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JUN 77 N POLLOCK, R G BROADBENT, L J ROBERTS

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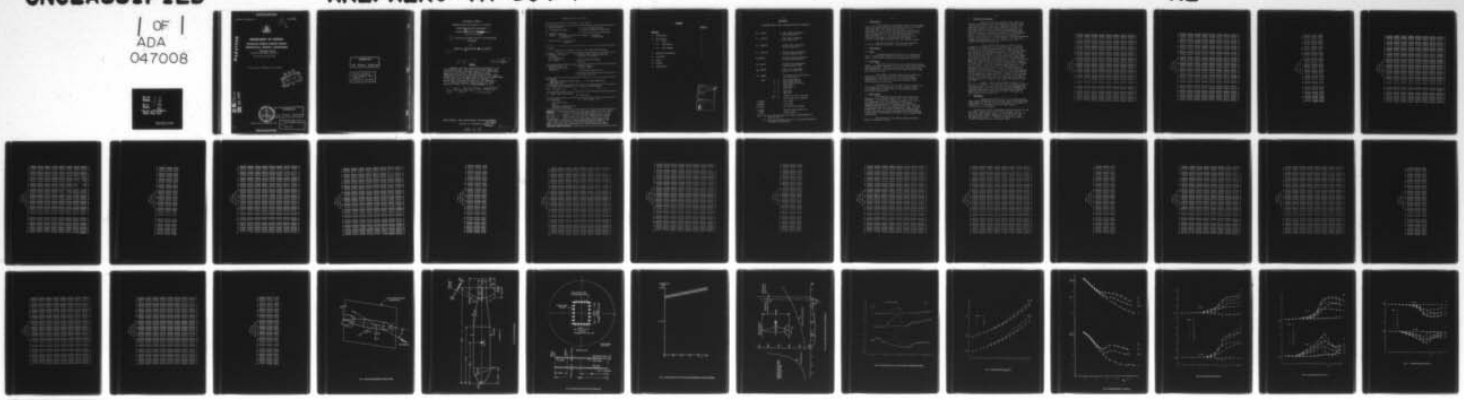

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DEPARTMENT OF DEFENCE

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TRANSONIC WIND TUNNEL TESTS ON A FIN STABILISED BOMB MODEL

N.Pollock, R.G. Broadbent & L.J. Roberts

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(6) TRANSONIC WIND TUNNEL TESTS ON A FIN STABILISED BOMB MODEL,

BY

(10) N. POLLOCK, R.G. BROADBENT AND L.J. ROBERTS

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SUMMARY

Transonic wind tunnel tests have been conducted on a fin stabilised bomb model. The tests covered a Mach number range of 0.95 to 1.20 and a pitch angle range of -2° to 28° for roll angles between 0° and 45°. The model exhibits normal longitudinal stability characteristics except for pitch angles between 14° and 21°, roll angles greater than 15° and a Mach number of 0.95 where a small unstable region was observed. The lateral force and moments were small for pitch angles up to 4°. At higher pitch angles and unsymmetrical roll angles significant lateral force and moments occurred.

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ABSTRACT: Transonic wind tunnel tests have been conducted on a fin stabilised bomb [illegible]. The tests covered a Mach number range of 0.95 to 1.20 and a pitch [illegible] range of -2° to 28° for roll angles between 0° and 45°. The model [illegible] normal longitudinal stability characteristics except for pitch angles between 14° and 21°, roll angles greater than 15° and a Mach number of 0.95 where a small unstable region was observed. The lateral force and moments were small for pitch angles up to 4°. At higher pitch angles and unsymmetrical roll angles significant lateral force and moments occurred.

CONTENTS

NOTATION

(Headings used in data listings are given in brackets)

C_x (AXIAL) = Axial force coefficient
= Axial force/$\frac{1}{2}\rho V^2 S$

C_Y (SIDE F) Side force coefficient
= side force/$\frac{1}{2}\rho V^2 S$

C_N (NORMAL) Normal Force coefficient
= Normal force/$\frac{1}{2}\rho V^2 S$

C_l (ROLL M) Rolling moment coefficient
= Rolling moment/$\frac{1}{2}\rho V^2 Sb$

Cm (PITCH) Pitching moment coefficient
= Pitching moment/$\frac{1}{2}\rho V^2 Sb$

C_n (YAW M) Yawing moment coefficient
= Yawing moment/$\frac{1}{2}\rho V^2 Sb$

C_{xb} (BASE) Base force coefficient
= (Pbase - P_o) Sb/$\frac{1}{2}\rho V^2 S$

C_D (DRAG) Drag coefficient corrected for Po acting on base

where
ρ = Free stream density
V = Free stream velocity
S = Body cross section area
= 2160.6 mm^2
b = Body diameter
= 52.45 mm
Sb = Base area
= 595.5 mm^2
Pbase = Pressure acting on base area
Po = Free Stream static pressure

θ (THETA) Pitch angle

ϕ (RANG) Roll angle

M_o (MACH) Free stream Mach number

R (REYN) Reynolds number based on b.

(SER) Serial number

Note: (i) The sign convention for coefficients and angles is shown in Fig. 1.

(ii) The moment reference centre is on the model centreline 124.6 mm aft of the nose.

1. Introduction

At the request of the Weapons Research and Development Wing of the Weapons Research Establishment a series of transonic wind tunnel tests were carried out on a model of a fin stabilised bomb. To avoid the construction of a new model for these tests, an existing model and strain gauge sting balance were supplied by W.R.E. This model had been tested at subsonic speeds at W.R.E. and the tests reported here were required to investigate the longitudinal and lateral stability of the bomb at transonic and low supersonic speeds.

The tests reported in this memo were conducted in the ARL transonic wind tunnel during December 1976.

2. Test Details

2.1 Model

A dimensioned drawing of the model is presented in Fig.2. Boundary layer transition was fixed on the body by two rows of 0.12mm diameter spheres located 20mm aft of the nose.

2.2 Wind Tunnel

These tests were conducted in the ARL transonic wind tunnel. The nominal dimensions of the tunnel test section are 813mm high by 533mm wide. For these tests the test section walls were all longitudinally slotted (Fig.3) with an open area ratio at the model location of 10.5%.

Mach number and dynamic pressure were derived from measurements of the static pressure in the plenum chamber surrounding the test section, and in the contraction entry, assuming these to be the static and total pressures of the test section flow respectively.

The frontal area of the model at zero incidence was 2252.2 mm^2 giving a blockage ratio of 0.52%. Because of this low blockage ratio no corrections for the effects of tunnel interference were applied.

2.3 Test Program

Six component force and moment coefficients were measured over a pitch angle range of $-2^\circ \leq \theta \leq 28^\circ$ in 2° increments. Roll angle was varied in the range $0 \leq \phi \leq 45^\circ$ in 7.5° increments. Due to the symmetry of the model the aerodynamic characteristics in the range $0 \leq \phi \leq 360^\circ$ can be determined from the tests in a single quadrant of ϕ. The range of Mach number covered for each attitude was $0.95 \leq M \leq 1.20$ in increments of 0.05. In addition, several runs were conducted at zero roll angle and various pitch angles with fine increments in Mach number to investigate the effects of wall reflected wave interference.

The variation of test Reynolds number with Mach number is presented in Fig.4.

3. Results and Discussion

Tests in slotted wall transonic wind tunnels are subject to interference from waves generated by the model being reflected back onto the model at low supersonic speeds. This interference covers the Mach number range from just above 1.0 until the reflection on the bow shock moves downstream of the model base. For the tests reported here the Mach number range for wall reflection interference is estimated to be $1.00 \leq M \leq 1.11$ (Fig.5). The effect of this interference is illustrated in Fig.6. In this Figure Cm is plotted against M with small increments in test Mach number for $\theta = 8^\circ$, 14°, and 28°. The lines drawn through the experimental points are considered to be the probable interference free results.

A full listing of the results of the main test program (not including the fine M increment runs) is presented in Table 1. To illustrate the trends of the data some of the M = 0.95 and M = 1.20 results are plotted. These two Mach numbers were chosen so that the discussion would not be complicated by wall reflection interference. In Fig. 7 C_N is plotted against θ for $\phi = 0^\circ$, 22.5° and 45°. It can be seen that for pitch angles up to about 8° ϕ has very little effect on CN. For larger pitch angles C_N is reduced as ϕ is increased from 0° to 45°. For C_N up to about -1.0 ($\theta \simeq 8^\circ$) ϕ has little effect and the model is stable. For larger values of C_N the stability is reduced as ϕ is increased from 0° to 45°. At M= 0.95 an unstable region appears at $-1.5 > C_N > -2.5$ ($14^\circ < \theta < 21^\circ$) as the model is rolled away from $\phi = 0^\circ$. Although not plotted, the M = 1.00 and 1.05 results also show vestiges of this unstable region. In Fig. 9 Cl is plotted against θ for $\phi = 0^\circ$ to 45° in 7.5° increments. As would be expected for the two symmetrical configurations $\phi = 0^\circ$ and 45°, C_l is near zero over the whole pitch angle range. For values of ϕ other than 0° and 45°, Cl is near zero up to $\theta \simeq 8^\circ$. For larger values of θ an increasing positive C_l appears. The largest Cl values occur for $\phi = 22.5^\circ$.

In Fig. 10 C_Y is plotted against θ for $\phi = 0^\circ$ to 45° in 7.5 increments. A similar plot of C_n is presented in Fig.11. From Figs. 10 and 11 it can be seen that for the two symmetrical configurations $\phi = 0^\circ$ and 45°, C_Y and C_n are small throughout the test pitch angle range. For values of ϕ other than 0° and 45° significant C_Y and C_n values occur for $\theta > 4^\circ$. The largest C_Y and C_n values occur for $\phi = 15^\circ$.

4. Conclusion

Transonic wind tunnel test on a fin stabilised bomb model supplied by WRE have been conducted. The tests covered a Mach number range of $0.95 \leq M \leq 1.20$ in 0.05 increments, a pitch angle of $-2^\circ \leq \theta \leq 28^\circ$ in 2° increments and a roll angle range of $0^\circ \leq \phi \leq 45^\circ$ in 7.5° increments.

The model has positive longitudinal stability over most of the test range. However for $14^\circ < \theta < 21^\circ$, $\phi > 7.5^\circ$ and M = 0.95 there is a small unstable region. For roll angles other than 0° and 45° the model exhibits significant C_Y and C_n when $\theta > 4^\circ$ and significant C_l when $\theta > 8^\circ$. For $\phi = 0^\circ$ and 45° C_Y, C_n and C_l are small through the entire pitch angle range.

TABLE 1.1

DATA LISTINGS

ROLL ANGLE = 0 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
2	0.183	0.951	-2.01	0.0	0.1472	0.1355	-0.2990	-0.0066	0.2974	0.0094	-0.0082	0.0002
3	0.190	0.998	-2.02	0.0	0.1577	0.1483	-0.3355	-0.0145	0.3263	0.0046	-0.0083	0.0008
4	0.195	1.050	-2.02	-0.1	0.1496	0.0922	-0.4923	0.0194	0.5166	0.0011	0.0131	-0.0004
5	0.196	1.099	-2.01	0.0	0.2063	0.2587	-0.6120	-0.0140	0.6048	0.0157	-0.0169	0.0010
6	0.201	1.149	-2.02	0.0	0.1359	0.0673	-0.6308	-0.0473	0.5878	0.0127	-0.0131	0.0005
7	0.206	1.201	-2.02	0.0	0.1881	0.1966	-0.6514	-0.0592	0.5984	0.0193	-0.0550	0.0013
8	0.206	1.201	0.00	0.0	0.0221	0.0464	-0.6467	-0.0642	0.5824	0.0145	-0.0438	0.0004
9	0.204	1.149	-0.01	0.0	-0.0251	-0.0810	-0.6297	-0.0495	0.5801	0.0157	-0.0171	0.0002
10	0.199	1.102	0.01	-0.1	0.0310	0.0793	-0.6126	-0.0220	0.5905	0.0155	-0.0195	-0.0002
11	0.195	1.049	-0.01	-0.1	-0.0000	-0.0035	-0.4917	0.0248	0.5165	0.0020	0.0123	-0.0003
12	0.191	1.000	-0.01	0.0	0.0016	0.0022	-0.3458	-0.0131	0.3326	0.0031	-0.0074	0.0003
13	0.186	0.951	0.00	0.0	0.0042	0.0103	-0.3014	-0.0128	0.2886	0.0050	-0.0117	-0.0001
16	0.173	0.951	2.01	0.0	-0.1752	-0.1445	-0.2974	-0.0128	0.2905	0.0090	-0.0090	0.0000
17	0.176	1.001	2.01	0.0	-0.1922	-0.1761	-0.3305	-0.0153	0.3217	0.0053	-0.0064	0.0000
18	0.183	1.050	2.01	-0.1	-0.1847	-0.1189	-0.4896	0.0175	0.5133	0.0049	-0.0012	-0.0002
19	0.188	1.098	2.01	0.0	-0.1891	-0.1403	-0.6111	-0.0208	0.5965	0.0140	-0.0198	0.0007
20	0.190	1.150	2.00	0.0	-0.2402	-0.2899	-0.6307	-0.0474	0.5912	0.0123	-0.0147	0.0000
21	0.195	1.200	2.01	0.0	-0.1882	-0.1330	-0.6568	-0.0612	0.6018	0.0277	-0.0278	0.0009
22	0.173	0.950	4.02	0.0	-0.3642	-0.3328	-0.3073	-0.0172	0.3149	0.0095	-0.0192	0.0001
23	0.180	0.998	4.02	0.0	-0.3780	-0.3328	-0.3291	-0.0184	0.3364	0.0076	-0.0154	0.0002
24	0.183	1.048	4.03	0.0	-0.3562	-0.2051	-0.4838	0.0132	0.5208	0.0043	0.0017	-0.0002
25	0.188	1.100	4.02	0.0	-0.4027	-0.3668	-0.6300	-0.0438	0.6130	0.0132	-0.0178	0.0011
26	0.191	1.150	4.02	0.0	-0.4378	-0.4776	-0.6319	-0.0569	0.6042	0.0144	-0.0294	0.0004
27	0.195	1.199	4.03	0.0	-0.3884	-0.3216	-0.6564	-0.0648	0.6174	0.0278	-0.0279	0.0011
28	0.176	0.950	6.02	0.0	-0.5860	-0.6149	-0.3076	-0.0248	0.3427	0.0080	-0.0313	0.0013
29	0.180	1.001	6.03	0.0	-0.5907	-0.5659	-0.3319	-0.0202	0.3720	0.0070	-0.0135	0.0002
30	0.185	1.049	6.05	0.0	-0.5533	-0.3502	-0.4950	0.0110	0.5615	0.0015	-0.0020	0.0009
31	0.190	1.099	6.03	0.0	-0.6463	-0.6721	-0.6484	-0.0481	0.6649	0.0198	-0.0382	0.0026
32	0.211	1.148	6.03	0.0	-0.6544	-0.7010	-0.6384	-0.0620	0.6440	0.0156	-0.0363	0.0028
33	0.198	1.200	6.04	0.0	-0.6130	-0.5567	-0.6633	-0.0666	0.6579	0.0231	-0.0678	0.0013
36	0.181	0.951	8.03	0.0	-0.8264	-0.9555	-0.2964	-0.0199	0.3892	0.0055	-0.0092	0.0001
37	0.185	0.998	8.04	-0.1	-0.8337	-0.8792	-0.3217	-0.0291	0.4063	0.0031	-0.0045	-0.0010
38	0.190	1.049	8.07	-0.1	-0.7734	-0.5528	-0.4890	0.0059	0.5981	0.0022	0.0019	-0.0009
39	0.195	1.102	8.04	0.0	-0.9010	-0.9992	-0.6608	-0.0581	0.7228	0.0132	-0.0176	0.0003
40	0.198	1.148	8.05	0.0	-0.8812	-0.9413	-0.6382	-0.0596	0.6963	0.0154	-0.0173	0.0002
41	0.201	1.198	8.06	0.0	-0.8483	-0.8049	-0.6671	-0.0688	0.7113	0.0226	-0.0537	0.0008
42	0.181	0.951	10.03	-0.1	-1.0771	-1.2951	-0.2898	-0.0305	0.4430	0.0047	-0.0082	-0.0006
43	0.186	1.001	10.05	-0.1	-1.0942	-1.1446	-0.3489	-0.0349	0.5002	0.0027	-0.0011	-0.0005
44	0.193	1.049	10.09	0.0	-1.0159	-0.7534	-0.5087	-0.0030	0.6759	-0.0033	0.0068	0.0026
45	0.198	1.100	10.05	0.0	-1.1725	-1.3126	-0.6654	-0.0715	0.7895	0.0166	-0.0251	0.0000
46	0.199	1.149	10.07	-0.1	-1.1183	-1.1585	-0.6487	-0.0643	0.7749	0.0125	-0.0082	-0.0029

TABLE 1.1

DATA LISTINGS

ROLL ANGLE = 0 DEG.

