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RESEARCH MEMORANDUM

TABULATED PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS MEASURED ON THE WING OF THE BELL X-1 AIRPLANE IN LEVEL FLIGHT AT MACH NUMBERS FROM 0.79 TO 1.00 AND IN A PULL-UP AT A MACH NUMBER OF 0.96

By H. Arthur Carner and Mary M. Payne

Langley Aeronautical Laboratory
Langley Air Force Base, Va.

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WASHINGTON

September 18, 1950

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RESEARCH MEMORANDUM

TABULATED PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS MEASURED ON THE WING OF THE BELL X-1 AIRPLANE IN LEVEL FLIGHT AT MACH NUMBERS FROM 0.79 TO 1.00 AND IN A PULL-UP AT A MACH NUMBER OF 0.96

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SUMMARY

Tabulated pressure coefficients and aerodynamic characteristics are presented for six spanwise stations on the left wing of the Bell X-1 research airplane. The data were obtained in level flight at Mach numbers from 0.79 to 1.00 and in a pull-up to an airplane normal-force coefficient of 0.91 at a Mach number of approximately 0.96.

INTRODUCTION

Flight tests are being conducted to determine the spanwise and chordwise loading on the wing of the Bell X-1 research airplane throughout the transonic and low supersonic range. The purpose of the present paper is to present the data obtained in a level run through a Mach number range from 0.79 to 1.00 and for an airplane normal-force-coefficient range from 0.27 to 0.91 at a Mach number of approximately 0.96. Analyzed data for station D (64.4 percent semispan) are presented in reference 1.

SYMBOLS

M	free-stream Mach number
n	normal load factor
W	airplane weight, pounds

S	wing area, including area projected through fuselage (130 sq ft)
S'	area of wing panels outboard of station A (99.4 sq ft)
C_{N_A}	airplane normal-force coefficient (nW/qS)
δ_{a_L}	left aileron angle, deg
$b/2$	wing semispan (14 ft)
$b'/2$	spanwise distance from station A to wing tip (11.42 ft)
c	local wing chord parallel to plane of symmetry, feet
$\bar{c}$	average chord of wing panel, feet (S'/b')
c'	mean aerodynamic chord of wing panel (M.A.C.), feet $\left(\frac{2}{S'}\int_0^{b'/2} c^2 dy'\right)$
x	chordwise distance from leading edge of local chord, feet
y	spanwise distance outboard of airplane center line, feet
y'	spanwise distance outboard of station A, feet
q	free-stream dynamic pressure, pounds per square foot
p_o	free-stream static pressure, pounds per square foot
p	local static pressure, pounds per square foot
p_u	local static pressure on upper surface, pounds per square foot
p_l	local static pressure on lower surface, pounds per square foot
P	pressure coefficient $\left(\frac{p - p_o}{q}\right)$
P_R	resultant pressure coefficient $\left(\frac{p_l - p_u}{q}\right)$
c_n	section normal-force coefficient $\left(\int_0^1 P_R \, d\frac{x}{c}\right)$

$c_{m_{c/4}}$ section pitching-moment coefficient about 0.25-local-chord point $\left(\int_0^1 - P_R\left(\frac{x}{c} - 0.25\right)d\,\frac{x}{c}\right)$

c_m' section pitching-moment coefficient about a line perpendicular to longitudinal axis of airplane, passing through 0.25-chord point of mean aerodynamic chord of wing panel $\left(\int_0^1 - P_R\left(\frac{x}{c} - \frac{0.40c - 0.15c'}{c}\right)d\,\frac{x}{c}\right)$

C_N' wing-panel normal-force coefficient $\left(\int_0^1 c_n \frac{c}{\bar{c}}\, d\,\frac{2y'}{b'}\right)$

C_{BM}' wing-panel bending-moment coefficient about station A $\left(\int_0^1 c_n \frac{c}{\bar{c}}\frac{2y'}{b'}\, d\,\frac{2y'}{b'}\right)$

C_M' wing-panel pitching-moment coefficient about 0.25 mean aerodynamic chord $\left(\frac{\bar{c}}{c'}\int_0^1 c_m'\left(\frac{c}{\bar{c}}\right)^2 d\,\frac{2y'}{b'}\right)$

c.p. center of pressure

DESCRIPTION OF AIRPLANE AND TEST PANEL

The Bell X-1 research airplane used in these tests is shown in figure 1. A three-view drawing of the airplane showing the general overall dimensions is given as figure 2. The spanwise and chordwise locations of the pressure-measuring orifices are shown in figure 3.

