2-up-mix

NASA TECHNICAL MEMORANDUM

NASA TM X-71937

COPY NO.

NASA TM X-71937

(NASA-TM-X-71937) PRESSURE DISTRIBUTION OF A TWIN-ENGINE UPPER-SURFACE BLOWN JET-FLAP MODEL (NASA) 51 p HC $5.25 CSCL 01C

N74-20655

Unclas G3/02 35327

PRESSURE DISTRIBUTION OF A TWIN-ENGINE UPPER-SURFACE BLOWN JET-FLAP MODEL

By

Charles C. Smith, Jr. and Lucy C. White

March 1974

This informal documentation medium is used to provide accelerated or special release of technical information to selected users. The contents may not meet NASA formal editing and publication standards, may be revised, or may be incorporated in another publication.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER, HAMPTON, VIRGINIA 23665

1. Report No. NASA TM X-71937	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Pressure Distribution of a Twin-Engine Upper-Surface Blown Jet-Flap Model		5. Report Date March 1974
		6. Performing Organization Code 35.210
7. Author(s) Charles C. Smith, Jr. and Lucy C. White		8. Performing Organization Report No.
9. Performing Organization Name and Address NASA Langley Research Center Hampton, Virginia 23665		10. Work Unit No. 760-61-02-01
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address NASA Langley Research Center Hampton, Virginia 23665		13. Type of Report and Period Covered Interim/Feb. 1974
		14. Sponsoring Agency Code

15. Supplementary Notes

Interim technical information release, subject to possible revision and/or later formal publication

16. Abstract

An investigation has been made to determine the chordwise and spanwise pressure distributions of a small-scale upper-surface blown jet-augmented flap STOL model. The model was powered by two simulated high-bypass-ratio turbofan engines mounted ahead of and above an unswept-untapered wing in a nacelle having a rectangular nozzle. The results of the investigation are presented as tabulated and plotted chordwise pressure distribution coefficients for nine spanwise stations.

17. Key Words (Suggested by Author(s)) (STAR category underlined) Aerodynamics, Powered Lift, Upper-Surface-Blown, Jet Flap, Fluid Mechanics		18. Distribution Statement No FEDD limitation Foreign distribution excluded	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price* $3.75

*Available from { The National Technical Information Service, Springfield, Virginia 22151
STIF/NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, MD 20740

PRESSURE DISTRIBUTION OF A TWIN-ENGINE UPPER-SURFACE BLOWN JET-FLAP MODEL

By Charles C. Smith, Jr. and Lucy C. White

SUMMARY

A wind-tunnel investigation has been made to determine the chordwise and spanwise pressure distributions of a small-scale upper-surface blown jet-augmented flap STOL model. The model was powered by two simulated high-bypass-ratio turbofan engines mounted ahead of and above the wing in a nacelle with a rectangular nozzle. The wing was unswept and untapered and was equipped with partial-span double-slotted trailing-edge flaps and a full-span leading-edge slat. The inboard portion of the trailing-edge flaps behind the engines was covered with thin sheetmetal to form a plain flap with a large radius to provide a smooth upper surface to enhance the turning of the jet sheet. The results of the investigation are presented as tabulated and plotted chordwise pressure distribution coefficients for nine spanwise stations.

INTRODUCTION

Although the upper-surface blown (USB) jet-flap concept is presently receiving a considerable amount of attention in STOL research, it is not a new concept. During the latter part of the 1950's, some preliminary aerodynamic and noise investigations were performed at Langley Research Center (see refs. 1 and 2). The results of the work showed that the concept provided good aerodynamic efficiency and, because the wing tended to shield the engine noise from the ground, offered advantages for minimizing the noise associated with powered lift (see refs. 3, 4, and 5). With the increasing emphasis on quiet STOL aircraft and the availability of lightweight, high-bypass-ratio turbofan engines, attention has once again been focused on the upper-surface blown jet flap as a promising candidate for STOL applications. One of the major problems with the USB concept is that of restoring lateral trim in the event of a failure of one engine.

This problem, of course, involves both roll and yaw, the roll problem being the more critical in an approach condition. The present investigation was made in order to gain a better understanding of the roll problem for an engine-out condition.

The present investigation consisted of wind-tunnel pressure distribution measurements for a small-scale model with an unswept rectangular wing. The model was equipped with two simualted high-bypass-ratio engines mounted in nacelles having moderate aspect-ratio (width-height ratio) rectangular nozzles. The top of the nacelle at the nozzle exit was contoured so that the exhaust flow was deflected downward toward the top of the wing for better spreading and flattening of the exhaust over the wing and flaps. The model had a full-span leading-edge slat and trailing-edge double-slotted flap. The slots in the trailing-edge flaps directly behind the engines were covered by using thin sheetmetal over the flaps.

The tests were performed at angles of attack of 1° and 16°, a trailing-edge flap deflection of 55°, and a range of thrust coefficients for both symmetrical and unsymmetrical power conditions. For some of the engine-out tests, the sheetmetal covering over the flaps behind the failed engine was removed in order to investigate the effects of opening the flap slots behind the dead engine. The results are presented in terms of chordwise pressure distributions for several stations with all engines operating and one engine inoperative.

SYMBOLS

The pressure coefficients are based on free-stream dynamic pressure. Measurements were made in the U.S. Customary Units. They are presented herein in the International System of Units (SI) with equivalent values in the U.S. Customary Units given parenthetically.

b	wing span, m (ft)
c	wing chord, 0.254 m (0.833 ft)
c_f	chord of rear element of trailing-edge flap, m (ft)
c_n	wing-section normal-force coefficient, $\int_0^1 c_p x dx/c$

c_p pressure coefficient, $\dfrac{p - p_\infty}{q}$

c_v chord of vane, or forward element of trailing-edge flap, m (ft)

C_μ gross thrust coefficient, T/qS

F_A net axial force, N (lb)

F_N normal force, N (lb)

F_R resultant, $\sqrt{F_N^2 + F_A^2}$, N (lb)

p surface static pressure, N/m^2 (lb/ft^2)

p_∞ free-stream static pressure, N/m^2 (lb/ft^2)

q free-stream dynamic pressure, N/m^2 (lb/ft^2)

T thrust (assumed equal to static thrust at same engine rpm), N (lb)

x longitudinal coordinate of airfoil, m (ft)

Y lateral distance from centerline, measured perpendicular to plane of symmetry, m (ft)

z airfoil surface ordinate, m (ft)

α angle of attack, deg

δ_f deflection of rear element of trailing-edge flap from wing chord reference plane (positive when trailing edge is down), deg

δ_v deflection of vane from wing chord plane, deg

Abbreviations:

USB upper-surface blown jet flap

EBF externally blown jet flap

WRP wing reference plane

Subscripts:

L	left
R	right
l	lower
u	upper

MODEL AND APPARATUS

The present investigation was conducted on the two-engine, high-wing model shown in figure 1. The model was full-span and not a half-model as might be inferred from the drawing of figure 1. The model was originally intended for use in a test program of an externally blown jet-flap (EBF) configuration but was modified to the USB configuration shown in figure 1 by moving the engines to the upper surface of the wing and closer inboard.

Figure 2 presents details of the engine-nacelle arrangement used in the tests. The top of the exhaust nozzle was contoured so that the exhaust-flow centerline was deflected downward toward the top of the wing; and the sides of the nacelle were flared outward in order to maintain the proper exit area for the turbofan simulators being used. The aspect ratio (width/height) of the nacelle exhaust nozzle was 4.5.