SER	REyN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
47	0,203	1,198	10.08	-0,1	-1.1048	-1.0565	-0,6788	-0.0817	0,7813	0.0190	-0.0388	-0.0009
48	0,181	0,950	12.04	-0,1	-1.3329	-1.6352	-0,2910	-0.0356	0,5278	0.0062	-0.0048	-0.0033
49	0,186	0,998	12.07	-0,1	-1.3634	-1.4286	-0,3381	-0.0408	0,5758	0.0051	-0.0043	-0.0010
50	0,193	1,050	12.12	-0,1	-1.2753	-0.9419	-0,5272	-0.0106	0,7727	-0.0061	0.0236	-0.0019
51	0,198	1,100	12.07	0,0	-1.4575	-1.6139	-0,6854	-0.0791	0,8978	0.0117	-0.0110	0.0010
52	0,201	1,149	12.09	-0,1	-1.3756	-1.3691	-0,6585	-0.0785	0,8554	0.0176	-0.0072	-0.0016
53	0,206	1,200	12.10	-0,1	-1.3664	-1.2881	-0,6881	-0.0832	0,8780	0.0198	-0.0490	-0.0012
56	0,173	0,950	14.05	-0,1	-1.6120	-1.9584	-0,2936	-0.0401	0,6371	0.0131	-0.0146	-0.0026
57	0,180	1,001	14.10	-0,1	-1.6596	-1.5563	-0,3641	-0.0454	0,7135	-0.0012	0.0029	-0.0028
58	0,181	1,051	14.14	-0,1	-1.6544	-1.0762	-0,5317	-0.0175	0,8785	0.0005	0.0056	-0.0017
59	0,185	1,099	14.09	0,0	-1.7715	-1.8716	-0,7003	-0.0909	1,0224	0.0129	-0.0140	0.0035
60	0,190	1,148	14.12	-0,1	-1.6685	-1.5341	-0,6682	-0.0845	0,9732	0.0178	-0.0223	-0.0031
61	0,195	1,201	14.13	0,0	-1.6760	-1.4894	-0,6959	-0.0883	0,9985	0.0276	-0.0801	0.0004
62	0,173	0,950	16.06	-0,1	-1.9001	-2.2441	-0,2975	-0.0486	0,7649	0.0175	-0.0200	-0.0026
63	0,180	1,000	16.13	-0,1	-1.9992	-1.8352	-0,3617	-0.0521	0,8528	0.0071	-0.0085	-0.0046
64	0,185	1,052	16.18	-0,1	-1.9064	-1.3331	-0,5544	-0.0212	1,0433	-0.0007	0.0029	-0.0024
65	0,190	1,100	16.13	0,0	-2.0947	-2.1035	-0,6990	-0.0837	1,1730	0.0079	-0.0112	0.0042
66	0,193	1,148	16.16	-0,1	-1.9762	-1.7339	-0,6729	-0.0823	1,1173	0.0258	-0.0333	-0.0040
67	0,196	1,198	16.17	-0,1	-2.0104	-1.7040	-0,6946	-0.0909	1,1398	0.0307	-0.0684	-0.0056
68	0,176	0,951	18.10	-0,1	-2.2861	-2.4837	-0,2925	-0.0601	0,9312	0.0302	-0.0336	-0.0074
69	0,181	1,001	18.17	-0,1	-2.4221	-2.1041	-0,3791	-0.0536	1,0648	0.0171	-0.0158	-0.0105
70	0,185	1,049	18.22	-0,1	-2.2804	-1.5299	-0,5505	-0.0260	1,2114	0.0033	0.0183	-0.0070
71	0,190	1,099	18.17	0,0	-2.4695	-2.3463	-0,7004	-0.0978	1,3427	0.0075	-0.0077	0.0014
72	0,195	1,149	18.21	-0,1	-2.4169	-2.0060	-0,6701	-0.0884	1,3079	0.0523	-0.0408	-0.0192
73	0,217	1,200	18.23	-0,1	-2.4682	-1.9929	-0,6860	-0.0896	1,3387	0.0327	-0.0752	-0.0085
76	0,181	0,950	20.17	-0,1	-2.8343	-2.7055	-0,2717	-0.0460	1,1891	0.0247	-0.0317	-0.0047
77	0,185	0,999	20.24	-0,1	-2.9960	-2.4122	-0,3700	-0.0485	1,3382	0.0058	0.0290	-0.0133
78	0,190	1,050	20.29	-0,1	-2.8283	-1.8513	-0,5217	-0.0274	1,4445	0.0093	0.0183	-0.0114
79	0,195	1,103	20.24	-0,1	-3.0075	-2.6580	-0,6842	-0.0846	1,6029	-0.0036	0.0203	-0.0050
80	0,199	1,150	20.27	-0,1	-2.8702	-2.2742	-0,6528	-0.0875	1,5247	0.0197	-0.0154	-0.0051
81	0,203	1,199	20.29	-0,1	-2.8660	-2.2169	-0,6714	-0.0860	1,5428	0.0278	-0.0378	-0.0138
82	0,181	0,951	22.23	0,0	-3.3000	-2.9017	-0,2630	-0.0527	1,4431	0.0186	-0.0166	0.0000
83	0,186	1,000	22.29	-0,1	-3.4044	-2.6035	-0,3551	-0.0467	1,5770	0.0097	0.0212	-0.0130
84	0,193	1,049	22.34	-0,1	-3.3367	-2.2275	-0,5380	-0.0270	1,7412	0.0151	0.0131	-0.0147
85	0,198	1,098	22.30	-0,1	-3.4344	-2.8447	-0,6718	-0.1001	1,8322	0.0001	0.0335	-0.0081
86	0,201	1,150	22.33	-0,1	-3.2716	-2.4871	-0,6439	-0.0880	1,7571	0.0269	-0.0231	-0.0095
87	0,206	1,201	22.35	-0,1	-3.2826	-2.4506	-0,6560	-0.0833	1,7778	0.0272	-0.0386	-0.0113
88	0,183	0,948	24.29	0,0	-3.6888	-2.9721	-0,2523	-0.0566	1,6958	0.0178	-0.0182	0.0001
89	0,190	1,001	24.35	-0,1	-3.8082	-2.7688	-0,3474	-0.0512	1,8402	0.0265	-0.0034	-0.0116
90	0,195	1,050	24.40	-0,1	-3.8045	-2.5172	-0,5338	-0.0333	2,0276	0.0216	0.0073	-0.0107
91	0,199	1,099	24.36	-0,1	-3.8596	-3.0247	-0,6637	-0.0998	2,1060	0.0072	0.0274	-0.0079

TABLE 1.1

DATA LISTINGS

ROLL ANGLE = 0 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
92	0.201	1.148	24.39	-0.1	-3.7107	-2.7318	-0.6345	-0.0976	2.0213	0.0365	-0.0333	-0.0041
93	0.206	1.199	24.41	-0.1	-3.6948	-2.6604	-0.6401	-0.0907	2.0272	0.0351	-0.0362	-0.0119
96	0.178	0.931	26.34	-0.1	-4.0896	-2.9350	-0.2509	-0.0599	1.9859	0.0276	-0.0211	-0.0028
97	0.185	1.001	26.40	-0.1	-4.2255	-2.8418	-0.3489	-0.0522	2.1445	0.0457	-0.0366	-0.0072
98	0.190	1.051	26.44	-0.1	-4.2593	-2.7424	-0.5281	-0.0466	2.3275	0.0270	0.0052	-0.0095
99	0.193	1.101	26.40	-0.1	-4.2959	-3.2386	-0.6573	-0.1019	2.4080	0.0128	0.0238	-0.0084
100	0.196	1.151	26.43	-0.1	-4.1402	-2.9320	-0.6267	-0.1015	2.3132	0.0341	-0.0317	-0.0076
101	0.199	1.197	26.45	-0.1	-4.1259	-2.8597	-0.6311	-0.0971	2.3160	0.0443	-0.0707	-0.0091
102	0.181	0.951	28.40	-0.1	-4.4820	-3.0094	-0.2335	-0.0732	2.2732	0.0562	-0.0604	-0.0047
103	0.185	0.999	28.46	-0.1	-4.6388	-2.9497	-0.3378	-0.0547	2.4598	0.0438	-0.0369	-0.0079
104	0.190	1.049	28.50	-0.1	-4.7469	-3.0237	-0.5195	-0.0539	2.6742	0.0487	-0.0333	-0.0038
105	0.195	1.100	28.47	-0.1	-4.7465	-3.4303	-0.6397	-0.1145	2.7246	0.0201	0.0062	-0.0057
106	0.199	1.149	28.49	-0.1	-4.5832	-3.1772	-0.6099	-0.1047	2.6305	0.0447	-0.0527	-0.0022
107	0.201	1.199	28.51	-0.1	-4.5494	-3.0933	-0.6105	-0.0976	2.6226	0.0568	-0.0906	-0.0055

TABLE 1.2

DATA LISTINGS

ROLL ANGLE = 7.5 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
16	0.173	0.950	-2.02	7.5	0.1465	0.1347	-0.2954	-0.0058	0.2945	-0.0027	0.0015	0.0007
17	0.180	1.002	-2.02	7.5	0.1557	0.1493	-0.3163	-0.0141	0.3075	-0.0027	0.0102	0.0004
18	0.181	1.051	-2.02	7.5	0.1488	0.1011	-0.4778	0.0204	0.5031	-0.0065	0.0113	0.0011
19	0.188	1.100	-2.02	7.5	0.1978	0.2348	-0.5921	-0.0167	0.5820	0.0057	0.0049	0.0006
20	0.191	1.152	-2.02	7.5	0.1358	0.0717	-0.6299	-0.0505	0.5837	0.0076	-0.0094	0.0015
21	0.195	1.201	-2.02	7.5	0.1844	0.1831	-0.6471	-0.0551	0.5980	0.0244	-0.0675	0.0012
24	0.178	0.950	0.00	7.4	-0.0118	-0.0043	-0.2912	-0.0068	0.2843	0.0029	-0.0042	-0.0003
25	0.181	1.000	0.01	7.4	-0.0164	-0.0142	-0.3293	-0.0043	0.3250	0.0035	-0.0038	0.0001
26	0.185	1.049	0.01	7.4	-0.0187	-0.0210	-0.4709	0.0201	0.4909	-0.0062	0.0205	-0.0006
27	0.190	1.101	0.01	7.5	0.0049	0.0513	-0.5882	-0.0029	0.5852	0.0084	-0.0052	0.0002
28	0.195	1.151	-0.01	7.5	-0.0443	-0.0821	-0.6290	-0.0368	0.5921	0.0092	-0.0150	0.0014
29	0.198	1.200	0.00	7.5	-0.0040	0.0041	-0.6381	-0.0498	0.5883	0.0088	-0.0195	0.0007
30	0.178	0.950	2.01	7.4	-0.1752	-0.1447	-0.2984	-0.0111	0.2932	0.0024	-0.0009	0.0000
31	0.185	0.999	2.01	7.5	-0.1904	-0.1753	-0.3102	-0.0157	0.3009	0.0027	-0.0041	0.0004
32	0.186	1.052	2.02	7.4	-0.1871	-0.1291	-0.4782	0.0168	0.5012	-0.0010	0.0098	-0.0004
33	0.193	1.101	2.02	7.5	-0.1846	-0.1273	-0.5886	-0.0142	0.5805	0.0102	-0.0100	0.0012
34	0.198	1.148	2.01	7.5	-0.2231	-0.2261	-0.6347	-0.0501	0.5920	0.0144	-0.0161	0.0006
35	0.201	1.200	2.02	7.5	-0.1841	-0.1344	-0.6442	-0.0518	0.5984	0.0257	-0.0766	0.0002
36	0.178	0.951	4.01	7.4	-0.3577	-0.3265	-0.2974	-0.0165	0.3052	0.0086	-0.0210	0.0000
37	0.185	0.999	4.02	7.5	-0.3744	-0.3331	-0.3180	-0.0166	0.3269	0.0098	-0.0255	0.0004
38	0.190	1.051	4.03	7.4	-0.3560	-0.2193	-0.4710	0.0137	0.5085	0.0029	0.0122	-0.0007
39	0.195	1.101	4.02	7.5	-0.3977	-0.3529	-0.6092	-0.0253	0.6104	0.0162	-0.0345	0.0020
40	0.196	1.150	4.02	7.5	-0.4247	-0.4283	-0.6354	-0.0513	0.6125	0.0175	-0.0278	0.0013
41	0.201	1.203	4.03	7.5	-0.3875	-0.3268	-0.6521	-0.0580	0.6198	0.0273	-0.0811	0.0008
44	0.173	0.951	6.02	7.5	-0.5676	-0.5913	-0.2877	-0.0148	0.3310	0.0167	-0.0513	0.0005
45	0.180	0.999	6.03	7.5	-0.5826	-0.5677	-0.3093	-0.0193	0.3496	0.0135	-0.0437	0.0004
46	0.183	1.048	6.05	7.5	-0.5424	-0.3379	-0.4783	0.0091	0.5418	0.0078	-0.0182	0.0002
47	0.188	1.098	6.03	7.5	-0.6342	-0.6362	-0.6217	-0.0302	0.6549	0.0221	-0.0599	0.0034
48	0.191	1.151	6.03	7.5	-0.6400	-0.6624	-0.6372	-0.0576	0.6437	0.0210	-0.0487	0.0032
49	0.195	1.201	6.04	7.5	-0.6070	-0.5522	-0.6558	-0.0680	0.6484	0.0260	-0.0766	0.0026
50	0.176	0.949	8.03	7.5	-0.8151	-0.9462	-0.2913	-0.0270	0.3755	0.0368	-0.0967	0.0006
51	0.180	0.999	8.04	7.4	-0.8276	-0.8680	-0.3194	-0.0212	0.4110	0.0260	-0.0694	-0.0010
52	0.185	1.049	8.07	7.4	-0.7635	-0.5310	-0.4870	0.0050	0.5943	0.0126	-0.0265	-0.0033
53	0.190	1.098	8.04	7.5	-0.8948	-0.9690	-0.6403	-0.0479	0.7118	0.0279	-0.0601	0.0013
54	0.195	1.151	8.05	7.5	-0.8692	-0.9013	-0.6429	-0.0587	0.7081	0.0268	-0.0608	0.0007
55	0.196	1.200	8.06	7.5	-0.8426	-0.7923	-0.6628	-0.0708	0.7043	0.0313	-0.0899	0.0023
56	0.176	0.950	10.03	7.5	-1.0583	-1.2692	-0.2845	-0.0344	0.4307	0.0631	-0.1640	0.0007
57	0.181	0.998	10.05	7.4	-1.0829	-1.1743	-0.3175	-0.0284	0.4736	0.0427	-0.1186	-0.0014
58	0.185	1.049	10.09	7.5	-0.9937	-0.7110	-0.4892	-0.0020	0.6537	0.0161	-0.0673	0.0019
59	0.190	1.098	10.06	7.5	-1.1620	-1.2692	-0.6533	-0.0530	0.7940	0.0303	-0.0884	0.0060
60	0.195	1.150	10.07	7.5	-1.1057	-1.1156	-0.6522	-0.0608	0.7756	0.0364	-0.0832	0.0011

TABLE 1.2

DATA LISTINGS

ROLL ANGLE = 7.5 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
61	0.198	1.200	10.08	7.5	-1.1007	-1.0470	-0.6731	-0.0727	0.7837	0.0385	-0.1092	0.0037
64	0.181	0.950	12.04	7.5	-1.5066	-1.5919	-0.2808	-0.0262	0.5215	0.0811	-0.2269	0.0029
65	0.185	0.998	12.07	7.4	-1.5459	-1.4055	-0.3234	-0.0351	0.5634	0.0448	-0.1288	-0.0003
66	0.190	1.049	12.12	7.4	-1.2488	-0.8810	-0.5035	-0.0088	0.7458	0.0239	-0.0573	-0.0010
67	0.195	1.099	12.08	7.5	-1.4479	-1.5626	-0.6740	-0.0698	0.8937	0.0472	-0.1379	0.0065
68	0.199	1.149	12.10	7.5	-1.5690	-1.3326	-0.6640	-0.0776	0.8602	0.0454	-0.0983	0.0018
69	0.203	1.199	12.11	7.5	-1.5712	-1.2846	-0.6801	-0.0809	0.8734	0.0417	-0.1269	0.0063
70	0.181	0.952	14.04	7.5	-1.5703	-1.9026	-0.2882	-0.0463	0.6159	0.1064	-0.2915	0.0101
71	0.186	0.998	14.09	7.5	-1.6429	-1.6081	-0.3372	-0.0448	0.6838	0.0534	-0.1455	0.0011
72	0.193	1.050	14.15	7.5	-1.5347	-1.0326	-0.5208	-0.0164	0.8644	0.0364	-0.0947	0.0027
73	0.196	1.102	14.10	7.5	-1.7518	-1.8258	-0.6940	-0.0836	1.0189	0.0569	-0.1596	0.0101
74	0.201	1.149	14.12	7.5	-1.6457	-1.5456	-0.6727	-0.0829	0.9735	0.0414	-0.1034	0.0047
75	0.203	1.200	14.14	7.5	-1.6553	-1.4914	-0.6888	-0.0783	0.9963	0.0411	-0.1377	0.0083
76	0.183	0.952	16.06	7.5	-1.8462	-2.1619	-0.2879	-0.0490	0.7405	0.1274	-0.3579	0.0167
77	0.186	1.000	16.13	7.5	-1.9723	-1.8090	-0.3488	-0.0503	0.8349	0.0782	-0.2112	0.0033
78	0.193	1.049	16.19	7.5	-1.8510	-1.2023	-0.5301	-0.0220	1.0042	0.0515	-0.1412	0.0080
79	0.199	1.101	16.14	7.5	-2.0712	-2.0290	-0.6911	-0.0765	1.1662	0.0766	-0.2183	0.0151
80	0.201	1.148	16.16	7.5	-1.9780	-1.7580	-0.6752	-0.0849	1.1177	0.0790	-0.2082	0.0078
81	0.206	1.198	16.18	7.5	-2.0006	-1.6934	-0.6880	-0.0852	1.1366	0.0734	-0.2186	0.0098
85	0.170	0.951	18.10	7.5	-2.2620	-2.3501	-0.2857	-0.0440	0.9326	0.1864	-0.4979	0.0268
86	0.176	0.999	18.16	7.4	-2.5976	-2.0464	-0.3618	-0.0524	1.0414	0.1268	-0.3289	-0.0003
87	0.180	1.048	18.22	7.5	-2.2035	-1.3398	-0.5246	-0.0270	1.1617	0.0943	-0.2430	0.0109
88	0.185	1.100	18.16	7.5	-2.4484	-2.2682	-0.6996	-0.0840	1.3483	0.1059	-0.3009	0.0205
89	0.188	1.150	18.20	7.5	-2.4139	-2.0060	-0.6799	-0.0873	1.3170	0.1647	-0.3565	0.0006
90	0.191	1.199	18.22	7.5	-2.4692	-1.9508	-0.6913	-0.0869	1.3463	0.1337	-0.3843	0.0239
91	0.170	0.952	20.16	7.5	-2.7393	-2.5145	-0.2787	-0.0595	1.1500	0.2081	-0.5413	0.0400
92	0.176	0.998	20.22	7.5	-2.9562	-2.3327	-0.3597	-0.0487	1.3141	0.1858	-0.5023	0.0212
93	0.180	1.051	20.28	7.5	-2.7687	-1.6484	-0.5289	-0.0287	1.4293	0.1528	-0.3972	0.0329
94	0.185	1.099	20.24	7.5	-2.9727	-2.5067	-0.6841	-0.0919	1.5839	0.1847	-0.5218	0.0396
95	0.190	1.151	20.26	7.5	-2.8518	-2.1911	-0.6638	-0.0872	1.5286	0.1887	-0.4988	0.0376
96	0.195	1.200	20.28	7.5	-2.8541	-2.1396	-0.6765	-0.0823	1.5465	0.1840	-0.5267	0.0428
97	0.170	0.949	22.22	7.5	-3.1406	-2.6780	-0.2674	-0.0624	1.3770	0.1661	-0.4825	0.0613
98	0.176	0.998	22.28	7.5	-3.3565	-2.4813	-0.3569	-0.0525	1.5542	0.2456	-0.6592	0.0413
99	0.183	1.049	22.34	7.5	-3.1996	-1.8601	-0.5292	-0.0356	1.6728	0.1857	-0.4724	0.0519
100	0.188	1.101	22.29	7.5	-3.3772	-2.6888	-0.6747	-0.0927	1.7994	0.2239	-0.6273	0.0570
101	0.191	1.152	22.32	7.5	-3.2388	-2.3560	-0.6511	-0.0917	1.7443	0.2245	-0.5985	0.0550
102	0.195	1.201	22.34	7.5	-3.2556	-2.3221	-0.6654	-0.0895	1.7701	0.2148	-0.6098	0.0590
105	0.176	0.951	24.28	7.5	-3.5534	-2.6902	-0.2587	-0.0623	1.8402	0.1490	-0.3909	0.0695
106	0.181	1.000	24.34	7.5	-3.7361	-2.5609	-0.3506	-0.0546	1.8095	0.2832	-0.7561	0.0607
107	0.188	1.049	24.40	7.6	-3.6451	-2.0768	-0.5179	-0.0448	1.9368	0.2318	-0.5793	0.0722
108	0.193	1.100	24.36	7.6	-3.7846	-2.8056	-0.6581	-0.0976	2.0715	0.2389	-0.6468	0.0729

TABLE 1.2

DATA LISTINGS

ROLL ANGLE = 7.5 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
109	0.195	1.151	24.38	7.6	-3.6619	-2.5806	-0.6406	-0.0999	2.0041	0.2423	-0.6495	0.0719
110	0.198	1.200	24.40	7.6	-3.6591	-2.5067	-0.6461	-0.0964	2.0123	0.2304	-0.6354	0.0658
111	0.178	0.951	26.36	7.6	-3.9574	-2.6364	-0.2657	-0.0844	1.9196	0.1302	-0.2831	0.0812
112	0.185	0.999	26.40	7.6	-4.1469	-2.6420	-0.3447	-0.0600	2.0995	0.3169	-0.8167	0.0778
113	0.188	1.050	26.45	7.6	-4.1356	-2.3878	-0.5220	-0.0470	2.2679	0.2604	-0.6665	0.0900
114	0.195	1.101	26.42	7.6	-4.2463	-3.0645	-0.6543	-0.1074	2.3792	0.2378	-0.6473	0.0704
115	0.199	1.152	26.44	7.6	-4.0964	-2.8156	-0.6273	-0.1039	2.2926	0.2472	-0.6665	0.0738
116	0.201	1.199	26.46	7.6	-4.0697	-2.7157	-0.6282	-0.0979	2.2884	0.2453	-0.6678	0.0681
117	0.178	0.950	28.42	7.6	-4.2254	-2.5260	-0.2471	-0.1052	2.1358	0.1333	-0.2612	0.1065
118	0.186	1.001	28.48	7.6	-4.5325	-2.6844	-0.3357	-0.0716	2.3933	0.3153	-0.8080	0.0868
119	0.190	1.048	28.52	7.6	-4.6141	-2.6381	-0.5141	-0.0584	2.6036	0.2672	-0.6767	0.1022
120	0.195	1.100	28.49	7.6	-4.6919	-3.2498	-0.6374	-0.1139	2.6980	0.2340	-0.6252	0.0756
121	0.199	1.149	28.50	7.6	-4.5444	-3.0705	-0.6119	-0.1113	2.6084	0.2406	-0.6309	0.0723
122	0.203	1.198	28.52	7.6	-4.4980	-2.9685	-0.6070	-0.1046	2.5893	0.2461	-0.6609	0.0722

