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DATA REPORT FOR THE APOLLO FS-9 MODEL IN THE NAAL WIND TUNNEL (NAAL 487)

NAS9-150

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Copy #1

Reissued 17 December 1962 [redacted] 4.5.5.1

CLASSIFICATION CHANGE

To UNCLASSIFIED
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[redacted]

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NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

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FOREWORD

The aerodynamic force test of the 0.105-scale FS-9 model was conducted under NASA Apollo Contract NAS9-150.

This report was prepared by D.G. Cummings of the Wind Tunnel Projects Group, Los Angeles Division of North American Aviation, Inc.

This report has been reissued with amendments to the data sections; all copies of the original issue, dated 15 November 1962, should be destroyed.

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I. INTRODUCTION

The Apollo 0.105-scale force model FS-9 was tested in the NAAL 7.75- by 11-foot wind tunnel from 27 July to 30 July 1962 to obtain aerodynamic force and stability characteristics of the command module prior to drogue parachute deployment. The model was tested through an angle-of-attack range of 0 to ±180 degrees at Mach number 0.26 and Reynolds number 2.49×10^6. The model configuration is shown in Figure 1.

The basic wind tunnel test data only is presented in this report to make test results available at the earliest possible date. Analyses and a summary of results will be published in a separate document.

A summary of the completed runs for the C_{18} configuration is presented in the following listing.

α Range (Deg)	Run Number
-10 to +30	1
20 to 70	3
50 to 100	2
81 to 125	4
115 to 156	5
143 to 187	6
5 to -30	7
-20 to -70	12
-50 to -100	8
-75 to -135	9
-110 to -160	10
-140 to -190	11

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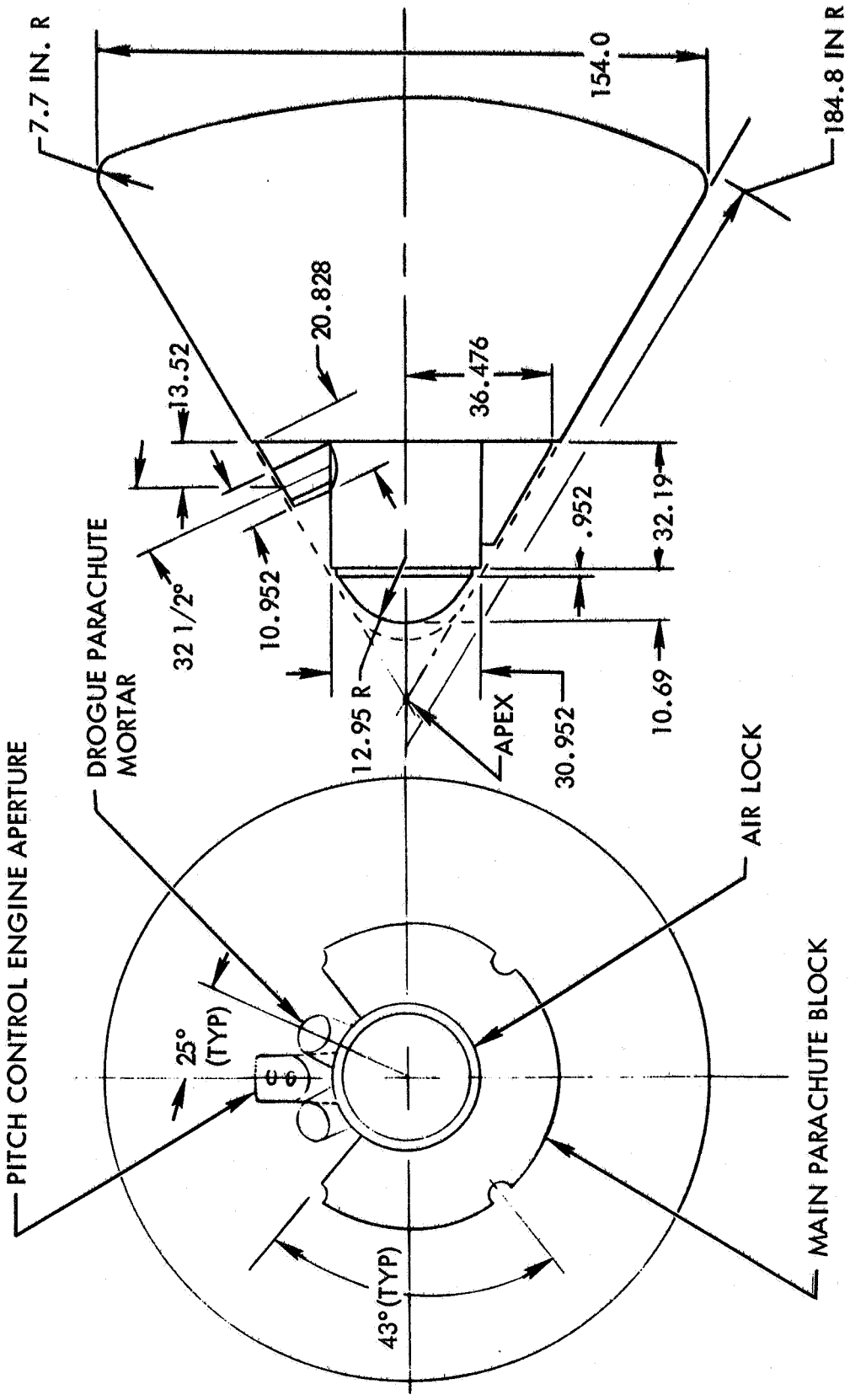


Figure 1. Command Module C_{18}

[redacted]

II. MODEL DESCRIPTION

MODEL CONSTRUCTION

To cover the required angle-of-attack range, one basic command module was constructed of laminated mahogany. Six different balance installations in which the angle between the module axis and balance axis varied were possible. The command module was constructed in halves and was joined with machine screws and barrel nuts. The nose section was constructed as a separate part that could be rotated 0 and 180 degrees with respect to the basic module. Orientation of the nose section would then permit the complete angle-of-attack range to be obtained by pitching the model in one direction only (Figure 1). NAA CO 7121-126[1] is a detail drawing of the model configuration.

INSTRUMENTATION

Six-component force and moment data were measured by the 2.5-inch Mark III-C internal balance.

Base pressures were not required, but one balance chamber pressure was measured with a Statham differential pressure transducer.

[1] Bristol, M. A. Apollo Recovery Model, Drawing No. CO7121-126 NAA/S&ID (16 June 1962).

CO[redacted]

III. TEST PROCEDURE

MODEL INSTALLATION

The Apollo FS-9 force model was installed on the Task 2.5-inch MK III-C internal balance and adaptor to the sting assembly. A typical tunnel installation is shown in Figure 2, and the actual installation is shown in Figures 3 through 8. The model was positioned in the yaw plane by rotating the model 90 degrees with respect to the balance, thereby measuring normal forces on the side force gages. This was done to increase the accuracy of the data. Angles of attack were accomplished by pitching the model in the yaw plane.

During the operation of this test, an angle-of-attack range of -30 to +30 degrees was covered with the sting support system. This range, combined with the various model offset angles (θ), allowed adequate coverage for the angles of attack on the model.

INSTRUMENTATION

The output of each force element was recorded on Leeds and Northrup Speed-O-Max strip chart recorders set to monitor several seconds of data at each point. The average values from the chart paper was transmitted to the 8B104 program, which was reduced by the IBM-709. The final computed data, presented in tabulated and card form, was then plotted on a Benson-Lehrner digital plotter.

Balance chamber pressure was measured with a Statham differential pressure transducer type PM5 TC ±0.25-350 (±0.25 PSID) referenced to the Po reference system.

DATA REDUCTION CONSTANTS

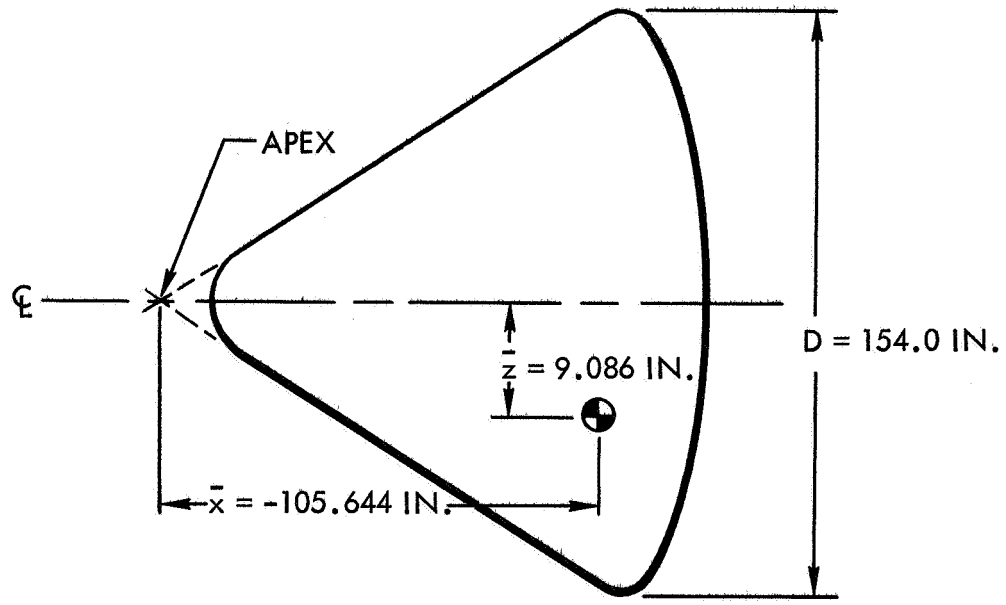
Force and moment coefficients were computed based on the following geometric constants.

A Model reference area = 1.4261 ft^2
(maximum cross-sectional area)

D Model reference diameter = 1.3475 ft
(maximum diameter of command module)

[redacted]

The reference center-of-gravity location for the command module alone was $\bar{x}/D = -0.686$ and $\bar{z}/D = 0.059$.



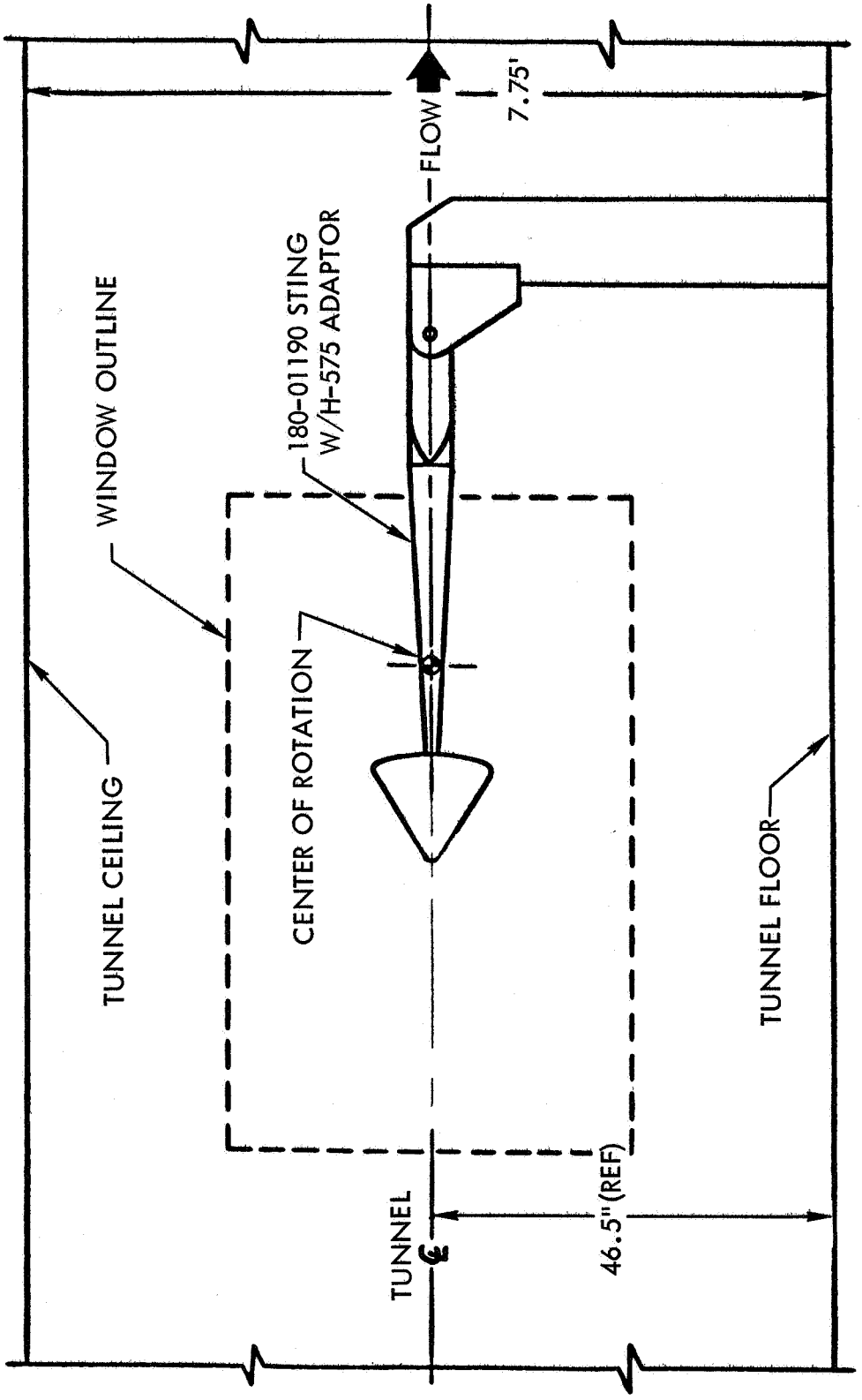
All angle-of-attack data were corrected for sting and balance deflection. Although balance pressure was measured, the data was not corrected for base drag.

DATA ACCURACY

The balance and recording instrumentation were set to provide maximum possible sensitivity within the capabilities of the amplifying instrumentation and the limits established by keeping maximum loads less than full scale on the recorder. The probable coefficient errors for all test conditions are presented in the following listing:

Mach No.	Reynolds No. x 10^{-6}	$\pm\Delta CN$	$\pm\Delta CA$	$\pm Cm_{cg}$	$\pm\Delta CMA$	$\pm\Delta CL$	$\pm\Delta CD$
0.26	2.49	0.002	0.002	0.0005	0.0014	0.002	0.002
0.185	1.77	0.003	0.003	0.0010	0.0027	0.003	0.003

CON[redacted]



IV. TEST PROCEDURE
B. MODEL INSTALLATION

NOTE: DWG NOT TO SCALE

Figure 2. Typical Installation

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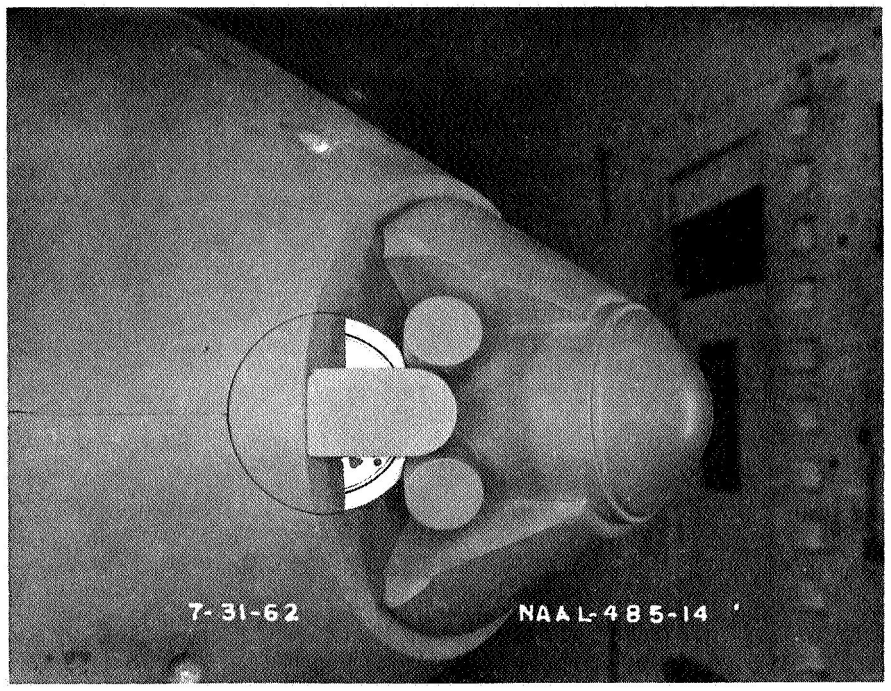