The model had an aspect-ratio-7, unswept, constant-chord wing and incorporated a full-span leading-edge slat and a 75-percent partial-span double-slotted trailing-edge flap (fig. 1). In order to close the flap slots behind the engines and provide a smooth contour for the exhaust jet to follow, a thin piece of sheetmetal was used to fair over the double-slotted trailing-edge flaps in the area immediately behind the engine as shown in figures 1 and 3. The positions of the slat and trailing-edge flaps were set in accordance with the results of previous tests on EBF models (ref. 6) and were not necessarily the best positions for the USB model. The trailing-edge flaps were deflected 55^{0} with gaps and overlaps shown in figure 4. Dimensional characteristics of the model are presented in table I. The airfoil sections for the vane and flap of the trailing-edge flap assembly were identical, and their coordinates are presented in table II. The wing used an NACA 4415 airfoil section.

In order to determine the chordwise and spanwise pressure distributions on the wing, pressure orifices were located on the upper and lower surfaces on the left wing and flap at eight spanwise stations (see figs. 5, 6, and 7). A few pressure orifices were located on the top of the fuselage (see figs. 5 and 8).

The model was sting-mounted in the 9- by 18-m (30- by 60-ft) test section of the Langley full-scale tunnel.

TESTS AND PROCEDURES

In preparation for the tests, engine calibrations were made to determine the installed static thrust of each engine as a function of engine rotational speed. These calibrations were made with the engines installed in the nacelles on top of the wing, with trailing-edge flaps removed, and with bellmouth inlets installed on the engines. The installed static thrust was computed to be the resultant of the normal and axial forces $\left(\text{Thrust} = \sqrt{F_N^2 + F_A^2}\right)$. The wind-on tests were run by setting the engine rotational speed to give the desired thrust and holding these speeds constant over the angle-of-attack range.

Tests were made at angles of attack of 1^o and 16^o for values of static gross thrust coefficient C_μ of 1.85 and 3.70 for the configuration with both engines operating; and values of C_μ of 0.925 and 1.85 with only one engine operating. Some of the tests with only one engine operating were run with the sheetmetal fairing of figures 1 and 3 removed in the area directly behind the inoperative engine. The free-stream dynamic pressure for the tests was 103.9 N/m^2 (2.17 lb/ft^2) for an airspeed of 13 m/sec (42.7 ft/sec) and a Reynolds number of 0.227×10^6 based on the mean aerodynamic chord.

PRESENTATION OF DATA

The data are presented, without analysis, as a potential source of design information. They are presented in tabular form in tables III to XII and also in graphical form in figures 9 to 19 as plots of pressure coefficient against chordwise station. In the pressure coefficient plots, c_p is plotted on the projected chordwise locations of the orifices for each spanwise station. In order to illustrate further the type of spanwise loading obtained in the tests, the pressure plots of figures 11, 13, 16, and 18 were faired and integrated to determine the section normal-force coefficient c_n for each section along the span. A sample of the fairing method used is illustrated in figure 14b. These normal-force coefficients c_n were then plotted against the wing semispan and presented as figures 20 and 21.

REFERENCES

1. Maglieri, Domenic J.; and Hubbard, Harvey H.: Preliminary Measurements of the Noise Characteristics of Some Jet-Augmented-Flap Configurations. NASA MEMO 12-4-58L, 1959.
2. Turner, Thomas R.; Davenport, Edwin E.; and Riebe, John M.: Low-Speed Investigation of Blowing From Nacelles Mounted Inboard and on the Upper Surface of an Aspect-Ratio-7.0 35° Swept Wing With Fuselage and Various Tail Arrangements. NASA MEMO 5-1-59L, 1959.
3. Phelps, Arthur E., III: Aerodynamics of the Upper-Surface Blown Flap. NASA SP-320, 1972.
4. Phelps, Arthur E., III; and Smith, Charles C., Jr.: Wind-Tunnel Investigation of an Upper Surface Blown Jet-Flap Powered-Lift Configuration. NASA TN D-7399, 1973.
5. Smith, Charles C., Jr.; Phelps, Arthur E., III; and Copeland, William L.: Wind-Tunnel Investigation of a Large-Scale Semispan Model with an Unswept Wing with an Upper-Surface Blown Jet Flap. NASA TN D-7526, 1974.
6. Smith, Charles C., Jr.: Effect of Wing Aspect Ratio and Flap Span on Aerodynamic Characteristics of an Externally Blown Jet-Flap STOL Model. NASA TN D-7205, 1973.

TABLE I.- DIMENSIONS OF MODEL

Fuselage:	
Length, m (ft)	1.830 (6.00)
Diameter, m (ft)	0.196 (0.642)
Wing:	
Aspect ratio	7.00
Area, m^2 (ft^2)	0.452 (4.86)
Span, m (ft)	1.778 (5.833)
Chord, m (ft)	0.254 (0.833)
Flap span, percent wing span	0.75
Vane chord, c_v, m (ft)	0.038 (0.125)
Flap chord, c_f, m (ft)	0.076 (0.250)
Leading-edge slat:	
Span, percent wing span	1.00
Chord, m (ft)	0.048 (0.158)

TABLE II.- VANE AND FLAP AIRFOIL COORDINATES[a]

$\frac{x}{\text{Chord}} \times 100$	$\frac{z_u}{\text{Chord}} \times 100$	$\frac{z_l}{\text{Chord}} \times 100$
0	0	0
5	9.8	-3.3
10	13.0	-4.1
15	15.0	-3.8
20	16.0	-3.8
25	17.2	-3.5
30	17.3	-3.3
40	17.0	-2.8
50	15.2	-2.2
60	12.5	-1.7
70	10.0	-1.3
80	7.1	-0.8
90	4.0	-0.7
100	1.2	-0.3

[a]Values are given in percent vane or flap chord.

TABLE III.- PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL. $C_{\mu L} = 0$, $C_{\mu R} = 0$.

(a) $\alpha = 1^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.3486			-.5045	-.5494	-.6577	-.8399	-.4701	-.3909
2	-.4041				.6392	.7237	.6497	.8637	.8161
3	-.5045			.5837	.6286	.6735	.7897	.7739	.7263
4	-.5494			-.5309	-.5018	-.3513	-.2483	-.0924	-.1056
5	-.6022			-.9212	-.7468	-.8418	-.9461	-.8368	-.5884
6	-.5573			-1.3844	-1.2152	-1.1596	-1.1038	-.9936	-.7404
7	-.5414			-1.5379	-1.3818	-1.3197	-1.1863	-1.0684	-.8344
8	-.5150			-1.4338	-1.3401	-1.2445	-1.1281	-.9815	-.7958
9	-.4807		-.9354	-1.1137	-1.1294	-1.0286	-.9413	-.7910	-.6391
10	-.4543	-.5659	-.7624	-.8978	-.8431	-.9801	-.7739	-.6584	-.5282
11	-.4332	-.3133	-.6197	-.6479	-.6115	-.6623	-.6186	-.4630	-.4679
12	-.4015	-.4279	-.4396	-.5126	-.4632	-.5386	-.5531	-.4076	-.4052
13			.6851	.6141	.5387	.4851	.4366	-.4052	-.3593
14			.5962	.5673	.5360	.4923	.4657	-.3159	-.2291
15				-1.5821	-.8041	-2.5643	-1.9505	-.0048	.0410
16				-.6115	-.9238	-.9655	-1.5745	.0748	.0699
17		-.5870	.0725		-.9316	-.8709	-.9583	.1640	.1543
18			-.3882	-.5517		-.7496	-.4852	.2195	.1616
19		.6780	.6944	.0520	.4476	.2644	.3274	.3473	-.0482
20		.6827	.8020	.9160	.9498	.9459	.9240	-.4582	-.4293
21		.7178	.8651	.9238	.9055	.8755	.8367	-.4992	-.4124
22		-.4560	-.4045	-.4216	-.5282	-.4706	-.6356	-.4896	-.3859
23		-.4466	-.4303	-.3955	-.5647	-.4245	-.5556		
24		-.4466	-.4373	-.3981	-.5465	-.3857	-.4779		
25		-.4373	-.4349	-.3799	-.5022	-.4003	-.4998		
26		.7762	.8581	.9628	.9524	.9386	.8949		
27		.7599	.8324	.8873	.9055	.9046	.8052		