The airplane has a 10-percent-thick wing and incorporates an NACA 65-110 airfoil section with slight modifications. The ordinates of the airfoil section are given in table 1. Over the landing flap, the section is modified rearward of the 0.85-chord point to give a finite trailing-edge thickness; over the ailerons, the cusp is replaced by a straight taper from 0.85 chord to the trailing edge (reference 2). A line passing through the 0.40-chord point of the local chords is perpendicular to the longitudinal axis of the airplane. The wing has an incidence angle with respect to the fuselage axis of 2.5° at the root and 1.5° at the tip, an aspect ratio of 6, and a taper ratio of 0.5. The skin thickness is approximately 0.4 inch at the root and 0.15 inch at the tip. The wing

was painted and polished during the test, but no refined filling or smoothing was attempted.

INSTRUMENTATION

Standard NACA recording instruments were used to obtain airspeed, pressure altitude, normal acceleration, and control positions. Wing-surface pressures were measured by two NACA recording multiple manometers. All records were synchronized by a common timer.

Free-stream static and dynamic pressures were recorded with an NACA high-speed pitot-static head located at the left wing tip. The static vents were located approximately 0.96 of the local chord ahead of the wing.

Wing-surface pressures were measured from flush-type orifices installed in the wing skin. The orifices were connected to the instrument compartment by $\frac{1}{8}$-inch-inside-diameter aluminum tubing. Rubber tubing of $\frac{3}{16}$-inch inside diameter was used between the aluminum tubing and the manometer cells. The length of the aluminum tubing varied from about 2 feet at the root station to about 14 feet at the tip station. About 3 feet of rubber tubing were used on each line.

ACCURACY

The accuracy of the test results is estimated to be within the following limits:

Mach number	±0.01
P	±0.02
c_n	±0.05
$c_{m_{c/4}}$	±0.006

TESTS

The data presented herein were obtained in level flight for a Mach number range of 0.79 to 1.00 at an airplane normal-force coefficient of approximately 0.31 and in a pull-up to an airplane normal-force coefficient of 0.91 at a Mach number of 0.96. Rolling velocities were low

despite a lateral oscillation encountered in the Mach number region of the tests. The ailerons were held close to neutral through most of the speed run and during the pull-up.

METHODS

The wing is treated herein as an isolated panel and the coefficients obtained from the pressure distributions are based on the geometric properties of the wing panel outboard of station A (fig. 3(a)). Station A is approximately 3 inches outboard of the wing-fuselage junction and 31 inches outboard of the center line of the airplane.

The pressure differential was measured at stations A, B, C, E, and F (fig. 3(a)). At station D, the individual surface pressures were measured relative to the instrument compartment pressure. Static pressure at the pitot-static head was also measured relative to compartment pressure. The measured static pressure at the boom was corrected to free-stream static pressure by use of the radar-tracking method of reference 3.

Ground tests were made to determine any effects of lag that might be present in measuring the wing-surface pressures. These tests show that the effects of lag are negligible and have been neglected in these data.

Section coefficients were obtained by mechanical integration of the chordwise pressure distributions. Panel coefficients were obtained by spanwise integration of the section coefficients.

PRESENTATION OF RESULTS

Table 2 presents the measured pressure coefficients and aerodynamic characteristics obtained in a level run from a Mach number of 0.79 to 1.00. Pressure coefficients are not presented for all the orifices as some of the orifices were inoperative during the tests. Some of the manometer cells did not have an adequate range to measure all pressures encountered; thus, pressure coefficients are not presented for the times when these cells were off scale.

Presented in table 3 are the measured pressure coefficients and aerodynamic characteristics obtained in a pull-up at a Mach number of approximately 0.96.

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National Advisory Committee for Aeronautics
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REFERENCES

1. Carner, H. Arthur, and Knapp, Ronald J.: Flight Measurements of the Pressure Distribution on the Wing of the X-1 Airplane (10-Percent-Thick Wing) over a Chordwise Station near the Midspan, in Level Flight at Mach Numbers from 0.79 to 1.00 and in a Pull-Up at a Mach Number of 0.96. NACA RM L50H04, 1950.

2. Ormsby, C. A.: Aerodynamic Design of the MX-653 Wing. Rep. No. 44-943-008 Bell Aircraft Corp., June 5, 1945.

3. Zalovcik, John A.: A Radar Method of Calibrating Airspeed Installations on Airplanes in Maneuvers at High Altitudes and at Transonic and Supersonic Speeds. NACA TN 1979, 1949.