Figure 3. Model Nose Section

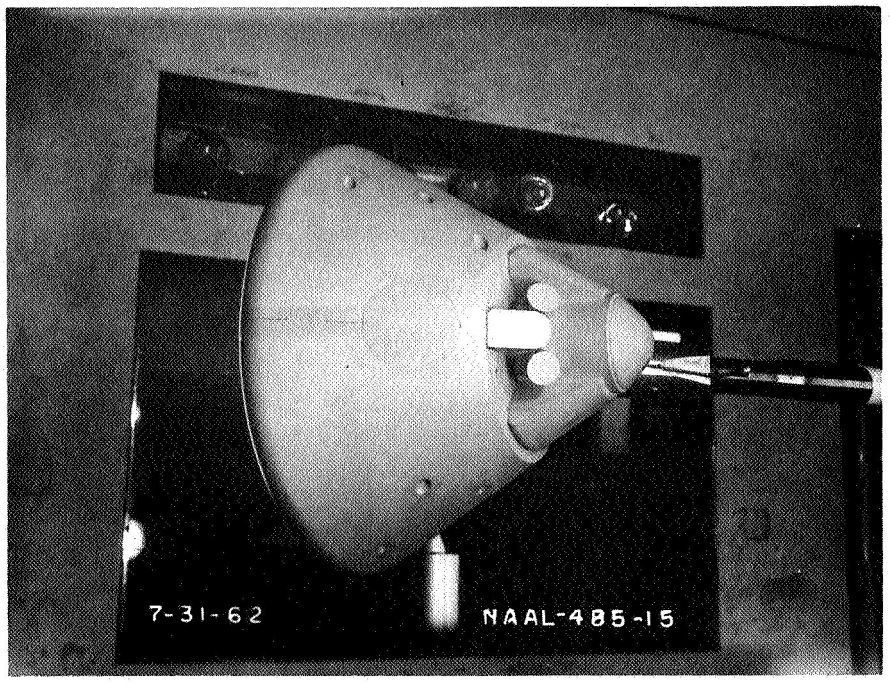

Figure 4. Command Module - θ = 135 Degrees

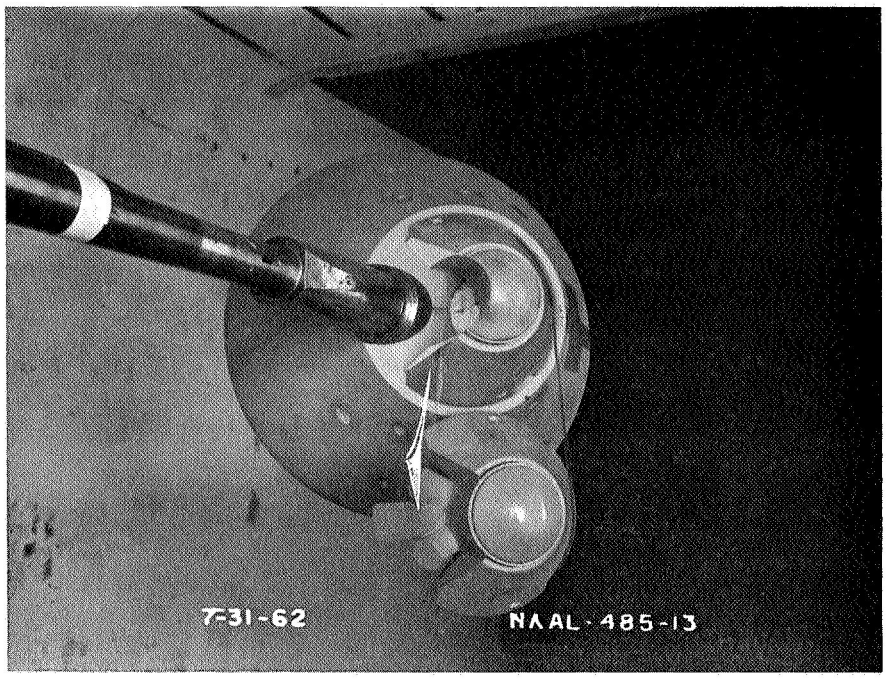

Figure 5. Interchangeable Nose Sections - θ = 135 Degrees

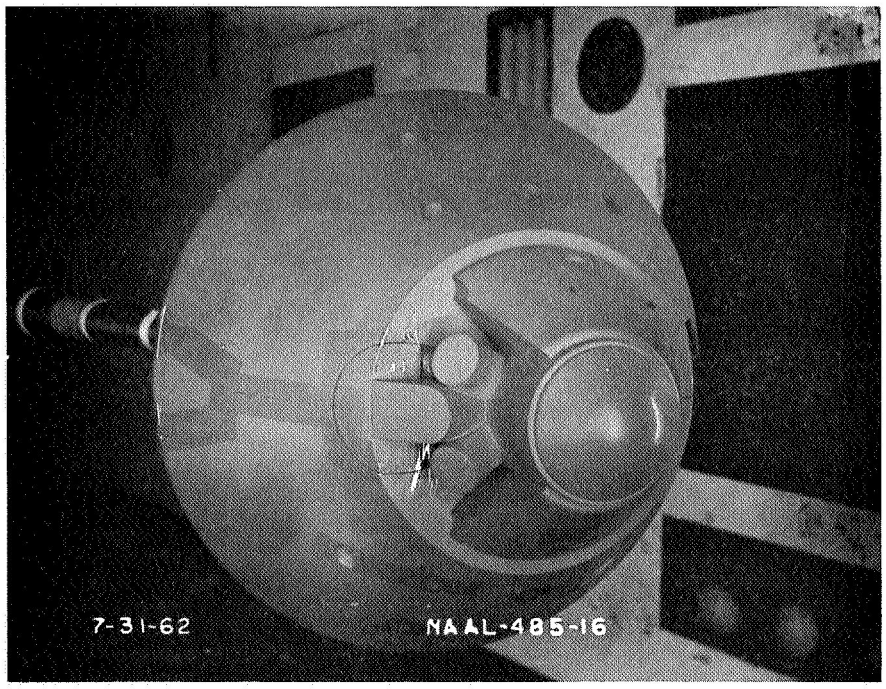

Figure 6. Command Module - θ = 15 Degrees

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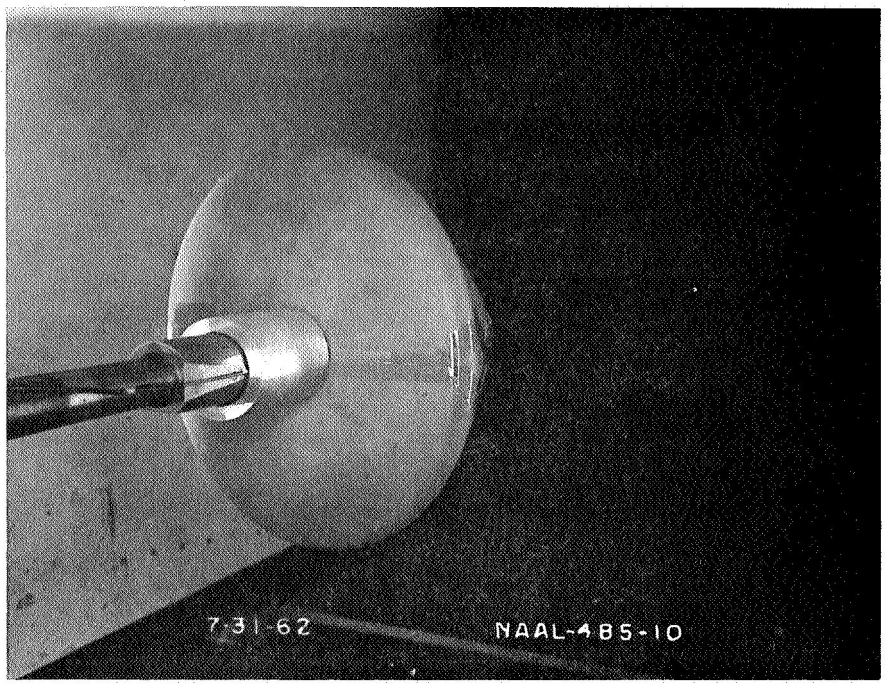

Figure 7. Command Module and Balance Shield - θ = 15 Degrees

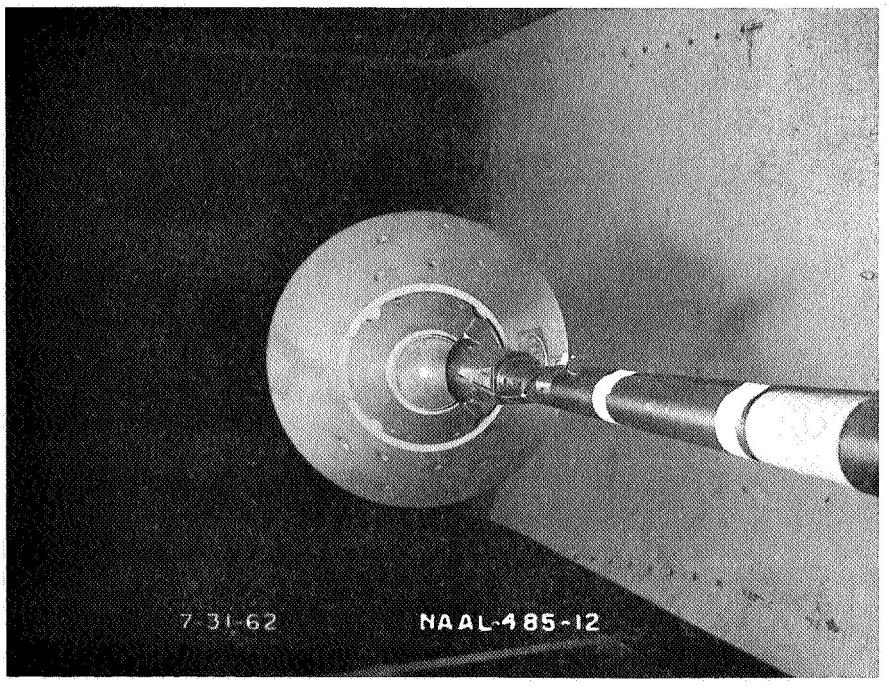

Figure 8. Command Module - θ = 165 Degrees

[redacted]

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IV. NOMENCLATURE

Mach	Test section free-stream Mach number
RN	Reynolds number x 10^{-6} (based on reference diameter)
q = Q	Test section free-stream dynamic pressure, lb/ft^2
Po	Test section free-stream static pressure, lb/ft^2
PBC	Balance chamber pressure, lb/ft^2
DP/q	Balance chamber pressure coefficient, PBC-Po/q
α	Angle of attack of model, degrees
ψ	Angle of yaw of model, degrees
ϕB	Model roll angle relative to the tunnel center line (ϕB = 90 degrees for these tests), degrees
θ	Angle between balance axis and model axis of symmetry, degrees
A	Model reference area, 1.4261 ft^2 (maximum cross-sectional area of command module)
d = D	Model reference diameter, 1.3475 ft (maximum diameter of command module)
$\bar{x}$	Distance along model ℄ from command module apex to center of gravity, inches (negative when aft of apex)
$\bar{z}$	Perpendicular distance from model ℄ to center of gravity, inches (positive when below model ℄)

<u>Stability system of axes with origin at center of gravity</u>

C_D	Drag coefficient, drag/qA
C_L	Lift coefficient, lift/qA

$C_{m_{cg}}$ Pitching moment coefficient, pitching moment/qAd

C_Y Side force coefficient, side force/qA

C_{NS} Yawing moment coefficient, yawing moment/qAd

C_{LS} Rolling moment coefficient, rolling moment/qAd

L/D Lift-to-drag ratio, CL/CD

Body system of axes with origin at center of gravity

C_A Axial force coefficient, axial force/qA

C_N Normal force coefficient, normal force/qA

C_{NB} Yawing moment coefficient, yawing moment/qAd

C_{LB} Rolling moment coefficient, rolling moment/qAd

Body system of axes with origin at command module projected cone apex

C_{MA} Pitching moment coefficient, pitching moment/qAd

XCPN/D Location of normal force center of pressure divided by the command module diameter, measured from the command module apex, C_{MA}/C_N

Subscripts

S Referenced to the stability axes system

B Referenced to the body axes system

[redacted]

APPENDIX A

TABULATED DATA

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CO[redacted]

TABULATED DATA KEY

The caption at the top of each listing identifies the type of data. The horizonal line across each listing contains the following identification:

1. Run number
2. Configuration tested
3. Theta = model offset angle (θ)
4. Phi = model roll angle (ϕ)
5. Type P6 = Pitch configuration using six force components
6. Mach number
7. RN = Reynolds number x 10^{-6} (based on command module diameter, 16.17 inches)
8. Q = Test section free-stream dynamic pressure, lb/ft^2
9. NAAL 487 = Test number

Under the first listing, Body-Axis Coefficients

Alpha = Model angle of attack, deg
Yaw = Model angle of yaw, deg
CA = Axial force coefficient
CN = Normal force coefficient
CMA = Pitching moment coefficient about the command module apex
CNB = Yawing moment coefficient
CLB = Rolling moment coefficient
XCPN/D = Location of normal force center of pressure divided by the command module diameter, measured from the command module apex, positive forward
DP/Q = Balance chamber pressure coefficient

C[redacted]

Under the second listing, Stability Axis Coefficient,

Alpha = Model angle of attack, deg
Yaw = Model angle of yaw, deg
CD = Drag coefficient
CL = Lift coefficient
Cmcg = Pitching moment coefficient about center of gravity
CY = Side force coefficient
CNS = Yawing moment coefficient
CLS = Rolling moment coefficient
L/D = Lift-to-drag ratio

[redacted]

BODY-AXIS COEFFICIENTS

RUN 1 CONF. C 18 THETA = 15 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-10.15	-0.	0.49210	-0.1438	0.1015	-0.0002	-0.0008	-0.7058	-0.3831
2	-5.11	-0.	0.50322	-0.0683	0.0521	-0.0007	-0.0008	-0.7627	-0.3823
3	-3.09	-0.	0.50460	-0.0423	0.0343	-0.0007	-0.0008	-0.8102	-0.3766
4	-2.09	-0.	0.50390	-0.0266	0.0239	-0.0007	-0.0009	-0.9004	-0.3747
5	-1.08	-0.	0.50324	-0.0114	0.0141	-0.0008	-0.0010	-1.2376	-0.3752
6	-0.07	-0.	0.50193	0.0001	0.0058	-0.0008	-0.0011	76.1896	-0.3710
7	0.94	-0.	0.50418	0.0149	-0.0040	-0.0007	-0.0010	-0.2715	-0.3710
8	1.94	-0.	0.50131	0.0265	-0.0120	-0.0007	-0.0010	-0.4518	-0.3697
9	2.95	-0.	0.49559	0.0452	-0.0237	-0.0006	-0.0011	-0.5239	-0.3678
10	3.96	-0.	0.49395	0.0544	-0.0305	-0.0006	-0.0013	-0.5606	-0.3637
11	4.97	-0.	0.49003	0.0690	-0.0401	-0.0006	-0.0012	-0.5809	-0.3639
12	6.98	-0.	0.48128	0.0894	-0.0548	-0.0004	-0.0014	-0.6131	-0.3564
13	10.00	-0.	0.46522	0.1317	-0.0826	-0.0005	-0.0015	-0.6269	-0.3504
14	12.02	-0.	0.45189	0.1551	-0.0987	-0.0006	-0.0015	-0.6361	-0.3483
15	15.04	-0.	0.42836	0.1903	-0.1223	-0.0002	-0.0015	-0.6427	-0.3386
16	17.05	-0.	0.41212	0.2158	-0.1394	-0.0004	-0.0015	-0.6459	-0.3390
17	20.07	-0.	0.38582	0.2407	-0.1573	-0.0005	-0.0015	-0.6538	-0.3318
18	25.10	-0.	0.34212	0.2840	-0.1890	-0.0001	-0.0012	-0.6655	-0.3270
19	30.11	-0.	0.35509	0.3128	-0.2180	-0.0004	-0.0010	-0.6969	-0.3632

STABILITY AXIS COEFFICIENTS

RUN 1 CONF C 18 THETA = 15 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-10.15	-0.	0.50974	-0.0549	0.0319	-0.0089	-0.0003	-0.0007	-0.108
2	-5.11	-0.	0.50730	-0.0232	0.0350	-0.0122	-0.0007	-0.0008	-0.046
3	-3.09	-0.	0.50615	-0.0150	0.0350	-0.0130	-0.0008	-0.0008	-0.030
4	-2.09	-0.	0.50453	-0.0082	0.0354	-0.0145	-0.0007	-0.0008	-0.016
5	-1.08	-0.	0.50336	-0.0019	0.0360	-0.0158	-0.0008	-0.0010	-0.004
6	-0.07	-0.	0.50193	0.0007	0.0355	-0.0164	-0.0008	-0.0011	0.001
7	0.94	-0.	0.50436	0.0067	0.0359	-0.0156	-0.0007	-0.0011	0.013
8	1.94	-0.	0.50192	0.0095	0.0358	-0.0158	-0.0006	-0.0011	0.019
9	2.95	-0.	0.49726	0.0196	0.0365	-0.0162	-0.0005	-0.0011	0.039
10	3.96	-0.	0.49652	0.0202	0.0359	-0.0186	-0.0005	-0.0013	0.041
11	4.97	-0.	0.49416	0.0263	0.0361	-0.0181	-0.0005	-0.0013	0.053
12	6.98	-0.	0.48857	0.0302	0.0349	-0.0190	-0.0002	-0.0014	0.062
13	10.00	-0.	0.48103	0.0489	0.0352	-0.0212	-0.0002	-0.0016	0.102
14	12.02	-0.	0.47428	0.0576	0.0343	-0.0219	-0.0003	-0.0016	0.122
15	15.04	-0.	0.46306	0.0726	0.0334	-0.0209	0.0002	-0.0015	0.157
16	17.05	-0.	0.45728	0.0854	0.0329	-0.0219	0.0000	-0.0016	0.187
17	20.07	-0.	0.44499	0.0937	0.0304	-0.0228	0.0001	-0.0016	0.210
18	25.10	-0.	0.43028	0.1121	0.0259	-0.0180	0.0005	-0.0011	0.260
19	30.11	-0.	0.46408	0.0925	0.0174	-0.0176	0.0002	-0.0011	0.199

[redacted]

[redacted]

BODY-AXIS COEFFICIENTS

RUN 2 CONF. C 18 THETA = 75 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	49.87	0.	0.29102	0.3544	-0.2623	-0.0085	-0.0045	-0.7402	-0.1570
2	51.88	0.	0.27135	0.3487	-0.2588	-0.0095	-0.0050	-0.7420	-0.1477
3	53.89	0.	0.25175	0.3426	-0.2555	-0.0096	-0.0052	-0.7458	-0.1295
4	55.90	0.	0.22666	0.3387	-0.2534	-0.0087	-0.0048	-0.7480	-0.1203
5	57.92	0.	0.20177	0.3329	-0.2499	-0.0076	-0.0040	-0.7506	-0.0928
6	59.82	-0.	0.24739	-0.0075	-0.0905	-0.0034	-0.0020	12.1152	0.1540
7	61.86	-0.	0.18751	0.0162	-0.1086	-0.0036	-0.0020	-6.7026	0.1329
8	63.89	-0.	0.13409	0.0381	-0.1239	-0.0031	-0.0016	-3.2487	0.1255
9	65.91	-0.	0.09931	0.0533	-0.1347	-0.0029	-0.0018	-2.5255	0.1265
10	67.92	-0.	0.07426	0.0645	-0.1426	-0.0025	-0.0015	-2.2116	0.1235
11	69.92	-0.	0.06992	0.0718	-0.1475	-0.0010	-0.0007	-2.0546	0.1079
12	71.91	-0.	0.09717	0.0805	-0.1523	-0.0006	-0.0003	-1.8926	0.0815
13	73.88	-0.	0.15600	0.0934	-0.1578	-0.0017	-0.0005	-1.6899	0.0613
14	74.87	-0.	0.18299	0.1044	-0.1594	-0.0015	-0.0004	-1.5276	0.0650
15	75.87	-0.	0.18961	0.1133	-0.1625	-0.0020	-0.0007	-1.4346	0.0512
16	77.86	-0.	0.21077	0.1316	-0.1706	-0.0029	-0.0013	-1.2962	0.0129
17	79.88	-0.	0.18935	0.1449	-0.1737	-0.0036	-0.0016	-1.1981	0.0017
18	81.87	-0.	0.21428	0.1585	-0.1805	-0.0040	-0.0014	-1.1391	-0.0625
19	83.88	-0.	0.20950	0.1883	-0.1982	-0.0035	-0.0014	-1.0526	-0.1414
20	85.89	-0.	0.18205	0.1978	-0.1984	-0.0041	-0.0016	-1.0034	-0.1066
21	87.91	-0.	0.15512	0.2038	-0.1956	-0.0033	-0.0011	-0.9600	-0.0717
22	89.93	-0.	0.12995	0.2084	-0.1914	-0.0017	0.0001	-0.9185	-0.0524
23	91.95	0.	0.10406	0.2133	-0.1858	-0.0012	-0.0001	-0.8710	-0.0598
24	93.96	0.	0.09035	0.2190	-0.1782	-0.0014	-0.0003	-0.8136	-0.0625
25	95.98	-0.	0.06397	0.2249	-0.1727	-0.0020	-0.0009	-0.7681	-0.0685
26	98.00	-0.	0.03348	0.2340	-0.1687	-0.0017	-0.0010	-0.7211	-0.0543
27	100.02	-0.	0.00502	0.2428	-0.1640	-0.0013	-0.0009	-0.6754	-0.0331