(b) $\alpha = 16^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.5422			.9727	.9541	.8558	.6192	.0558	-.0000
2	-.7149				-.1674	.0505	.3428	.5794	.7946
3	-.9328			-1.5308	-1.4856	-1.1667	-.7760	-.4917	-.1993
4	-1.0046			-2.3573	-2.3972	-2.1181	-1.8470	-1.3740	-1.1348
5	-.9807			-2.6655	-2.1759	-2.6583	-2.6534	-2.7615	-1.7739
6	-.8531			-3.0478	-2.9614	-3.0513	-3.0416	-2.6984	-2.0505
7	-.7282			-2.5163	-2.6576	-2.5412	-2.5436	-2.2034	-1.7496
8	-.6166			-1.6600	-1.9612	-1.9455	-1.9358	-1.6331	-1.3395
9	-.5687		-1.2143	-.9479	-1.1521	-1.2791	-1.2279	-1.1745	-.9343
10	-.4996	-.7553	-.9530	-.8798	-.6860	-.7250	-.8055	-.8081	-.7474
11	-.4970	-.3082	-.7012	-.7070	-.5106	-.4955	-.4980	-.5411	-.6334
12	-.4764	-.3341	-.5529	-.7122	-.4608	-.4199	-.3564	-.4319	-.5169
13			.8069	.7200	.6624	.6125	.5540	-.3810	-.4853
14			.7646	.7331	.7148	.6467	.5857	-.3422	-.3834
15				-1.1547	-.4687	-.4492	-.4711	-.0582	-.0898
16				-.7672	-.6336	-.4101	-.5199	.0777	-.0194
17		-.5271	.0094		-.6886	-.4052	-.4565	.1650	.0315
18			-.5129	-.6572		-.3881	-.3808	.2402	.0801
19		.7975	.7999	.2618	.5656	.5564	.5784	.3713	.1869
20		.8611	.8164	.9583	.9766	.9542	.9347	.5630	.3980
21		.8916	.8799	.9347	.9452	.8883	.8468	.8542	.7450
22		-.5012	-.4847	-.4556	-1.3956	-1.3475	-1.2132	.8857	.8857
23		-.4965	-.5153	-.4451	-1.0683	-.9886	-1.0228		
24		-.5035	-.4729	-.4294	-.6782	-.6200	-.6469		
25		-.4988	-.4447	-.4268	-.4242	-.4052	-.4247		
26		.9552	.9246	.9635	.9478	.9103	.8566		
27		.8775	.8846	.9321	.9452	.9225	.7980		

TABLE IV. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL.
$C_{\mu L} = 0.925$, $C_{\mu R} = 0.925$.

(a) $\alpha = 1^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.6300			-.1975	-.6193	-.9877	-.9076	-.6140	-.5286
2	-.7848				.8970	.7715	.7154	.8970	.8516
3	-.9049			.1495	.3951	.6487	.6674	.7208	.7128
4	-1.0197			-1.2680	-.9610	-.5953	-.3978	-.1308	-.1842
5	-1.0197			-1.7595	-1.2125	-.8631	-1.3657	-1.0359	-.7483
6	-.9797			-2.3644	-1.7832	-1.4712	-1.4393	-1.1480	-.8726
7	-.9450			-2.4275	-1.9594	-1.6306	-1.4957	-1.2114	-.9701
8	-.9049			-2.2408	-1.8147	-1.5251	-1.4074	-1.1090	-.9165
9	-.8863		-1.9407	-1.8516	-1.5991	-1.2897	-1.1941	-.9384	-.7654
10	-.8542	.0685	-1.6239	-1.6438	-1.2335	-1.0617	-.9783	-.7532	-.6362
11	-.8088	-.0142	-1.1653	-1.4202	-.9100	-.8140	-.8116	-.6021	-.5460
12	-.7688	-.8935	-4.4724	-1.2046	-.6601	-.6669	-.7282	-.5167	-.4729
13			.7113	.5970	.5286	.4682	.3947	-.4851	-.4290
14			.6262	.5786	.5313	.4706	.4045	-.4071	-.2901
15				-3.1981	-1.1520	-1.4638	-2.1087	-.0902	-.0049
16				-2.3276	-1.1125	-1.2162	-1.7948	0.0000	.0244
17		-19.0316	.0095		-1.1599	-1.0151	-1.3682	.0853	.1243
18			-2.7302	-1.7937		-1.0519	-.9391	.1682	.1414
19		.6569	.7137	.0210	.3971	.3285	.2721	.3047	.0609
20		.7373	.7562	.9889	.9810	.9756	.9609	-.1048	-.4704
21		.7775	.8035	.9126	.9126	.8874	.8334	-.6167	-.5094
22		-14.0627	-2.1109	-1.9462	-.6338	-.7601	-.9048	-.6142	-.4680
23		-12.4387	-1.9430	-1.7069	-.6444	-.7503	-.8190		
24		-10.5051	-1.8012	-1.7069	-.6891	-.7822	-.8116		
25		-5.7347	-1.2646	-.7943	-.6601	-.8042	-.8337		
26		.7633	.8365	.9442	.9442	.9290	.8923		
27		.7822	.8224	.8810	.9021	.8923	.7746		

(b) $\alpha = 16^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-1.2722			.4811	.9034	.9996	.9087	.2111	.0294
2	-1.6677				-2.0018	-.9782	-.6575	.1764	.5987
3	-2.2210			-3.7097	-3.3301	-2.2504	-1.7827	-.9435	-.5746
4	-2.4829			-4.6905	-4.1320	-3.2313	-2.7796	-1.8735	-1.4967
5	-2.4856			-4.9794	-3.6049	-3.6701	-3.5842	-3.3531	-2.1671
6	-2.2638			-5.9063	-4.8398	-4.3157	-4.0972	-3.4263	-2.5185
7	-1.9163			-5.1190	-4.3132	-3.6676	-3.4786	-2.8553	-2.1744
8	-1.5582			-4.0156	-3.4495	-2.8698	-2.7348	-2.1329	-1.6936
9	-1.2802		-3.7749	-3.0782	-2.5858	-2.1210	-1.9492	-1.5789	-1.2592
10	-1.0317	-.2768	-2.5489	-2.3910	-1.8854	-1.5269	-1.4877	-1.2056	-1.0957
11	-.8766	-.0095	-.7904	-1.8274	-1.2824	-1.0605	-1.0851	-.9274	-.9640
12	-.7483	-.8945	-5.0482	-1.4641	-.9374	-.8788	-.8592	-.7370	-.8493
13			.8115	.7110	.6425	.5571	.4933	-.6589	-.7858
14			.8162	.7952	.7268	.6528	.5767	-.5296	-.6174
15				-2.5568	-1.3640	-1.1096	-1.4140	-.1611	-.1415
16				-2.2540	-1.2850	-1.1243	-1.2815	-.0098	-.0757
17		-18.6119	-.0521		-1.2850	-1.1415	-1.3404	.1025	.0000
18			-4.2316	-1.8538		-1.1440	-1.2127	.2001	.0512
19		.8021	.8091	.1527	.4187	.4246	.3804	.3636	.1611
20		.9535	.8446	.9506	.9479	.9449	.9007	.5955	.3980
21		.9819	.8872	.8900	.8979	.8492	.7903	.8492	.7223
22		-14.1293	-2.7004	-2.2646	-.7821	-.7438	-.8985	.9127	.9420
23		-12.5862	-2.2104	-2.0355	-.7768	-.7512	-.8469		
24		-10.5177	-1.7608	-2.0144	-.8005	-.8003	-.8911		
25		-5.4552	-1.4649	-1.0191	-.7663	-.8175	-.9599		
26		.9700	.9038	.9005	.9032	.8762	.8099		
27		.9558	.8730	.9111	.9216	.8958	.7535		