TABLE 1.3

DATA LISTINGS

ROLL ANGLE = 15 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
2	0.176	0.949	-2.01	14.9	0.1418	0.1319	-0.2904	-0.0080	0.2871	0.0070	-0.0021	-0.0002
3	0.180	1.000	-2.02	14.9	0.1519	0.1461	-0.3196	-0.0150	0.3096	0.0049	0.0046	-0.0001
4	0.185	1.052	-2.02	14.9	0.1428	0.0969	-0.4765	0.0181	0.4993	-0.0069	0.0237	-0.0004
5	0.190	1.101	-2.01	15.0	0.1956	0.2413	-0.6009	-0.0232	0.5842	0.0079	-0.0014	0.0015
6	0.193	1.149	-2.02	15.0	0.1326	0.0709	-0.6334	-0.0444	0.5932	0.0115	0.0018	0.0010
7	0.196	1.199	-2.02	15.0	0.1802	0.1791	-0.6492	-0.0624	0.5927	0.0289	-0.0733	0.0015
8	0.176	0.950	0.01	15.0	-0.0155	-0.0077	-0.2999	-0.0201	0.2797	0.0019	0.0114	0.0008
9	0.181	0.998	0.01	15.0	-0.0210	-0.0177	-0.3264	-0.0158	0.3105	0.0015	0.0039	0.0010
10	0.188	1.049	0.01	14.9	-0.0226	-0.0247	-0.4722	0.0169	0.4891	-0.0030	0.0309	-0.0003
11	0.193	1.100	0.01	15.0	0.0055	0.0549	-0.5931	-0.0114	0.5816	0.0075	0.0013	0.0012
12	0.196	1.150	0.01	15.0	-0.0428	-0.0655	-0.6337	-0.0402	0.5934	0.0122	-0.0150	0.0019
13	0.199	1.199	0.00	15.0	-0.0059	0.0080	-0.6443	-0.0528	0.5915	0.0125	-0.0355	0.0013
14	0.178	0.952	2.01	15.0	-0.1814	-0.1472	-0.3026	-0.0154	0.2933	0.0007	-0.0050	0.0003
15	0.185	0.999	2.01	14.9	-0.1972	-0.1809	-0.3179	-0.0156	0.3089	0.0007	0.0039	-0.0008
16	0.188	1.051	2.02	14.9	-0.1907	-0.1293	-0.4809	0.0118	0.4990	-0.0032	0.0207	-0.0002
17	0.193	1.100	2.02	15.0	-0.1881	-0.1265	-0.5921	-0.0151	0.5833	0.0129	-0.0183	0.0013
18	0.196	1.149	2.01	15.0	-0.2332	-0.2512	-0.6333	-0.0488	0.5923	0.0144	-0.0150	0.0011
19	0.201	1.200	2.01	15.0	-0.1897	-0.1395	-0.6475	-0.0644	0.5893	0.0222	-0.0665	0.0007
22	0.173	0.952	4.02	15.0	-0.3608	-0.3264	-0.2963	-0.0138	0.3071	0.0114	-0.0203	0.0007
23	0.176	1.001	4.02	15.0	-0.3737	-0.3339	-0.3094	-0.0216	0.3132	0.0104	-0.0212	0.0001
24	0.180	1.048	4.04	15.0	-0.3529	-0.1943	-0.4761	0.0143	0.5140	0.0068	-0.0079	0.0006
25	0.204	1.099	4.03	15.0	-0.3968	-0.3440	-0.6121	-0.0333	0.6052	0.0226	-0.0382	0.0017
26	0.190	1.151	4.02	15.0	-0.4311	-0.4435	-0.6335	-0.0544	0.6079	0.0240	-0.0572	0.0029
27	0.191	1.199	4.03	15.0	-0.3902	-0.3287	-0.6500	-0.0642	0.6118	0.0298	-0.0855	0.0013
28	0.173	0.950	6.03	15.0	-0.5632	-0.5733	-0.2906	-0.0204	0.3279	0.0301	-0.0820	0.0012
29	0.180	0.997	6.03	15.0	-0.5818	-0.5538	-0.3111	-0.0172	0.3534	0.0235	-0.0629	0.0003
30	0.183	1.049	6.05	15.0	-0.5410	-0.3305	-0.4745	0.0111	0.5399	0.0148	-0.0317	0.0007
31	0.188	1.100	6.04	15.0	-0.6300	-0.6150	-0.6164	-0.0348	0.6447	0.0268	-0.0650	0.0036
32	0.211	1.148	6.04	15.0	-0.6371	-0.6378	-0.6404	-0.0566	0.6476	0.0288	-0.0698	0.0031
33	0.214	1.200	6.05	15.0	-0.6078	-0.5445	-0.6553	-0.0670	0.6491	0.0314	-0.0908	0.0031
37	0.168	0.950	8.03	15.0	-0.8005	-0.9019	-0.2866	-0.0153	0.3805	0.0596	-0.1667	0.0017
38	0.175	1.000	8.04	14.9	-0.8128	-0.8169	-0.3170	-0.0254	0.4024	0.0439	-0.1248	-0.0005
39	0.198	1.050	8.07	14.9	-0.7546	-0.4871	-0.4917	0.0020	0.5947	0.0278	-0.0541	-0.0016
40	0.201	1.101	8.05	15.0	-0.8900	-0.9425	-0.6565	-0.0608	0.7144	0.0462	-0.1144	0.0021
41	0.185	1.150	8.05	15.0	-0.8682	-0.8857	-0.6444	-0.0641	0.6961	0.0439	-0.0867	0.0012
42	0.190	1.199	8.06	15.0	-0.8427	-0.7698	-0.6686	-0.0728	0.7081	0.0361	-0.0931	0.0035
43	0.170	0.949	10.03	15.0	-1.0408	-1.2072	-0.2831	-0.0289	0.4317	0.0973	-0.2681	0.0025
44	0.173	1.002	10.06	14.9	-1.0600	-1.0700	-0.3245	-0.0293	0.4758	0.0596	-0.1742	-0.0026
45	0.180	1.050	10.09	15.0	-0.9786	-0.6444	-0.4962	0.0010	0.6610	0.0283	-0.0759	0.0034
46	0.185	1.101	10.06	15.0	-1.1493	-1.2156	-0.6587	-0.0657	0.7846	0.0518	-0.1568	0.0092
47	0.190	1.148	10.07	15.0	-1.0996	-1.0747	-0.6598	-0.0698	0.7732	0.0585	-0.1224	0.0024

TABLE 1.3

DATA LISTINGS

ROLL ANGLE = 15 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
48	0.191	1.198	10.08	15.0	-1.0965	-1.0064	-0.6800	-0.0763	0.7863	0.0442	-0.1231	0.0082
49	0.170	0.951	12.04	15.0	-1.2764	-1.4995	-0.2845	-0.0409	0.5045	0.1330	-0.3591	0.0081
50	0.176	1.000	12.08	15.0	-1.3189	-1.2544	-0.3411	-0.0322	0.5780	0.0692	-0.1836	0.0001
51	0.199	1.049	12.12	15.0	-1.2311	-0.7907	-0.5090	-0.0082	0.7481	0.0363	-0.0962	0.0032
52	0.185	1.100	12.08	15.0	-1.4409	-1.5054	-0.6847	-0.0835	0.8895	0.0728	-0.2104	0.0119
53	0.190	1.149	12.09	15.0	-1.3676	-1.2869	-0.6698	-0.0801	0.8632	0.0623	-0.1581	0.0061
54	0.195	1.200	12.10	15.0	-1.3631	-1.2259	-0.6841	-0.0834	0.8733	0.0533	-0.1622	0.0138
77	0.168	0.951	14.04	15.0	-1.5307	-1.7793	-0.2825	-0.0303	0.6162	0.1566	-0.4573	0.0156
78	0.175	0.999	14.10	15.0	-1.6024	-1.4216	-0.3431	-0.0386	0.6858	0.0782	-0.2312	0.0049
79	0.176	1.052	14.14	15.0	-1.4965	-0.9204	-0.5189	-0.0115	0.8579	0.0448	-0.1333	0.0106
80	0.180	1.100	14.10	15.0	-1.7317	-1.7386	-0.6894	-0.0855	1.0076	0.0893	-0.2802	0.0197
81	0.185	1.149	14.12	15.0	-1.6536	-1.4754	-0.6716	-0.0793	0.9779	0.0908	-0.2442	0.0101
82	0.190	1.199	14.14	15.0	-1.6494	-1.4268	-0.6868	-0.0891	0.9824	0.0664	-0.2225	0.0183
83	0.170	0.951	16.07	15.0	-1.8148	-1.9936	-0.2905	-0.0598	0.7240	0.2029	-0.5747	0.0261
84	0.175	0.998	16.13	15.0	-1.9131	-1.6311	-0.3420	-0.0499	0.8122	0.1184	-0.3443	0.0074
85	0.180	1.050	16.19	15.0	-1.7908	-1.0343	-0.5254	-0.0237	0.9811	0.0802	-0.2262	0.0180
86	0.185	1.100	16.13	15.0	-2.0400	-1.9216	-0.6897	-0.0845	1.1482	0.1318	-0.3993	0.0288
87	0.188	1.149	16.16	15.0	-1.9583	-1.6555	-0.6747	-0.0811	1.1151	0.1394	-0.3792	0.0174
88	0.190	1.201	16.17	15.0	-1.9719	-1.5842	-0.6903	-0.0791	1.1364	0.1167	-0.3523	0.0231
89	0.170	0.951	18.12	15.0	-2.1570	-2.0903	-0.2877	-0.0627	0.8844	0.2700	-0.7434	0.0516
90	0.175	0.998	18.18	15.0	-2.3090	-1.7992	-0.3573	-0.0464	1.0159	0.2042	-0.5538	0.0116
91	0.180	1.051	18.24	15.0	-2.1574	-1.1712	-0.5385	-0.0245	1.1633	0.1488	-0.4099	0.0359
92	0.185	1.102	18.18	15.0	-2.3930	-2.1027	-0.6915	-0.0905	1.3175	0.1930	-0.5745	0.0445
93	0.188	1.148	18.21	15.0	-2.3606	-1.8520	-0.6759	-0.0908	1.2934	0.2491	-0.6194	0.0234
94	0.191	1.200	18.24	15.0	-2.4002	-1.7750	-0.6841	-0.0884	1.3168	0.2213	-0.6576	0.0504
97	0.168	0.950	20.17	15.1	-2.6046	-2.1263	-0.2791	-0.0593	1.1048	0.3013	-0.8396	0.0881
98	0.175	1.000	20.24	15.0	-2.8181	-1.9462	-0.3629	-0.0482	1.2701	0.3077	-0.8653	0.0498
99	0.195	1.051	20.29	15.1	-2.6432	-1.3019	-0.5330	-0.0343	1.3847	0.2658	-0.7263	0.0771
100	0.183	1.101	20.24	15.1	-2.8744	-2.2471	-0.6788	-0.0979	1.5394	0.3211	-0.9231	0.0852
101	0.185	1.150	20.27	15.1	-2.7760	-1.9854	-0.6632	-0.0941	1.4953	0.3171	-0.8830	0.0802
102	0.190	1.200	20.28	15.1	-2.7713	-1.9132	-0.6757	-0.0908	1.5092	0.2945	-0.8433	0.0821
103	0.170	0.949	22.24	15.1	-2.9844	-2.1653	-0.2879	-0.0851	1.3171	0.2197	-0.6328	0.1158
104	0.175	1.001	22.30	15.1	-3.1955	-2.0486	-0.3627	-0.0617	1.4907	0.3807	-1.0411	0.0843
105	0.180	1.051	22.35	15.1	-3.0380	-1.4203	-0.5380	-0.0473	1.6093	0.2842	-0.7611	0.1016
106	0.185	1.102	22.29	15.1	-3.2880	-2.4456	-0.6769	-0.1035	1.7779	0.3386	-0.9749	0.1024
107	0.206	1.152	22.32	15.1	-3.1512	-2.1407	-0.6517	-0.0919	1.7145	0.3395	-0.9497	0.0979
108	0.190	1.201	22.34	15.1	-3.1669	-2.0988	-0.6643	-0.0916	1.7333	0.3181	-0.9245	0.1012
110	0.170	0.949	24.29	15.1	-3.3888	-2.2238	-0.2899	-0.0907	1.5760	0.1599	-0.4465	0.1402
111	0.176	1.002	24.36	15.1	-3.5699	-2.0816	-0.3738	-0.0705	1.7486	0.3998	-1.1019	0.1120
112	0.181	1.051	24.42	15.1	-3.5003	-1.6505	-0.5465	-0.0557	1.8938	0.2795	-0.7514	0.1141
113	0.185	1.098	24.37	15.1	-3.6986	-2.5289	-0.6653	-0.1085	2.0330	0.3129	-0.9083	0.1153

TABLE 1.3

DATA LISTINGS

ROLL ANGLE = 15 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
114	0.190	1.149	24.38	15.1	-3.5790	-2.3336	-0.6455	-0.1032	1.9713	0.3355	-0.9480	0.1145
115	0.191	1.200	24.40	15.1	-3.5684	-2.2867	-0.6497	-0.0986	1.9759	0.3230	-0.9335	0.1095
118	0.175	0.952	26.36	15.1	-3.8041	-2.2697	-0.2783	-0.0958	1.8529	0.1411	-0.3435	0.1424
119	0.181	1.001	26.43	15.1	-3.9452	-2.0564	-0.3719	-0.0851	2.0125	0.4084	-1.1215	0.1375
120	0.185	1.052	26.48	15.1	-3.9199	-1.8061	-0.5308	-0.0638	2.1657	0.2956	-0.7978	0.1265
121	0.190	1.099	26.43	15.1	-4.1133	-2.6996	-0.6612	-0.1171	2.3178	0.3022	-0.8708	0.1238
122	0.195	1.152	26.44	15.1	-3.9872	-2.5422	-0.6315	-0.1114	2.2410	0.3138	-0.8817	0.1134
123	0.196	1.199	26.46	15.1	-3.9709	-2.4781	-0.6364	-0.1060	2.2441	0.3186	-0.9145	0.1130
124	0.175	0.952	28.42	15.2	-4.1442	-2.2280	-0.2642	-0.1224	2.0977	0.1580	-0.3821	0.1698
125	0.181	0.999	28.49	15.2	-4.3194	-2.0805	-0.3686	-0.0981	2.2984	0.3719	-1.0036	0.1644
126	0.185	1.049	28.54	15.2	-4.3501	-1.9206	-0.5231	-0.0772	2.4706	0.2833	-0.7373	0.1563
127	0.190	1.100	28.50	15.1	-4.5396	-2.8352	-0.6500	-0.1320	2.6210	0.2877	-0.8129	0.1311
128	0.195	1.152	28.51	15.1	-4.4152	-2.7289	-0.6218	-0.1221	2.5463	0.2941	-0.8149	0.1219
129	0.198	1.202	28.52	15.1	-4.3934	-2.6945	-0.6233	-0.1109	2.5482	0.2957	-0.8392	0.1119

TABLE 1.4

DATA LISTINGS

ROLL ANGLE = 22,5 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
3	0.178	0.952	-2.02	22.4	0.1427	0.1292	-0.2939	-0.0123	0.2863	0.0036	0.0084	-0.0001
4	0.185	1.030	-2.02	22.5	0.1521	0.1455	-0.3193	-0.0116	0.3127	0.0003	0.0115	0.0002
5	0.193	1.051	-2.02	22.5	0.1432	0.0909	-0.4767	0.0179	0.4992	-0.0061	0.0372	0.0001
6	0.195	1.099	-2.02	22.5	0.1956	0.2345	-0.5987	-0.0171	0.5880	0.0068	0.0145	0.0008
7	0.196	1.149	-2.02	22.5	0.1429	0.1081	-0.6387	-0.0474	0.5958	0.0126	-0.0079	0.0015
8	0.201	1.200	-2.03	22.5	0.1797	0.1747	-0.6475	-0.0554	0.5981	0.0212	-0.0530	0.0005
9	0.181	0.951	0.00	22.5	-0.0146	-0.0056	-0.3031	-0.0132	0.2899	0.0047	-0.0008	0.0005
10	0.185	1.001	0.00	22.5	-0.0202	-0.0189	-0.3231	-0.0114	0.3117	0.0010	0.0060	0.0005
11	0.193	1.051	0.01	22.5	-0.0214	-0.0209	-0.4807	0.0196	0.5002	-0.0049	0.0327	0.0001
12	0.195	1.100	0.01	22.5	0.0042	0.0534	-0.5974	-0.0066	0.5907	0.0063	0.0102	0.0004
13	0.199	1.149	-0.01	22.5	-0.0465	-0.0855	-0.6330	-0.0442	0.5888	0.0145	-0.0138	0.0015
14	0.203	1.200	0.00	22.5	-0.0068	0.0033	-0.6456	-0.0582	0.5874	0.0174	-0.0231	0.0004
15	0.181	0.950	2.00	22.5	-0.1784	-0.1489	-0.3011	-0.0207	0.2864	0.0019	0.0039	0.0004
16	0.186	1.002	2.01	22.5	-0.1963	-0.1803	-0.3189	-0.0133	0.3122	-0.0010	0.0086	0.0003
17	0.193	1.049	2.01	22.4	-0.1924	-0.1394	-0.4729	0.0097	0.4890	-0.0029	0.0204	-0.0007
18	0.198	1.100	2.01	22.5	-0.1883	-0.1333	-0.5998	-0.0130	0.5930	0.0112	-0.0064	0.0009
19	0.199	1.150	2.00	22.5	-0.2362	-0.2683	-0.6305	-0.0508	0.5876	0.0122	-0.0103	0.0010
20	0.203	1.200	2.01	22.5	-0.1936	-0.1473	-0.6468	-0.0567	0.5964	0.0224	-0.0546	0.0007
23	0.178	0.950	4.02	22.5	-0.3533	-0.3098	-0.2941	-0.0146	0.3035	0.0079	-0.0224	0.0012
24	0.181	0.999	4.02	22.4	-0.3713	-0.3260	-0.3133	-0.0202	0.3184	0.0060	-0.0016	-0.0001
25	0.185	1.048	4.04	22.4	-0.3488	-0.1824	-0.4809	0.0110	0.5152	0.0036	0.0014	0.0000
26	0.191	1.102	4.03	22.5	-0.3922	-0.3347	-0.6103	-0.0268	0.6096	0.0207	-0.0334	0.0013
28	0.195	1.150	4.03	22.5	-0.4231	-0.4169	-0.6352	-0.0596	0.6039	0.0196	-0.0383	0.0013
29	0.198	1.201	4.03	22.5	-0.3907	-0.3290	-0.6481	-0.0645	0.6096	0.0258	-0.0876	0.0013
32	0.176	0.949	6.02	22.5	-0.5547	-0.5411	-0.2943	-0.0211	0.3300	0.0290	-0.0771	0.0006
31	0.185	0.999	6.03	22.4	-0.5721	-0.5168	-0.3200	-0.0168	0.3617	0.0217	-0.0577	-0.0017
32	0.190	1.051	6.05	22.4	-0.5319	-0.2984	-0.4819	0.0049	0.5442	0.0136	-0.0294	-0.0001
33	0.193	1.098	6.04	22.5	-0.6226	-0.5914	-0.6141	-0.0341	0.6423	0.0244	-0.0529	0.0021
34	0.196	1.151	6.03	22.5	-0.6330	-0.6296	-0.6355	-0.0589	0.6400	0.0283	-0.0702	0.0017
35	0.201	1.200	6.05	22.5	-0.6067	-0.5436	-0.6551	-0.0631	0.6526	0.0304	-0.0992	0.0027
36	0.178	0.951	8.03	22.5	-0.7771	-0.8444	-0.2872	-0.0362	0.3571	0.0594	-0.1678	0.0009
37	0.185	1.000	8.04	22.4	-0.7941	-0.7725	-0.3125	-0.0218	0.3990	0.0488	-0.1481	-0.0024
38	0.190	1.051	8.07	22.4	-0.7399	-0.4577	-0.4827	0.0029	0.5845	0.0219	-0.0553	-0.0020
39	0.195	1.101	8.05	22.5	-0.8705	-0.8869	-0.6355	-0.0459	0.7057	0.0417	-0.1071	0.0022
42	0.198	1.148	8.06	22.5	-0.8535	-0.8306	-0.6419	-0.0639	0.6914	0.0384	-0.0995	0.0005
41	0.201	1.200	8.06	22.5	-0.8345	-0.7567	-0.6652	-0.0695	0.7069	0.0411	-0.1292	0.0047
44	0.173	0.951	10.03	22.5	-1.0071	-1.1217	-0.2740	-0.0240	0.4216	0.0956	-0.2764	0.0010
45	0.176	0.997	10.05	22.4	-1.0300	-1.0546	-0.2983	-0.0271	0.4468	0.0696	-0.2127	-0.0034
46	0.181	1.051	10.10	22.5	-0.9576	-0.5856	-0.4904	0.0030	0.6536	0.0251	-0.0979	0.0035
47	0.185	1.099	10.06	22.5	-1.1313	-1.1672	-0.6572	-0.0653	0.7845	0.0545	-0.1532	0.0065
48	0.193	1.149	10.07	22.5	-1.0823	-1.0256	-0.6502	-0.0691	0.7614	0.0512	-0.1270	0.0017