[redacted]

[redacted]

STABILITY AXIS COEFFICIENTS

RUN 2 CONF. C 18 THETA = 75 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	49.87	0.	0.45854	0.0059	-0.0022	0.0581	-0.0020	-0.0094	0.013
2	51.88	0.	0.44186	0.0018	-0.0037	0.0595	-0.0019	-0.0106	0.004
3	53.89	0.	0.42513	-0.0015	-0.0058	0.0589	-0.0014	-0.0108	-0.004
4	55.90	0.	0.40756	0.0022	-0.0078	0.0591	-0.0010	-0.0099	0.005
5	57.92	0.	0.38927	0.0059	-0.0098	0.0539	-0.0006	-0.0086	0.015
6	59.82	-0.	0.11790	-0.2176	-0.0810	-0.0301	0.0001	-0.0039	-1.846
7	61.86	-0.	0.10273	-0.1577	-0.0864	-0.0229	0.0001	-0.0041	-1.535
8	63.89	-0.	0.09327	-0.1036	-0.0898	-0.0186	0.0001	-0.0035	-1.111
9	65.91	-0.	0.08922	-0.0689	-0.0923	-0.0178	0.0004	-0.0034	-0.772
10	67.92	-0.	0.08768	-0.0446	-0.0940	-0.0159	0.0005	-0.0029	-0.508
11	69.92	-0.	0.09141	-0.0410	-0.0941	-0.0087	0.0003	-0.0012	-0.449
12	71.91	-0.	0.10665	-0.0674	-0.0914	-0.0024	0.0001	-0.0007	-0.632
13	73.88	-0.	0.13301	-0.1239	-0.0846	-0.0106	0.0000	-0.0017	-0.932
14	74.87	-0.	0.14850	-0.1494	-0.0771	-0.0157	-0.0000	-0.0016	-1.006
15	75.87	-0.	0.15614	-0.1562	-0.0737	-0.0195	0.0002	-0.0021	-1.001
16	77.86	-0.	0.17295	-0.1784	-0.0679	-0.0210	0.0006	-0.0031	-1.031
17	79.88	-0.	0.17596	-0.1609	-0.0631	-0.0213	0.0010	-0.0038	-0.915
18	81.87	-0.	0.18719	-0.1897	-0.0592	-0.0196	0.0008	-0.0041	-1.013
19	83.88	-0.	0.20959	-0.1882	-0.0568	-0.0203	0.0011	-0.0036	-0.898
20	85.89	-0.	0.21030	-0.1674	-0.0521	-0.0246	0.0013	-0.0042	-0.796
21	87.91	-0.	0.20931	-0.1476	-0.0468	-0.0165	0.0010	-0.0033	-0.705
22	89.93	-0.	0.20858	-0.1297	-0.0409	-0.0032	-0.0001	-0.0017	-0.622
23	91.95	0.	0.20968	-0.1113	-0.0334	-0.0001	0.0002	-0.0012	-0.531
24	93.96	0.	0.21224	-0.1053	-0.0227	0.0007	0.0004	-0.0014	-0.496
25	95.98	-0.	0.21700	-0.0871	-0.0148	-0.0081	0.0011	-0.0019	-0.401
26	98.00	-0.	0.22704	-0.0657	-0.0063	-0.0150	0.0012	-0.0016	-0.289
27	100.02	-0.	0.23819	-0.0472	0.0028	-0.0149	0.0011	-0.0011	-0.198

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BODY-AXIS COEFFICIENTS

RUN 3 CONF. C 18 THETA = 45 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	19.92	-0.	0.42418	0.2354	-0.1568	0.0000	-0.0036	-0.6664	-0.3743
2	24.96	-0.	0.37118	0.2909	-0.1952	0.0002	-0.0034	-0.6712	-0.3679
3	29.99	-0.	0.32569	0.3354	-0.2289	0.0002	-0.0031	-0.6824	-0.3725
4	35.03	0.	0.29845	0.4317	-0.3049	0.0016	0.0014	-0.7063	-0.3945
5	40.06	-0.	0.23908	0.4589	-0.3251	0.0008	0.0018	-0.7084	-0.3972
6	45.09	-0.	0.18037	0.4736	-0.3364	0.0003	0.0019	-0.7103	-0.3977
7	47.10	-0.	0.14766	0.4717	-0.3357	-0.0010	-0.0022	-0.7116	-0.3972
8	49.08	0.	0.16413	0.4279	-0.3117	0.0037	-0.0029	-0.7283	-0.3711
9	51.06	0.	0.17821	0.4010	-0.2997	0.0038	-0.0030	-0.7473	-0.3463
10	53.04	0.	0.17653	0.3545	-0.2674	0.0073	0.0029	-0.7543	-0.3037
11	55.04	0.	0.16255	0.3277	-0.2507	0.0092	0.0076	-0.7648	-0.2734
12	57.03	0.	0.15101	0.3094	-0.2414	0.0095	0.0084	-0.7800	-0.2532
13	58.85	-0.	0.25245	-0.0238	-0.0842	-0.0017	-0.0036	3.5399	0.1578
14	60.87	-0.	0.22196	-0.0021	-0.0994	-0.0016	-0.0036	46.2819	0.1633
15	62.88	-0.	0.20107	0.0102	-0.1095	-0.0001	-0.0043	-10.7069	0.2046
16	64.89	-0.	0.18441	0.0282	-0.1197	-0.0006	-0.0037	-4.2487	0.1670
17	66.90	-0.	0.17033	0.0479	-0.1313	-0.0008	-0.0024	-2.7439	0.1541
18	68.92	-0.	0.14209	0.0681	-0.1449	-0.0002	-0.0013	-2.1285	0.1844
19	69.93	-0.	0.13020	0.0775	-0.1504	-0.0000	-0.0017	-1.9399	0.1715

STABILITY AXIS COEFFICIENTS

RUN 3 CONF. C 18 THETA = 45 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	19.92	-0.	0.47899	0.0768	0.0295	-0.0216	0.0013	-0.0034	0.160
2	24.96	-0.	0.45927	0.1071	0.0261	-0.0206	0.0016	-0.0030	0.233
3	29.99	-0.	0.44974	0.1277	0.0203	-0.0217	0.0017	-0.0026	0.284
4	35.03	0.	0.49216	0.1822	0.0087	-0.0030	0.0005	0.0021	0.370
5	40.06	-0.	0.47835	0.1974	0.0036	-0.0059	-0.0006	0.0019	0.413
6	45.09	-0.	0.46277	0.2067	-0.0011	-0.0096	-0.0011	0.0016	0.447
7	47.10	-0.	0.44603	0.2129	-0.0036	-0.0261	0.0009	-0.0022	0.477
8	49.08	0.	0.43083	0.1563	-0.0086	0.0310	0.0046	0.0009	0.363
9	51.06	0.	0.42389	0.1134	-0.0143	0.0366	0.0048	0.0011	0.268
10	53.04	0.	0.38942	0.0721	-0.0140	0.0711	0.0020	0.0076	0.185
11	55.04	0.	0.36173	0.0546	-0.0164	0.0936	-0.0010	0.0119	0.151
12	57.03	0.	0.34177	0.0417	-0.0203	0.0971	-0.0018	0.0125	0.122
13	58.85	-0.	0.11023	-0.2284	-0.0857	-0.0182	0.0022	-0.0033	-2.072
14	60.87	-0.	0.10619	-0.1949	-0.0877	-0.0186	0.0024	-0.0032	-1.836
15	62.88	-0.	0.10077	-0.1743	-0.0906	-0.0138	0.0038	-0.0021	-1.730
16	64.89	-0.	0.10376	-0.1550	-0.0895	-0.0184	0.0031	-0.0022	-1.494
17	66.90	-0.	0.11084	-0.1379	-0.0885	-0.0212	0.0019	-0.0017	-1.244
18	68.92	-0.	0.11461	-0.1081	-0.0898	-0.0153	0.0011	-0.0007	-0.943
19	69.93	-0.	0.11752	-0.0957	-0.0896	-0.0150	0.0016	-0.0006	-0.814

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BODY-AXIS COEFFICIENTS

RUN 4 CONF. C 18 THETA = 105 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	80.83	-0.	0.21231	0.1334	-0.1686	-0.0042	-0.0006	-1.2642	-0.0899
2	82.83	0.	0.22371	0.1640	-0.1850	-0.0032	-0.0007	-1.1281	-0.0734
3	84.83	0.	0.21872	0.1772	-0.1873	-0.0014	-0.0009	-1.0568	-0.0862
4	86.82	0.	0.22369	0.2084	-0.2035	-0.0015	-0.0014	-0.9763	-0.2339
5	88.83	0.	0.21562	0.2165	-0.2017	-0.0014	-0.0012	-0.9318	-0.2348
6	90.84	0.	0.20147	0.2175	-0.1949	-0.0011	-0.0008	-0.8960	-0.2330
7	92.86	0.	0.18001	0.2175	-0.1853	-0.0006	-0.0009	-0.8520	-0.2275
8	94.87	0.	0.15766	0.2201	-0.1768	-0.0003	-0.0008	-0.8030	-0.2192
9	96.89	-0.	0.12002	0.2217	-0.1682	-0.0003	-0.0008	-0.7589	-0.2174
10	98.92	-0.	0.08350	0.2253	-0.1606	-0.0006	-0.0003	-0.7130	-0.2174
11	100.94	-0.	0.04206	0.2281	-0.1517	-0.0005	-0.0005	-0.6652	-0.2119
12	102.98	-0.	-0.02104	0.2299	-0.1435	-0.0003	-0.0008	-0.6244	-0.2036
13	105.00	-0.	-0.04842	0.2279	-0.1316	-0.0005	-0.0003	-0.5777	-0.1578
14	107.02	-0.	-0.08135	0.2175	-0.1144	-0.0010	-0.0004	-0.5261	-0.0834
15	109.05	-0.	-0.13647	0.2133	-0.1026	-0.0016	-0.0006	-0.4808	-0.0339
16	111.08	-0.	-0.19249	0.2122	-0.0956	-0.0019	-0.0012	-0.4505	-0.0706
17	113.11	-0.	-0.23790	0.2098	-0.0882	-0.0021	-0.0007	-0.4205	-0.0706
18	115.15	-0.	-0.30399	0.1813	-0.0669	-0.0007	-0.0004	-0.3693	-0.1789
19	117.17	-0.	-0.33713	0.1616	-0.0482	-0.0016	-0.0004	-0.2985	-0.2541
20	119.19	-0.	-0.37240	0.1393	-0.0267	-0.0009	0.0001	-0.1918	-0.2999
21	121.22	0.	-0.40465	0.1006	0.0050	0.0015	0.0008	0.0495	-0.2770
22	123.28	-0.	-0.50571	0.0698	0.0297	0.0012	0.0006	0.4251	-0.3321
23	125.32	-0.	-0.57632	0.0495	0.0473	-0.0010	0.0006	0.9549	-0.3513

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STABILITY AXIS COEFFICIENTS

RUN 4 CONF. C 18 THETA = 105 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	80.83	-0.	0.16548	-0.1884	-0.0647	-0.0097	-0.0001	-0.0043	-1.138
2	82.83	0.	0.19068	-0.2015	-0.0594	-0.0048	0.0003	-0.0033	-1.057
3	84.83	0.	0.19624	-0.2019	-0.0529	0.0012	0.0008	-0.0015	-1.029
4	86.82	0.	0.22049	-0.2118	-0.0474	-0.0037	0.0013	-0.0016	-0.961
5	88.83	0.	0.22082	-0.2112	-0.0406	-0.0032	0.0012	-0.0014	-0.956
6	90.84	0.	0.21449	-0.2046	-0.0339	-0.0022	0.0008	-0.0011	-0.954
7	92.86	0.	0.20822	-0.1906	-0.0256	-0.0028	0.0010	-0.0005	-0.915
8	94.87	0.	0.20596	-0.1758	-0.0166	-0.0023	0.0008	-0.0002	-0.853
9	96.89	-0.	0.20566	-0.1458	-0.0092	-0.0048	0.0008	-0.0002	-0.709
10	98.92	-0.	0.20959	-0.1174	-0.0013	-0.0052	0.0004	-0.0005	-0.560
11	100.94	-0.	0.21597	-0.0846	0.0071	-0.0053	0.0006	-0.0004	-0.392
12	102.98	-0.	0.22871	-0.0311	0.0128	-0.0063	0.0008	-0.0001	-0.136
13	105.00	-0.	0.23266	-0.0122	0.0217	-0.0069	0.0004	-0.0004	-0.052
14	107.02	-0.	0.23181	0.0141	0.0299	-0.0091	0.0007	-0.0008	0.061
15	109.05	-0.	0.24616	0.0594	0.0356	-0.0140	0.0011	-0.0013	0.241
16	111.08	-0.	0.26728	0.1033	0.0385	-0.0204	0.0018	-0.0013	0.386
17	113.11	-0.	0.28634	0.1365	0.0416	-0.0159	0.0014	-0.0016	0.477
18	115.15	-0.	0.29326	0.1982	0.0394	-0.0096	0.0006	-0.0005	0.676
19	117.17	-0.	0.29767	0.2262	0.0426	-0.0171	0.0011	-0.0012	0.760
20	119.19	-0.	0.30322	0.2572	0.0468	-0.0127	0.0003	-0.0008	0.848
21	121.22	0.	0.29580	0.2939	0.0501	0.0057	-0.0015	0.0009	0.994
22	123.28	-0.	0.33580	0.3845	0.0477	-0.0031	-0.0012	0.0007	1.145
23	125.32	-0.	0.37358	0.4416	0.0472	-0.0193	0.0001	-0.0012	1.182

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BODY-AXIS COEFFICIENTS

RUN 5 CONF. C 18 THETA = 135 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	115.04	0.	-0.21778	0.1722	-0.0546	0.0002	-0.0012	-0.3169	-0.2403
2	117.06	0.	-0.23289	0.1385	-0.0239	-0.0000	-0.0008	-0.1725	-0.2220
3	119.09	-0.	-0.27354	0.1252	-0.0086	-0.0000	-0.0008	-0.0689	-0.2293
4	121.15	-0.	-0.41963	0.0960	0.0108	-0.0023	-0.0026	0.1123	-0.2036
5	123.17	-0.	-0.45744	0.0821	0.0267	-0.0029	-0.0018	0.3253	-0.3275
6	124.20	-0.	-0.51398	0.0680	0.0347	-0.0016	-0.0001	0.5101	-0.3550
7	126.23	-0.	-0.56289	0.0430	0.0565	-0.0016	-0.0009	1.3133	-0.3944
8	128.25	-0.	-0.61046	0.0226	0.0728	-0.0008	0.0012	3.2215	-0.3991
9	130.28	-0.	-0.64693	-0.0011	0.0917	-0.0008	0.0020	-79.9239	-0.3992
10	132.30	-0.	-0.67945	-0.0282	0.1114	-0.0002	0.0009	-3.9563	-0.3994
11	134.32	-0.	-0.70054	-0.0542	0.1317	0.0010	0.0003	-2.4305	-0.3995
12	135.33	0.	-0.71748	-0.0558	0.1318	0.0024	-0.0002	-2.3609	-0.3997
13	136.34	0.	-0.73231	-0.0629	0.1378	0.0022	-0.0004	-2.1895	-0.3998
14	138.35	-0.	-0.76665	-0.0669	0.1418	0.0008	-0.0004	-2.1209	-0.3997
15	140.37	-0.	-0.79709	-0.0777	0.1490	0.0007	-0.0006	-1.9182	-0.3999
16	142.38	-0.	-0.82417	-0.0893	0.1565	0.0005	-0.0014	-1.7518	-0.3999
17	144.40	-0.	-0.86052	-0.1033	0.1643	0.0002	-0.0015	-1.5901	-0.4002
18	146.42	-0.	-0.90917	-0.1087	0.1634	-0.0000	-0.0017	-1.5024	-0.4003
19	148.43	-0.	-0.95391	-0.1006	0.1532	-0.0004	-0.0013	-1.5227	-0.4002
20	150.39	-0.	-0.94504	-0.0324	0.0914	0.0001	0.0002	-2.8188	-0.3999
21	152.39	-0.	-0.95047	-0.0291	0.0819	-0.0005	0.0007	-2.8113	-0.3999
22	154.38	-0.	-0.95115	-0.0243	0.0736	-0.0006	0.0016	-3.0287	-0.3999
23	156.38	-0.	-0.95023	-0.0171	0.0614	-0.0009	0.0017	-3.5998	-0.3997