TABLE 1

AIRFOIL ORDINATES OF THE X-1 WING

[Abscissa and ordinates in percent of local chord]

Abscissa	Ordinate			
	Flap stations		Aileron stations	
	Upper surface	Lower surface	Upper surface	Lower surface
0	0	0	0	0
.50	.796	-.746	.796	-.746
.75	.966	-.896	.966	-.896
1.25	1.222	-1.115	1.222	-1.115
2.50	1.667	-1.481	1.667	-1.481
5.00	2.334	-2.018	2.334	-2.018
7.50	2.859	-2.435	2.859	-2.435
10.00	3.298	-2.781	3.298	-2.781
15.00	4.002	-3.329	4.002	-3.329
20.00	4.541	-3.745	4.541	-3.745
25.00	4.951	-4.056	4.951	-4.056
30.00	5.246	-4.274	5.246	-4.274
35.00	5.439	-4.409	5.439	-4.409
40.00	5.532	-4.461	5.532	-4.461
45.00	5.511	-4.416	5.511	-4.416
50.00	5.364	-4.261	5.364	-4.261
55.00	5.078	-3.983	5.078	-3.983
60.00	4.682	-3.611	4.682	-3.611
65.00	4.197	-3.167	4.197	-3.167
70.00	3.642	-2.670	3.642	-2.670
75.00	3.032	-2.137	3.032	-2.137
80.00	2.385	-1.589	2.385	-1.589
85.00	1.721	-1.048	1.721	-1.048
90.00	1.100	-.687	1.148	-.698
95.00	.525	-.295	.574	-.349
100.00	0	0	0	0
L.E. radius = 0.687 percent chord				

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$

(a) $M = 0.793$; $C_{N_A} = 0.340$; $\delta_{a_L} = 0.05^\circ$ up

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.048	-----	-----	-----
2	1.097	0.951	0.933	-.270	0.468	1.249	0.809
3	1.136	.852	.753	-----	.316	.927	.578
4	.917	.822	.748	-.516	.186	.677	.456
5	.588	-----	-----	-----	-----	-----	.452
6	.540	.633	.617	-.717	-----	.590	.191
7	-----	-----	-----	-.788	-.274	.465	.245
8	-----	-----	.499	-.810	-----	-----	.284
9	.519	.556	.535	-.859	-.343	.441	-----
10	.580	.560	-----	-.936	-.331	.479	-----
11	.550	.558	.637	-.966	-.354	.550	.199
12	.124	.572	.838	-1.078	-.311	-----	.209
13	.071	.075	.207	-.406	-----	.241	.116
14	.065	.047	-----	-.301	-.201	.083	.049
15	.055	.024	-----	-.175	-.118	.079	.039
16	-----	.039	.032	-----	-.068	.057	.075
17	-----	-----	.067	-----	.008	-----	.024
18	.14	.193	-----	.040	.105	.012	.083
19	-----	-----	-----	.091	-----	-----	.037
20	.012	-----	.057	.128	-----	-.053	-.043
21	-----	-----	-----	.158	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.339	0.405	0.406	0.386	0.341	0.185
$c_{m_{c/4}}$	-0.006	-0.029	-0.031	-0.029	-0.008	-0.003

Integrated panel aerodynamic characteristics	
$C_N' = 0.362$ $C_{BM}' = 0.150$ $C_M' = -0.020$	Lateral c.p. (percent panel span) = 41.3 Chord c.p. (percent M.A.C.) = 30.6

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(b) $M = 0.808$; $C_{N_A} = 0.331$; $\delta_{a_L} = 0.00°$

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.076	-----	-----	-----
2	1.050	0.891	0.867	-.222	0.457	1.000	0.780
3	1.093	.799	.677	-----	.300	.867	.561
4	.876	.761	.701	-.586	.141	.645	.438
5	.556	-----	-----	-----	-----	-----	.443
6	.501	.616	.597	-.706	-----	.559	.181
7	-----	-----	-----	-.803	-.299	.482	.272
8	-----	-----	.508	-.829	-----	-----	.282
9	.501	.544	.527	-.884	-.379	.445	-----
10	.556	.535	-----	-.959	-.372	.421	-----
11	.571	.539	.612	-.961	-.398	.318	.236
12	.397	.742	.824	-1.099	-.338	-----	.275
13	.132	.224	.330	-.538	-----	.412	.147
14	.077	.176	-----	-.437	-.208	.217	.051
15	.051	.104	-----	-.338	-.124	.132	.046
16	-----	.060	.123	-----	-.071	.089	.077
17	-----	-----	.079	-----	.002	-----	.024
18	.017	.246	-----	.004	.110	.007	.092
19	-----	-----	-----	.072	-----	-----	.043
20	.014	-----	.041	.129	-----	-.063	-.043
21	-----	-----	-----	.146	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.341	0.416	0.401	0.400	0.341	0.196
$c_{m_{c/4}}$	-0.011	-0.041	-0.033	-0.041	-0.011	-0.007