TABLE 1.4

DATA LISTINGS

ROLL ANGLE = 22,5 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
49	0.195	1.199	10.08	22.5	-1.0795	-0.9580	-0,6750	-0.0720	0,7827	0.0437	-0.1329	0.0104
2	0.170	0,951	12.05	22.5	-1.2365	-1.3779	-0,2758	-0.0290	0,4994	0.1315	-0.3772	0.0073
3	0.176	0,999	12.08	22.4	-1.2700	-1.1239	-0,3284	-0.0317	0,5560	0.0646	-0.1963	0.0027
4	0.180	1,052	12.12	22.5	-1.2058	-0.7157	-0,5070	-0.0042	0,7448	0.0388	-0.1204	0.0062
5	0.185	1,099	12.08	22.5	-1.4084	-1.4001	-0,6752	-0.0766	0,8801	0.0704	-0.2138	0.0144
6	0.190	1.148	12.10	22.5	-1.3446	-1.2171	-0,6738	-0.0773	0,8650	0.0619	-0.1644	0.0082
7	0.191	1,198	12.11	22.5	-1.3469	-1.1664	-0,6897	-0.0854	0,8734	0.0581	-0.1885	0.0186
8	0.173	0,949	14.06	22.5	-1.4788	-1.6252	-0,2838	-0.0386	0,5971	0.1593	-0.4885	0.0177
9	0.180	1,001	14.12	22.5	-1.5458	-1.2413	-0,3491	-0.0352	0,6815	0.0795	-0.2300	0.0061
10	0.183	1,049	14.15	22.5	-1.4712	-0.8287	-0,5206	-0.0132	0,8518	0.0521	-0.1560	0.0144
11	0.188	1,099	14.11	22.5	-1.6879	-1.5873	-0,6777	-0.0774	0,9938	0.0959	-0.2993	0.0248
12	0.191	1,151	14.13	22.5	-1.6170	-1.3644	-0,6746	-0.0833	0,9682	0.1014	-0.2826	0.0168
13	0.195	1,201	14.15	22.5	-1.6216	-1.3320	-0,6911	-0.0814	0,9874	0.0830	-0.2685	0.0264
14	0.176	0,950	16.09	22.5	-1.7372	-1.7966	-0,2863	-0.0493	0,7089	0.2035	-0.5897	0.0271
15	0.180	1,000	16.15	22.5	-1.8379	-1.3841	-0,3437	-0.0402	0,8028	0.1260	-0.3874	0.0136
16	0.185	1,051	16.20	22.5	-1.7429	-0.8801	-0,5214	-0.0161	0,9710	0.1019	-0.3048	0.0264
17	0.188	1,100	16.15	22.5	-1.7990	-1.7827	-0,6924	-0.0881	1,1364	0.1586	-0.4948	0.0402
18	0.193	1,150	16.17	22.5	-1.7122	-1.5188	-0,6781	-0.0827	1,1044	0.1587	-0.4497	0.0304
19	0.196	1,202	16.19	22.5	-1.7395	-1.4517	-0,6976	-0.0894	1,1249	0.1393	-0.4381	0.0352
22	0.170	0,950	18.12	22.5	-2.2294	-1.7596	-0,2821	-0.0477	0,8541	0.2595	-0.7385	0.0611
23	0.175	1,000	18.19	22.5	-2.1837	-1.4248	-0,3536	-0.0395	0,9792	0.2337	-0.6574	0.0242
24	0.180	1,050	18.24	22.5	-2.0637	-0.9147	-0,5298	-0.0219	1,1283	0.1859	-0.5395	0.0516
25	0.183	1,097	18.18	22.5	-2.0149	-1.8725	-0,6813	-0.0826	1,2911	0.2390	-0.7212	0.0617
26	0.186	1,149	18.22	22.5	-2.2781	-1.6213	-0,6670	-0.0848	1,2650	0.2992	-0.7937	0.0393
27	0.191	1,199	18.24	22.5	-2.3279	-1.5582	-0,6809	-0.0839	1,2984	0.2744	-0.8216	0.0620
28	0.170	0,948	20.20	22.6	-2.3858	-1.5957	-0,2987	-0.0864	1,0229	0.2139	-0.6496	0.1248
29	0.173	1,002	20.27	22.5	-2.6660	-1.4902	-0,3713	-0.0564	1,2187	0.3467	-1.0094	0.0617
30	0.180	1,048	20.31	22.6	-2.5532	-1.0054	-0,5400	-0.0351	1,3599	0.2590	-0.7370	0.0869
31	0.185	1,100	20.26	22.6	-2.7932	-1.9905	-0,6764	-0.0924	1,5148	0.3430	-1.0073	0.0959
32	0.188	1,148	20.28	22.6	-2.6963	-1.7396	-0,6586	-0.0870	1,4706	0.3438	-0.9820	0.0911
33	0.191	1,199	20.30	22.5	-2.6894	-1.6689	-0,6676	-0.0865	1,4780	0.3224	-0.8924	0.0874
34	0.170	0,949	22.26	22.6	-2.8007	-1.6512	-0,3044	-0.0993	1,2508	0.1837	-0.5245	0.1431
35	0.176	1,000	22.32	22.6	-3.0174	-1.5487	-0,3606	-0.0699	1,4147	0.3832	-1.0901	0.0912
36	0.180	1,048	22.38	22.6	-2.9318	-1.0933	-0,5431	-0.0461	1,5757	0.2340	-0.6597	0.1071
37	0.185	1,099	22.32	22.6	-3.1902	-2.1421	-0,6761	-0.0946	1,7492	0.3313	-0.9845	0.1098
38	0.190	1,151	22.34	22.6	-3.0596	-1.8739	-0,6496	-0.0937	1,6796	0.3351	-0.9553	0.1028
39	0.195	1,202	22.37	22.6	-3.0758	-1.8207	-0,6604	-0.0920	1,6957	0.3071	-0.9182	0.1028
42	0.173	0,948	24.32	22.6	-3.2483	-1.7947	-0,2969	-0.0968	1,5241	0.1425	-0.4031	0.1602
43	0.180	0,998	24.39	22.6	-3.3284	-1.4353	-0,3806	-0.0860	1,6424	0.3188	-0.9070	0.1489
44	0.185	1,051	24.45	22.6	-3.3026	-1.0822	-0,5548	-0.0643	1,8135	0.1835	-0.51 4	0.1397
45	0.188	1,100	24.38	22.6	-3.5887	-2.2362	-0,6733	-0.1120	1,9926	0.3084	-0.9176	0.1271

TABLE 1.4

DATA LISTINGS

ROLL ANGLE = 22,5 DEG.

SER	REY'N	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
46	0.193	1.150	24.40	22.6	-3.4801	-2.0537	-0,6445	-0.1047	1,9291	0.3188	-0.9233	0.1160
47	0.196	1.198	24.42	22.6	-3.4907	-1.9892	-0,6524	-0.1029	1,9394	0.3050	-0.9090	0.1090
48	0.175	0.952	26.39	22.7	-3.7206	-1.9229	-0,2892	-0.1107	1,8140	0.1085	-0.2845	0.1720
49	0.181	1.000	26.47	22.7	-3.7251	-1.3964	-0,3947	-0.1016	1,9226	0.3191	-0.8903	0.1731
50	0.185	1.051	26.52	22.7	-3.6983	-1.0800	-0,5607	-0.0864	2,0762	0.1455	-0.3832	0.1650
51	0.190	1.099	26.46	22.7	-4.0124	-2.3373	-0,6737	-0.1298	2,2746	0.3078	-0.8731	0.1396
52	0.195	1.148	26.47	22.6	-3.9128	-2.2412	-0,6434	-0.1166	2,2153	0.3014	-0.8648	0.1280
53	0.196	1.200	26.49	22.6	-3.8938	-2.1776	-0,6437	-0.1063	2,2199	0.2927	-0.8660	0.1145
54	0.175	0.951	28.44	22.7	-4.0298	-1.8980	-0,2627	-0.1143	2,0502	0.1442	-0.3769	0.1928
55	0.181	0.998	28.53	22.7	-4.1257	-1.4425	-0,3889	-0.1029	2,2219	0.3076	-0.8572	0.1893
56	0.186	1.052	28.59	22.7	-4.1218	-1.2131	-0,5443	-0.0895	2,3723	0.1321	-0.3189	0.1788
57	0.193	1.100	28.52	22.7	-4.4467	-2.4987	-0,6633	-0.1379	2,5852	0.2766	-0.7865	0.1481
58	0.195	1.150	28.53	22.7	-4.3262	-2.3957	-0,6294	-0.1226	2,5120	0.2807	-0.7806	0.1368
59	0.199	1.198	28.55	22.7	-4.3037	-2.3620	-0,6300	-0.1167	2,5061	0.2784	-0.7873	0.1279

TABLE 1.5

DATA LISTINGS

ROLL ANGLE = 30 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
2	0.181	0.948	-2.01	30.0	0.1432	0.1382	-0.2919	-0.0079	0.2888	0.0031	-0.0088	0.0014
3	0.186	0.999	-2.01	30.0	0.1507	0.1447	-0.3167	-0.0064	0.3154	-0.0030	0.0098	0.0011
4	0.190	1.049	-2.02	29.9	0.1457	0.0985	-0.4712	0.0200	0.4959	-0.0051	0.0270	-0.0001
5	0.195	1.101	-2.01	30.0	0.1962	0.2370	-0.5985	-0.0134	0.5916	0.0069	0.0058	0.0017
6	0.199	1.149	-2.02	30.0	0.1362	0.0860	-0.6335	-0.0485	0.5894	0.0098	-0.0054	0.0023
7	0.203	1.198	-2.02	30.0	0.1813	0.1777	-0.6455	-0.0608	0.5907	0.0214	-0.0607	0.0014
8	0.181	0.950	0.00	30.0	-0.0122	-0.0030	-0.2958	-0.0121	0.2837	0.0036	0.0026	0.0014
9	0.190	1.001	0.00	30.0	-0.0183	-0.0127	-0.3255	-0.0093	0.3162	0.0024	-0.0033	0.0014
10	0.193	1.049	0.00	30.0	-0.0230	-0.0163	-0.4747	0.0166	0.4913	-0.0040	0.0184	0.0009
11	0.196	1.102	0.00	30.0	0.0074	0.0551	-0.5926	-0.0056	0.5869	0.0074	0.0031	0.0016
12	0.201	1.151	0.00	30.0	-0.0285	-0.0271	-0.6332	-0.0413	0.5918	0.0131	-0.0166	0.0016
13	0.206	1.200	0.00	30.0	-0.0060	0.0042	-0.6360	-0.0605	0.5754	0.0097	-0.0331	0.0016
14	0.181	0.947	2.01	30.0	-0.1756	-0.1458	-0.2899	-0.0163	0.2795	0.0020	-0.0003	0.0008
15	0.190	0.999	2.01	30.0	-0.1920	-0.1761	-0.3106	-0.0143	0.3028	0.0016	0.0010	0.0008
16	0.193	1.049	2.01	29.9	-0.1932	-0.1327	-0.4722	0.0145	0.4930	-0.0028	0.0170	-0.0003
17	0.199	1.101	2.01	30.0	-0.1871	-0.1286	-0.5985	-0.0176	0.5871	0.0102	-0.0043	0.0015
18	0.204	1.148	2.01	30.0	-0.2268	-0.2313	-0.6306	-0.0514	0.5868	0.0111	-0.0112	0.0018
19	0.206	1.200	2.01	30.0	-0.1917	-0.1525	-0.6437	-0.0589	0.5911	0.0234	-0.0605	0.0012
22	0.173	0.951	4.02	30.0	-0.3451	-0.2962	-0.2866	-0.0127	0.2975	0.0041	-0.0187	0.0013
23	0.176	0.998	4.02	30.0	-0.3624	-0.3089	-0.3032	-0.0175	0.3184	0.0097	-0.0270	0.0014
24	0.183	1.048	4.03	30.0	-0.3457	-0.1750	-0.4736	0.0103	0.5069	0.0014	-0.0088	0.0009
25	0.188	1.100	4.03	30.0	-0.3858	-0.3057	-0.5979	-0.0207	0.6029	0.0162	-0.0326	0.0029
26	0.193	1.149	4.02	30.0	-0.4139	-0.3871	-0.6341	-0.0538	0.6079	0.0158	-0.0423	0.0022
27	0.195	1.199	4.03	30.0	-0.3904	-0.3280	-0.6477	-0.0628	0.6109	0.0244	-0.0823	0.0016
28	0.173	0.950	6.02	30.0	-0.5404	-0.4991	-0.2937	-0.0183	0.3336	0.0231	-0.0714	0.0018
29	0.180	0.999	6.03	29.9	-0.5550	-0.4843	-0.3090	-0.0194	0.3463	0.0198	-0.0532	0.0000
30	0.185	1.051	6.05	30.0	-0.5216	-0.4726	-0.4802	0.0091	0.5416	0.0095	-0.0100	0.0001
31	0.193	1.098	6.03	30.0	-0.6151	-0.5701	-0.6166	-0.0283	0.6498	0.0295	-0.0639	0.0032
32	0.191	1.150	6.04	30.0	-0.6217	-0.5885	-0.6381	-0.0569	0.6434	0.0237	-0.0588	0.0016
33	0.196	1.200	6.04	30.0	-0.6029	-0.5259	-0.6579	-0.0701	0.6480	0.0294	-0.0943	0.0031
34	0.175	0.951	8.03	30.0	-0.7522	-0.7810	-0.2792	-0.0191	0.3626	0.0494	-0.1423	0.0011
35	0.180	0.999	8.05	29.9	-0.7761	-0.7137	-0.3156	-0.0213	0.4000	0.0364	-0.1112	-0.0011
36	0.185	1.049	8.08	29.9	-0.7262	-0.4137	-0.4842	0.0060	0.5873	0.0217	-0.0591	-0.0003
37	0.190	1.098	8.05	30.0	-0.8581	-0.8433	-0.6309	-0.0537	0.6917	0.0395	-0.1034	0.0035
38	0.195	1.151	8.06	30.0	-0.8332	-0.7784	-0.6468	-0.0598	0.6980	0.0380	-0.0996	0.0023
39	0.198	1.200	8.06	30.0	-0.8236	-0.7266	-0.6647	-0.0702	0.7042	0.0443	-0.1440	0.0073
42	0.172	0.950	10.04	30.0	-0.9766	-1.0345	-0.2729	-0.0221	0.4172	0.0777	-0.2272	0.0006
43	0.176	0.999	10.06	29.9	-0.9991	-0.9461	-0.3017	-0.0274	0.4445	0.0493	-0.1559	-0.0031
44	0.183	1.050	10.10	29.9	-0.9430	-0.5428	-0.4892	0.0000	0.6469	0.0218	-0.0677	0.0000
45	0.185	1.098	10.06	30.0	-1.1074	-1.0894	-0.6451	-0.0614	0.7683	0.0396	-0.1116	0.0067
46	0.190	1.151	10.08	30.0	-1.0646	-0.9739	-0.6530	-0.0691	0.7611	0.0363	-0.0956	0.0032

TABLE 1.5

DATA LISTINGS

ROLL ANGLE = 30 DEG.