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STABILITY AXIS COEFFICIENTS

RUN 5 CONF. C 18 THETA = 135 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	115.04	0.	0.24820	0.1244	0.0506	0.0019	0.0010	0.0007	0.501
2	117.06	0.	0.22930	0.1444	0.0573	-0.0037	0.0007	0.0004	0.630
3	119.09	-0.	0.24238	0.1782	0.0611	-0.0081	0.0007	0.0004	0.735
4	121.15	-0.	0.29921	0.3095	0.0518	-0.0356	0.0034	-0.0006	1.034
5	123.17	-0.	0.31903	0.3380	0.0560	-0.0401	0.0031	-0.0014	1.059
6	124.20	-0.	0.34512	0.3869	0.0510	-0.0228	0.0010	-0.0013	1.121
7	126.23	-0.	0.36738	0.4286	0.0528	-0.0239	0.0017	-0.0008	1.167
8	128.25	-0.	0.39573	0.4654	0.0523	-0.0181	-0.0004	-0.0013	1.176
9	130.28	-0.	0.41737	0.4943	0.0528	-0.0187	-0.0010	-0.0018	1.184
10	132.30	-0.	0.43647	0.5215	0.0520	-0.0188	-0.0005	-0.0007	1.195
11	134.32	-0.	0.45069	0.5391	0.0532	-0.0106	-0.0009	0.0005	1.196
12	135.33	0.	0.47097	0.5441	0.0512	0.0140	-0.0016	0.0018	1.155
13	136.34	0.	0.48632	0.5511	0.0514	0.0110	-0.0013	0.0018	1.133
14	138.35	-0.	0.52843	0.5595	0.0508	-0.0106	-0.0004	0.0008	1.059
15	140.37	-0.	0.56432	0.5683	0.0487	-0.0116	-0.0001	0.0009	1.007
16	142.38	-0.	0.59830	0.5738	0.0466	-0.0143	0.0004	0.0014	0.959
17	144.40	-0.	0.63954	0.5849	0.0427	-0.0189	0.0007	0.0013	0.915
18	146.42	-0.	0.69727	0.5935	0.0352	-0.0263	0.0009	0.0014	0.851
19	148.43	-0.	0.76003	0.5852	0.0280	-0.0288	0.0010	0.0009	0.770
20	150.39	-0.	0.80559	0.4951	0.0134	-0.0229	-0.0002	-0.0001	0.615
21	152.39	-0.	0.82870	0.4664	0.0059	-0.0272	0.0001	-0.0009	0.563
22	154.38	-0.	0.84714	0.4332	0.0008	-0.0341	-0.0001	-0.0017	0.511
23	156.38	-0.	0.86376	0.3964	-0.0063	-0.0365	0.0001	-0.0020	0.459

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BODY-AXIS COEFFICIENTS

RUN 6 CONF. C 18 THETA = 165 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	143.21	0.	-0.81594	-0.0959	0.1590	0.0006	-0.0000	-1.6580	0.0027
2	145.22	0.	-0.84734	-0.0991	0.1610	0.0025	0.0011	-1.6246	-0.1578
3	147.23	0.	-0.87637	-0.1110	0.1673	0.0030	0.0016	-1.5075	-0.2294
4	149.24	-0.	-0.90782	-0.1187	0.1678	0.0023	0.0005	-1.4142	-0.3092
5	151.21	0.	-0.95405	-0.0675	0.1248	-0.0004	-0.0013	-1.8485	-0.4000
6	153.21	0.	-0.96184	-0.0659	0.1177	-0.0011	-0.0016	-1.7868	-0.4001
7	155.20	0.	-0.97309	-0.0640	0.1103	-0.0007	-0.0016	-1.7230	-0.4002
8	157.21	0.	-0.97464	-0.0697	0.1091	-0.0007	-0.0016	-1.5650	-0.4002
9	159.19	0.	-0.96773	-0.0571	0.0962	-0.0001	-0.0012	-1.6854	-0.4003
10	161.19	0.	-0.97386	-0.0580	0.0901	-0.0002	-0.0012	-1.5537	-0.4003
11	163.19	0.	-0.98397	-0.0607	0.0844	-0.0001	-0.0010	-1.3906	-0.4002
12	165.19	0.	-0.97733	-0.0622	0.0794	0.0001	-0.0010	-1.2764	-0.4000
13	167.19	0.	-0.97327	-0.0602	0.0729	-0.0001	-0.0010	-1.2124	-0.4000
14	169.17	0.	-0.96207	-0.0447	0.0563	0.0003	-0.0007	-1.2618	-0.3997
15	171.16	0.	-0.94854	-0.0292	0.0399	0.0000	-0.0007	-1.3676	-0.3995
16	173.15	-0.	-0.94546	-0.0177	0.0271	0.0004	-0.0008	-1.5368	-0.3993
17	175.15	-0.	-0.95071	-0.0153	0.0212	-0.0002	-0.0008	-1.3819	-0.3993
18	177.14	-0.	-0.95877	-0.0015	0.0075	-0.0002	-0.0008	-4.8251	-0.3993
19	179.13	-0.	-0.95403	0.0074	-0.0031	-0.0002	-0.0008	-0.4209	-0.3993
20	181.13	-0.	-0.96059	0.0136	-0.0117	0.0001	-0.0007	-0.8589	-0.3996
21	183.13	-0.	-0.97257	0.0128	-0.0152	0.0004	-0.0007	-1.1912	-0.3996
22	185.12	0.	-0.97211	0.0101	-0.0197	0.0000	-0.0007	-1.9450	-0.4000
23	187.12	0.	-0.98234	0.0202	-0.0317	0.0002	-0.0004	-1.5658	-0.4003

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STABILITY AXIS COEFFICIENTS

RUN 6 CONF. C 18 THETA = 165 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	143.21	0.	0.59603	0.5654	0.0451	0.0130	-0.0005	0.0004	0.949
2	145.22	0.	0.63943	0.5647	0.0431	0.0251	-0.0027	0.0005	0.883
3	147.23	0.	0.67681	0.5677	0.0395	0.0298	-0.0033	0.0003	0.839
4	149.24	-0.	0.71936	0.5663	0.0329	-0.0030	-0.0022	0.0007	0.787
5	151.21	0.	0.80361	0.5186	0.0222	-0.0003	0.0010	0.0010	0.645
6	153.21	0.	0.82889	0.4924	0.0158	-0.0022	0.0017	0.0010	0.594
7	155.20	0.	0.85655	0.4662	0.0090	-0.0031	0.0013	0.0011	0.544
8	157.21	0.	0.87150	0.4419	0.0038	-0.0032	0.0013	0.0012	0.507
9	159.19	0.	0.88435	0.3971	0.0000	-0.0016	0.0006	0.0011	0.449
10	161.19	0.	0.90316	0.3689	-0.0071	-0.0019	0.0006	0.0011	0.408
11	163.19	0.	0.92439	0.3426	-0.0153	0.0021	0.0003	0.0009	0.371
12	165.19	0.	0.92896	0.3099	-0.0209	0.0007	0.0002	0.0010	0.334
13	167.19	0.	0.93568	0.2745	-0.0257	-0.0014	0.0003	0.0009	0.293
14	169.17	0.	0.93655	0.2246	-0.0310	-0.0056	-0.0002	0.0008	0.240
15	171.16	0.	0.93278	0.1746	-0.0361	-0.0062	0.0001	0.0007	0.187
16	173.15	-0.	0.93660	0.1303	-0.0407	-0.0090	-0.0003	0.0008	0.139
17	175.15	-0.	0.94600	0.0957	-0.0454	-0.0104	0.0003	0.0008	0.101
18	177.14	-0.	0.95750	0.0494	-0.0502	-0.0105	0.0002	0.0008	0.052
19	179.13	-0.	0.95404	0.0071	-0.0543	-0.0104	0.0002	0.0007	0.007
20	181.13	-0.	0.96013	-0.0325	-0.0590	-0.0098	-0.0001	0.0007	-0.034
21	183.13	-0.	0.97042	-0.0658	-0.0639	-0.0093	-0.0004	0.0007	-0.068
22	185.12	0.	0.96733	-0.0969	-0.0701	-0.0065	-0.0001	0.0007	-0.100
23	187.12	0.	0.97226	-0.1418	-0.0758	-0.0025	-0.0003	0.0004	-0.146

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BODY-AXIS COEFFICIENTS

RUN 7 CONF. C 18 THETA = -15 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-35.18	0.	0.27175	-0.4369	0.3121	0.0005	-0.0013	-0.7145	-0.3779
2	-30.15	0.	0.33189	-0.4053	0.2900	0.0012	-0.0005	-0.7154	-0.3751
3	-25.11	0.	0.37533	-0.3178	0.2237	0.0023	-0.0002	-0.7041	-0.3660
4	-20.07	-0.	0.38248	-0.2472	0.1648	0.0010	-0.0008	-0.6667	-0.3325
5	-15.04	-0.	0.42382	-0.1937	0.1284	0.0015	-0.0004	-0.6626	-0.3394
6	-10.01	-0.	0.45656	-0.1417	0.0931	0.0014	-0.0002	-0.6572	-0.3430
7	-6.99	-0.	0.47215	-0.1054	0.0686	0.0015	-0.0000	-0.6514	-0.3504
8	-4.97	-0.	0.48110	-0.0785	0.0506	0.0017	0.0002	-0.6440	-0.3531
9	-2.96	-0.	0.48722	-0.0535	0.0334	0.0019	0.0003	-0.6254	-0.3540
10	-1.95	-0.	0.49031	-0.0376	0.0232	0.0017	0.0003	-0.6171	-0.3531
11	-0.94	-0.	0.49082	-0.0247	0.0144	0.0020	0.0005	-0.5821	-0.3549
12	0.07	0.	0.49155	-0.0110	0.0054	0.0023	0.0006	-0.4905	-0.3531
13	1.07	-0.	0.49378	0.0018	-0.0030	0.0020	0.0007	-1.6776	-0.3513
14	2.08	0.	0.49134	0.0146	-0.0118	0.0024	0.0008	-0.8104	-0.3540
15	3.09	0.	0.49386	0.0284	-0.0210	0.0026	0.0009	-0.7413	-0.3641
16	5.10	0.	0.49101	0.0572	-0.0402	0.0024	0.0010	-0.7024	-0.3595

STABILITY AXIS COEFFICIENTS

RUN 7 CONF. C 18 THETA = -15 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-35.18	0.	0.47381	-0.2005	0.0287	0.0293	-0.0004	-0.0013	-0.423
2	-30.15	0.	0.49059	-0.1838	0.0317	0.0311	0.0007	-0.0010	-0.375
3	-25.11	0.	0.47470	-0.1285	0.0280	-0.0098	0.0020	-0.0012	-0.271
4	-20.07	-0.	0.44409	-0.1009	0.0179	-0.0144	0.0007	-0.0011	-0.227
5	-15.04	-0.	0.45957	-0.0771	0.0206	-0.0136	0.0014	-0.0008	-0.168
6	-10.01	-0.	0.47423	-0.0602	0.0229	-0.0142	0.0013	-0.0005	-0.127
7	-6.99	-0.	0.48146	-0.0471	0.0243	-0.0151	0.0015	-0.0002	-0.098
8	-4.97	-0.	0.48610	-0.0365	0.0251	-0.0147	0.0017	0.0000	-0.075
9	-2.96	-0.	0.48933	-0.0283	0.0255	-0.0142	0.0019	0.0003	-0.058
10	-1.95	-0.	0.49130	-0.0209	0.0264	-0.0161	0.0017	0.0002	-0.042
11	-0.94	-0.	0.49116	-0.0166	0.0264	-0.0149	0.0020	0.0004	-0.034
12	0.07	0.	0.49154	-0.0115	0.0269	-0.0134	0.0023	0.0006	-0.023
13	1.07	-0.	0.49373	-0.0075	0.0274	-0.0139	0.0020	0.0007	-0.015
14	2.08	0.	0.49155	-0.0033	0.0272	-0.0126	0.0023	0.0009	-0.007
15	3.09	0.	0.49467	0.0017	0.0276	-0.0123	0.0025	0.0011	0.004
16	5.10	0.	0.49415	0.0133	0.0280	-0.0129	0.0023	0.0012	0.027

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BODY-AXIS COEFFICIENTS

RUN 8 CONF. C 18 THETA = -75 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-100.03	0.	0.00180	-0.2923	0.1896	-0.0005	0.0008	-0.6486	-0.0390
2	-98.01	0.	0.03143	-0.2870	0.1964	0.0002	0.0007	-0.6842	-0.0362
3	-96.00	0.	0.05601	-0.2853	0.2051	0.0005	0.0009	-0.7189	-0.0317
4	-93.97	0.	0.08824	-0.2824	0.2128	0.0000	0.0011	-0.7537	-0.0449
5	-91.96	0.	0.10705	-0.2744	0.2194	-0.0004	0.0014	-0.7996	-0.0528
6	-89.94	0.	0.13162	-0.2695	0.2248	-0.0001	0.0012	-0.8340	-0.0555
7	-87.92	0.	0.16230	-0.2637	0.2291	0.0000	0.0010	-0.8691	-0.0940
8	-85.90	0.	0.19305	-0.2554	0.2319	0.0005	0.0013	-0.9079	-0.1399
9	-83.88	0.	0.21502	-0.2443	0.2320	0.0005	0.0014	-0.9493	-0.1601
10	-81.86	0.	0.24107	-0.2284	0.2283	0.0005	0.0016	-0.9996	-0.1638
11	-79.85	0.	0.25821	-0.2128	0.2248	0.0003	0.0021	-1.0564	-0.1518
12	-77.83	0.	0.27559	-0.1898	0.2150	-0.0010	0.0026	-1.1329	-0.1307
13	-75.83	-0.	0.27605	-0.1521	0.1912	-0.0039	0.0021	-1.2577	-0.0436
14	-74.85	0.	0.23216	-0.1227	0.1696	-0.0024	0.0033	-1.3819	0.0527
15	-73.85	0.	0.22840	-0.1049	0.1603	-0.0017	0.0033	-1.5285	0.0680
16	-71.87	0.	0.18204	-0.0880	0.1554	-0.0013	0.0033	-1.7674	0.0748
17	-69.88	0.	0.15598	-0.0731	0.1467	-0.0004	0.0038	-2.0078	0.0940
18	-67.89	0.	0.12885	-0.0643	0.1412	-0.0002	0.0037	-2.1970	0.1041
19	-65.89	0.	0.12361	-0.0585	0.1369	-0.0000	0.0027	-2.3394	0.1087
20	-63.87	-0.	0.15989	-0.0422	0.1261	-0.0004	0.0019	-2.9897	0.1170
21	-61.85	-0.	0.20571	-0.0229	0.1127	-0.0008	0.0010	-4.9325	0.1188
22	-59.83	-0.	0.24174	-0.0038	0.0978	-0.0012	0.0002	-25.7989	0.1188
23	-57.91	-0.	0.21182	-0.3293	0.2476	0.0031	-0.0100	-0.7517	-0.1032
24	-55.91	-0.	0.22737	-0.3390	0.2531	0.0033	-0.0103	-0.7465	-0.1234
25	-53.89	-0.	0.25313	-0.3392	0.2526	0.0028	-0.0103	-0.7446	-0.1262
26	-51.88	-0.	0.27393	-0.3462	0.2555	0.0046	-0.0111	-0.7382	-0.1353
27	-49.88	-0.	0.28500	-0.3558	0.2615	0.0031	-0.0085	-0.7351	-0.1482

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STABILITY AXIS COEFFICIENTS

RUN 8 CONF. C 18 THETA = -75 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-100.03	0.	0.28750	0.0527	-0.0107	-0.0056	0.0009	0.0004	0.183
2	-98.01	0.	0.27985	0.0711	0.0015	-0.0029	0.0007	-0.0003	0.254
3	-96.00	0.	0.27784	0.0855	0.0128	-0.0016	0.0009	-0.0006	0.308
4	-93.97	0.	0.27557	0.1076	0.0245	-0.0015	0.0011	-0.0001	0.390
5	-91.96	0.	0.27056	0.1164	0.0376	-0.0008	0.0015	0.0004	0.430
6	-89.94	0.	0.26968	0.1313	0.0478	-0.0003	0.0012	0.0001	0.487
7	-87.92	0.	0.26937	0.1526	0.0580	-0.0041	0.0010	0.0000	0.567
8	-85.90	0.	0.26856	0.1743	0.0682	-0.0032	0.0014	-0.0004	0.649
9	-83.88	0.	0.26586	0.1878	0.0771	-0.0032	0.0014	-0.0003	0.706
10	-81.86	0.	0.26024	0.2063	0.0860	-0.0028	0.0017	-0.0002	0.793
11	-79.85	0.	0.25495	0.2167	0.0941	-0.0000	0.0022	0.0000	0.850
12	-77.83	0.	0.24359	0.2294	0.1012	-0.0031	0.0023	0.0016	0.942
13	-75.83	-0.	0.21501	0.2304	0.1033	-0.0196	0.0011	0.0043	1.072
14	-74.85	0.	0.17911	0.1920	0.0991	-0.0116	0.0026	0.0032	1.072
15	-73.85	0.	0.16430	0.1902	0.1019	-0.0076	0.0027	0.0026	1.158
16	-71.87	0.	0.14024	0.1456	0.1059	-0.0058	0.0028	0.0023	1.038
17	-69.88	0.	0.12228	0.1213	0.1058	0.0029	0.0034	0.0017	0.992
18	-67.89	0.	0.10803	0.0952	0.1047	0.0029	0.0033	0.0016	0.881
19	-65.89	0.	0.10388	0.0889	0.1040	-0.0038	0.0024	0.0011	0.856
20	-63.87	-0.	0.10828	0.1250	0.1066	-0.0123	0.0015	0.0012	1.154
21	-61.85	-0.	0.11720	0.1706	0.1092	-0.0209	0.0005	0.0012	1.456
22	-59.83	-0.	0.12478	0.2071	0.1095	-0.0293	-0.0005	0.0011	1.660
23	-57.91	-0.	0.39155	0.0045	0.0343	-0.0866	-0.0068	-0.0079	0.012
24	-55.91	-0.	0.40822	-0.0018	0.0341	-0.0874	-0.0067	-0.0084	-0.004
25	-53.89	-0.	0.42320	0.0046	0.0350	-0.0877	-0.0066	-0.0083	0.011
26	-51.88	-0.	0.44144	0.0018	0.0344	-0.0843	-0.0059	-0.0104	0.004
27	-49.88	-0.	0.45572	-0.0113	0.0345	-0.0826	-0.0045	-0.0079	-0.025

