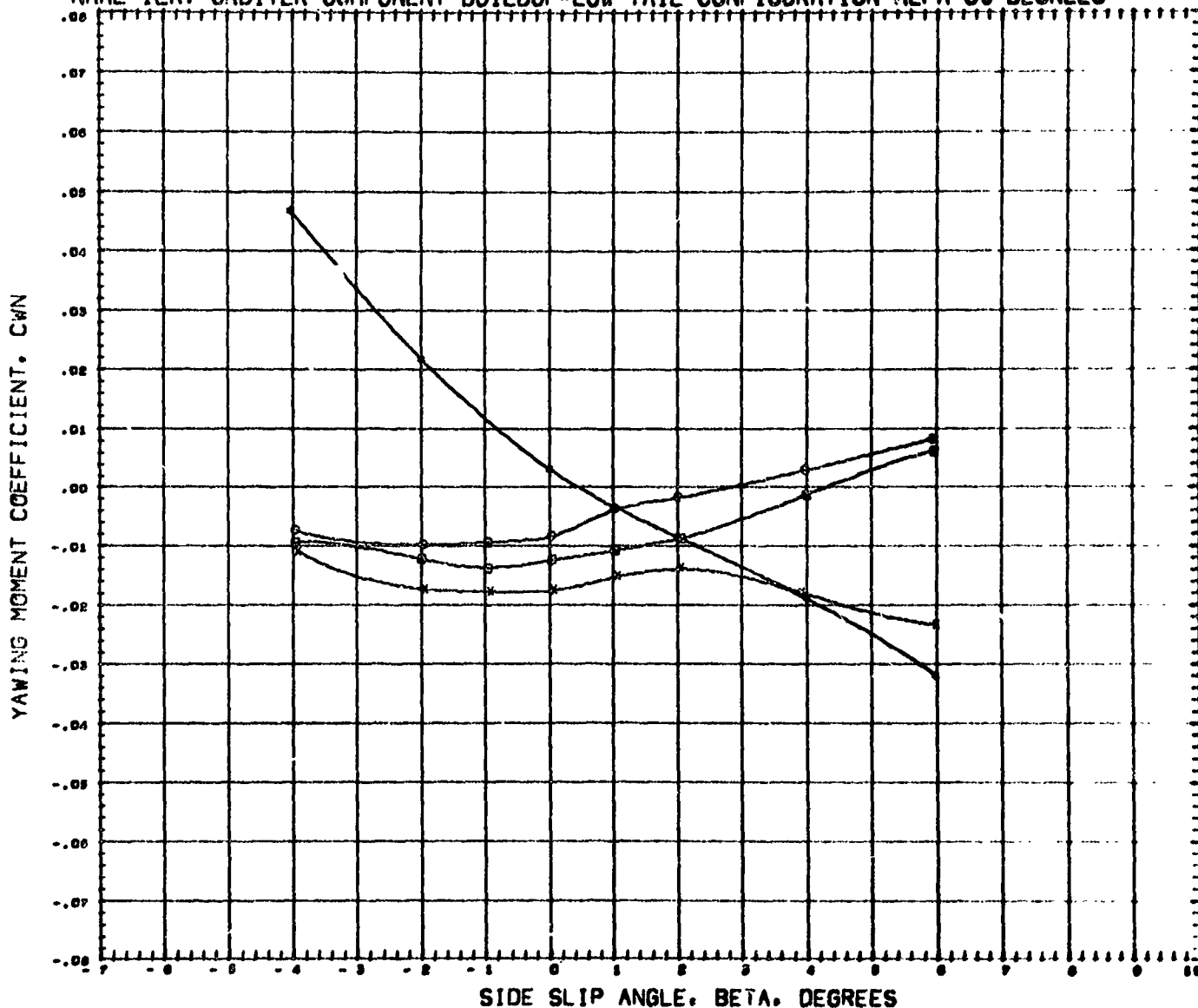
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=60 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | B6           | DATA SET | DATE      | MACH  | REFERENCE INFORMATION                  |
|--------|---------------------------------|--------------|----------|-----------|-------|----------------------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | B6           | (RC4004) | 11 AUG 70 | 0.250 | REFS 1.70000X10 <sup>-01</sup> 50.71.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W6        | (RC4007) | 11 AUG 70 |       | REFL 1.97370X10 <sup>-01</sup> INCHES  |
| g      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W6 H13    | (RC4010) | 11 AUG 70 |       | REFS 1.13300X10 <sup>-01</sup> INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B6 W6 H13 V5 | (RC4014) | 11 AUG 70 |       | ENRP 0.13800X10 <sup>-01</sup> INCHES  |
|        |                                 |              |          |           |       | YHRP 0.00000X10 <sup>-01</sup> INCHES  |
|        |                                 |              |          |           |       | ZHRP -3.04000X10 <sup>-01</sup> INCHES |
|        |                                 |              |          |           |       | SCALE 1.01000X10 <sup>-01</sup> SCALE  |

REFERENCE FILE NAAL 029 NA-70-331

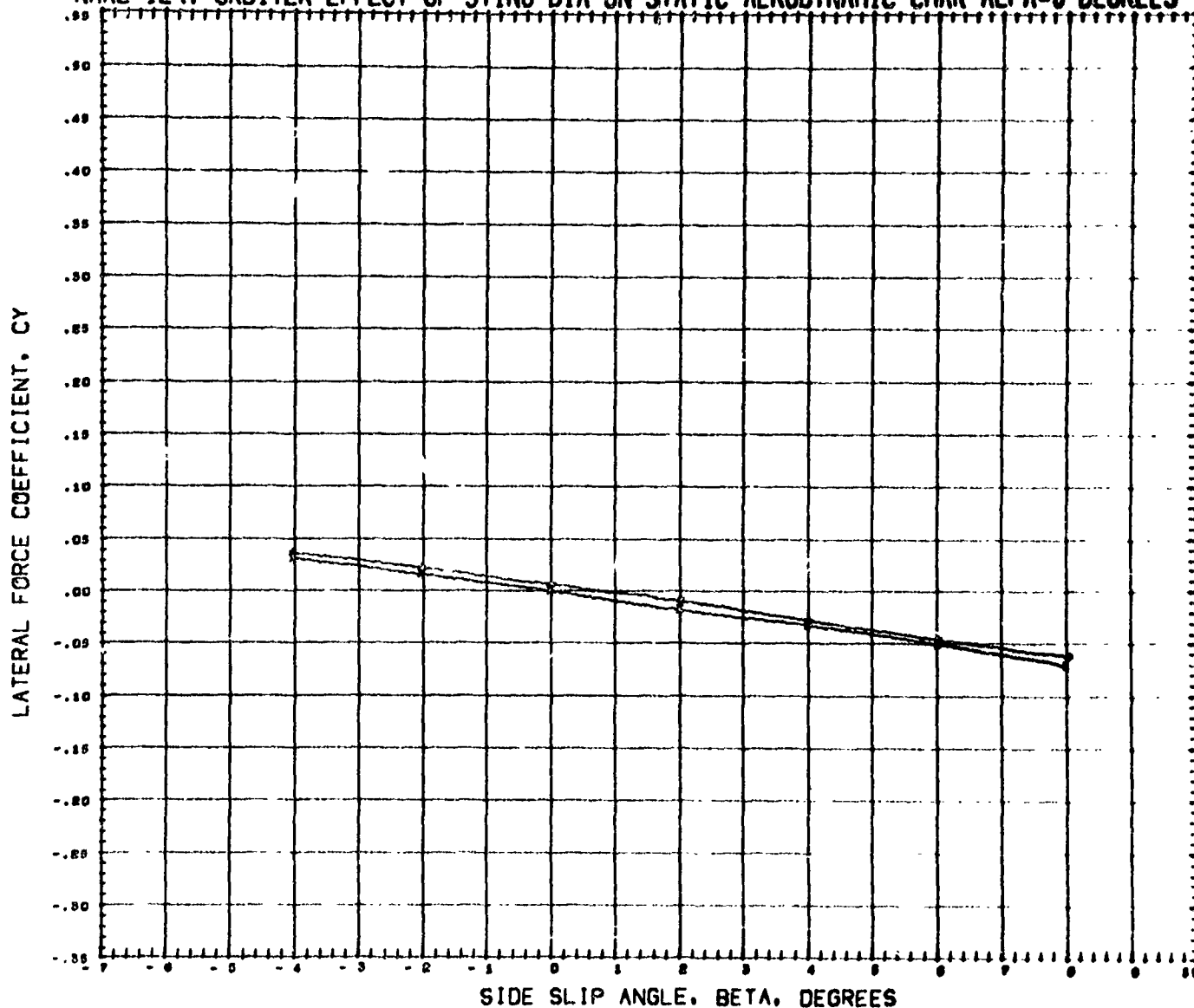
# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION ALFA=60 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | NACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| ●      | NAAL 020 BSV-ILRV STRAIGHT WING | RC4004   | 11 AUG 70 | 0.850 | REFS 1.700000E-01 00.FT.  |
| ×      | NAAL 020 BSV-ILRV STRAIGHT WING | RC4007   | 11 AUG 70 |       | REFL 1.073700E-01 INCHES  |
| □      | NAAL 020 BSV-ILRV STRAIGHT WING | RC4010   | 11 AUG 70 |       | REFD 1.120000E-01 INCHES  |
| ◇      | NAAL 020 BSV-ILRV STRAIGHT WING | RC4014   | 11 AUG 70 |       | ENRP 0.100000E-01 INCHES  |
|        |                                 |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                 |          |           |       | ZMRP -3.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=0 DEGREES



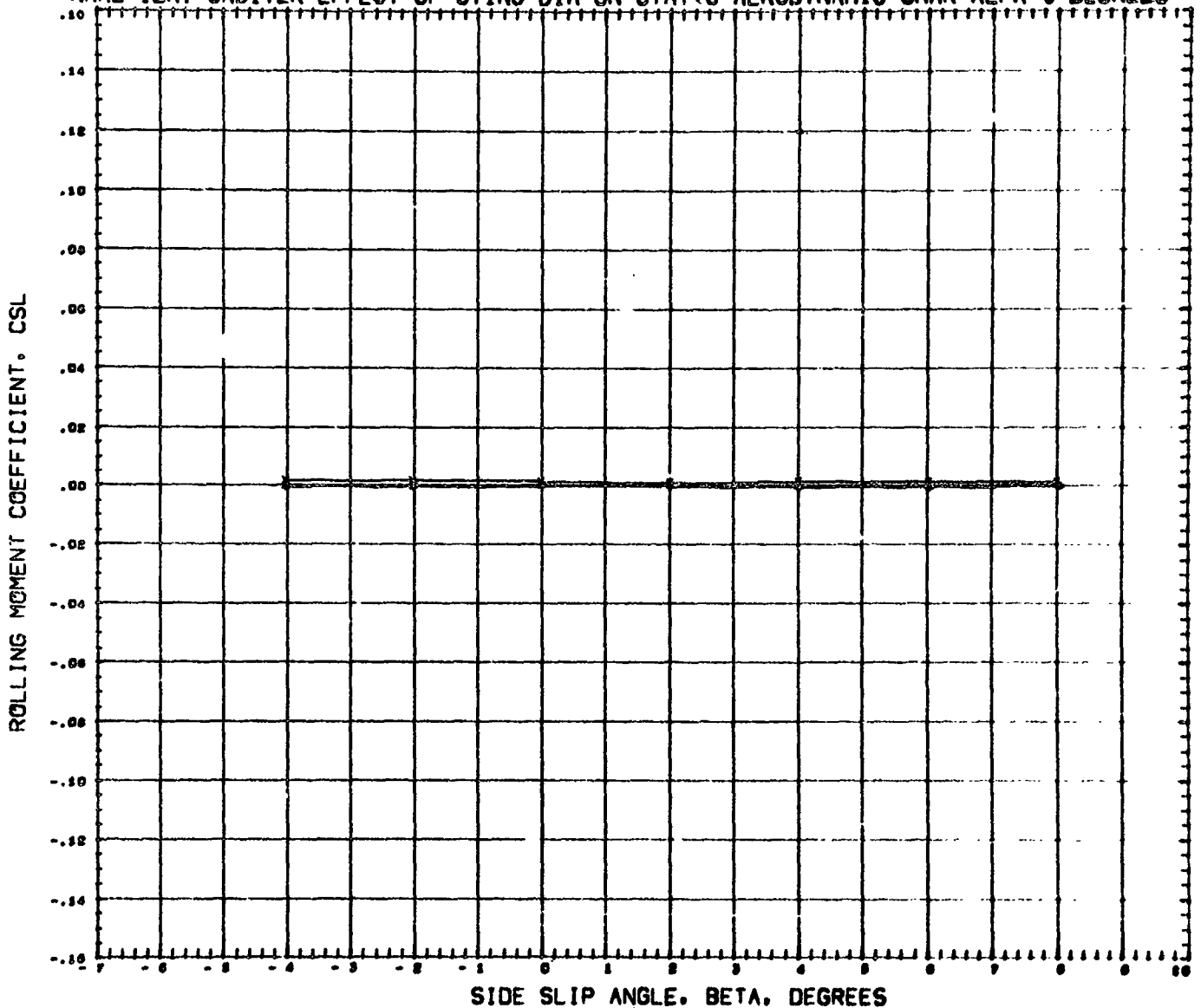
| SYMBOL | CONFIGURATION DESCRIPTION       | SS |
|--------|---------------------------------|----|
| O      | NAAL 020 BSV-ILRV STRAIGHT WING | 00 |
| X      | NAAL 020 BSV-ILRV STRAIGHT WING | 00 |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4002) | 11 AUG 70 | 0.250 |
| (RC4004) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000X10-01  | 00.FY. |
| REFL                  | 1.07370X10-01  | INCHES |
| REFD                  | 1.13800X10-00  | INCHES |
| YMRP                  | 0.13200X10-00  | INCHES |
| YMRP                  | 0.00000X10-01  | INCHES |
| ZMRP                  | -3.04000X10-01 | INCHES |
| SCALE                 | 1.01000X10-03  | SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=0 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| O      | NAAL 620 SSV-ILRV STRAIGHT WING |
| X      | NAAL 620 SSV-ILRV STRAIGHT WING |

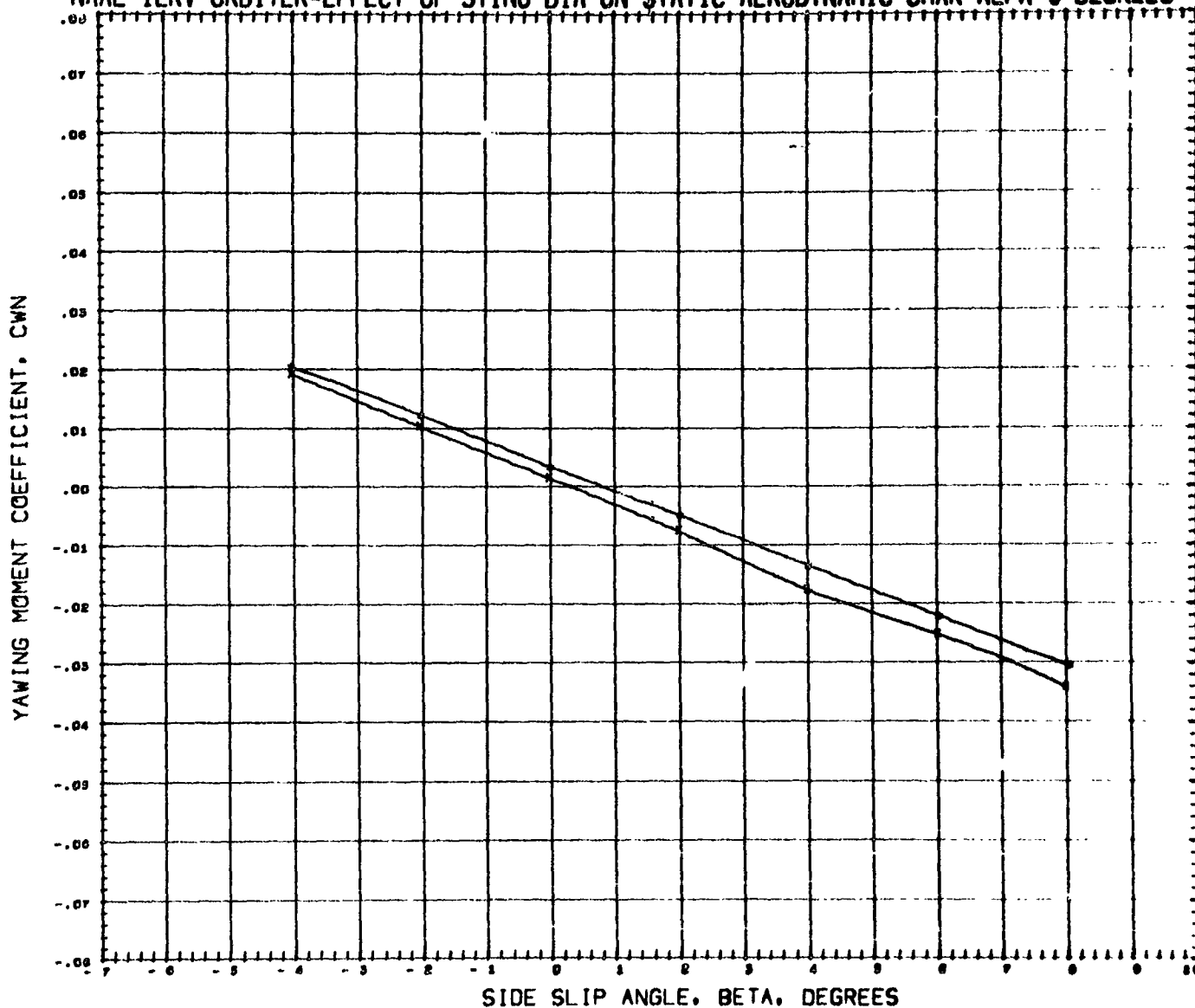
| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4002) | 11 AUG 70 | 0.250 |
| (RC4004) | 11 AUG 70 |       |

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFD                  | 1.700000E-01  | 50.77. |
| REFL                  | 1.673700E-01  | INCHES |
| REFD                  | 1.153000E-01  | INCHES |
| YMRP                  | 0.000000E+00  | INCHES |
| YMRP                  | 0.000000E+00  | INCHES |
| ZMRP                  | -3.040000E-01 | INCHES |
| SCALE                 | 7.010000E-01  | SCALE  |

REFERENCE FILE

NAAL 620 NA-70-391

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=0 DEGREES



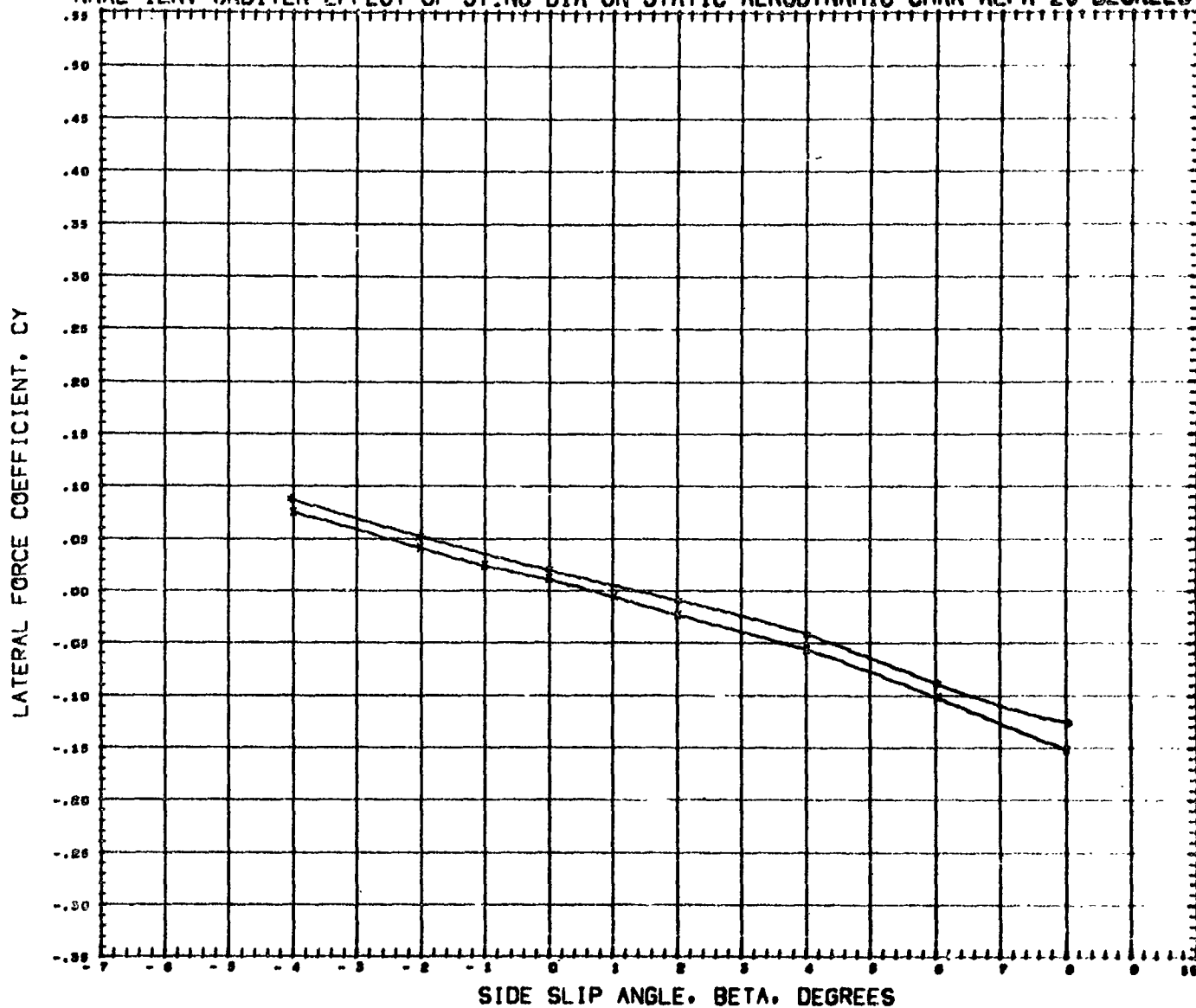
| SYMBOL | CONFIGURATION DESCRIPTION       | SS |
|--------|---------------------------------|----|
| *      | NAAL 629 SSV-ILRV STRAIGHT WING | 88 |
| X      | NAAL 629 SSV-ILRV STRAIGHT WING | 88 |

| DATA SET | DATE      | NACH  |
|----------|-----------|-------|
| (RC4002) | 11 AUG 70 | 0.250 |
| (RC4004) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000X10-01  | 88.FY. |
| REFL                  | 1.87370X10-01  | INCHES |
| REFS                  | 1.13300X10-00  | INCHES |
| YMRP                  | 0.13800X10-00  | INCHES |
| YMRP                  | 0.00000X10-00  | INCHES |
| YMRP                  | -3.04000X10-01 | INCHES |
| SCALE                 | 7.01000X10-01  | SCALE  |

REFERENCE FILE NAAL 629 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=20 DEGREES

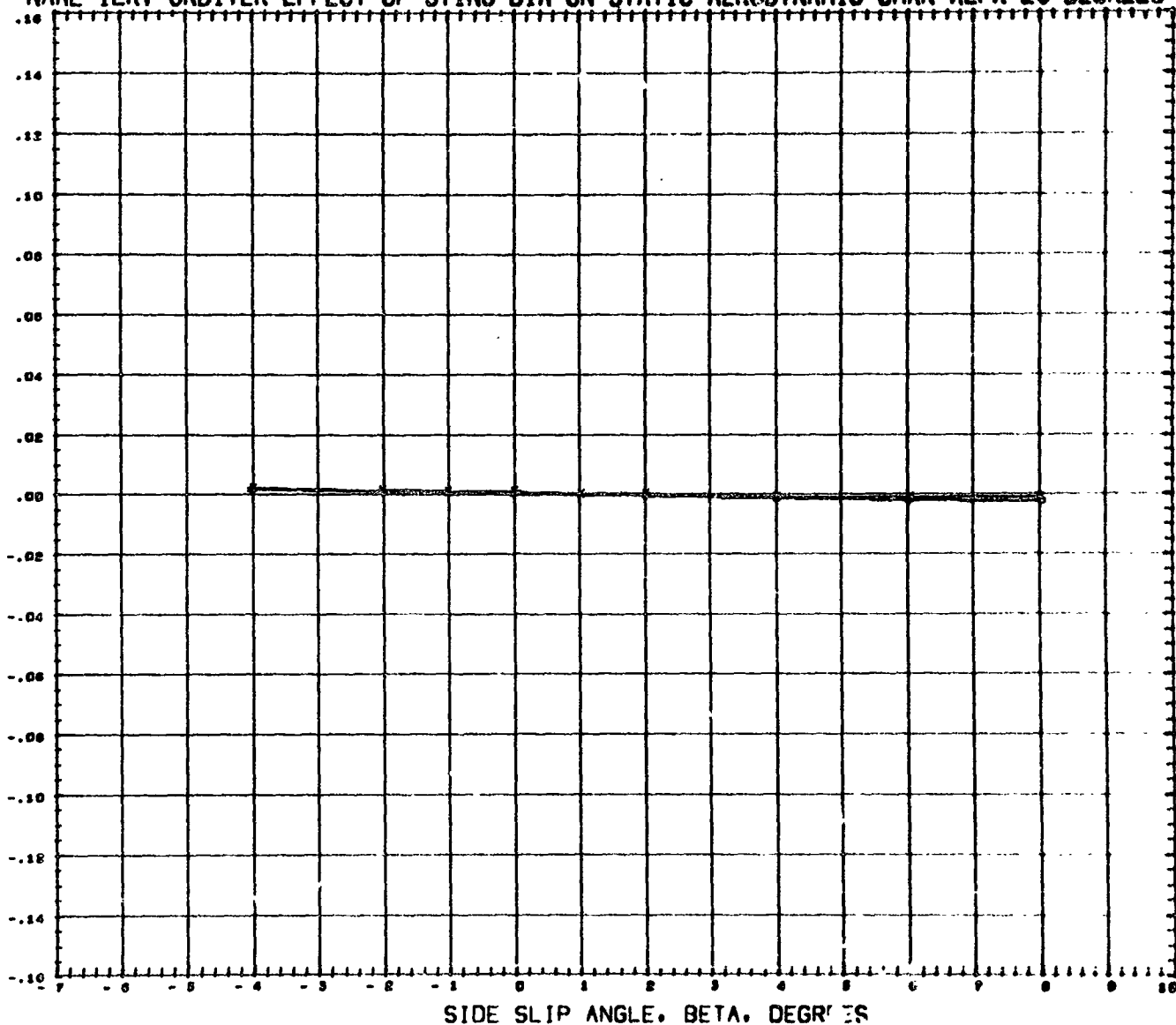


| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|------------------------------------|----------|-----------|-------|----------------------------|
| o      | NAAL 029 SSV-ILRV STRAIGHT WING 88 | (RC4003) | 11 AUG 70 | 0.859 | REFS 1.70000E10-01 88.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING 89 | (RC4006) | 11 AUG 70 |       | REFL 1.67370E10-01 INCHES  |
|        |                                    |          |           |       | REFS 1.13300E10-00 INCHES  |
|        |                                    |          |           |       | YNRP 0.13000E10-00 INCHES  |
|        |                                    |          |           |       | YNRP 0.00000E10-01 INCHES  |
|        |                                    |          |           |       | YNRP -3.04000E10-01 INCHES |
|        |                                    |          |           |       | SCALE 7.01000E10-03 SCALE  |

REFERENCE FILE NAAL 029 NA-70-352

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=20 DEGREES

ROLLING MOMENT COEFFICIENT, CSL



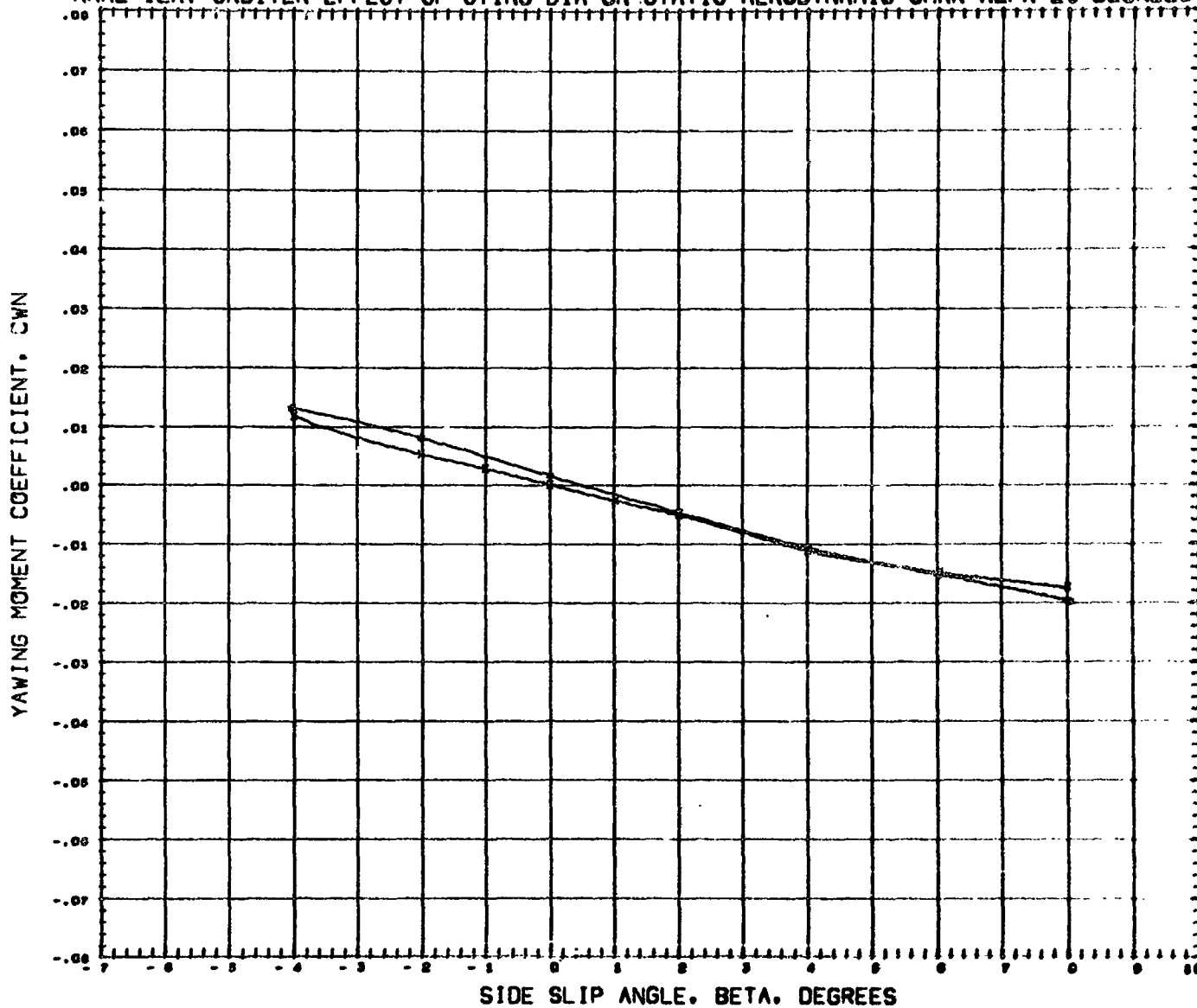
| SYMBOL | CONFIGURATION DESCRIPTION          |
|--------|------------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING B6 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING B8 |

| DATA SET | DATE      | WACC  |
|----------|-----------|-------|
| (RC4003) | 11 AUG 70 | 0.870 |
| (RC4080) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                            |        |
|-----------------------|----------------------------|--------|
| SEPL                  | 1.70000X10 <sup>-01</sup>  | 88.77  |
| REPL                  | 1.87370X10 <sup>-01</sup>  | INCHES |
| REFD                  | 1.13300X10 <sup>-01</sup>  | INCHES |
| ZMRP                  | 0.13200X10 <sup>-00</sup>  | INCHES |
| YMRP                  | 0.00000X10 <sup>-01</sup>  | INCHES |
| ZMRP                  | -3.04000X10 <sup>-01</sup> | INCHES |
| SCALE                 | 7.01000X10 <sup>-01</sup>  | SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=20 DEGREES

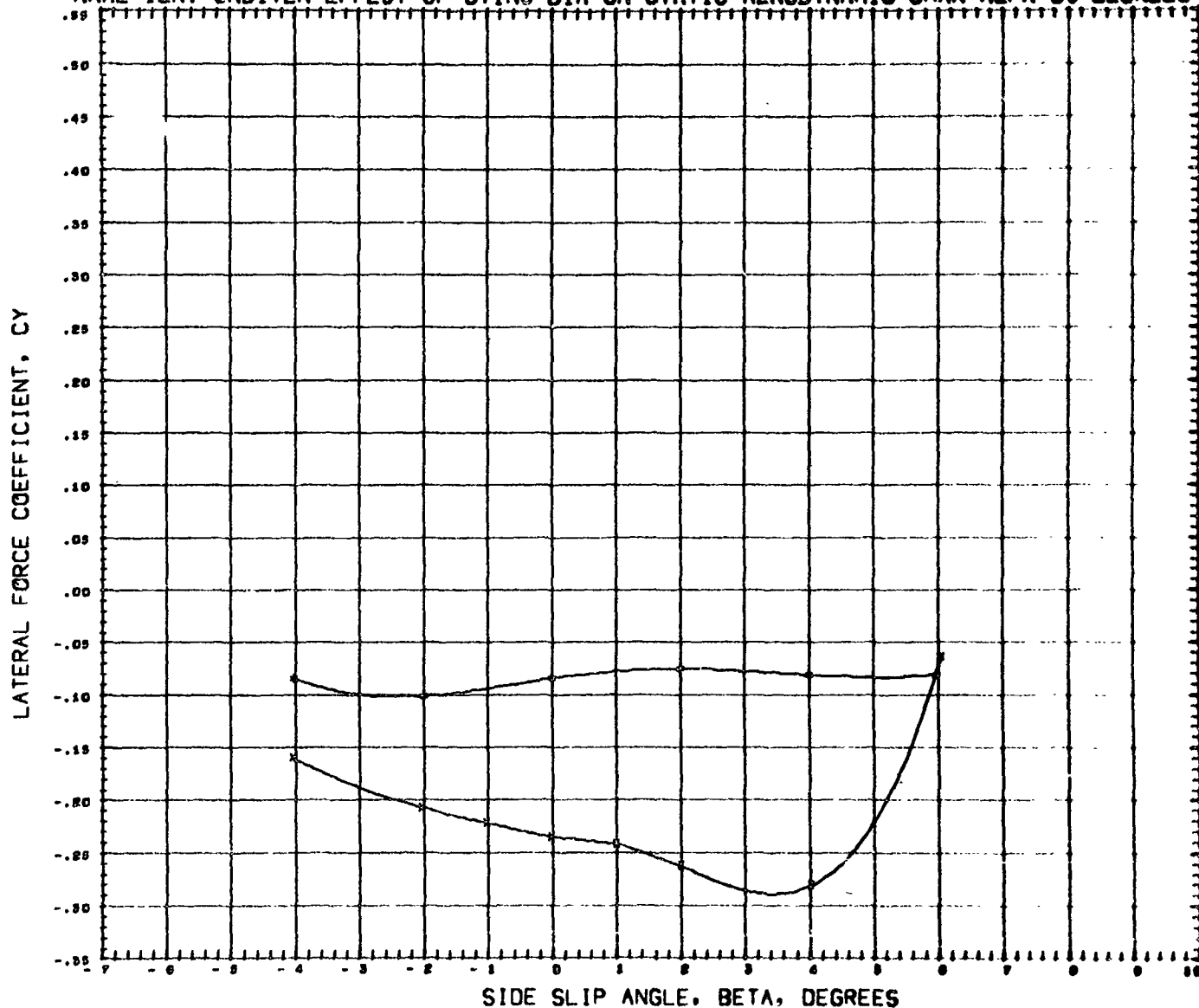


| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  |
|--------|------------------------------------|----------|-----------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING B6 | (RC4003) | 11 AUG 70 | 0.250 |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING B8 | (RC4006) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFS                  | 1.00000010-01 00.01.  |
| REFL                  | 1.07370010-01 INCHES  |
| REFD                  | 1.13300010-01 INCHES  |
| ENRP                  | 0.13300010-00 INCHES  |
| YMRP                  | 0.00000010-01 INCHES  |
| ZMRP                  | -3.04000010-01 INCHES |
| SCALE                 | 7.00000010-01 SCALE   |

REFERENCE FILE NAAL 020 NA-70-351

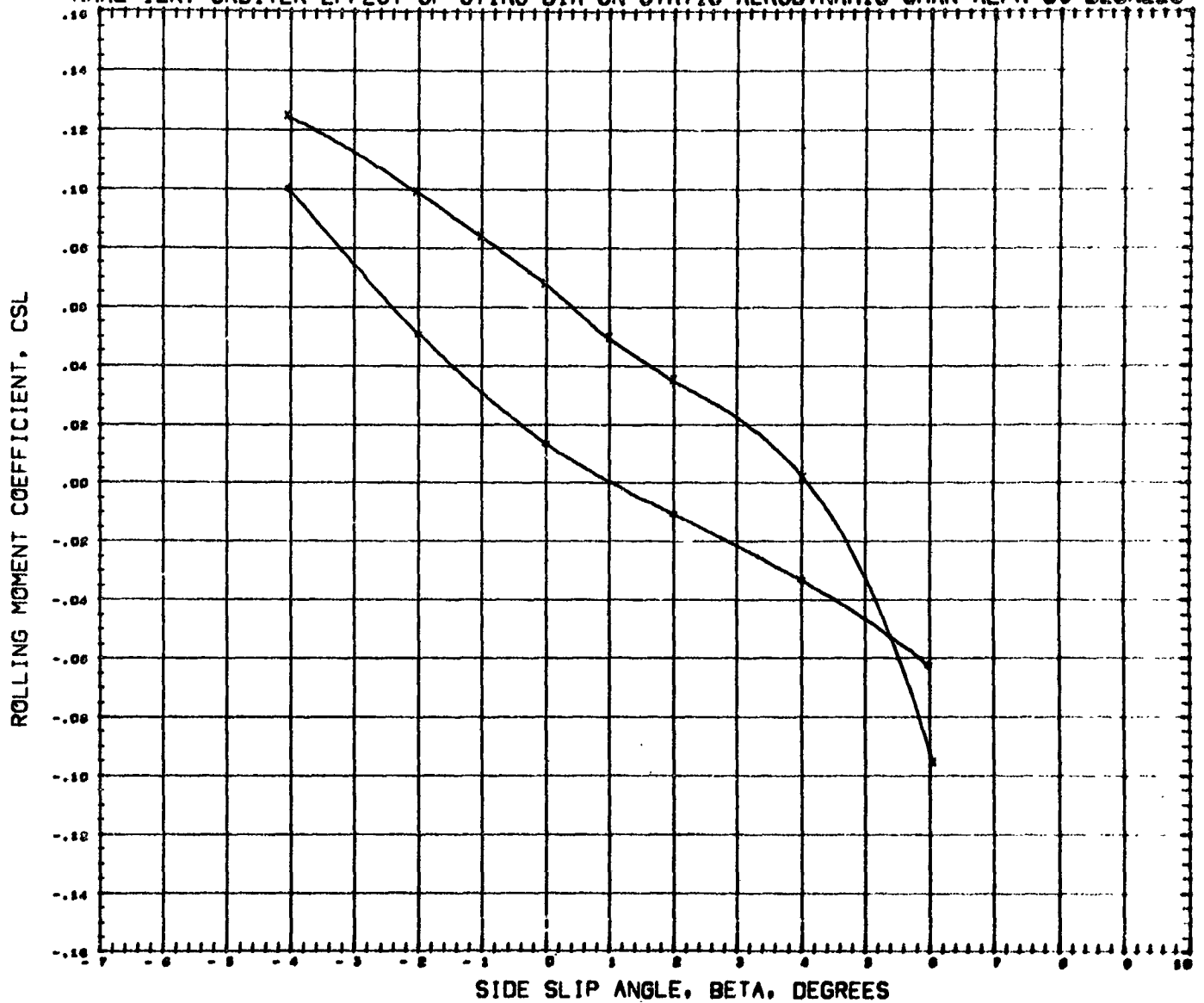
# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=60 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| B6     | NAAL 629 SSV-ILRV STRAIGHT WING | (RC4004) | 11 AUG 70 | 0.250 | REFS 1.70000E+01 80.71.  |
| B6     | NAAL 629 SSV-ILRV STRAIGHT WING | (RC4007) | 11 AUG 70 | 0.250 | REFL 1.97570E+01 INCHES  |
|        |                                 |          |           |       | REFD 1.13500E+00 INCHES  |
|        |                                 |          |           |       | YMRP 0.13500E+00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000E+00 INCHES  |
|        |                                 |          |           |       | YMRP -3.04000E+01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E+00 SCALE  |

REFERENCE FILE NAAL 629 NA-70-351

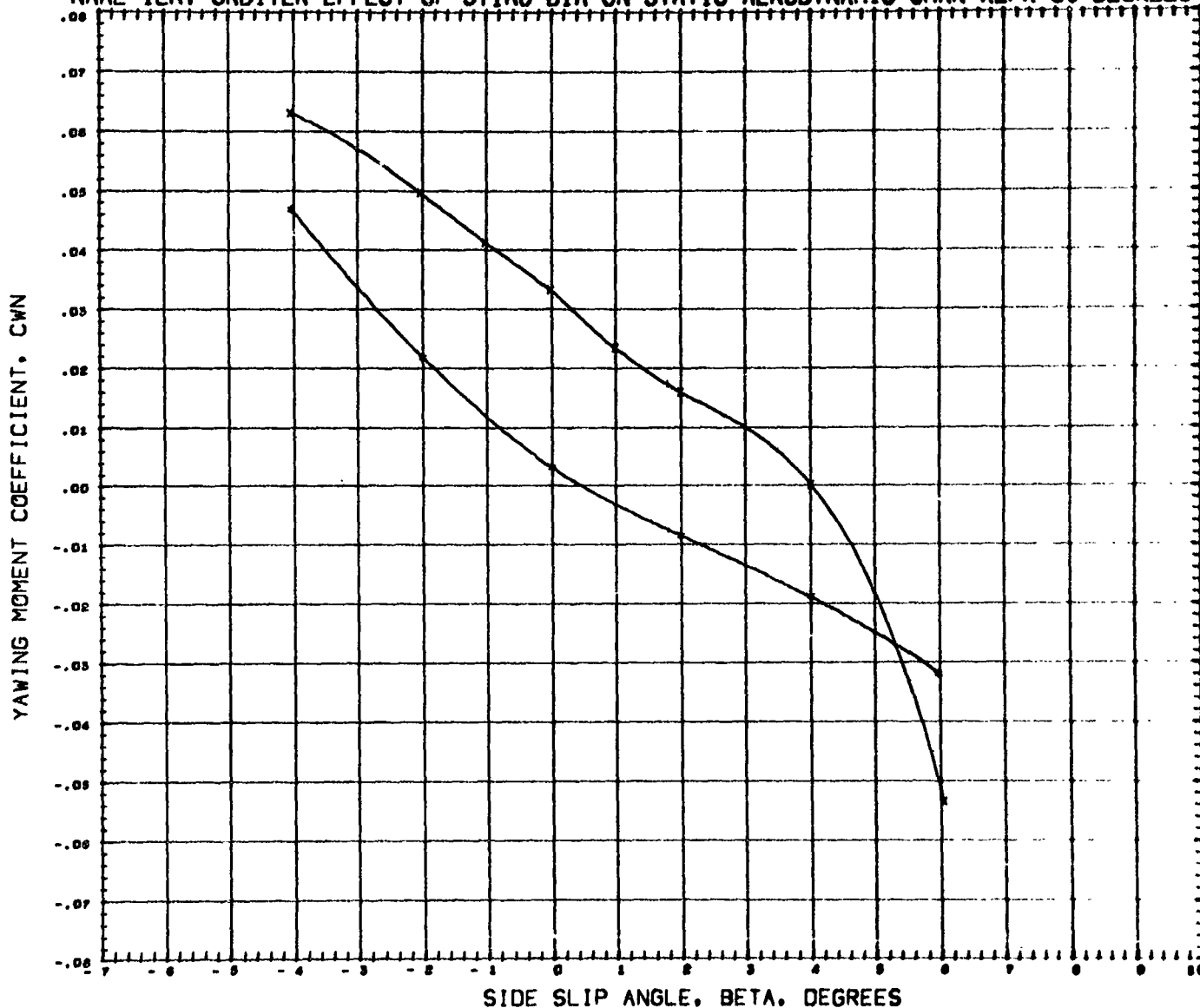
# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=60 DEGREES



| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|------------------------------------|----------|-----------|-------|----------------------------|
| x      | NAAL 020 00V-ILRV STRAIGHT WING 00 | (RC4004) | 11 AUG 70 | 0.250 | REFS 1.70000010-01 00.FT.  |
| o      | NAAL 020 00V-ILRV STRAIGHT WING 00 | (RC4007) | 11 AUG 70 |       | REFL 1.07370010-01 INCHES  |
|        |                                    |          |           |       | REFS 1.13300010-00 INCHES  |
|        |                                    |          |           |       | ENRF 0.13300010-00 INCHES  |
|        |                                    |          |           |       | YNRF 0.00000010-01 INCHES  |
|        |                                    |          |           |       | ZNRF -0.00000010-01 INCHES |
|        |                                    |          |           |       | SCALE 7.01000010-00 SCALE  |

REFERENCE FILE NAAL 020 NA-70-591

# NAAL ILRV ORBITER-EFFECT OF STING DIA ON STATIC AERODYNAMIC CHAR ALFA=60 DEGREES

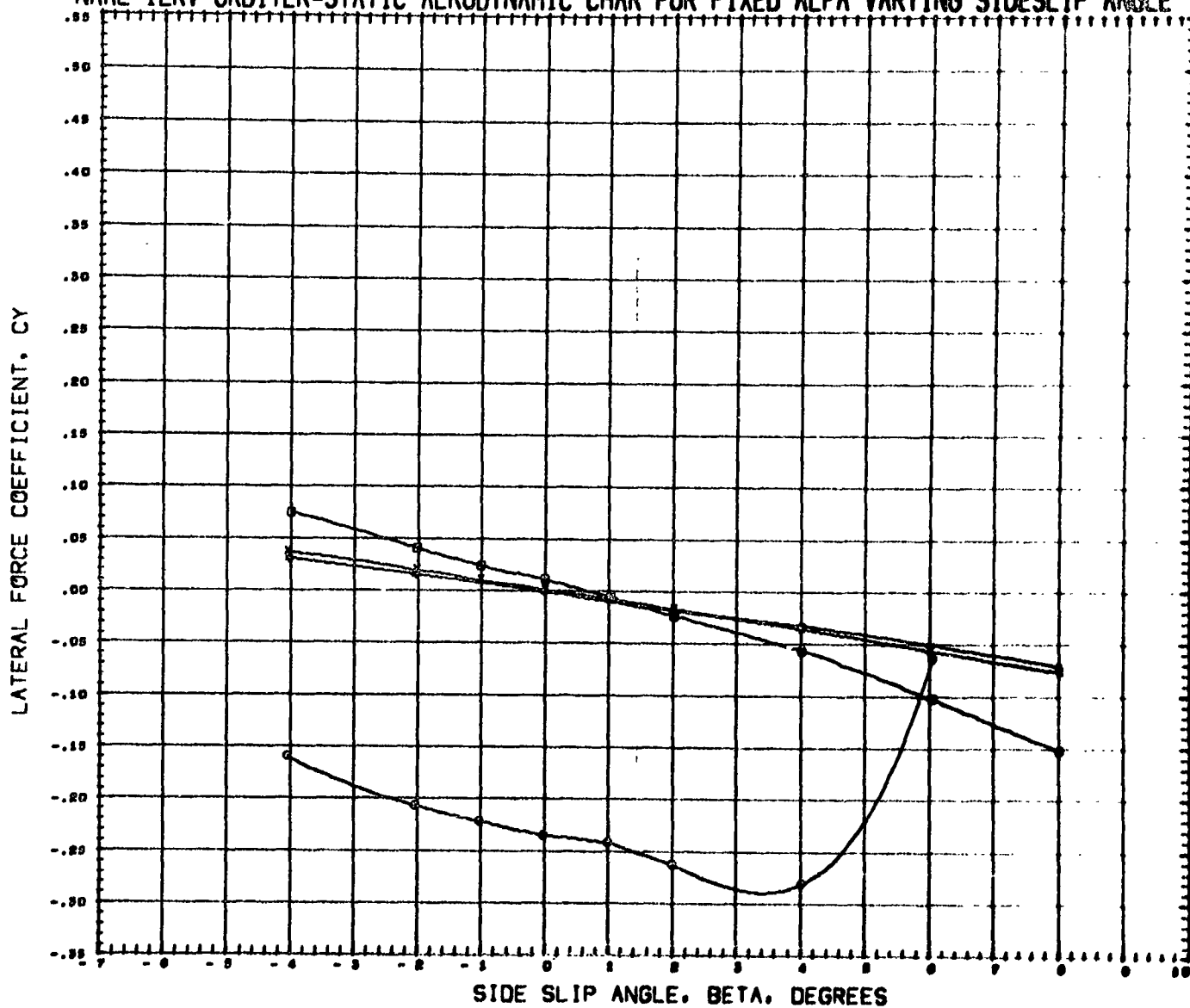


| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  |
|--------|------------------------------------|----------|-----------|-------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING BS | (RC4004) | 11 AUG 70 | 0.250 |
| X      | NAAL 029 SSV-ILRV STRAIGHT WING BS | (RC4007) | 11 AUG 70 | 0.250 |

| REFERENCE INFORMATION |              |        |
|-----------------------|--------------|--------|
| REF4                  | 1.70000E-01  | 60.FY. |
| REF1                  | 1.97370E-01  | INCHES |
| REF2                  | 1.13300E-00  | INCHES |
| YNRP                  | 0.13200E-00  | INCHES |
| YNRP                  | 0.00000E-00  | INCHES |
| YNRP                  | -3.04000E-01 | INCHES |
| SCALE                 | 7.01000E-03  | SCALE  |