TABLE V. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL.
$C_{\mu L} = 1.85$, $C_{\mu R} = 1.85$.

(a) $\alpha = 1°$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.6793			-.4405	-.5865	-1.0854	-1.0031	-.6050	-.5069
2	-.8465				.9209	.8121	.7643	.8704	.8386
3	-.9686			.1221	.4246	.4883	.6157	.6953	.7032
4	-1.0986			-1.3109	-.8651	-.6422	-.5307	-.2203	-.2521
5	-1.0986			-1.7622	-1.2079	-1.0335	-1.3552	-1.0250	-.7439
6	-1.1039			-2.3949	-1.7779	-1.4966	-1.4064	-1.1582	-.8675
7	-1.0668			-2.5126	-2.0289	-1.6989	-1.5356	-1.2552	-.9862
8	-1.0429			-2.4027	-1.9008	-1.6209	-1.4820	-1.1728	-.9668
9	-.9951		-2.1689	-2.0184	-1.6759	-1.3991	-1.2797	-.9983	-.8045
10	-.9580	-.2467	-1.8611	-1.7648	-1.3543	-1.1822	-1.1212	-.8117	-.7124
11	-.9261	.2067	-.6837	-1.6445	-1.0223	-.9945	-.9847	-.6809	-.6082
12	-.8625	-.4605	-5.0429	-1.5034	-.7504	-.8653	-.9799	-.5815	-.5476
13			.6906	.5857	.5360	.4191	.3509	-.5622	-.4822
14			.6084	.5883	.5412	.4459	.3680	-.4604	-.3344
15				-4.4133	-1.2890	-2.7495	-3.3150	-.1308	-.0630
16				-2.8969	-1.2602	-1.8379	-2.6520	-.0315	-.0073
17		-30.3823	.0399		-1.2314	-1.2163	-1.5917	.0436	.0267
18			-4.5376	-2.1779		-1.3236	-.7117	.1212	.0993
19		.5990	.6813	-.1255	.3791	.1511	.1218	.2908	.1696
20		.7094	.7799	.9726	.9830	.9479	.9406	-.0024	-.4289
21		.7494	.8551	.8915	.9151	.8626	.8139	-.6542	-.5743
22		-21.4690	-3.2358	-2.4106	-.7112	-.8482	-1.3309	-.6954	-.5307
23		-19.5820	-2.7822	-1.9714	-.7321	-.8629	-1.1139		
24		-17.3636	-2.6318	-1.9374	-.7739	-.8775	-1.0042		
25		-10.5793	-1.7624	-.9125	-.7399	-.9189	-1.0189		
26		.7470	.8997	.9491	.9752	.9187	.8724		
27		.7658	.8152	.8863	.9177	.8748	.7627		

(b) $\alpha = 16°$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-1.4593			.4009	.8660	.9702	.9061	.3876	.0561
2	-1.9030				-2.5204	-1.2696	-.5853	.1363	.6816
3	-2.4189			-4.0626	-3.3998	-2.3815	-1.7614	-.9943	-.5078
4	-2.6781			-5.0489	-4.3005	-3.2287	-2.7557	-1.8950	-1.5342
5	-2.5525			-5.2377	-3.7630	-3.7807	-3.6654	-3.4558	-2.2257
6	-2.2879			-6.1752	-4.9322	-4.4092	-4.1367	-3.4948	-2.5479
7	-1.8790			-5.3799	-4.4424	-3.7488	-3.5401	-2.8944	-2.2087
8	-1.5529			-4.2976	-3.5392	-2.9755	-2.7766	-2.1916	-1.7352
9	-1.2562		-4.1655	-3.3891	-2.6491	-2.2365	-1.9689	-1.6791	-1.2739
10	-1.0424	-1.0011	-2.8898	-2.6123	-1.9671	-1.6203	-1.5467	-1.2666	-1.1300
11	-.8954	.3620	-.3573	-2.0356	-1.3298	-1.1318	-1.1318	-.9762	-.9933
12	-.7511	-.2319	-5.3868	-1.7011	-.9770	-.9378	-.8985	-.7810	-.8810
13			.7784	.7136	.6583	.5670	.4933	-.6931	-.8176
14			.7997	.7821	.7505	.6455	.5817	-.5638	-.6174
15				-3.8473	-1.3799	-1.1882	-1.5663	-.1733	-.1318
16				-3.2443	-1.3456	-1.1931	-1.3871	-.0268	-.0805
17		-31.4979	-.0331		-1.3720	-1.2128	-1.4288	.0927	-.0146
18			-5.8720	-2.3621		-1.2201	-1.3233	.1708	.0317
19		.6956	.7571	.0395	.4240	.3976	.3632	.3343	.1562
20		.8518	.8541	.9453	.9848	.9376	.9351	.5686	.3929
21		.9038	.9109	.9059	.9164	.8615	.8026	.8615	.7395
22		-22.8352	-3.7774	-2.6965	-.8269	-.8249	-.9476	.9079	.9323
23		-20.7429	-3.1644	-2.2278	-.8348	-.8200	-.9305		
24		-17.7110	-2.8093	-1.7907	-.8664	-.8789	-.9476		
25		-10.2815	-2.0874	-1.0981	-.8295	-.8789	-1.0508		
26		.8612	.9393	.9006	.9348	.8737	.8296		
27		.8920	.8778	.9138	.9480	.9057	.7805		

TABLE VI.- PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL. $C_{\mu L} = 0.925$, $C_{\mu R} = 0$.