SER	REyN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
47	0.191	1.199	10.08	30.0	-1.0693	-0.9230	-0.6771	-0.0803	0.7748	0.0413	-0.1434	0.0121
48	0.173	0.950	12.05	30.0	-1.1943	-1.2732	-0.2747	-0.0274	0.4912	0.1005	-0.2889	0.0044
49	0.176	0.998	12.09	29.9	-1.2330	-1.0546	-0.3187	-0.0291	0.5424	0.0499	-0.1517	-0.0054
50	0.181	1.051	12.13	30.0	-1.1790	-0.6483	-0.4986	-0.0011	0.7342	0.0369	-0.1086	0.0054
51	0.188	1.098	12.09	30.0	-1.3710	-1.2992	-0.6584	-0.0721	0.8605	0.0590	-0.1727	0.0124
52	0.193	1.149	12.10	30.0	-1.3144	-1.1465	-0.6658	-0.0747	0.8536	0.0626	-0.1595	0.0075
53	0.195	1.198	12.11	30.0	-1.3170	-1.1125	-0.6785	-0.0767	0.8648	0.0656	-0.2079	0.0162
54	0.176	0.950	14.07	30.0	-1.4251	-1.4826	-0.2792	-0.0338	0.5844	0.1259	-0.3834	0.0135
55	0.180	1.000	14.12	30.0	-1.4813	-1.1136	-0.3255	-0.0319	0.6462	0.0640	-0.1988	0.0043
56	0.185	1.049	14.17	30.0	-1.4200	-0.7094	-0.5046	-0.0061	0.8338	0.0476	-0.1448	0.0154
57	0.190	1.101	14.12	30.0	-1.6417	-1.4842	-0.6725	-0.0778	0.9773	0.0936	-0.2793	0.0227
58	0.193	1.149	14.13	30.0	-1.5676	-1.2799	-0.6700	-0.0821	0.9530	0.1018	-0.2722	0.0160
59	0.196	1.198	14.15	30.0	-1.5639	-1.2103	-0.6859	-0.0838	0.9663	0.0904	-0.2777	0.0220
60	0.176	0.951	16.09	30.0	-1.6770	-1.5959	-0.2816	-0.0356	0.7012	0.1638	-0.4923	0.0260
61	0.181	0.998	16.16	30.0	-1.7498	-1.1399	-0.3363	-0.0337	0.7779	0.1017	-0.3084	0.0145
62	0.185	1.049	16.21	30.0	-1.6820	-0.7270	-0.5145	-0.0100	0.9540	0.1013	-0.2984	0.0333
63	0.193	1.101	16.16	30.0	-1.9249	-1.5993	-0.6795	-0.0844	1.1073	0.1508	-0.4621	0.0414
64	0.195	1.150	16.18	30.0	-1.8324	-1.3433	-0.6708	-0.0803	1.0777	0.1540	-0.4310	0.0308
65	0.196	1.201	16.20	30.0	-1.8540	-1.2636	-0.6861	-0.0801	1.0992	0.1435	-0.4382	0.0310
66	0.168	0.950	18.14	30.0	-1.9574	-1.5049	-0.2796	-0.0420	0.8352	0.2125	-0.6103	0.0521
69	0.175	0.998	18.20	30.0	-2.0655	-1.1306	-0.3362	-0.0430	0.9238	0.2153	-0.5905	0.0238
70	0.180	1.051	18.25	30.0	-1.9723	-0.6928	-0.5208	-0.0135	1.0994	0.1652	-0.4715	0.0483
71	0.183	1.098	18.19	30.0	-2.0280	-1.6349	-0.6721	-0.0834	1.2551	0.2141	-0.6395	0.0575
72	0.188	1.150	18.23	30.0	-2.1960	-1.3723	-0.6606	-0.0827	1.2359	0.2760	-0.7267	0.0388
73	0.191	1.200	18.25	30.0	-2.2516	-1.3546	-0.6748	-0.0844	1.2658	0.2401	-0.7186	0.0546
74	0.170	0.949	20.22	30.1	-2.2752	-1.2634	-0.3009	-0.0816	0.9922	0.1259	-0.3795	0.1177
75	0.175	0.998	20.26	30.0	-2.3340	-1.1381	-0.3567	-0.0543	1.1619	0.2888	-0.8407	0.0552
76	0.180	1.051	20.34	30.1	-2.4052	-0.6156	-0.5292	-0.0288	1.3051	0.1864	-0.5241	0.0820
77	0.185	1.100	20.27	30.1	-2.7042	-1.7331	-0.6800	-0.0941	1.4866	0.2863	-0.8398	0.0802
78	0.190	1.152	20.30	30.1	-2.5915	-1.4564	-0.6534	-0.0891	1.4282	0.2874	-0.8148	0.0745
79	0.191	1.198	20.32	30.1	-2.6005	-1.4343	-0.6608	-0.0854	1.4425	0.2488	-0.7304	0.0668
80	0.170	0.949	22.27	30.1	-2.6499	-1.3000	-0.3033	-0.0944	1.1979	0.1113	-0.2979	0.1355
81	0.176	1.000	22.35	30.1	-2.8256	-0.9937	-0.3717	-0.0751	1.3488	0.2421	-0.6819	0.1000
82	0.183	1.049	22.41	30.1	-2.7246	-0.5019	-0.5610	-0.0662	1.4963	0.0597	-0.1438	0.1213
83	0.186	1.100	22.34	30.1	-3.0906	-1.8523	-0.6763	-0.0960	1.7094	0.2751	-0.8009	0.0896
84	0.193	1.149	22.35	30.1	-2.9793	-1.6278	-0.6487	-0.0922	1.6479	0.2776	-0.7710	0.0842
85	0.195	1.201	22.38	30.1	-2.9877	-1.5687	-0.6587	-0.0906	1.6629	0.2550	-0.7490	0.0815
88	0.176	0.951	24.34	30.1	-3.0838	-1.4222	-0.2916	-0.0916	1.4533	0.0853	-0.2368	0.1513
89	0.181	1.000	24.42	30.1	-3.1716	-0.9314	-0.3905	-0.0916	1.5834	0.1910	-0.5332	0.1405
90	0.186	1.052	24.48	30.1	-3.1154	-0.5508	-0.5589	-0.0817	1.7254	0.0351	-0.0821	0.1357
91	0.193	1.099	24.40	30.1	-3.4878	-1.9349	-0.6717	-0.1076	1.9548	0.2523	-0.7326	0.1055

TABLE 1.5

DATA LISTINGS

ROLL ANGLE = 30 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
92	0.196	1.149	24.42	30.1	-3.3943	-1.7840	-0.6442	-0.0996	1.8992	0.2593	-0.7320	0.0959
93	0.198	1.200	24.44	30.1	-3.3983	-1.7334	-0.6513	-0.0970	1.9109	0.2470	-0.7247	0.0868
94	0.178	0.951	26.40	30.1	-3.3981	-1.6045	-0.2904	-0.1014	1.7697	0.0748	-0.1803	0.1551
95	0.185	1.001	26.48	30.2	-3.3679	-0.9772	-0.3878	-0.0955	1.8532	0.2080	-0.5558	0.1578
96	0.188	1.049	26.55	30.2	-3.3743	-0.7092	-0.5613	-0.0889	2.0206	0.0445	-0.0680	0.1490
97	0.191	1.102	26.48	30.1	-3.9087	-2.0438	-0.6672	-0.1183	2.2341	0.2294	-0.6645	0.1143
98	0.198	1.148	26.49	30.1	-3.8229	-1.9725	-0.6399	-0.1095	2.1799	0.2331	-0.6536	0.1045
99	0.201	1.198	26.51	30.1	-3.8097	-1.9171	-0.6414	-0.1074	2.1785	0.2362	-0.6866	0.0906
100	0.181	0.950	28.46	30.2	-3.9450	-1.6594	-0.2637	-0.1059	2.0190	0.0985	-0.2136	0.1651
101	0.185	0.998	28.55	30.2	-3.9780	-1.0553	-0.3805	-0.1031	2.1454	0.2130	-0.5669	0.1658
102	0.190	1.052	28.61	30.2	-4.0420	-0.9684	-0.5507	-0.0985	2.3330	0.0376	-0.0245	0.1552
103	0.195	1.101	28.55	30.1	-4.3480	-2.2210	-0.6589	-0.1301	2.5424	0.2036	-0.5673	0.1211
104	0.199	1.149	28.56	30.1	-4.2455	-2.1565	-0.6277	-0.1172	2.4780	0.2051	-0.5620	0.1102
105	0.201	1.199	28.57	30.1	-4.2107	-2.1112	-0.6225	-0.1097	2.4644	0.2156	-0.5991	0.1008

TABLE 1.6

DATA LISTINGS

ROLL ANGLE = 37,5 DEG.

SER	REyN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
109	0.168	0.952	-2.02	37.5	0.1418	0.1288	-0.2935	0.0000	0.2982	0.0023	0.0036	0.0013
110	0.172	1.001	-2.02	37.5	0.1529	0.1463	-0.3179	-0.0122	0.3108	0.0026	0.0075	0.0009
111	0.178	1.050	-2.02	37.5	0.1452	0.0991	-0.4600	0.0083	0.4731	-0.0034	0.0265	0.0014
112	0.183	1.100	-2.02	37.5	0.1890	0.2090	-0.5899	-0.0141	0.5820	0.0073	0.0139	0.0017
113	0.185	1.151	-2.02	37.5	0.1455	0.1106	-0.6371	-0.0471	0.5947	0.0134	0.0006	0.0019
114	0.188	1.199	-2.02	37.5	0.1814	0.1776	-0.6439	-0.0557	0.5942	0.0273	-0.0757	0.0017
115	0.168	0.948	0.00	37.5	-0.0150	-0.0050	-0.2978	-0.0210	0.2767	0.0012	-0.0009	0.0017
116	0.175	0.999	0.00	37.5	-0.0188	-0.0120	-0.3132	-0.0099	0.3033	0.0027	-0.0010	0.0012
117	0.176	1.051	0.01	37.5	-0.0239	-0.0269	-0.4714	0.0103	0.4816	-0.0040	0.0217	0.0018
118	0.183	1.100	0.00	37.5	-0.0056	0.0519	-0.5896	-0.0080	0.5815	0.0065	0.0062	0.0015
119	0.185	1.149	0.01	37.5	-0.0361	-0.0519	-0.6393	-0.0429	0.5964	0.0106	-0.0029	0.0021
120	0.190	1.200	-0.01	37.5	-0.0076	0.0008	-0.6415	-0.0532	0.5882	0.0111	-0.0347	0.0017
121	0.170	0.950	2.00	37.5	-0.1755	-0.1436	-0.2942	-0.0161	0.2840	0.0029	-0.0044	0.0014
122	0.175	1.001	2.00	37.5	-0.1938	-0.1758	-0.3205	-0.0120	0.3151	0.0042	0.0021	0.0011
123	0.180	1.050	2.01	37.5	-0.1904	-0.1413	-0.4687	0.0072	0.4822	-0.0022	0.0262	0.0003
124	0.185	1.100	2.01	37.5	-0.1823	-0.1178	-0.5955	-0.0158	0.5858	0.0112	-0.0003	0.0014
125	0.188	1.148	2.00	37.5	-0.2191	-0.2089	-0.6385	-0.0509	0.5948	0.0135	0.0000	0.0010
126	0.190	1.199	2.01	37.5	-0.1931	-0.1564	-0.6443	-0.0583	0.5924	0.0236	-0.0633	0.0009
127	0.170	0.950	4.02	37.5	-0.3479	-0.2987	-0.2984	-0.0217	0.3004	0.0060	-0.0062	0.0013
128	0.176	1.002	4.02	37.5	-0.3610	-0.3044	-0.3152	-0.0204	0.3194	0.0044	0.0046	0.0007
129	0.180	1.049	4.03	37.5	-0.3459	-0.1857	-0.4738	0.0040	0.5009	0.0037	0.0184	0.0009
130	0.185	1.102	4.02	37.5	-0.3875	-0.3132	-0.6109	-0.0282	0.6085	0.0154	-0.0157	0.0022
131	0.190	1.153	4.02	37.5	-0.4192	-0.4114	-0.6347	-0.0531	0.6096	0.0181	-0.0259	0.0026
132	0.191	1.198	4.03	37.5	-0.3912	-0.3297	-0.6503	-0.0595	0.6168	0.0273	-0.0812	0.0018
133	0.176	0.949	6.03	37.5	-0.5277	-0.4769	-0.2845	-0.0090	0.3294	0.0137	-0.0364	0.0012
136	0.180	1.000	6.03	37.4	-0.5495	-0.4620	-0.3125	-0.0212	0.3475	0.0119	-0.0263	-0.0002
137	0.185	1.049	6.05	37.5	-0.5163	-0.2612	-0.4765	0.0020	0.5302	0.0047	0.0061	0.0001
138	0.188	1.101	6.05	37.5	-0.5090	-0.5529	-0.6116	-0.0363	0.6361	0.0216	-0.0319	0.0026
139	0.191	1.151	6.05	37.5	-0.5146	-0.5691	-0.6408	-0.0587	0.6435	0.0232	-0.0422	0.0017
140	0.196	1.199	6.05	37.5	-0.5999	-0.5214	-0.6567	-0.0700	0.6467	0.0328	-0.1008	0.0039
141	0.176	0.950	8.03	37.5	-0.7399	-0.7319	-0.2841	-0.0211	0.3639	0.0294	-0.0817	0.0009
142	0.181	1.001	8.05	37.4	-0.7619	-0.6766	-0.3139	-0.0230	0.3947	0.0223	-0.0586	-0.0012
143	0.185	1.049	8.08	37.5	-0.7119	-0.3811	-0.4814	0.0009	0.5776	0.0135	-0.0211	0.0006
144	0.190	1.102	8.06	37.5	-0.8507	-0.8259	-0.6363	-0.0416	0.7081	0.0341	-0.0830	0.0046
145	0.195	1.149	8.06	37.5	-0.8296	-0.7690	-0.6522	-0.0646	0.6962	0.0331	-0.0721	0.0033
146	0.196	1.199	8.06	37.5	-0.8289	-0.7202	-0.6656	-0.0685	0.7064	0.0381	-0.1152	0.0071
147	0.175	0.952	10.05	37.5	-0.9603	-0.9792	-0.2796	-0.0220	0.4213	0.0460	-0.1251	0.0005
148	0.181	0.999	10.07	37.4	-0.9902	-0.8780	-0.3196	-0.0229	0.4653	0.0272	-0.0745	-0.0018
149	0.188	1.049	10.10	37.4	-0.9335	-0.5266	-0.4879	-0.0010	0.6431	0.0183	-0.0218	-0.0038
150	0.192	1.100	10.07	37.5	-1.1019	-1.0771	-0.6463	-0.0638	0.7663	0.0317	-0.0609	0.0025
151	0.196	1.152	10.09	37.5	-1.0595	-0.9666	-0.6559	-0.0746	0.7579	0.0287	-0.0560	0.0024

TABLE 1.6

DATA LISTINGS

ROLL ANGLE = 37,5 DEG.

SER	REyN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
152	0.199	1.198	10.09	37.5	-1.0631	-0.9166	-0,6760	-0.0741	0.7789	0.0463	-0.1400	0.0090
155	0.168	0.949	12.06	37.5	-1.1749	-1.2036	-0,2726	-0.0186	0.4938	0.0575	-0.1506	0.0014
156	0.173	1.001	12.09	37.4	-1.2123	-0.9983	-0,3118	-0.0273	0.5321	0.0264	-0.0740	-0.0041
157	0.178	1.048	12.13	37.5	-1.1636	-0.6109	-0,4915	-0.0073	0.7179	0.0195	-0.0423	0.0033
158	0.183	1.100	12.10	37.5	-1.3555	-1.2547	-0,6620	-0.0613	0.8714	0.0421	-0.1084	0.0103
159	0.185	1.148	12.10	37.5	-1.3010	-1.0991	-0,6667	-0.0760	0.8504	0.0494	-0.1029	0.0044
160	0.190	1.199	12.12	37.5	-1.2994	-1.0493	-0,6814	-0.0796	0.8612	0.0528	-0.1528	0.0100
164	0.168	0.952	14.07	37.5	-1.3867	-1.3815	-0,2697	-0.0262	0.5734	0.0668	-0.1949	0.0073
165	0.172	1.000	14.13	37.4	-1.4572	-1.0021	-0,3246	-0.0259	0.6435	0.0324	-0.0901	-0.0012
166	0.175	1.050	14.15	37.5	-1.3975	-0.6313	-0,5061	-0.0043	0.8284	0.0323	-0.0806	0.0146
167	0.180	1.102	14.12	37.5	-1.6176	-1.4017	-0,6706	-0.0730	0.9743	0.0643	-0.1776	0.0170
168	0.183	1.149	14.14	37.5	-1.5444	-1.1787	-0,6703	-0.0760	0.9536	0.0660	-0.1599	0.0128
169	0.188	1.198	14.15	37.5	-1.5463	-1.1159	-0,6818	-0.0817	0.9600	0.0622	-0.1897	0.0192
170	0.168	0.951	16.11	37.5	-1.6331	-1.4545	-0,2847	-0.0388	0.6892	0.0950	-0.2529	0.0069
171	0.172	1.001	16.16	37.5	-1.5892	-0.9561	-0,3325	-0.0310	0.7600	0.0676	-0.1581	0.0045
172	0.178	1.050	16.20	37.5	-1.6289	-0.5852	-0,5008	-0.0074	0.9284	0.0679	-0.1862	0.0244
173	0.180	1.100	16.16	37.5	-1.5975	-1.4898	-0,6723	-0.0681	1.1086	0.0989	-0.2854	0.0276
174	0.185	1.149	16.18	37.5	-1.5152	-1.2458	-0,6690	-0.0760	1.0754	0.1094	-0.2775	0.0210
175	0.188	1.199	16.20	37.5	-1.5448	-1.1789	-0,6812	-0.0742	1.0977	0.1045	-0.3016	0.0223
176	0.168	0.950	18.15	37.5	-1.7127	-1.3829	-0,2800	-0.0465	0.8178	0.1363	-0.3524	0.0238
177	0.175	0.998	18.22	37.5	-2.0130	-0.9103	-0,3371	-0.0385	0.9122	0.1478	-0.3716	0.0162
178	0.178	1.048	18.26	37.5	-1.9346	-0.5389	-0,5100	-0.0125	1.0787	0.1110	-0.2854	0.0290
179	0.183	1.101	18.21	37.5	-2.2104	-1.5394	-0,6782	-0.0781	1.2609	0.1419	-0.4019	0.0345
180	0.185	1.150	18.25	37.5	-2.1673	-1.2440	-0,6663	-0.0827	1.2329	0.1892	-0.4414	0.0144
181	0.190	1.200	18.27	37.5	-2.2226	-1.2156	-0,6772	-0.0844	1.2597	0.1554	-0.4506	0.0310
182	0.170	0.952	20.24	37.5	-2.2572	-1.1013	-0,2898	-0.0665	0.9903	0.0547	-0.1376	0.0803
183	0.173	1.002	20.30	37.5	-2.4357	-0.8555	-0,3453	-0.0465	1.1253	0.1695	-0.4679	0.0341
184	0.180	1.052	20.35	37.5	-2.5210	-0.3686	-0,5266	-0.0359	1.2674	0.0550	-0.1292	0.2615
185	0.185	1.100	20.29	37.5	-2.6471	-1.5148	-0,6772	-0.0922	1.4669	0.1704	-0.4776	0.0453
186	0.188	1.150	20.32	37.5	-2.5603	-1.3153	-0,6596	-0.0902	1.4230	0.1852	-0.4994	0.0435
187	0.190	1.198	20.33	37.5	-2.5656	-1.2910	-0,6674	-0.0872	1.4359	0.1556	-0.4378	0.0354
190	0.173	0.950	22.30	37.6	-2.6234	-1.1376	-0,2903	-0.0712	1.1980	0.0182	-0.0104	0.0922
191	0.180	1.000	22.37	37.5	-2.7443	-0.7208	-0,3627	-0.0691	1.3161	0.1040	-0.2613	0.0676
192	0.183	1.049	22.43	37.6	-2.6694	-0.3410	-0,5442	-0.0565	1.4691	-0.0372	0.1631	0.0784
193	0.188	1.099	22.36	37.5	-3.0161	-1.5967	-0,6681	-0.1010	1.6718	0.1573	-0.4340	0.0501
194	0.191	1.150	22.38	37.5	-2.9244	-1.4519	-0,6511	-0.0887	1.6333	0.1767	-0.4545	0.0451
195	0.195	1.198	22.39	37.5	-2.9378	-1.4047	-0,6576	-0.0875	1.6463	0.1538	-0.4317	0.0407
196	0.176	0.951	24.35	37.6	-3.2740	-1.2781	-0,2915	-0.0893	1.4520	0.0254	-0.0357	0.1018
197	0.180	1.001	24.43	37.6	-3.1198	-0.7720	-0,3758	-0.0769	1.5627	0.0651	-0.1278	0.0918
198	0.183	1.049	24.49	37.6	-3.0754	-0.3956	-0,5501	-0.0751	1.7074	-0.0445	0.2011	0.0839
199	0.188	1.101	24.42	37.5	-3.4451	-1.7624	-0,6715	-0.1010	1.9440	0.1530	-0.4186	0.0609

TABLE 1.6

DATA LISTINGS

ROLL ANGLE = 37,5 DEG.