REFERENCE FILE NAAL 029 NA-70-391

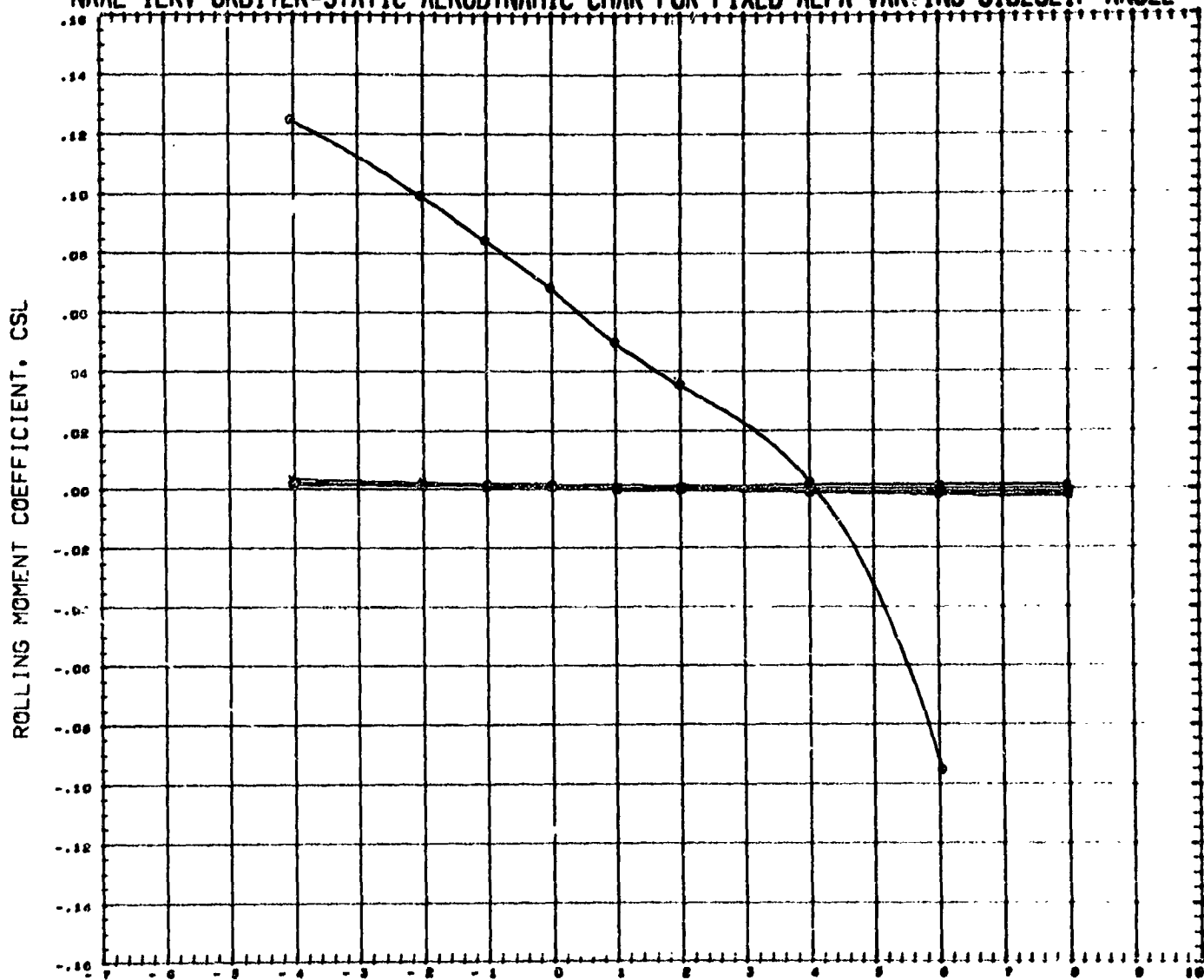
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|------------------------------------|----------|-----------|-------|---------------------------|
| S      | NAAL 020 BSV-ILRV STRAIGHT WING 00 | (RC4004) | 11 AUG 70 | 0.250 | REFS 1.700000E+01 00.FT.  |
| X      | NAAL 020 BSV-ILRV STRAIGHT WING 00 | (RC4005) | 11 AUG 70 |       | REFL 1.575700E+01 INCHES  |
| G      | NAAL 020 BSV-ILRV STRAIGHT WING 00 | (RC4006) | 11 AUG 70 |       | REFS 1.133000E+00 INCHES  |
| O      | NAAL 020 BSV-ILRV STRAIGHT WING 00 | (RC4007) | 11 AUG 70 |       | SNRP 0.132000E+00 INCHES  |
|        |                                    |          |           |       | VMRP 0.000000E+00 INCHES  |
|        |                                    |          |           |       | ZMRP -2.040000E+01 INCHES |
|        |                                    |          |           |       | SCALE 7.010000E+01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



SIDE SLIP ANGLE, BETA, DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |

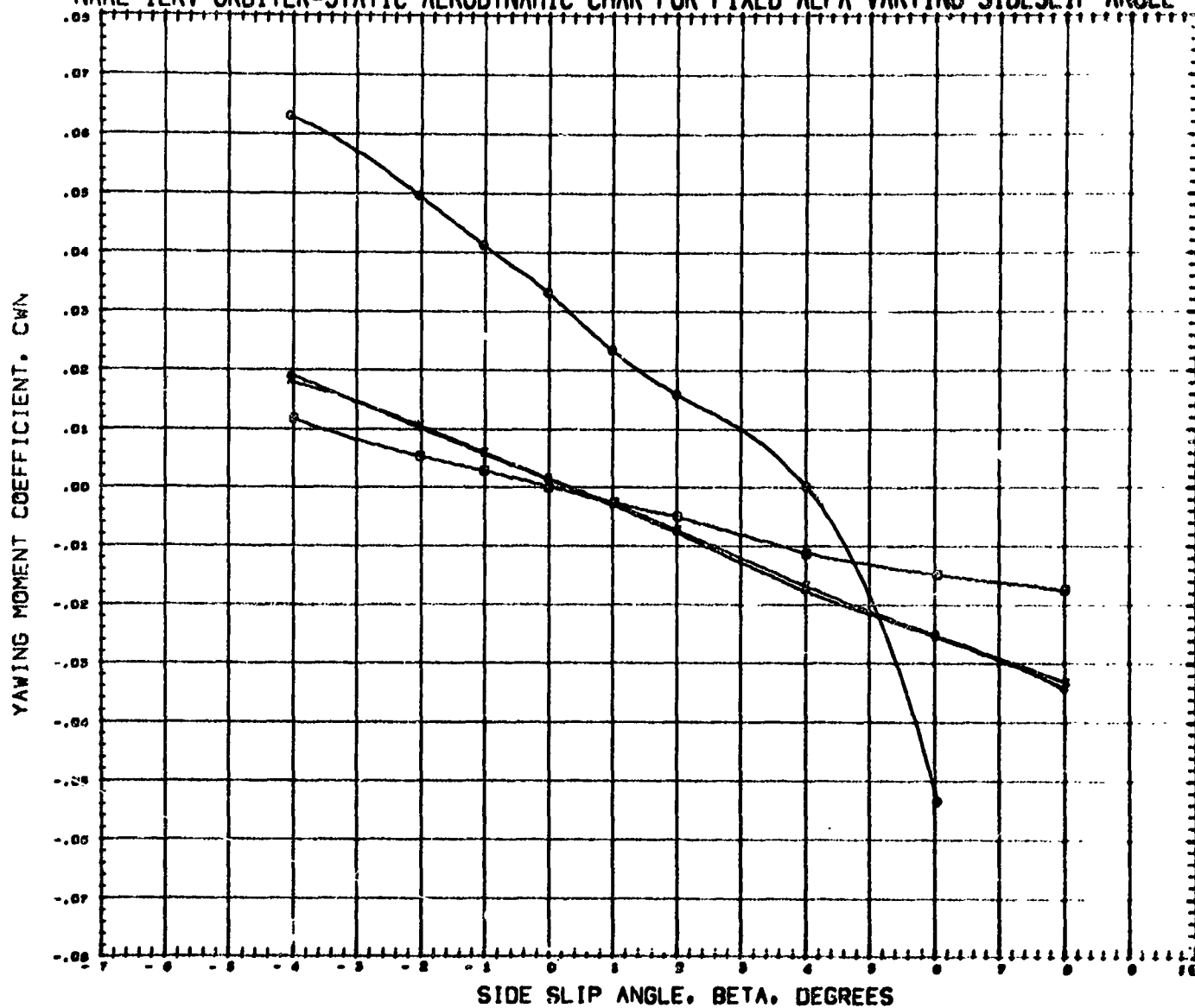
| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4004) | 11 AUG 70 | 0.250 |
| (RC4005) | 11 AUG 70 |       |
| (RC4006) | 11 AUG 70 |       |
| (RC4007) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                                   |
|-----------------------|-----------------------------------|
| REFS                  | 1.70000X10 <sup>-01</sup> INCHES  |
| REFL                  | 1.97370X10 <sup>-01</sup> INCHES  |
| REFD                  | 1.13300X10 <sup>-00</sup> INCHES  |
| YNRP                  | 0.13800X10 <sup>-00</sup> INCHES  |
| YNRP                  | 0.00000X10 <sup>-01</sup> INCHES  |
| YNRP                  | -3.04000X10 <sup>-01</sup> INCHES |
| SCALE                 | 7.01000X10 <sup>-03</sup> SCALE   |

REFERENCE FILE

NAAL 029 NA-70-391

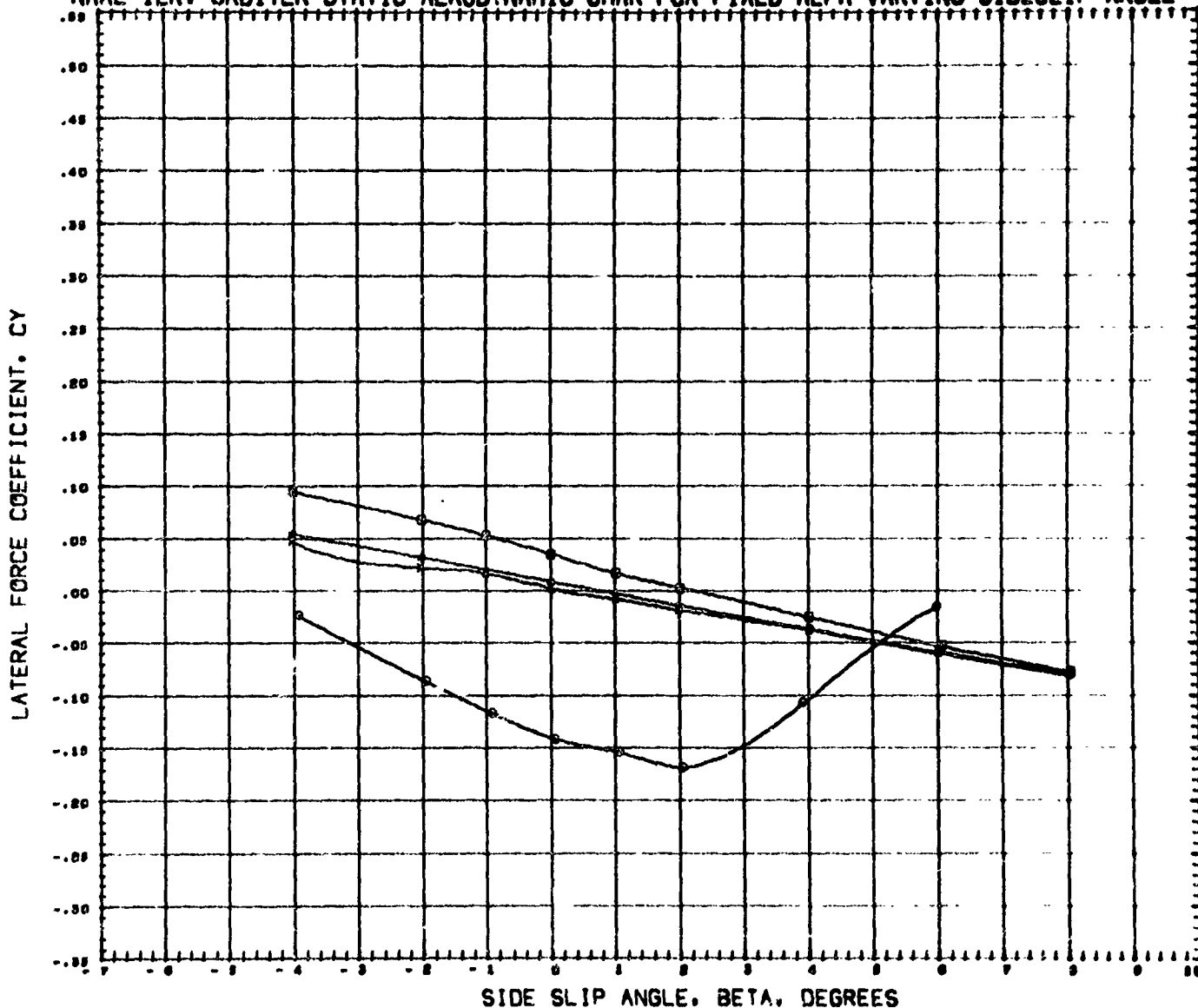
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|------------------------------------|----------|-----------|-------|----------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING 00 | (RC4004) | 11 AUG 70 | 0.899 | REFS 1.70000010-01 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING 00 | (RC4005) | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING 00 | (RC4006) | 11 AUG 70 |       | REFD 1.13300010-00 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING 00 | (RC4007) | 11 AUG 70 |       | YMRP 0.13300010-00 INCHES  |
|        |                                    |          |           |       | YMRP 0.00000010-00 INCHES  |
|        |                                    |          |           |       | ZMRP -3.04000010-01 INCHES |
|        |                                    |          |           |       | SCALE 7.00000010-00 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

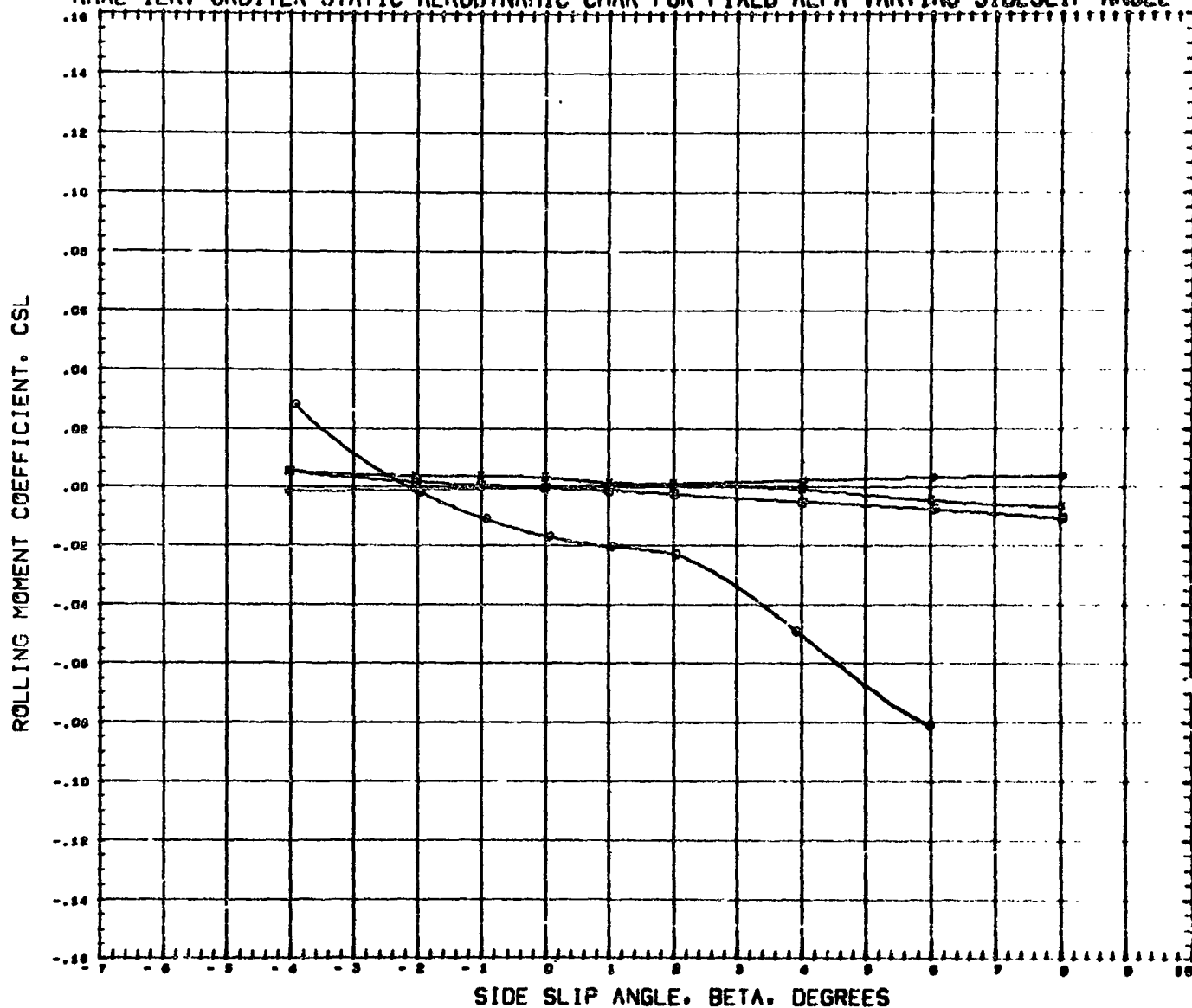
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION |
|--------|---------------------------------|----------|-----------|-------|-----------------------|
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4017   | 11 AUG 70 | 0.290 | REFS 1.70000E+01      |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4004   | 11 AUG 70 |       | REFL 1.97370E+01      |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4000   | 11 AUG 70 |       | REFS 1.19390E+00      |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4007   | 11 AUG 70 |       | REFS 0.13860E+00      |
|        |                                 |          |           |       | YMRP 0.60000E+01      |
|        |                                 |          |           |       | YMRP -3.04000E+01     |
|        |                                 |          |           |       | SCALE 7.01000E+01     |

REFERENCE FILE NAAL 020 NA-70-351

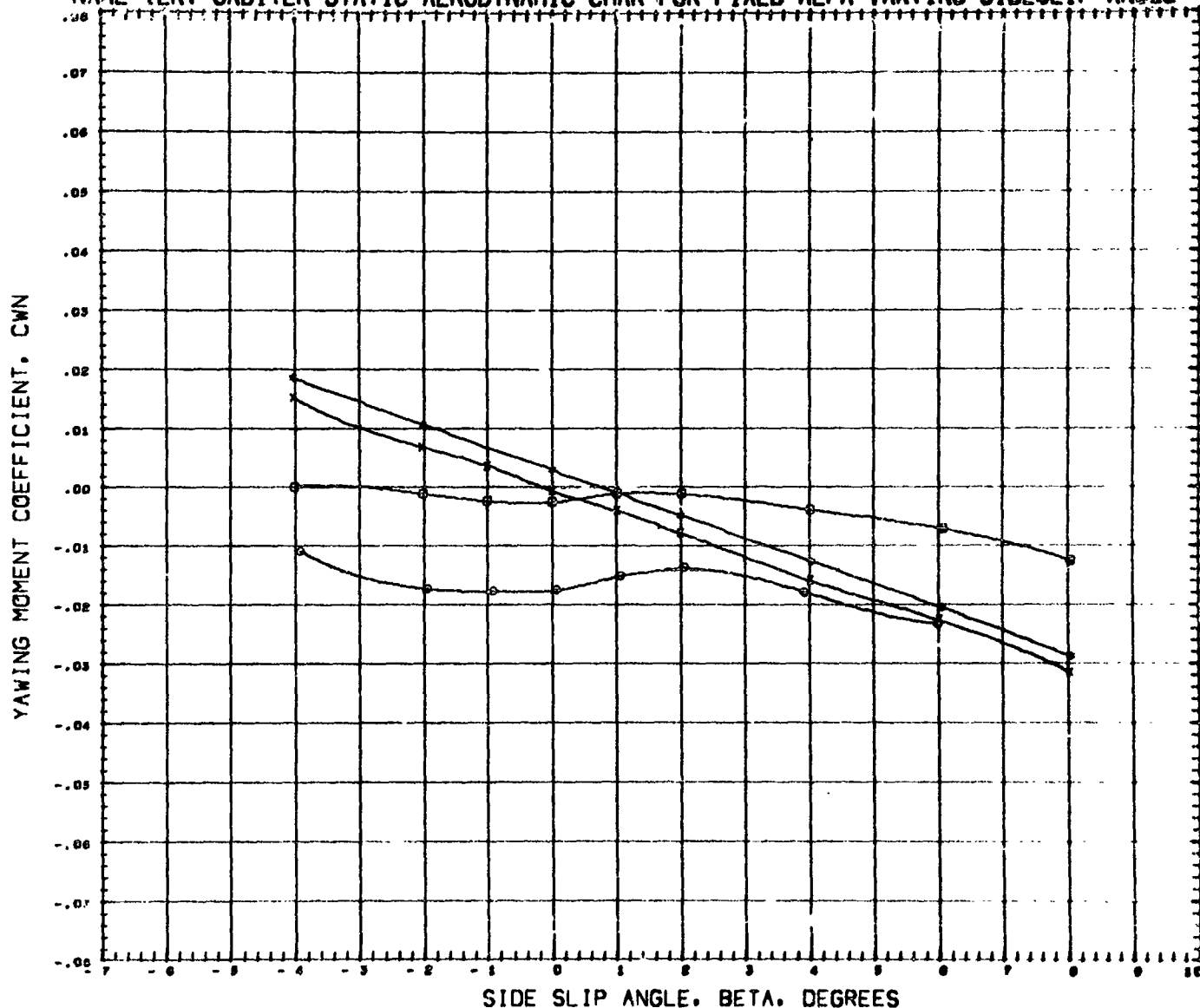
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------------|----------|-----------|-------|---------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W0 | (RC4017) | 11 AUG 70 | 0.200 | REFS 1.700000E-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W0 | (RC4004) | 11 AUG 70 |       | REFL 1.973700E-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W0 | (RC4006) | 11 AUG 70 |       | REFD 1.130000E-01 INCHES  |
| d      | NAAL 020 SSV-ILRV STRAIGHT WING 00 W0 | (RC4007) | 11 AUG 70 |       | YMRP 0.130000E-01 INCHES  |
|        |                                       |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                       |          |           |       | YMRP -5.000000E-01 INCHES |
|        |                                       |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

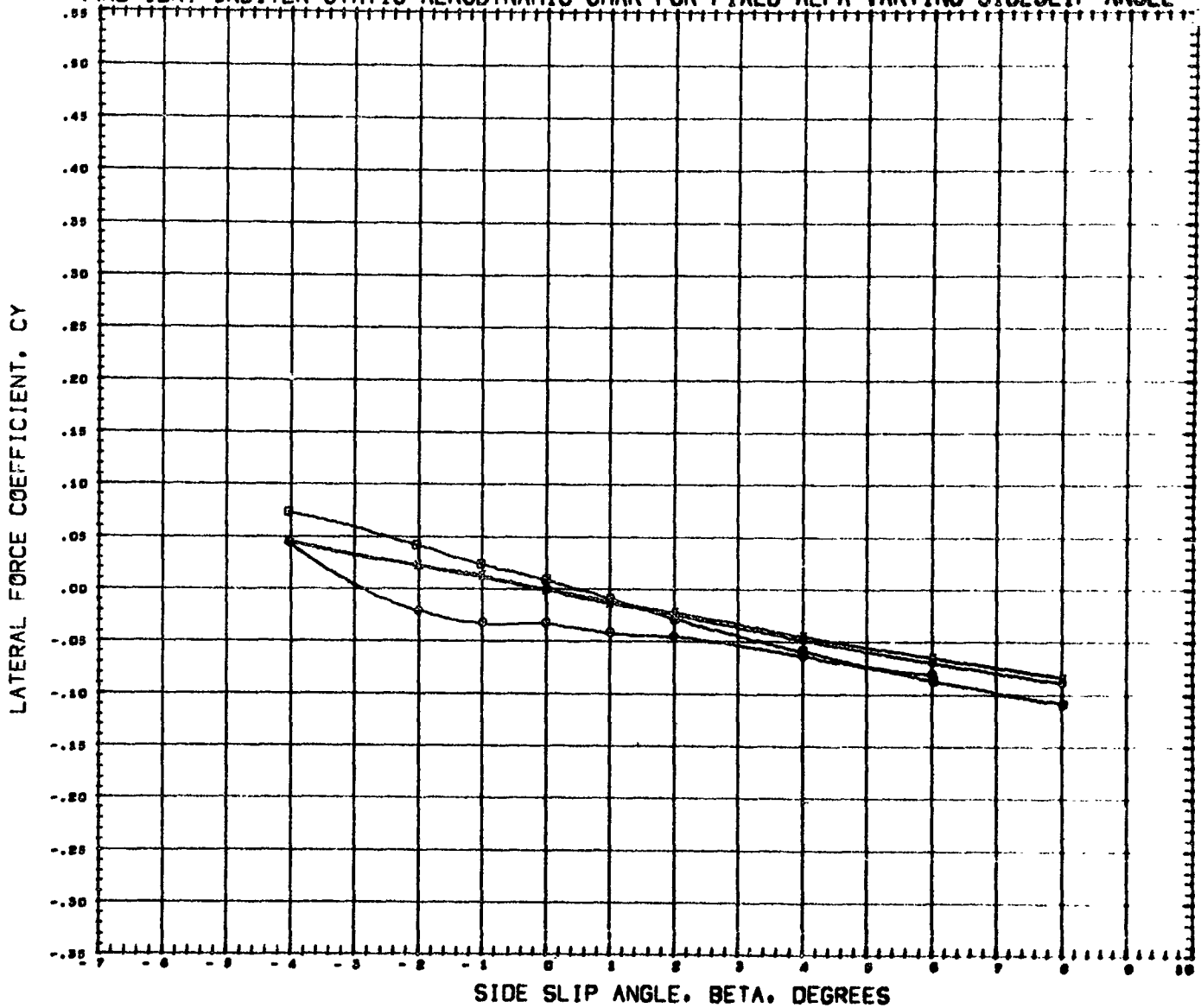
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION |                        |       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION |                                   |
|--------|---------------------------|------------------------|-------|----------|-----------|-------|-----------------------|-----------------------------------|
| *      | NAAL 020                  | SSV-ILRV STRAIGHT WING | B6 W6 | (RC4017) | 11 AUG 70 | 0.250 | REFS                  | 1.70000X10 <sup>-01</sup> SQ.FT.  |
| x      | NAAL 020                  | SSV-ILRV STRAIGHT WING | B6 W6 | (RC4004) | 11 AUG 70 |       | REFL                  | 1.97370X10 <sup>-01</sup> INCHES  |
| Q      | NAAL 020                  | SSV-ILRV STRAIGHT WING | B6 W6 | (RC4006) | 11 AUG 70 |       | REFD                  | 1.13300X10 <sup>-01</sup> INCHES  |
| O      | NAAL 020                  | SSV-ILRV STRAIGHT WING | B6 W6 | (RC4007) | 11 AUG 70 |       | XNRP                  | 0.13200X10 <sup>-00</sup> INCHES  |
|        |                           |                        |       |          |           |       | YNRP                  | 0.00000X10 <sup>-01</sup> INCHES  |
|        |                           |                        |       |          |           |       | ZNRP                  | -2.04000X10 <sup>-01</sup> INCHES |
|        |                           |                        |       |          |           |       | SCALE                 | 7.01000X10 <sup>-01</sup> SCALE   |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

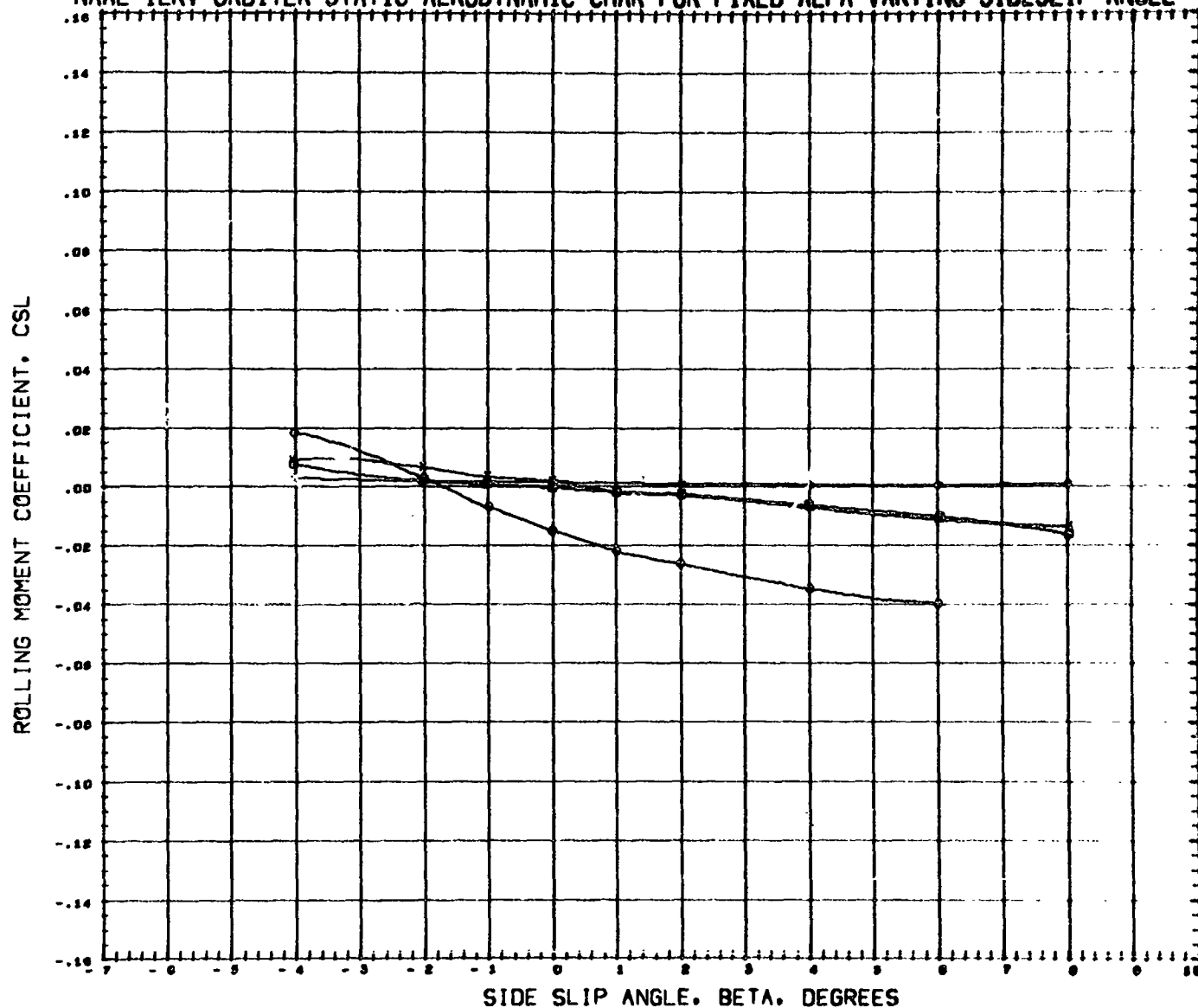


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| •      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4059) | 11 AUG 70 | 0.859 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4060) | 11 AUG 70 |       |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4061) | 11 AUG 70 |       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4062) | 11 AUG 70 |       |

REFERENCE FILE NAAL 029 NA-PD-331

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFS                  | 1.700000E-01  | 00.07. |
| REFL                  | 1.573700E-01  | INCHES |
| REFS                  | 1.133000E-01  | INCHES |
| REFL                  | 0.132000E-01  | INCHES |
| REFS                  | 0.000000E-01  | INCHES |
| REFL                  | -0.040000E-01 | INCHES |
| SCALE                 | 1.010000E-01  | SCALE  |

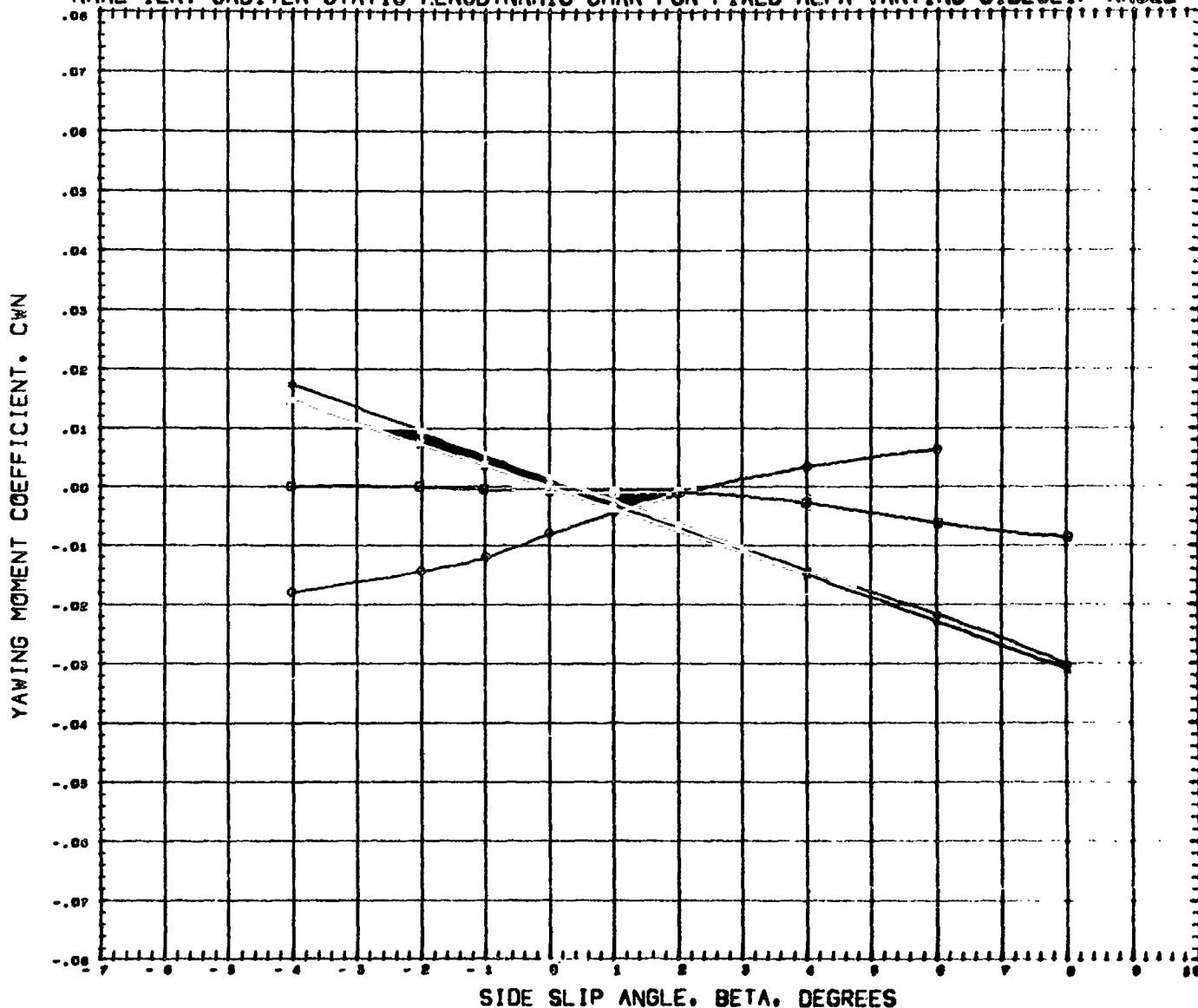
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL                            | CONFIGURATION DESCRIPTION |     |          |               | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION |                            |
|-----------------------------------|---------------------------|-----|----------|---------------|-----------|----------|-----------|-----------------------|----------------------------|
| *                                 | NAAL                      | 020 | SSV-ILRV | STRAIGHT WING | B6 W6 N12 | (RC4050) | 11 AUG 70 | 0.250                 | REFS 1.70000X10-01 88.FT.  |
| x                                 | NAAL                      | 020 | SSV-ILRV | STRAIGHT WING | B6 W6 N12 | (RC4060) | 11 AUG 70 |                       | REFL 1.87370X10-01 INCHES  |
| @                                 | NAAL                      | 020 | SSV-ILRV | STRAIGHT WING | B6 W6 N12 | (RC4061) | 11 AUG 70 |                       | REFB 1.13390X10-01 INCHES  |
| o                                 | NAAL                      | 020 | SSV-ILRV | STRAIGHT WING | B6 W6 N12 | (RC4062) | 11 AUG 70 |                       | YNRP 0.13800X10-00 INCHES  |
|                                   |                           |     |          |               |           |          |           |                       | YNRP 0.00000X10-01 INCHES  |
|                                   |                           |     |          |               |           |          |           |                       | ZNRP -3.84000X10-01 INCHES |
|                                   |                           |     |          |               |           |          |           |                       | SCALE 7.01000X10-03 SCALE  |
| REFERENCE FILE NAAL 020 NA 88-151 |                           |     |          |               |           |          |           |                       |                            |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

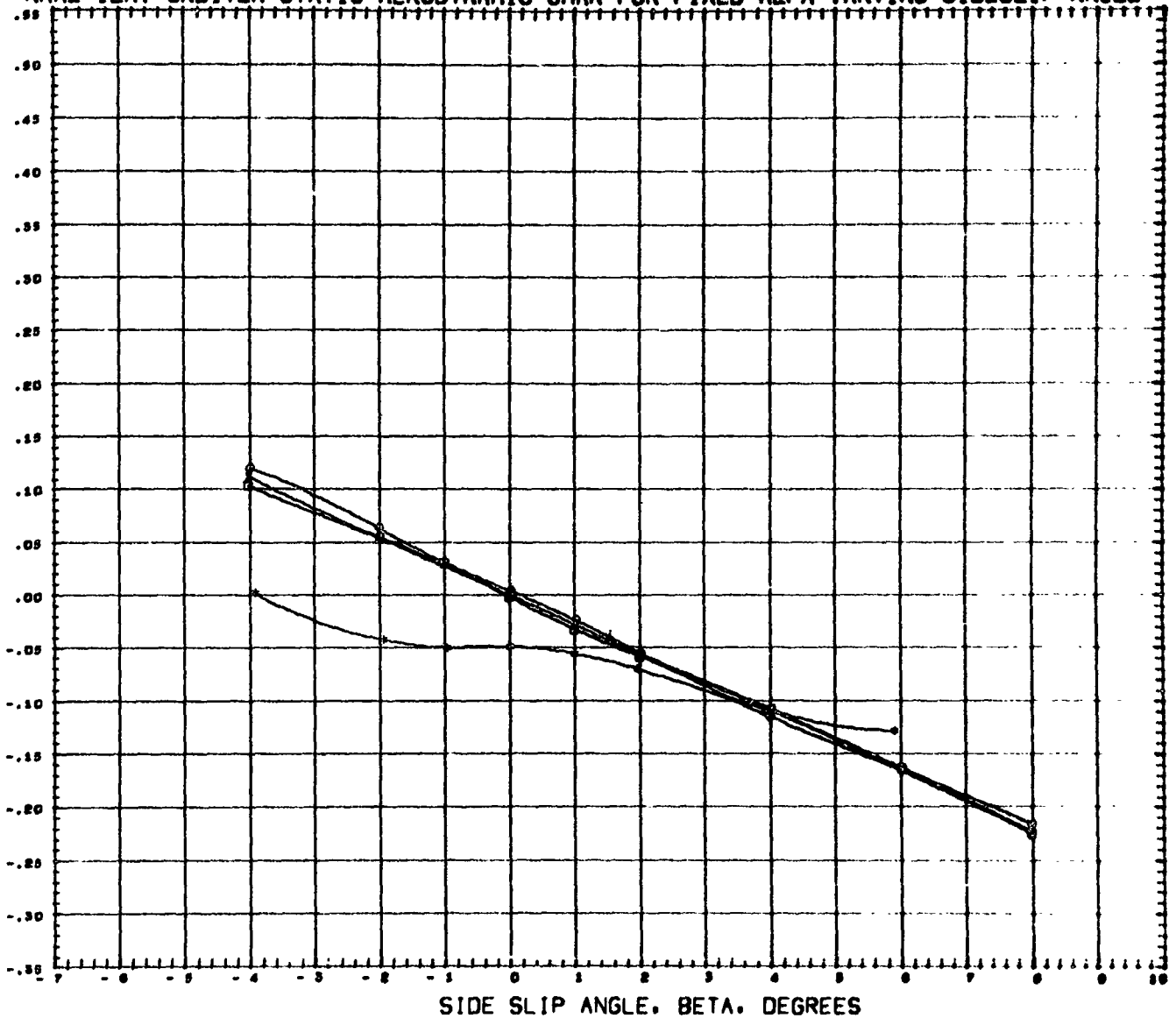


| SYMBOL                            | CONFIGURATION DESCRIPTION |     |                        |           | DATA SET | DATE      | MACH  | REFERENCE INFORMATION |                       |
|-----------------------------------|---------------------------|-----|------------------------|-----------|----------|-----------|-------|-----------------------|-----------------------|
| +                                 | NAAL                      | 020 | SSV-ILRV STRAIGHT WING | 06 W0 H12 | (RC4030) | 11 AUG 70 | 0.290 | REFS                  | 1.70000X10-01 60.FT.  |
| x                                 | NAAL                      | 020 | SSV-ILRV STRAIGHT WING | 06 W0 H12 | (RC4000) | 11 AUG 70 |       | REFL                  | 1.07370X10-01 INCHES  |
| o                                 | NAAL                      | 020 | SSV-ILRV STRAIGHT WING | 06 W0 H12 | (RC4001) | 11 AUG 70 |       | REFB                  | 1.13300X10-01 INCHES  |
| o                                 | NAAL                      | 020 | SSV-ILRV STRAIGHT WING | 06 W0 H12 | (RC4002) | 11 AUG 70 |       | ENRP                  | 0.13200X10-00 INCHES  |
|                                   |                           |     |                        |           |          |           |       | YMRP                  | 0.00000X10-00 INCHES  |
|                                   |                           |     |                        |           |          |           |       | ZMRP                  | -3.04000X10-01 INCHES |
|                                   |                           |     |                        |           |          |           |       | SCALE                 | 7.61000X10-01 SCALE   |
| REFERENCE FILE NAAL 020 NA-70-354 |                           |     |                        |           |          |           |       |                       |                       |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

LATERAL FORCE COEFFICIENT, CY



| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING |

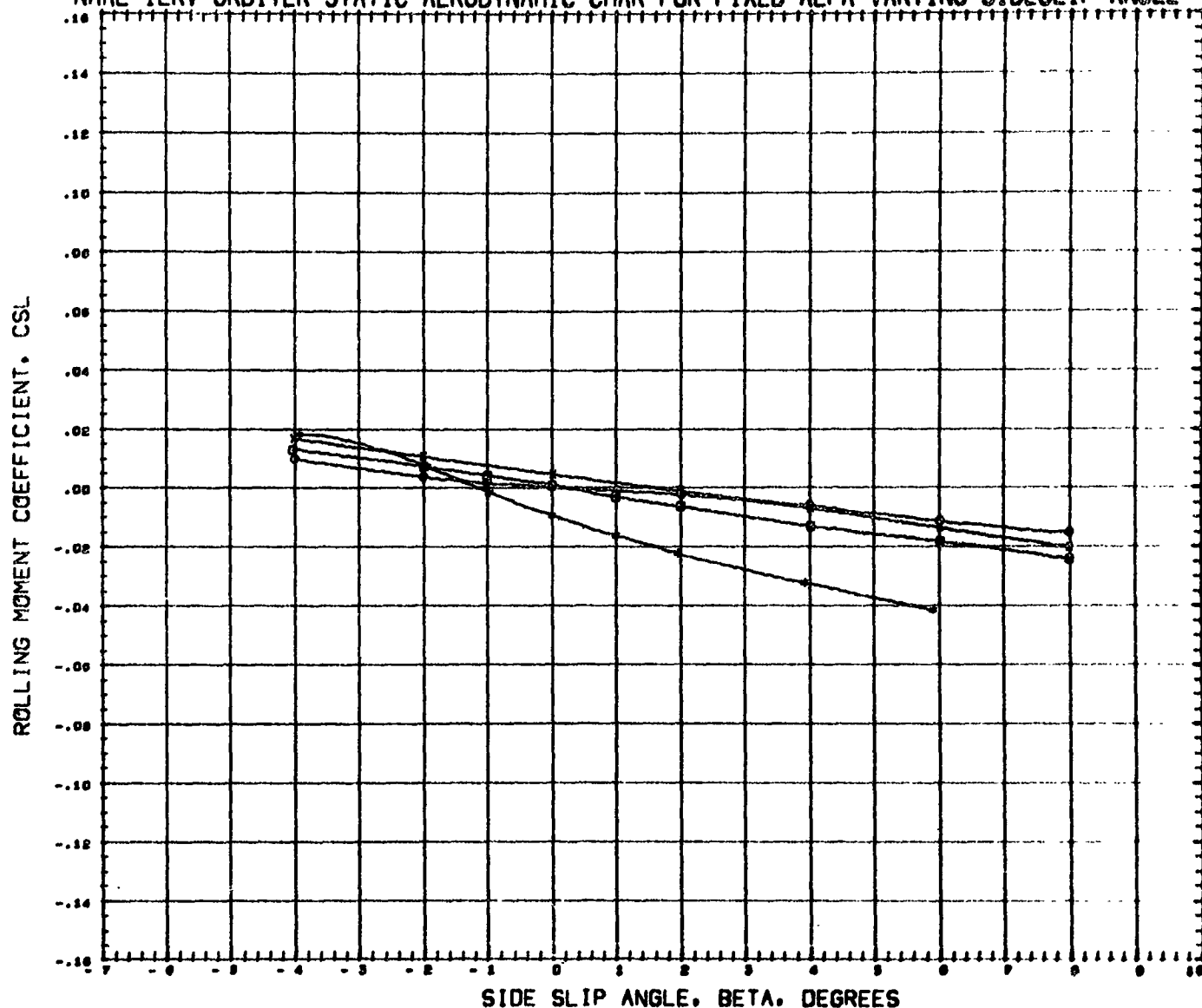
SIDE SLIP ANGLE, BETA, DEGREES

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4041) | 11 AUG 70 | 0.250 |
| (RC4042) | 11 AUG 70 |       |
| (RC4043) | 11 AUG 70 |       |
| (RC4044) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFS                  | 1.70000E10-01 88.77.  |
| REFL                  | 1.57370E10-01 INCHES  |
| REFD                  | 1.15300E10-01 INCHES  |
| YMRP                  | 0.13800E10-00 INCHES  |
| YMRP                  | 0.00000E10-01 INCHES  |
| ZMRP                  | -3.04000E10-01 INCHES |
| SCALE                 | 7.01000E10 SCALE      |

REFERENCE FILE NAAL 020 NA-70-351

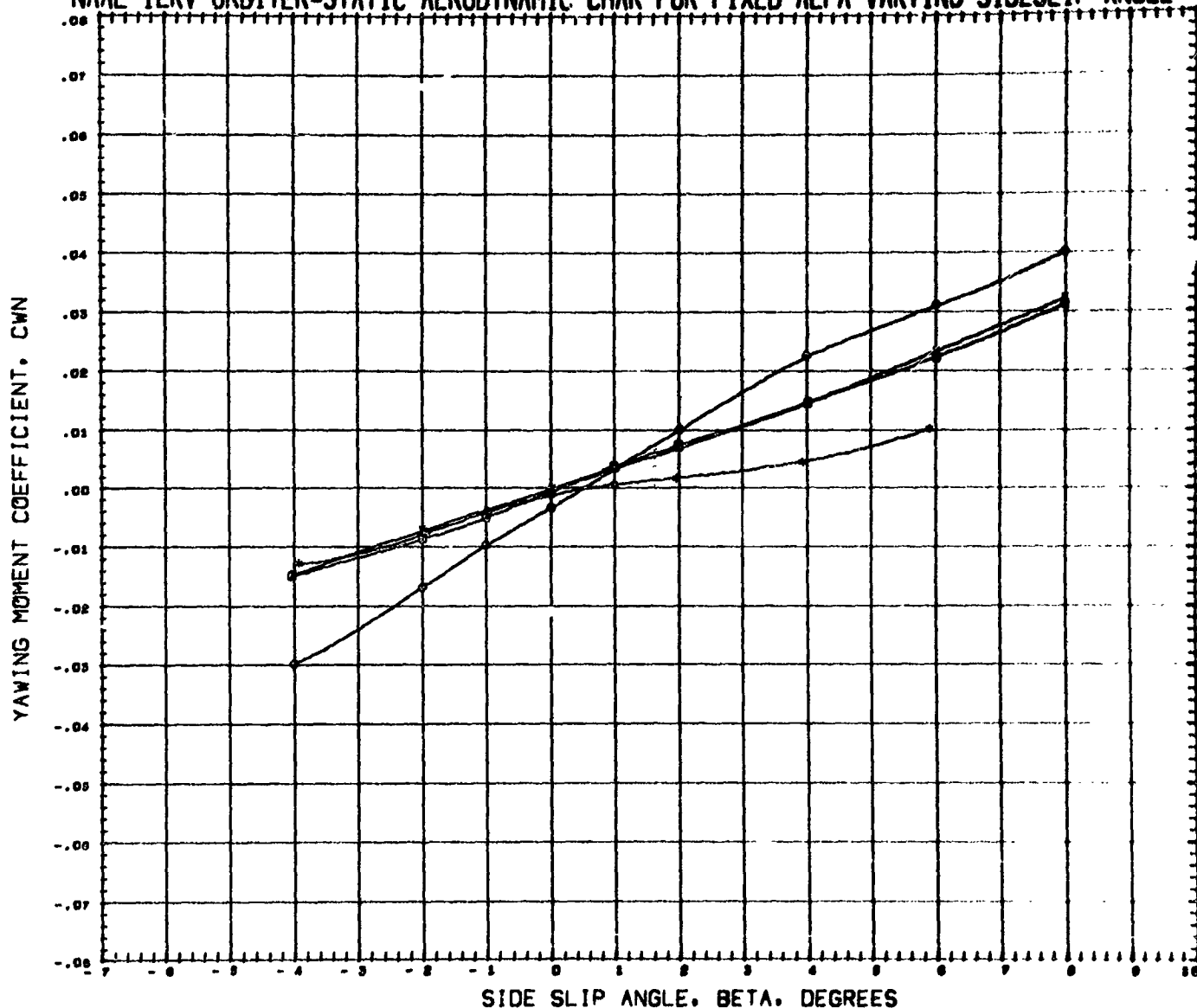
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4041) | 11 AUG 70 | 0.850 | REFD 1.70000010-01 00.77.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4042) | 11 AUG 70 |       | REFL 1.07570010-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4043) | 11 AUG 70 |       | REFB 1.13000010-00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V5 (RC4044) | 11 AUG 70 |       | YMRP 0.00000010-00 INCHES  |
|        |                                 |                       |           |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |                       |           |       | ZMRP -3.04000010-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000010 SCALE     |