(a) $\alpha = 1°$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.4640			-.4535	-.6829	-.9044	-.9729	-.5774	-.4667
2	-.5431				.8411	.7594	.7251	.8701	.8147
3	-.6802			.3770	.4878	.5880	.6117	.7093	.7040
4	-.7198			-.9175	-.7277	-.5379	-.4113	-.1635	-.1714
5	-.7356			-1.3742	-.9793	-.9203	-1.1697	-.9461	-.6909
6	-.7251			-1.8470	-1.6184	-1.3029	-1.3126	-1.0497	-.8378
7	-.7356			-2.1535	-1.7404	-1.5282	-1.3828	-1.1532	-.9269
8	-.6987			-1.9924	-1.7301	-1.4313	-1.3780	-1.0713	-.8980
9	-.6802		-1.7417	-1.7249	-1.4521	-1.2642	-1.1504	-.9124	-.7174
10	-.6750	.5602	-1.5409	-1.5144	-1.1768	-1.0680	-.9929	-.7367	-.6163
11	-.6776	.0327	-1.0342	-1.3118	-.8780	-.8573	-.8743	-.5850	-.5585
12	-.6776	-.5976	-4.4897	-1.1430	-.6390	-.7556	-.8646	-.5128	-.4863
13			.7025	.5793	.5351	.4334	.3729	-.4935	-.4165
14			.6092	.5845	.5325	.4503	.4019	-.3996	-.2696
15				-2.8523	-1.1222	-2.4291	-3.0369	-.1035	-.0072
16				-2.2314	-1.0728	-1.4095	-2.4218	.0024	.0578
17		-18.4985	-.0443		-1.0962	-1.0438	-1.4361	.0963	.1324
18			-2.7853	-1.7197		-1.0898	-.6127	.1469	.1517
19		.6138	.6885	-.0520	.4026	.1840	.1646	.3226	.0385
20		.6955	.7399	.9637	.9689	.9346	.9297	-.1709	-.4526
21		.7492	.7912	.9092	.9118	.8692	.8256	-.5946	-.4863
22		-14.3029	-2.1689	-1.9275	-.6053	-.7629	-.9639	-.6283	-.4622
23		-12.5518	-1.8747	-1.7353	-.6001	-.7677	-.8161		
24		-10.6629	-1.7673	-1.5716	-.6157	-.7943	-.7919		
25		-5.7552	-1.2794	-.7845	-.6234	-.8452	-.7968		
26		.7656	.8379	.9559	.9637	.9273	.8764		
27		.8099	.8239	.8936	.9144	.8813	.7651		

(b) $\alpha = 16°$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.9042			.8623	.9462	.9567	.7889	.2280	.0734
2	-1.1453				-1.5490	-.7129	-.1887	.3198	.6683
3	-1.4494			-3.1399	-2.6078	-1.8556	-1.2580	-.6526	-.4639
4	-1.5752			-3.8711	-3.5016	-2.7939	-2.3877	-1.6590	-1.3734
5	-1.3970			-4.3769	-3.1038	-3.4570	-3.2018	-3.2547	-1.9911
6	-1.2030			-5.1593	-4.2917	-4.0059	-3.7218	-3.2212	-2.3118
7	-.8990			-4.4337	-3.8165	-3.3679	-3.1440	-2.6731	-1.9791
8	-.7732			-3.4912	-3.1090	-2.6529	-2.5181	-1.9863	-1.5843
9	-.7915		-3.1146	-2.6519	-2.3188	-1.9524	-1.7670	-1.4909	-1.1631
10	-.7679	.2622	-2.1444	-2.1097	-1.6552	-1.3987	-1.3385	-1.1224	-.9979
11	-.7758	.1508	-.5175	-1.6371	-1.1388	-.9389	-.9774	-.8328	-.9046
12	-.7548	-.6103	-5.1732	-1.3066	-.7953	-.7920	-.7463	-.6725	-.7778
13			.8074	.7179	.6636	.5680	.5199	-.5911	-.7156
14			.8028	.7643	.7333	.6402	.5776	-.4834	-.5337
15				-2.4066	-1.2162	-1.0111	-1.2663	-.1316	-.1173
16				-2.1536	-1.1517	-1.0135	-1.1772	.0024	-.0550
17		-17.2651	-.1114		-1.1697	-1.0304	-1.1868	.1149	.0072
18			-4.9899	-1.6862		-1.0280	-1.0905	.2010	.0526
19		.7855	.7749	.2040	.4416	.4380	.3899	.3374	.1699
20		.9072	.8793	.9244	.9632	.9170	.9170	.5480	.3973
21		.9234	.9281	.8934	.9296	.8640	.8207	.8424	.7371
22		-13.2987	-2.9869	-2.0658	-.6636	-.6163	-.7655	.8998	.9046
23		-11.7205	-2.2349	-1.8101	-.6843	-.6355	-.7487		
24		-9.8661	-2.0655	-1.8773	-.7101	-.7030	-.7680		
25		-5.1407	-1.4296	-.9038	-.6585	-.7318	-.8209		
26		.9118	.9397	.9012	.9167	.8833	.8303		
27		.9327	.8608	.9167	.9296	.9194	.7629		

TABLE VII. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL.
$C_{\mu L} = 1.85$, $C_{\mu R} = 0$.

(a) $\alpha = 1^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.5050			-.4866	-.7260	-1.0363	-.8969	-.5234	-.4314
2	-.5997				.8022	.7233	.6444	.8627	.8312
3	-.7128			.1841	.4603	.6628	.6734	.7076	.7181
4	-.7638			-1.1494	-.8917	-.4866	-.4182	-.1499	-.1841
5	-.8180			-1.4123	-1.1325	-.9664	-1.2974	-.9439	-.7181
6	-.8022			-2.1457	-1.7259	-1.4351	-1.3578	-1.1240	-.8334
7	-.7838			-2.2157	-1.9073	-1.5462	-1.4544	-1.1792	-.9511
8	-.7601			-2.1042	-1.7881	-1.4810	-1.4037	-1.0976	-.9126
9	-.7260		-1.9937	-1.8399	-1.5704	-1.2998	-1.2031	-.9270	-.7565
10	-.7260	-.7429	-1.7910	-1.6870	-1.2750	-1.1258	-1.0654	-.7661	-.6485
11	-.7286	.1723	-.4401	-1.5574	-.9640	-.9253	-.9205	-.6316	-.5644
12	-.7075	-.4098	-4.8888	-1.4460	-.7075	-.8118	-.9253	-.5308	-.4947
13			.6659	.5779	.5157	.4203	.3454	-.4947	-.4347
14			.5821	.5520	.5157	.4299	.3671	-.3915	-.3050
15				-4.2681	-1.2413	-2.6141	-3.1504	-.1105	-.0312
16				-2.7987	-1.1791	-1.8071	-2.5392	.0048	.0408
17		-30.6868	-.0629		-1.2050	-1.1355	-1.5341	.0769	.1057
18			-5.1916	-2.2157		-1.2346	-.6741	.1705	.1201
19		.5402	.6519	-.2643	.3654	.1618	.1280	.2089	-.0841
20		.6659	.7358	.9718	.9562	.9516	.9226	-.4395	-.3987
21		.7265	.7870	.9225	.8837	.8743	.8067	-.5860	-.5308
22		-22.5650	-3.5775	-2.1224	-.6841	-.8335	-1.1162	-.5980	-.4611
23		-20.3592	-2.8671	-1.8891	-.6712	-.8118	-.9229		
24		-17.7995	-2.7297	-1.7803	-.6997	-.8480	-.8625		
25		-10.5767	-1.7980	-.9588	-.6841	-.8770	-.8987		
26		.7148	.8475	.9459	.9199	.9106	.8502		
27		.7591	.7754	.8655	.8785	.8647	.7439		