Integrated panel aerodynamic characteristics	
$C_N' = 0.367$ $C_{BM}' = 0.152$ $C_M' = -0.029$	Lateral c.p. (percent panel span) = 41.5 Chord c.p. (percent M.A.C.) = 32.8

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(c) $M = 0.839$; $C_{N_A} = 0.328$; $\delta_{a_L} = 0.47^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	-1.101	-----	-----	-----
2	0.953	0.791	0.786	-.210	0.458	1.126	0.738
3	1.029	.723	.608	-----	.308	.841	.538
4	.838	.696	.626	-.496	.205	.593	.430
5	.513	-----	-----	-----	-----	-----	.405
6	.488	.586	.561	-.666	-----	.508	.198
7	-----	-----	-----	-.754	-.298	.465	.265
8	-----	-----	.465	-.831	-----	-----	.278
9	.428	.463	.488	-.891	-.393	.463	-----
10	.453	.390	-----	-.901	-.396	.460	-----
11	.435	.375	.465	-.911	-.519	.418	.178
12	.588	.586	.698	-.513	-.578	-----	.325
13	.208	.180	.308	-.408	-----	.458	.325
14	.133	.210	-----	-.396	-.218	.278	.103
15	.105	.238	-----	-.381	-.135	.288	.055
16	-----	.235	.300	-----	-.098	.263	.080
17	-----	-----	.245	-----	-.018	-----	.035
18	.028	.403	-----	-.190	.092	.098	.125
19	-----	-----	-----	-.170	-----	-----	.053
20	.015	-----	.048	-.123	-----	-.058	-.040
21	-----	-----	-----	-.093	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.336	0.430	0.413	0.370	0.368	0.204
$c_{m_{c/4}}$	-0.018	-0.064	-0.052	-0.045	-0.034	-0.014

Integrated panel aerodynamic characteristics	
$C_N' = 0.371$ $C_{BM}' = 0.155$ $C_M' = -0.044$	Lateral c.p. (percent panel span) = 41.7 Chord c.p. (percent M.A.C.) = 36.7

*Resultant pressure coefficient

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(d) $M = 0.847$; $C_{N_A} = 0.286$; $\delta_{a_L} = 0.40^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.148	-----	-----	-----
2	0.746	0.657	0.615	-.273	0.424	0.873	0.562
3	.801	.595	.490	-.201	.284	.622	.373
4	.684	.587	.525	-.402	.138	.483	.311
5	.450	-----	-----	-----	-----	-----	.343
6	.391	.485	.460	-.569	-----	.416	.144
7	-----	-----	-----	-.686	-.325	.376	.216
8	-----	-----	.361	-.731	-----	-----	.219
9	.363	.401	.386	-.788	-.455	.336	-----
10	.396	.323	-----	-.828	-.407	.363	-----
11	.363	.281	.507	-.868	-.509	.343	.154
12	.393	.366	.617	-.569	-.604	-----	.194
13	.207	.057	-.025	-.392	-----	.435	.323
14	.137	.199	-----	-.375	-.231	.269	.137
15	.127	.231	-----	-.350	-.121	.304	.062
16	-----	.254	.348	-----	-.081	.318	.080
17	-----	-----	.314	-----	-.017	-----	.025
18	.050	.430	-----	-.203	.098	.142	.095
19	-----	-----	-----	-.178	-----	-----	.045
20	.015	-----	.062	-.139	-----	-.047	-.045
21	-----	-----	-----	-.104	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.284	0.368	0.343	0.296	0.323	0.166
$c_{m_{c/4}}$	-0.022	-0.061	-0.048	-0.046	-0.043	-0.013

Integrated panel aerodynamic characteristics	
$C_N' = 0.313$	
$C_{BM}' = 0.131$	Lateral c.p. (percent panel span) = 41.8
$C_M' = -0.043$	Chord c.p. (percent M.A.C.) = 38.7

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $\dot{C}_{N_A} \approx 0.31$ - Continued