REFERENCE FILE NAAL 020 NA-70-351

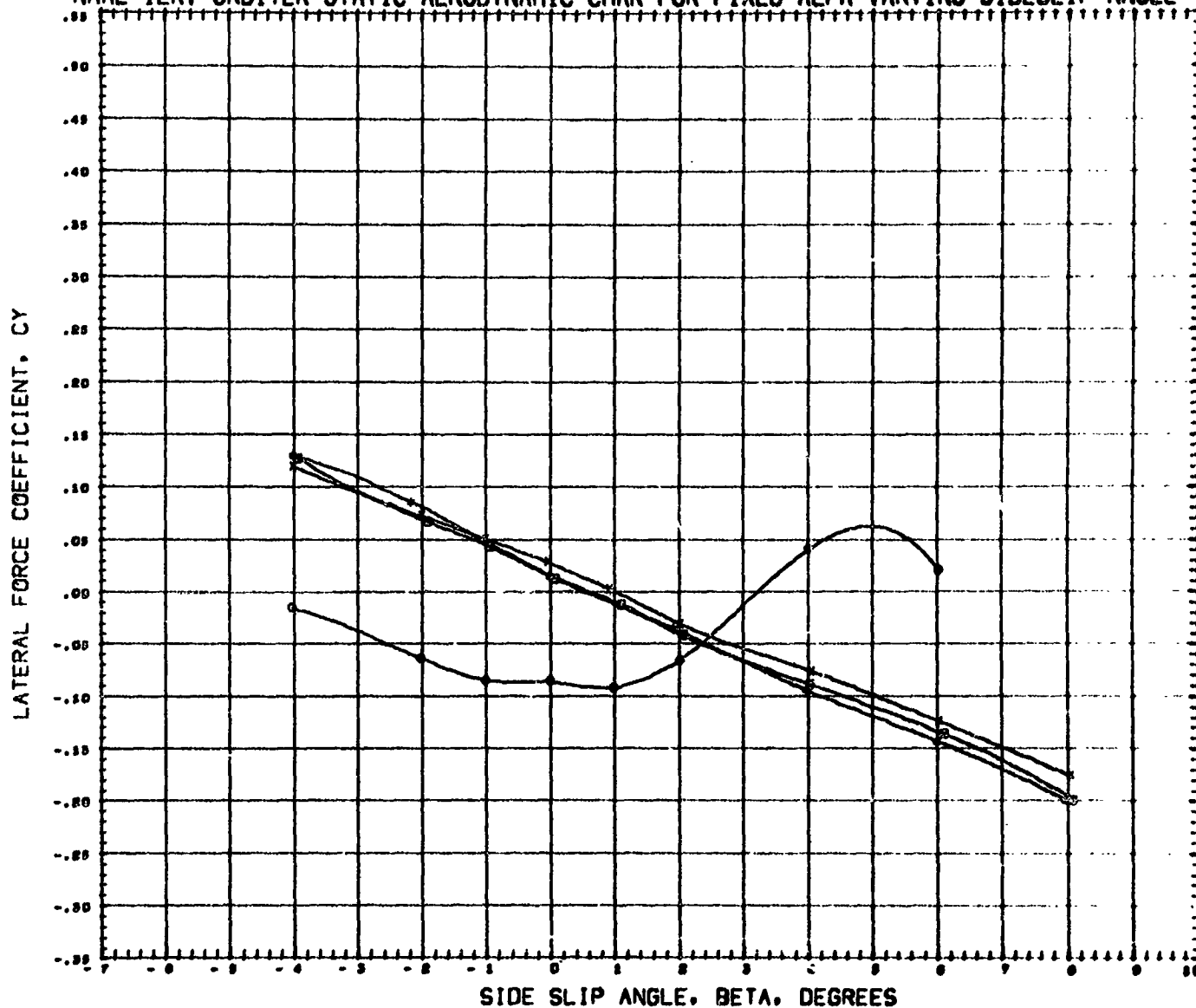
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION                  |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------------------|
| +      | NAAL 629 SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4041) | 11 AUG 70 | 0.250 | REFS 1.76000X10 <sup>-01</sup> 86.FT.  |
| x      | NAAL 629 SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4042) | 11 AUG 70 |       | REFL 1.97570X10 <sup>-01</sup> INCHES  |
| @      | NAAL 629 SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4043) | 11 AUG 70 |       | REFS 1.13300X10 <sup>-01</sup> INCHES  |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING | 86 W6 H12 V5 (RC4044) | 11 AUG 70 |       | ZNRP 0.13200X10 <sup>-01</sup> INCHES  |
|        |                                 |                       |           |       | YNRP 0.00000X10 <sup>-01</sup> INCHES  |
|        |                                 |                       |           |       | ZNRP -3.64000X10 <sup>-01</sup> INCHES |
|        |                                 |                       |           |       | SCALE 7.01000X10 <sup>-01</sup> SCALE  |

REFERENCE FILE NAAL 629 NA-70-331

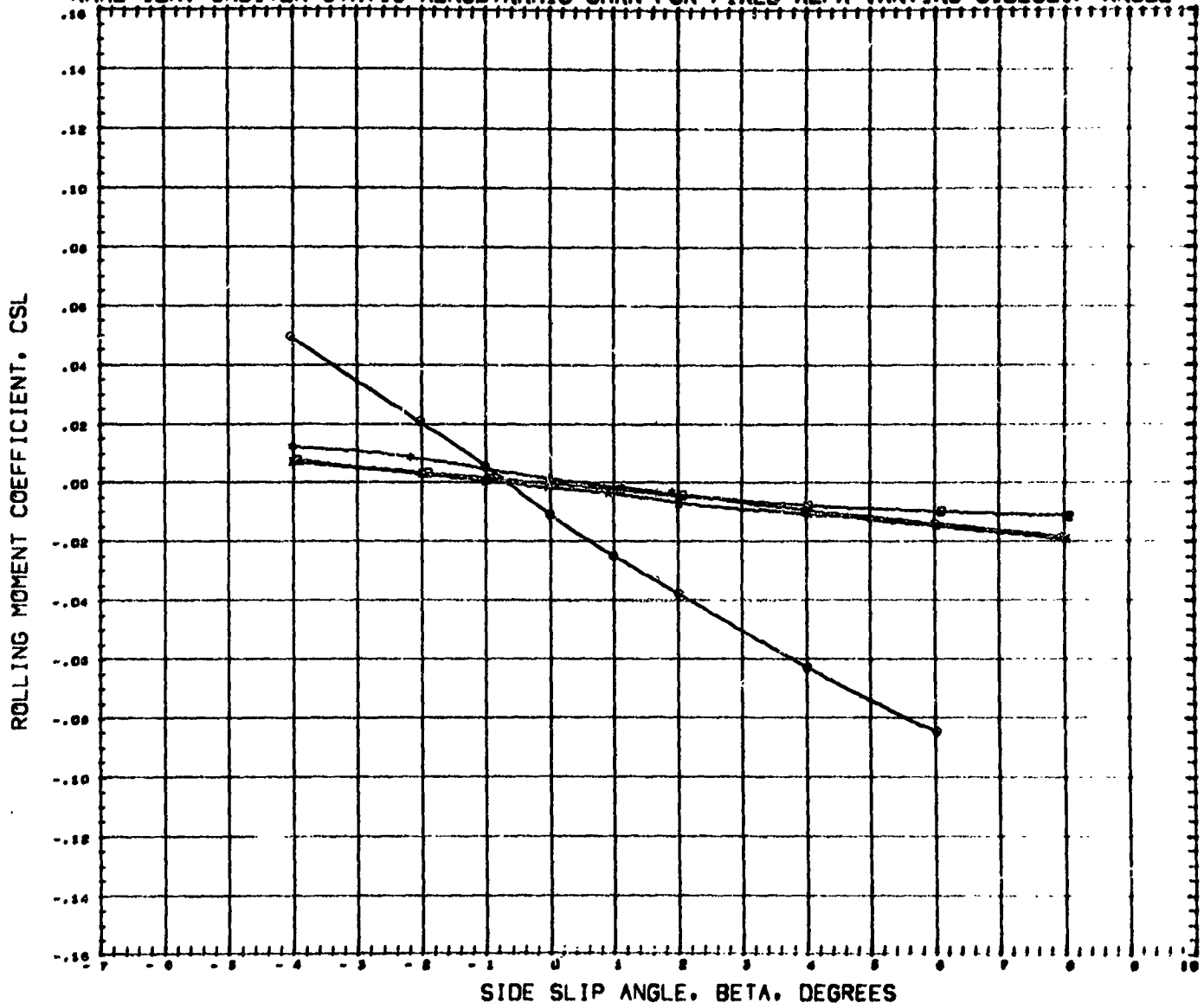
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| C      | NAAL 020 00V-ILRV STRAIGHT WING | 06 W6 H12 V5 (RC4046) | 11 AUG 70 | 0.250 | REFS 1.70000X10-01 60.71.  |
| X      | NAAL 020 00V-ILRV STRAIGHT WING | 06 W6 H12 V5 (RC4047) | 11 AUG 70 |       | REFL 1.57770X10-01 INCHES  |
| U      | NAAL 020 00V-ILRV STRAIGHT WING | 06 W6 H12 V5 (RC4048) | 11 AUG 70 |       | REFD 1.13300X10-00 INCHES  |
| O      | NAAL 020 00V-ILRV STRAIGHT WING | 06 W6 H12 V5 (RC4049) | 11 AUG 70 |       | INRP 0.13200X10-00 INCHES  |
|        |                                 |                       |           |       | YMRP 0.00000X10-00 INCHES  |
|        |                                 |                       |           |       | ZMRP -0.04000X10-01 INCHES |
|        |                                 |                       |           |       | SCALE 1.01000X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-381

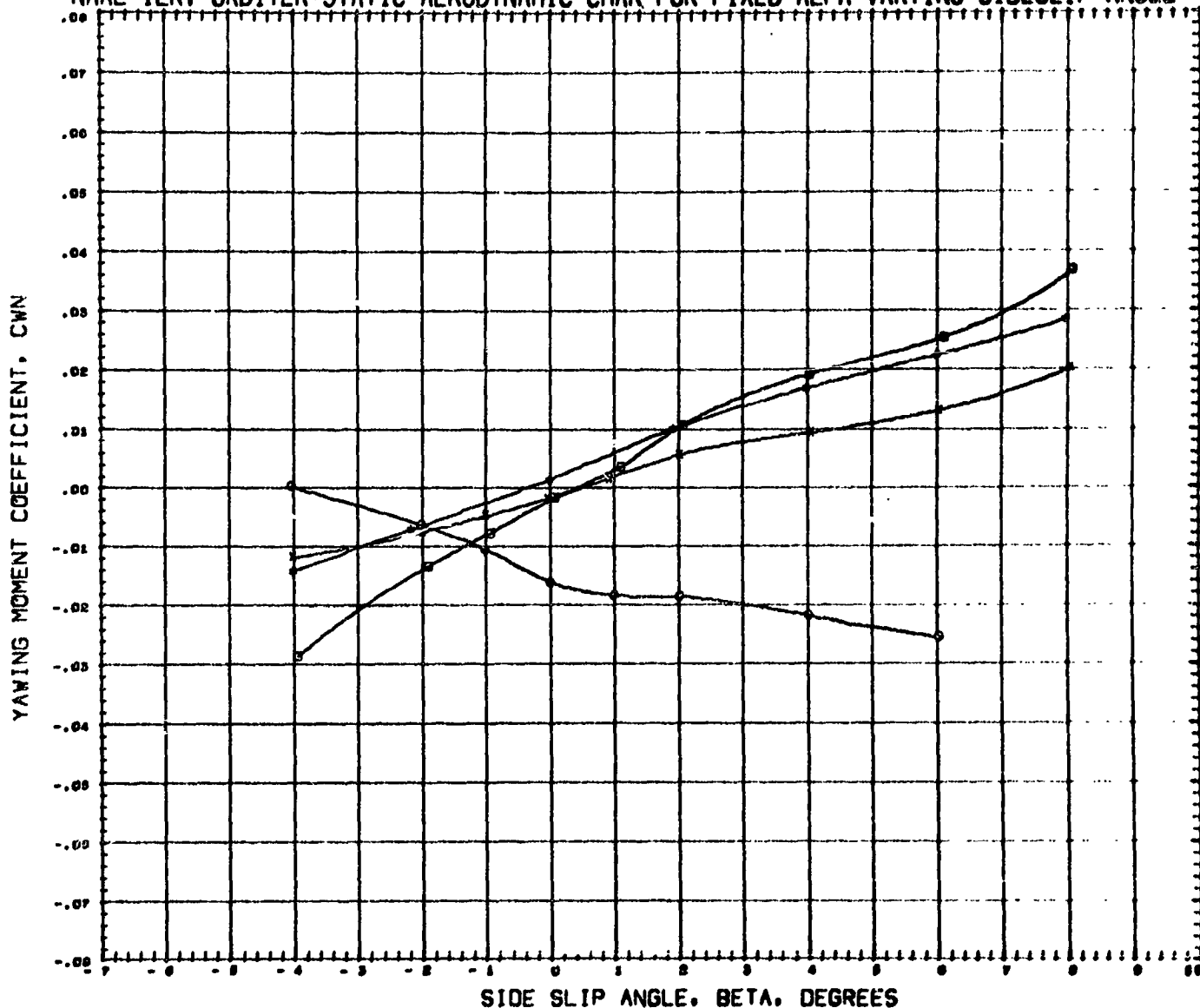
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL         | CONFIGURATION DESCRIPTION |                        | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION |                            |
|----------------|---------------------------|------------------------|--------------|----------|-----------|-----------------------|----------------------------|
| #              | NAAL 020                  | BSV-ILRV STRAIGHT WING | B6 W6 H12 V5 | (RC4046) | 11 AUG 70 | 0.250                 | REFD 1.70000X10-01 86.FT.  |
| X              | NAAL 020                  | BSV-ILRV STRAIGHT WING | B6 W6 H12 V5 | (RC4047) | 11 AUG 70 |                       | REFL 1.97370X10-01 INCHES  |
| □              | NAAL 020                  | BSV-ILRV STRAIGHT WING | B6 W6 H12 V5 | (RC4048) | 11 AUG 70 |                       | REFD 1.13300X10-00 INCHES  |
| ○              | NAAL 020                  | BSV-ILRV STRAIGHT WING | B6 W6 H12 V5 | (RC4049) | 11 AUG 70 |                       | ENRP 0.13200X10-00 INCHES  |
|                |                           |                        |              |          |           |                       | YNRP 0.00000X10-00 INCHES  |
|                |                           |                        |              |          |           |                       | ZNRP -3.04600X10-01 INCHES |
|                |                           |                        |              |          |           |                       | SCALE 7.01000X10-01 SCALE  |
| REFERENCE FILE |                           | NAAL 020 NA-70-351     |              |          |           |                       |                            |

REFERENCE FILE NAAL 020 NA-70-351

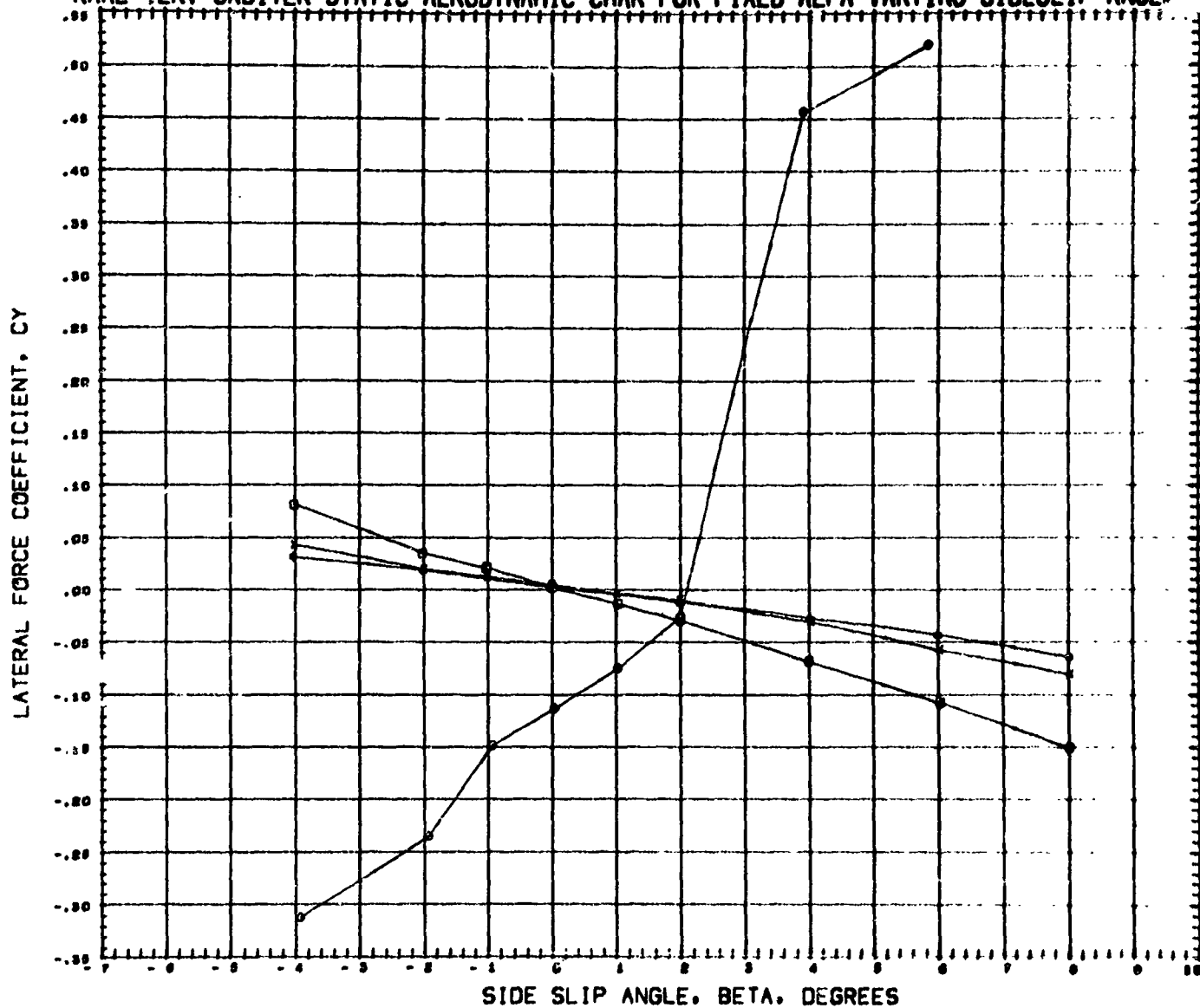
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|-----------------------|-----------|-------|---------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V3 (RC4046) | 11 AUG 70 | 0.830 | REF 1.700000E-01 00.FY.   |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V3 (RC4047) | 11 AUG 70 |       | REFL 1.073700E-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V3 (RC4048) | 11 AUG 70 |       | REFD 1.133000E-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H12 V3 (RC4049) | 11 AUG 70 |       | ENRP 0.137000E-01 INCHES  |
|        |                                 |                       |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                 |                       |           |       | ZMRP -0.040000E-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



SYMBOL CONFIGURATION DESCRIPTION

|   |          |                        |    |
|---|----------|------------------------|----|
| * | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |
| x | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |
| + | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |
| o | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4000) | 12 AUG 70 | 0.250 |
| (RC4001) | 11 AUG 70 |       |
| (RC4002) | 11 AUG 70 |       |

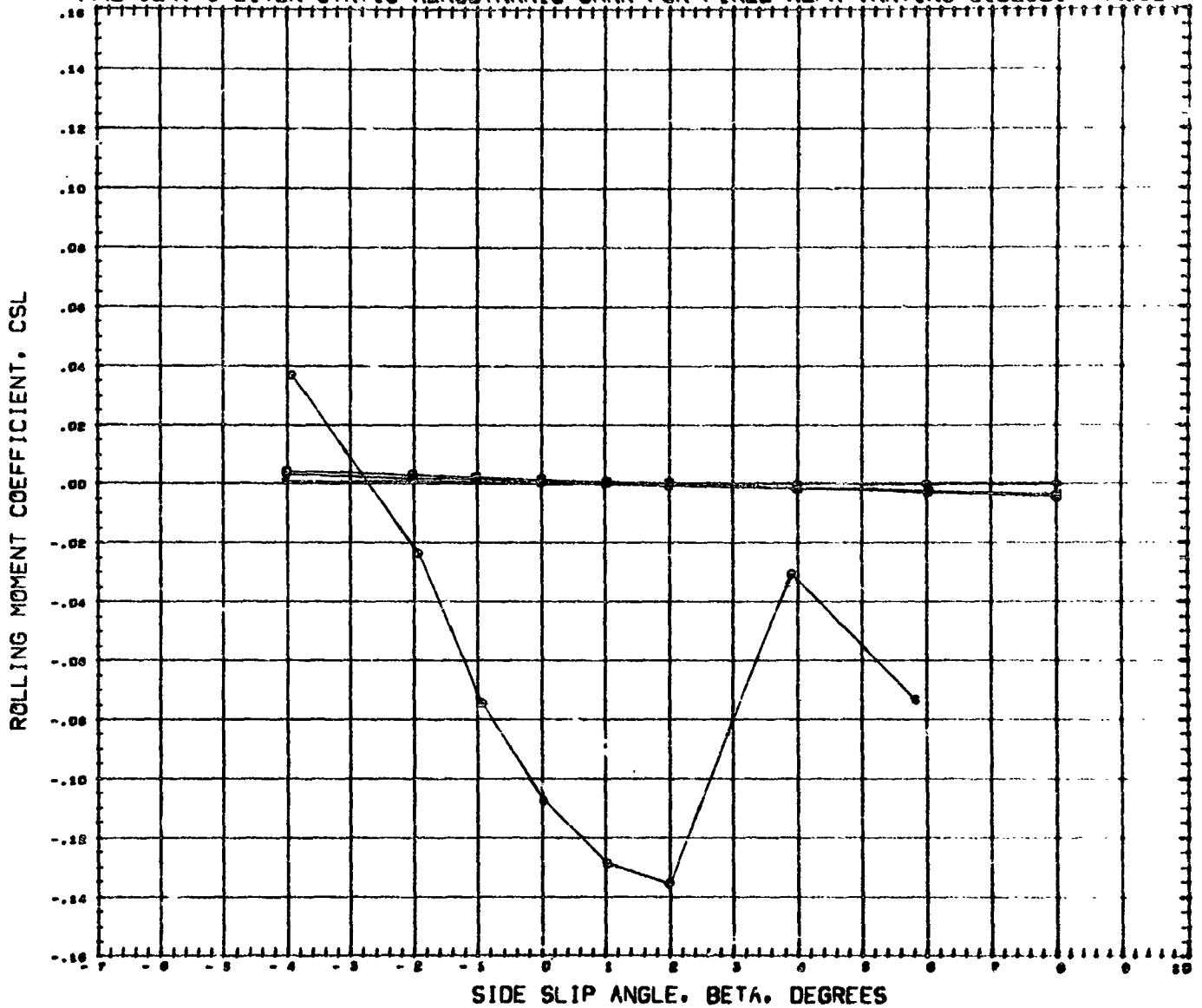
REFERENCE INFORMATION

|       |              |         |
|-------|--------------|---------|
| REFS  | 1.700000E-01 | 00. FT. |
| REFL  | 1.07370E-01  | INCHES  |
| REFS  | 1.13300E-01  | INCHES  |
| UNRP  | 0.13300E-01  | INCHES  |
| UNRP  | 0.00000E-01  | INCHES  |
| UNRP  | -0.04000E-01 | INCHES  |
| SCALE | 7.01000E-01  | SCALE   |

REFERENCE FILE

NAAL 020 NA-70-391

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



SYMBOL CONFIGURATION DESCRIPTION

|   |          |                        |    |
|---|----------|------------------------|----|
| o | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |
| x | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |
| □ | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |
| ◇ | NAAL 020 | SSV-ILRV STRAIGHT WING | 07 |

DATA SET

DATE

MACH

|          |           |       |
|----------|-----------|-------|
| (RC4000) | 12 AUG 70 | 0.250 |
| (RC4000) | 11 AUG 70 |       |
| (RC4001) | 11 AUG 70 |       |
| (RC4002) | 11 AUG 70 |       |

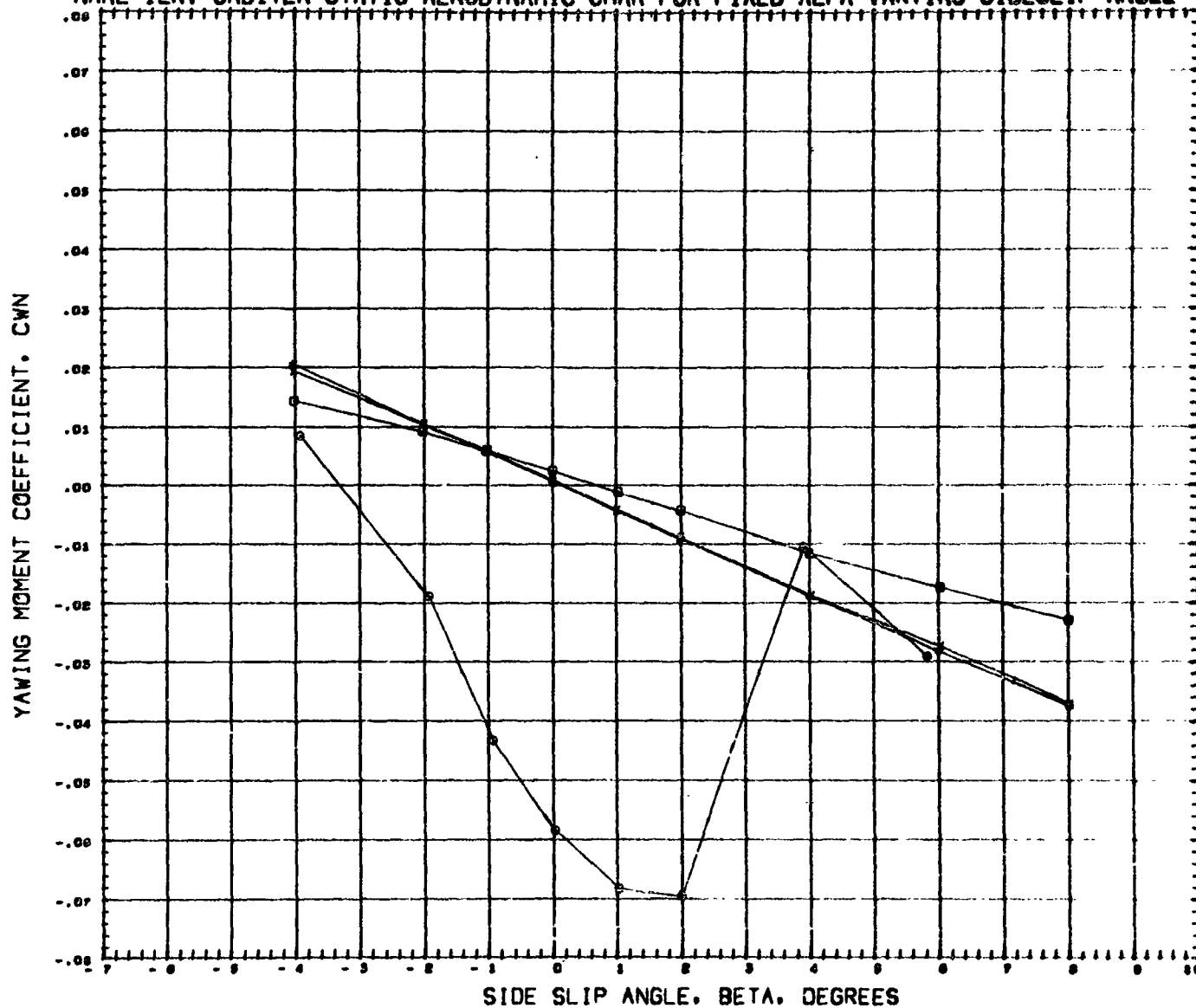
REFERENCE INFORMATION

|       |              |        |
|-------|--------------|--------|
| REFS  | 1.700000E-01 | 80.77. |
| REFL  | 1.07370E-01  | INCHES |
| REFD  | 1.13200E-01  | INCHES |
| ENRP  | 0.13200E-01  | INCHES |
| ENRP  | 0.00000E-01  | INCHES |
| ENRP  | -3.04000E-01 | INCHES |
| SCALE | 7.01000E-01  | SCALE  |

REFERENCE FILE

NAAL 020 NA-70-391

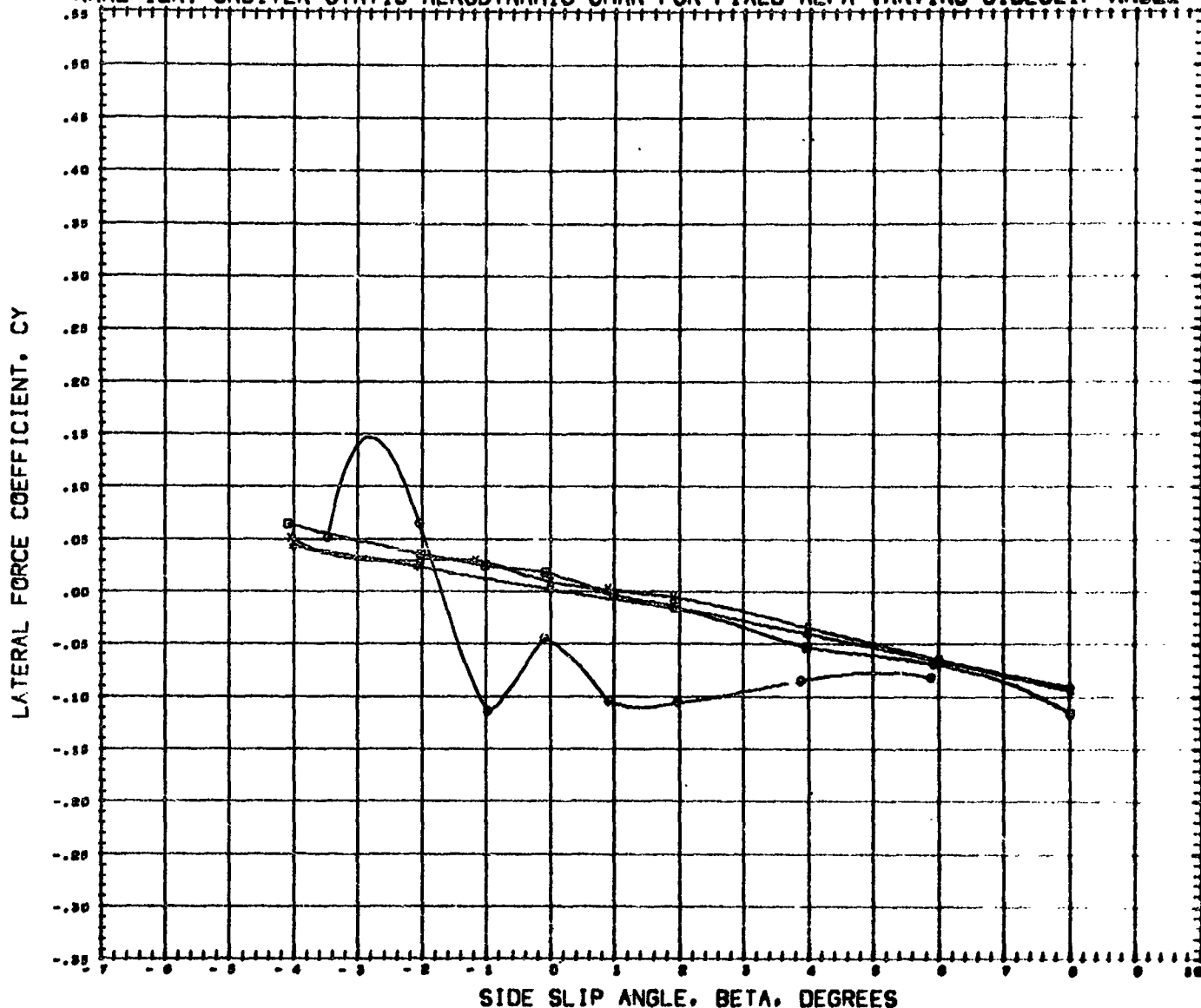
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION          | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|------------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 629 SSV-ILRV STRAIGHT WING B7 | (RC4080) | 12 AUG 70 | 0.250 | REFS 1.70000E+01 66.FT.  |
| x      | NAAL 629 SSV-ILRV STRAIGHT WING B7 | (RC4080) | 11 AUG 70 |       | REFL 1.97370E+01 INCHES  |
| G      | NAAL 629 SSV-ILRV STRAIGHT WING B7 | (RC4091) | 11 AUG 70 |       | REFD 1.13300E+01 INCHES  |
| O      | NAAL 629 SSV-ILRV STRAIGHT WING B7 | (RC4092) | 11 AUG 70 |       | KNRP 0.13200E+00 INCHES  |
|        |                                    |          |           |       | YNRP 0.00000E+00 INCHES  |
|        |                                    |          |           |       | ZMRP -3.04000E+01 INCHES |
|        |                                    |          |           |       | SCALE 7.01000E+03 SCALE  |

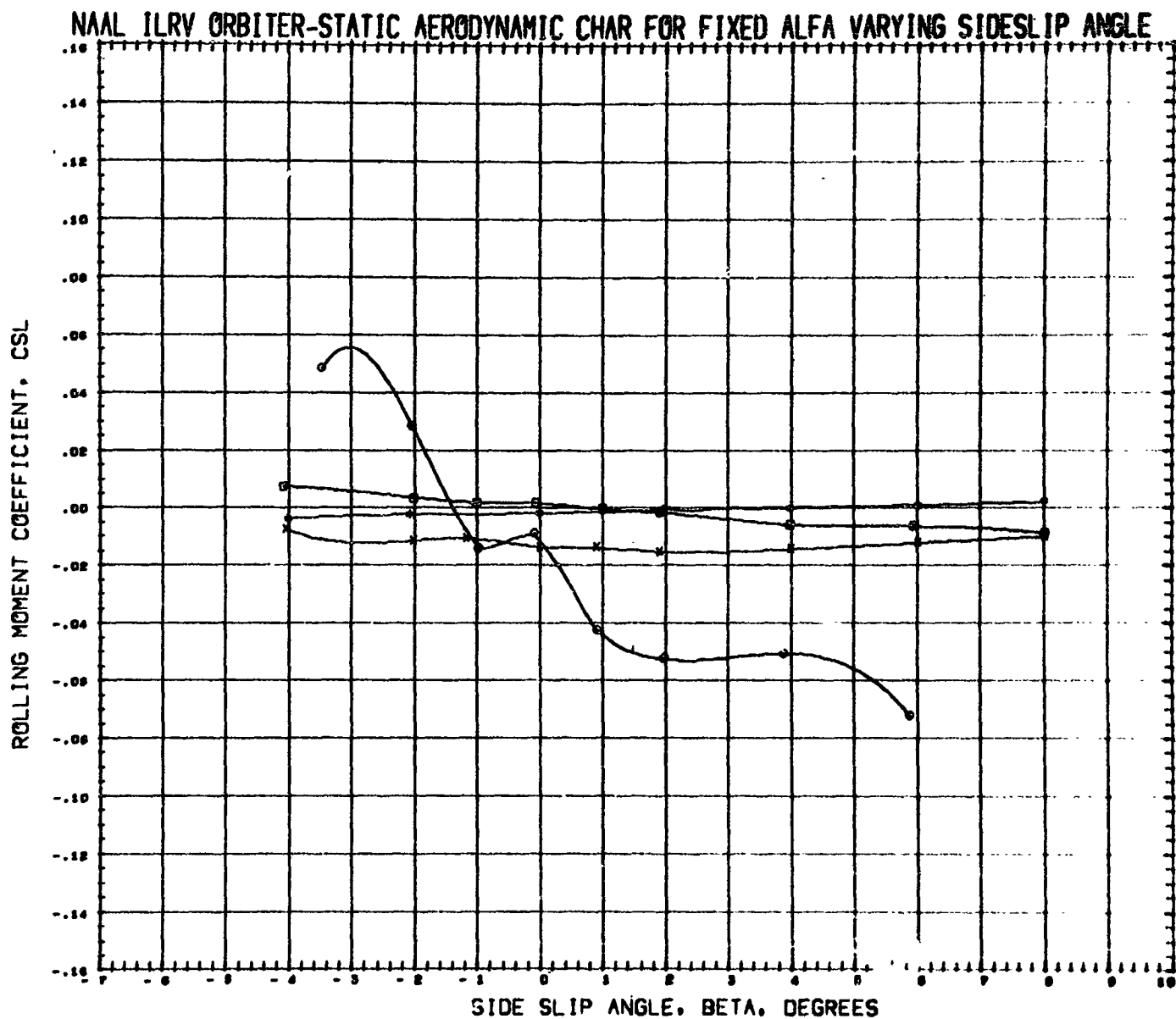
REFERENCE FILE NAAL 629 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------------|----------|-----------|-------|----------------------------|
| o      | NAAL 020 SSV-ILRV STRAIGHT WING BY WS | (RC4094) | 11 AUG 70 | 0.830 | REFS 1.70000E10-01 SQ.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING BY WS | (RC4095) | 11 AUG 70 |       | REFL 1.07370E10-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING BY WS | (RC4096) | 11 AUG 70 |       | REFS 1.03300E10-00 INCHES  |
| ◇      | NAAL 020 SSV-ILRV STRAIGHT WING BY WS | (RC4097) | 11 AUG 70 |       | SWRP 0.52000E10-00 INCHES  |
|        |                                       |          |           |       | YMRP 0.00000E10-00 INCHES  |
|        |                                       |          |           |       | ZMRP -3.04000E10-01 INCHES |
|        |                                       |          |           |       | SCALE 7.01000E10-01 SCALE  |

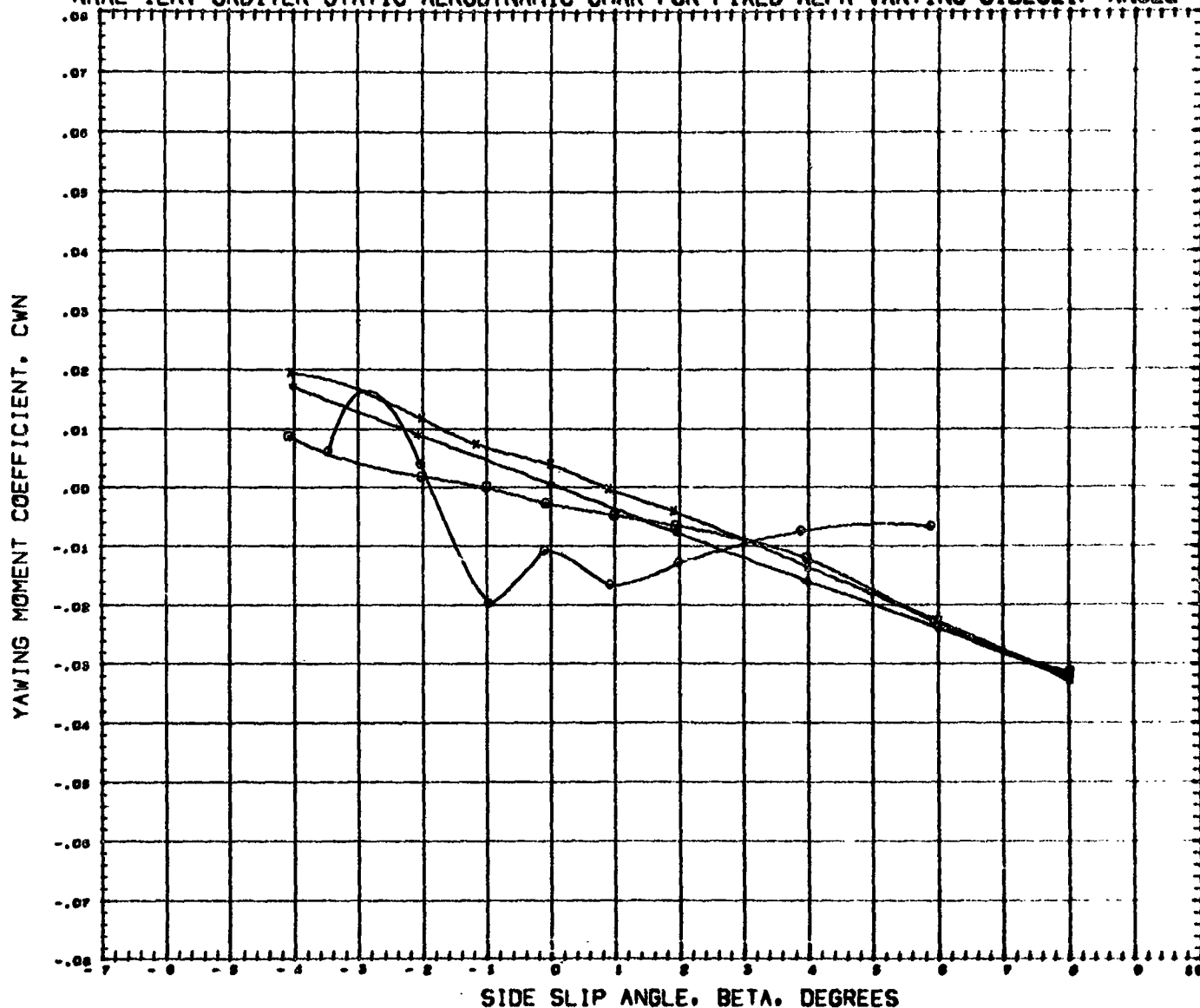
REFERENCE FILE NAAL 020 NA-70-391



| SYMBOL | CONFIGURATION DESCRIPTION |          |          |      | DATA SET | DATE      | MACH      | REFERENCE INFORMATION |                                        |
|--------|---------------------------|----------|----------|------|----------|-----------|-----------|-----------------------|----------------------------------------|
| *      | NAAL 020                  | SSV-ILRV | STRAIGHT | WING | BT WD    | (RC4094)  | 11 AUG 70 | 0.850                 | REFS 1.70000X10 <sup>-01</sup> 00.FT.  |
| X      | NAAL 020                  | SSV-ILRV | STRAIGHT | WING | BT WD    | (RC4095)  | 11 AUG 70 |                       | REFL 1.97370X10 <sup>-01</sup> INCHES  |
| Q      | NAAL 020                  | SSV-ILRV | STRAIGHT | WING | BT WD    | (RC4096)  | 11 AUG 70 |                       | REFB 1.13300X10 <sup>-00</sup> INCHES  |
| Q      | NAAL 020                  | SSV-ILRV | STRAIGHT | WING | BT WD    | (RC4097)  | 11 AUG 70 |                       | XMRP 0.13200X10 <sup>-00</sup> INCHES  |
|        |                           |          |          |      |          |           |           |                       | YMRP 0.00000X10 <sup>-01</sup> INCHES  |
|        |                           |          |          |      |          |           |           |                       | ZMRP -3.04000X10 <sup>-01</sup> INCHES |
|        |                           |          |          |      |          |           |           |                       | SCALE 7.01000X10 <sup>-01</sup> SCALE  |
|        | REFERENCE FILE            |          |          |      | NAAL 020 | NA-70-351 |           |                       |                                        |

REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

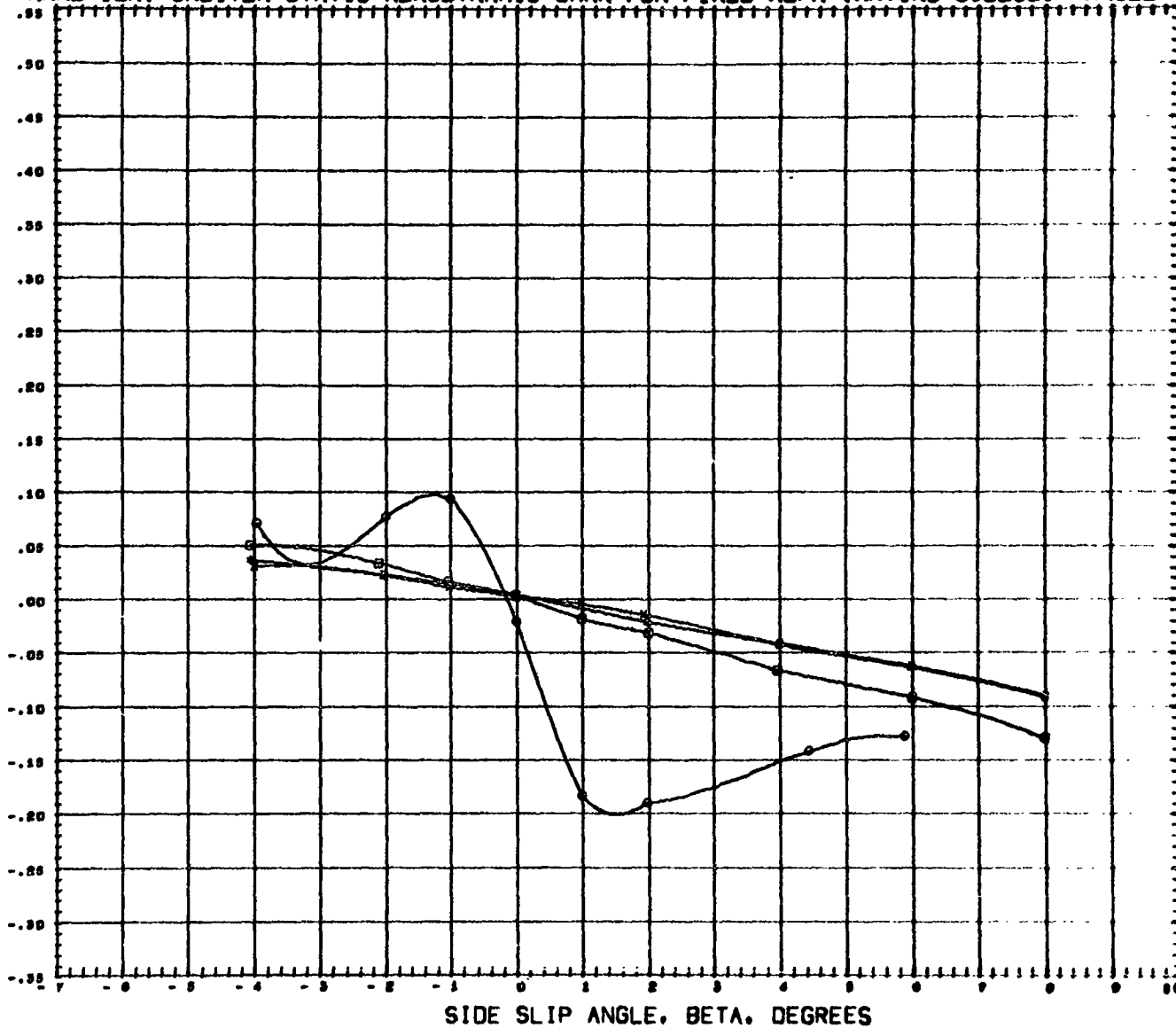


| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | NACH  | REFERENCE INFORMATION    |
|--------|---------------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 07 W9 | (RC4004) | 11 AUG 70 | 0.250 | REFS 1.700000E-01 00.FT. |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING 07 W9 | (RC4005) | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING 07 W9 | (RC4006) | 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING 07 W9 | (RC4007) | 11 AUG 70 |       | ENRP 0.13200E-01 INCHES  |
|        |                                       |          |           |       | VNRP 0.00000E-01 INCHES  |
|        |                                       |          |           |       | ENRP -3.04000E-01 INCHES |
|        |                                       |          |           |       | SCALE 7.00000E-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

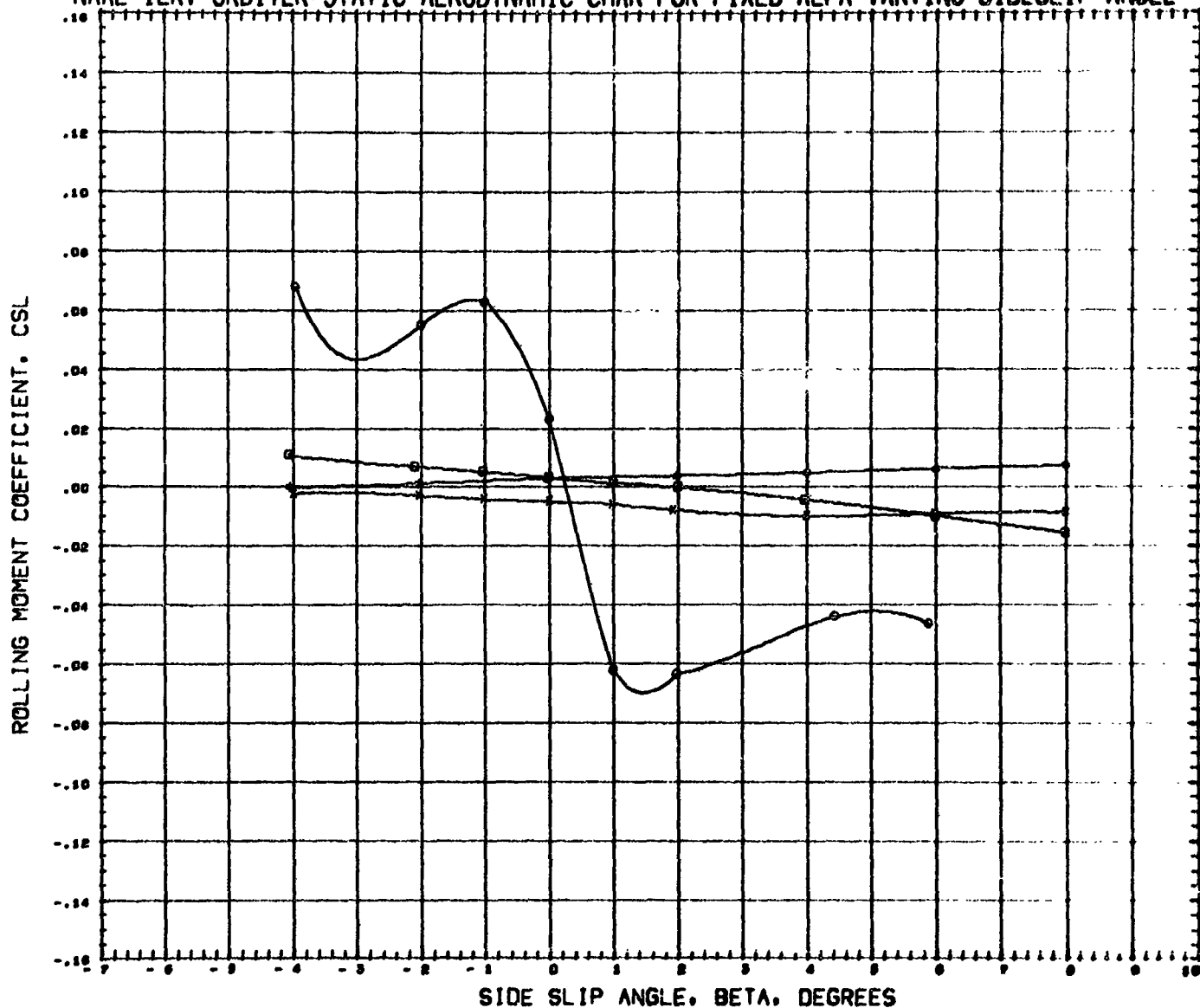
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|-------------------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING B7 W0 M13 | (RC4114) | 11 AUG 70 | 0.850 | REFD 1.70000E+01 SQ.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING B7 W0 M13 | (RC4115) | 11 AUG 70 |       | REFL 1.97370E+01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING B7 W0 M13 | (RC4116) | 11 AUG 70 |       | REFD 1.13300E+01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING B7 W0 M13 | (RC4117) | 11 AUG 70 |       | XMRP 0.13200E+00 INCHES  |
|        |                                           |          |           |       | YMRP 0.00000E+00 INCHES  |
|        |                                           |          |           |       | ZMRP -3.04000E-01 INCHES |
|        |                                           |          |           |       | SCALE 7.61000E+00 SCALE  |