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BODY-AXIS COEFFICIENTS

RUN 9 CONF. C 18 THETA = -105 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-135.43	-0.	-0.75177	0.0373	-0.1229	-0.0001	0.0018	-3.2992	-0.3988
2	-130.38	0.	-0.67090	-0.0171	-0.0819	0.0020	0.0030	4.8017	-0.3980
3	-125.28	0.	-0.51088	-0.0865	-0.0277	0.0110	0.0083	0.3199	-0.3444
4	-120.20	0.	-0.38488	-0.1820	0.0457	0.0054	0.0058	-0.2509	-0.2903
5	-115.13	0.	-0.27406	-0.2310	0.0910	0.0010	0.0014	-0.3940	-0.1646
6	-110.06	0.	-0.14968	-0.2514	0.1185	-0.0003	-0.0003	-0.4714	-0.0912
7	-104.99	-0.	-0.04680	-0.2731	0.1576	-0.0000	-0.0009	-0.5770	-0.2224
8	-99.92	-0.	0.06586	-0.2810	0.1859	-0.0005	-0.0017	-0.6615	-0.2609
9	-94.88	-0.	0.13500	-0.2718	0.2031	-0.0000	-0.0016	-0.7475	-0.2738
10	-89.84	-0.	0.19358	-0.2645	0.2230	-0.0000	-0.0015	-0.8429	-0.2802
11	-84.81	-0.	0.24187	-0.2322	0.2196	-0.0004	-0.0016	-0.9457	-0.2178
12	-79.80	-0.	0.26181	-0.1798	0.1981	-0.0005	-0.0023	-1.1017	-0.1747
13	-74.84	0.	0.20138	-0.1015	0.1608	0.0023	0.0008	-1.5847	0.0345

STABILITY AXIS COEFFICIENTS

RUN 9 CONF. C 18 THETA = -105 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-135.43	-0.	0.50938	-0.5541	-0.1417	-0.0086	0.0014	-0.0012	-1.088
2	-130.38	0.	0.44760	-0.5001	-0.1332	-0.0036	0.0010	-0.0034	-1.117
3	-125.28	0.	0.36572	-0.3671	-0.1171	0.0567	0.0004	-0.0138	-1.004
4	-120.20	0.	0.35086	-0.2411	-0.1018	0.0564	0.0023	-0.0076	-0.687
5	-115.13	0.	0.32554	-0.1500	-0.0835	0.0314	0.0008	-0.0015	-0.461
6	-110.06	0.	0.28749	-0.0544	-0.0627	-0.0003	-0.0001	0.0004	-0.189
7	-104.99	-0.	0.27587	0.0254	-0.0324	-0.0054	-0.0009	0.0003	0.092
8	-99.92	-0.	0.26545	0.1133	-0.0029	-0.0077	-0.0016	0.0008	0.427
9	-94.88	-0.	0.25930	0.1576	0.0248	-0.0057	-0.0016	0.0001	0.608
10	-89.84	-0.	0.26506	0.1928	0.0530	-0.0056	-0.0015	0.0000	0.727
11	-84.81	-0.	0.25312	0.2199	0.0747	-0.0135	-0.0017	0.0002	0.869
12	-79.80	-0.	0.22335	0.2258	0.0903	-0.0183	-0.0023	0.0001	1.011
13	-74.84	0.	0.15062	0.1678	0.1031	0.0114	0.0014	-0.0020	1.114

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CONFIDENTIAL

BODY-AXIS COEFFICIENTS

RUN 10 CONF. C 18 THETA = -135 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-160.36	0.	-0.93590	-0.0014	-0.0395	0.0007	0.0012	28.7687	-0.3967
2	-155.36	0.	-0.91929	-0.0001	-0.0533	0.0014	0.0024	675.8871	-0.3986
3	-150.40	0.	-0.94613	0.0551	-0.1090	0.0028	0.0076	-1.9786	-0.3991
4	-145.40	0.	-0.87533	0.0848	-0.1474	0.0003	0.0033	-1.7370	-0.3992
5	-140.36	0.	-0.79807	0.0712	-0.1434	-0.0001	0.0036	-2.0131	-0.3990
6	-135.32	0.	-0.72246	0.0320	-0.1165	0.0002	0.0030	-3.6383	-0.3655
7	-130.27	0.	-0.64735	-0.0348	-0.0710	0.0008	0.0044	2.0429	-0.3889
8	-125.21	0.	-0.55592	-0.0948	-0.0245	0.0008	0.0030	0.2586	-0.3894
9	-120.07	-0.	-0.26960	-0.1775	0.0383	-0.0010	-0.0011	-0.2158	-0.2821
10	-115.01	0.	-0.19359	-0.2308	0.0916	-0.0008	0.0003	-0.3970	-0.2986
11	-109.95	-0.	-0.10640	-0.2703	0.1381	-0.0009	-0.0003	-0.5109	-0.3288

STABILITY AXIS COEFFICIENTS

RUN 10 CONF. C 18 THETA = -135 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-160.36	0.	0.88191	-0.3133	-0.0957	0.0056	-0.0003	-0.0014	-0.355
2	-155.36	0.	0.83562	-0.3832	-0.1076	0.0136	-0.0002	-0.0028	-0.459
3	-150.40	0.	0.79546	-0.5152	-0.1271	0.0379	0.0013	-0.0079	-0.648
4	-145.40	0.	0.67230	-0.5669	-0.1408	0.0104	0.0017	-0.0029	-0.843
5	-140.36	0.	0.56916	-0.5640	-0.1417	0.0075	0.0024	-0.0026	-0.991
6	-135.32	0.	0.49119	-0.5308	-0.1372	0.0113	0.0020	-0.0023	-1.081
7	-130.27	0.	0.44494	-0.4715	-0.1330	0.0226	0.0028	-0.0034	-1.060
8	-125.21	0.	0.39793	-0.3996	-0.1223	0.0164	0.0020	-0.0024	-1.004
9	-120.07	-0.	0.28873	-0.1444	-0.0993	-0.0039	-0.0004	0.0014	-0.500
10	-115.01	0.	0.29099	-0.0779	-0.0780	-0.0031	0.0006	0.0006	-0.268
11	-109.95	-0.	0.29040	-0.0078	-0.0535	-0.0056	0.0000	0.0009	-0.027

BODY-AXIS COEFFICIENTS

RUN 11 CONF. C 18 THETA = -165 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-190.13	-0.	-0.99310	-0.0060	0.0297	0.0000	-0.0008	-4.9563	-0.3995
2	-185.13	-0.	-0.98181	-0.0043	0.0171	-0.0005	-0.0014	-3.9642	-0.3992
3	-180.13	-0.	-0.96667	-0.0039	0.0056	-0.0011	-0.0015	-1.4409	-0.3988
4	-175.15	-0.	-0.96258	0.0115	-0.0149	-0.0014	-0.0024	-1.2957	-0.3986
5	-170.17	-0.	-0.96926	0.0408	-0.0474	-0.0009	-0.0025	-1.1622	-0.3988
6	-165.19	-0.	-0.98225	0.0541	-0.0709	0.0007	-0.0035	-1.3100	-0.3990
7	-160.19	-0.	-0.97642	0.0542	-0.0879	0.0030	-0.0055	-1.6203	-0.3995
8	-155.22	-0.	-0.97231	0.0827	-0.1229	0.0014	-0.0024	-1.4859	-0.3994
9	-150.21	-0.	-0.94828	0.0719	-0.1292	0.0004	-0.0011	-1.7960	-0.3990
10	-145.22	-0.	-0.86115	0.1063	-0.1586	-0.0041	-0.0019	-1.4919	-0.1995
11	-140.20	-0.	-0.77512	0.0835	-0.1489	-0.0023	-0.0009	-1.7836	0.0179

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STABILITY AXIS COEFFICIENTS

RUN 11 CONF. C 18 THETA = -165 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-190.13	-0.	0.97658	0.1805	-0.0330	-0.0134	0.0001	0.0008	0.185
2	-185.13	-0.	0.97749	0.0921	-0.0438	-0.0218	0.0006	0.0013	0.094
3	-180.13	-0.	0.96665	0.0061	-0.0541	-0.0252	0.0011	0.0015	0.006
4	-175.15	-0.	0.95815	-0.0929	-0.0638	-0.0349	0.0012	0.0025	-0.097
5	-170.17	-0.	0.94807	-0.2057	-0.0766	-0.0335	0.0004	0.0027	-0.217
6	-165.19	-0.	0.93576	-0.3035	-0.0917	-0.0365	-0.0016	0.0032	-0.324
7	-160.19	-0.	0.90028	-0.3819	-0.1083	-0.0425	-0.0047	0.0042	-0.424
8	-155.22	-0.	0.84809	-0.4827	-0.1235	-0.0201	-0.0023	0.0016	-0.569
9	-150.21	-0.	0.78726	-0.5335	-0.1358	-0.0139	-0.0009	0.0008	-0.678
10	-145.22	-0.	0.64670	-0.5785	-0.1365	-0.0416	0.0023	0.0039	-0.895
11	-140.20	-0.	0.54209	-0.5603	-0.1374	-0.0181	0.0012	0.0022	-1.034

BODY-AXIS COEFFICIENTS

RUN 12 CONF. C 18 THETA = -45 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CA	CN	CMA	CNB	CLB	XCPN/D	DP/Q
1	-69.93	-0.	0.13741	-0.0894	0.1570	0.0005	-0.0003	-1.7550	0.1757
2	-67.92	-0.	0.14707	-0.0700	0.1470	0.0007	-0.0018	-2.0987	0.1702
3	-65.90	-0.	0.17364	-0.0523	0.1381	0.0003	-0.0035	-2.6400	0.1748
4	-63.88	-0.	0.20535	-0.0308	0.1247	-0.0004	-0.0036	-4.0519	0.1830
5	-61.86	-0.	0.23926	-0.0080	0.1086	-0.0014	-0.0037	-13.5928	0.1858
6	-59.84	-0.	0.27769	0.0153	0.0925	-0.0013	-0.0038	6.0444	0.1836
7	-57.82	-0.	0.31010	0.0294	0.0843	-0.0009	-0.0040	2.8679	0.1619
8	-56.04	-0.	0.14672	-0.3283	0.2553	-0.0108	-0.0050	-0.7775	-0.3105
9	-54.06	-0.	0.14460	-0.3632	0.2768	-0.0076	-0.0067	-0.7620	-0.3289
10	-52.06	-0.	0.16737	-0.4005	0.2991	-0.0080	-0.0103	-0.7467	-0.3472
11	-50.07	-0.	0.16802	-0.4223	0.3102	-0.0076	-0.0065	-0.7346	-0.3665
12	-48.07	-0.	0.18741	-0.4230	0.3101	-0.0080	-0.0053	-0.7331	-0.3821
13	-46.06	-0.	0.20428	-0.4235	0.3098	-0.0081	-0.0047	-0.7314	-0.3940
14	-45.05	-0.	0.21455	-0.4204	0.3077	-0.0079	-0.0041	-0.7320	-0.3940
15	-40.03	-0.	0.27190	-0.4118	0.3004	-0.0074	-0.0042	-0.7294	-0.3968
16	-35.03	-0.	0.30523	-0.4306	0.3090	-0.0038	-0.0006	-0.7176	-0.3982
17	-29.98	-0.	0.34404	-0.3290	0.2308	-0.0009	-0.0010	-0.7014	-0.3674
18	-24.96	-0.	0.36955	-0.2841	0.1958	-0.0012	-0.0019	-0.6891	-0.3656
19	-19.92	-0.	0.42191	-0.2300	0.1580	-0.0011	-0.0020	-0.6871	-0.3702

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STABILITY AXIS COEFFICIENTS

RUN 12 CONF. C 18 THETA = -45 PHI = 90 TYPE P6 MACH = 0.26 RN = 2.49 Q = 100 NAAL 487

POINT	ALPHA	YAW	CD	CL	CMCG	CY	CNS	CLS	L/D
1	-69.93	-0.	0.13116	0.0984	0.1038	-0.0027	-0.0001	-0.0006	0.750
2	-67.92	-0.	0.12017	0.1100	0.1076	-0.0017	-0.0014	-0.0014	0.915
3	-65.90	-0.	0.11866	0.1371	0.1125	-0.0062	-0.0031	-0.0016	1.156
4	-63.88	-0.	0.11803	0.1708	0.1157	-0.0130	-0.0034	-0.0012	1.447
5	-61.86	-0.	0.11988	0.2072	0.1173	-0.0209	-0.0040	-0.0005	1.728
6	-59.84	-0.	0.12628	0.2478	0.1194	-0.0180	-0.0040	-0.0008	1.962
7	-57.82	-0.	0.14028	0.2781	0.1227	-0.0126	-0.0038	-0.0014	1.983
8	-56.04	-0.	0.35429	-0.0617	0.0388	-0.1265	-0.0101	0.0061	-0.174
9	-54.06	-0.	0.37894	-0.0961	0.0363	-0.0871	-0.0099	0.0023	-0.254
10	-52.06	-0.	0.41879	-0.1142	0.0344	-0.0878	-0.0131	-0.0001	-0.273
11	-50.07	-0.	0.43165	-0.1422	0.0306	-0.0851	-0.0099	0.0017	-0.329
12	-48.07	-0.	0.43991	-0.1433	0.0312	-0.0833	-0.0092	0.0024	-0.326
13	-46.06	-0.	0.44671	-0.1468	0.0315	-0.0846	-0.0090	0.0025	-0.329
14	-45.05	-0.	0.44908	-0.1451	0.0322	-0.0847	-0.0085	0.0026	-0.323
15	-40.03	-0.	0.47309	-0.1405	0.0341	-0.0761	-0.0084	0.0015	-0.297
16	-35.03	-0.	0.49707	-0.1774	0.0318	-0.0330	-0.0034	0.0017	-0.357
17	-29.98	-0.	0.46241	-0.1131	0.0255	-0.0020	-0.0013	-0.0004	-0.245
18	-24.96	-0.	0.45492	-0.1017	0.0228	-0.0068	-0.0019	-0.0012	-0.223
19	-19.92	-0.	0.47504	-0.0725	0.0252	-0.0067	-0.0017	-0.0015	-0.153

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C[redacted]

APPENDIX B

PLOTTED DATA

C[redacted]

INDEX OF PLOTTED DATA

DESCRIPTION

Command module characteristics

C_D, C_L, L/D, $C_{mc.g.}$, C_A, C_N, C_{mA}, $X_{CP/D}$ versus α for Configuration C_{18}

α = -10 to +180 Degrees	B-3 to B-10
α = +5 to -180 Degrees	B-11 to B-18

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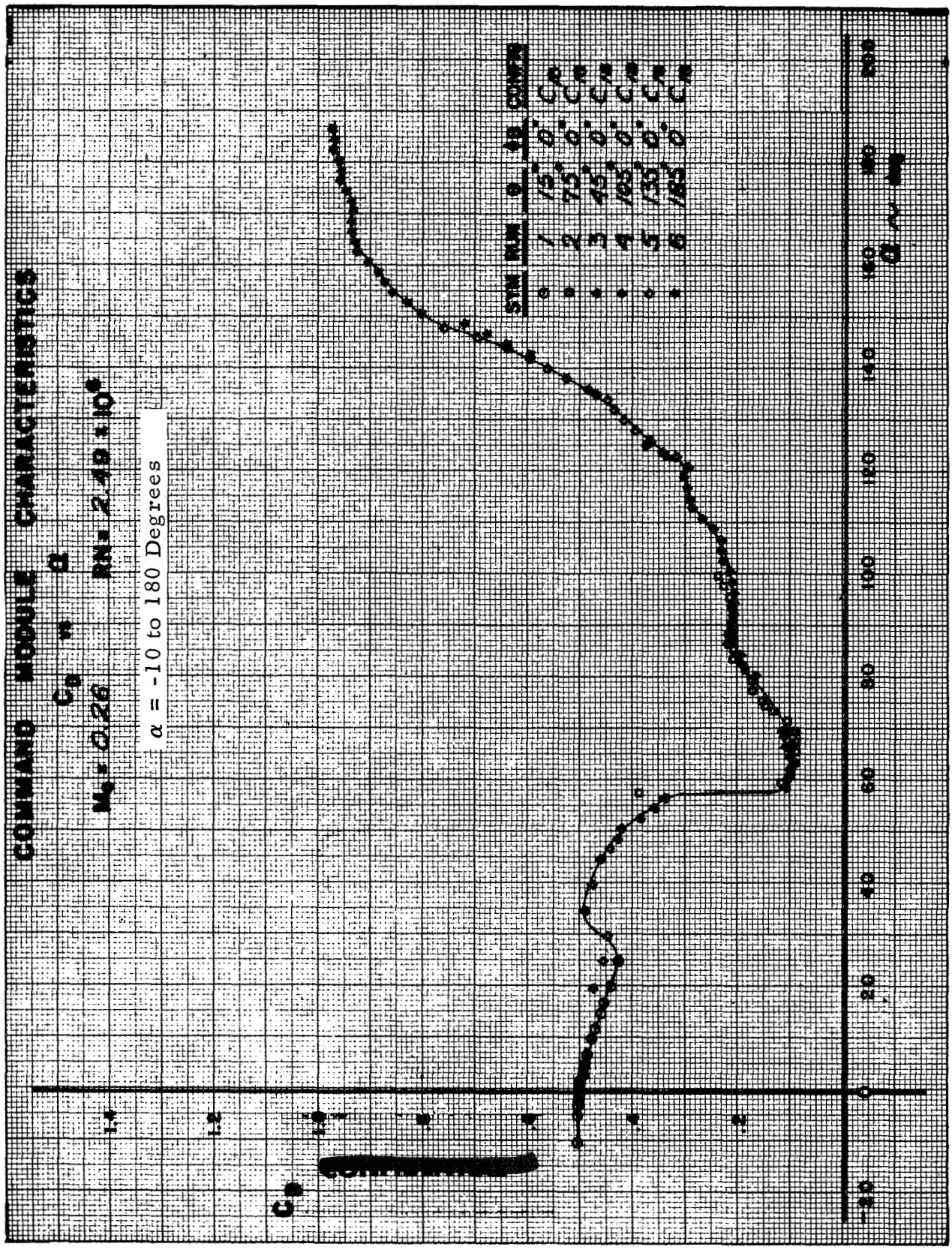