(e) $M = 0.867$; $C_{N_A} = 0.277$; $\delta_{a_L} = 0.74^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.099	-----	-----	-----
2	1.054	0.862	0.862	-.116	0.516	1.112	0.751
3	1.088	.819	.673	-.252	.360	.823	.537
4	.921	.775	.653	-.444	.205	.595	.418
5	.595	-----	-----	-----	-----	-----	.389
6	.505	.607	.559	-.616	-----	.493	.243
7	-----	-----	-----	-.716	-.281	.444	.265
8	-----	-----	.430	-.771	-----	-----	.270
9	.449	.432	.474	-.808	-.412	.393	-----
10	.471	.398	-----	-.869	-.385	.418	-----
11	.398	.265	.095	-.703	-.490	.398	.164
12	-.058	-.180	-.056	-.402	-.582	-----	.216
13	-.189	-.260	-.270	-.354	-----	-.187	.192
14	-.202	-.279	-----	-.361	-.716	-.248	.002
15	-.024	-.277	-----	-.329	-.711	-.051	.066
16	-----	.131	.034	-----	-.351	.274	.117
17	-----	-----	.182	-----	-.133	-----	.055
18	.092	.474	-----	-.247	.047	.347	.146
19	-----	-----	-----	-.242	-----	-----	.068
20	.039	-----	.197	-.239	-----	.163	-.032
21	-----	-----	-----	-.210	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.279	0.323	0.276	0.234	0.314	0.195
$c_{m_{c/4}}$	0.007	-0.023	-0.024	0.000	-0.033	-0.010

Integrated panel aerodynamic characteristics	
$C_N' = 0.280$ $C_{BM}' = 0.118$ $C_M' = -0.017$	Lateral c.p. (percent panel span) = 42.2 Chord c.p. (percent M.A.C.) = 31.2

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(f) $M = 0.886$; $C_{N_A} = 0.283$; $\delta_{a_L} = 1.54^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.091	-----	-----	-----
2	1.176	1.005	1.033	-.150	0.597	1.295	0.960
3	1.223	.937	.843	-.291	.461	1.019	.691
4	1.000	.848	.750	-.469	.274	.782	.609
5	.714	-----	-----	-----	-----	-----	.422
6	.574	.682	.632	-.651	-----	.543	.300
7	-----	-----	-----	-.717	-.227	.520	.312
8	-----	-----	.494	-.780	-----	-----	.314
9	.494	.506	.529	-.855	-.363	.464	-----
10	.501	.443	-----	-.883	-.349	.468	-----
11	.431	.368	.508	-.820	-.443	.459	.185
12	.040	.040	.225	-.457	-.523	-----	.253
13	-.129	-.145	-.073	-.410	-----	-.021	.204
14	-.155	-.159	-----	-.401	-.670	-.094	.155
15	-.330	-.216	-----	-.391	-.694	-.117	.124
16	-----	-.220	-.230	-----	-.691	-.105	.021
17	-----	-----	-.084	-----	-.654	-----	-.162
18	-.141	.443	-----	-.335	-.321	.321	.227
19	-----	-----	-----	-.333	-----	-----	.223
20	.063	-----	.138	-.323	-----	.176	.064
21	-----	-----	-----	-.298	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.263	0.356	0.316	0.251	0.336	0.237
$c_{m_{c/4}}$	0.038	-0.013	0.003	0.018	-0.018	-0.013

Integrated panel aerodynamic characteristics	
$C_N' = 0.303$ $C_{BM}' = 0.131$ $C_M' = 0.001$	Lateral c.p. (percent panel span) = 43.1 Chord c.p. (percent M.A.C.) = 24.7

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(g) $M = 0.890$; $C_{N_A} = 0.326$; $\delta_{a_L} = 1.81^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.057	-----	-----	-----
2	1.351	1.142	1.216	-.210	0.658	1.376	1.066
3	1.216	1.066	.980	-----	.503	1.161	.788
4	1.156	.959	.855	-.530	.327	.911	.704
5	.823	-----	-----	-----	-----	-----	.517
6	.681	.762	.686	-.690	-----	.614	.329
7	-----	-----	-----	-.757	-.196	.565	.348
8	-----	-----	.570	-.808	-----	-----	.348
9	.544	.616	.595	-.866	-.333	.498	-----
10	.556	.505	-----	-.926	-.308	.517	-----
11	.487	.385	.556	-.885	-.426	.510	.199
12	.046	.056	.118	-.495	-.519	-----	.264
13	-.097	-.079	-.042	-.449	-----	.037	.222
14	-.093	-.127	-----	-.435	-.651	-.039	.169
15	-.266	-.174	-----	-.421	-.158	-.067	.130
16	-----	-.171	-.204	-----	-.667	-.076	.169
17	-----	-----	-.037	-----	-.627	-----	-.120
18	-.243	.429	-----	-.361	-.331	.176	.209
19	-----	-----	-----	-.368	-----	-----	.236
20	.044	-----	.118	-.375	-----	.202	.116
21	-----	-----	-----	-.333	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.303	0.402	0.354	0.304	0.387	0.277
$c_{m_{c/4}}$	-0.042	-0.007	-0.003	-0.018	-0.015	-0.020