REFERENCE FILE NAAL 020 NA-70-335

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

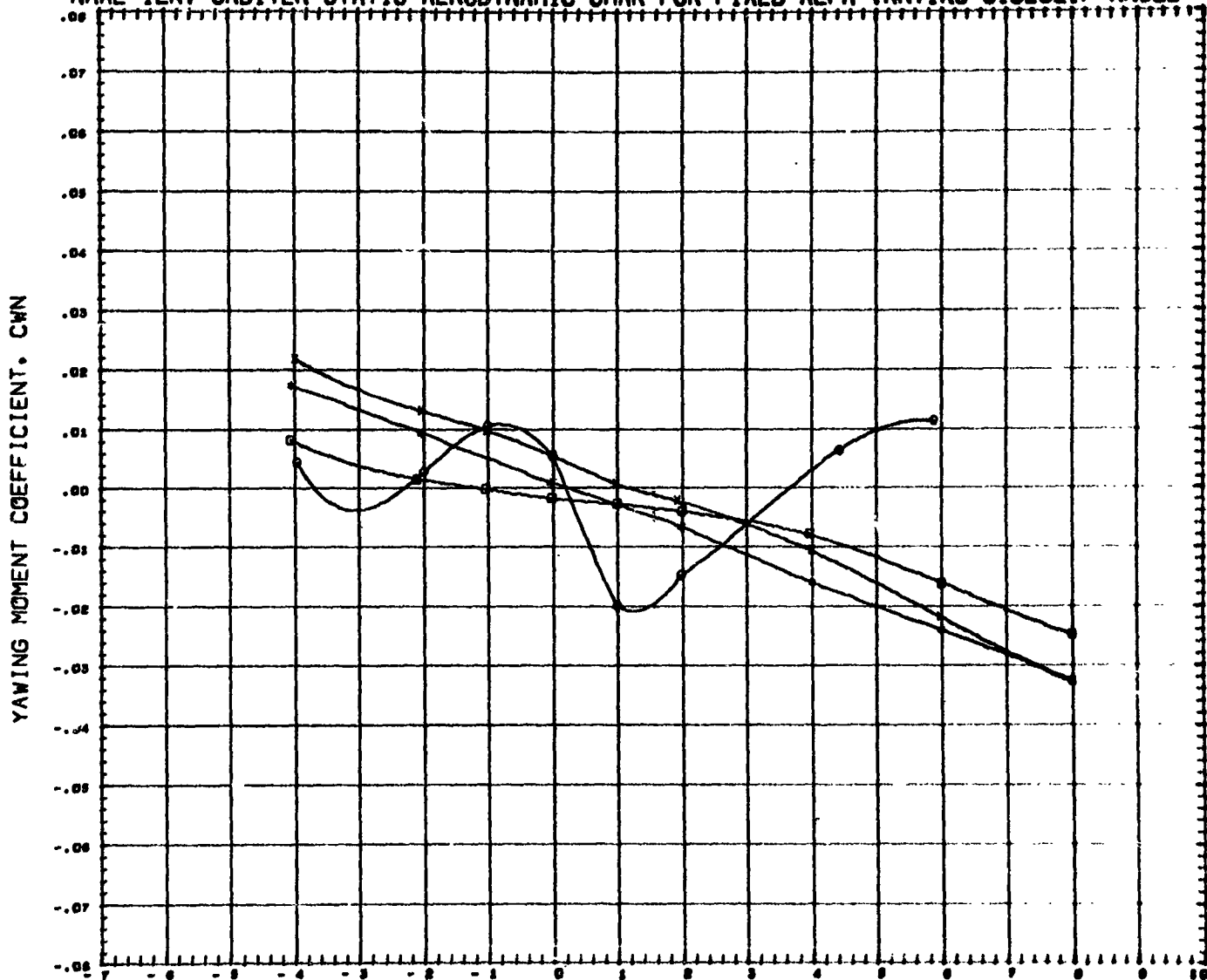


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE               | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------|--------------------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | BT WD N13 | (RC4114) 11 AUG 70 | 0.850 | REFD 1.70000010-01 50.71   |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | BT WD N13 | (RC4115) 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | BT WD N13 | (RC4116) 11 AUG 70 |       | REFD 1.13300010-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | BT WD N13 | (RC4117) 11 AUG 70 |       | INRP 0.13200010-00 INCHES  |
|        |                                 |           |                    |       | INRP 0.06000010-00 INCHES  |
|        |                                 |           |                    |       | INRP -0.04000010-01 INCHES |
|        |                                 |           |                    |       | SCALE 7.61000010-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-391

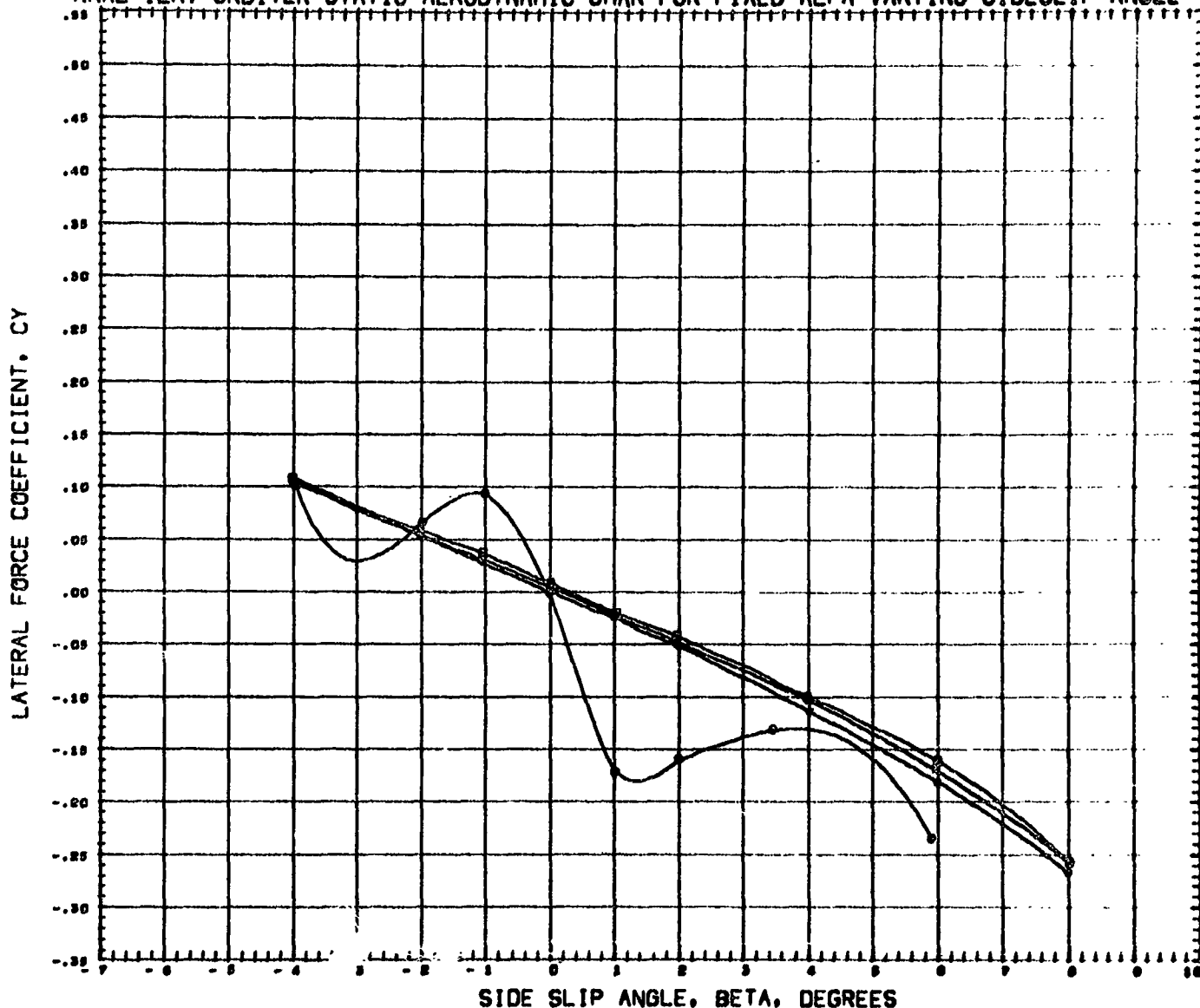
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      | REFERENCE INFORMATION                                                                                                                                                                                    |
|--------|---------------------------------|-----------|----------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 | (RC4114) | 11 AUG 70 | 0.890                                                                                                                                                                                                    |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 | (RC4115) | 11 AUG 70 |                                                                                                                                                                                                          |
| @      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 | (RC4116) | 11 AUG 70 |                                                                                                                                                                                                          |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 | (RC4117) | 11 AUG 70 |                                                                                                                                                                                                          |
|        |                                 |           |          |           | REF8 1.70000X10-01 60.71.<br>REFL 1.97370X10-01 INCHES<br>REF8 1.13300X10-00 INCHES<br>XMRP 0.13000X10-00 INCHES<br>YMRP 0.00000X10-01 INCHES<br>ZMRP -3.04000X10-01 INCHES<br>SCALE 7.01000X10-01 SCALE |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHART FOR FIXED ALFA VARYING SIDESLIP ANGLE

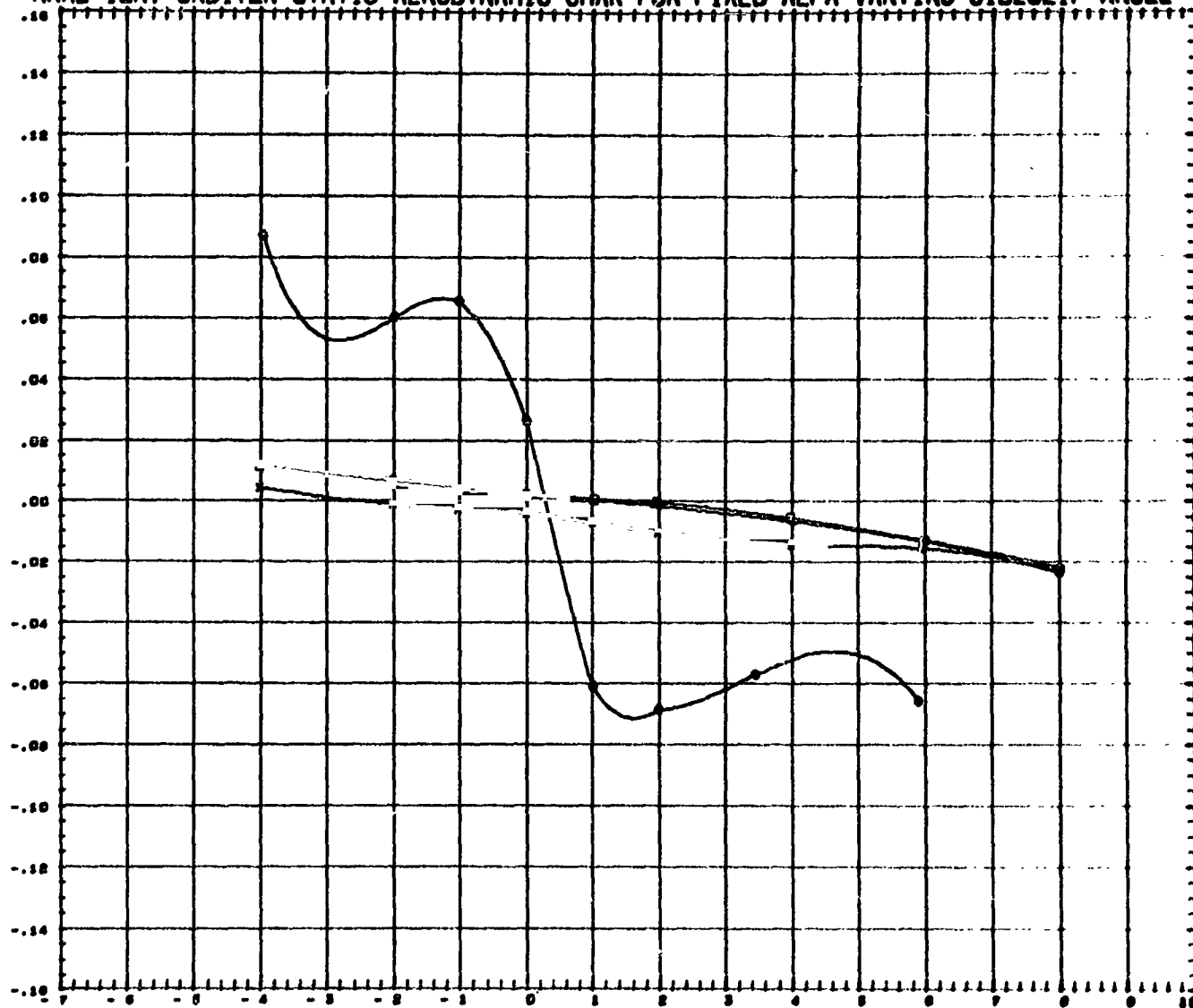


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|-----------------------|-----------|-------|---------------------------|
| *      | NAAL 020 00V-ILRV STRAIGHT WING | 07 WD H13 V5 (RC4100) | 11 AUG 70 | 0.250 | REFS 1.700000E-01 00.FT.  |
| x      | NAAL 020 00V-ILRV STRAIGHT WING | 07 WD H13 V5 (RC4110) | 11 AUG 70 |       | REFL 1.973700E-01 INCHES  |
| □      | NAAL 020 00V-ILRV STRAIGHT WING | 07 WD H13 V5 (RC4111) | 11 AUG 70 |       | REFS 1.133000E-00 INCHES  |
| o      | NAAL 020 00V-ILRV STRAIGHT WING | 07 WD H13 V5 (RC4112) | 11 AUG 70 |       | INRP 0.132000E-00 INCHES  |
|        |                                 |                       |           |       | VNRP 0.000000E-01 INCHES  |
|        |                                 |                       |           |       | ZNRP -3.040000E-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

ROLLING MOMENT COEFFICIENT, CSL



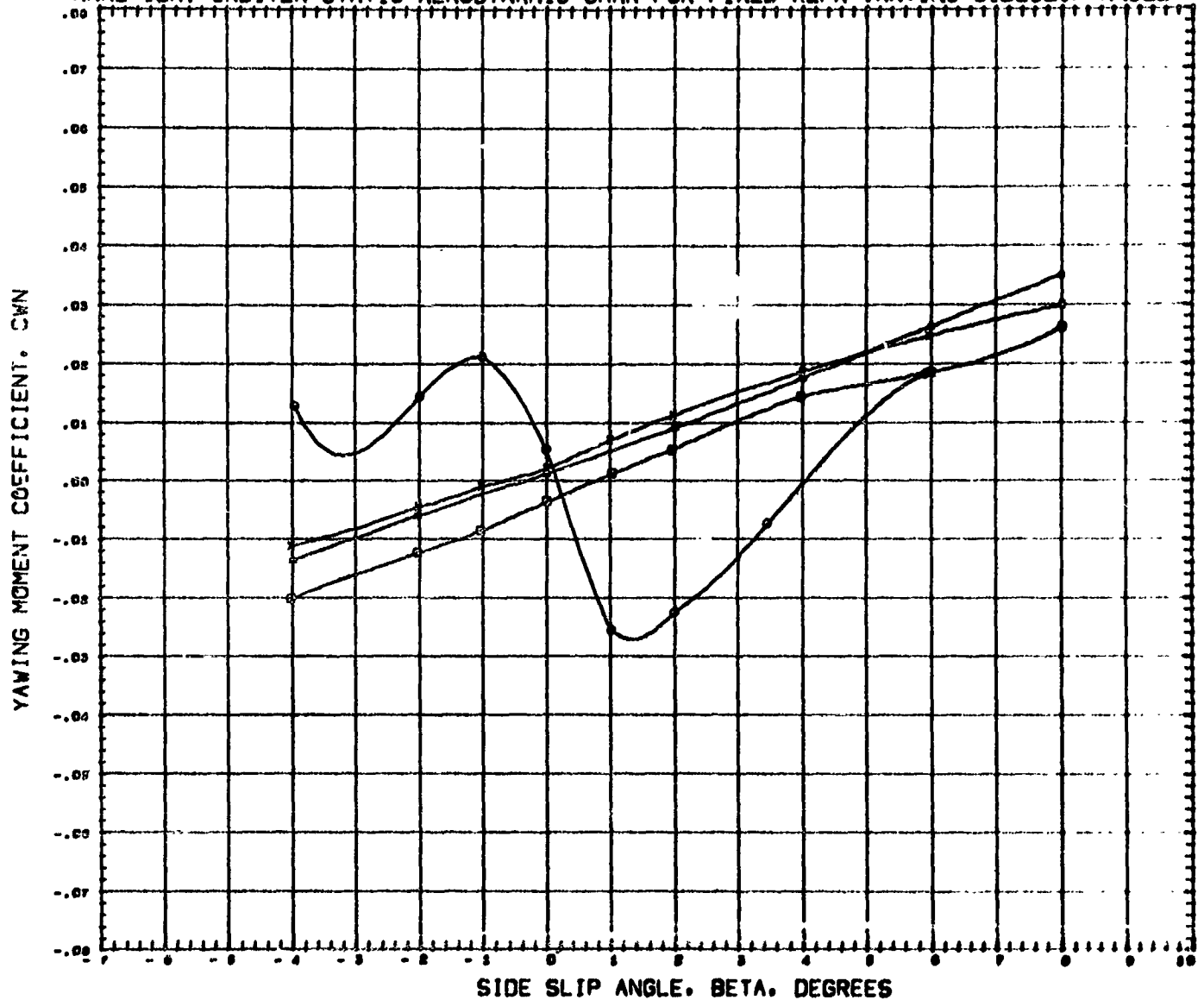
SIDE SLIP ANGLE, BETA, DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|--------------------|-------|--------------------------|
| •      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 V5 | (RC4100) 11 AUG 70 | 0.850 | REFS 1.70000E-01 00.71.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 V5 | (RC4110) 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 V5 | (RC4111) 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
| ◊      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M13 V5 | (RC4112) 11 AUG 70 |       | ENRP 0.13200E-00 INCHES  |
|        |                                 |              |                    |       | VNRP 0.00000E-01 INCHES  |
|        |                                 |              |                    |       | ZNRP -3.04000E-01 INCHES |
|        |                                 |              |                    |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

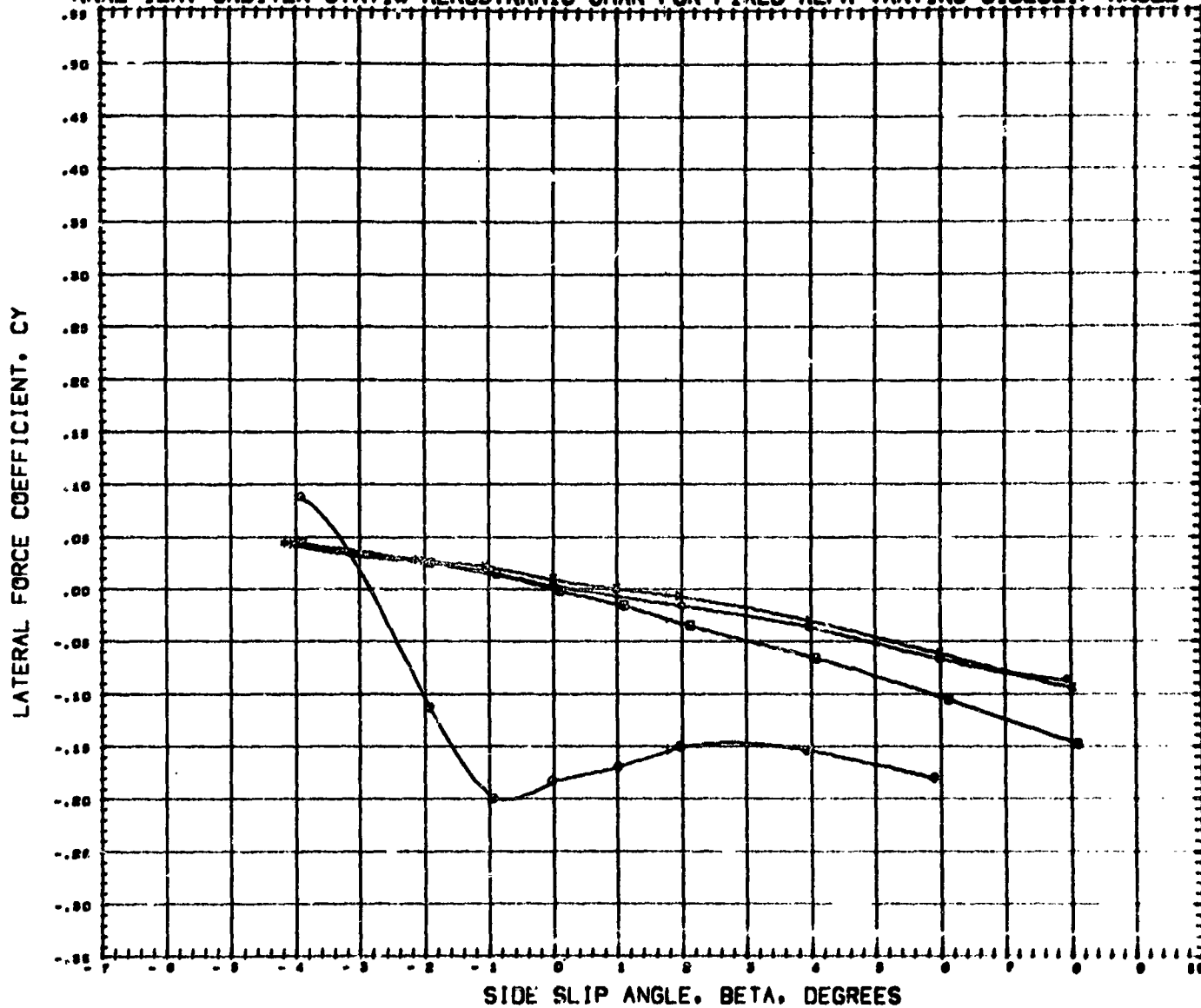
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| S      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4100   | 11 AUG 70 | 0.850 | REFD 1.7000000000 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4110   | 11 AUG 70 |       | REFL 1.0757000000 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4111   | 11 AUG 70 |       | REFD 1.1000000000 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4112   | 11 AUG 70 |       | SNRP 0.1000000000 INCHES  |
|        |                                 |          |           |       | SNRP 0.0000000000 INCHES  |
|        |                                 |          |           |       | SNRP -0.0000000000 INCHES |
|        |                                 |          |           |       | SCALE 7.0000000000 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

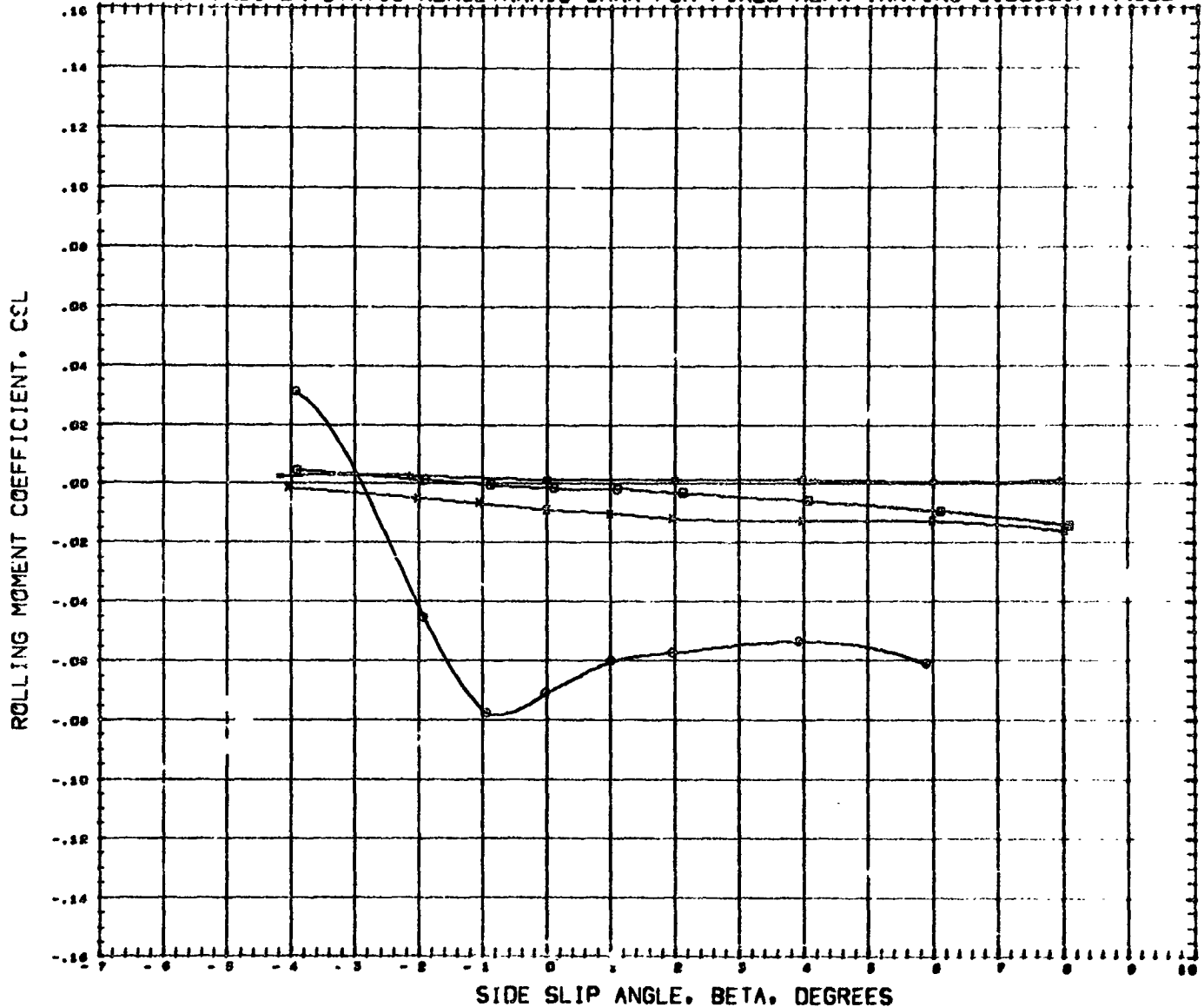


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE               | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|-----------|--------------------|-------|---------------------------|
| ●      | NAAL 020 SSV-ILRV STRAIGHT WING | BY W0 N12 | (RC4009) 11 AUG 70 | 0.250 | REFD 1.700000E-01 INCHES  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | BY W0 N12 | (RC4100) 11 AUG 70 |       | REFD 1.873700E-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | BY W0 N12 | (RC4101) 11 AUG 70 |       | REFD 1.130000E-01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | BY W0 N12 | (RC4102) 11 AUG 70 |       | REFD 0.130000E-01 INCHES  |
|        |                                 |           |                    |       | REFD 0.000000E-01 INCHES  |
|        |                                 |           |                    |       | REFD -0.040000E-01 INCHES |
|        |                                 |           |                    |       | SCALE 7.510000E-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



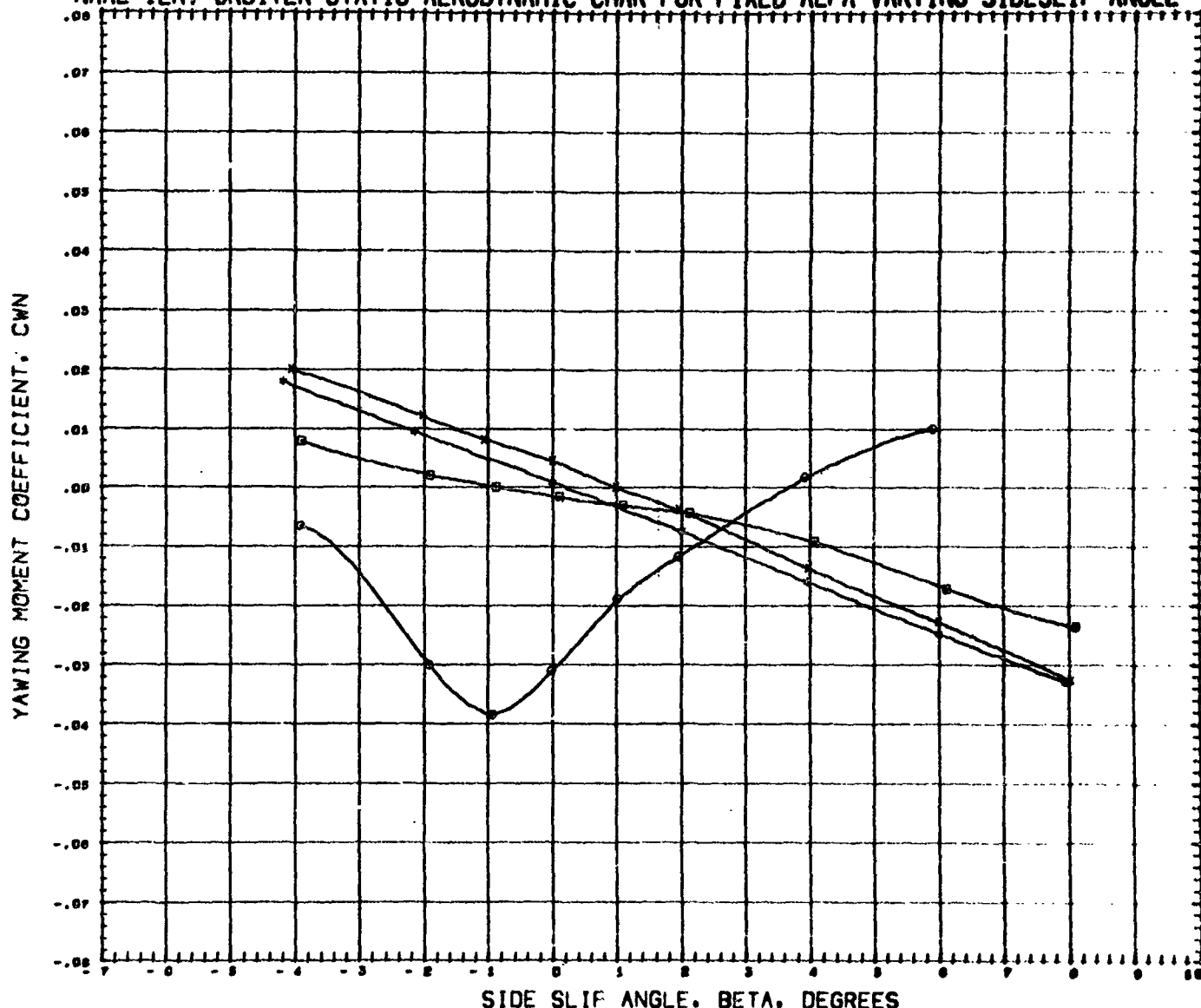
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  |
|--------|---------------------------------|--------------------|-----------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | BY WS N12 (RC0000) | 11 AUG 70 | 0.250 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | BY WV N12 (RC4100) | 11 AUG 70 |       |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | BY WD N12 (RC4101) | 11 AUG 70 |       |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | BY WD N12 (RC4102) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 020 NA-70-391

| REFERENCE INFORMATION |                                   |
|-----------------------|-----------------------------------|
| REF0                  | 1.70000X10 <sup>-01</sup> 00.FT.  |
| REF1                  | 1.87370X10 <sup>-01</sup> INCHES  |
| REF2                  | 1.19300X10 <sup>-01</sup> INCHES  |
| YMRP                  | 0.19200X10 <sup>-00</sup> INCHES  |
| YMRP                  | 0.00000X10 <sup>-00</sup> INCHES  |
| ZMRP                  | -3.04000X10 <sup>-01</sup> INCHES |
| SCALE                 | 7.01000X10 <sup>-01</sup> SCALE   |

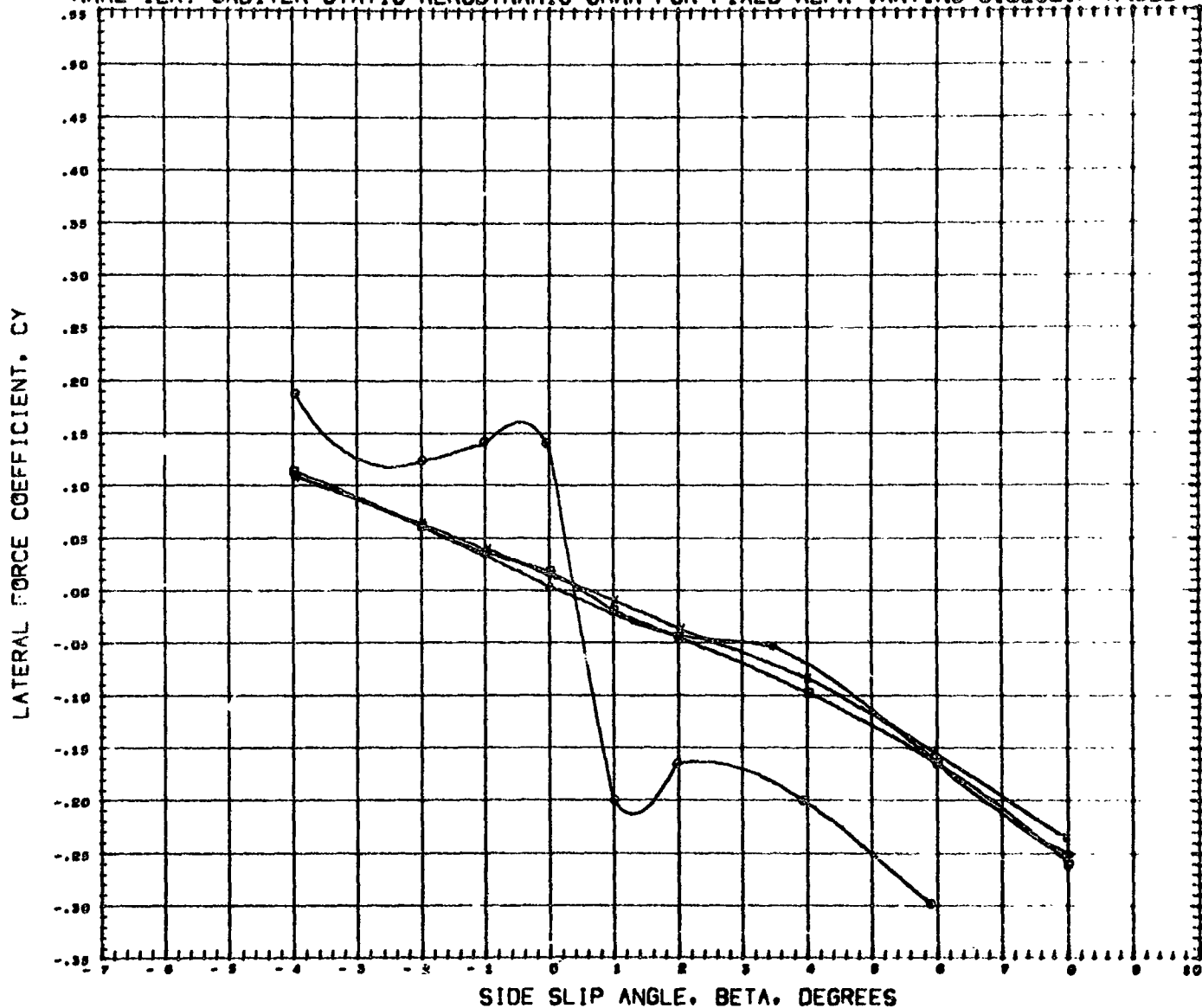
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE      | MACH  | REFERENCE INFORMATION                 |
|--------|---------------------------------|-----------|-----------|-------|---------------------------------------|
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 87 W9 H12 | 11 AUG 70 | 0.850 | REFS 1.7000X10 <sup>-01</sup> 60.07.  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | 87 W9 H12 | 11 AUG 70 |       | REFL 1.9757X10 <sup>-01</sup> INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 87 W9 H12 | 11 AUG 70 |       | REFD 1.1550X10 <sup>-01</sup> INCHES  |
|        |                                 |           |           |       | ENRP 0.1320X10 <sup>-00</sup> INCHES  |
|        |                                 |           |           |       | YMRP 0.0000X10 <sup>-00</sup> INCHES  |
|        |                                 |           |           |       | ZMRP -3.6400X10 <sup>-01</sup> INCHES |
|        |                                 |           |           |       | SCALE 7.0100X10 <sup>-03</sup> SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

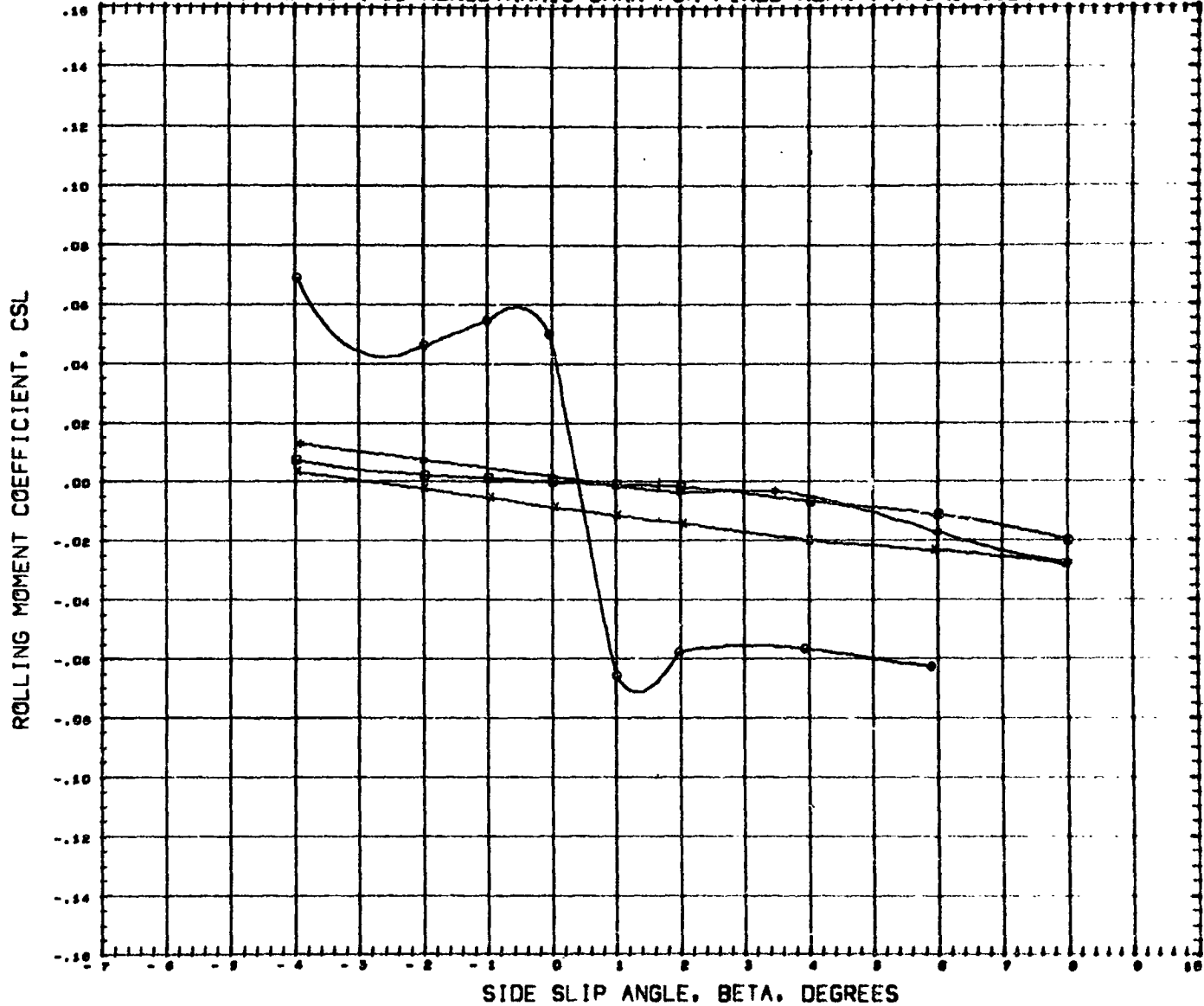
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| •      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4304) | 11 AUG 70 | 0.230 | REFS 1.70000E10-01 88.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4305) | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4306) | 11 AUG 70 |       | REFS 1.13700E10-01 INCHES  |
| ◇      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4307) | 11 AUG 70 |       | KWRP 0.13800E10-00 INCHES  |
|        |                                 |          |           |       | YWRP 0.00000E10-01 INCHES  |
|        |                                 |          |           |       | ZWRP -3.00000E10-00 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E10-00 SCALE  |

REFERENCE FILE NAAL 029 NA-70-391

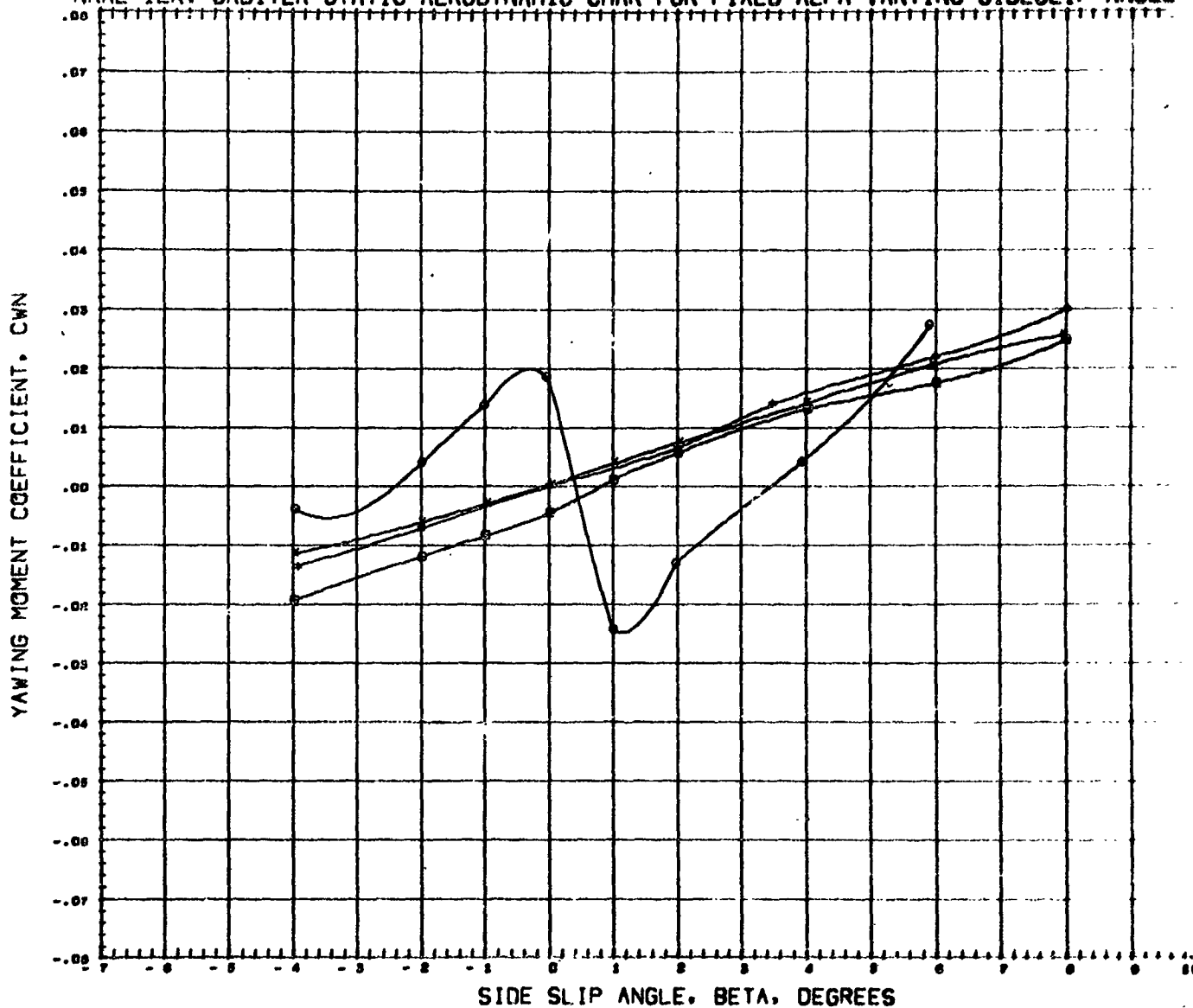
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|--------------------|-------|----------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | B7 W9 H12 V5 | (RC4104) 11 AUG 70 | 0.259 | REFS 1.70000X10-01 80.F1.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | B7 W9 H12 V5 | (RC4105) 11 AUG 70 |       | REFL 1.97370X10-01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B7 W9 H12 V5 | (RC4106) 11 AUG 70 |       | REFS 1.13300X10-00 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | B7 W9 H12 V5 | (RC4107) 11 AUG 70 |       | YMRP 0.13800X10-00 INCHES  |
|        |                                 |              |                    |       | YMRP 0.00000X10-01 INCHES  |
|        |                                 |              |                    |       | ZMRP -3.04000X10-01 INCHES |
|        |                                 |              |                    |       | SCALE 7.01000X10-01 SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

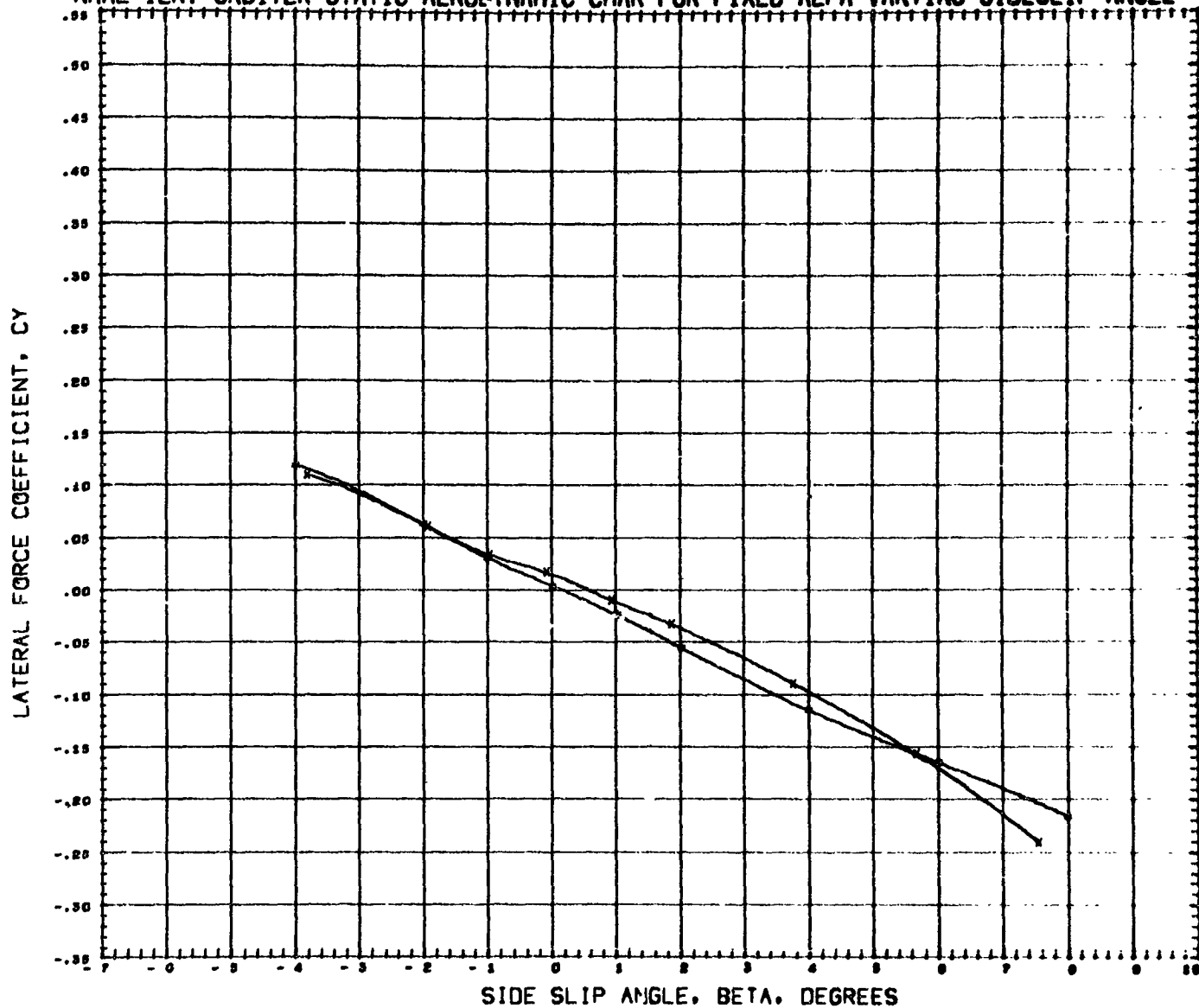
# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION       |
|--------|---------------------------------|-----------------------|-----------|-------|-----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M12 V5 (RC4104) | 11 AUG 70 | 0.239 | REFS 1.70000E10 .01 SQ.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M12 V5 (RC4105) | 11 AUG 70 |       | REFL 1.57370E10 .01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M12 V5 (RC4106) | 11 AUG 70 |       | REFD 1.13300E10 .00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 M12 V5 (RC4107) | 11 AUG 70 |       | KWRP 0.13200E10 .00 INCHES  |
|        |                                 |                       |           |       | VWRP 0.00000E10 .01 INCHES  |
|        |                                 |                       |           |       | ZWRP -3.04000E10 .01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000E10 .00 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  |
|--------|---------------------------------|--------------|--------------------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W8 H12 V5 | (RC4044) 11 AUG 70 | 0.250 |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W9 H12 V5 | (RC4119) 11 AUG 70 |       |