SER	REyN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
200	0,193	1,147	24.44	37,5	-3.3532	-1.6239	-0,6455	-0.0982	1,8856	0.1665	-0.4257	0.0502
201	0,196	1,198	24.46	37,5	-3.3501	-1.5682	-0,6502	-0.0956	1,8921	0,1549	-0.4282	0.0424
202	0,176	0,949	26.41	37,6	-3.0749	-1.4426	-0,2887	-0.1009	1,7590	0.0535	-0.0819	0.0986
203	0,181	1,000	26.50	37,6	-3.0214	-0.8198	-0,3751	-0.0887	1,8277	0.0945	-0.1959	0.0977
204	0,186	1,052	26.56	37,6	-3.0452	-0,6160	-0,5580	-0.0909	2,0032	-0.0427	0.2133	0.0920
205	0,190	1,100	26.50	37,5	-3.8731	-1.8874	-0,6625	-0.1078	2.2243	0,1399	-0.3722	0.0635
206	0,195	1,151	26.51	37,5	-3.7688	-1.8003	-0,6341	-0.1042	2,1563	0,1467	-0.3694	0.0553
207	0,196	1,200	26.53	37,5	-3.7685	-1.7731	-0,6344	-0.0981	2,1629	0,1435	-0.3842	0.0425
208	0,176	0,949	28.47	37,6	-3.8993	-1.4978	-0,2545	-0.1043	1,9911	0.0822	-0.1225	0.0929
209	0,181	1,001	28.58	37,6	-3.9047	-0.8199	-0,3781	-0.0929	2,1181	0.1225	-0.2728	0.0920
210	0,188	1,049	28.62	37,6	-4.0291	-0,8874	-0,5517	-0.1021	2.3249	-0.0213	0.1701	0.0821
211	0,190	1,099	28.56	37,5	-4.3266	-2.1128	-0,6531	-0.1225	2.5345	0.1281	-0.3187	0.0664
212	0,195	1,148	28.57	37,5	-4.2066	-2.0424	-0,6243	-0.1116	2,4620	0.1264	-0.3177	0.0625
213	0,199	1,198	28.58	37,5	-4.1674	-1.9565	-0,6157	-0.1050	2.4429	0.1350	-0.3402	0.0501

TABLE 1.7

DATA LISTINGS

ROLL ANGLE = 45 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
2	0.173	0.952	-2.02	45.0	0.1464	0.1392	-0.2998	-0.0137	0.2909	0.0021	-0.0003	0.0010
3	0.183	1.000	-2.02	45.0	0.1561	0.1476	-0.3222	-0.0162	0.3112	0.0013	0.0072	0.0008
4	0.183	1.049	-2.02	45.0	0.1475	0.1006	-0.4754	0.0163	0.4965	-0.0035	0.0255	0.0006
5	0.186	1.098	-2.02	45.0	0.1991	0.2383	-0.6059	-0.0166	0.5959	0.0066	0.0051	0.0009
6	0.193	1.148	-2.02	45.0	0.1399	0.0869	-0.6398	-0.0504	0.5939	0.0073	0.0091	0.0013
7	0.195	1.199	-2.02	45.0	0.1833	0.1844	-0.6462	-0.0585	0.5937	0.0211	-0.0058	0.0013
8	0.173	0.948	0.00	45.0	-0.0134	-0.0091	-0.3031	-0.0147	0.2884	0.0002	0.0078	0.0009
9	0.180	0.999	0.00	45.0	-0.0172	-0.0150	-0.3315	-0.0117	0.3198	-0.0021	0.0098	0.0013
10	0.185	1.051	0.00	45.0	-0.0190	-0.0171	-0.4769	0.0221	0.4989	-0.0050	0.0215	0.0005
11	0.190	1.099	0.00	45.0	0.0052	0.0511	-0.5945	-0.0097	0.5848	0.0052	0.0062	0.0011
12	0.193	1.149	0.00	45.0	-0.0337	-0.0418	-0.6372	-0.0425	0.5946	0.0086	-0.0063	0.0014
13	0.196	1.201	0.00	45.0	-0.0069	0.0030	-0.6497	-0.0596	0.5901	0.0096	-0.0250	0.0008
14	0.176	0.951	2.01	45.0	-0.1751	-0.1438	-0.3026	-0.0167	0.2918	-0.0036	0.0032	0.0008
15	0.181	1.001	2.01	45.0	-0.1925	-0.1720	-0.3247	-0.0126	0.3186	-0.0024	0.0102	0.0006
16	0.185	1.051	2.01	45.0	-0.1891	-0.1323	-0.4740	0.0159	0.4962	-0.0066	0.0306	0.0003
17	0.190	1.100	2.01	45.0	-0.1846	-0.1237	-0.6040	-0.0181	0.5920	0.0074	0.0034	0.0011
18	0.195	1.149	2.01	45.0	-0.2240	-0.2273	-0.6355	-0.0520	0.5910	0.0059	0.0076	0.0006
19	0.196	1.199	2.02	45.0	-0.1947	-0.1514	-0.6526	-0.0634	0.5957	0.0226	-0.0702	0.0011
20	0.176	0.948	4.02	45.0	-0.3451	-0.2868	-0.2977	-0.0177	0.3034	-0.0017	0.0023	0.0011
21	0.181	0.999	4.03	45.0	-0.3628	-0.2992	-0.3164	-0.0188	0.3224	-0.0016	-0.0021	0.0010
22	0.186	1.049	4.03	45.0	-0.3450	-0.1768	-0.4813	0.0098	0.5142	-0.0054	0.0214	0.0009
23	0.193	1.101	4.03	45.0	-0.3881	-0.3157	-0.6091	-0.0357	0.5993	0.0074	-0.0056	0.0018
24	0.195	1.149	4.03	45.0	-0.4247	-0.4149	-0.6368	-0.0533	0.6119	0.0081	-0.0213	0.0019
25	0.196	1.202	4.03	45.0	-0.3936	-0.3246	-0.6603	-0.0626	0.6238	0.0253	-0.0856	0.0009
28	0.168	0.948	6.03	45.0	-0.5271	-0.4692	-0.2844	-0.0187	0.3196	-0.0056	0.0092	0.0004
29	0.175	1.000	6.04	44.9	-0.5481	-0.4604	-0.3118	-0.0219	0.3460	-0.0048	0.0144	-0.0007
30	0.180	1.051	6.06	44.9	-0.5175	-0.2415	-0.4876	0.0082	0.5477	-0.0096	0.0310	-0.0001
31	0.183	1.097	6.04	45.0	-0.6154	-0.5516	-0.6195	-0.0367	0.6424	0.0144	-0.0095	0.0021
32	0.188	1.148	6.04	45.0	-0.6150	-0.5609	-0.6448	-0.0618	0.6445	0.0072	0.0004	0.0018
33	0.193	1.199	6.05	45.0	-0.5998	-0.5093	-0.6619	-0.0696	0.6522	0.0257	-0.0823	0.0033
34	0.173	0.948	8.04	45.0	-0.7369	-0.7183	-0.2843	-0.0253	0.3595	-0.0024	0.0027	0.0007
35	0.175	0.999	8.05	45.0	-0.7591	-0.6426	-0.3199	-0.0195	0.4037	-0.0066	0.0164	0.0001
36	0.180	1.050	8.07	44.9	-0.7155	-0.3697	-0.4912	0.0061	0.5934	-0.0113	0.0411	-0.0005
37	0.185	1.101	8.05	45.0	-0.8568	-0.8251	-0.6383	-0.0597	0.6931	0.0174	-0.0074	0.0016
38	0.188	1.149	8.07	45.0	-0.8358	-0.7710	-0.6503	-0.0649	0.6968	0.0092	-0.0048	0.0012
39	0.190	1.198	8.07	45.0	-0.8230	-0.7000	-0.6721	-0.0717	0.7099	0.0243	-0.0770	0.0047
42	0.170	0.950	10.05	44.9	-0.9539	-0.9508	-0.2757	-0.0261	0.4117	-0.0049	0.0106	-0.0005
41	0.176	1.000	10.07	45.0	-0.9881	-0.8179	-0.3315	-0.0193	0.4803	-0.0088	0.0213	0.0001
42	0.180	1.049	10.10	45.0	-0.9379	-0.5141	-0.4893	0.0040	0.6503	-0.0158	0.0300	0.0049
43	0.185	1.100	10.07	45.0	-1.1128	-1.0847	-0.6634	-0.0670	0.7816	0.0056	-0.0074	0.0028
44	0.190	1.149	10.09	45.0	-1.0626	-0.9561	-0.6613	-0.0708	0.7675	0.0060	0.0042	0.0014

TABLE 1.7

DATA LISTINGS

ROLL ANGLE = 45 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
45	0.191	1.199	10.10	45.0	-1.0592	-0.8870	-0.6788	-0.0702	0.7848	0.0310	-0.0932	0.0039
46	0.172	0.948	12.07	44.9	-1.1759	-1.1799	-0.2775	-0.0260	0.4919	-0.0029	0.0130	-0.0020
48	0.176	1.001	12.10	44.9	-1.2144	-0.9618	-0.3212	-0.0244	0.5448	-0.0093	0.0238	-0.0012
49	0.183	1.049	12.14	44.9	-1.1719	-0.6110	-0.5029	-0.0011	0.7370	-0.0085	0.0248	0.0000
50	0.188	1.100	12.09	45.0	-1.3622	-1.2839	-0.6789	-0.0770	0.8741	0.0161	-0.0346	0.0037
51	0.193	1.148	12.12	44.9	-1.2958	-1.0961	-0.6627	-0.0767	0.8449	0.0318	-0.0595	-0.0009
52	0.195	1.200	12.12	45.0	-1.2934	-1.0400	-0.6798	-0.0792	0.8589	0.0414	-0.1245	0.0026
55	0.176	0.949	14.09	44.9	-1.3943	-1.3593	-0.2744	-0.0267	0.5796	-0.0016	0.0044	-0.0027
56	0.181	1.000	14.14	44.9	-1.4536	-0.9550	-0.3389	-0.0252	0.6594	-0.0098	0.0242	-0.0038
57	0.185	1.051	14.17	44.9	-1.3993	-0.6156	-0.5024	-0.0010	0.8289	-0.0207	0.0593	-0.0014
58	0.193	1.101	14.14	45.0	-1.6213	-1.4020	-0.6776	-0.0757	0.9798	0.0062	-0.0097	0.0041
59	0.195	1.151	14.15	44.9	-1.5334	-1.1417	-0.6621	-0.0727	0.9466	0.0155	-0.0219	-0.0033
60	0.196	1.201	14.17	45.0	-1.5397	-1.0920	-0.6778	-0.0737	0.9627	0.0168	-0.0571	0.0039
63	0.170	0.951	16.11	44.9	-1.6239	-1.4303	-0.2758	-0.0336	0.6834	0.0056	-0.0113	-0.0034
64	0.173	1.001	16.17	44.9	-1.6642	-0.8243	-0.3426	-0.0284	0.7656	-0.0081	0.0293	-0.0072
65	0.180	1.050	16.21	44.9	-1.6349	-0.5549	-0.5103	-0.0011	0.9455	-0.0165	0.0504	-0.0031
66	0.185	1.101	16.17	45.0	-1.8977	-1.4964	-0.6823	-0.0760	1.1109	0.0040	-0.0112	0.0049
67	0.186	1.151	16.20	44.9	-1.7987	-1.1718	-0.6638	-0.0729	1.0692	0.0193	-0.0102	-0.0096
68	0.191	1.198	16.21	44.9	-1.8442	-1.1429	-0.6885	-0.0759	1.1033	0.0199	-0.0629	-0.0015
69	0.170	0.951	18.16	44.9	-1.9135	-1.3412	-0.2800	-0.0434	0.8214	0.0163	-0.0103	-0.0132
70	0.176	1.000	18.24	44.9	-1.9859	-0.7711	-0.3544	-0.0313	0.9286	0.0170	-0.0081	-0.0145
71	0.180	1.052	18.27	44.9	-1.9747	-0.5817	-0.5327	-0.0062	1.1192	-0.0015	0.0295	-0.0111
72	0.185	1.098	18.23	45.0	-2.2202	-1.5339	-0.6853	-0.0821	1.2675	0.0095	-0.0120	0.0003
73	0.190	1.152	18.27	44.9	-2.1582	-1.1676	-0.6665	-0.0831	1.2306	0.0435	-0.0464	-0.0155
74	0.191	1.202	18.28	44.9	-2.2127	-1.1567	-0.6834	-0.0785	1.2688	0.0255	-0.0703	-0.0035
75	0.170	0.948	20.23	44.9	-2.2450	-1.0865	-0.2754	-0.0465	0.9916	0.0263	0.0008	-0.0159
76	0.176	1.002	20.32	44.9	-2.4191	-0.7148	-0.3585	-0.0373	1.1415	0.0158	-0.0198	-0.0106
77	0.183	1.048	20.36	44.9	-2.3443	-0.3867	-0.5219	-0.0213	1.2849	0.0114	-0.0002	-0.0122
78	0.185	1.100	20.31	44.9	-2.6403	-1.4879	-0.6870	-0.0946	1.4722	0.0123	-0.0185	-0.0020
79	0.192	1.148	20.34	44.9	-2.5431	-1.2438	-0.6646	-0.0871	1.4252	0.0395	-0.0685	-0.0031
80	0.195	1.198	20.35	44.9	-2.5675	-1.2406	-0.6766	-0.0824	1.4501	0.0287	-0.0753	-0.0028
81	0.173	0.951	22.31	44.9	-2.7045	-1.1117	-0.2831	-0.0583	1.2350	0.0221	-0.0114	-0.0063
82	0.176	0.999	22.38	44.9	-2.7722	-0.6946	-0.3682	-0.0456	1.3541	0.0220	-0.0187	-0.0106
83	0.183	1.048	22.43	44.9	-2.7313	-0.4393	-0.5519	-0.0403	1.5150	-0.0105	0.0796	-0.0073
84	0.188	1.101	22.37	44.9	-3.0256	-1.5817	-0.6835	-0.0948	1.6962	0.0179	-0.0243	-0.0038
85	0.191	1.152	22.40	44.9	-2.9082	-1.3538	-0.6565	-0.0918	1.6302	0.0410	-0.0625	-0.0054
86	0.195	1.200	22.42	44.9	-2.9458	-1.3439	-0.6683	-0.0870	1.6607	0.0296	-0.0722	-0.0051
89	0.166	0.948	24.34	44.9	-3.0495	-1.2148	-0.2717	-0.0594	1.4505	0.0310	-0.0123	-0.0100
90	0.175	1.000	24.42	44.9	-3.1203	-0.7344	-0.3676	-0.0526	1.5770	0.0167	0.0134	-0.0072
91	0.178	1.048	24.47	44.9	-3.1317	-0.5169	-0.5670	-0.0604	1.7584	0.0035	0.0498	-0.0085
92	0.183	1.101	24.42	44.9	-3.4226	-1.7085	-0.6781	-0.0999	1.9415	0.0174	-0.0187	-0.0029

TABLE 1.7

DATA LISTINGS

ROLL ANGLE = 45 DEG.

SER	REYN	MACH	THETA	RANG	NORMAL	PITCH	AXIAL	BASE	DRAG	SIDE F	YAW M	ROLL M
93	0.185	1.151	24.44	44.9	-3.3095	-1.4900	-0.6495	-0.0997	1.8699	0.0321	-0.0422	-0.0014
94	0.190	1.200	24.46	44.9	-3.3414	-1.4942	-0.6558	-0.0954	1.8937	0.0280	-0.0643	-0.0067
95	0.170	0.952	26.41	44.9	-3.0729	-1.3680	-0.2824	-0.0849	1.7665	0.0382	-0.0367	-0.0043
96	0.175	0.998	26.49	44.9	-3.0120	-0.6798	-0.3800	-0.0684	1.8458	0.0293	-0.0067	-0.0051
97	0.180	1.051	26.53	44.9	-3.0863	-0.6939	-0.5649	-0.0832	2.0332	0.0171	0.0139	-0.0078
98	0.185	1.100	26.48	44.9	-3.8673	-1.8569	-0.6720	-0.1078	2.2298	0.0185	-0.0139	-0.0015
99	0.188	1.148	26.50	44.9	-3.7515	-1.7049	-0.6414	-0.1018	2.1570	0.0321	-0.0274	-0.0018
100	0.190	1.200	26.52	44.9	-3.7649	-1.6941	-0.6445	-0.0963	2.1719	0.0310	-0.0569	-0.0068
101	0.170	0.950	28.46	44.9	-3.9182	-1.4690	-0.2532	-0.0865	2.0140	0.0424	-0.0176	-0.0077
102	0.175	0.999	28.56	44.9	-3.9051	-0.6992	-0.3862	-0.0806	2.1356	0.0326	-0.0163	-0.0055
103	0.180	1.049	28.59	44.9	-4.0977	-1.0317	-0.5612	-0.0827	2.3813	0.0245	0.0112	-0.0078
104	0.185	1.098	28.56	44.9	-4.2970	-1.9804	-0.6533	-0.1159	2.5261	0.0194	-0.0043	-0.0028
105	0.188	1.149	28.56	44.9	-4.1818	-1.9295	-0.6260	-0.1084	2.4542	0.0291	-0.0185	-0.0022
106	0.191	1.200	28.58	44.9	-4.1777	-1.9024	-0.6233	-0.0984	2.4599	0.0354	-0.0462	-0.0065