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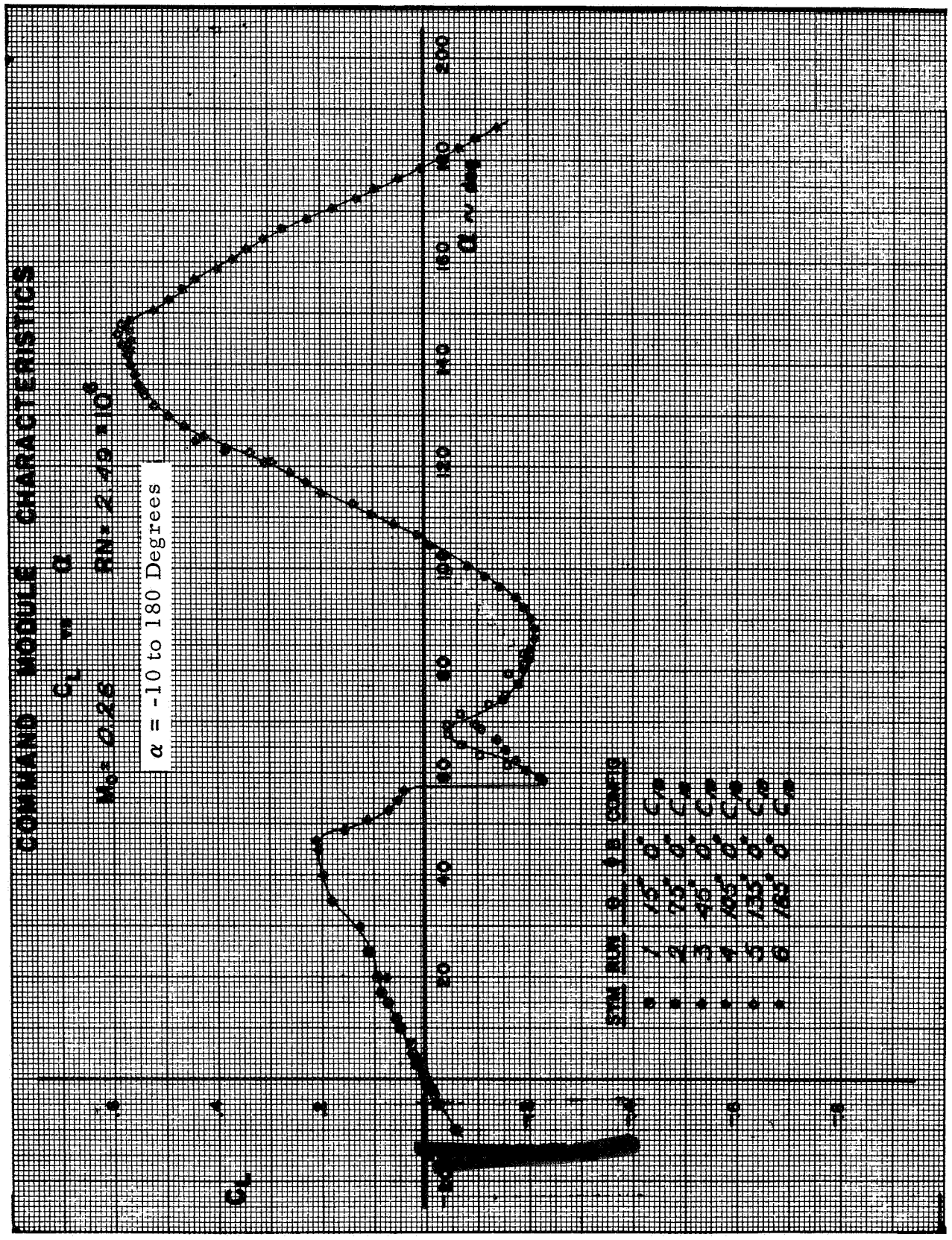

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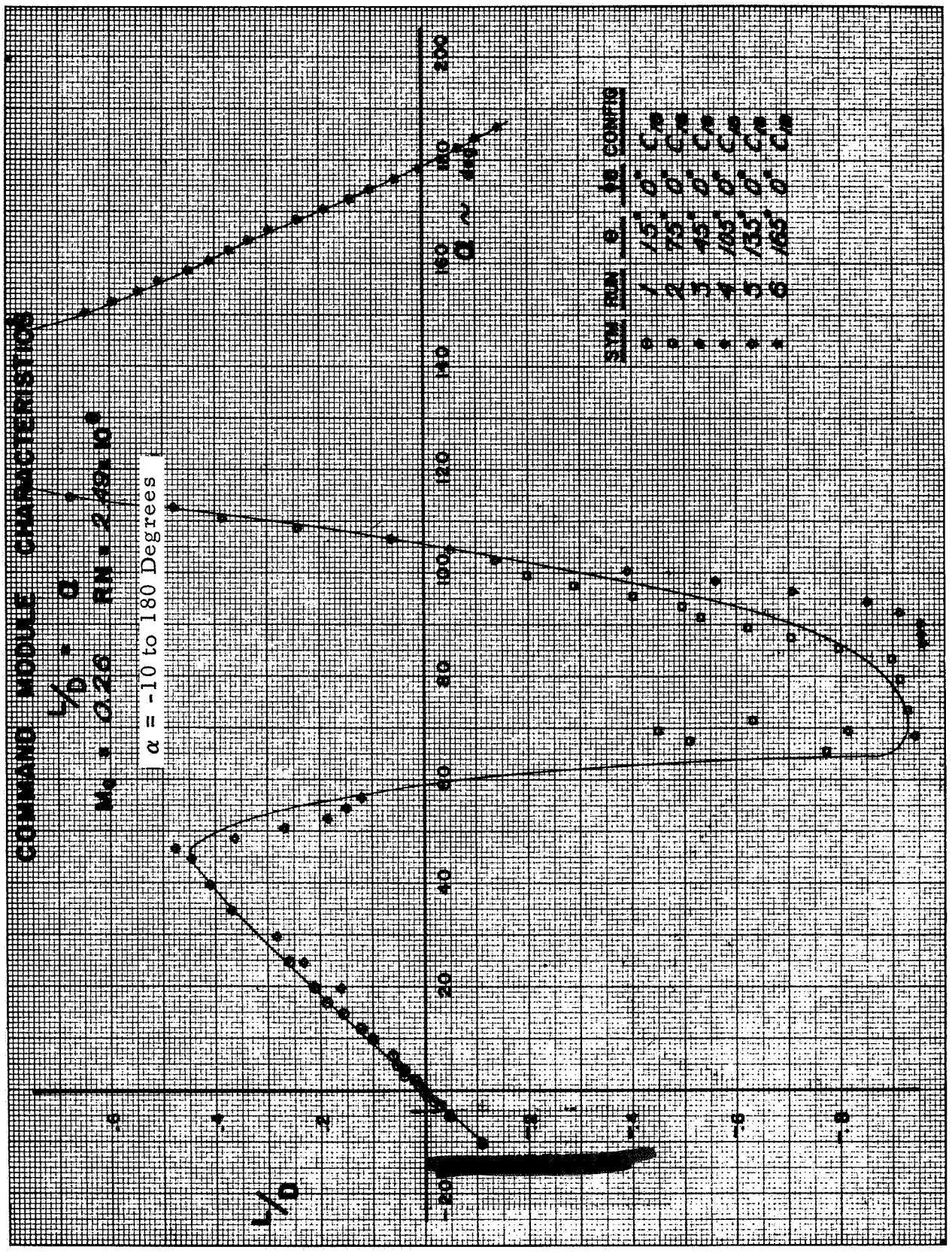

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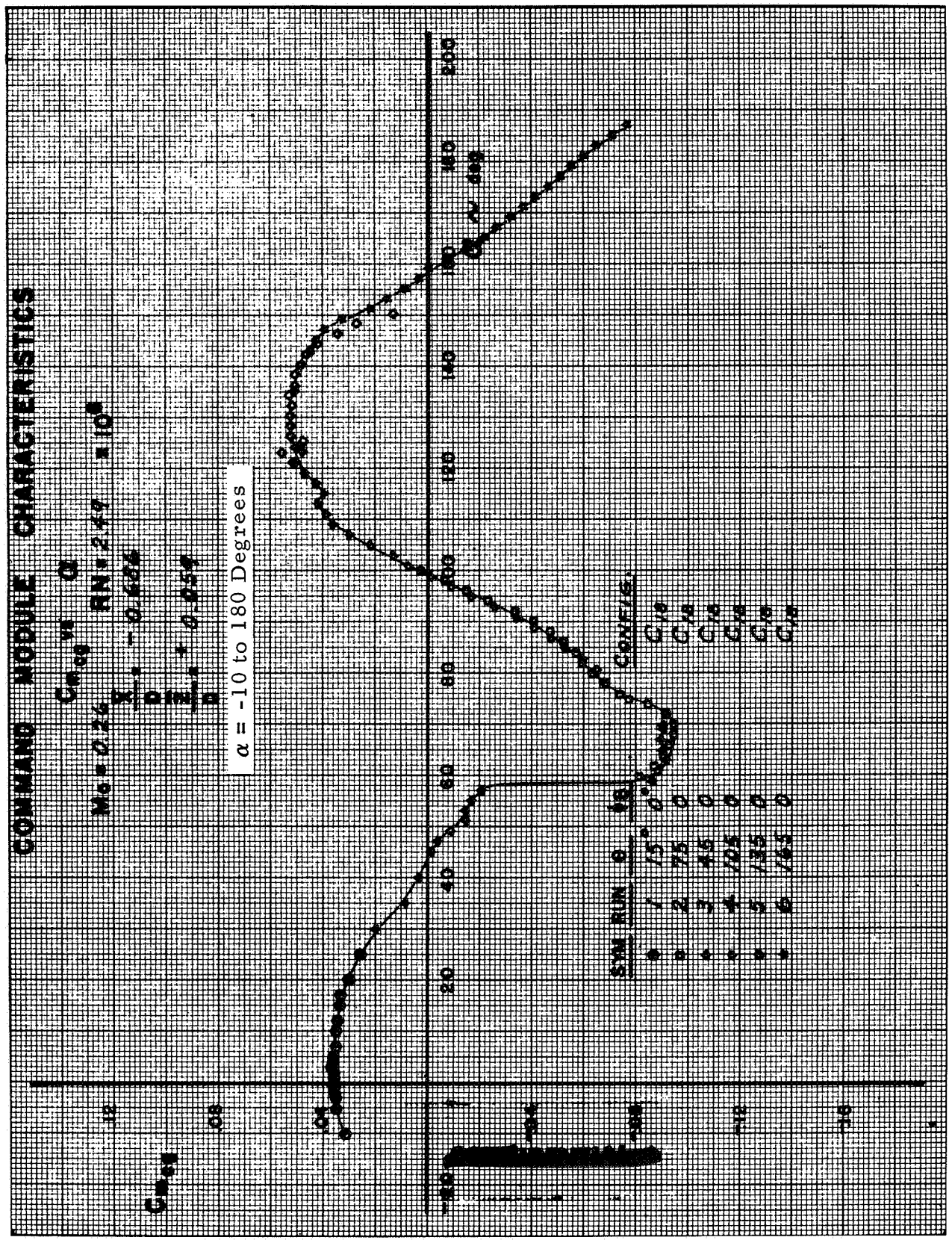

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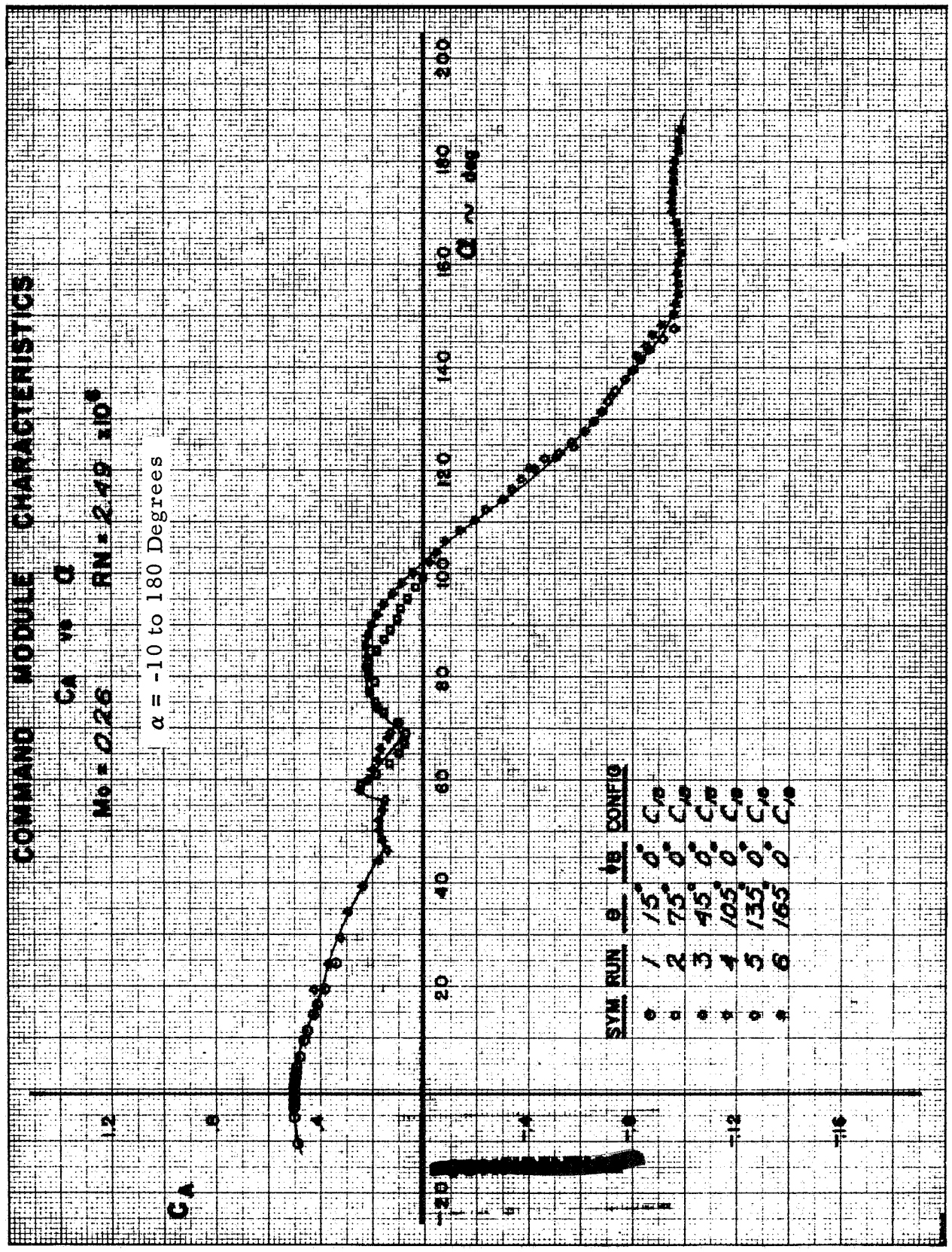

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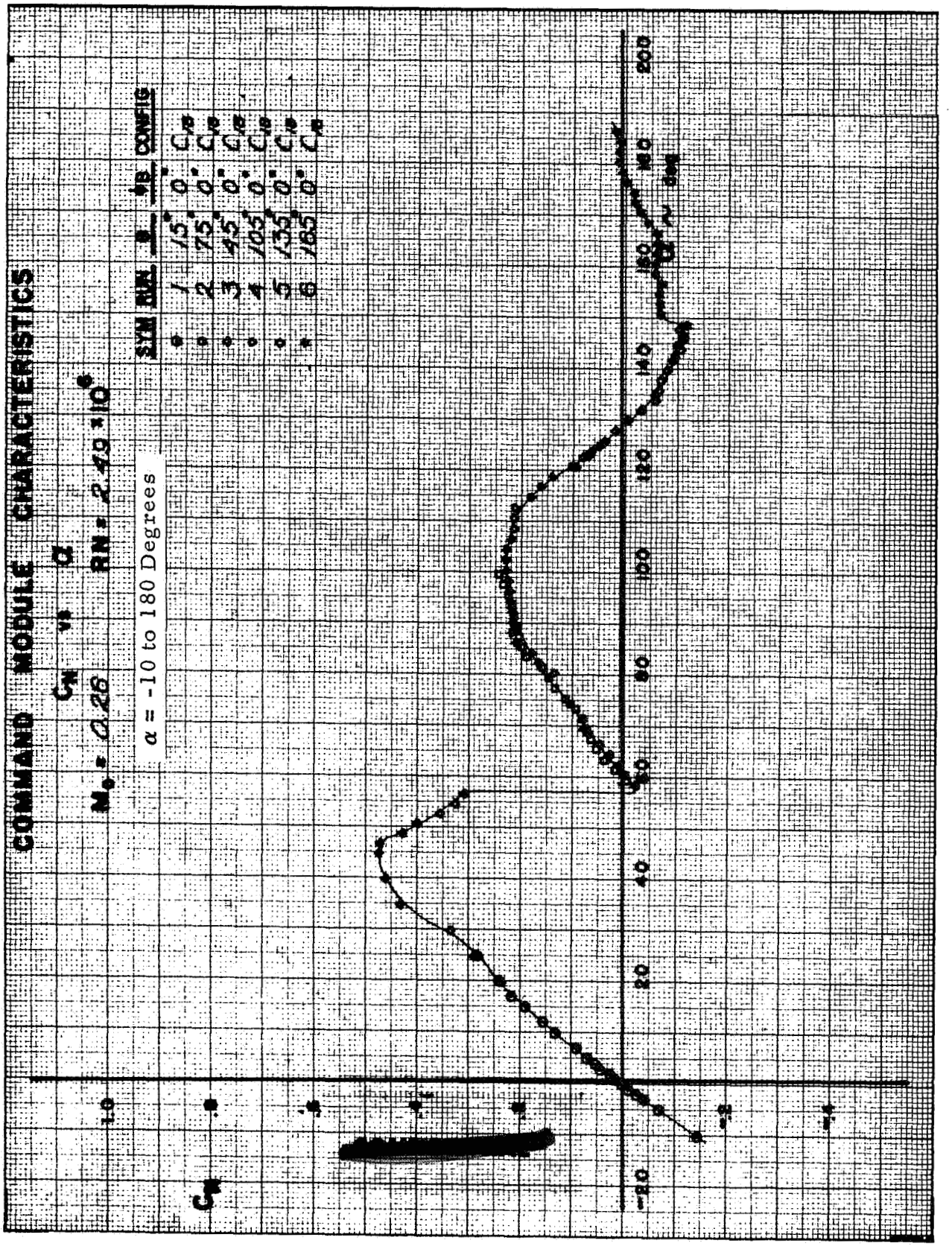