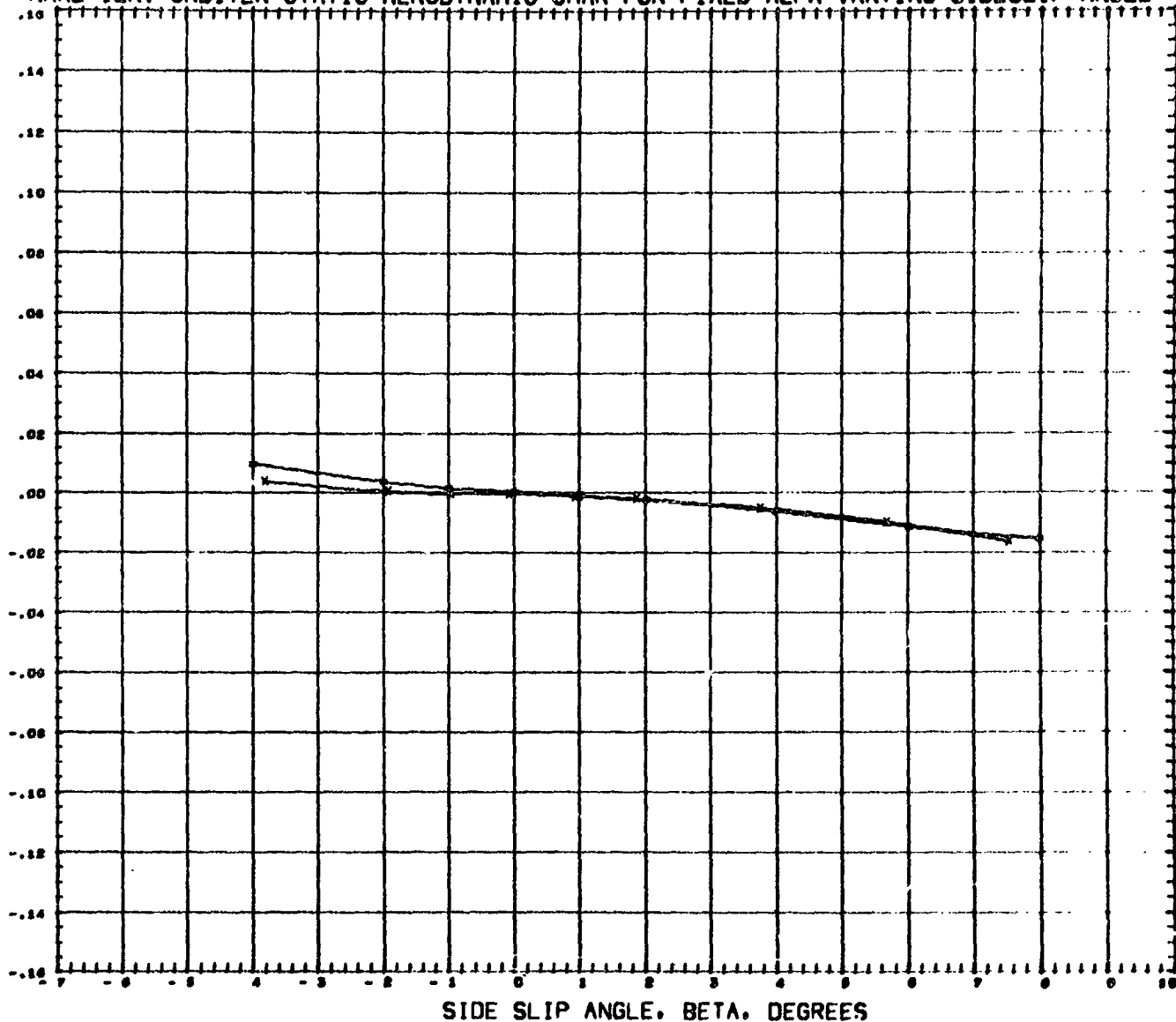
REFERENCE FILE

NAAL 020 NA-70-351

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REFS                  | 1.700000E-01 80 FT   |
| REFL                  | 1.573700E-01 INCHES  |
| REFD                  | 1.133000E-01 INCHES  |
| YNRP                  | 0.132000E-00 INCHES  |
| YNRP                  | 0.000000E-00 INCHES  |
| YNRP                  | -3.040000E-01 INCHES |
| SCALE                 | 7.610000E-03 SCALE   |

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

ROLLING MOMENT COEFFICIENT, CSL



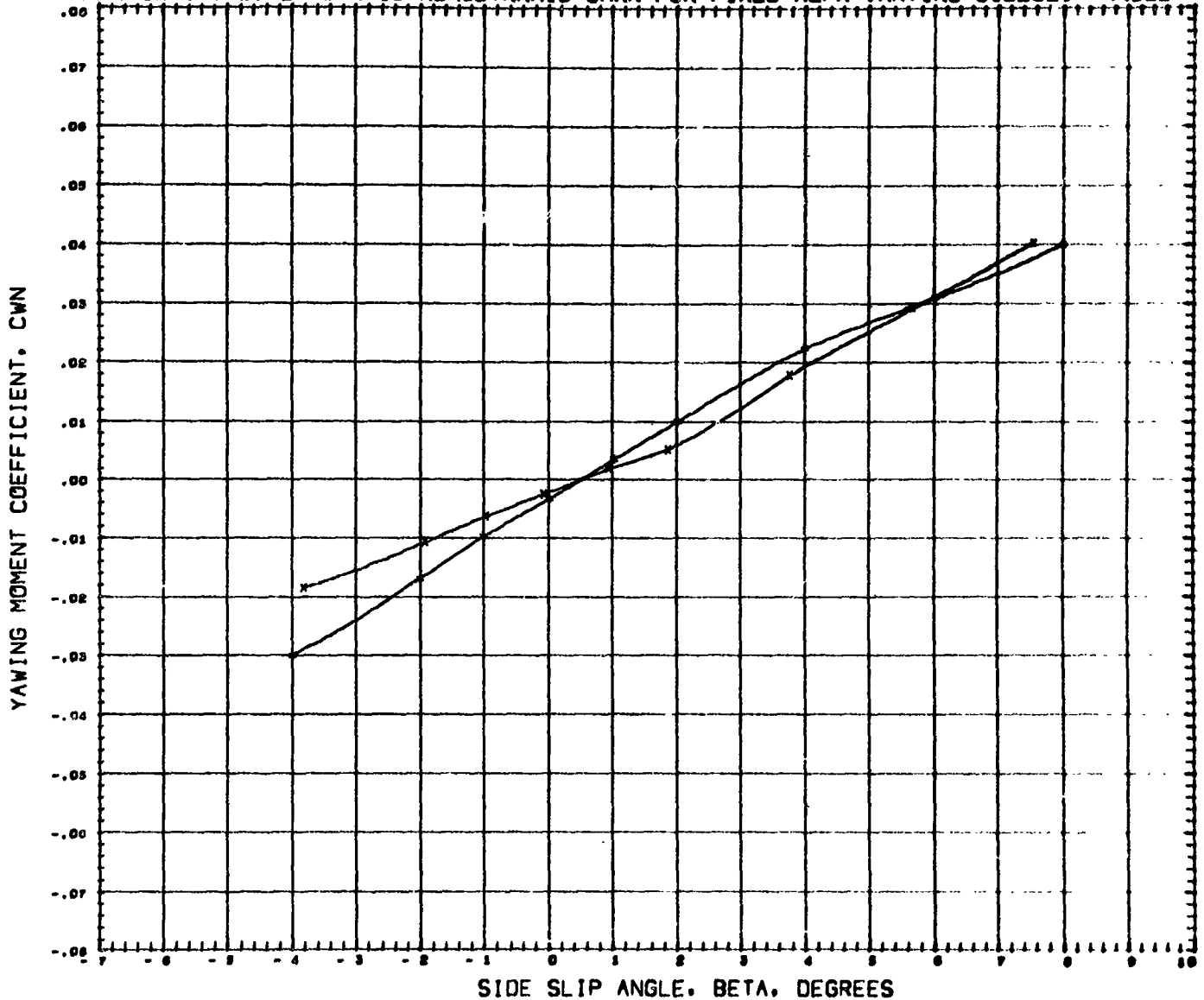
SIDE SLIP ANGLE, BETA, DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| 0      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W0 H12 V5 (RC4044) | 11 AUG 70 | 0.250 |
| X      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W0 H12 V5 (RC4119) | 11 AUG 70 |       |

REFERENCE FILE NAAL 029 NA-70-351

| REFERENCE INFORMATION |                      |
|-----------------------|----------------------|
| REF0                  | 1.700000E-01 INCHES  |
| REF1                  | 1.975700E-01 INCHES  |
| REF2                  | 1.155000E-01 INCHES  |
| REF3                  | 0.150000E-01 INCHES  |
| REF4                  | 0.000000E-01 INCHES  |
| REF5                  | -2.000000E-01 INCHES |
| SCALE                 | 7.010000E-01 SCALE   |

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

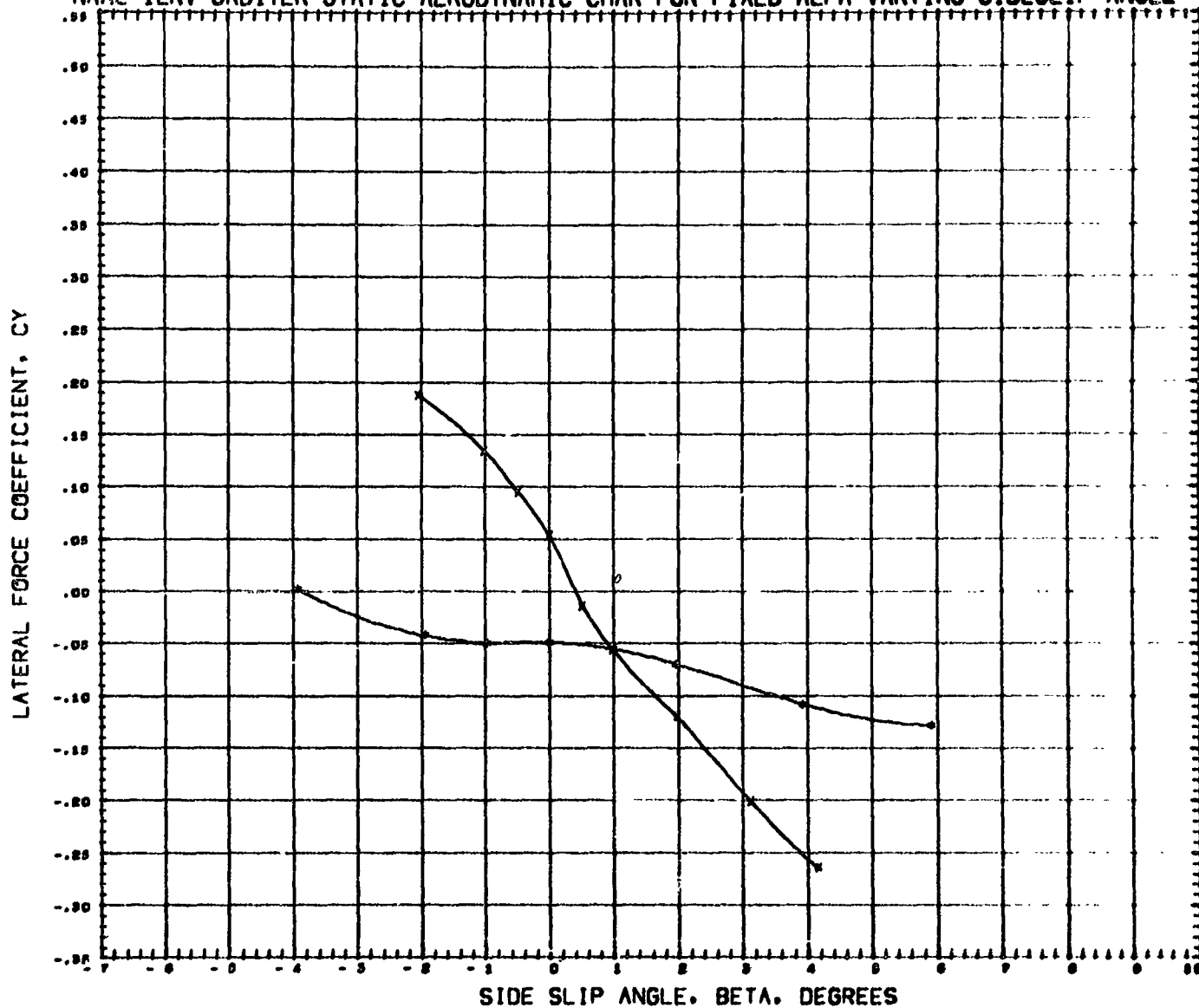


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE               | MACH  |
|--------|---------------------------------|--------------|--------------------|-------|
| o      | NAAL 629 SSV-ILRV STRAIGHT WING | B6 W6 M12 V5 | (RC4044) 11 AUG 70 | 0.250 |
| x      | NAAL 629 SSV-ILRV STRAIGHT WING | B6 W6 M12 V5 | (RC4119) 11 AUG 70 | 0.250 |

REFERENCE FILE NAAL 629 NA-70-351

| REFERENCE INFORMATION |                     |
|-----------------------|---------------------|
| REFD                  | 1.70000E-01 88.77.  |
| REFL                  | 1.97570E-01 INCHES  |
| REFD                  | 1.13390E-01 INCHES  |
| YNRP                  | 0.13300E-00 INCHES  |
| YNRP                  | 0.00000E-01 INCHES  |
| YNRP                  | -3.04000E-01 INCHES |
| SCALE                 | 7.01000E-10 SCALE   |

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  |
|--------|---------------------------------|--------------|-----------|-------|
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H12 V5 | 11 AUG 70 | 0.250 |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 H12 V5 | 11 AUG 70 | 0.250 |

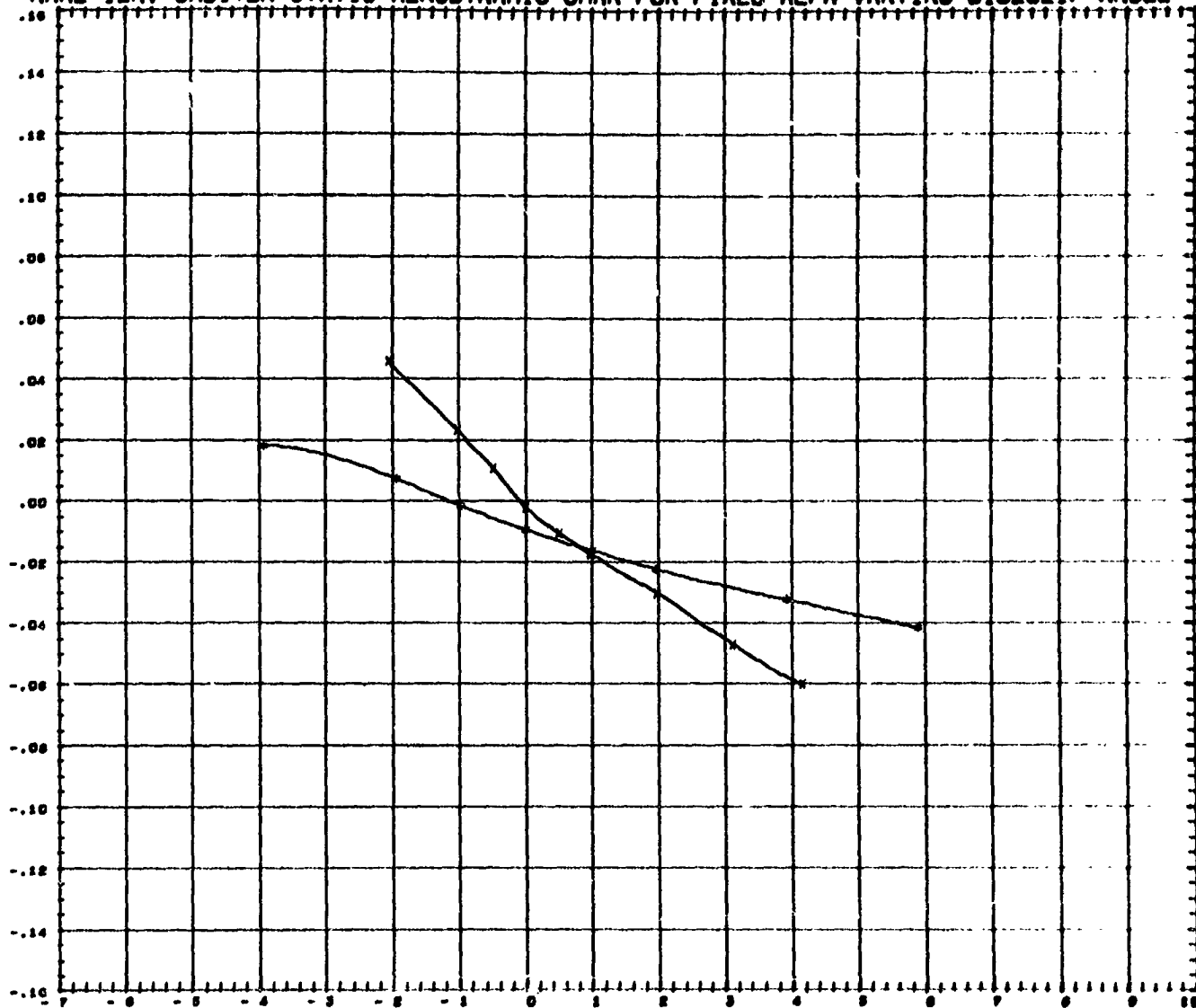
REFERENCE FILE

NAAL 020 NA-70-391

| REFERENCE INFORMATION |               |        |
|-----------------------|---------------|--------|
| REFD                  | 1.700000E-01  | 00 FT. |
| REFL                  | 1.073700E-01  | INCHES |
| REFD                  | 1.100000E-01  | INCHES |
| YMRP                  | 0.100000E-00  | INCHES |
| YMRP                  | 0.000000E-00  | INCHES |
| YMRP                  | -3.040000E-01 | INCHES |
| SCALE                 | 7.010000E-03  | SCALE  |

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHART FOR FIXED ALFA VARYING SIDESLIP ANGLE

ROLLING MOMENT COEFFICIENT, CSL



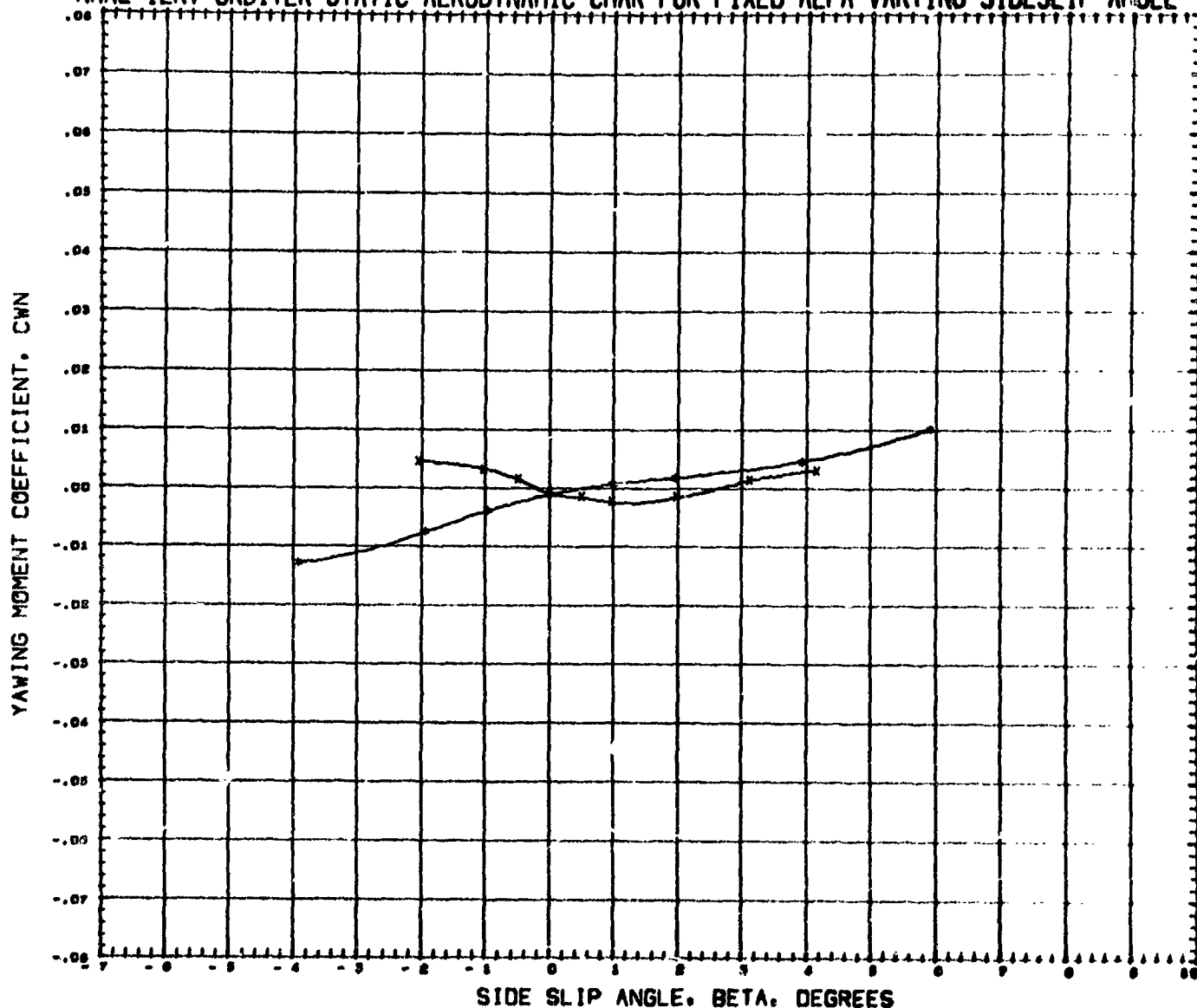
SIDE SLIP ANGLE, BETA, DEGREES

| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W6 M12 V5 (RC4011) | 11 AUG 70 | 0.250 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W9 M12 V5 (RC4121) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFS                  | 1.70000X10-01 80.FT.  |
| REFL                  | 1.87370X10-01 INCHES  |
| REFS                  | 1.13300X10-01 INCHES  |
| INRP                  | 0.13800X10-00 INCHES  |
| YNRP                  | 0.00000X10-00 INCHES  |
| ZNRP                  | -3.04000X10-01 INCHES |
| SCALE                 | 7.01000X10-01 SCALE   |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-STATIC AERODYNAMIC CHAR FOR FIXED ALFA VARYING SIDESLIP ANGLE

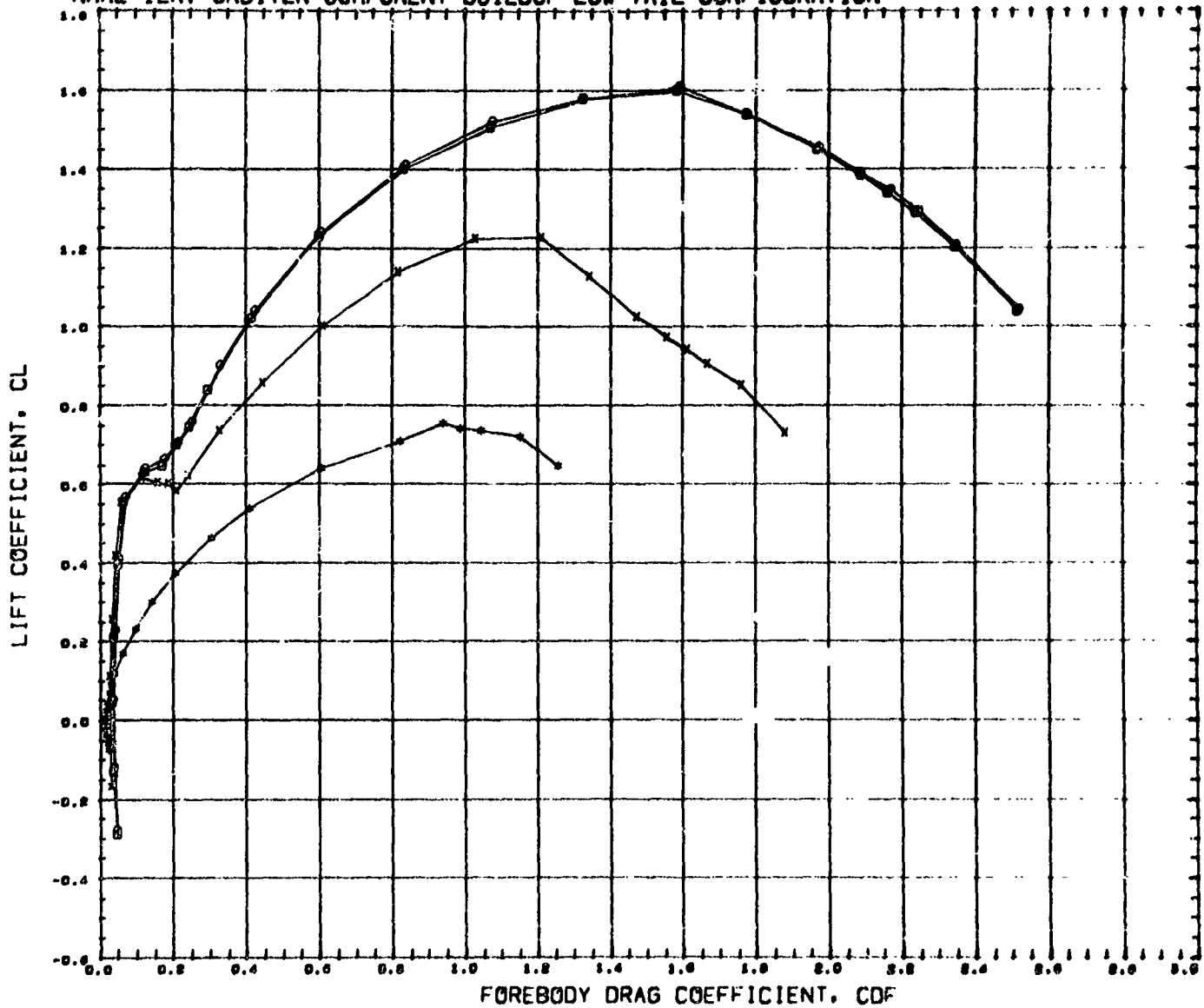


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  |
|--------|---------------------------------|----------|-----------|-------|
| 1      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4041   | 11 AUG 70 | 0.800 |
| 2      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4121   | 11 AUG 70 | 0.800 |

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REF1                  | 1.70000010-01 60.FT.  |
| REF2                  | 1.57570010-01 INCHES  |
| REF3                  | 1.13300010-01 INCHES  |
| REF4                  | 0.13200010-01 INCHES  |
| REF5                  | 0.00000010-01 INCHES  |
| REF6                  | -3.04000010-01 INCHES |
| SCALE                 | 1.01000010-70 SCALE   |

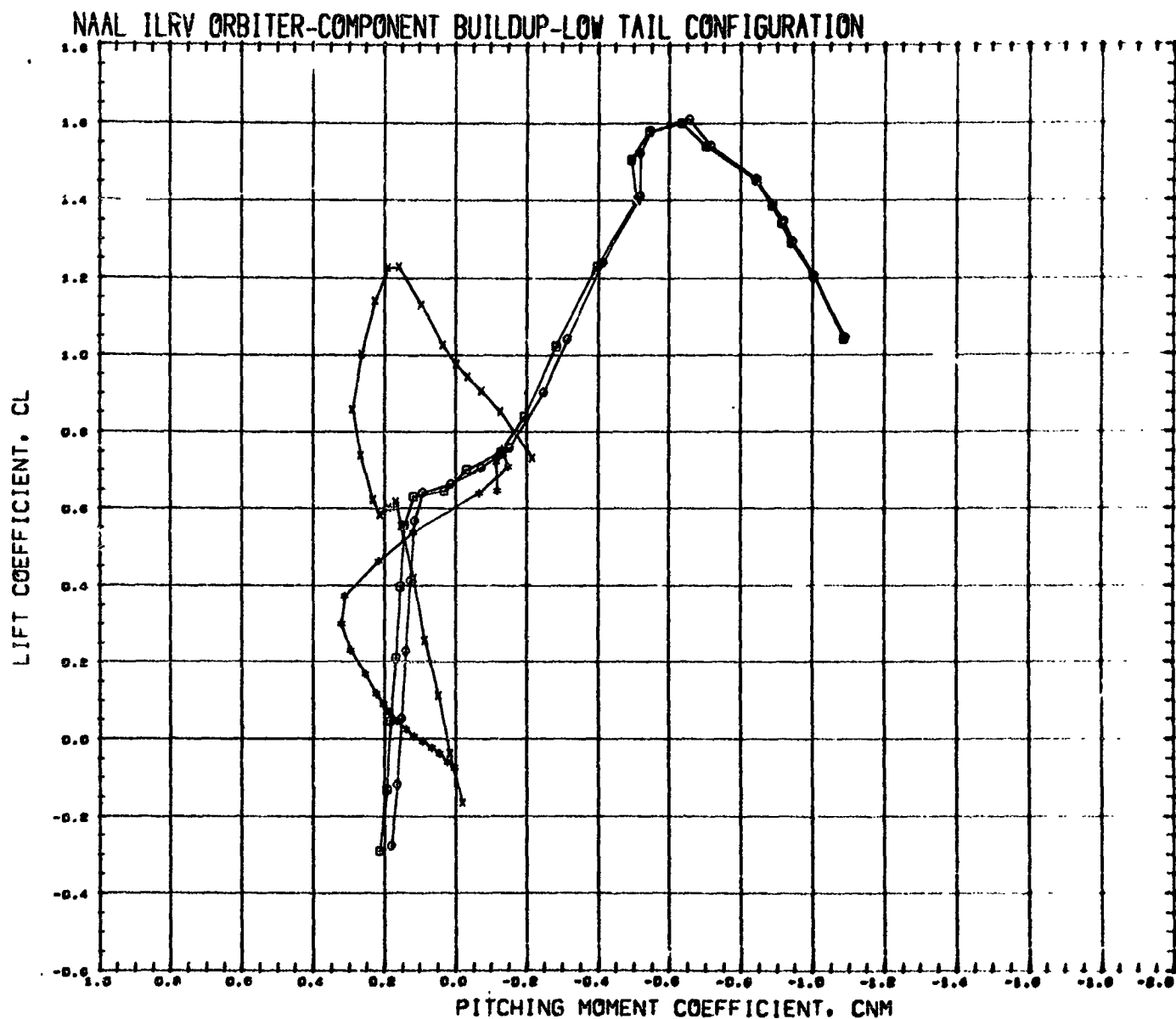
REFERENCE FILE NAAL 020 NA-PD-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION                    | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|----------------------------------------------|----------|-----------|-------|--------------------------|
| 1      | NAAL 020 BSV-ILRV STRAIGHT WING 00           | (RC4001) | 11 AUG 70 | 0.850 | REFS 1.70000E+01 00.FT.  |
| 2      | NAAL 020 BSV-ILRV STRAIGHT WING 00 W0        | (RC4002) | 11 AUG 70 |       | REFL 1.07370E+01 INCHES  |
| 3      | NAAL 020 BSV-ILRV STRAIGHT WING 00 W0 H13    | (RC4003) | 11 AUG 70 |       | REFL 1.13380E+01 INCHES  |
| 4      | NAAL 020 BSV-ILRV STRAIGHT WING 00 W0 H13 V5 | (RC4013) | 11 AUG 70 |       | REFL 1.13380E+01 INCHES  |
|        |                                              |          |           |       | YMRP 0.00000E+00 INCHES  |
|        |                                              |          |           |       | YMRP -3.04000E+01 INCHES |
|        |                                              |          |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351



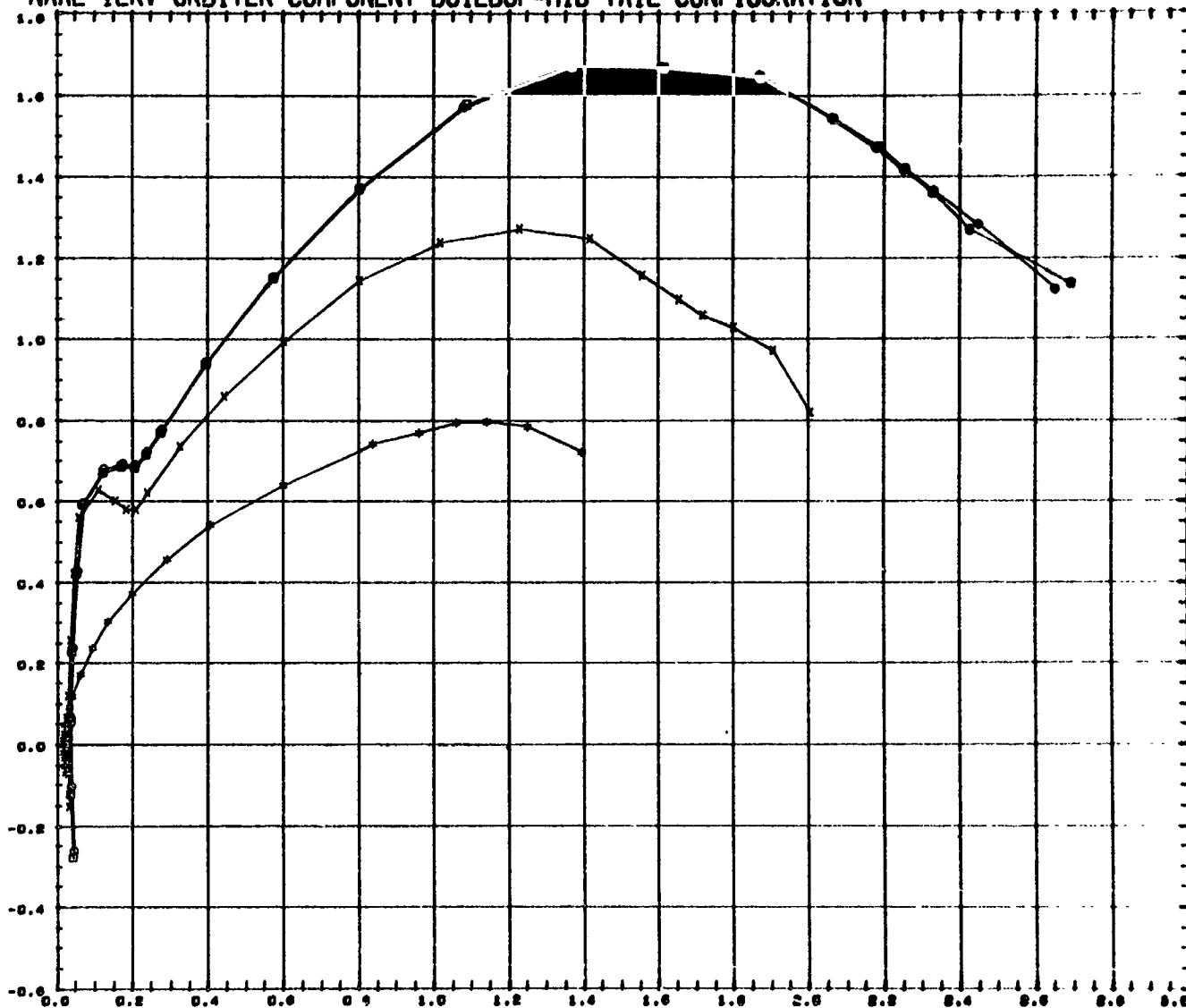
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|----------|-----------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 00           | (RC4001) | 11 AUG 70 | REFD 1.70000E10-01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0        | (RC4002) | 11 AUG 70 | REFL 1.57370E10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N13    | (RC4003) | 11 AUG 70 | REFD 1.13300E10-00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 00 W0 N13 Y5 | (RC4013) | 11 AUG 70 | YNRP 0.13200E10-00 INCHES  |
|        |                                 |              |          |           | YNRP 0.00000E10-00 INCHES  |
|        |                                 |              |          |           | YNRP -3.04000E10-01 INCHES |
|        |                                 |              |          |           | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

LIFT COEFFICIENT, CL

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION



FOREBODY DRAG COEFFICIENT, CDF

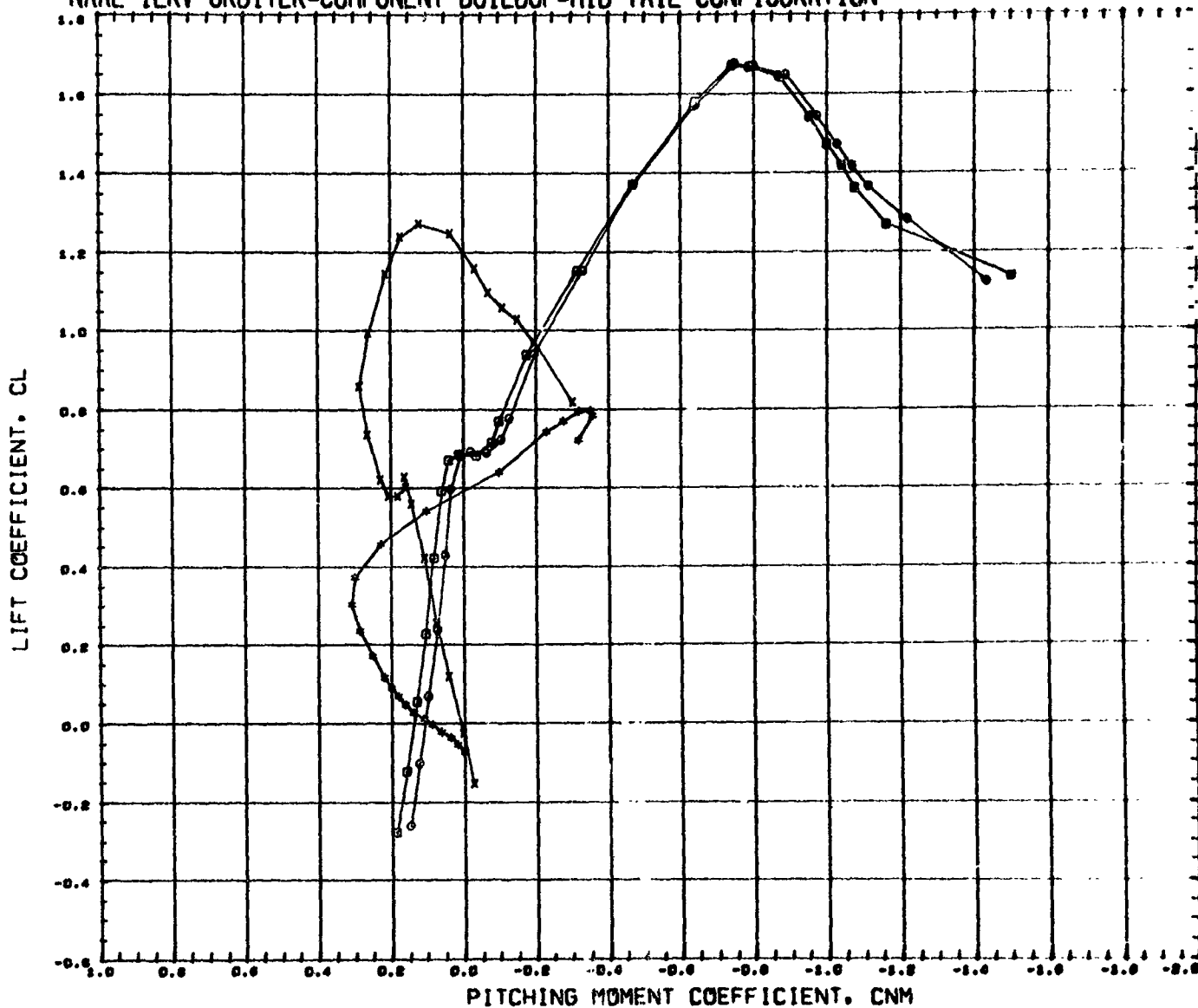
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 (RC4030)           | 11 AUG 70 | 0.250 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 (RC4063)        | 11 AUG 70 |       |
| □      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 H12 (RC4039)    | 11 AUG 70 |       |
| ◇      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W6 H12 V5 (RC4040) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 029 NA-70-391

| REFERENCE INFORMATION |                       |
|-----------------------|-----------------------|
| REFS                  | 1.70000X10-01 00.FT.  |
| REFL                  | 1.07370X10-01 INCHES  |
| REFS                  | 1.13300X10-00 INCHES  |
| XNRP                  | 0.13800X10-00 INCHES  |
| YNRP                  | 0.00000X10-01 INCHES  |
| ZNRP                  | -3.04000X10-01 INCHES |
| SCALE                 | 7.01000X10-03 SCALE   |

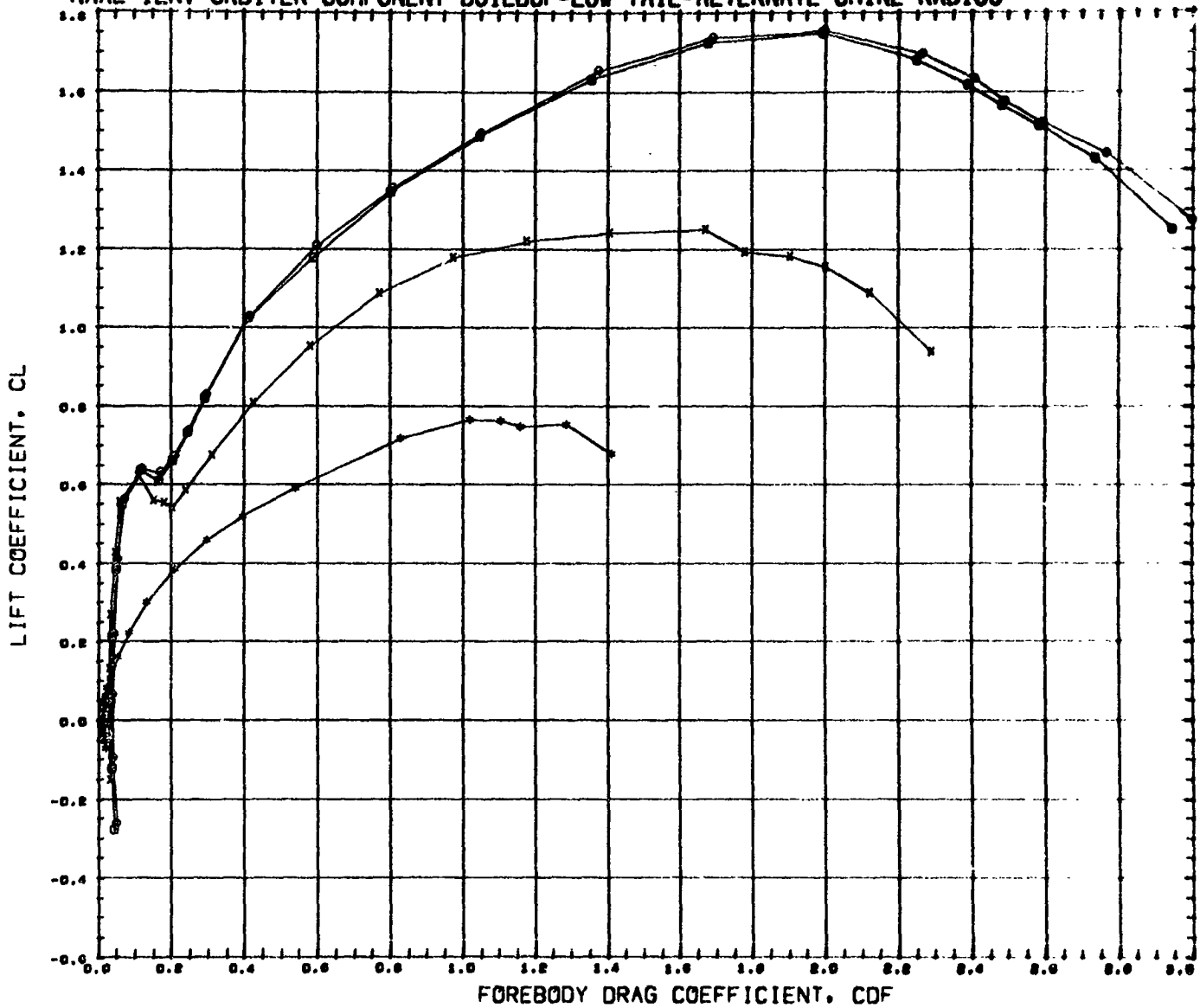
# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 (RC4030)           | 11 AUG 70 | 0.250 | REFD 1.70000E10-01 86.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W0 (RC4063)        | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W0 N12 (RC4035)    | 11 AUG 70 |       | REFD 1.13300E10-01 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W0 N12 V3 (RC4040) | 11 AUG 70 |       | ENRP 0.13200E10-00 INCHES  |
|        |                                 |                       |           |       | VNRP 0.08800E10-00 INCHES  |
|        |                                 |                       |           |       | ENRP -3.04000E10-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000E10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-353

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS



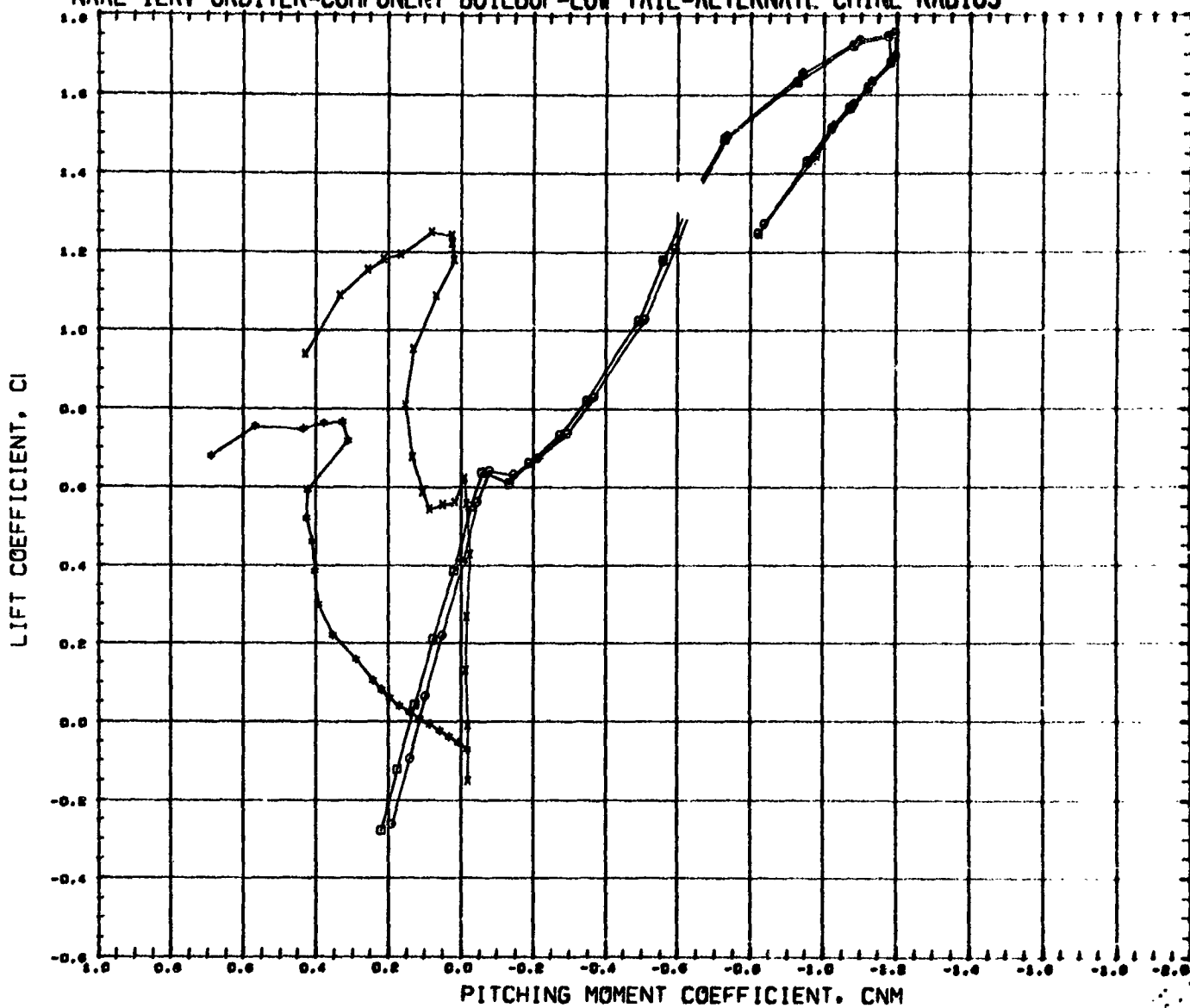
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4000) | 12 AUG 70 | 0.250 |
| (RC4093) | 11 AUG 70 |       |
| (RC4113) | 12 AUG 70 |       |
| (RC4108) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.700000E-01     |
| REFL 1.073700E-01     |
| REFD 1.133000E-01     |
| REFP 0.133000E-01     |
| REFQ 0.000000E-01     |
| REFR 0.000000E-01     |
| REFS 0.000000E-01     |
| REFL 0.000000E-01     |
| REFD 0.000000E-01     |
| REFP 0.000000E-01     |
| REFQ 0.000000E-01     |
| REFR 0.000000E-01     |
| SCALE 1.000000E-01    |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-LOW TAIL-ALTERNATE CHINE RADIUS

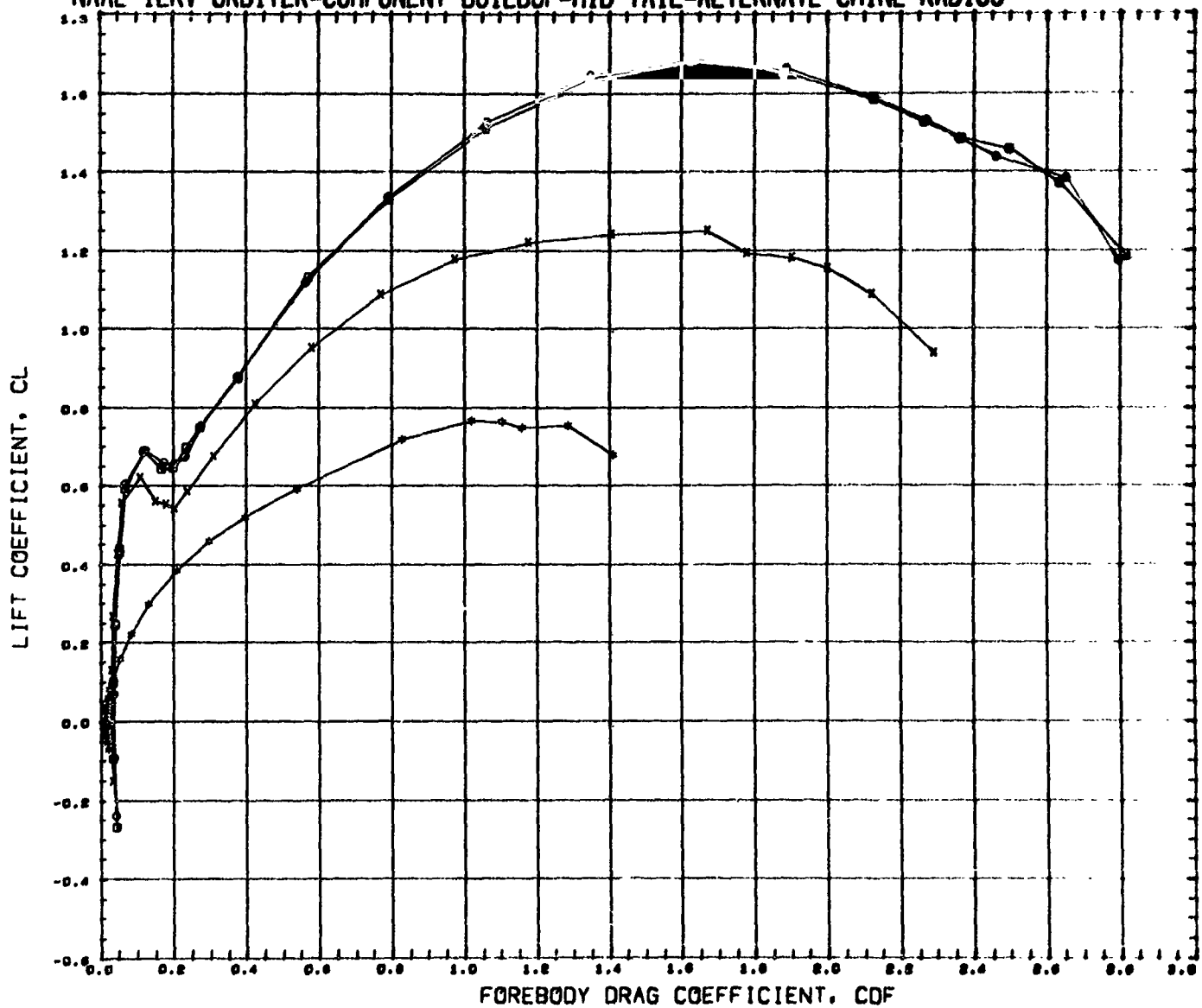


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|----------|-----------|--------------------------|
| ●      | NAAL 629 SSV-ILRV STRAIGHT WING | B7           | (RC4066) | 12 AUG 70 | 0.250                    |
| ×      | NAAL 629 SSV-ILRV STRAIGHT WING | B7 M9        | (RC4093) | 11 AUG 70 | REFS 1.70000E+01 86.77   |
| □      | NAAL 629 SSV-ILRV STRAIGHT WING | B7 M9 H13    | (RC4113) | 12 AUG 70 | REFL 1.57370E+01 INCHES  |
| ◇      | NAAL 629 SSV-ILRV STRAIGHT WING | B7 M9 H13 V9 | (RC4108) | 11 AUG 70 | REFD 1.13300E+00 INCHES  |
|        |                                 |              |          |           | YMRP 0.13800E+00 INCHES  |
|        |                                 |              |          |           | YMRP 0.00000E+01 INCHES  |
|        |                                 |              |          |           | ZMRP -3.04000E+01 INCHES |
|        |                                 |              |          |           | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE

NAAL 629 NA-70-351

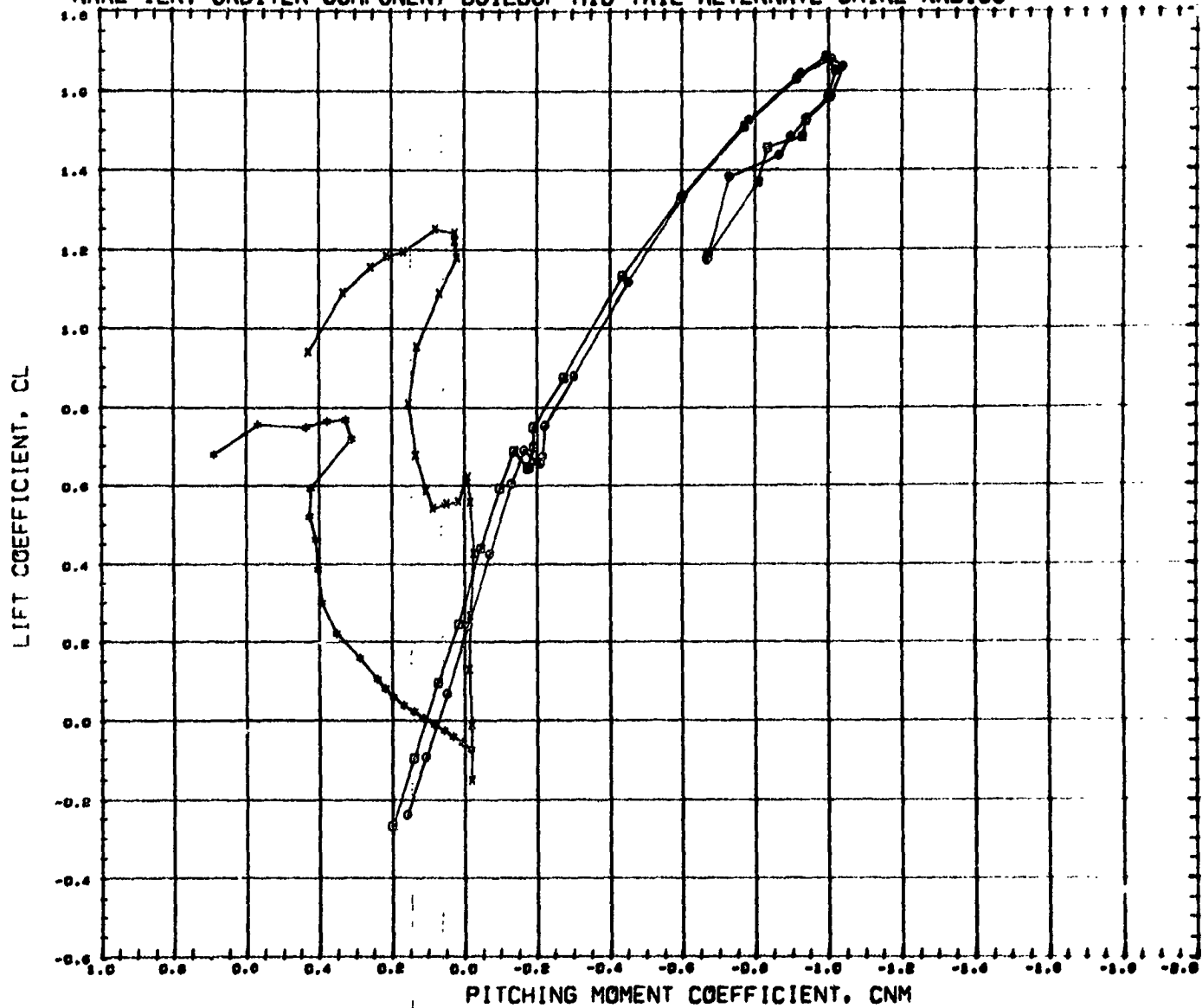
# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4000)     | 12 AUG 70 | 0.250 | REFS 1.70000X10-01 SQ.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0        | 11 AUG 70 |       | REPL 1.97370X10-02 INCHES  |
| q      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 N12    | 11 AUG 70 |       | REFS 1.13300X10-00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 07 W0 N12 V5 | 11 AUG 70 |       | KHRP 0.13200X10-00 INCHES  |
|        |                                 |              |           |       | VHRP 0.00000X10-01 INCHES  |
|        |                                 |              |           |       | ZHRP -3.04000X10-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000X10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-COMPONENT BUILDUP-MID TAIL-ALTERNATE CHINE RADIUS

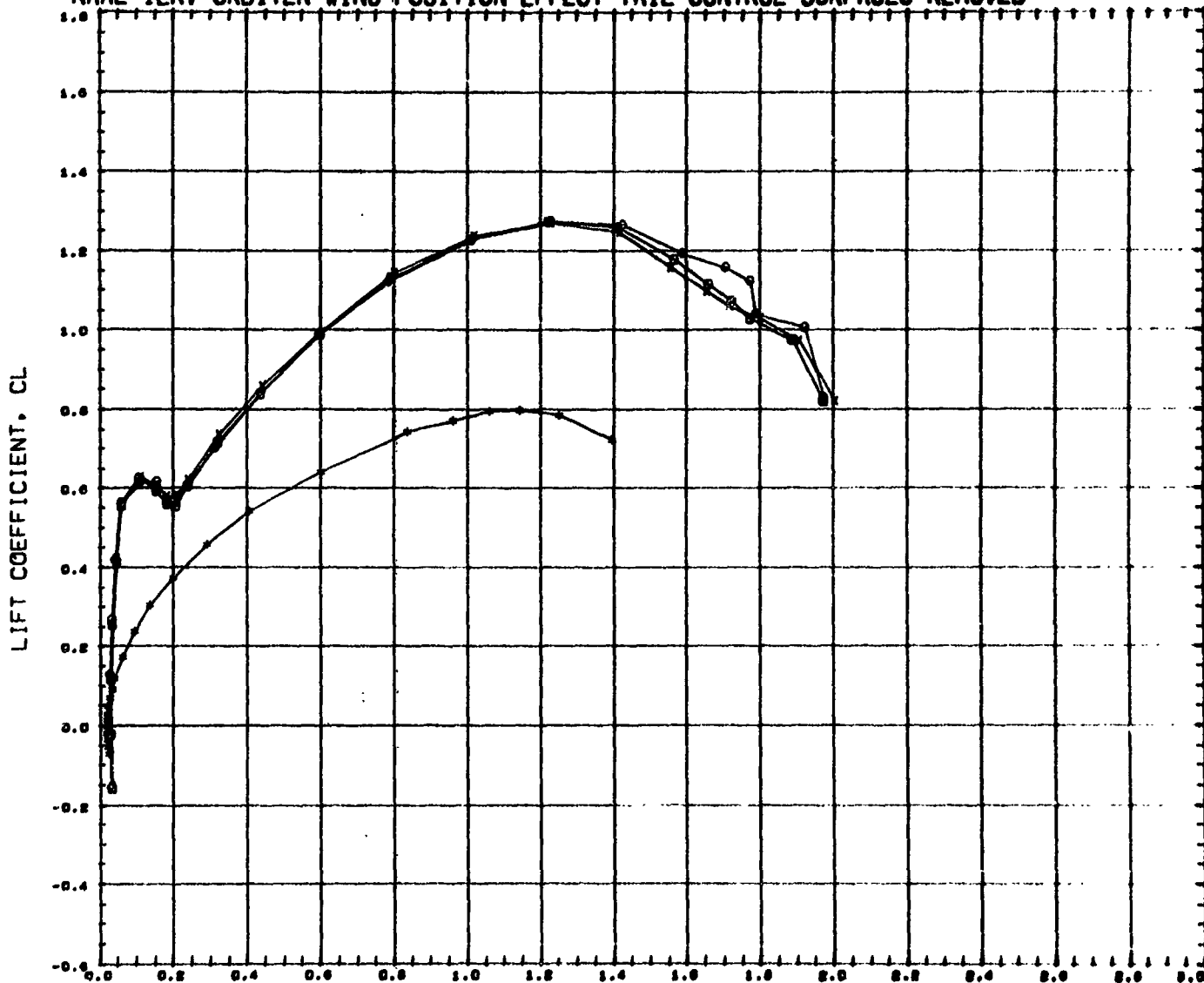


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4085) | 12 AUG 70 | 0.250 | REFD 1.70000010-01 80.71   |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4085) | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4086) | 11 AUG 70 |       | REFD 1.19300010-00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4103) | 11 AUG 70 |       | YNRP 0.00000010-00 INCHES  |
|        |                                 |          |           |       | YNRP 0.00000010-01 INCHES  |
|        |                                 |          |           |       | YNRP -9.64000010-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000010-01 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED



FOREBODY DRAG COEFFICIENT, CDF

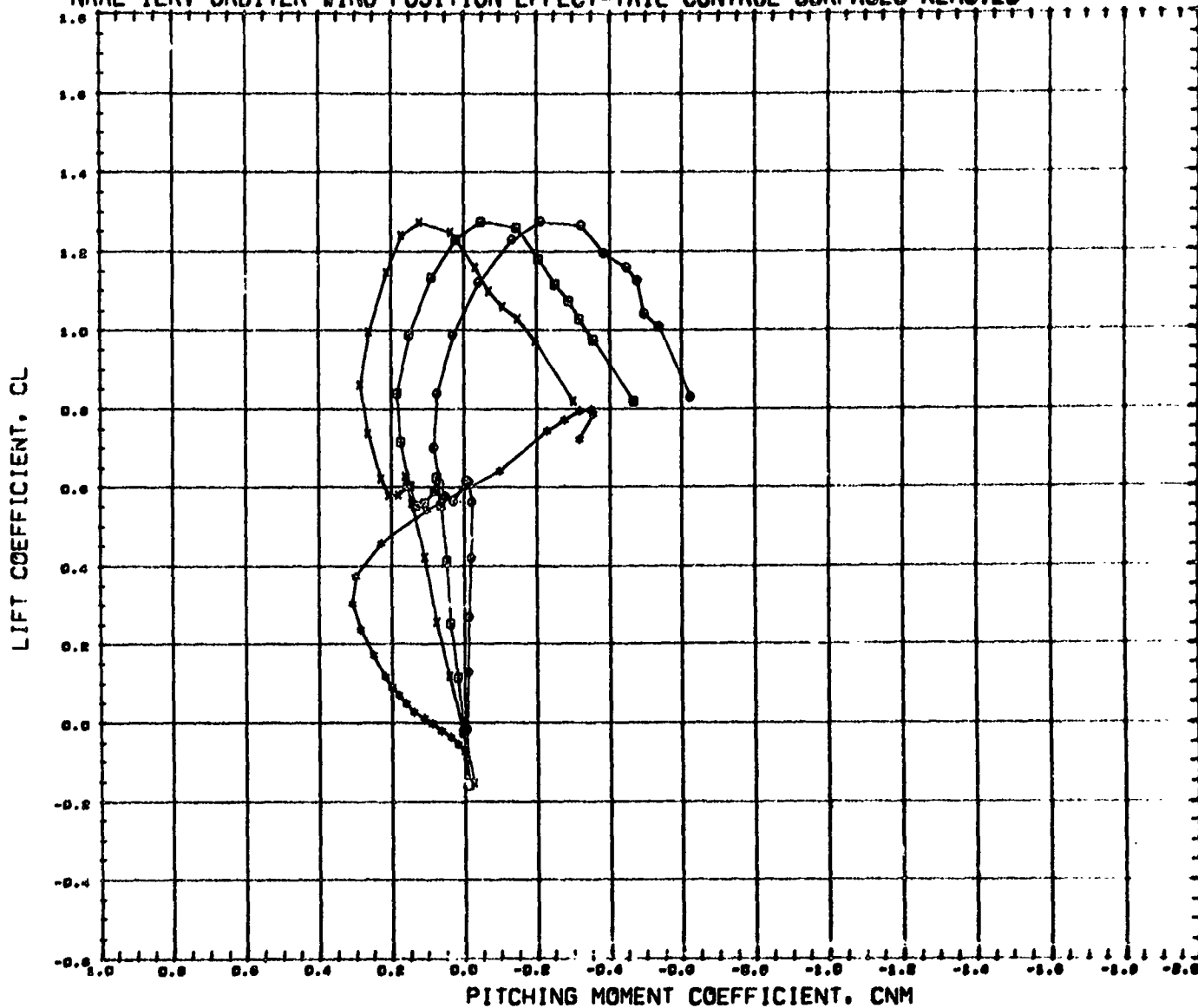
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING |
| @      | NAAL 420 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4030) | 11 AUG 70 | 0.250 |
| (RC4063) | 11 AUG 70 |       |
| (RC4024) | 11 AUG 70 |       |
| (RC4025) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000X10-01  | 60.77. |
| REFL                  | 1.07370X10-01  | INCHES |
| REFD                  | 1.13300X10-01  | INCHES |
| XMRP                  | 0.13200X10-00  | INCHES |
| YMRP                  | 0.00000X10-01  | INCHES |
| ZMRP                  | -3.04000X10-01 | INCHES |
| SCALE                 | 7.01000X10-03  | SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

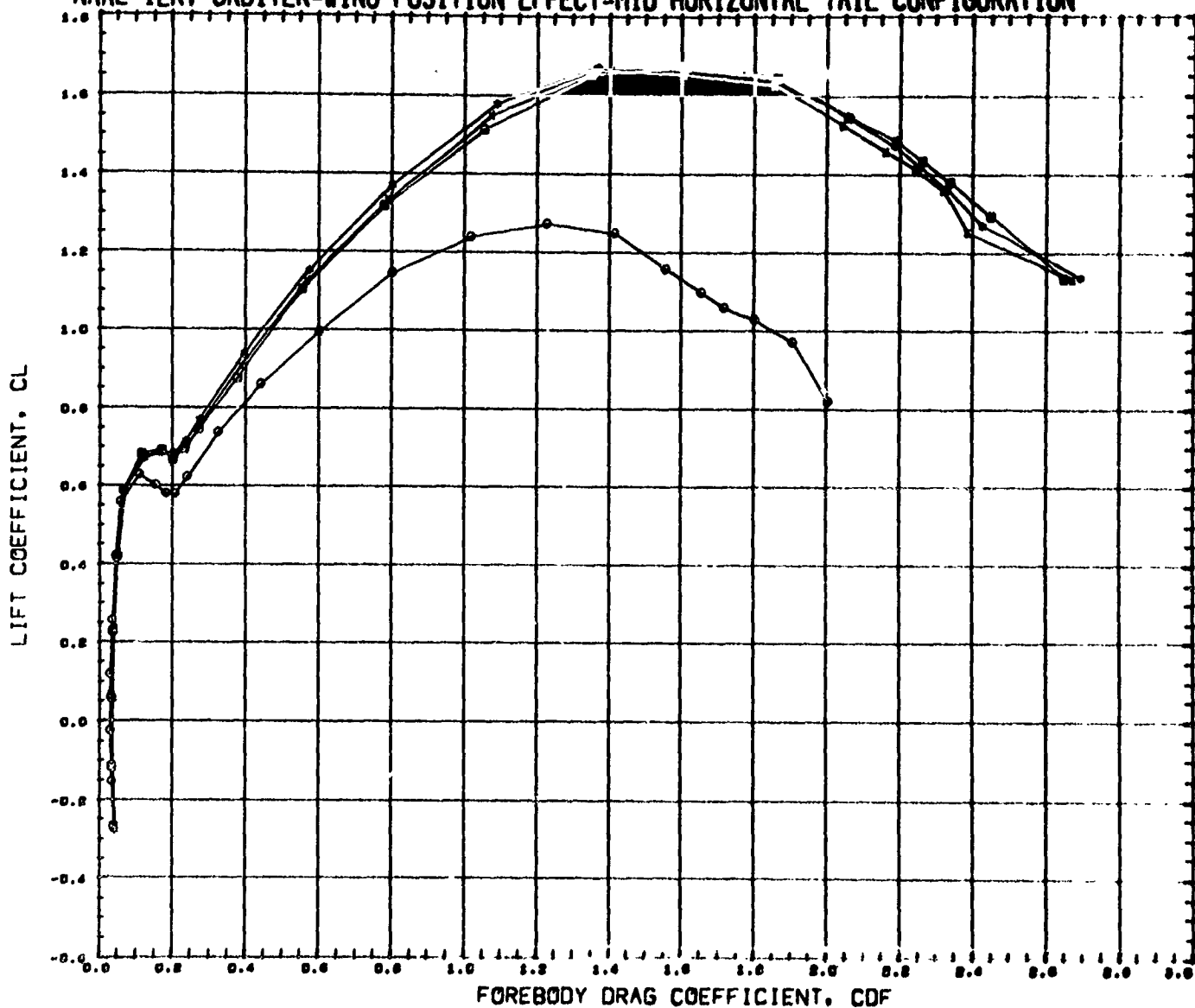
# NAAL ILRV ORBITER-WING POSITION EFFECT-TAIL CONTROL SURFACES REMOVED



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|----------|-----------|-------|--------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 | 0.850 | REFS 1.70000E+01 80.71.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4031) | 11 AUG 70 |       | REFL 1.87570E+01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4032) | 11 AUG 70 |       | REFS 1.13300E+01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4033) | 11 AUG 70 |       | REFS 0.00000E+00 INCHES  |
|        |                                 |          |           |       | REFS 0.00000E+00 INCHES  |
|        |                                 |          |           |       | REFS -3.04000E+01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E+01 SCALE  |

REFERENCE FILE NAAL 029 NA-PC-391

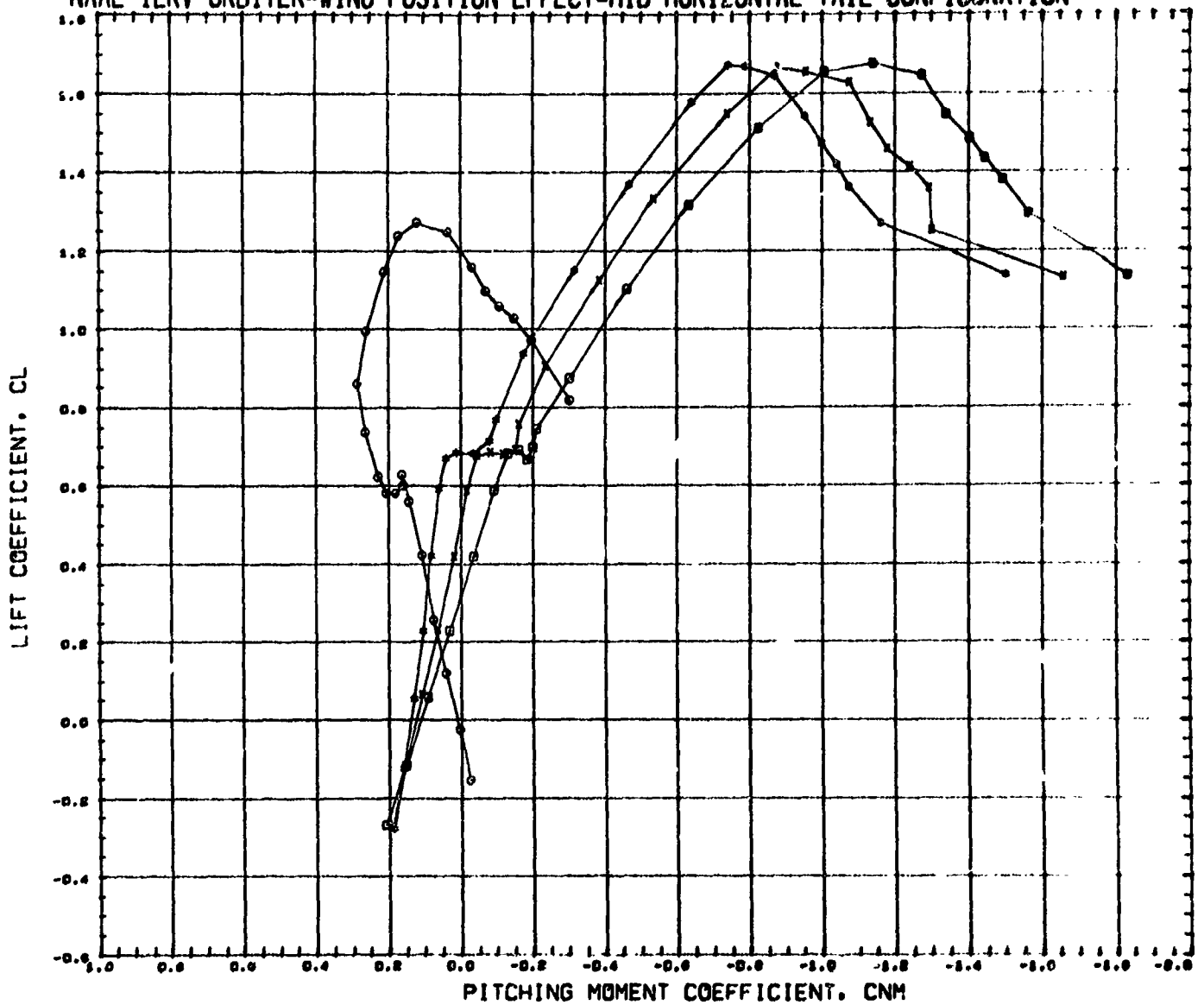
# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|-------------------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 06 W8 H12 | (RC4035) | 11 AUG 70 | 0.899 | REFS 1.70000X10-01 SQ.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING 06 W8 H12 | (RC4036) | 11 AUG 70 |       | REFL 1.97570X10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING 06 W8 H12 | (RC4037) | 11 AUG 70 |       | REFD 1.53300X10-00 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING 06 W8     | (RC4043) | 11 AUG 70 |       | ZMRP 0.13200X10-00 INCHES  |
|        |                                           |          |           |       | VMRP 0.00000X10-01 INCHES  |
|        |                                           |          |           |       | ZMRP -3.04000X10-01 INCHES |
|        |                                           |          |           |       | SCALE 7.01000X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-WING POSITION EFFECT-MID HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| A      | NAAL 020 BSV-ILRV STRAIGHT WING |
| B      | NAAL 020 BSV-ILRV STRAIGHT WING |
| C      | NAAL 020 BSV-ILRV STRAIGHT WING |
| D      | NAAL 020 BSV-ILRV STRAIGHT WING |

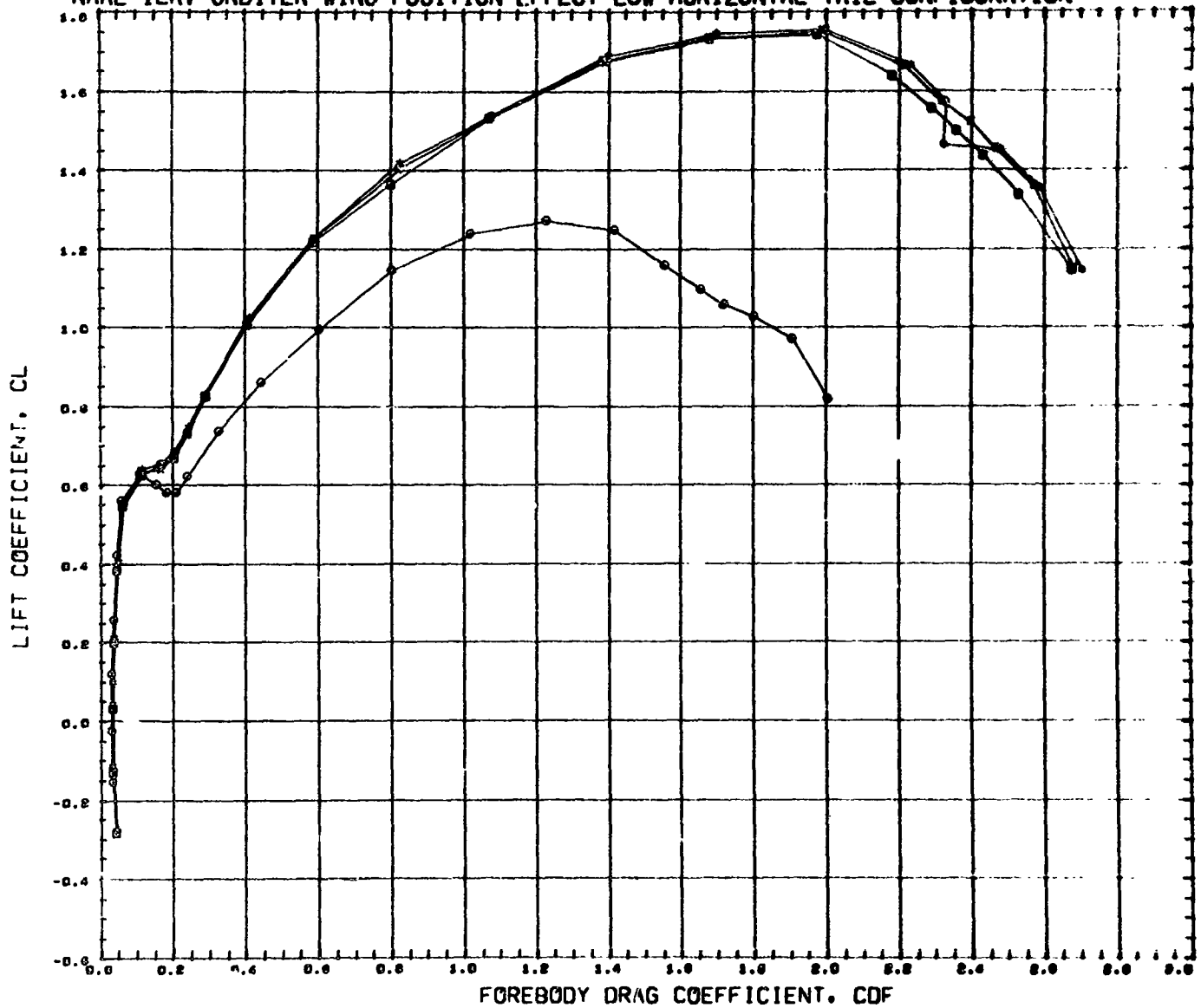
| DATA SET | DATE       | MACH  |
|----------|------------|-------|
| (RC4035) | 11 AUG 70  | 0.250 |
| (RC4036) | 11 / 14 70 |       |
| (RC4037) | 11 AUG 70  |       |
| (RC4038) | 11 AUG 70  |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.700000E-01     |
| REFL 1.073700E-01     |
| REFS 1.133000E-01     |
| THRP 0.132000E-00     |
| THRP 0.000000E-00     |
| THRP -2.040000E-01    |
| SCALE 7.010000E-01    |

REFERENCE FILE

NAAL 020 NA-70-381

# NAAL ILRV ORBITER-WING POSITION EFFECT-LOW HORIZONTAL TAIL CONFIGURATION



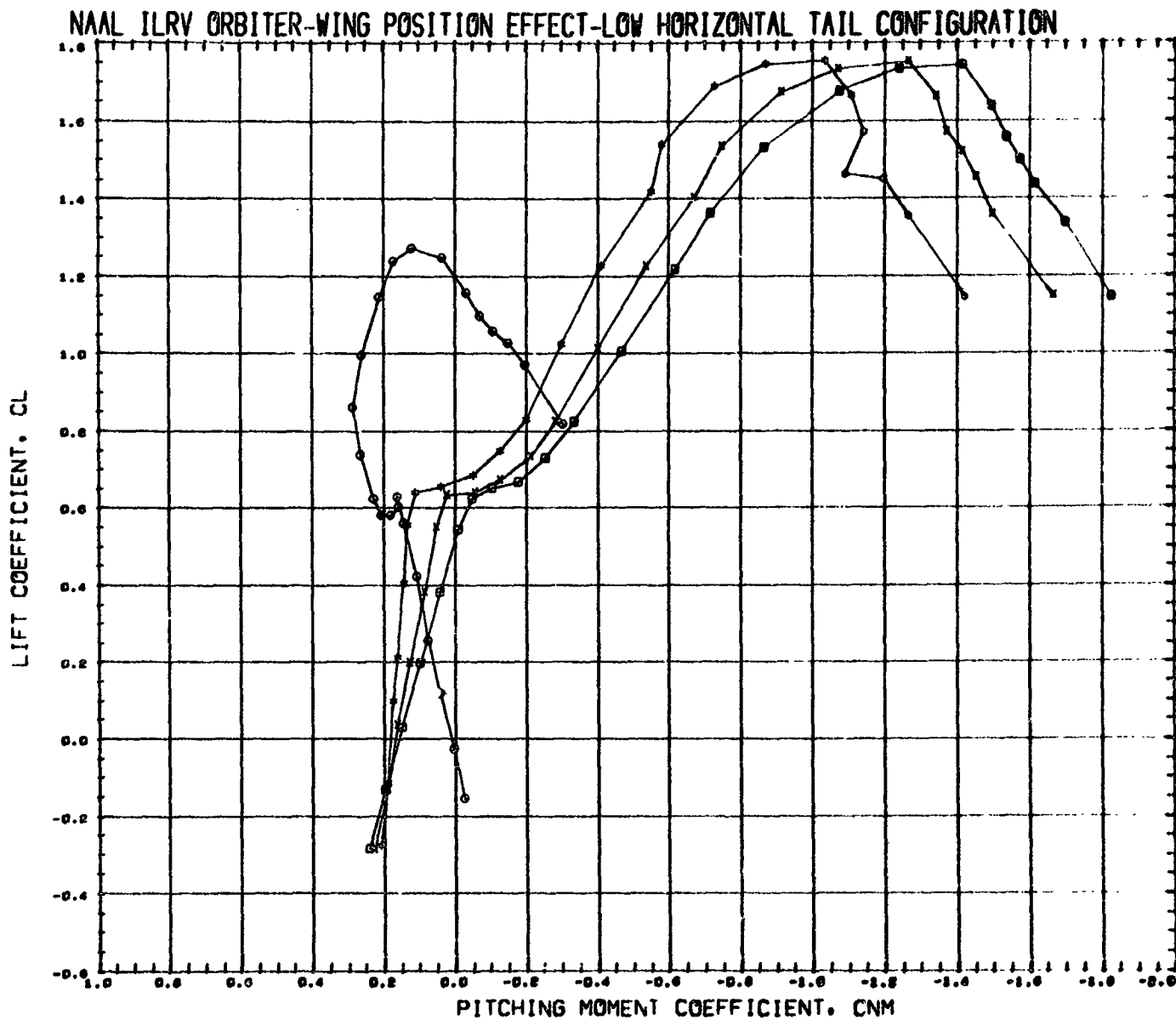
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 629 SSV-ILRV STRAIGHT WING |
| x      | NAAL 629 SSV-ILRV STRAIGHT WING |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING |
| o      | NAAL 629 SSV-ILRV STRAIGHT WING |

FOREBODY DRAG COEFFICIENT, CDF

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4379) | 11 AUG 70 | 0.250 |
| (RC4029) | 11 AUG 70 |       |
| (RC4026) | 11 AUG 70 |       |
| (RC4003) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.700000E-01     |
| REFL 1.773780E-01     |
| REFS 1.133900E-00     |
| YMRP 0.132000E-00     |
| YMRP 0.080000E-01     |
| ZMRP -3.040000E-01    |
| SCALE 7.610000E-03    |

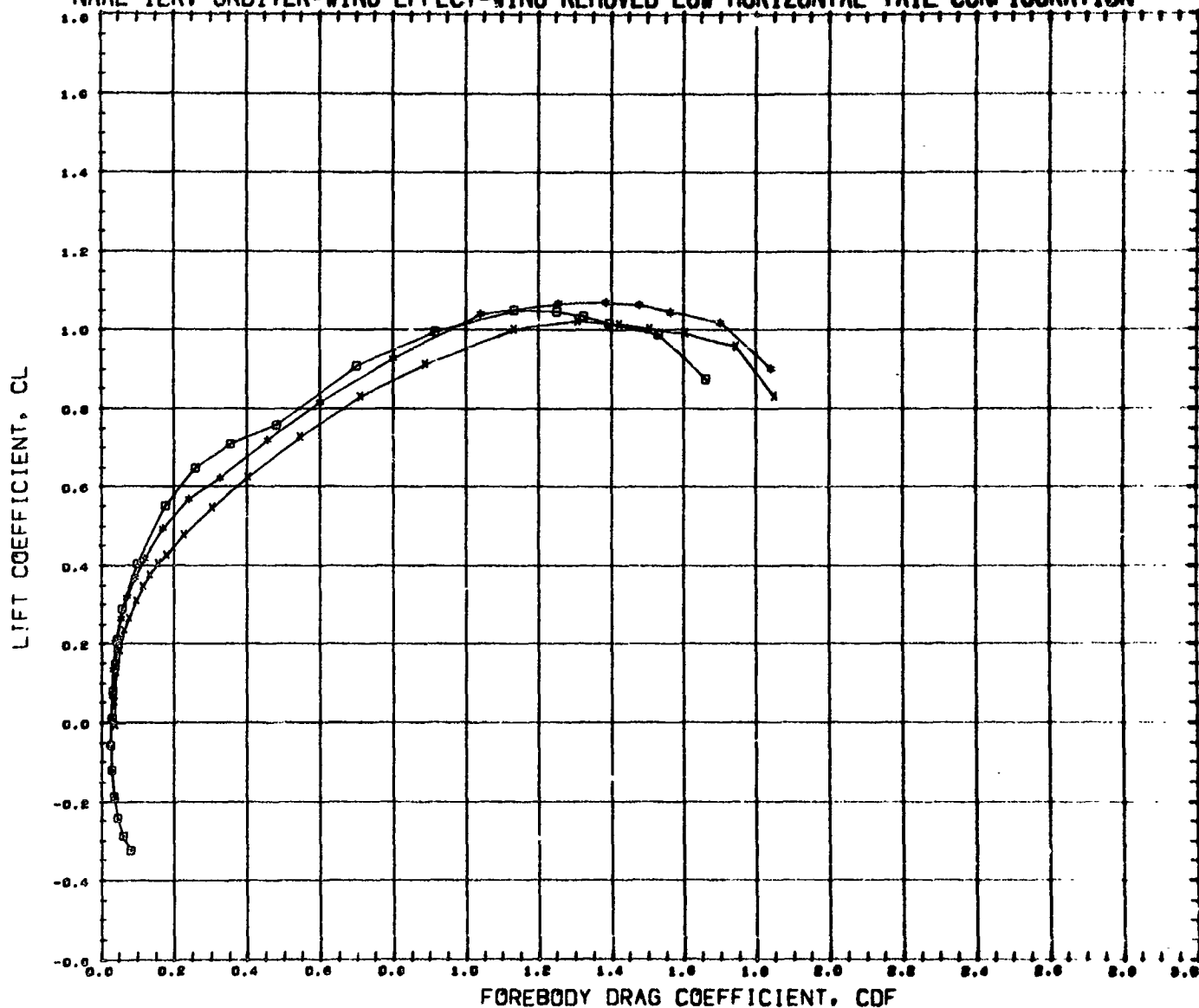
REFERENCE FILE NAAL 629 NA-70-351



| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|-------------------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6 H13 | (RC4070) | 11 AUG 70 | 0.250 | REFS 1.70000010-01 86.77.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6 H13 | (RC4020) | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W9 H13 | (RC4020) | 11 AUG 70 |       | REFD 1.13300010-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING 86 W6     | (RC4003) | 11 AUG 70 |       | ENRP 0.13300010-00 INCHES  |
|        |                                           |          |           |       | ENRP 0.00000010-01 INCHES  |
|        |                                           |          |           |       | ENRP -2.04000010-01 INCHES |
|        |                                           |          |           |       | SCALE 7.01000010-02 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



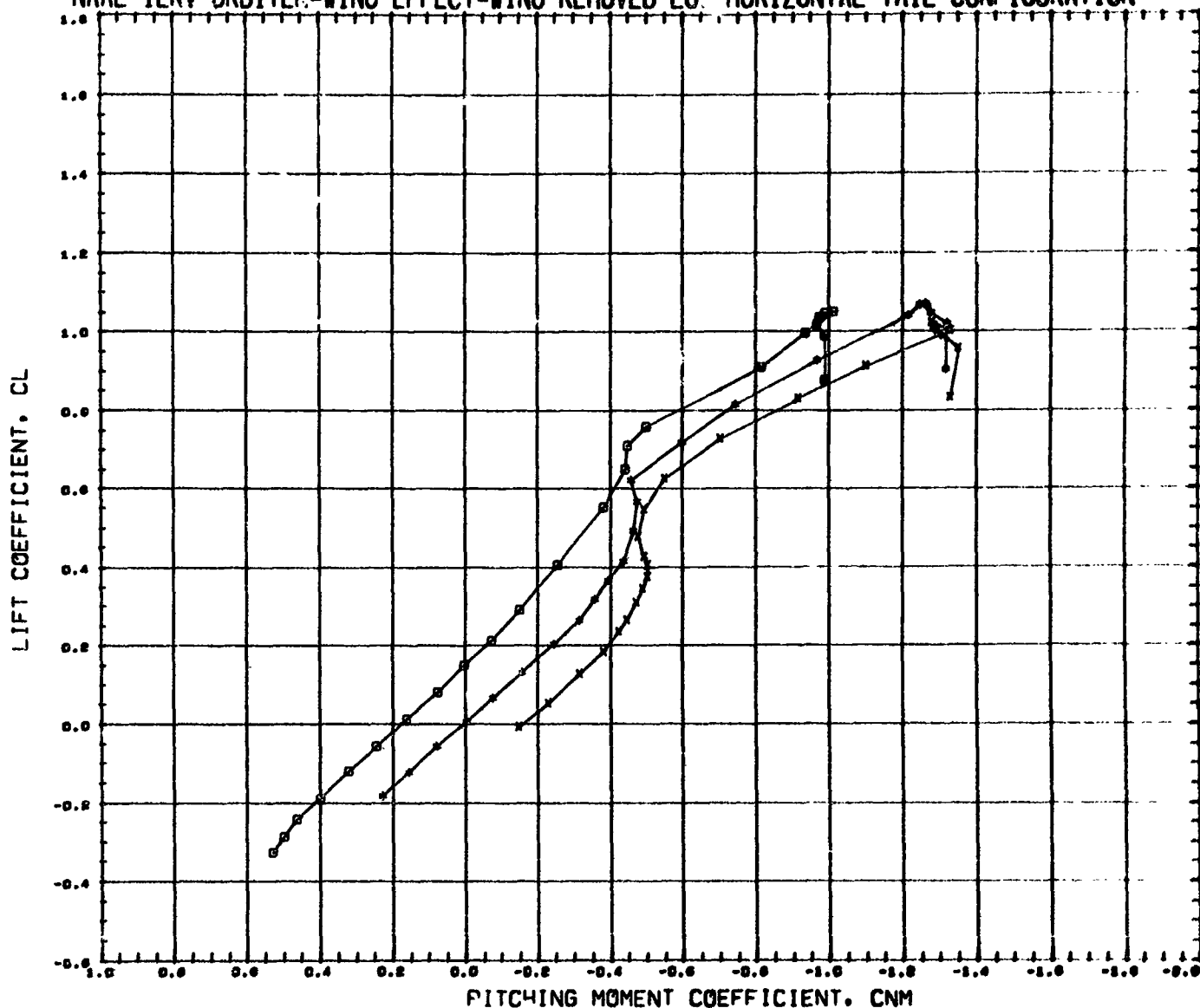
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE     | MACH      |
|--------|---------------------------------|-----------|----------|-----------|
| A      | NAAL 629 SSV-ILRV STRAIGHT WING | BB H13 V5 | (RC4001) | 12 AUG 70 |
| X      | NAAL 629 SSV-ILRV STRAIGHT WING | BB H13 V5 | (RC4002) | 11 AUG 70 |
| G      | NAAL 629 SSV-ILRV STRAIGHT WING | BB H13 V5 | (RC4003) | 11 AUG 70 |

REFERENCE FILE

NAAL 629 NA-70-351

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000E10-01  | SQ.FT. |
| REFL                  | 1.57370E10-01  | INCHES |
| REFS                  | 1.13300E10-01  | INCHES |
| REFL                  | 0.13200E10-00  | INCHES |
| REFS                  | 0.00000E10-01  | INCHES |
| REFL                  | -5.04000E10-01 | INCHES |
| SCALE                 | 7.01000E10     | SCALE  |

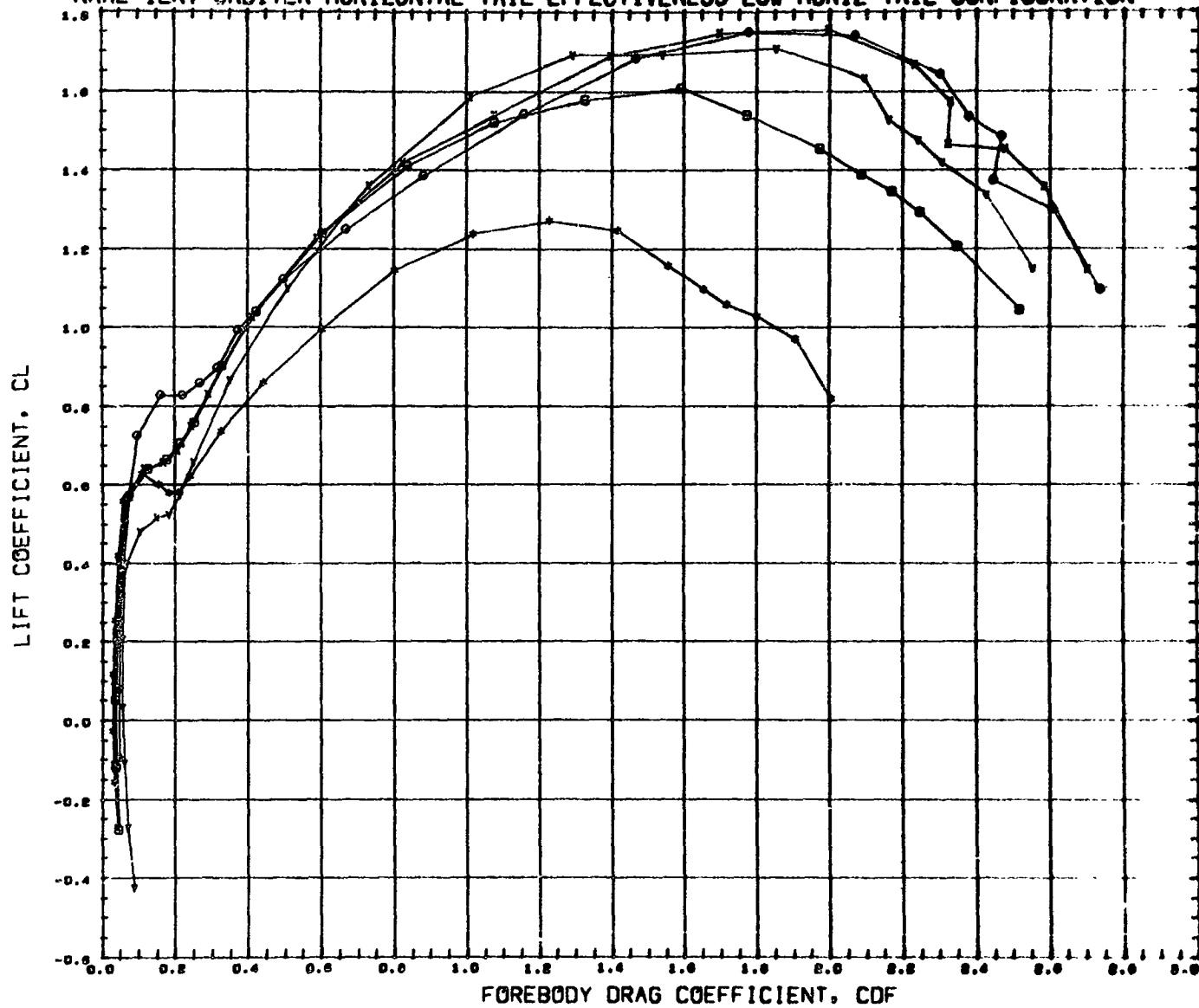
# NAAL ILRV ORBITER-WING EFFECT-WING REMOVED LOW HORIZONTAL TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4001   | 12 AUG 70 | 0.250 | REFS 1.70000010-01 00.77.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4002   | 11 AUG 70 |       | REFL 1.97370010-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 |       | REFD 1.13300010-01 INCHES  |
|        |                                 |          |           |       | YMRP 0.13300010-00 INCHES  |
|        |                                 |          |           |       | YMRP 0.00000010-01 INCHES  |
|        |                                 |          |           |       | ZMRP -2.04000010-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000010-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

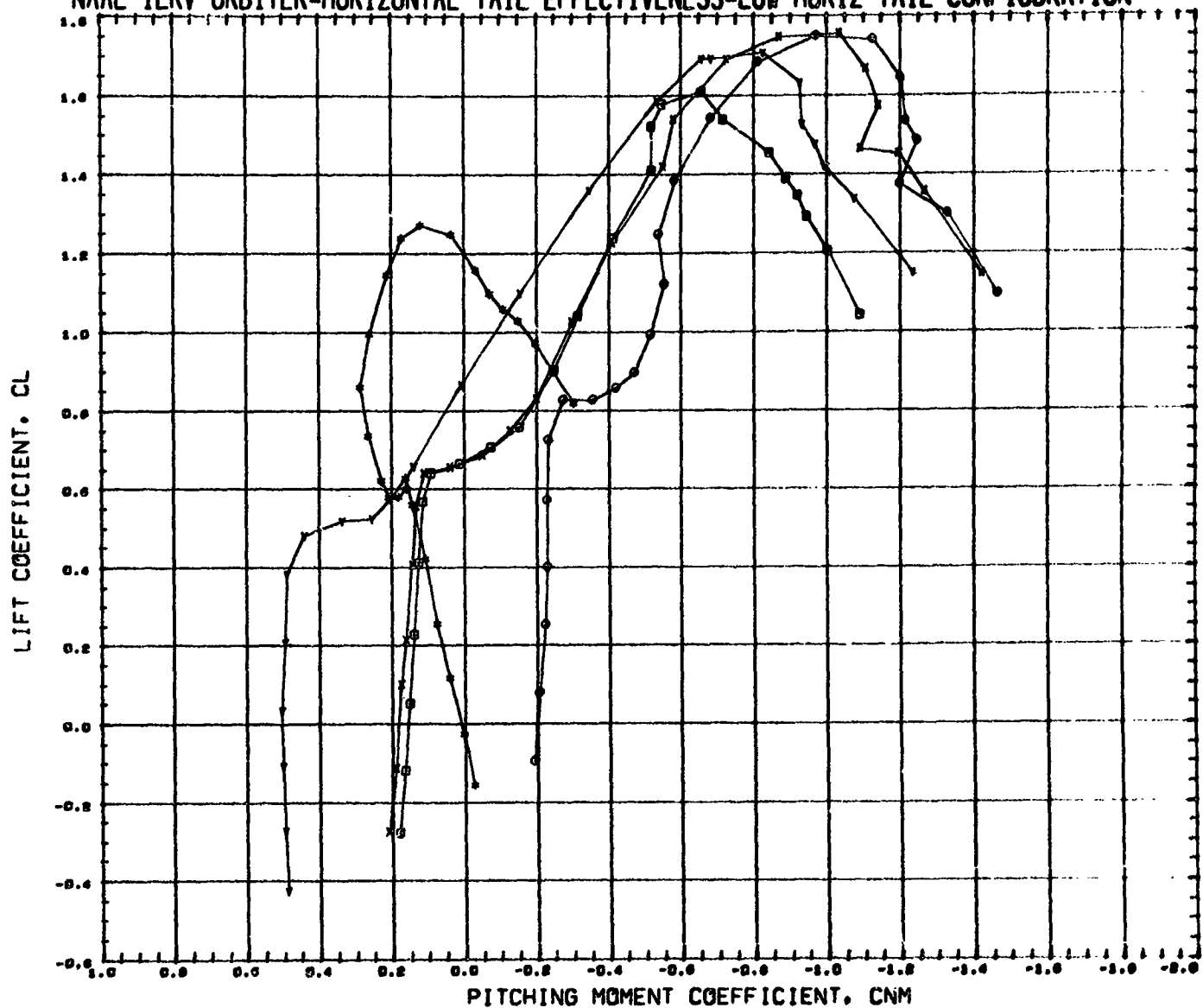


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION                  |
|--------|---------------------------------|----------|-----------|-------|----------------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 | 0.250 | REFS 1.70000X10 <sup>-01</sup> 80.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4070   | 11 AUG 70 |       | REFL 1.07370X10 <sup>-01</sup> INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4013   | 11 AUG 70 |       | REFS 1.13300X10 <sup>-01</sup> INCHES  |
| v      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4076   | 11 AUG 70 |       | REFS 0.13200X10 <sup>-01</sup> INCHES  |
|        |                                 |          |           |       | REFS 0.00000X10 <sup>-01</sup> INCHES  |
|        |                                 |          |           |       | REFS -3.04000X10 <sup>-01</sup> INCHES |
|        |                                 |          |           |       | SCALE 7.01000X10 <sup>-01</sup> SCALE  |