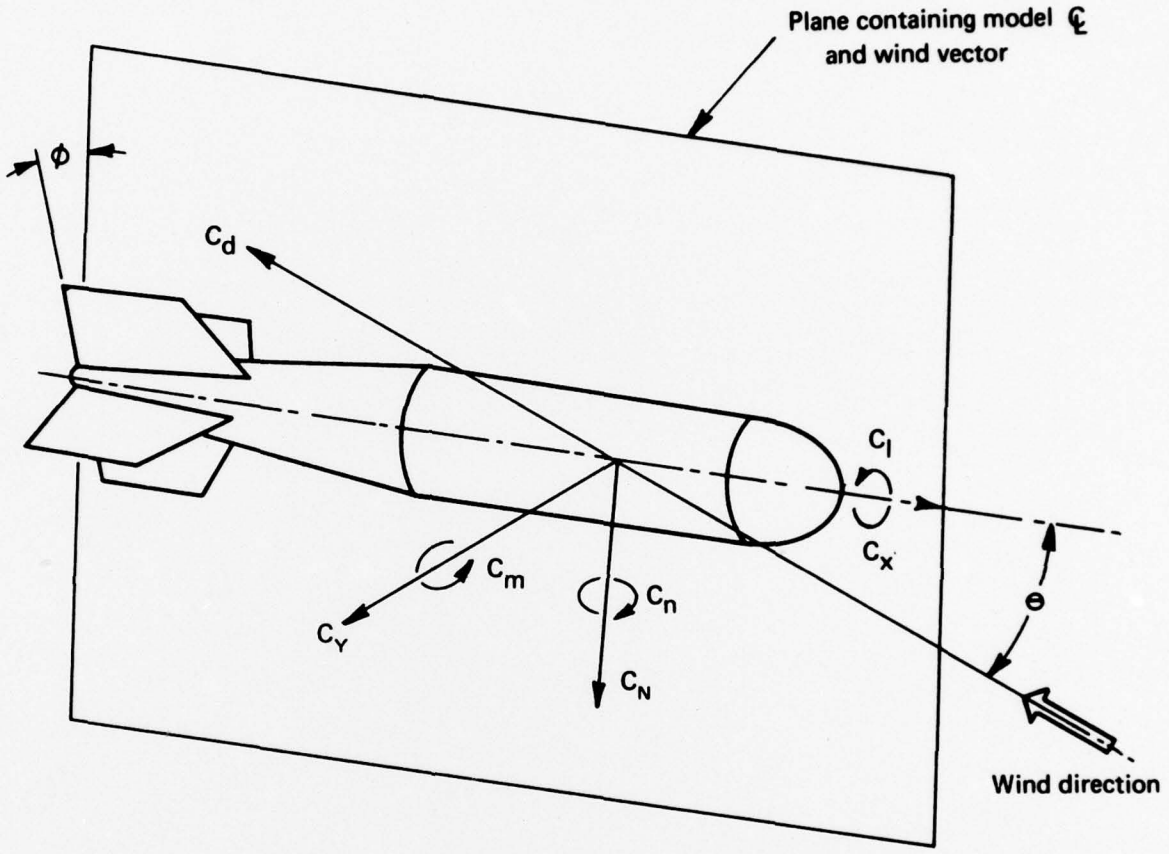


FIG. 1 FORCE AND MOMENT AXES SYSTEM

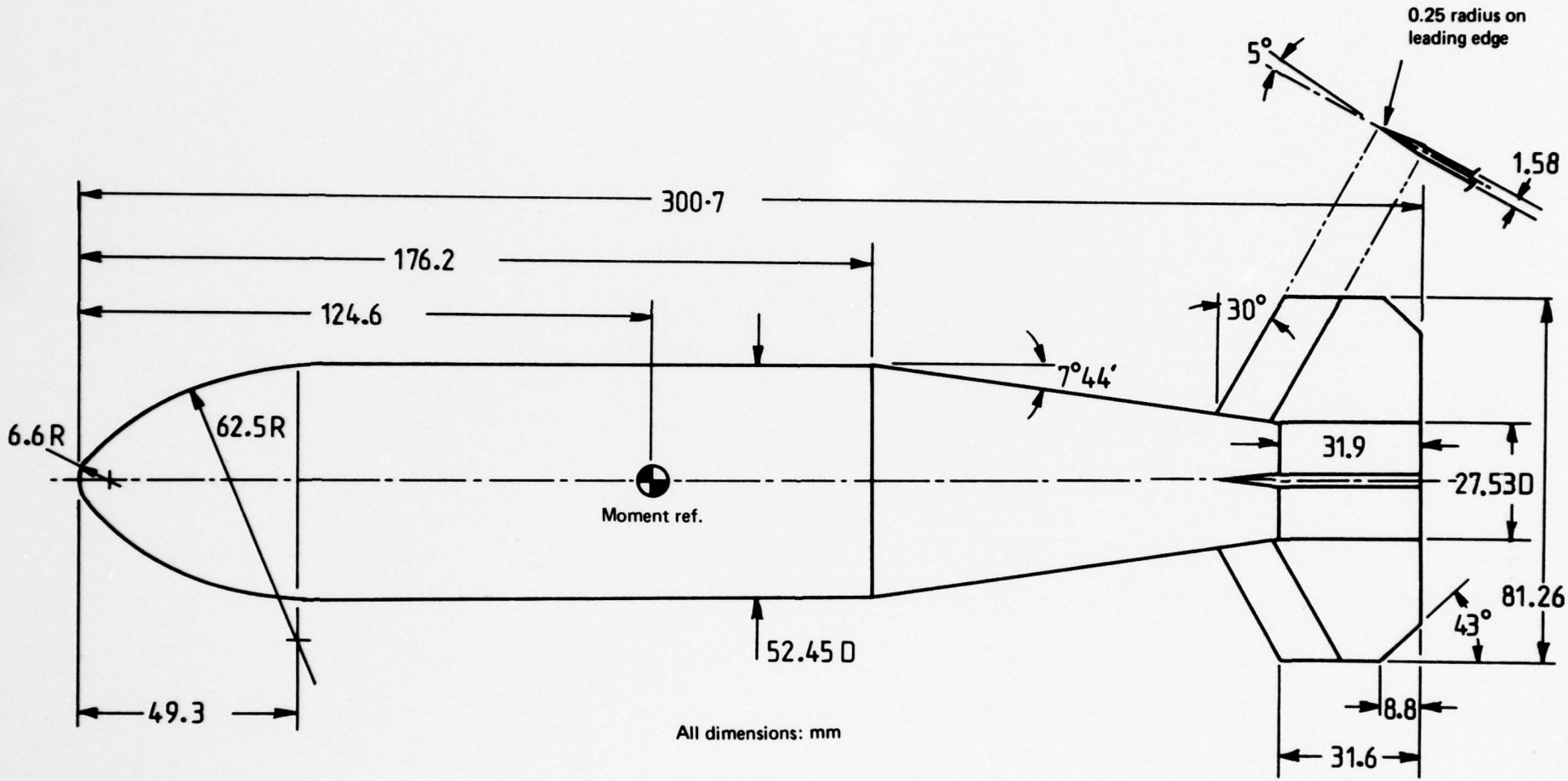
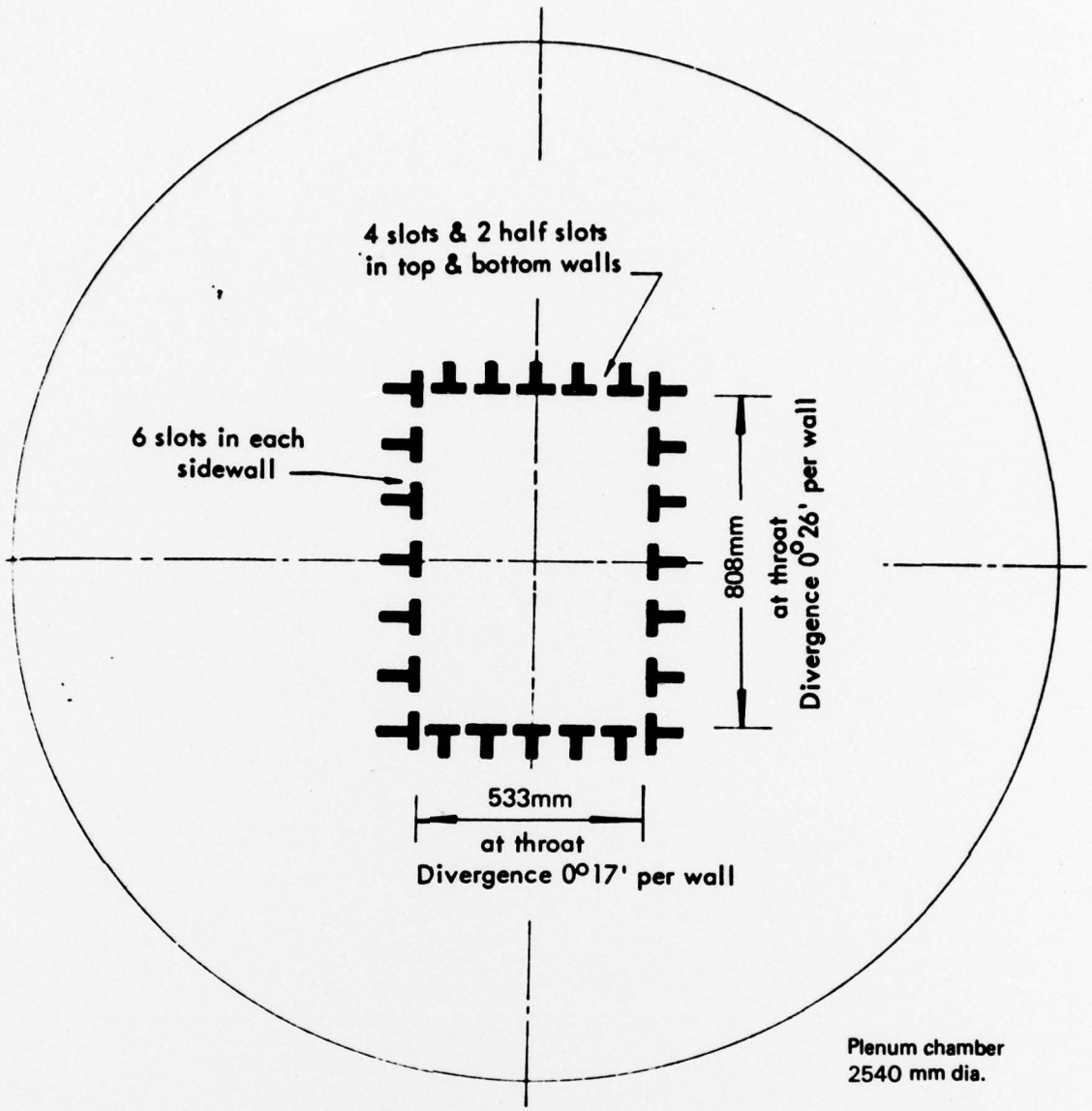


FIG. 2 DETAILS OF MODEL



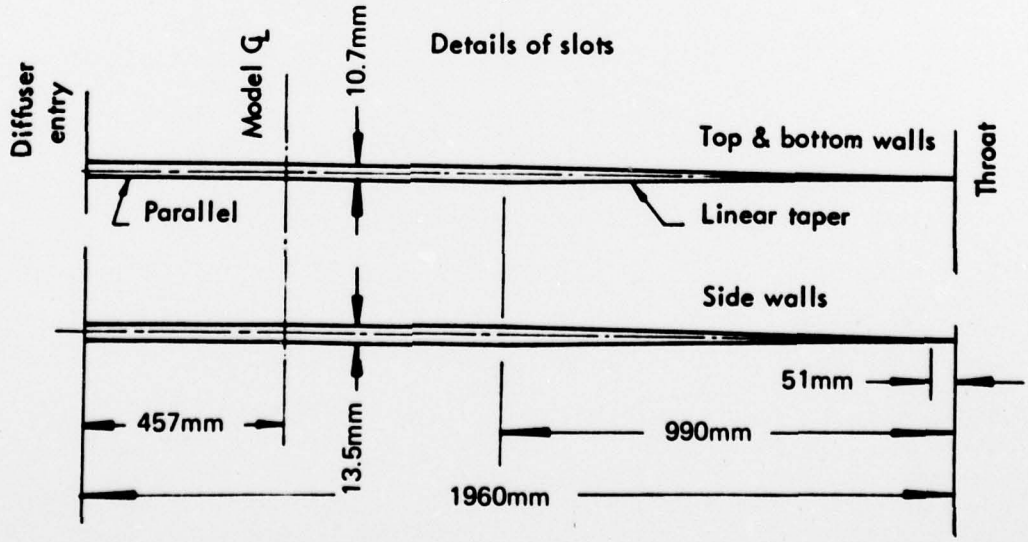


FIG. 3 DETAILS OF SLOTTED TEST SECTION

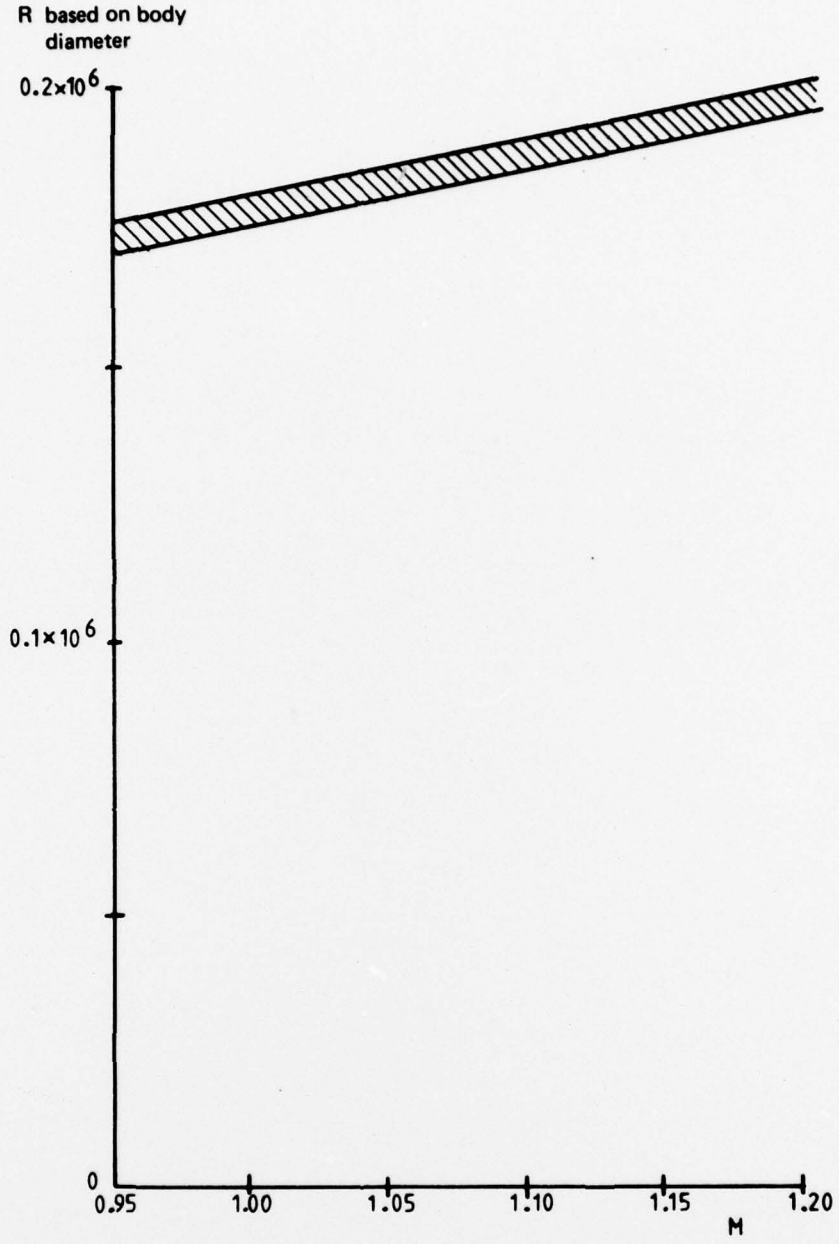


FIG. 4 VARIATION OF TEST REYNOLDS NUMBER WITH MACH NUMBER

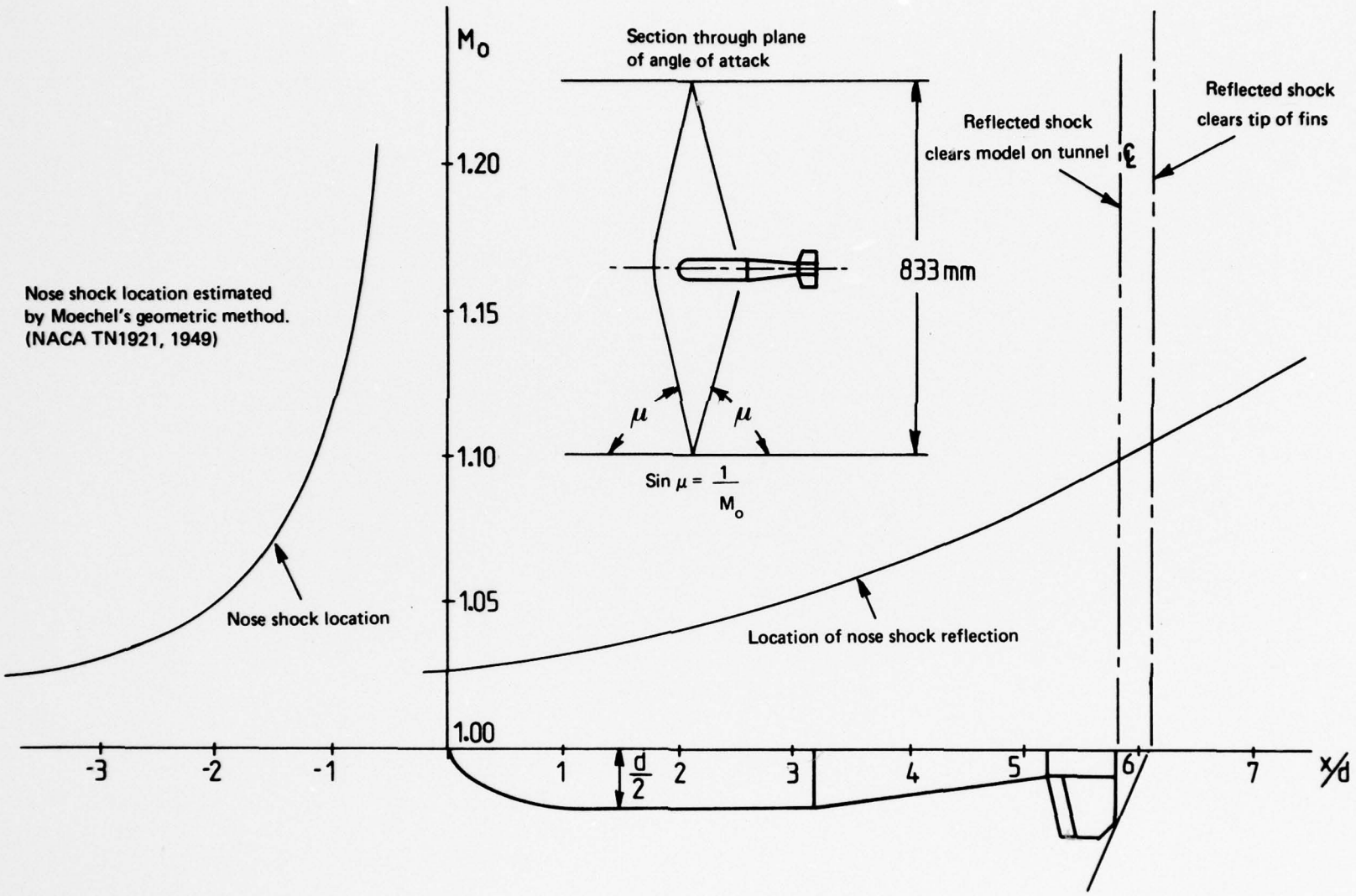


FIG. 5 WALL REFLECTED WAVE INTERFERENCE

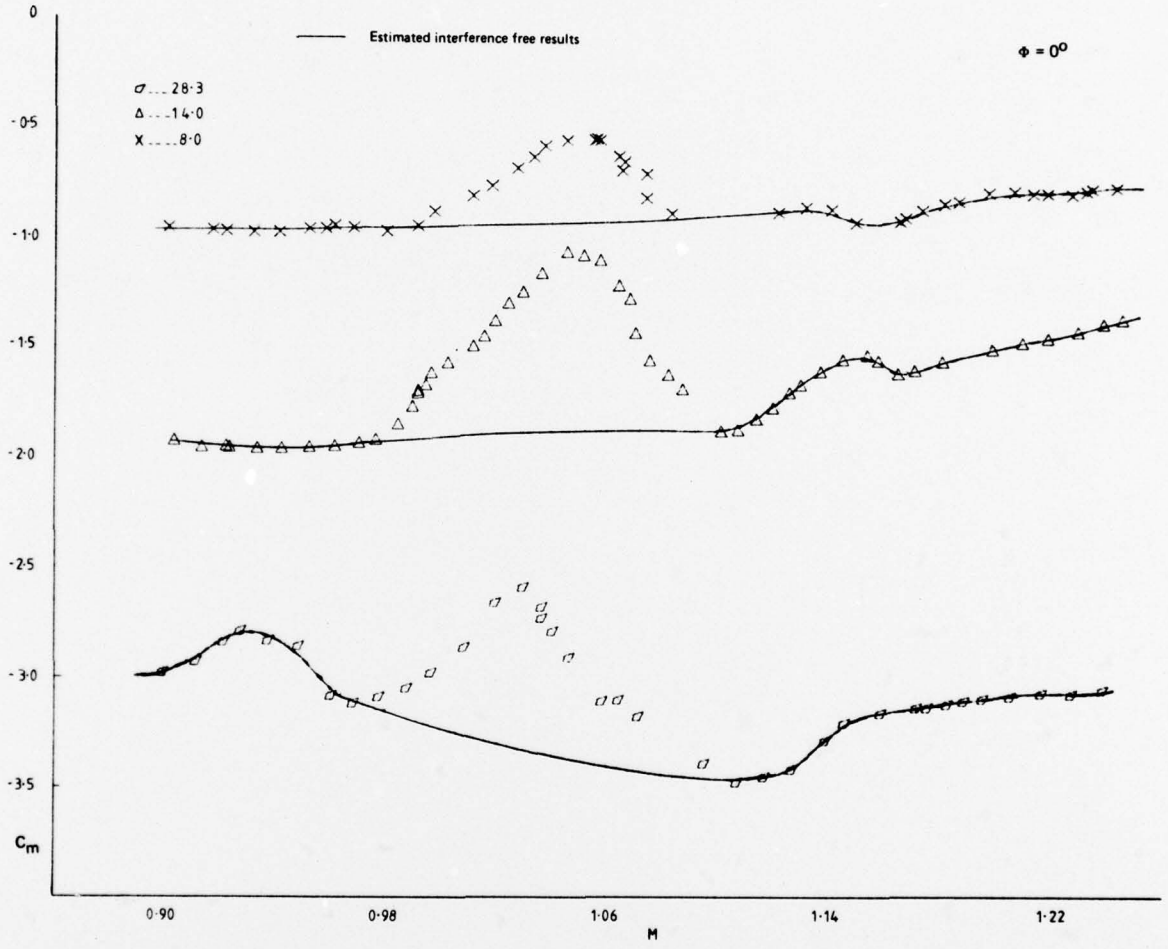


FIG. 6 VARIATION OF C_m WITH M (FINE M INCREMENT RUNS)