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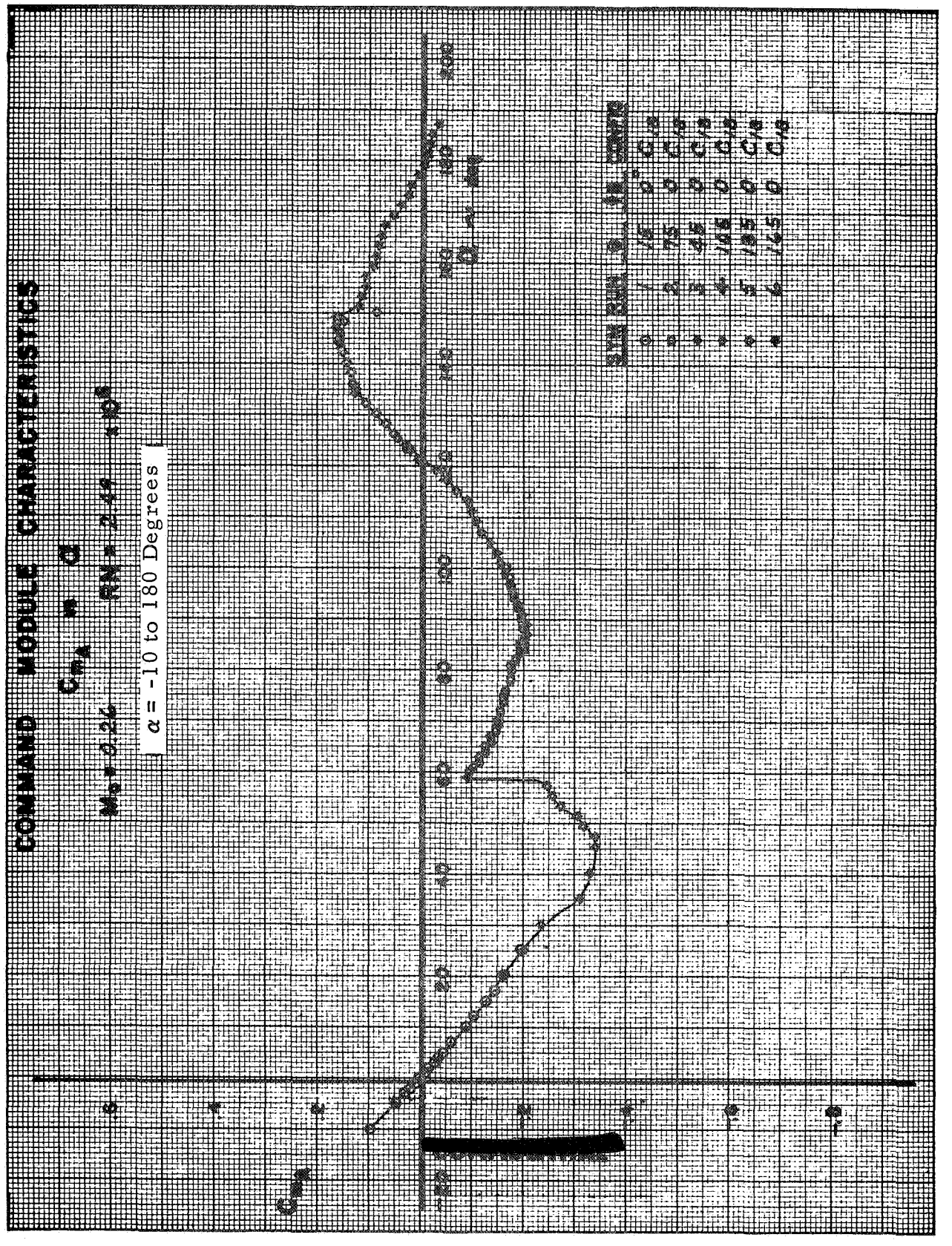

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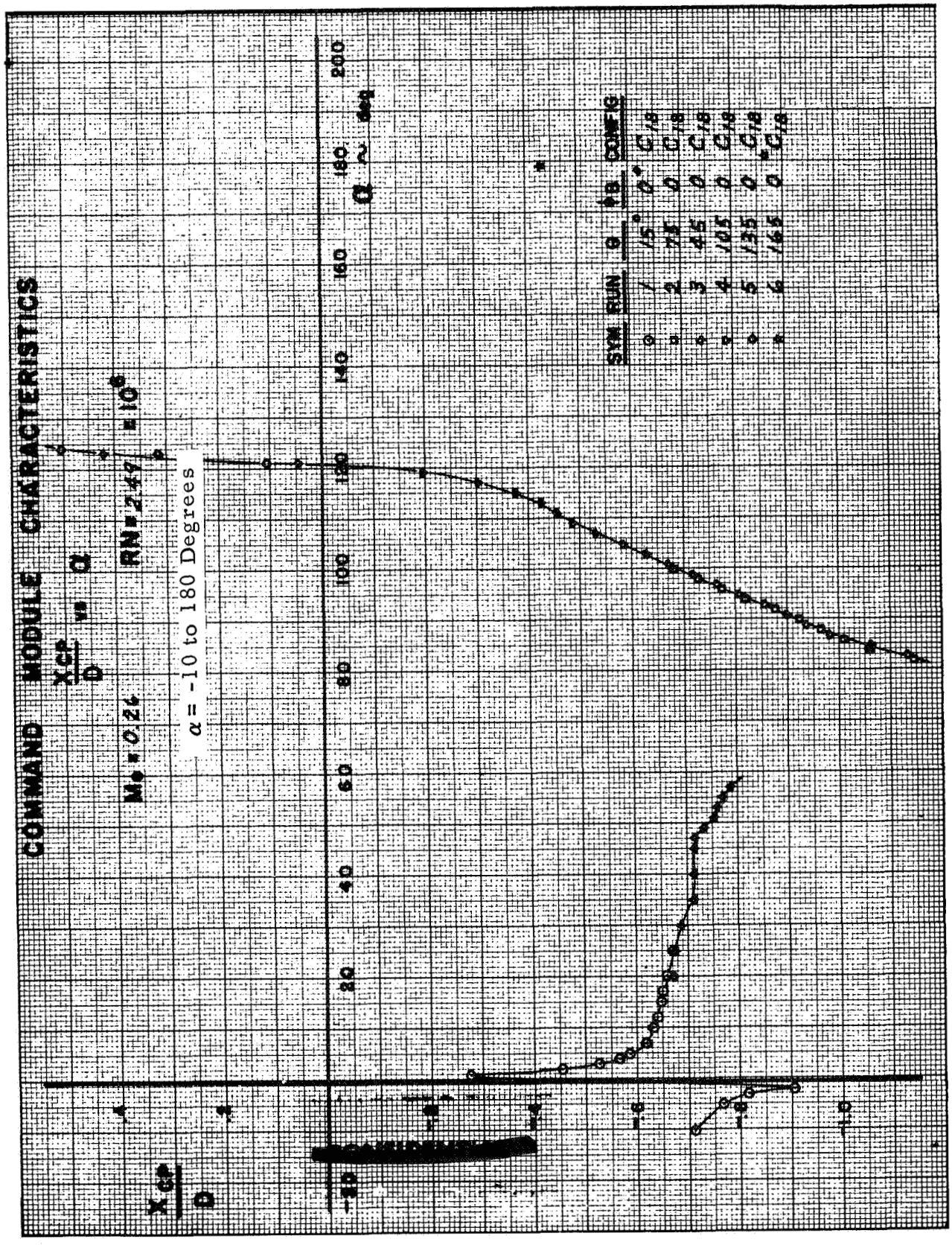

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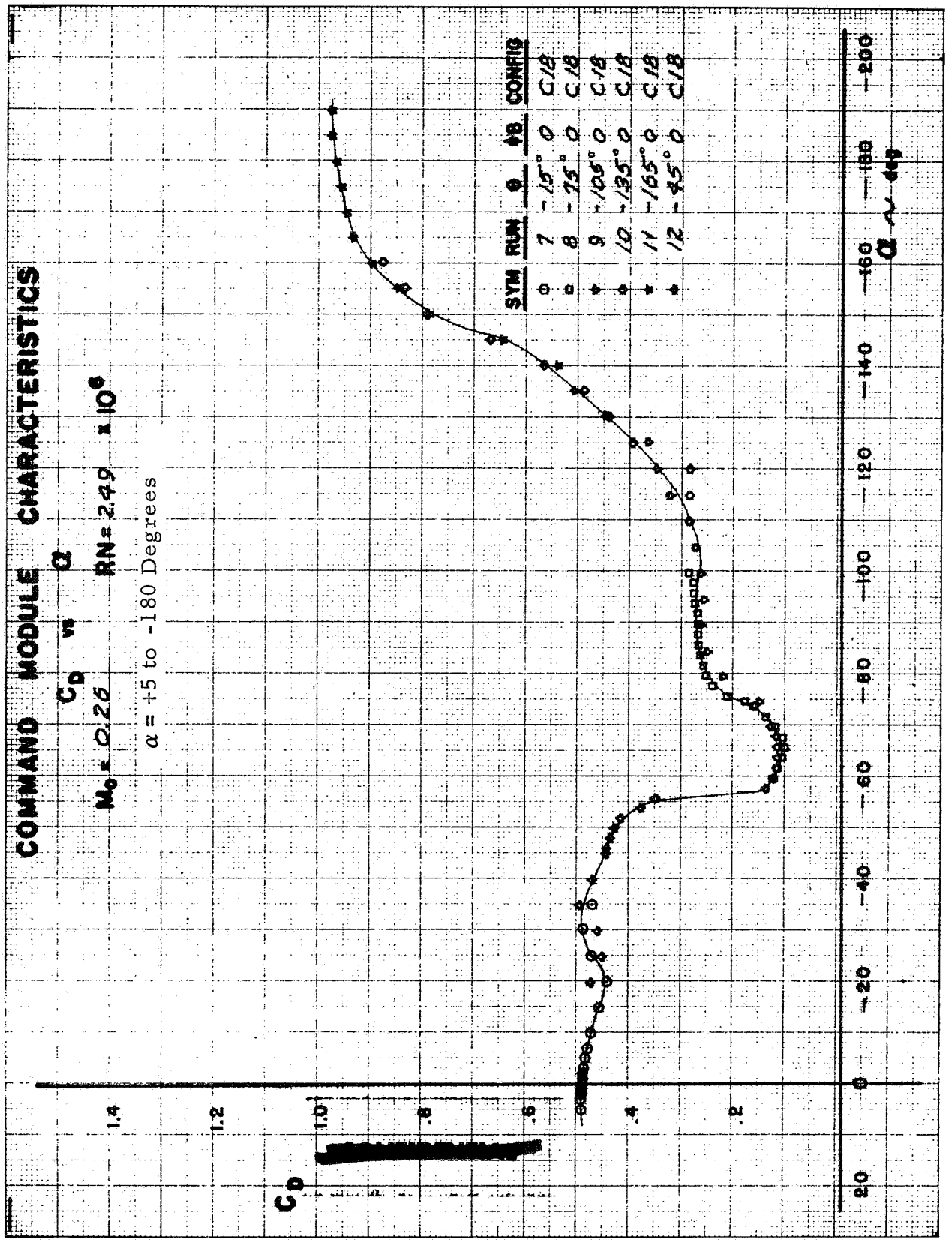

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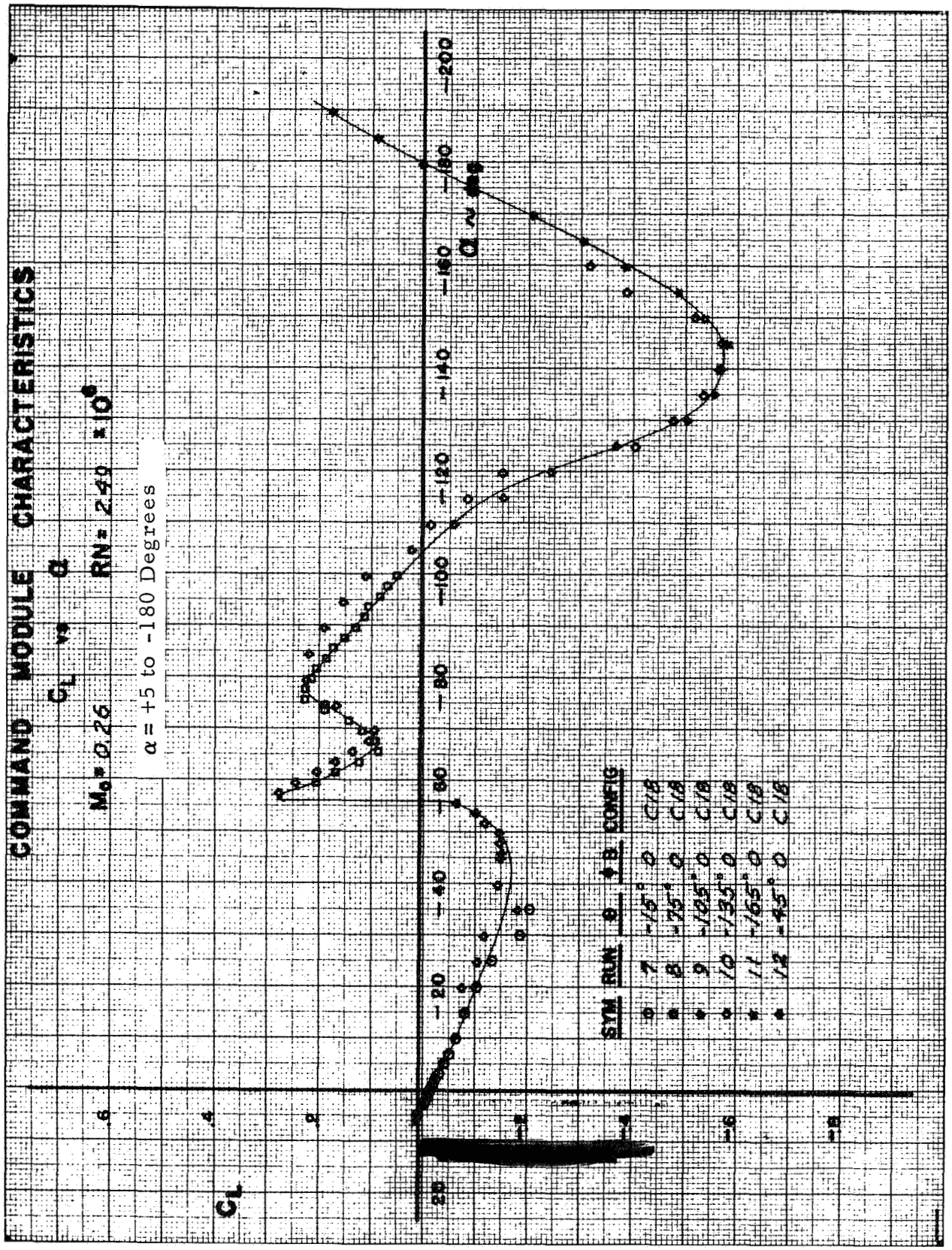

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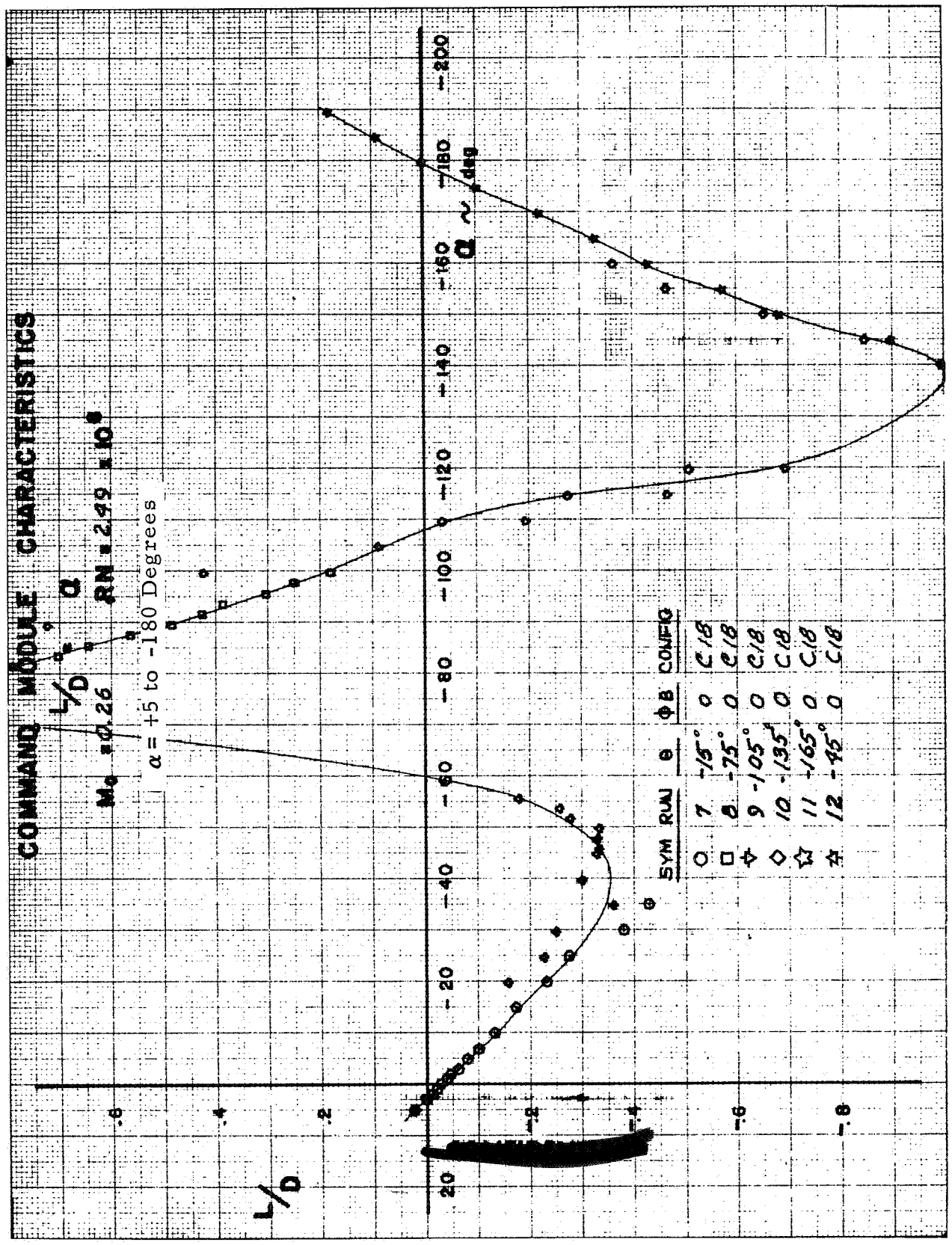