REFERENCE FILE

NAAL 020 NA-70-351

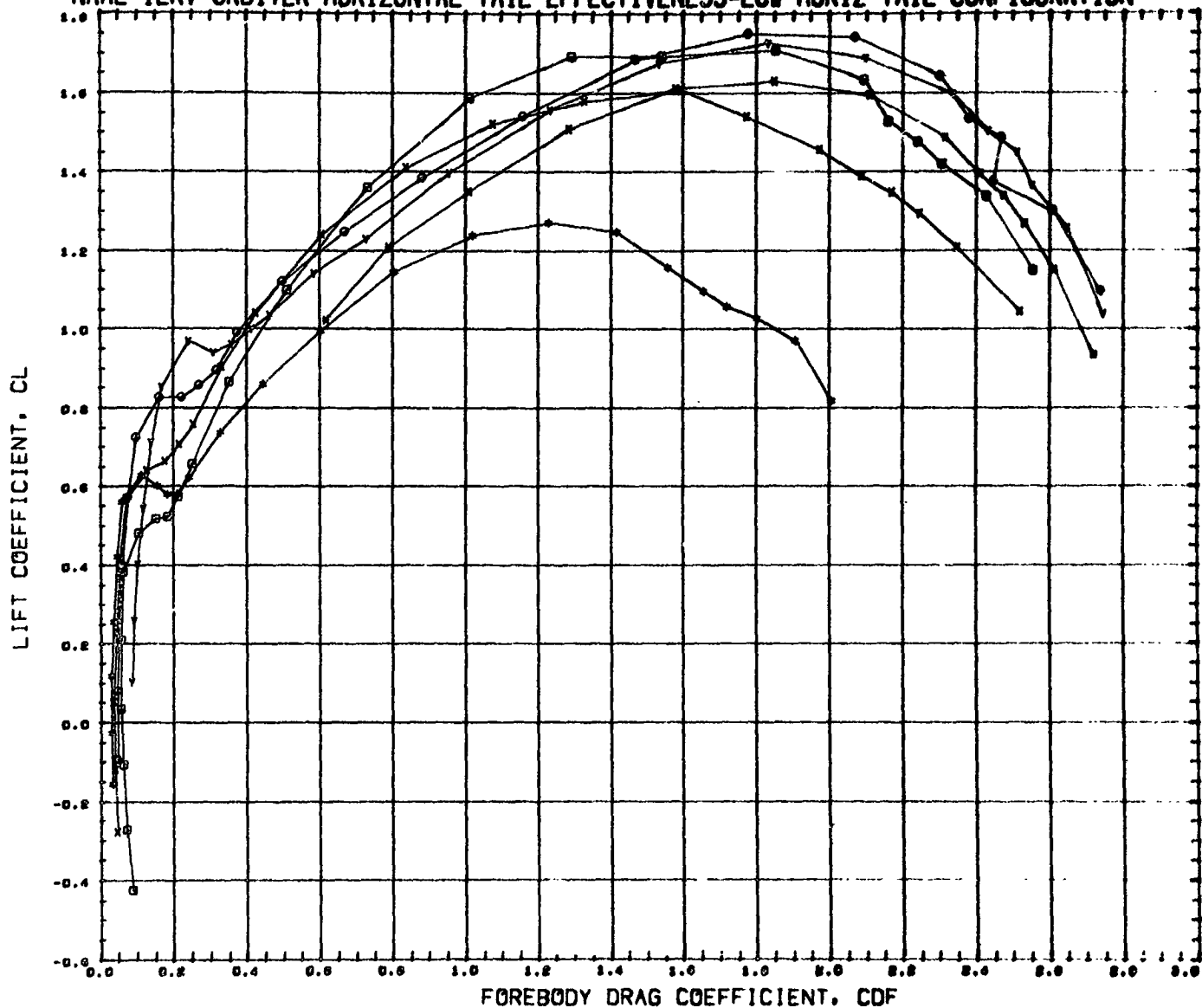
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8        | 11 AUG 70 | 0.890 | REFS 1.70000X10-01 50.71.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13    | 11 AUG 70 |       | REFL 1.97370X10-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13 V5 | 11 AUG 70 |       | REFD 1.13300X10-00 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13 V5 | 11 AUG 70 |       | YMFP 0.19800X10-00 INCHES  |
| △      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W8 H13 V5 | 11 AUG 70 |       | YMFP 0.00000X10-01 INCHES  |
|        |                                 |              |           |       | ZMFP -3.04000X10-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000X10-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



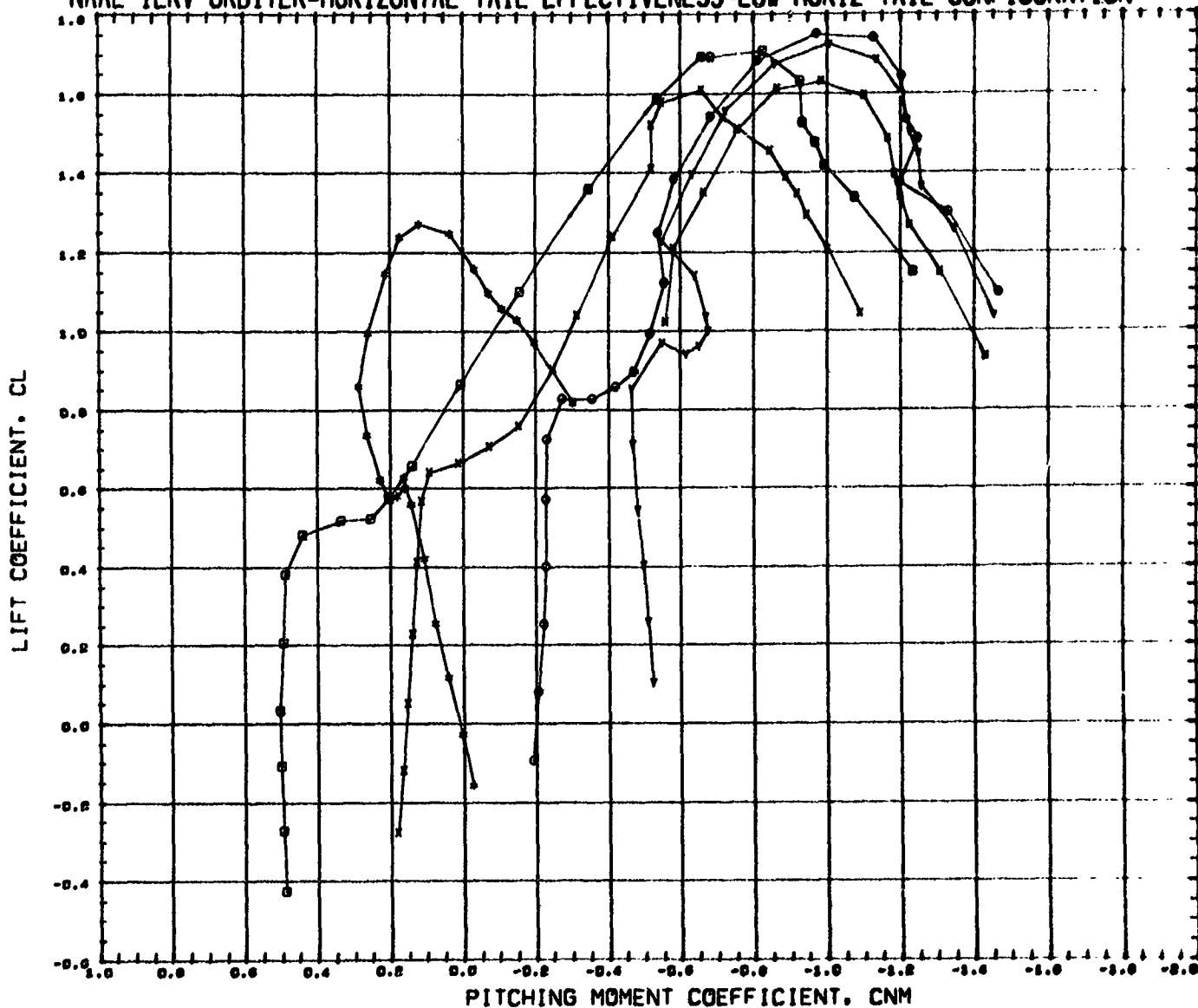
| SYMBOL | CONFIGURATION DESCRIPTION       |
|--------|---------------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING |
| q      | NAAL 029 SSV-ILRV STRAIGHT WING |
| y      | NAAL 029 SSV-ILRV STRAIGHT WING |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (RC4063) | 11 AUG 70 | 0.250 |
| (RC4013) | 11 AUG 70 |       |
| (RC4074) | 11 AUG 70 |       |
| (RC4076) | 11 AUG 70 |       |
| (RC4077) | 11 AUG 70 |       |
| (RC4078) | 11 AUG 70 |       |

| REFERENCE INFORMATION |              |        |
|-----------------------|--------------|--------|
| REFD                  | 1.70000E+01  | 80.FT. |
| REFL                  | 1.97370E+01  | INCHES |
| REFD                  | 1.13300E+00  | INCHES |
| YMRP                  | 0.13200E+00  | INCHES |
| YMRP                  | 0.00000E+00  | INCHES |
| ZMRP                  | -3.64000E+00 | INCHES |
| SCALE                 | 7.61000E+00  | SCALE  |

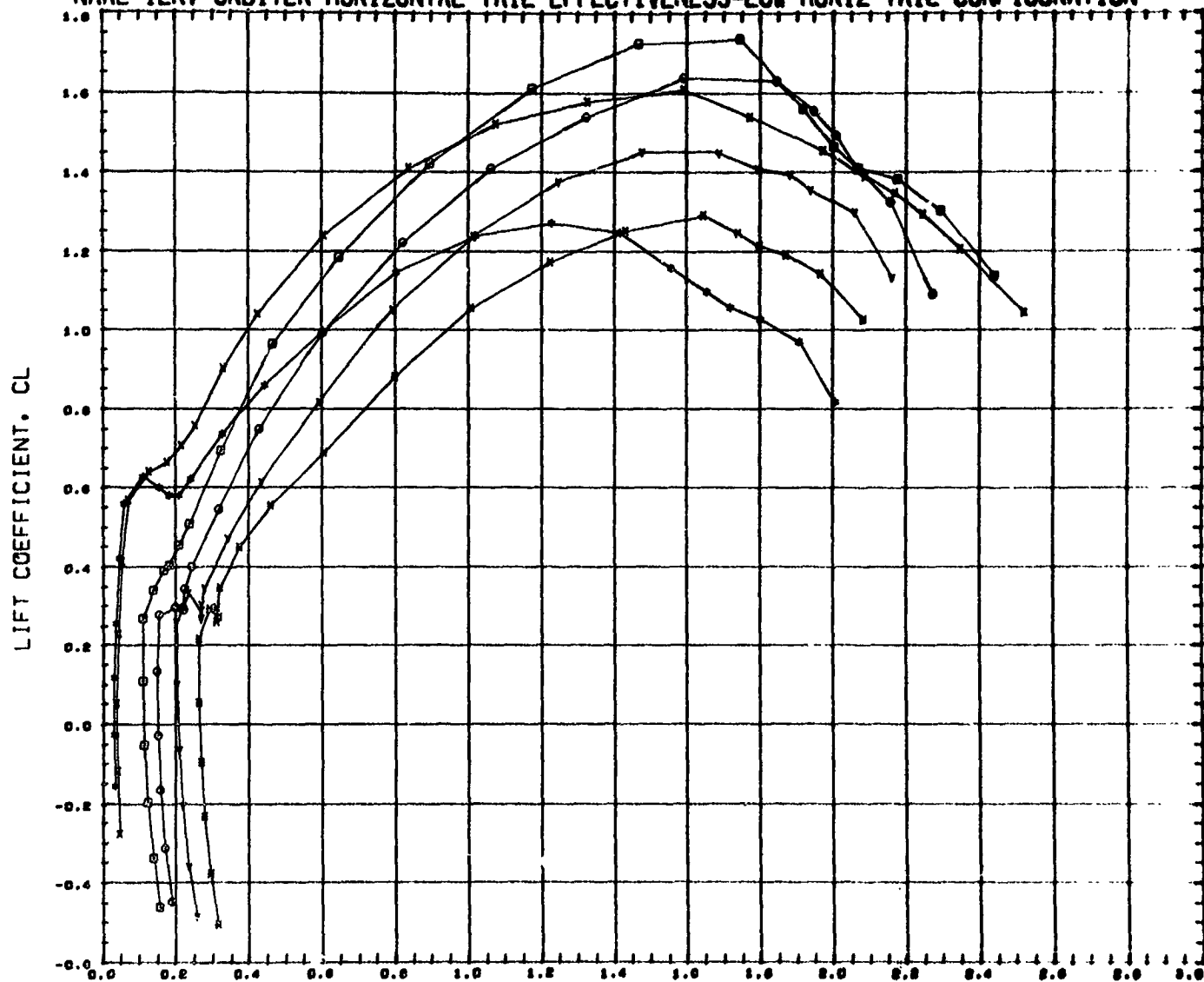
REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | BO W6              | DATA SET | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------------|----------|-----------|-------|--------------------------|
| +      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | (RC4063) | 11 AUG 70 | 0.250 | REF6 1.70000E+01 00.FT.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | (RC4013) | 11 AUG 70 |       | REF1 1.57370E+01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | (RC4074) | 11 AUG 70 |       | REF8 1.13300E+01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | (RC4076) | 11 AUG 70 |       | XMRP 0.13200E+01 INCHES  |
| v      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | (RC4077) | 11 AUG 70 |       | YMRP 0.00000E+01 INCHES  |
| n      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 W6 M13 V5       | (RC4078) | 11 AUG 70 |       | ZMRP -3.04000E+01 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-331 |          |           |       | SCALE 7.01000E+01 SCALE  |

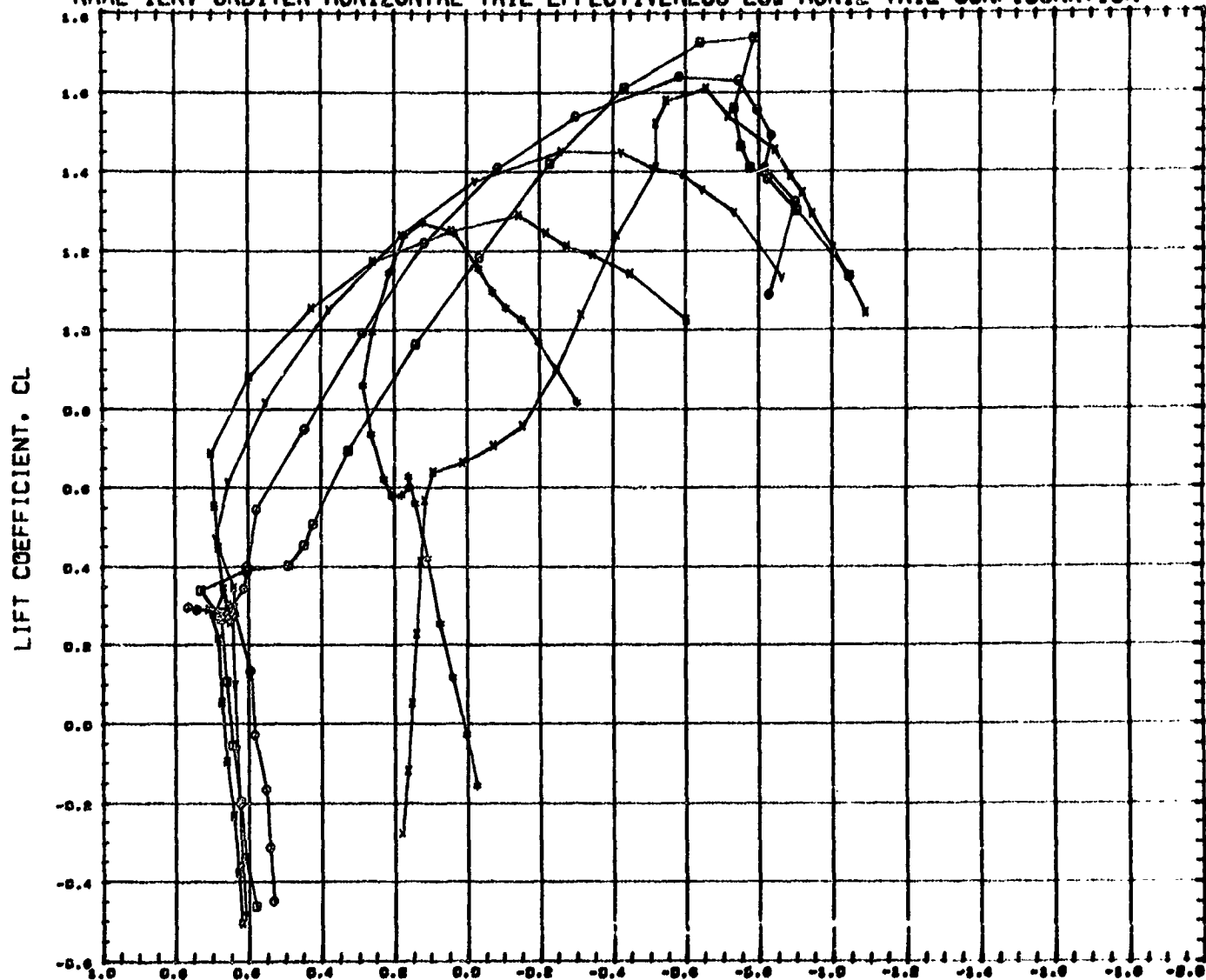
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| W      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6        | 11 AUG 70 | 0.250 | REFS 1.70000E-01 88.71.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 | 11 AUG 70 |       | REFD 1.13300E-00 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 | 11 AUG 70 |       | YMFP 0.13800E-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 | 11 AUG 70 |       | YMFP 0.00000E-01 INCHES  |
| K      | NAAL 020 SSV-ILRV STRAIGHT WING | B6 W6 M13 V5 | 11 AUG 70 |       | YMFP -3.04000E-01 INCHES |
|        |                                 |              |           |       | SCALE 7.01000E-02 SCALE  |

REFERENCE FILE NAAL 020 NA-70-391

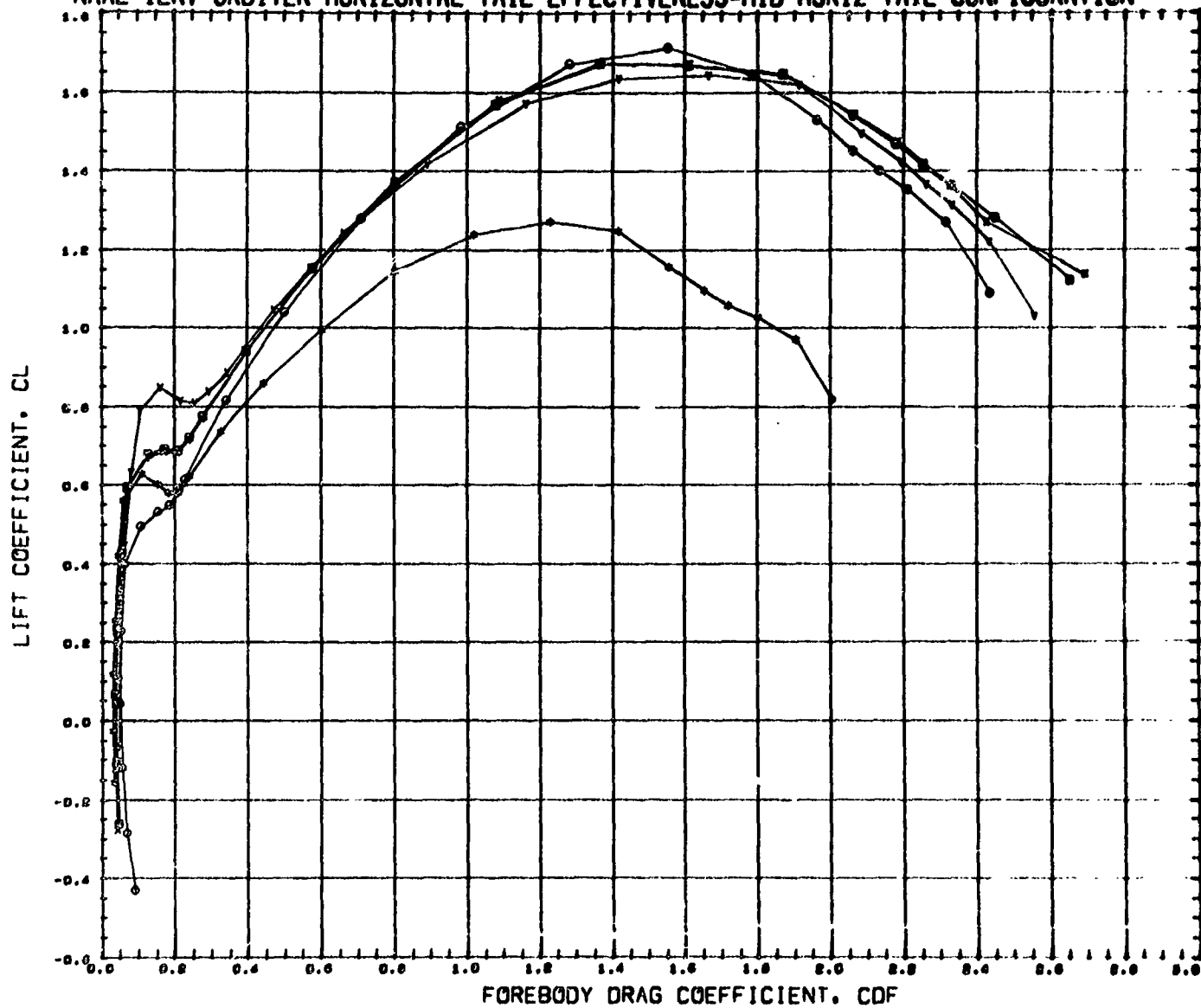
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | NACM  | REFERENCE INFORMATION     |
|--------|---------------------------------|--------------|-----------|-------|---------------------------|
| 0      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6        | 11 AUG 70 | 0.079 | REFD 1.70000X10-01 00.FT. |
| X      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 H13 V5 | 11 AUG 70 |       | REFL 1.57370X10-01 INCHES |
| Q      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 H13 V5 | 11 AUG 70 |       | REFD 1.55300X10-01 INCHES |
| Q      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 H13 V5 | 11 AUG 70 |       | WHP 0.00000X10-00 INCHES  |
| V      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 H13 V5 | 11 AUG 70 |       | WHP 0.00000X10-00 INCHES  |
| N      | NAAL 029 SSV-ILRV STRAIGHT WING | 00 W6 H13 V5 | 11 AUG 70 |       | WHP -0.00000X10-00 INCHES |
|        |                                 |              |           |       | SCALE 7.00000X10-00 SCALE |

REFERENCE FILE NAAL 029 NA-PG-351

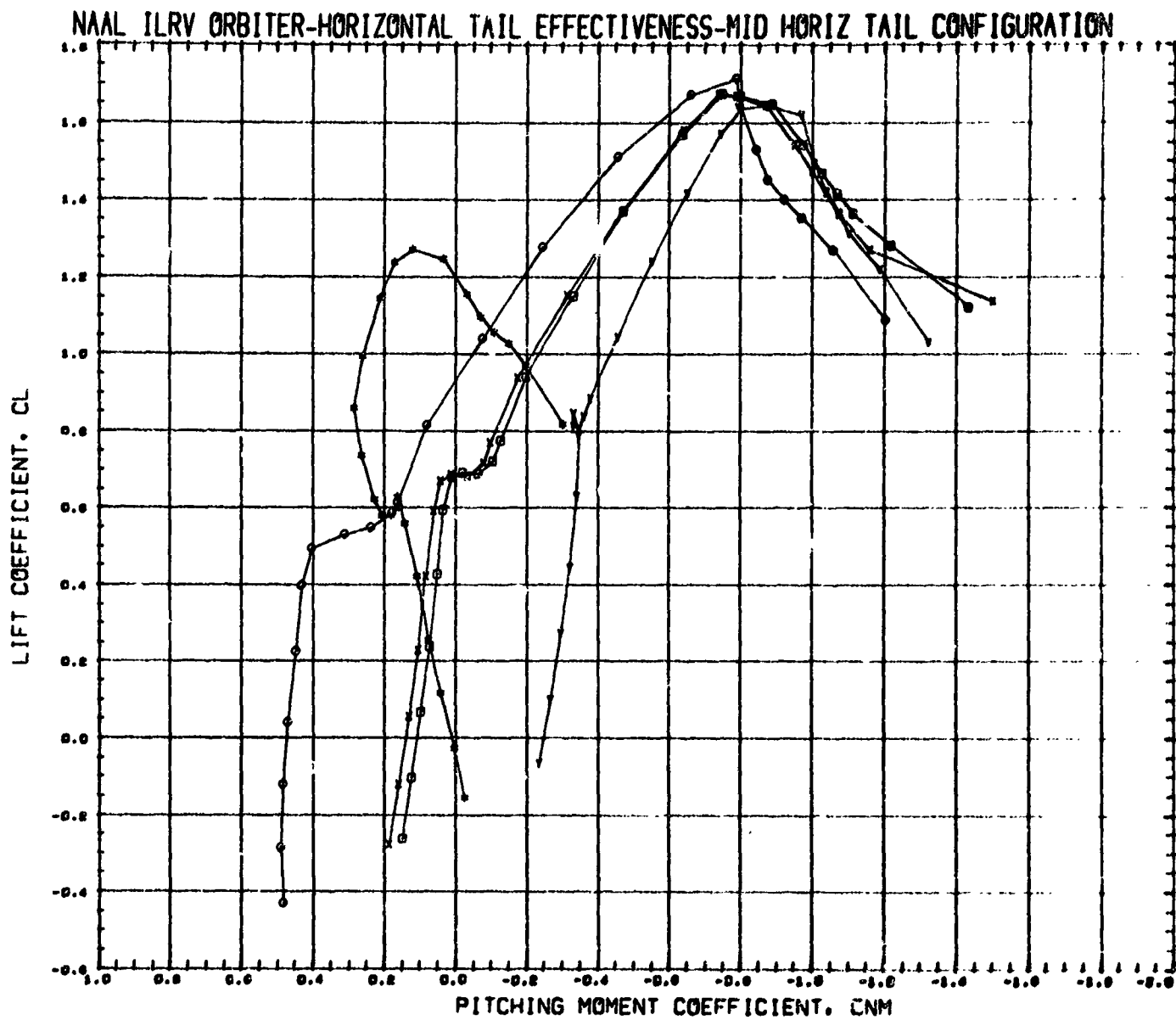
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  |
|--------|---------------------------------|--------------|-----------|-------|
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W0        | 11 AUG 70 | 0.250 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W0 H12    | 11 AUG 70 |       |
| u      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W0 H12 V5 | 11 AUG 70 |       |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W0 H12 V5 | 11 AUG 70 |       |
| v      | NAAL 029 SSV-ILRV STRAIGHT WING | 06 W0 H12 V5 | 11 AUG 70 |       |

REFERENCE FILE NAAL 029 NA-70-351

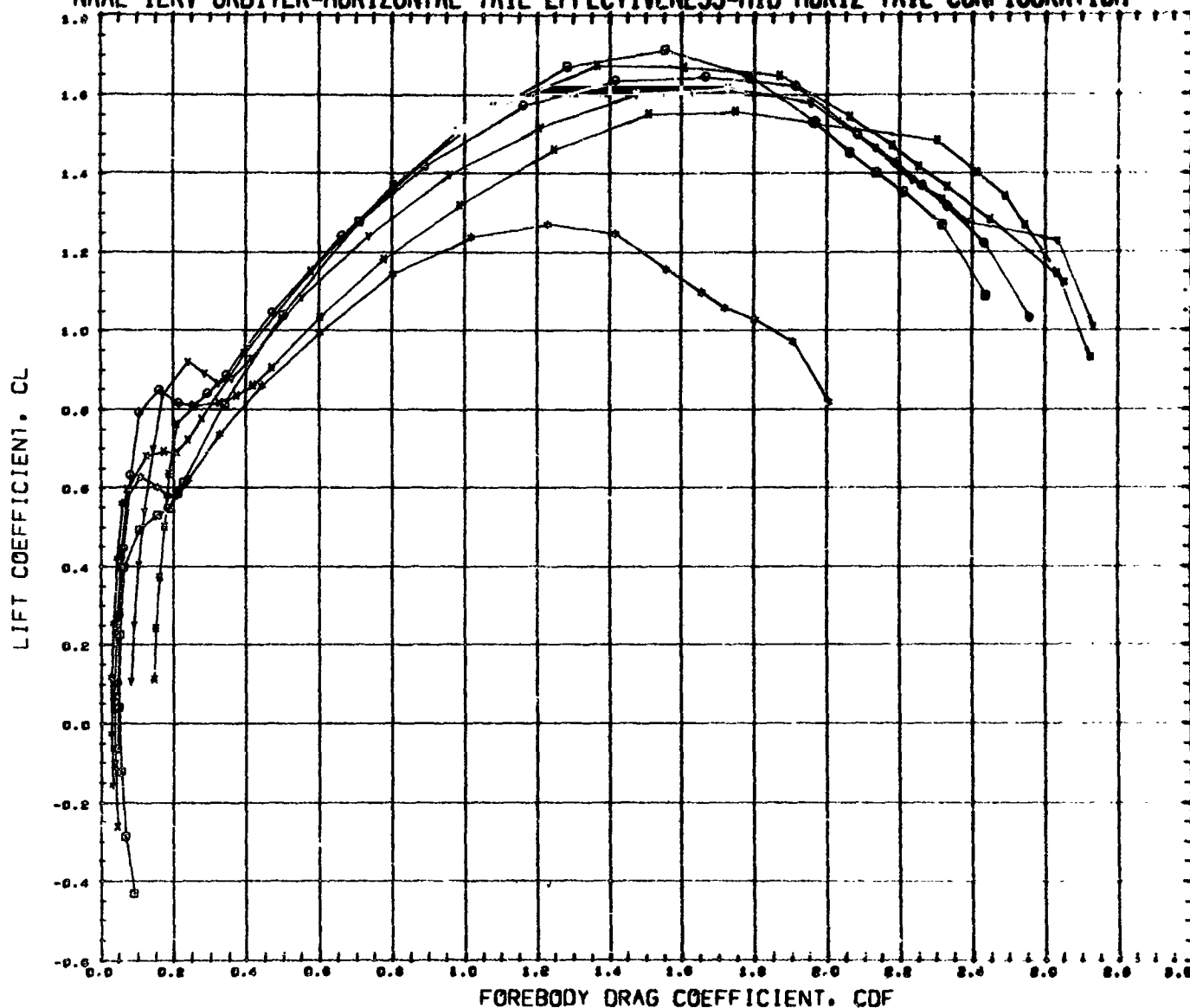
| REFERENCE INFORMATION |              |        |
|-----------------------|--------------|--------|
| REFs                  | 1.700000E-01 | 00 FT. |
| REFL                  | 1.973700E-01 | INCHES |
| REFD                  | 1.133000E-01 | INCHES |
| YMRP                  | 0.130000E-00 | INCHES |
| ZMRP                  | 0.000000E-00 | INCHES |
| SCALE                 | 1.010000E-01 | SCALE  |



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | SCALE | REFERENCE INFORMATION |
|--------|---------------------------------|----------|-----------|-------|-----------------------|
| *      | NAAL 020 DBV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 | 0.250 | REFS 1.70000E10-01    |
| x      | NAAL 020 DBV-ILRV STRAIGHT WING | RC4003   | 11 AUG 70 |       | REFL 1.07570E10-01    |
| o      | NAAL 020 DBV-ILRV STRAIGHT WING | RC4040   | 11 AUG 70 |       | REFB 1.13500E10-01    |
| y      | NAAL 020 DBV-ILRV STRAIGHT WING | RC4034   | 11 AUG 70 |       | INBP 0.13000E10-00    |
|        |                                 | RC4032   | 11 AUG 70 |       | INBP 0.00000E10-00    |
|        |                                 |          |           |       | INBP -3.04000E10-01   |
|        |                                 |          |           |       | SCALE 7.01000E10-01   |

REFERENCE FILE NAAL 020 NA-70-391

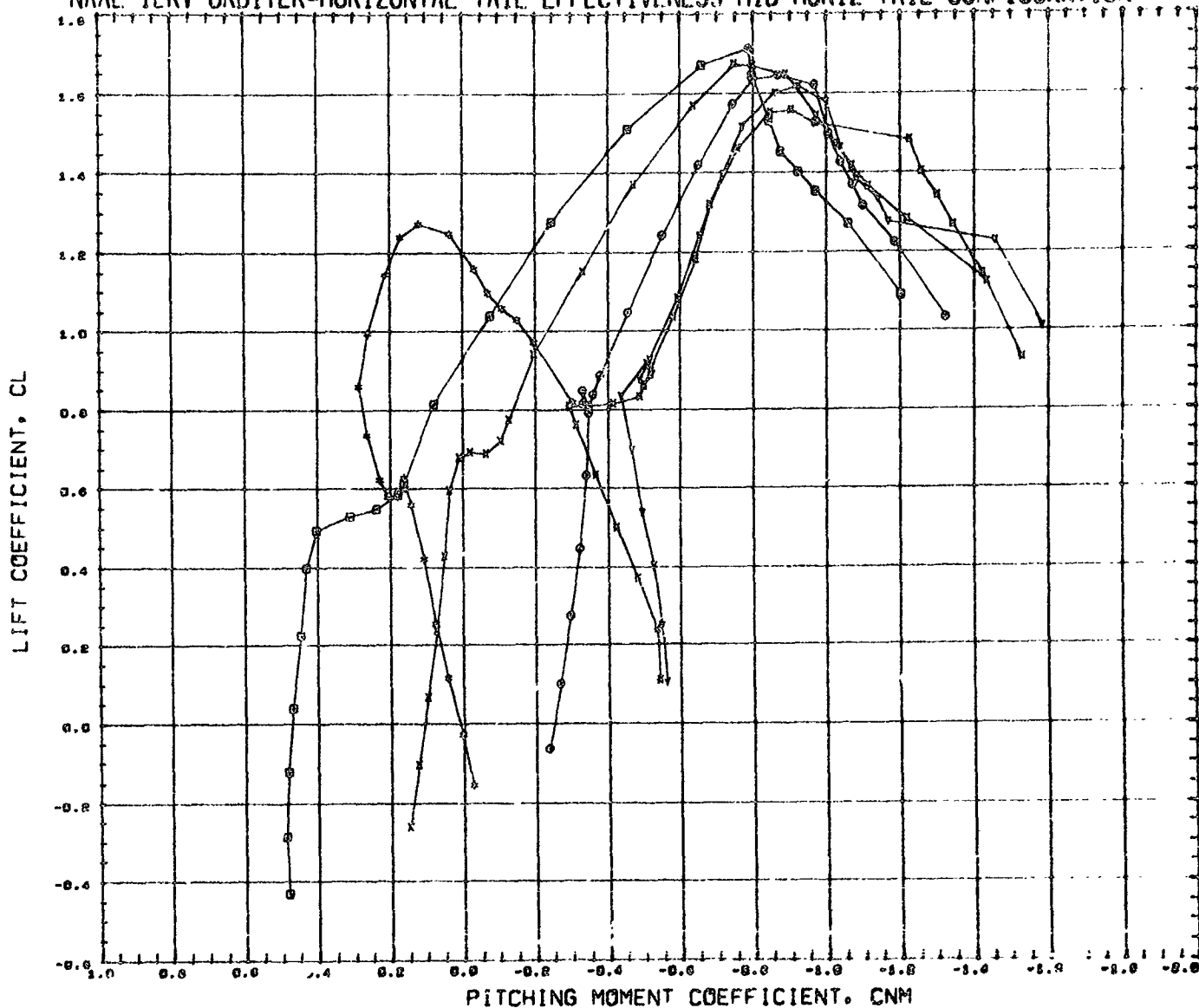
# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION                    | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|----------------------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W6        | (RC4003) | 11 AUG 70 | 0.250 | REFS 1.70000E10-01 60.71.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W6 H12 V5 | (RC4040) | 11 AUG 70 |       | REFL 1.87370E10-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W6 H12 V5 | (RC4094) | 11 AUG 70 |       | REFD 1.13300E10-00 INCHES  |
| O      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W6 H12 V5 | (RC4030) | 11 AUG 70 |       | KNRP 0.13800E10-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W6 H12 V5 | (RC4037) | 11 AUG 70 |       | YNRP 0.00000E10-01 INCHES  |
| K      | NAAL 020 SSV-ILRV STRAIGHT WING B6 W6 H12 V5 | (RC4030) | 11 AUG 70 |       | ZNRP -3.84000E10-03 INCHES |
|        |                                              |          |           |       | SCALE 7.01000E10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-331

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



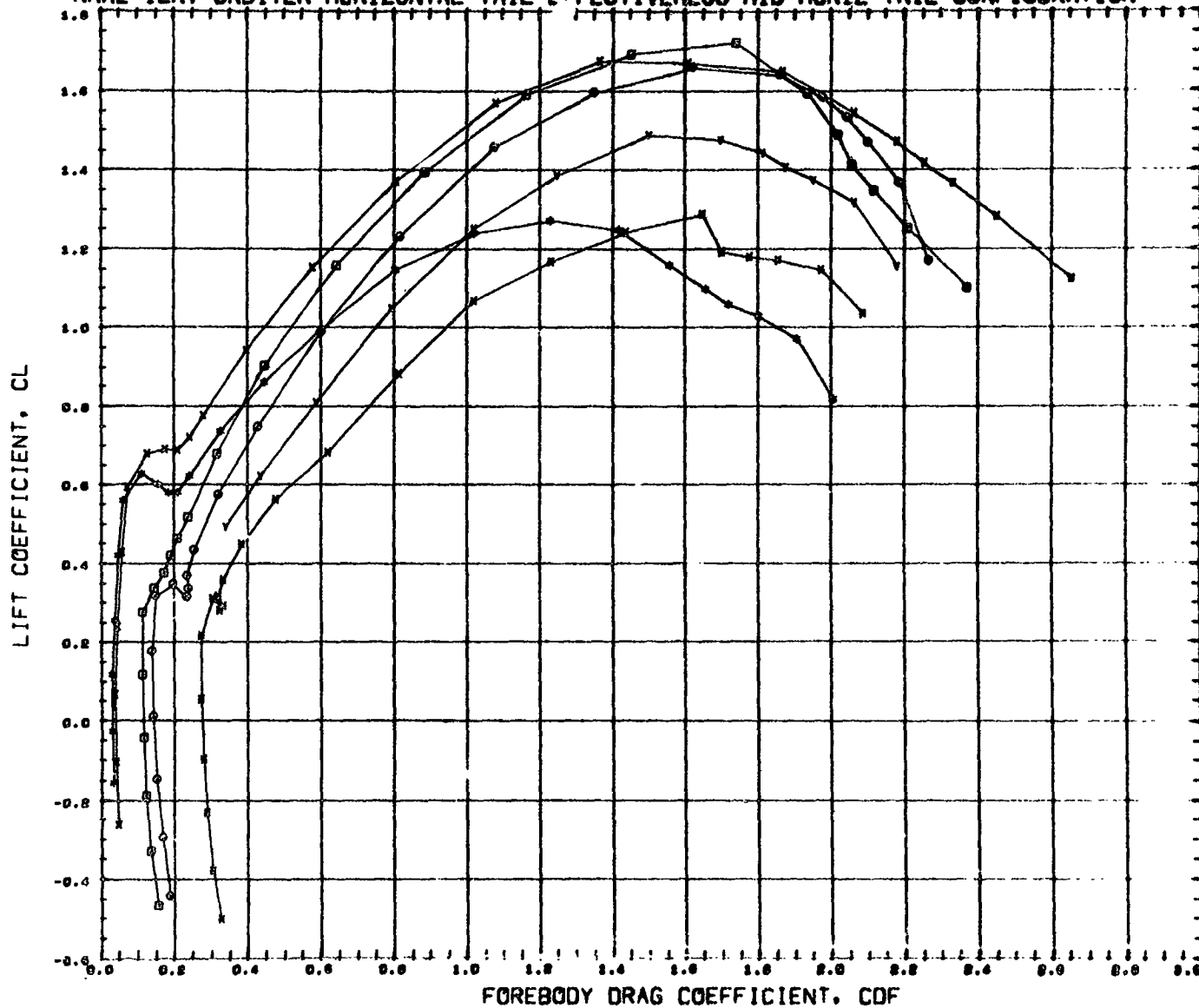
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE      | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|--------------|-----------|-------|--------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W6        | 11 AUG 70 | 0.250 | REFS 1.70000E-01 50.77.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W6 M12 V5 | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| □      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W6 M12 V5 | 11 AUG 70 |       | REFD 1.13500E-01 INCHES  |
| ○      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W6 M12 V5 | 11 AUG 70 |       | ENRP 0.13800E-01 INCHES  |
| △      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W6 M12 V5 | 11 AUG 70 |       | YNRP 0.00000E-01 INCHES  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 86 W6 M12 V5 | 11 AUG 70 |       | ENRP -3.00000E-01 INCHES |

REFERENCE FILE

NAAL 020 NA-70-331

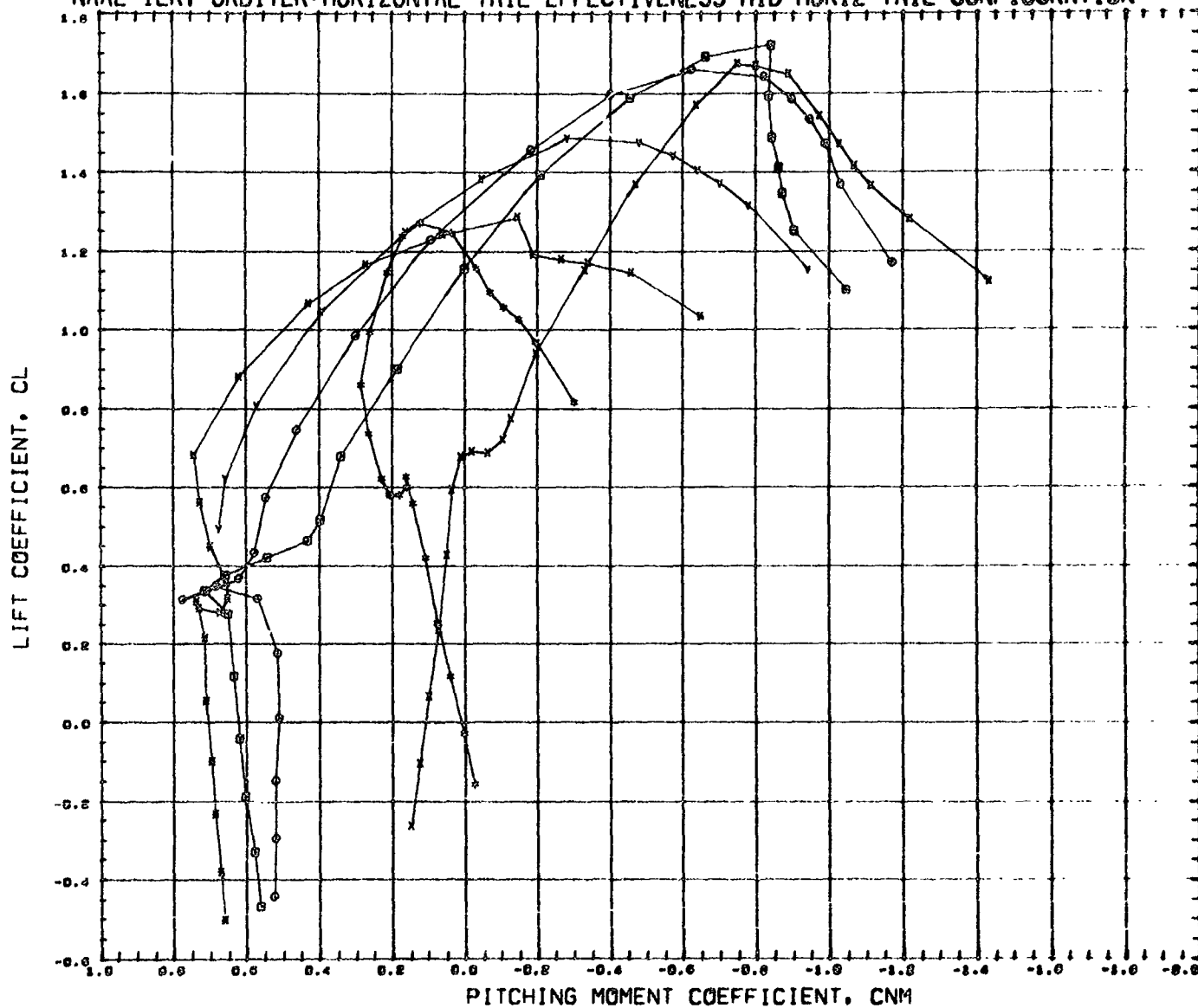
SCALE 1.01000E-01 SCALE

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET           | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|--------------------|-----------|-------|----------------------------|
| A      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4003             | 11 AUG 70 | 0.250 | REFD 1.70000E10-01 00.FT.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4040             | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
| Q      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4052             | 11 AUG 70 |       | REFD 1.13300E10-01 INCHES  |
| 9      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4051             | 11 AUG 70 |       | YMRP 0.13300E10-00 INCHES  |
| Y      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4050             | 11 AUG 70 |       | YMRP 0.00000E10-01 INCHES  |
| K      | NAAL 020 SSV-ILRV STRAIGHT WING | RC4049             | 11 AUG 70 |       | ZMRP -3.04000E10-03 INCHES |
|        | REFERENCE FILE                  | NAAL 020 NA-70-351 |           |       | SCALE 7.01000E10 SCALE     |

# NAAL ILRV ORBITER-HORIZONTAL TAIL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION

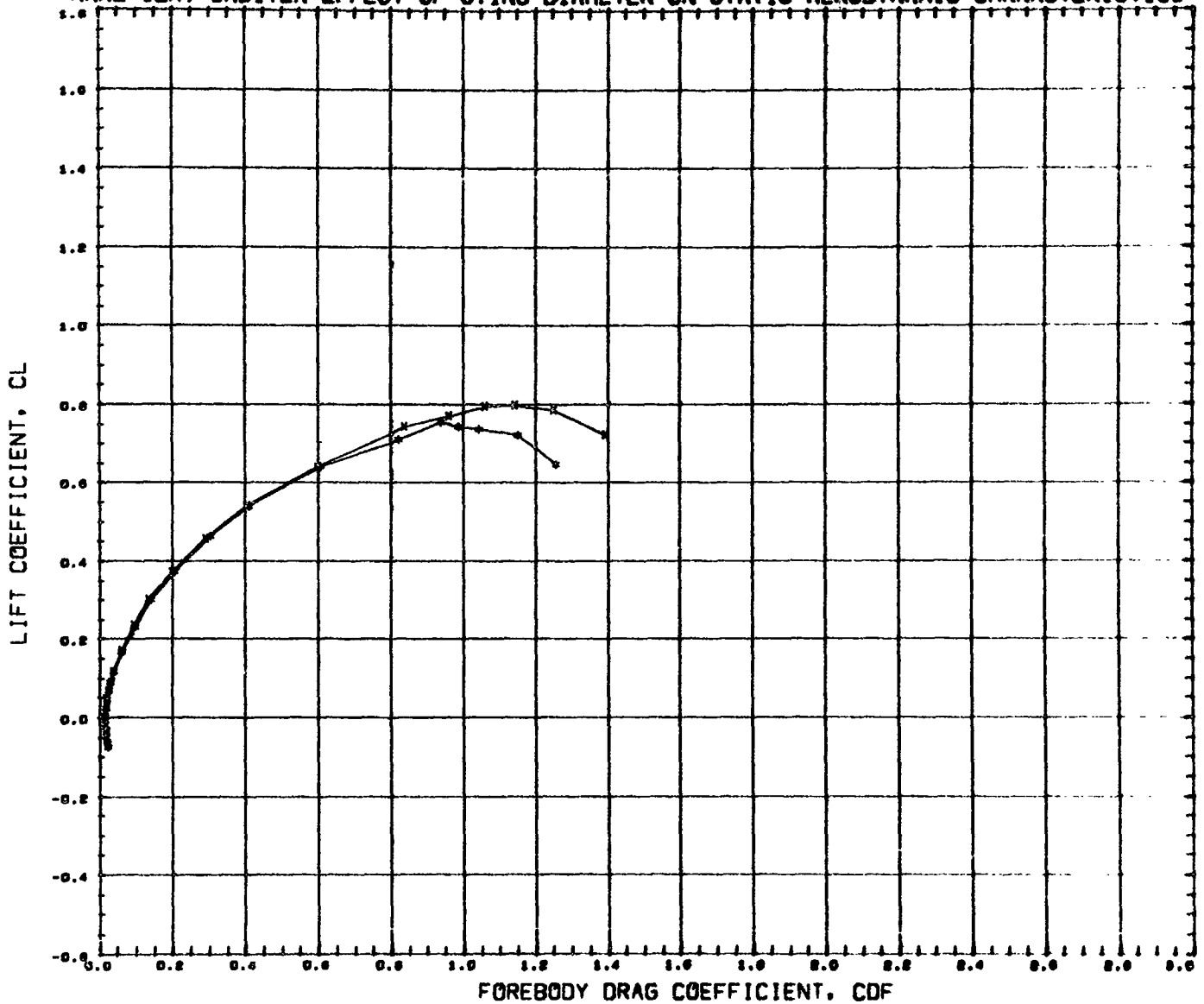


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | HACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|----------|-----------|-------|----------------------------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4053) | 11 AUG 70 | 0.250 | REFD 1.70000E10-01 SQ.FT.  |
| X      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 |       | REFL 1.97378E10-01 INCHES  |
| Q      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4052) | 11 AUG 70 |       | REFD 1.13200E10-01 INCHES  |
| Q      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4051) | 11 AUG 70 |       | INRP 0.13200E10-01 INCHES  |
| Y      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4050) | 11 AUG 70 |       | INRP 0.00000E10-01 INCHES  |
| N      | NAAL 029 SSV-ILRV STRAIGHT WING | (RC4049) | 11 AUG 70 |       | INRP -3.00000E10-01 INCHES |
|        |                                 |          |           |       | SCALE 7.01000E10-01 SCALE  |