(b) $\alpha = 16^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.9243			.8384	.9191	.9477	.7212	.1432	.0443
2	-1.1690				-1.4580	-.6717	-.1718	.3072	.6743
3	-1.4945			-2.9890	-2.6140	-1.9059	-1.4424	-.6743	-.5337
4	-1.5856			-4.1502	-3.6451	-2.8432	-2.4865	-1.6793	-1.3565
5	-1.3799			-4.5096	-3.3091	-3.4772	-3.3816	-3.2641	-2.1230
6	-1.1326			-5.3227	-4.3762	-4.0177	-3.8001	-3.2427	-2.4035
7	-.8722			-4.6686	-3.8683	-3.4772	-3.1974	-2.7530	-2.0374
8	-.8358			-3.6810	-3.2039	-2.7143	-2.5685	-2.0279	-1.6095
9	-.7941		-3.3776	-2.8602	-2.4061	-2.0184	-1.8247	-1.5263	-1.2029
10	-.7759	-.1567	-2.4875	-2.2830	-1.7828	-1.4636	-1.4182	-1.1578	-1.0437
11	-.8332	.4866	.3872	-1.7931	-1.2108	-.9877	-1.0355	-.8654	-.9248
12	-.7655	-.1106	-5.6025	-1.5083	-.8542	-.5251	-.7940	-.7037	-.7988
13			.7560	.6849	.6156	.5571	.4758	-.6229	-.7322
14			.7629	.7439	.6875	.6336	.5571	-.5064	-.5634
15				-3.4579	-1.3031	-1.0714	-1.3942	-.1498	-.1308
16				-2.6986	-1.2441	-1.0714	-1.2986	-.0095	-.0713
17		-27.9021	-.1452		-1.2339	-1.0929	-1.3034	.0951	-.0071
18			-6.7345	-2.0675		-1.0833	-1.1910	.1759	.0380
19		.6937	.7306	.0077	.4181	.4064	.3778	.3138	.1569
20		.8044	.8551	.9311	.9311	.9205	.9085	.5468	.3780
21		.8597	.9311	.8721	.8901	.8464	.7890	.8392	.7180
22		-20.9370	-3.7326	-2.4574	-.7516	-.7103	-.8585	.8772	.8820
23		-19.0948	-3.3476	-2.0137	-.7593	-.7342	-.8059		
24		-16.0191	-2.8588	-1.7802	-.7670	-.7796	-.8275		
25		-9.1969	-2.0865	-1.0030	-.7619	-.7725	-.9112		
26		.8159	.9496	.8773	.8927	.8607	.8201		
27		.8827	.8758	.9055	.9081	.8966	.7603		

TABLE VIII. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL. $C_{\mu,L} = 0$, $C_{\mu,R} = 0.925$.

(a) $\alpha = 1^\circ$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.4703			-.5149	-.6699	-.7698	-.7672	-.4440	-.4598
2	-.5649				.7724	.7567	.7094	.8250	.7961
3	-.6437			.4703	.6227	.6700	.7225	.7251	.7251
4	-.6936			-.6148	-.5018	-.3941	-.3389	-.1261	-.1025
5	-.7435			-1.1286	-.7688	-.8880	-1.0401	-.8924	-.6045
6	-.7094			-1.5401	-1.2373	-1.1776	-1.1076	-.9788	-.7413
7	-.7015			-1.6462	-1.4392	-1.3345	-1.2138	-1.0507	-.8300
8	-.6936			-1.4081	-1.3486	-1.2307	-1.1776	-.9452	-.7964
9	-.6621		-.9840	-1.1130	-1.1519	-1.0401	-.9942	-.7940	-.6501
10	-.6410	-.5932	-.7444	-.8620	-.8697	-.8784	-.8277	-.6333	-.5446
11	-.6121	-.2023	-.5722	-.6549	-.6212	-.6684	-.6974	-.4822	-.4846
12	-.5832	-.2209	-.4373	-.5384	-.4711	-.5478	-.6781	-.4294	-.4174
13			.6768	.6135	.5410	.4729	.4053	-.3814	-.3790
14			.6047	.5902	.5384	.4801	.4077	-.3406	-.2447
15				-1.4444	-.8438	-1.9330	-1.9450	-.0384	.0192
16				-.5462	-.8801	-.8060	-1.5565	.0576	.0384
17		-.5699	.0581		-.9422	-.7481	-.9436	.1607	.1103
18			-.4001	-.5384		-.7457	-.5092	.2015	.1847
19		.6977	.6628	-.0673	.4504	.2533	.2992	.3119	.1008
20		.7000	.8256	.9241	.9681	.9409	.9361	-.3526	-.4414
21		.7419	.8791	.9396	.9085	.8830	.8299	-.5302	-.3934
22		-.4885	-.4070	-.4219	-.5384	-.3933	-.6853	-.5446	-.3982
23		-.4768	-.4210	-.3883	-.4996	-.3982	-.6009		
24		-.4792	-.4466	-.3986	-.5798	-.4199	-.5164		
25		.9303	-.4350	-.3857	-.5047	-.4271	-.5188		
26		.7605	.8931	.9603	.9655	.9385	.8902		
27		.7512	.8163	.8982	.9085	.8878	.7744		

(b) $\alpha = 16^\circ$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.7230			.9605	.9526	.8735	.6782	.2612	-.0158
2	-.9394				-.1504	0.0000	.1108	.5647	.7469
3	-1.2323			-1.2983	-1.4672	-1.2086	-.9236	-.3826	-.3457
4	-1.3326			-1.9606	-2.3116	-2.2456	-2.0451	-1.3458	-1.1927
5	-1.2904			-2.0357	-2.1059	-2.6686	-2.7655	-2.8094	-1.8480
6	-1.0661			-2.3372	-2.8390	-3.1800	-3.0976	-2.8504	-2.0818
7	-.9869			-1.8459	-2.4516	-2.6371	-2.6395	-2.3492	-1.8095
8	-.7600			-1.1413	-1.8719	-2.0554	-2.0675	-1.7300	-1.3975
9	-.7468		-1.0491	-.8033	-1.1569	-1.4518	-1.4155	-1.2746	-.9951
10	-.6808	-.7173	-.9136	-.6942	-.8059	-1.0107	-1.0689	-.9204	-.8313
11	-.6544	-.1191	-.6869	-.6968	-.7825	-.6956	-.7562	-.6674	-.7204
12	-.6597	-.1098	-.6448	-.9957	-.8241	-.5332	-.6011	-.5156	-.6313
13			.8012	.6915	.6318	.5646	.5234	-.4626	-.5807
14			.7545	.7227	.6785	.6252	.5597	-.3927	-.4482
15				-1.1205	-1.8563	-.8168	-1.1537	-.0795	-.0988
16				-.6994	-1.8355	-.9162	-1.1174	.0506	-.0313
17		-.4953	-.0397		-1.4975	-.8023	-1.0786	.1494	.0313
18			-.5630	-.7331		-.8217	-.9138	.2144	.0723
19		.7732	.8012	.2210	.3536	.4701	.4555	.3349	.1855
20		.8363	.8199	.9281	.9567	.9232	.9305	.5493	.3879
21		.9040	.8596	.9021	.9281	.8602	.8384	.8385	.7541
22		-.4696	-.5584	-.6864	-1.7055	-.6762	-.5575	.8722	.8602
23		-.5000	-.5303	-.6682	-1.3363	-.5890	-.5575		
24		-.4906	-.5210	-.5616	-1.0243	-.6278	-.5623		
25		-.4626	-.4696	-.5850	-.6240	-.6496	-.5696		
26		.9381	.9437	.9567	.9177	.9062	.8554		
27		.8770	.8970	.9047	.9255	.9087	.7802		

TABLE IX.- PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL. $C_{\mu L} = 0$, $C_{\mu R} = 1.85$.