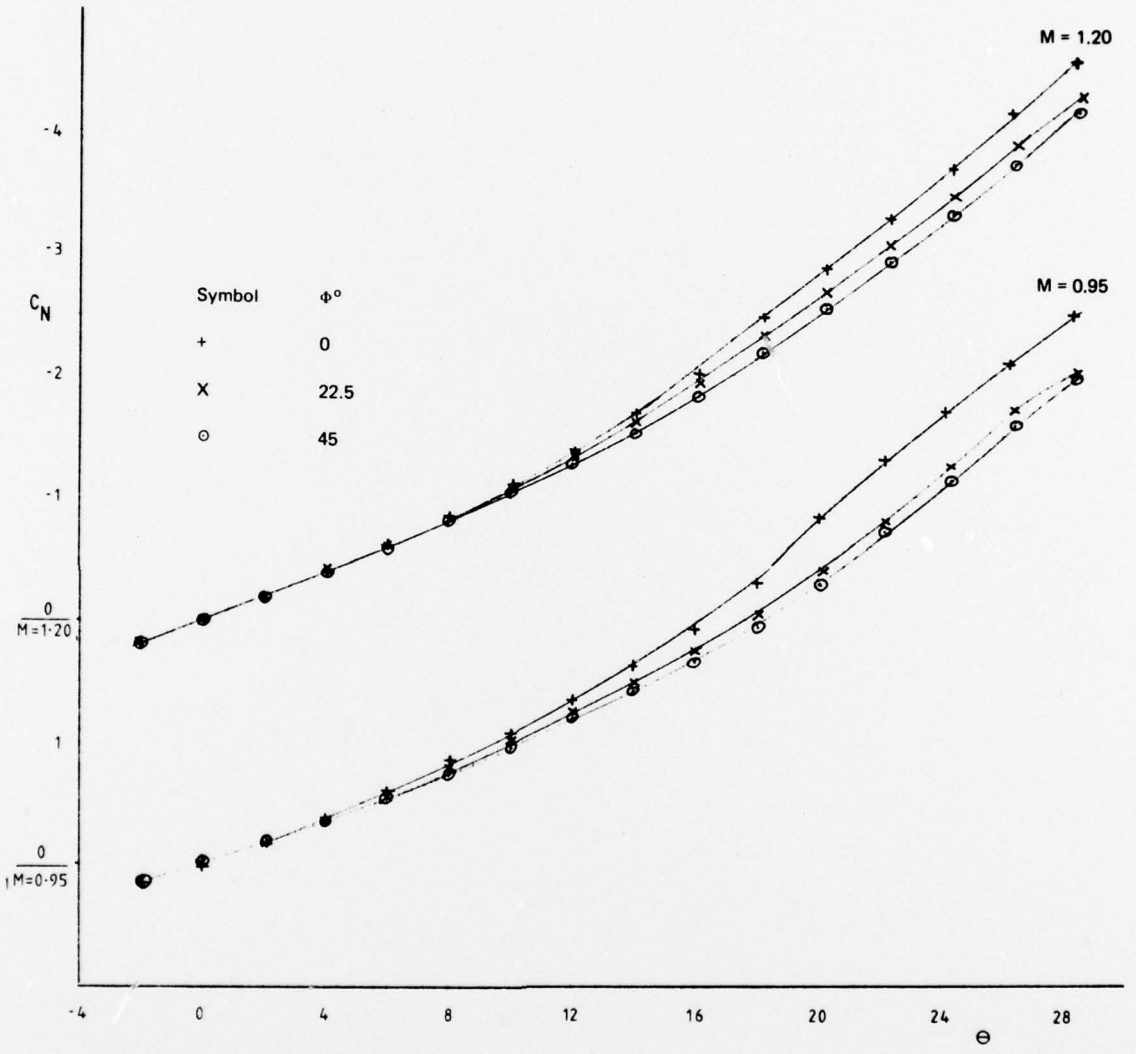


FIG. 7 VARIATION OF C_N WITH θ

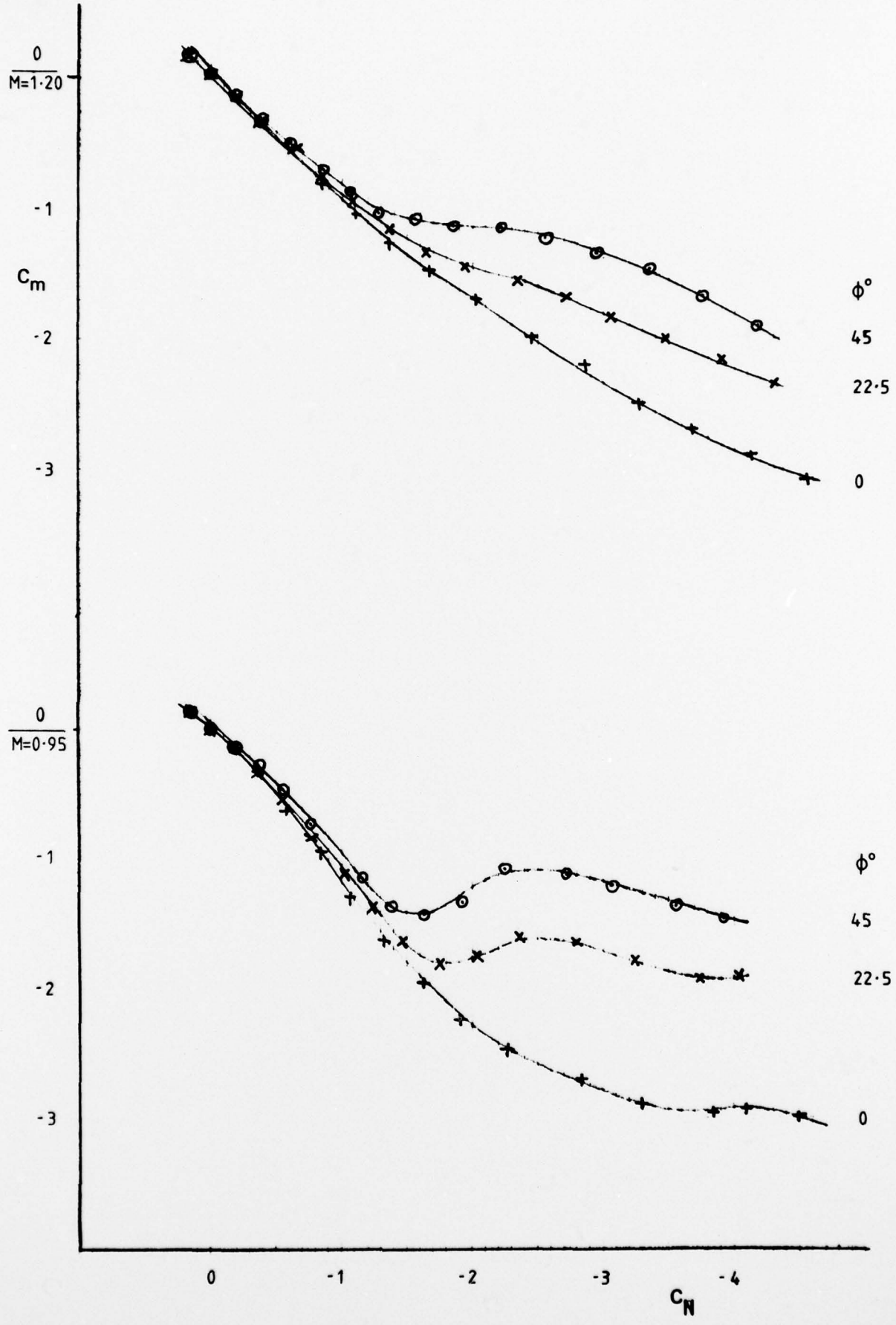
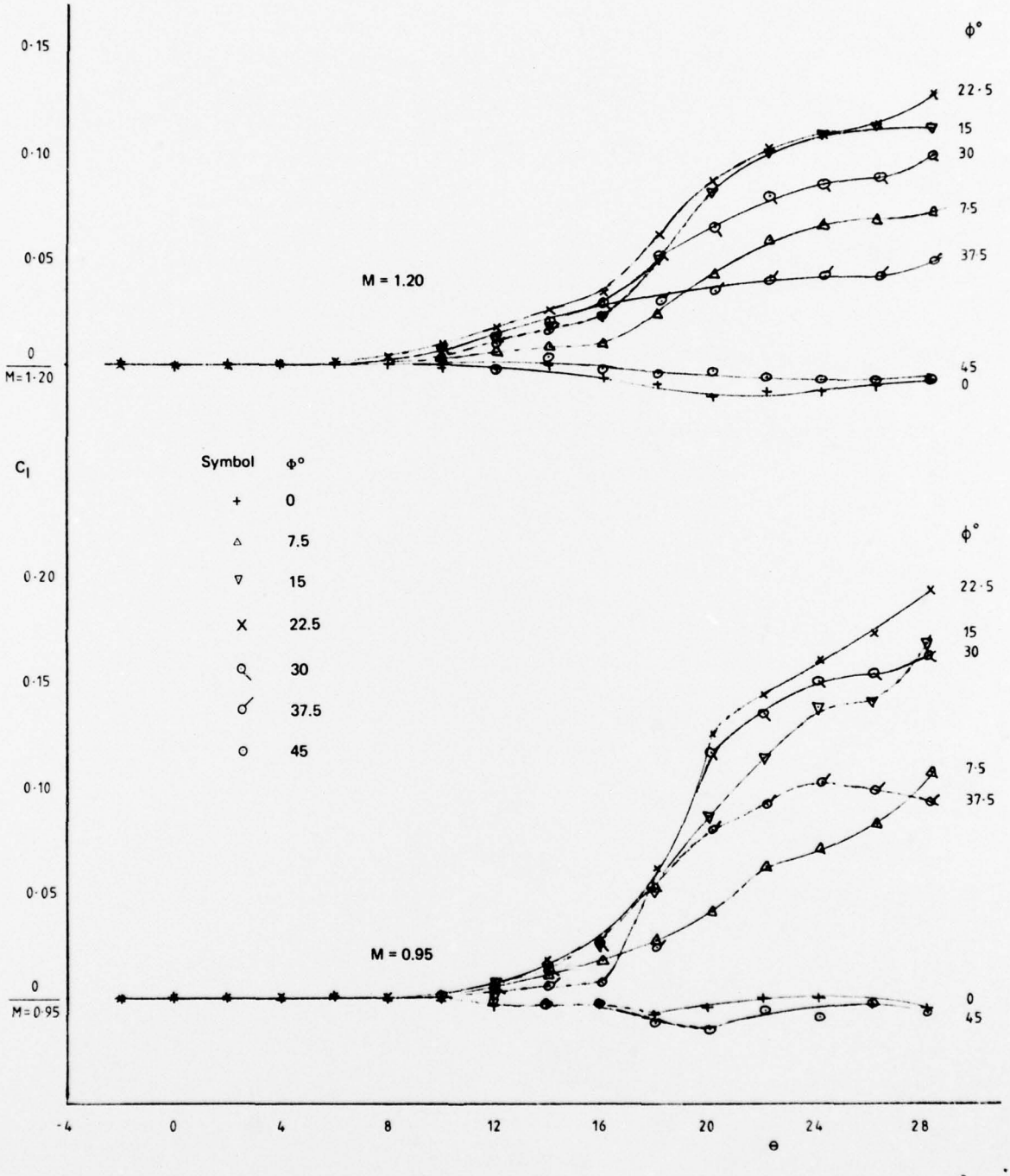


FIG. 8 VARIATION OF C_m WITH C_N



C_l

FIG. 9 VARIATION OF C_l WITH θ

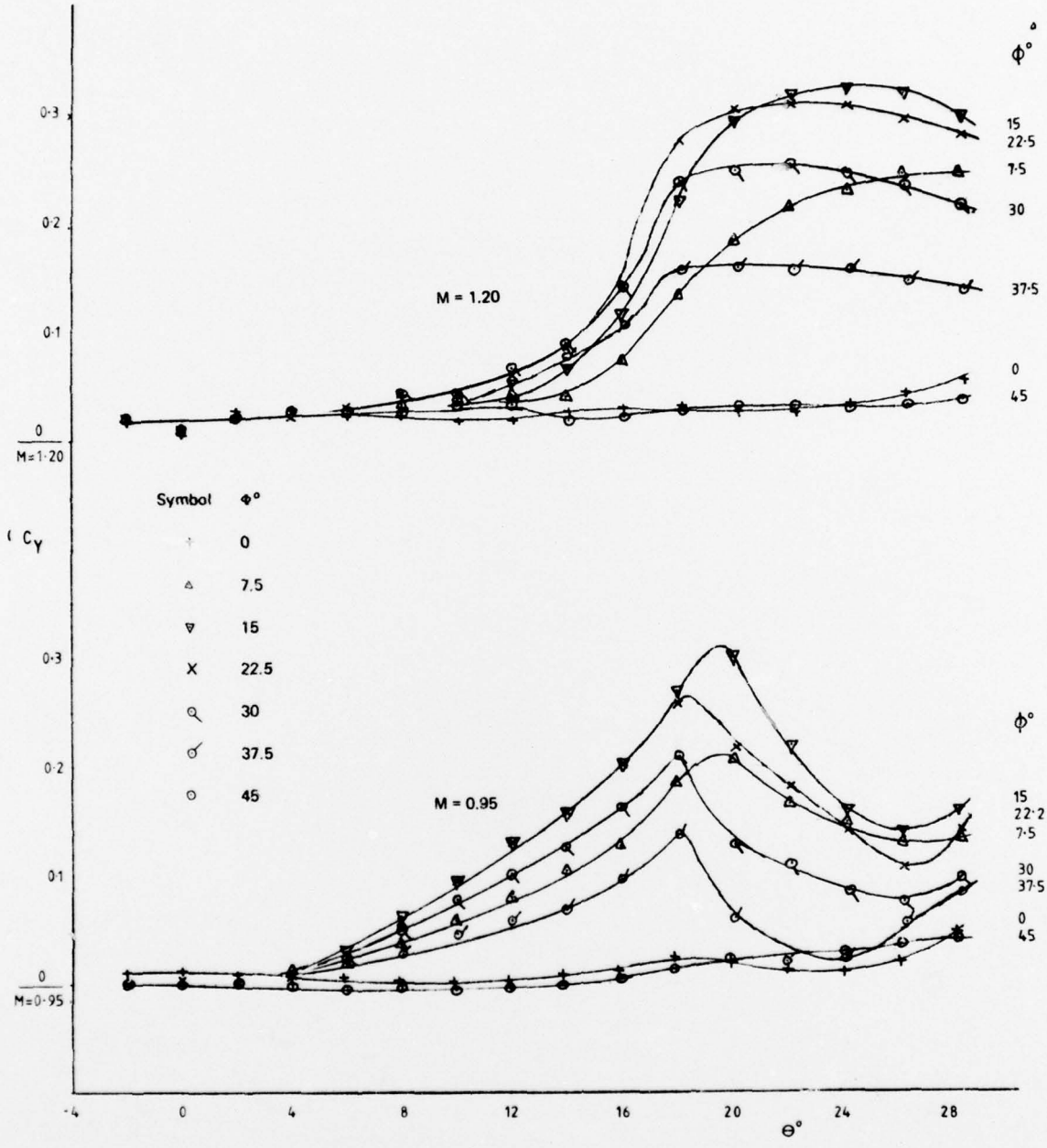


FIG. 10 VARIATION OF C_Y WITH θ

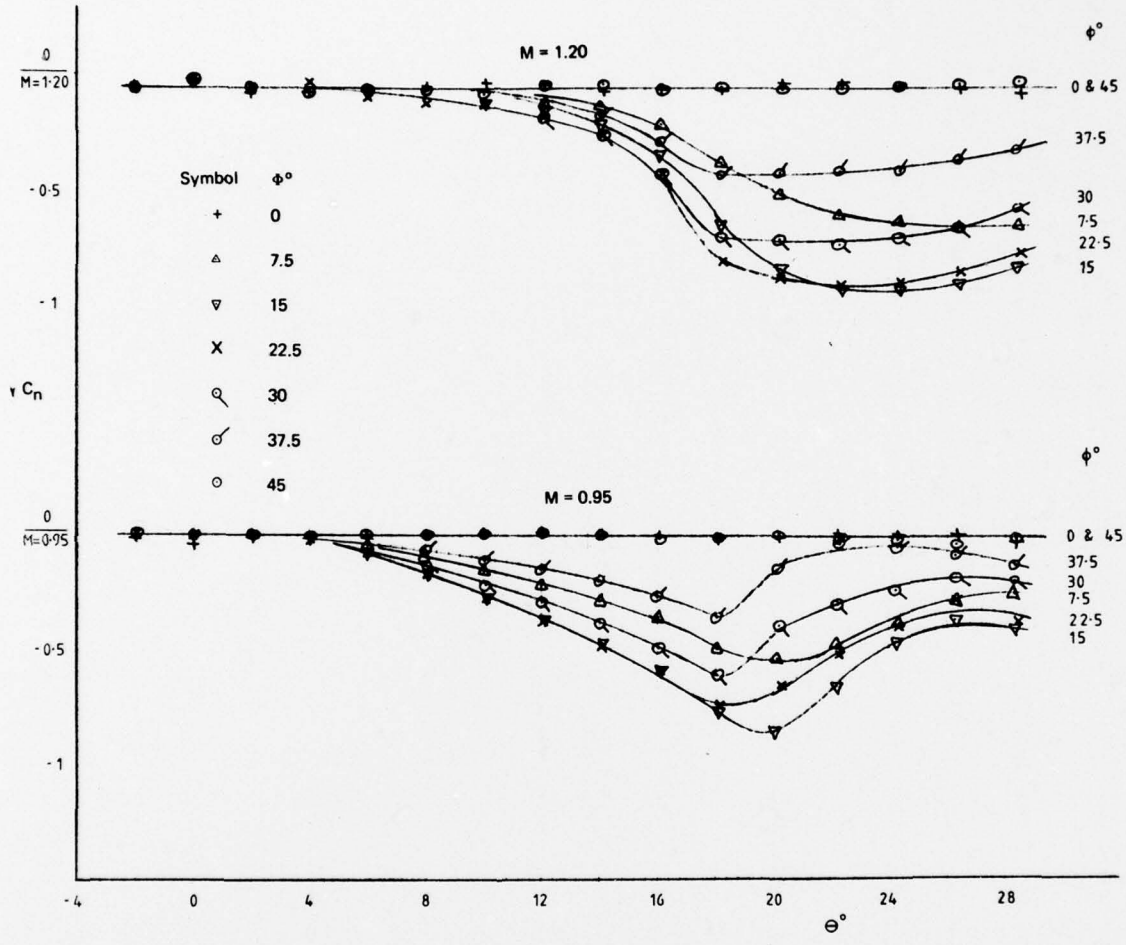


FIG. 11 VARIATION OF C_n WITH θ

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