REFERENCE FILE

NAAL 029 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



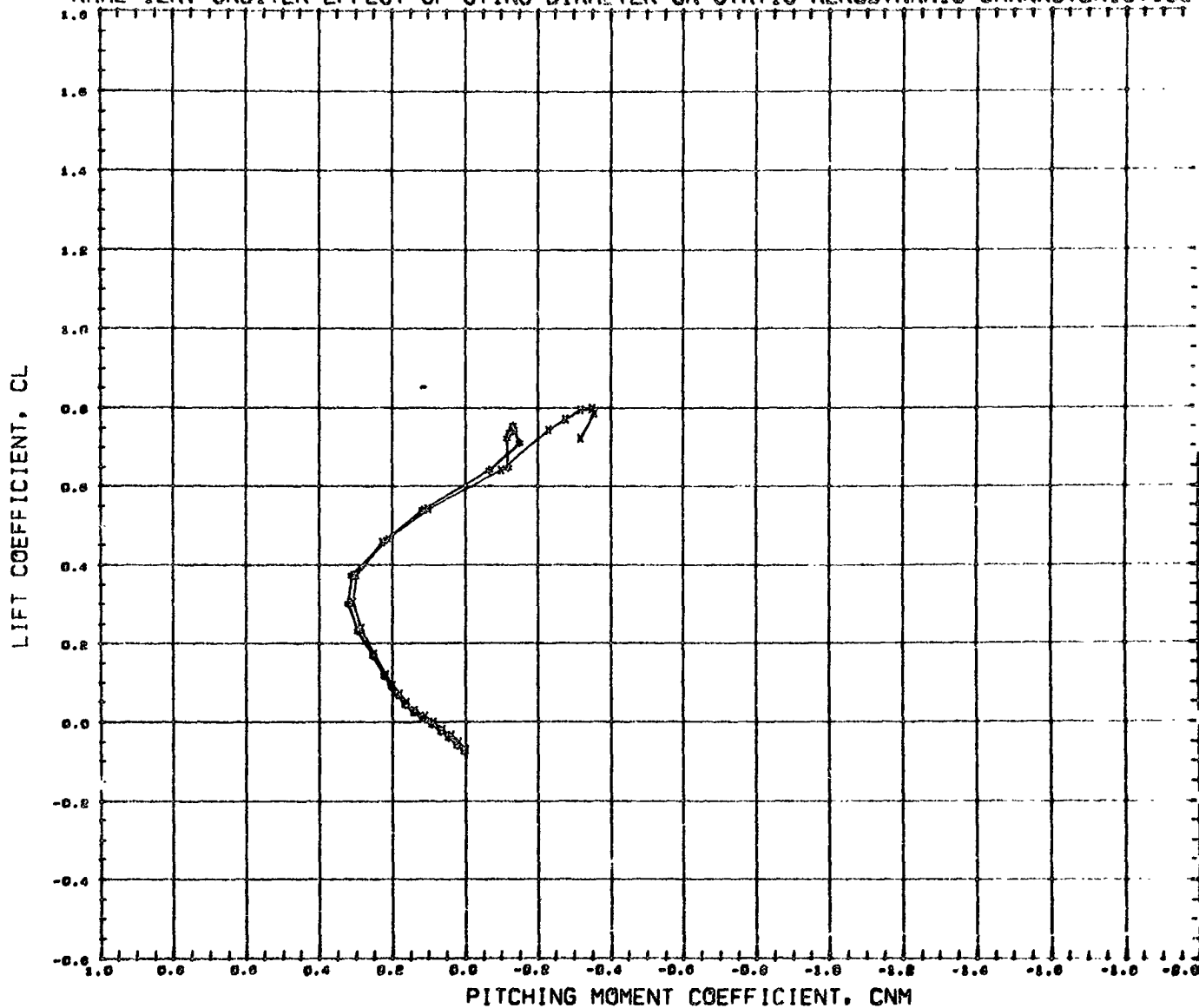
| SYMBOL | CONFIGURATION DESCRIPTION          |
|--------|------------------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING 86 |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING 86 |

| DATA SET | DATE      | MACH  |
|----------|-----------|-------|
| (NC4001) | 11 AUG 70 | 0.250 |
| (NC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |                |        |
|-----------------------|----------------|--------|
| REFS                  | 1.70000E10-01  | 86.FT. |
| REPL                  | 1.87370E10-01  | INCHES |
| REFS                  | 1.13300E10-01  | INCHES |
| KNRP                  | 0.13200E10-00  | INCHES |
| YNRP                  | 0.00000E10-00  | INCHES |
| ZNRP                  | -0.00000E10-01 | INCHES |
| SCALE                 | 7.61000E10     | SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



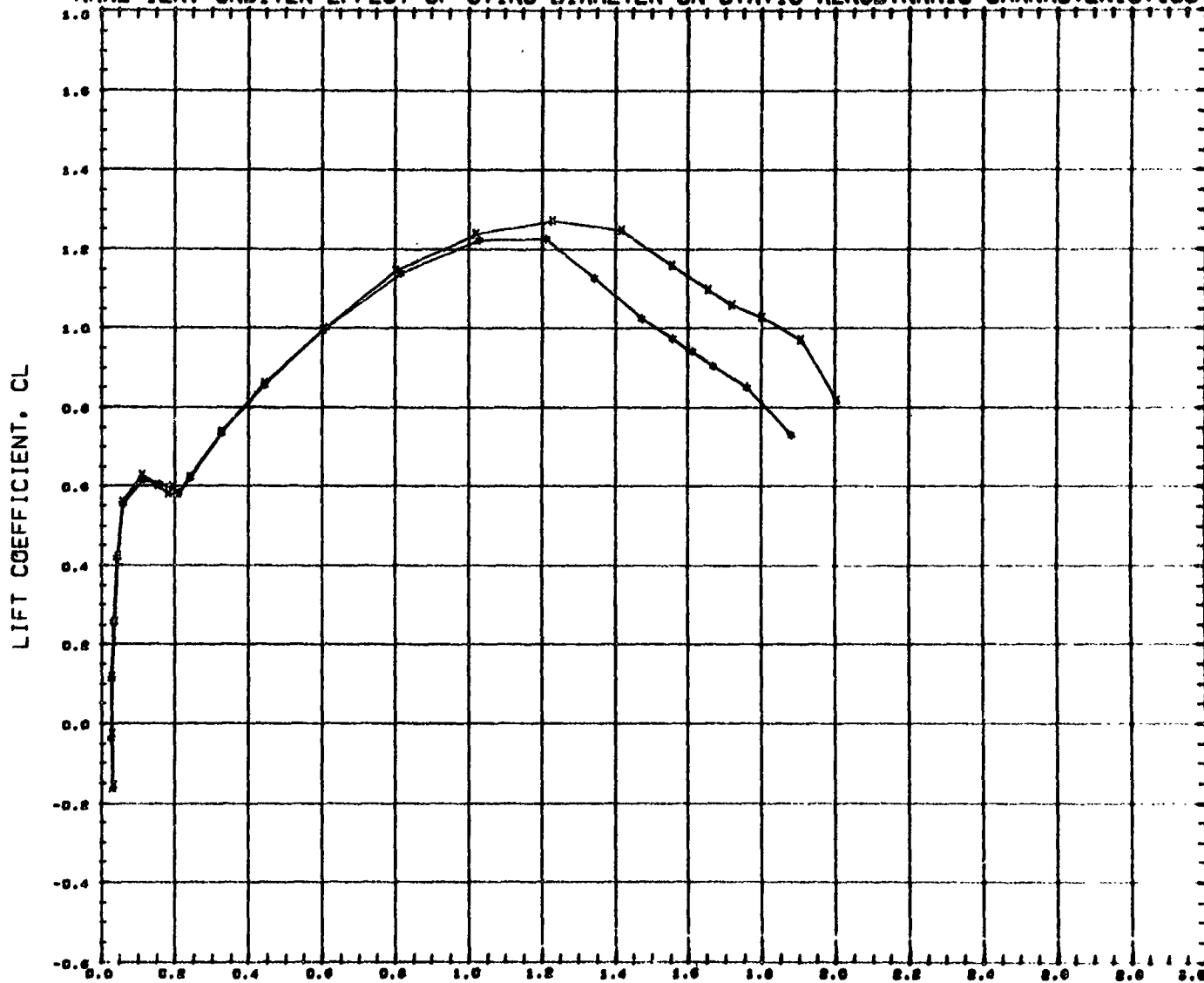
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|--------|---------------------------------|----------|-----------|-------|
| O      | NAAL 929 SSV-ILRV STRAIGHT WING | (RC4001) | 11 AUG 70 | 0.250 |
| X      | NAAL 920 SSV-ILRV STRAIGHT WING | (RC4030) | 11 AUG 70 |       |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000010-01    |
| REFL 1.07370010-01    |
| REFS 1.13300010-00    |
| SNRP 0.13300010-00    |
| YMRP 0.00000010-01    |
| ZMRP -2.04000010-01   |
| SCALE 7.01000010-01   |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000010-01    |
| REFL 1.07370010-01    |
| REFS 1.13300010-00    |
| SNRP 0.13300010-00    |
| YMRP 0.00000010-01    |
| ZMRP -2.04000010-01   |
| SCALE 7.01000010-01   |

REFERENCE FILE NAAL 929 NA-70-351

# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



FOREBODY DRAG COEFFICIENT, CDF

SYMBOL CONFIGURATION DESCRIPTION

\* NAAL 020 SSV-ILRV STRAIGHT WING B6 W6  
x NAAL 020 SSV-ILRV STRAIGHT WING B6 W6

DATA SET

(RC4005) 11 AUG 70  
(RC4003) 11 AUG 70

DATE

MACH

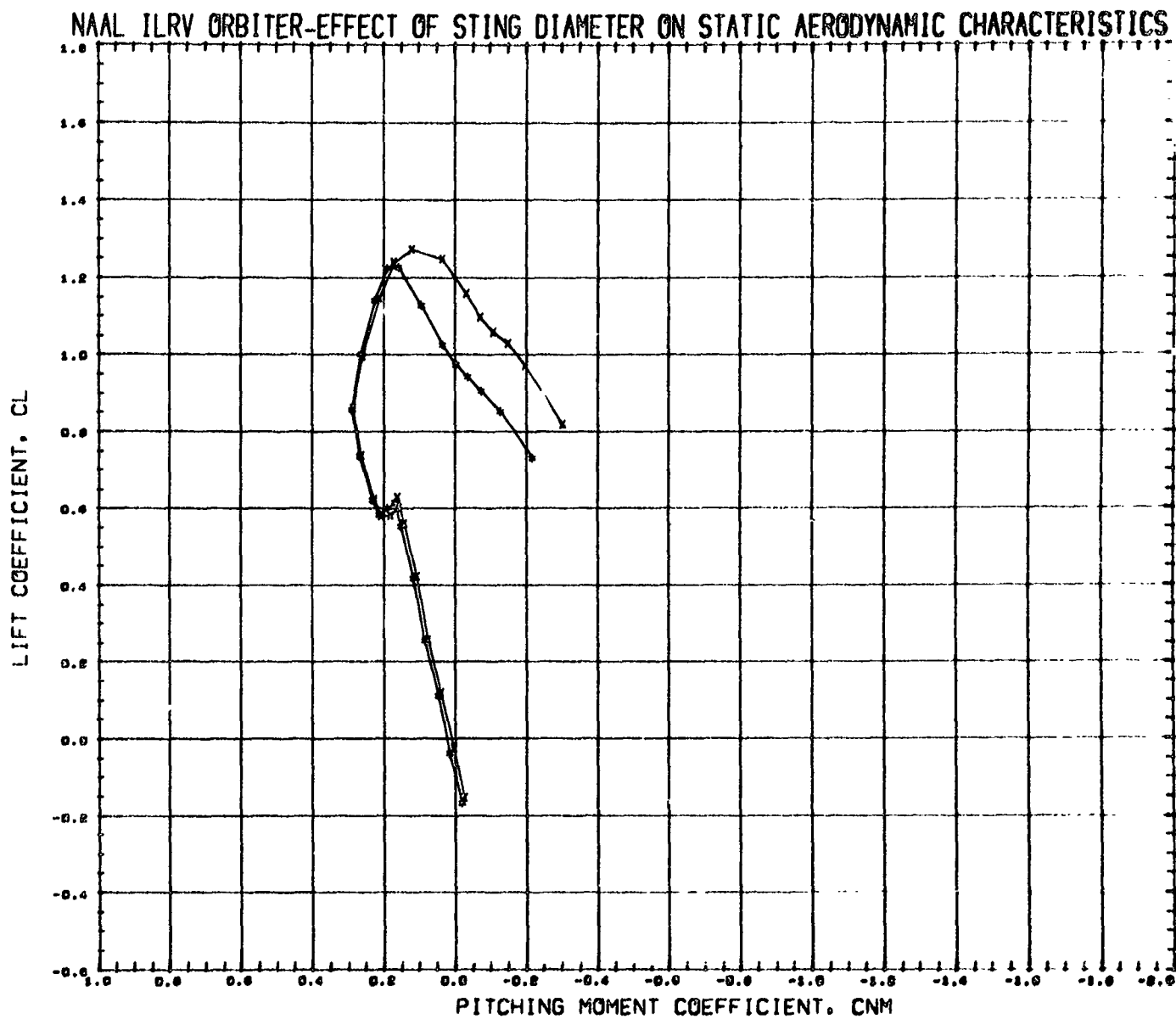
0.250

REFERENCE INFORMATION

REFS 1.70000X10-01 00.FT.  
REFL 1.07370X10-01 INCHES  
REFS 1.13300X10-00 INCHES  
XMRP 0.13200X10-00 INCHES  
YMRP 0.60000X10-01 INCHES  
ZMRP -3.64000X10-01 INCHES  
SCALE 7.01000X10-01 SCALE

REFERENCE FILE

NAAL 020 NA-70-351



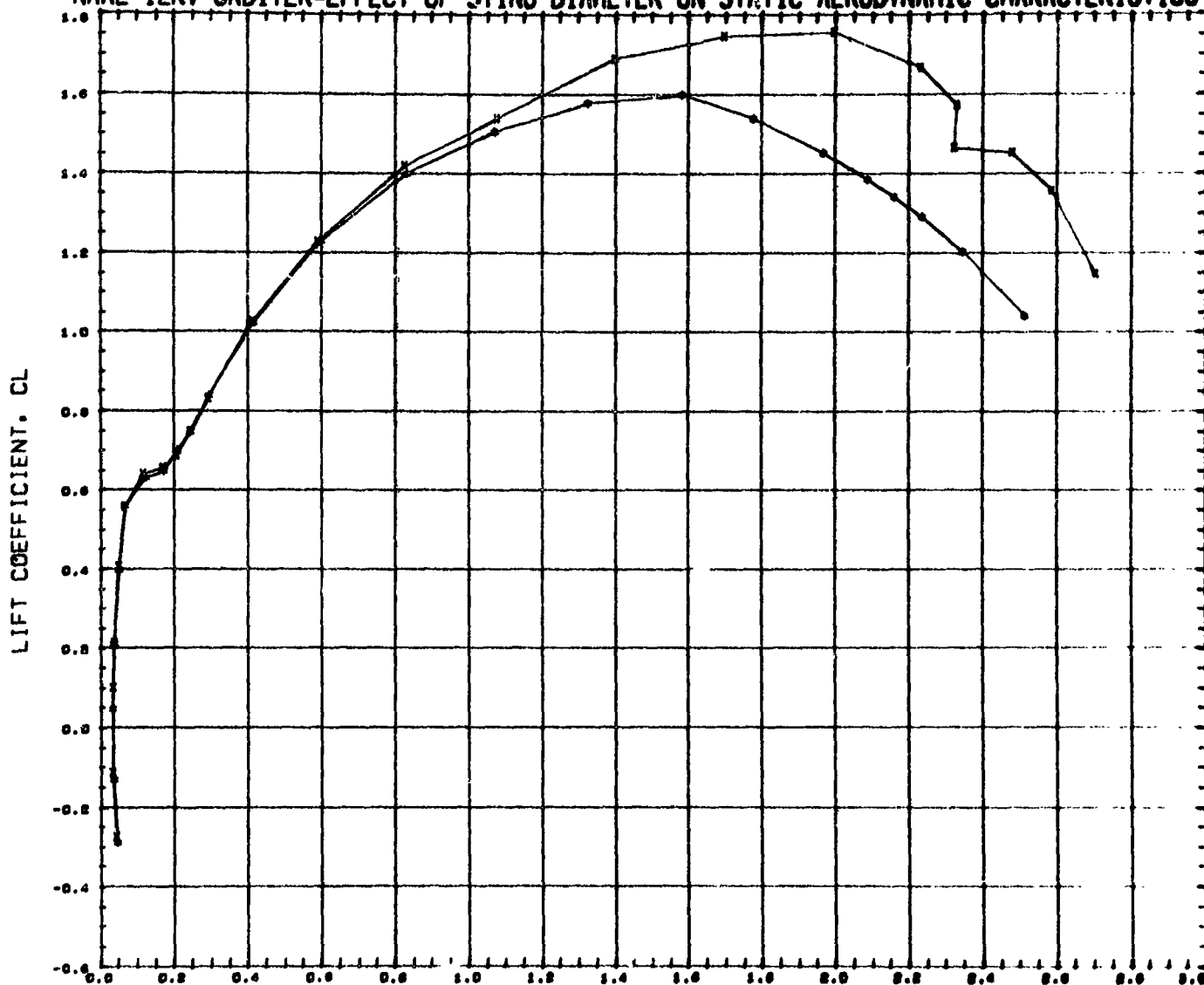
| SYMBOL | CONFIGURATION DESCRIPTION             | DATA SET | DATE      | MACH  |
|--------|---------------------------------------|----------|-----------|-------|
| *      | NAAL 029 SSV-ILRV STRAIGHT WING 66 IN | (RC4003) | 11 AUG 70 | 0.250 |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING 68 IN | (RC4003) | 11 AUG 70 | 0.250 |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000E10-01    |
| REFL 1.07370E10-01    |
| REFS 1.10000E10-00    |
| XMRP 0.13200E10-00    |
| YMRP 0.00000E10-00    |
| ZMRP -3.00000E10-01   |
| SCALE 7.01000E10-03   |

| REFERENCE INFORMATION |
|-----------------------|
| REFS 1.70000E10-01    |
| REFL 1.07370E10-01    |
| REFS 1.10000E10-00    |
| XMRP 0.13200E10-00    |
| YMRP 0.00000E10-00    |
| ZMRP -3.00000E10-01   |
| SCALE 7.01000E10-03   |

REFERENCE FILE NAAL 029 NA-70-351

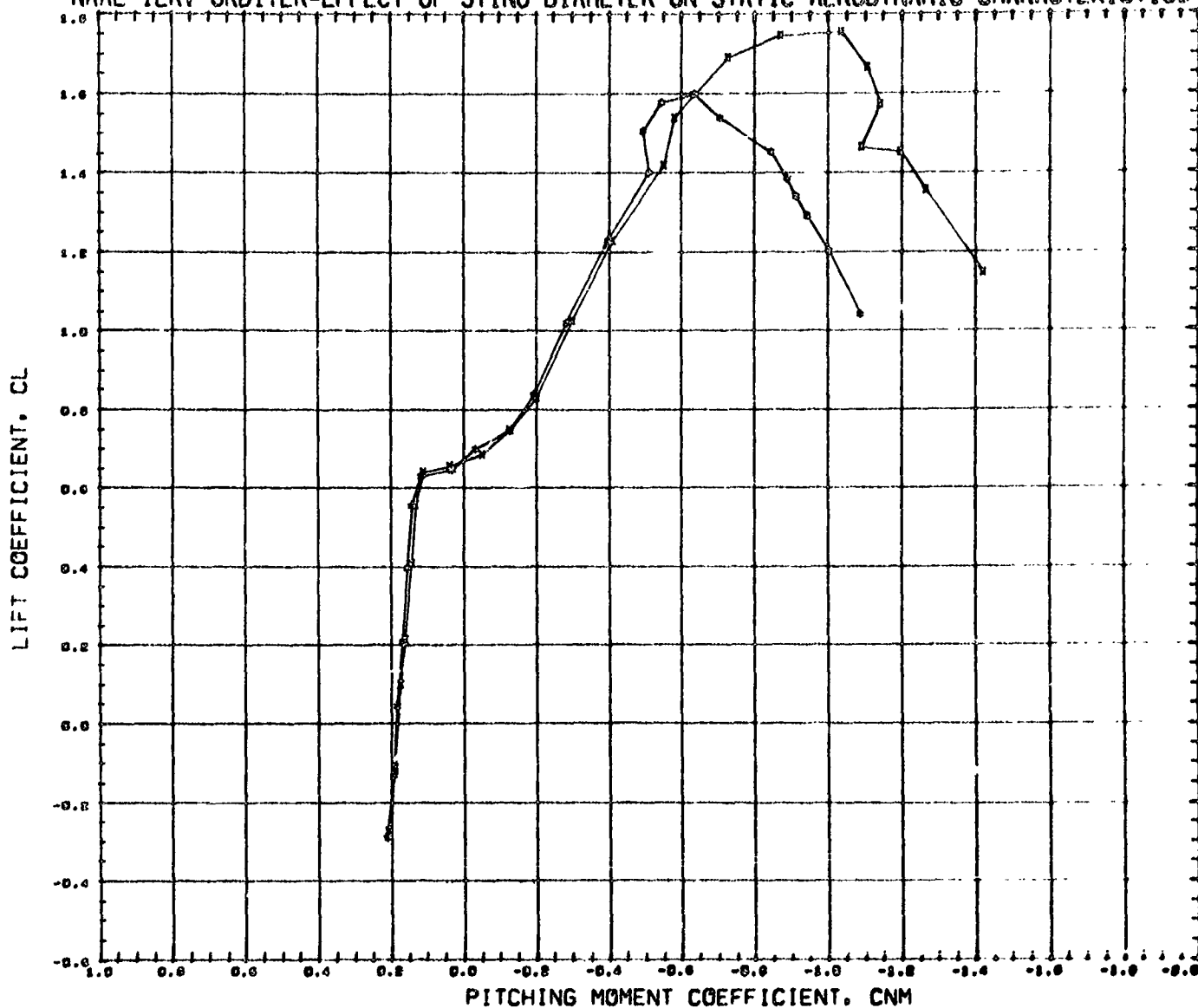
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET  | DATE               | MACH  | REFERENCE INFORMATION    |
|--------|---------------------------------|-----------|--------------------|-------|--------------------------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6 N13 | (RC4003) 11 AUG 70 | 0.250 | REFS 1.70000E-01 60.FT.  |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W6 N13 | (RC4070) 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
|        |                                 |           |                    |       | REFD 1.13300E-01 INCHES  |
|        |                                 |           |                    |       | YNRP 0.13300E-01 INCHES  |
|        |                                 |           |                    |       | YNRP 0.00000E-01 INCHES  |
|        |                                 |           |                    |       | YNRP -3.04000E-01 INCHES |
|        |                                 |           |                    |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

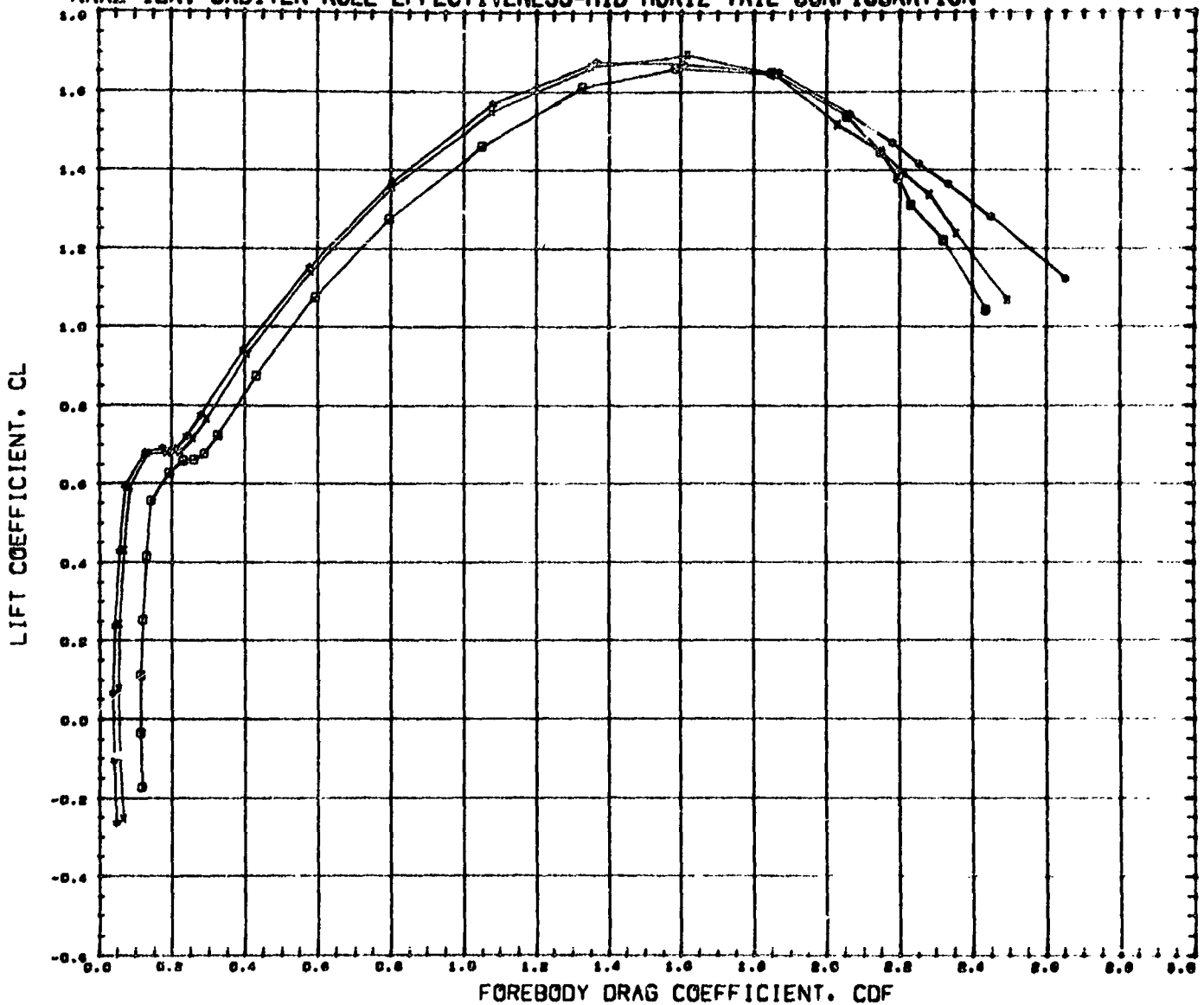
# NAAL ILRV ORBITER-EFFECT OF STING DIAMETER ON STATIC AERODYNAMIC CHARACTERISTICS



| SYMBOL | CONFIGURATION DESCRIPTION                 | DATA SET | DATE      | MACH  | REFERENCE INFORMATION      |
|--------|-------------------------------------------|----------|-----------|-------|----------------------------|
| O      | NAAL 020 BSV-ILRV STRAIGHT WING 86 W8 H13 | (RC4008) | 11 AUG 70 | 0.200 | REF6 1.70000E10-01 86.77.  |
| X      | NAAL 020 BSV-ILRV STRAIGHT WING 86 W8 H13 | (RC4070) | 11 AUG 70 |       | REFL 1.97370E10-01 INCHES  |
|        |                                           |          |           |       | REF8 1.13300E10-00 INCHES  |
|        |                                           |          |           |       | INBP 0.13000E10-00 INCHES  |
|        |                                           |          |           |       | YMRP 0.00000E10-01 INCHES  |
|        |                                           |          |           |       | ZMRP -5.04000E10-01 INCHES |
|        |                                           |          |           |       | SCALE 7.41000E10-03 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



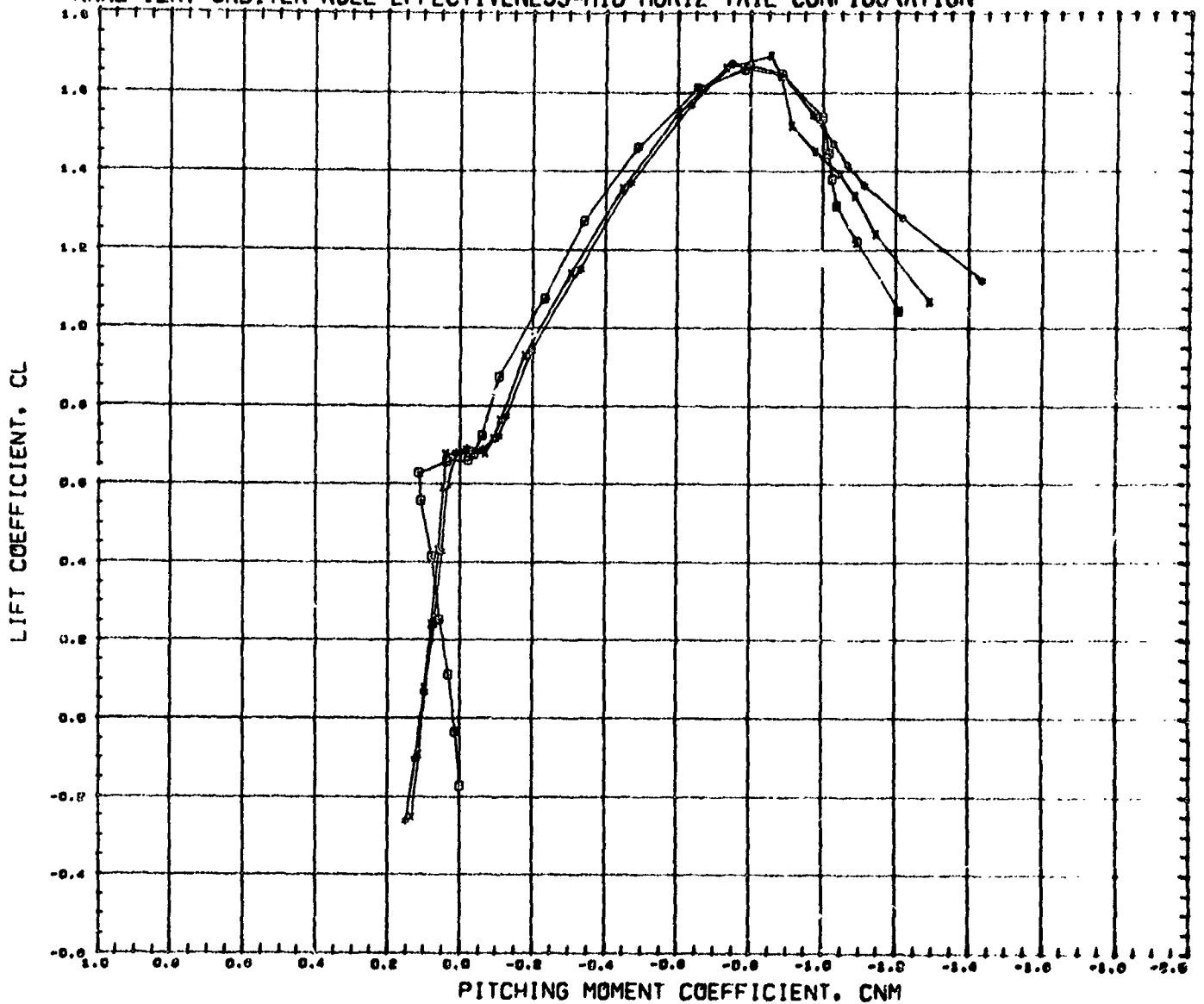
| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | MACH  |
|--------|---------------------------------|-----------------------|-----------|-------|
| *      | NAAL 029 BSV-ILRV STRAIGHT WING | B6 W3 H12 V3 (RC4040) | 11 AUG 70 | 0.259 |
| x      | NAAL 029 BSV-ILRV STRAIGHT WING | B6 W6 H12 V3 (RC4059) | 11 AUG 70 |       |
| o      | NAAL 029 BSV-ILRV STRAIGHT WING | B6 W6 H12 V3 (RC4093) | 11 AUG 70 |       |

REFERENCE FILE

NAAL 029 NA-70-351

| REFERENCE INFORMATION |                     |
|-----------------------|---------------------|
| REFS                  | 1.700000E+01 00 FT. |
| REFL                  | 1.07370E+01 INCHES  |
| REFD                  | 1.13300E+00 INCHES  |
| REFP                  | 0.13300E+00 INCHES  |
| REFM                  | 0.00000E+00 INCHES  |
| REFN                  | -3.04000E+01 INCHES |
| SCALE                 | 7.01000E+00 SCALE   |

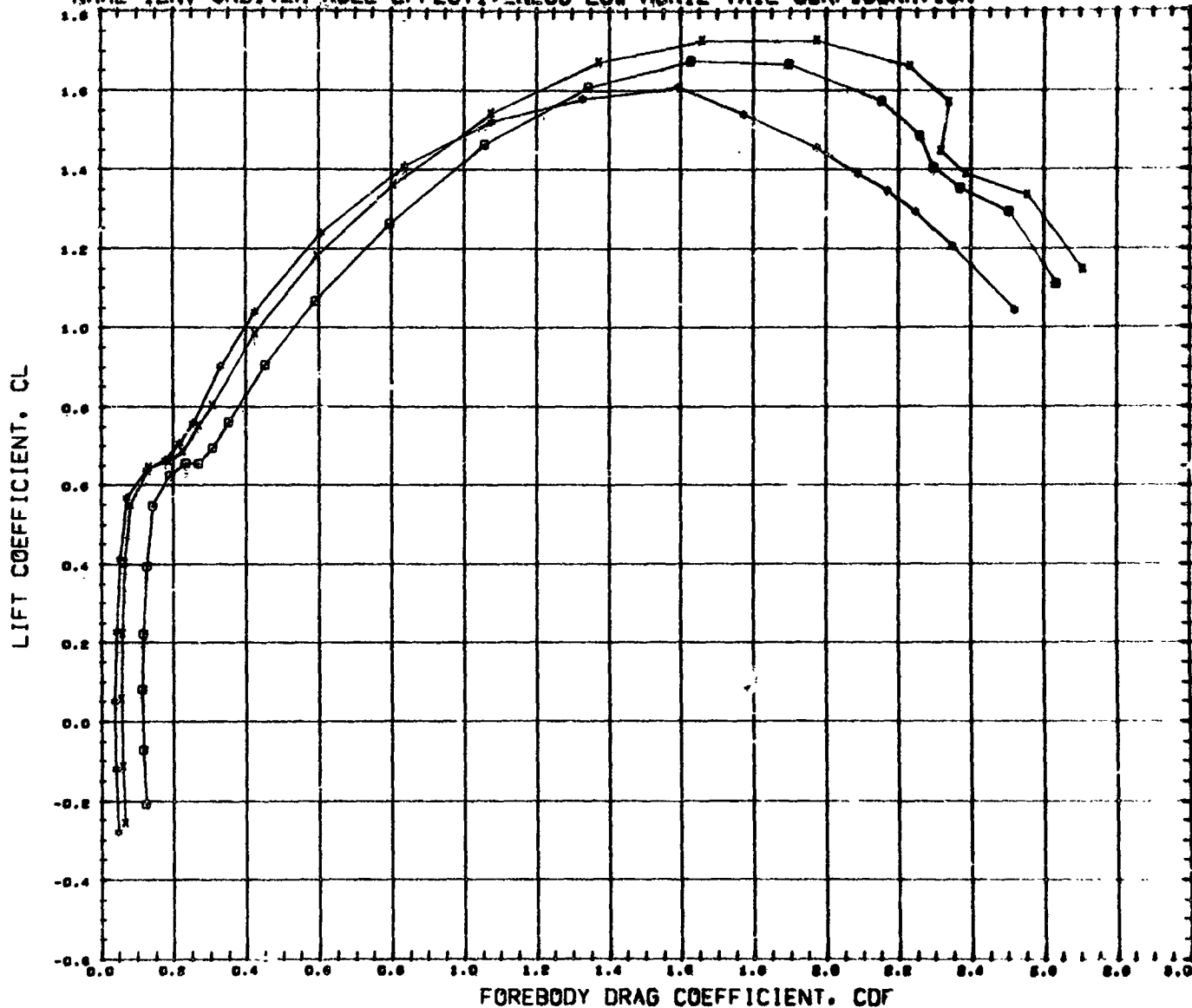
# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-MID HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET | DATE      | MACH  | REFERENCE INFORMATION     |
|--------|---------------------------------|----------|-----------|-------|---------------------------|
| O      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4040) | 11 AUG 70 | 0.250 | REFS 1.700000E-01 80.77.  |
| X      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4050) | 11 AUG 70 |       | REFL 1.573700E-01 INCHES  |
| G      | NAAL 020 SSV-ILRV STRAIGHT WING | (RC4053) | 11 AUG 70 |       | REFD 1.133000E-01 INCHES  |
|        |                                 |          |           |       | YMRP 0.133000E-01 INCHES  |
|        |                                 |          |           |       | YMRP 0.000000E-01 INCHES  |
|        |                                 |          |           |       | YMRP -3.040000E-01 INCHES |
|        |                                 |          |           |       | SCALE 7.010000E-01 SCALE  |

REFERENCE FILE NAAL 020 NA-70-351

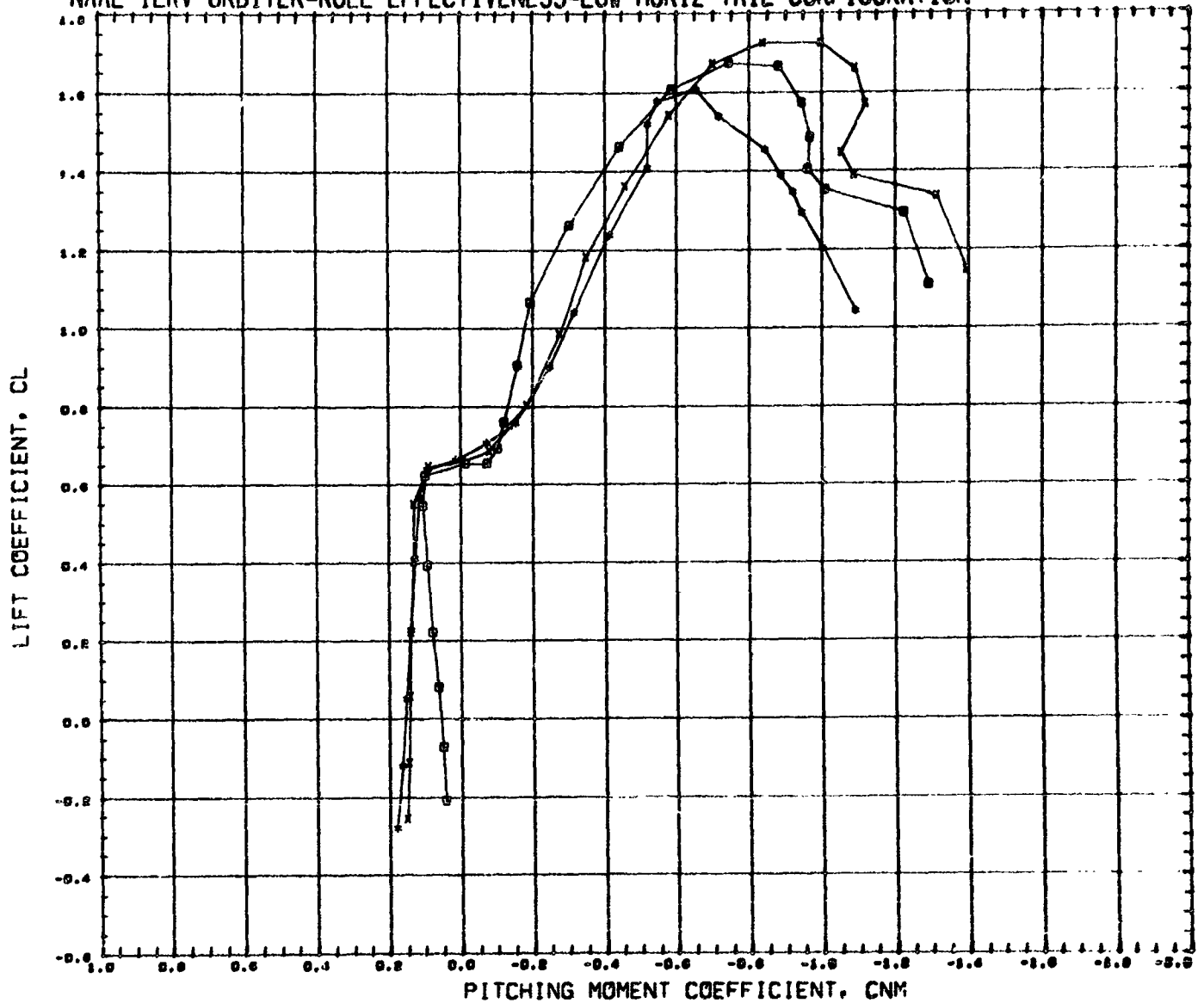
# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION



| SYMBOL | CONFIGURATION DESCRIPTION                    | DATA SET | DATE      | NACH  | REFERENCE INFORMATION    |
|--------|----------------------------------------------|----------|-----------|-------|--------------------------|
| x      | NAAL 029 SSV-ILRV STRAIGHT WING 00 W8 H13 V' | (RC4013) | 11 AUG 70 | 0.220 | REFD 1.70000E-01 00.FT.  |
| x      | NAAL 029 SSV-ILRV STRAIGHT WING 00 W8 H13 V5 | (RC4075) | 11 AUG 70 |       | REFL 1.97370E-01 INCHES  |
| o      | NAAL 029 SSV-ILRV STRAIGHT WING 00 W8 H13 V5 | (RC4073) | 11 AUG 70 |       | REFD 1.13300E-01 INCHES  |
|        |                                              |          |           |       | THRP 0.13200E-01 INCHES  |
|        |                                              |          |           |       | YMRP 0.00000E-01 INCHES  |
|        |                                              |          |           |       | ZMRP -3.04000E-01 INCHES |
|        |                                              |          |           |       | SCALE 7.01000E-01 SCALE  |

REFERENCE FILE NAAL 029 NA-70-351

# NAAL ILRV ORBITER-ROLL EFFECTIVENESS-LOW HORIZ TAIL CONFIGURATION

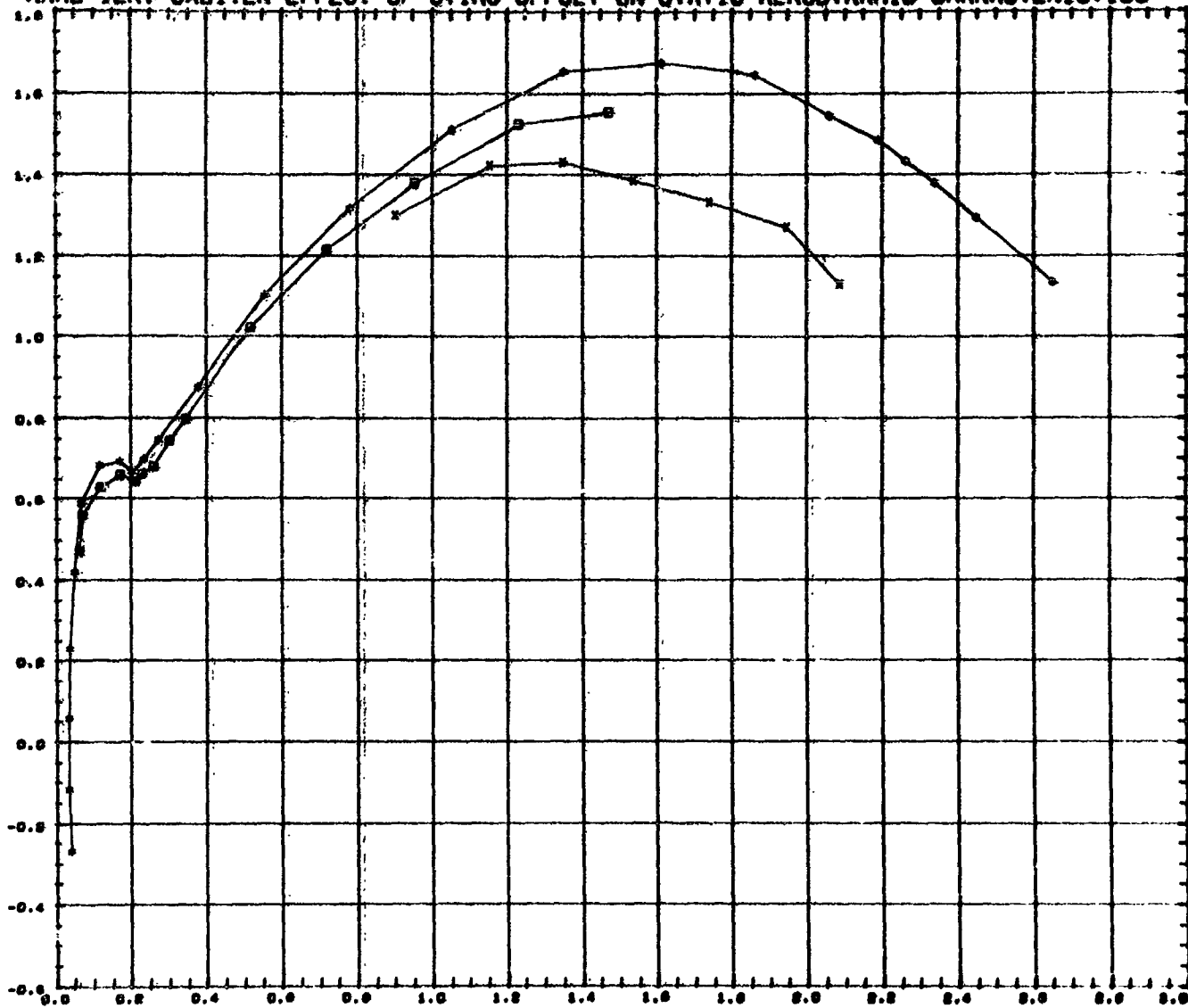


| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET              | DATE      | NACH  | REFERENCE INFORMATION      |
|--------|---------------------------------|-----------------------|-----------|-------|----------------------------|
| *      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13 VS (RC4013) | 11 AUG 70 | 0.800 | REFS 1.70000E10-01 04.71.  |
| x      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13 VS (RC4075) | 11 AUG 70 |       | REFL 1.87370E10-01 INCHES  |
| o      | NAAL 020 SSV-ILRV STRAIGHT WING | 06 WS H13 VS (RC4075) | 11 AUG 70 |       | REFS 1.13300E10-01 INCHES  |
|        |                                 |                       |           |       | ENRP 0.15000E10-00 INCHES  |
|        |                                 |                       |           |       | ENRP 0.00000E10-00 INCHES  |
|        |                                 |                       |           |       | ENRP -0.04000E10-01 INCHES |
|        |                                 |                       |           |       | SCALE 7.01000E10-00 SCALE  |

REFERENCE FILE

NAAL 020 NA-70-391

## LIFT COEFFICIENT, CL



FOREBODY DRAG COEFFICIENT, CDF

| SYMBOL     | CONFIGURATION DESCRIPTION |          |      |              | DATA SET | DATE      | NAEN  |
|------------|---------------------------|----------|------|--------------|----------|-----------|-------|
| * NAAL 020 | 83V-ILRV                  | STRAIGHT | WING | 00 W0 H12    | (RC4027) | 11 AUG 70 | 0.050 |
| X NAAL 020 | 83V-ILRV                  | STRAIGHT | WING | 00 W0 H12    | (RC4120) | 11 AUG 70 |       |
| Q NAAL 020 | 83V-ILRV                  | STRAIGHT | WING | 00 W0 H12 VS | (RC4130) | 11 AUG 70 |       |

### REFERENCE INFORMATION

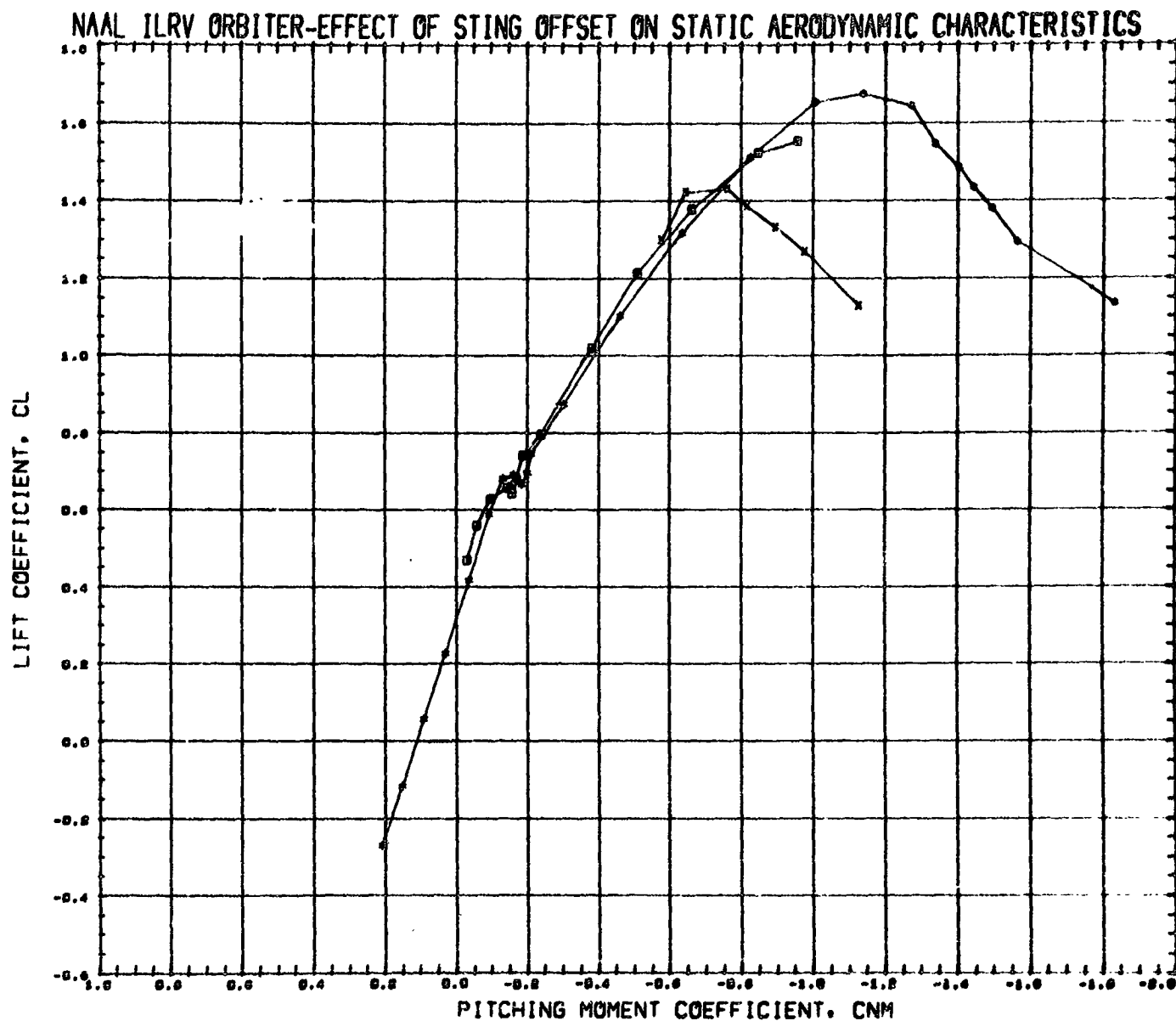
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REFD 1.000000E+01 00.000000
ENRP 0.000000E+00 00.000000
VGRP 0.000000E+00 00.000000
ENRP -0.000000E+00 00.000000
SCALE 0.000000E+00 00.000000

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**REFERENCE FILE**

NAAL 020 NA-70-351



| SYMBOL | CONFIGURATION DESCRIPTION       | DATA SET     | DATE     | MACH      | REFERENCE INFORMATION |
|--------|---------------------------------|--------------|----------|-----------|-----------------------|
| *      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W9 N12    | (RC4027) | 11 AUG 70 | 0.200                 |
| x      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W9 N12    | (RC4120) | 11 AUG 70 |                       |
| □      | NAAL 020 BSV-ILRV STRAIGHT WING | 06 W9 N12 V3 | (RC4110) | 11 AUG 70 |                       |

|       |                |        |
|-------|----------------|--------|
| REFS  | 1.70000010-01  | 00.FT. |
| REFL  | 1.57370010-01  | INCHES |
| REFS  | 1.13300010-01  | INCHES |
| INHP  | 0.13200010-00  | INCHES |
| INHP  | 0.00063310-00  | INCHES |
| INHP  | -3.04000010-01 | INCHES |
| SCALE | 7.01000010-01  | SCALE  |

REFERENCE FILE NAAL 020 NA-70-391