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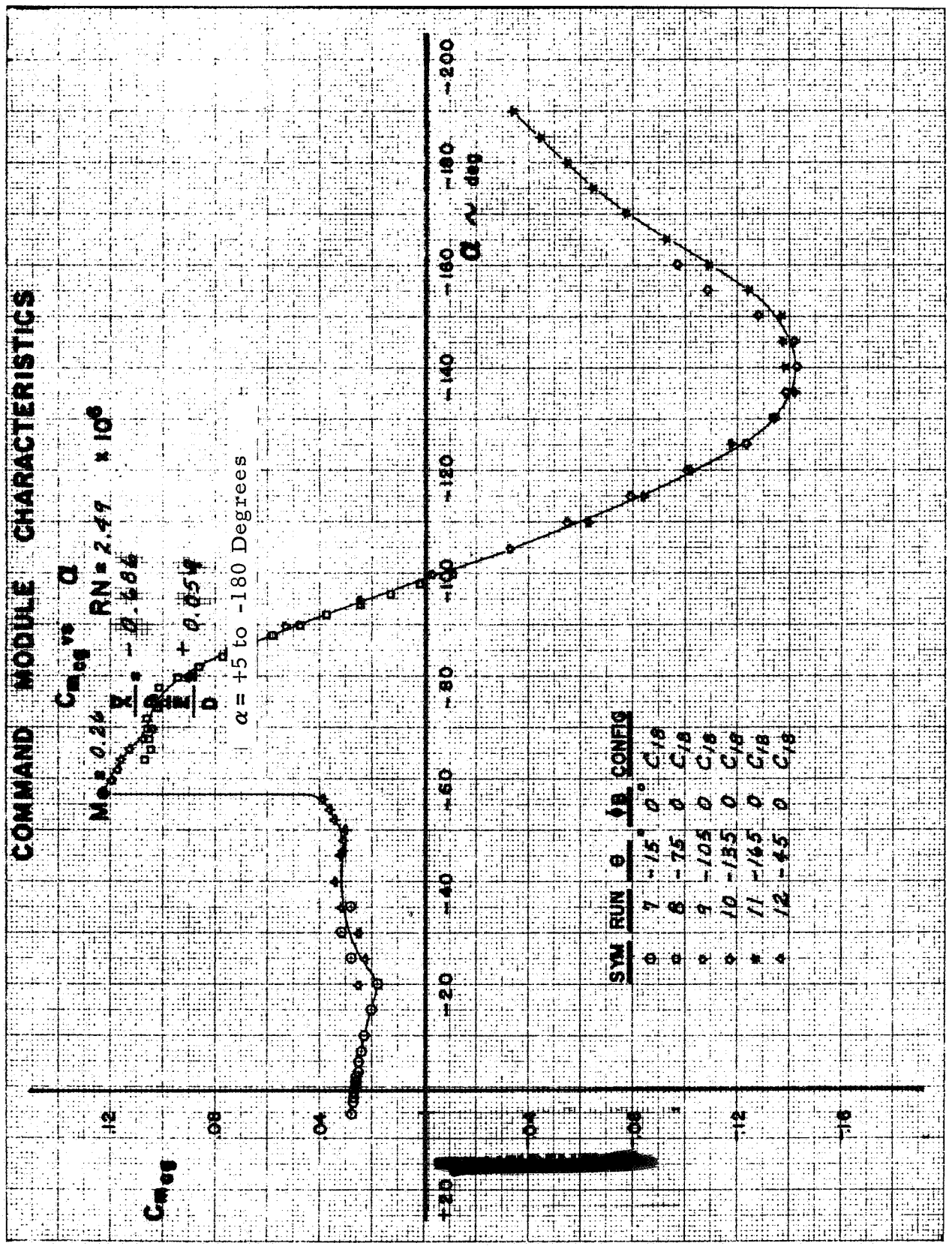

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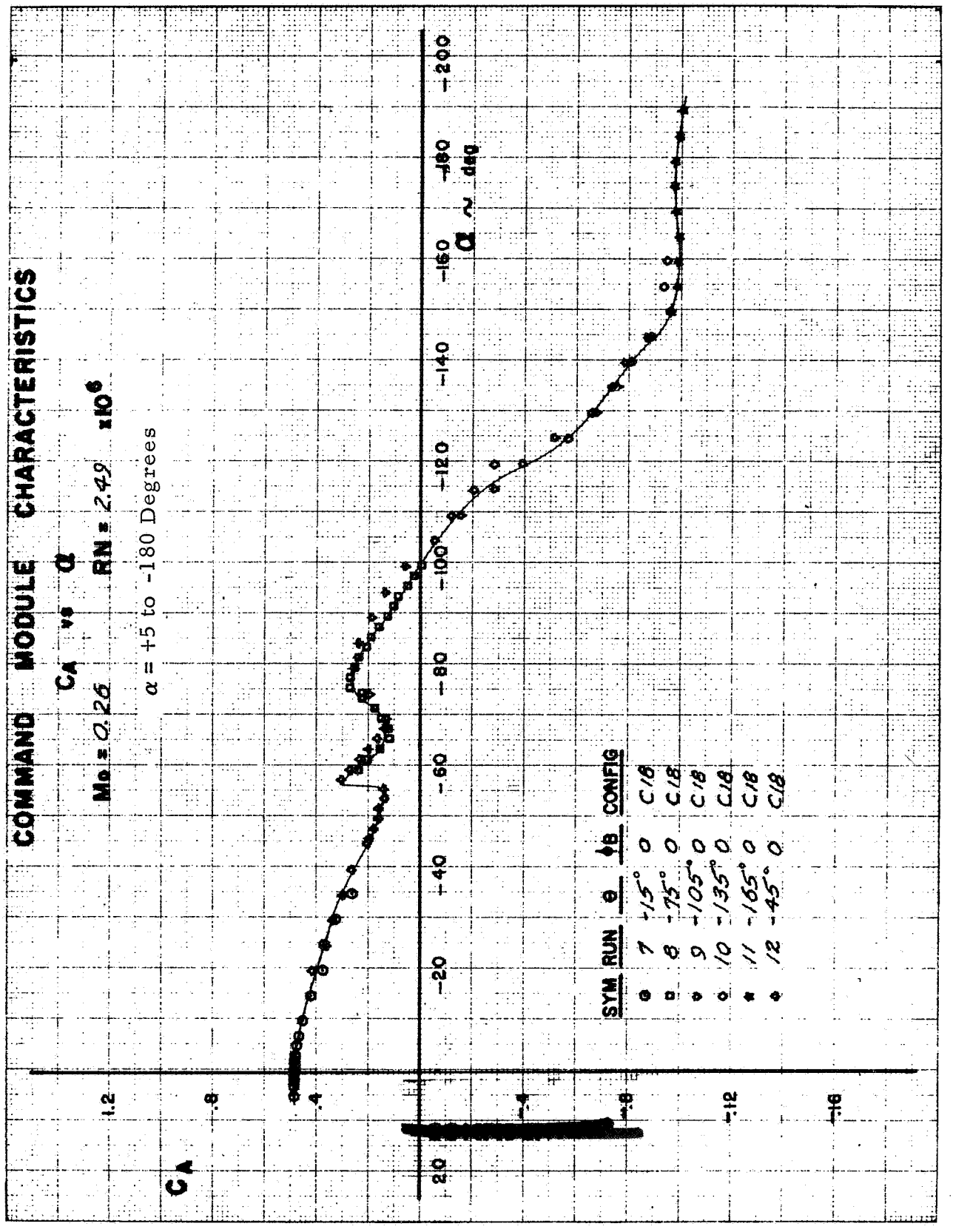

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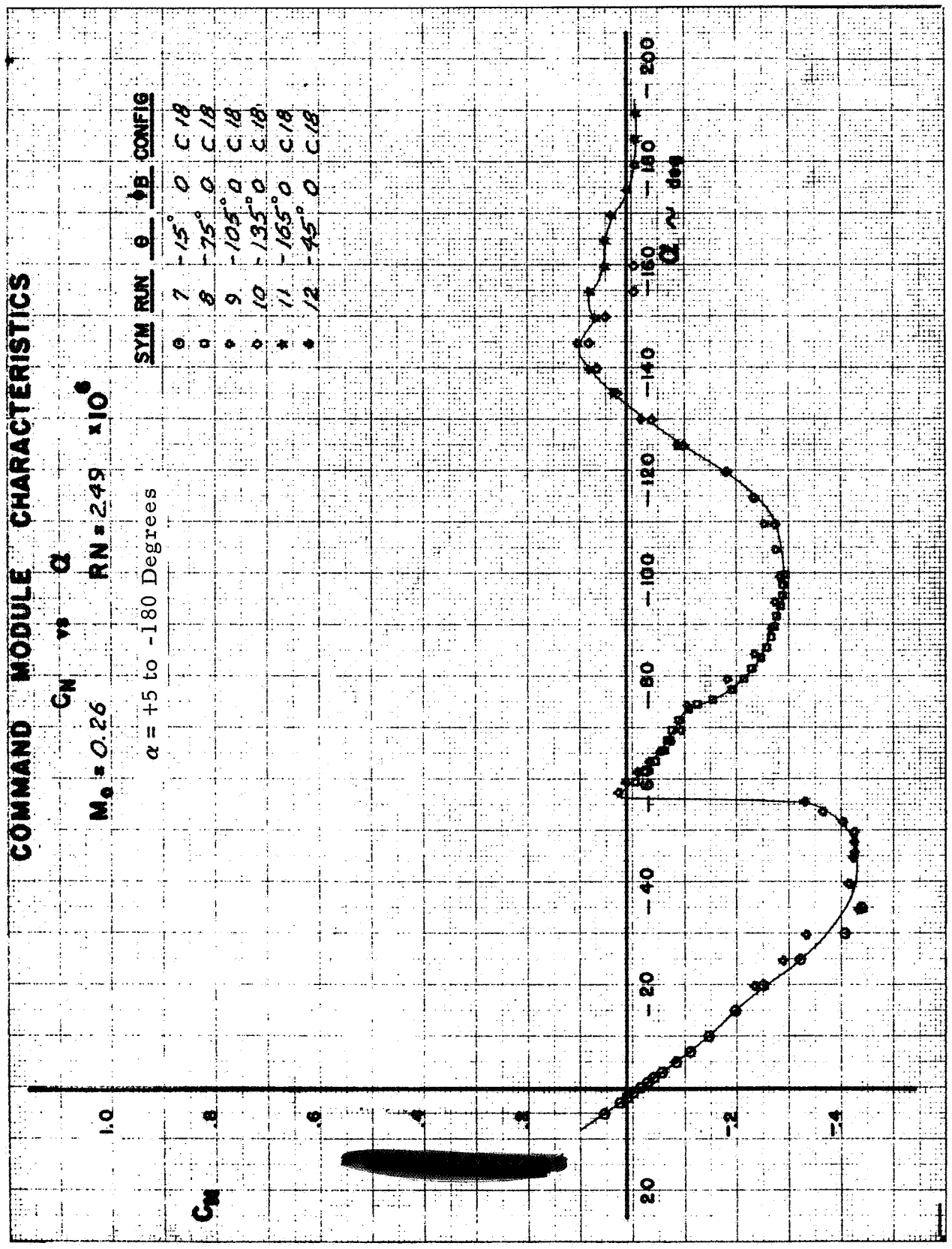

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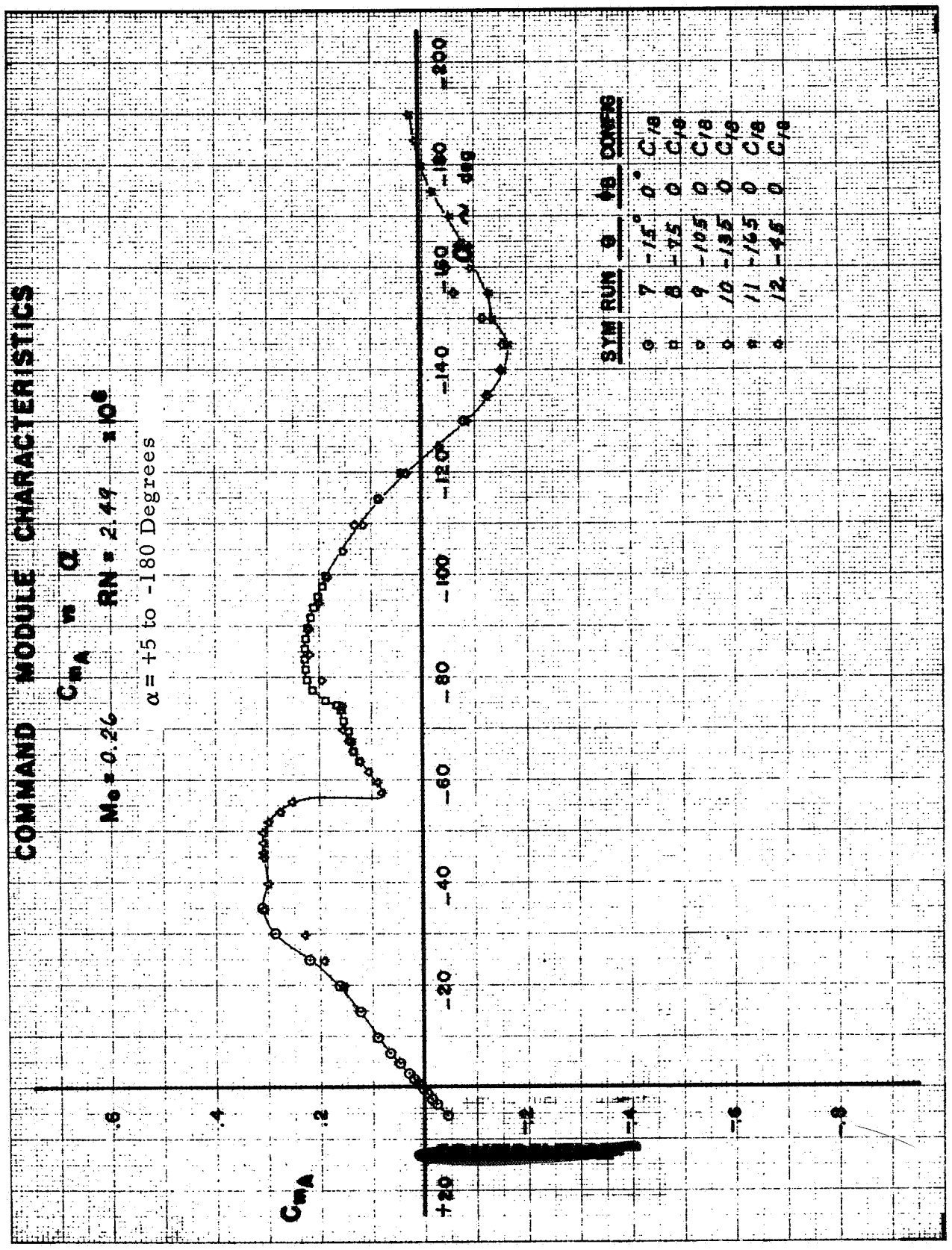

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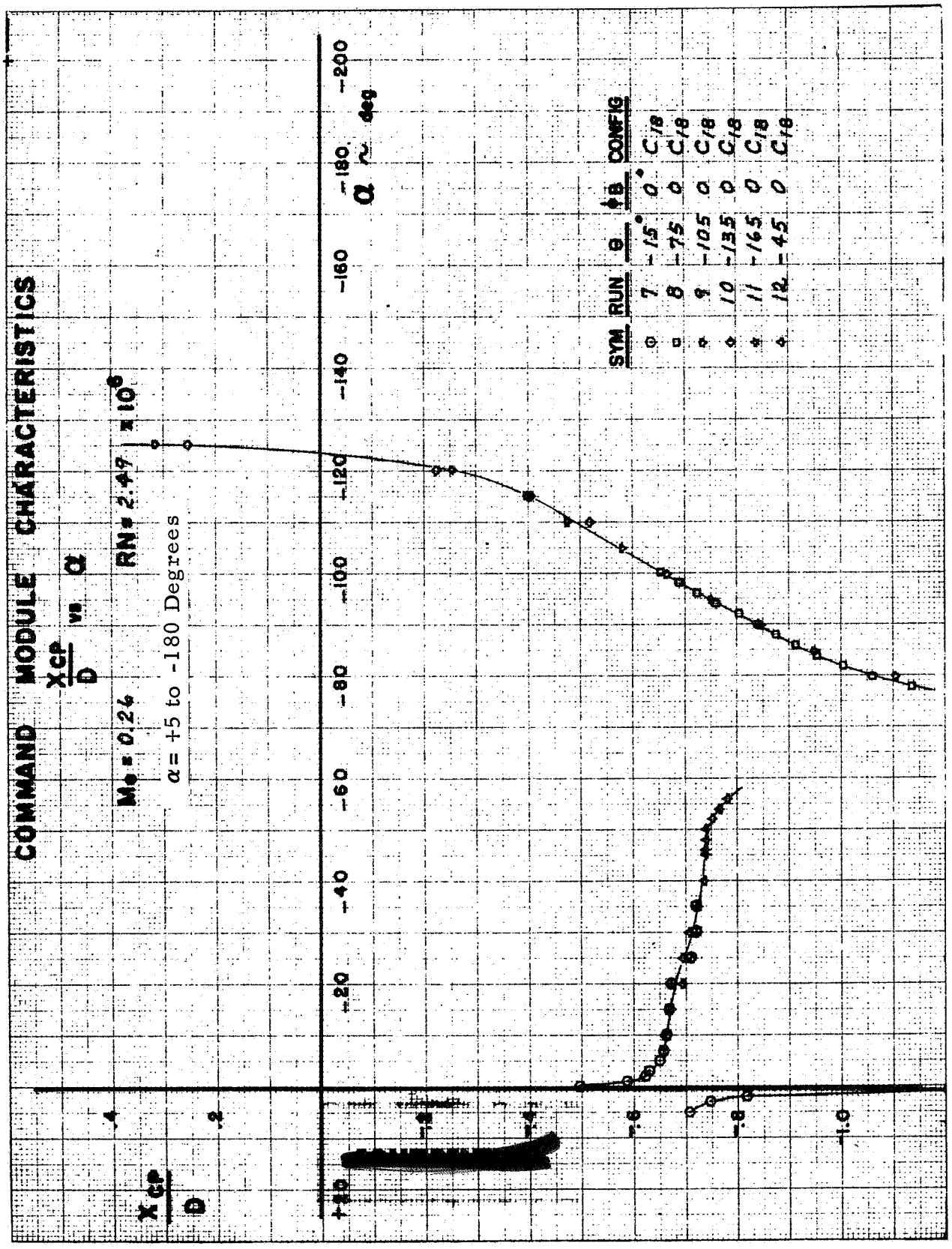

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