(a) $\alpha = 1^\circ$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.5180			-.5389	-.6200	-.8450	-.8476	-.5049	-.4657
2	-.6096				.8319	.7979	.6750	.8215	.7979
3	-.7090			.4971	.4971	.5886	.6462	.7456	.7273
4	-.7482			-.7247	-.6540	-.4997	-.4003	-.1203	-.1413
5	-.7456			-1.1289	-.8583	-.9251	-1.1318	-.8886	-.6760
6	-.7744			-1.6599	-1.2578	-1.3072	-1.1390	-1.0558	-.7572
7	-.7639			-1.6650	-1.4949	-1.3240	-1.2664	-1.0534	-.8719
8	-.7561			-1.5259	-1.3996	-1.2760	-1.2135	-.9866	-.8289
9	-.7351		-.9891	-1.1650	-1.1573	-1.0933	-.9972	-.8289	-.6712
10	-.7142	-.6161	-.7783	-.8660	-.9047	-.8867	-.8627	-.6521	-.5637
11	-.6828	-.1922	-.5976	-.6830	-.6495	-.6896	-.7281	-.5016	-.5064
12	-.6519	-.2408	-.4262	-.5722	-.5000	-.5743	-.7161	-.4348	-.4252
13			.6832	.6109	.5387	.4564	.3916	-.4109	-.3774
14			.5952	.5799	.5310	.4757	.4468	-.3535	-.2365
15				-1.4331	-.8892	-1.8767	-2.5447	-.0645	.0358
16				-.5619	-.9098	-.8362	-2.0353	.0263	.0741
17		-.5721	.0764		-.9330	-.7473	-1.1606	.0979	.1314
18			-.4146	-.5670		-.7449	-.4566	.1577	.1720
19		.6762	.6739	-.1237	.4356	.2426	.2186	.2914	-.0096
20		.7133	.8244	.9047	.9614	.9321	.9201	-.1887	-.4443
21		.7318	.8708	.9098	.8995	.8720	.8192	-.5518	-.4300
22		-.4887	-.4377	-.4124	-.5361	-.4301	-.8771	-.6354	-.4085
23		-.4841	-.4424	-.4459	-.5542	-.4349	-.7497		
24		-.4933	-.4377	-.4201	-.5052	-.4469	-.6103		
25		1.6304	-.4215	-.4253	-.4846	-.4734	-.5839		
26		.7550	.8522	.9588	.9330	.9225	.8432		
27		.7318	.8082	.8815	.8738	.8648	.7375		

(b) $\alpha = 16^\circ$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.7984			.9402	.9455	.8352	.6119	.0683	-.0657
2	-1.0820				-.3178	.1392	.1024	.5962	.7301
3	-1.2921			-1.2291	-1.3604	-1.1477	-.9428	-.5358	-.2915
4	-1.3998			-1.9723	-2.3163	-2.1640	-2.0117	-1.4943	-1.2291
5	-1.3315			-2.0803	-2.1295	-2.6897	-2.7886	-2.8129	-1.8704
6	-1.0846			-2.4659	-2.8488	-3.2180	-3.1166	-2.8920	-2.1150
7	-.9349			-1.9820	-2.5564	-2.7162	-2.6776	-2.3860	-1.8105
8	-.8299			-1.1669	-1.8966	-2.1083	-2.0745	-1.7793	-1.4052
9	-.7590		-1.0208	-.8668	-1.2316	-1.5197	-1.4474	-1.3117	-1.0144
10	-.7511	-.8046	-.9953	-.7581	-.8125	-1.0469	-1.0879	-.9496	-.8609
11	-.6776	-.1302	-.7487	-.7452	-.8176	-.7406	-.8057	-.7122	-.7674
12	-.6802	-.1093	-.6906	-1.0065	-.8254	-.5693	-.6272	-.5587	-.6690
13			.7904	.6805	.6081	.5667	.4944	-.4916	-.6187
14			.7463	.7141	.6727	.6198	.5498	-.4077	-.4820
15				-1.2523	-1.6819	-.8612	-1.1675	-.1031	-.1031
16				-.7400	-1.7310	-.8684	-1.0952	.0288	-.0528
17		-.5348	.0139		-1.6172	-.9070	-1.1145	.1247	0.0000
18			-.6255	-.7141		-.8829	-.9649	.1990	.0480
19		.7904	.7835	.1889	.3364	.4654	.4148	.3261	.1655
20		.8532	.8114	.9418	.9470	.9453	.9164	.5443	.3693
21		.9183	.8369	.9056	.9004	.8682	.8199	.8345	.7194
22		-.5394	-.5883	-.7788	-1.6456	-.6489	-.6151	.8849	.8968
23		-.5115	-.5697	-.7685	-1.4438	-.6320	-.5838		
24		-.4790	-.5441	-.6081	-1.0350	-.7092	-.6127		
25		-.4883	-.5139	-.6029	-.6727	-.6344	-.5934		
26		.9578	.9299	.9289	.9211	.8754	.8513		
27		.8625	.8858	.8849	.9159	.8923	.7669		

TABLE X. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL WITH METAL FLAP BEHIND LEFT ENGINE REMOVED. $C_{\mu,L} = 0$, $C_{\mu,R} = 0$.

(a) $\alpha = 1^\circ$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.3596			-.4981	-.6419	-.7911	-.8577	-.5514	-.4315
2	-.4422				.7592	.7805	.7379	.8658	.8364
3	-.5114			.4875	.6073	.6660	.7139	.6979	.7459
4	-.5647			-.6313	-.5780	-.3702	-.3862	-.1731	-.1252
5	-.5700			-.9815	-.6666	-.9296	-1.0005	-.9048	-.6105
6	-.5727			-1.4775	-1.2466	-1.2207	-1.1546	-1.0264	-.7637
7	-.5327			-1.5274	-1.3935	-1.2941	-1.1987	-1.0386	-.8440
8	-.4981			-1.3516	-1.3358	-1.2427	-1.1620	-.9462	-.8002
9	-.4794		-.9553	-1.0550	-1.1259	-1.0176	-.9687	-.7783	-.6470
10	-.4501	-.5260	-.7453	-.7453	-.8608	-.7999	-.7999	-.6081	-.5473
11	-.4235	-.4505	-.5307	-.5327	-.6220	-.5993	-.6067	-.4865	-.4743
12	-.4022	-.3632	-.3727	-.4514	-.4934	-.5553	-.5088	-.4451	-.4135
13			.5943	.5905	.5537	.4868	.4428	-.3940	-.3673
14			.5519	.5668	.5406	.4843	.4281	-.3430	-.2505
15				-.6482	-.9763	-1.7662	-2.0402	-.0389	.0049
16				-.6403	-1.2098	-1.2818	-1.6537	.0462	.0462
17		-.8067	.0613		-1.2020	-.6849	-1.0176	.1313	.0997
18			-.6510	-.6508		-.8048	-.6703	.1849	.1386
19		.5566	.5943	.4593	.4041	.3253	.3792	.3648	.1370
20		.9033	.9882	.9762	.9657	.9589	.9295	-.4062	-.4329
21		.9221	.9434	.9237	.9080	.8880	.8219	-.5375	-.4475
22		-.5519	-.4080	-.3517	-.9526	-.4477	-.4183	-.5254	-.4013
23		-.5165	-.4246	-.3254	-1.0288	-.4892	-.4917		
24		-.4694	-.3986	-.3385	-.6377	-.5088	-.4477		
25		-.4057	-.3868	-.3438	-.4461	-.4868	-.4477		
26		.9717	.9599	.9683	.9237	.9418	.8757		
27		.9269	.9009	.9080	.9001	.8929	.7632		