Integrated panel aerodynamic characteristics	
$C_N' = 0.345$	
$C_{BM}' = 0.149$	Lateral c.p. (percent panel span) = 43.2
$C_M' = 0.004$	Chord c.p. (percent M.A.C.) = 23.8

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(h) $M = 0.919$; $C_{N_A} = 0.321$; $\delta_{a_L} = 1.43^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.123	-----	-----	-----
2	1.039	0.879	0.852	-.064	0.591	1.169	0.835
3	1.106	.798	.714	-.200	.459	.889	.607
4	.876	.748	.631	-.367	.305	.681	.542
5	.640	-----	-----	-----	-----	-----	.369
6	.497	.601	.560	-.561	-----	.495	.252
7	-----	-----	-----	-.623	-.185	.482	.306
8	-----	-----	-.436	-.695	-----	-----	.291
9	.447	.453	.466	-.775	-.331	.423	-----
10	.438	.395	-----	-.803	-.320	.427	-----
11	.382	.334	.453	-.803	-.407	.425	.171
12	.351	.382	.471	-.914	-.472	-----	.228
13	.325	.362	.410	-.879	-----	.399	.195
14	.388	.382	-----	-.966	-.610	.380	.143
15	.254	.000	-----	-.754	-.623	.432	.108
16	-----	-.059	-.065	-----	-.643	.380	.148
17	-----	-----	.048	-----	-.608	-----	.117
18	-.106	.375	-----	-.476	-.439	.039	.297
19	-----	-----	-----	-.487	-----	-----	.323
20	-.074	-----	.008	-.515	-----	-.020	.076
21	-----	-----	-----	-.493	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.343	0.407	0.351	0.352	0.386	0.244
$c_{m_{c/4}}$	-0.011	-0.046	-0.025	-0.021	-0.040	-0.030

Integrated panel aerodynamic characteristics	
$C_N' = 0.359$ $C_{BM}' = 0.155$ $C_M' = 0.029$	Lateral c.p. (percent panel span) = 43.1 Chord c.p. (percent M.A.C.) = 33.1

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(i) $M = 0.933$; $C_{N_A} = 0.283$; $\delta_{a_L} = 1.35^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.155	-----	-----	-----
2	0.792	0.658	0.629	.059	0.529	0.912	0.605
3	.876	.612	.491	-.093	.406	.686	.430
4	.715	.576	.506	-.261	.269	.495	.377
5	.459	-----	-----	-----	-----	-----	.307
6	.406	.495	.461	-.466	-----	.398	.167
7	-----	-----	-----	-.555	-.195	.394	.262
8	-----	-----	.345	-.625	-----	-----	.248
9	.370	.362	.394	-.703	-.347	.349	-----
10	.368	.330	-----	-.713	-.339	.358	-----
11	.320	.265	.362	-.739	-.409	.341	.138
12	.288	.320	.411	-.845	-.479	-----	.188
13	.267	.292	.351	-.807	-----	.337	.159
14	.326	.324	-----	-.904	-.608	.320	.127
15	.260	.353	-----	-.944	-.616	.368	.085
16	-----	.381	.281	-----	-.648	.330	.125
17	-----	-----	.394	-----	-.610	-----	.085
18	.042	.463	-----	-.557	-.468	.243	.248
19	-----	-----	-----	-.525	-----	-----	.277
20	-.108	-----	-.004	-.531	-----	-.025	.034
21	-----	-----	-----	-.487	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.296	0.401	0.357	0.315	0.335	0.192
$c_{m_{c/4}}$	-0.021	-0.079	-0.058	-0.041	-0.050	-0.025

Integrated panel aerodynamic characteristics	
$C_N' = 0.332$	
$C_{BM}' = 0.138$	Lateral c.p. (percent panel span) = 41.5
$C_M' = -0.051$	Chord c.p. (percent M.A.C.) = 40.4

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(j) M = 0.948; $C_{N_A} = 0.274$; $\delta_{a_L} = 1.00^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	-1.182	-----	-----	-----
2	0.699	0.575	0.544	.127	0.513	0.781	0.494
3	.775	.540	.433	-.027	.387	.569	.340
4	.637	.515	.455	-.194	.251	.420	.288
5	.410	-----	-----	-----	-----	-----	.251
6	.354	.455	.416	-.404	-----	.344	.132
7	-----	-----	-----	-.503	-.178	.340	.256
8	-----	-----	.305	.571	-----	-----	.229
9	.336	.338	.354	-.614	-.338	.299	-----
10	.342	.276	-----	-.658	-.329	.301	-----
11	.286	.225	.330	-.687	-.406	.313	.115
12	.260	.290	.367	-.785	-.476	-----	.171
13	.247	.260	.291	-.755	-----	.305	.148
14	.307	.301	-----	-.847	-.590	.284	.113
15	.235	.317	-----	-.876	-.600	.424	.070
16	-----	.342	.239	-----	-.625	.288	.107
17	-----	-----	.375	-----	-.600	-----	.074
18	.212	-----	-----	-.893	-.499	.237	.149
19	-----	-----	-----	-.889	-----	-----	.190
20	.047	-----	.291	-.835	-----	-.025	-.019
21	-----	-----	-----	-.707	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.297	0.348	0.352	0.337	0.297	0.158
$c_{m_{c/4}}$	-0.039	-0.064	-0.075	-0.075	-0.047	-0.018

Integrated panel aerodynamic characteristics	
$C_N' = 0.311$	
$C_{BM}' = 0.128$	Lateral c.p. (percent panel span) = 41.2
$C_M' = -0.056$	Chord c.p. (percent M.A.C.) = 43.2

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(k) M = 0.965; C_{N_A} = 0.272; δ_{a_L} = 0.52° down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.189	-----	-----	-----
2	0.691	0.576	0.546	.143	0.534	0.781	0.510
3	.771	.530	.430	-.006	.420	.576	.355
4	.622	.514	.458	-.152	.281	.424	.303
5	.400	-----	-----	-----	-----	-----	.249
6	.343	.440	.408	-.375	-----	.351	.141
7	-----	-----	-----	-.470	-.142	.357	.247
8	-----	-----	.303	-.540	-----	-----	.239
9	.331	.333	.349	-.600	-.311	.295	-----
10	.339	.281	-----	-.628	-.291	.317	-----
11	.285	.231	.309	-.656	-.363	.309	.124
12	.265	.293	.345	-.761	-.436	-----	.177
13	.239	.259	.291	-.727	-----	.311	.143
14	.303	.291	-----	-.823	-.554	.295	.110
15	.233	.311	-----	-.849	-.570	.341	.074
16	-----	.343	.239	-----	-.596	.267	.110
17	-----	-----	.371	-----	-.564	-----	.072
18	.211	-----	-----	-.847	-.494	.207	.095
19	-----	-----	-----	-.835	-----	-----	.147
20	.090	-----	.281	-.799	-----	-.010	-.026
21	-----	-----	-----	-.699	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.293	0.352	0.343	0.334	0.299	0.161
$c_{m_{c/4}}$	-0.041	-0.066	-0.070	-0.069	-0.044	-0.017

Integrated panel aerodynamic characteristics	
$C_{N'}$ = 0.310 $C_{BM'}$ = 0.129 $C_{M'}$ = -0.057	Lateral c.p. (percent panel span) = 41.6 Chord c.p. (percent M.A.C.) = 43.0

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Continued

(l) M = 0.979; C_{N_A} = 0.325; δ_{a_L} = 0.95° down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.172	-----	-----	-----
2	0.917	0.766	0.720	.094	0.630	0.994	0.651
3	.969	.705	.603	-.053	.492	.747	.479
4	.800	.655	.574	-.186	.351	.557	.394
5	.527	-----	-----	-----	-----	-----	.301
6	.431	.546	.494	-.406	-----	.406	.186
7	-----	-----	-----	-.482	-.105	.412	.295
8	-----	-----	.372	-.542	-----	-----	.262
9	.404	.381	.408	-.611	-.241	.354	-----
10	.391	.339	-----	-.645	-.243	.352	-----
11	.337	.287	.394	-.662	-.322	.356	.142
12	.310	.343	.402	-.758	-.383	-----	.197
13	.280	.316	.362	-.729	-----	.352	.167
14	.343	.331	-----	-.818	-.507	.329	.115
15	.268	.354	-----	-.854	-.526	.389	.081
16	-----	.389	.308	-----	-.547	.312	.117
17	-----	-----	.419	-----	-.519	-----	.084
18	.236	.419	-----	-.848	-.473	.251	.115
19	-----	-----	-----	-.842	-----	-----	.176
20	.124	-----	.320	-.818	-----	.069	.031
21	-----	-----	-----	-.687	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.360	0.410	0.412	0.373	0.353	0.194
$c_{m_{c/4}}$	-0.046	-0.071	-0.082	-0.075	-0.053	-0.021

Integrated panel aerodynamic characteristics	
C_N' = 0.365	
C_{BM}' = 0.152	Lateral c.p. (percent panel span) = 41.5
C_M' = -0.063	Chord c.p. (percent M.A.C.) = 42.2

*Resultant pressure coefficient.

TABLE 2

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; LEVEL RUN AT $C_{N_A} \approx 0.31$ - Concluded

(m) $M = 1.00$; $C_{N_A} = 0.322$; $\delta_{a_L} = 0.89^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.179	-----	-----	-----
2	0.878	0.721	0.689	.129	0.593	0.959	0.637
3	.935	.665	.560	-.013	.514	.732	.462
4	.772	.637	.547	-.152	.377	.538	.392
5	.501	-----	-----	-----	-----	-----	.296
6	.408	.432	.473	-.364	-----	.399	.179
7	-----	-----	-----	-.432	-.063	.397	.290
8	-----	-----	.364	-.495	-----	-----	.253
9	.384	.377	.397	-.567	-.205	.347	-----
10	.377	.322	-----	-.591	-.196	.353	-----
11	.325	.277	.381	-.612	-.277	.357	.146
12	.292	.325	.362	-.704	-.340	-----	.190
13	.270	.299	.349	-.671	-----	.346	.161
14	.338	.325	-----	-.767	-.458	.318	.116
15	.259	.349	-----	-.791	-.475	.375	.092
16	-----	.375	.303	-----	-.493	.307	.122
17	-----	-----	.410	-----	-.466	-----	.085
18	.235	-----	-----	-.791	-.388	.249	.111
19	-----	-----	-----	-.774	-----	-----	.170
20	.115	-----	.314	-.750	-----	.042	.033
21	-----	-----	-----	-.645	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.348	0.380	0.404	0.379	0.344	0.176
$c_{m_{c/4}}$	-0.046	-0.068	-0.080	-0.079	-0.051	-0.016

Integrated panel aerodynamic characteristics	
$C_N' = 0.351$	
$C_{BM}' = 0.146$	Lateral c.p. (percent panel span) = 41.6
$C_M' = 0.0616$	Chord c.p. (percent M.A.C.) = 42.6

*Resultant pressure coefficient.

TABLE 3

TABULATION OF PRESSURE COEFFICIENTS AND AERODYNAMIC CHARACTERISTICS OF THE X-1 WING; PULL-UP AT $M \approx 0.96$

(a) $M = 0.953$; $C_{N_A} = 0.272$; $\delta_{a_L} = 0.95^\circ$ down

Orifice	Pressure coefficients						
	Station A*	Station B*	Station C*	Station D		Station E*	Station F*
				Upper	Lower		
1	-----	-----	-----	1.184	-----	-----	-----
2	0.682	0.554	0.533	.126	0.514	0.778	0.502
3	.762	.535	.419	-.028	.389	.564	.337
4	.623	.504	.451	-.193	.254	.417	.302
5	.406	-----	-----	-----	-----	-----	.255
6	.345	.435	.413	-.401	-----	.327	.131
7	-----	-----	-----	-.493	-.171	.351	.266
8	-----	-----	.302	-.565	-----	-----	.233
9	.333	.341	.343	-.618	-.330	.296	-----
10	.339	.274	-----	-.655	-.321	.298	-----
11	.284	.231	.327	-.675	-.397	.310	.127
12	.253	.288	.357	-.777	-.452	-----	.170
13	.237	.251	.288	-.747	-----	.306	.147
14	.300	.298	-----	-.834	-.583	.288	.112
15	.233	.315	-----	-.881	-.595	.339	.076
16	-----	.345	.237	-----	-.614	.282	.102
17	-----	-----	.368	-----	-.589	-----	.074
18	.210	-----	-----	-.887	-.497	.235	.137
19	-----	-----	-----	-.875	-----	-----	.182
20	.078	-----	.288	-.822	-----	-.018	-.018
21	-----	-----	-----	-.712	-----	-----	-----

Integrated section aerodynamic characteristics						
c_n	0.297	0.342	0.341	0.336	0.292	0.159
$c_{m_{c/4}}$	-0.042	-0.062	-0.065	-0.070	-0.046	-0.018

Integrated panel aerodynamic characteristics	
$C_N' = 0.308$	
$C_{BM}' = 0.129$	Lateral c.p. (percent panel span) = 42.0
$C_M' = -0.055$	Chord c.p. (percent M.A.C.) = 42.9

*Resultant pressure coefficient.