(b) $\alpha = 16^\circ$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.5734			.9744	.9638	.9080	.6292	.2416	.0637
2	-.7699				-.6106	-.2867	.1062	.3717	.6558
3	-.9849			-1.9910	-1.7601	-1.3406	-1.1737	-.6079	-.3902
4	-1.0572			-2.7237	-2.6760	-2.3282	-2.1344	-1.4654	-1.2822
5	-.9769			-2.7909	-2.4299	-2.8355	-2.8501	-2.8727	-1.8594
6	-.8469			-3.2878	-3.2224	-3.3255	-3.1744	-2.9042	-2.1139
7	-.6955			-2.7647	-2.8798	-2.7965	-2.7112	-2.3878	-1.8278
8	-.6345			-1.8126	-2.1683	-2.1138	-2.0699	-1.7454	-1.4036
9	-.5177		-1.6292	-1.0381	-1.4360	-1.4360	-1.3873	-1.2485	-.9963
10	-.4856	-.7429	-1.0391	-.9599	-.8448	-.8948	-.9533	-.8727	-.8145
11	-.4676	-.5759	-.7687	-.7690	-.5885	-.5973	-.6290	-.6182	-.6936
12	-.4605	-.5125	-.6324	-.6774	-.5362	-.4998	-.4754	-.4727	-.5988
13			.6911	.7036	.6669	.6071	.5461	-.4194	-.5285
14			.7263	.7428	.7062	.6631	.5876	-.3539	-.4073
15				-.6173	-.6696	-.5510	-.6949	-.0267	-.0994
16				-.6461	-.6565	-.5486	-.6485	.0848	-.0121
17		-.7194	-.0071		-.6931	-.5583	-.6680	.1697	.0388
18			-.7029	-.6277		-.5608	-.6071	.2497	.0897
19		.7428	.6323	.5022	.5126	.5339	.5242	.3757	.1939
20		.9943	.9990	.9834	.9651	.9460	.9362	.5794	.4048
21		.9473	.9473	.9389	.9206	.8850	.8289	.8387	.7321
22		-.4654	-.3973	-.3871	-.3374	-.3413	-.3901	.8921	.9211
23		-.4607	-.4278	-.3714	-.3583	-.3340	-.3608		
24		-.4366	-.4067	-.3793	-.3688	-.3438	-.3828		
25		-.4796	-.4208	-.3714	-.3426	-.3438	-.3755		
26		.9755	.9614	.9677	.9416	.9045	.8631		
27		.9473	.9402	.9363	.9389	.8948	.7948		

TABLE XI. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL WITH METAL FLAP BEHIND LEFT ENGINE REMOVED. $C_{\mu L} = 0$, $C_{\mu R} = 0.925$.

(a) $\alpha = 1^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.4683			-.4550	-.5960	-.8673	-.8913	-.6305	-.5002
2	-.5773				.8802	.8009	.8036	.8914	.8621
3	-.6891			.4709	.5109	.5987	.5854	.6492	.6599
4	-.7476			-.7290	-.6705	-.5294	-.4363	-.1570	-.2182
5	-.7689			-1.1691	-.8808	-.8992	-1.1142	-.9475	-.6487
6	-.7609			-1.5676	-1.3816	-1.2559	-1.2266	-1.0690	-.7944
7	-.7104			-1.7013	-1.5047	-1.4221	-1.2755	-1.1321	-.8770
8	-.6811			-1.5047	-1.4129	-1.3292	-1.2193	-1.0010	-.8285
9	-.6545		-1.0225	-1.1324	-1.1613	-1.0531	-.9920	-.8066	-.6778
10	-.6252	-.6031	-.8034	-.7576	-.8808	-.7868	-.8088	-.6195	-.5807
11	-.6146	-.4900	-.5631	-.5819	-.6213	-.5693	-.6280	-.4859	-.5102
12	-.5960	-.3769	-.4076	-.4745	-.5033	-.4569	-.5302	-.4252	-.4470
13			.6078	.5976	.5505	.5033	.4374	-.4300	-.3790
14			.5677	.5819	.5426	.4862	.4374	-.3741	-.2575
15				-.5950	-.9568	-.6402	-1.6347	-.0607	.0024
16				-.6265	-.9673	-.6573	-1.3708	.0437	.0364
17		-.7421	.0495		-1.0223	-.6817	-.9847	.1118	.1118
18			-.6644	-.6317		-.6744	-.7013	.1822	.1579
19		.5607	.6502	.4587	.4273	.4642	.3518	.3328	.0948
20		.9281	.9870	.9725	.9672	.9529	.9285	.3498	-.3984
21		.9258	.9753	.9200	.9279	.8723	.8503	-.5734	-.4640
22		-.5065	-.3911	-.3486	-1.1980	-.4007	-.5033	-.6268	-.4470
23		-.5042	-.4029	-.3539	-1.1062	-.4203	-.4423		
24		-.4806	-.4029	-.3617	-.7733	-.4300	-.4447		
25		-.4311	-.3746	-.3486	-.4928	-.4056	-.4471		
26		.9823	.9870	.9646	.9384	.9334	.8894		
27		.9211	.9140	.9069	.9069	.8992	.7794		

(b) $\alpha = 16^{\circ}$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.8635			.9679	.9839	.9277	.7406	.2246	.0187
2	-1.1335				-.6764	-.3475	-.0909	.4331	.6978
3	[illegible]			-1.0655	-1.8927	-1.3607	-1.2511	-.6336	-.4491
4	-1.5105			-2.2991	-2.6814	-2.2884	-2.1494	-1.6040	-1.3340
5	-1.3928			-2.4417	-2.3706	-2.8677	-2.9831	-2.9514	-1.9627
6	-1.2072			-2.7683	-3.1634	-3.3956	-3.3047	-2.9856	-2.2191
7	-1.0040			-2.2336	-2.8052	-2.8652	-2.8088	-2.4754	-1.9066
8	-.9170			-1.4355	-2.1256	-2.2097	-2.1360	-1.9211	-1.4281
9	-.8688		-1.2452	-1.1115	-1.4355	-1.5492	-1.4559	-1.3134	-1.0180
10	-.7830	-.9327	-1.0559	-1.1010	-1.0009	-1.0533	-1.0680	-.9545	-.8495
11	-.7405	-.7883	-.9446	-1.0852	-.7639	-.6875	-.7415	-.7080	-.7519
12	-.5764	-.6865	-.8807	-.9193	-.6638	-.5622	-.5451	-.5444	-.6323
13			.7077	.7085	.6637	.5991	.5524	-.4809	-.5761
14			.7385	.7375	.7111	.6580	.5892	-.3906	-.4712
15				-.7639	-.9403	-.7611	-.8863	-.0659	-.0952
16				-.7955	-.9614	-.7194	-.8421	.0610	-.0195
17		-.7789	-.0402		-.9719	-.7415	-.8446	.1562	.0488
18			-.7670	-.7270		-.7317	-.7513	.2466	.0781
19		.7267	.6415	.4688	.4688	.5131	.5033	.3711	.2026
20		1.0084	.9847	.9929	.9640	.9501	.9207	.5737	.4150
21		.9658	.9303	.9455	.9087	.8937	.8225	.8593	.7299
22		-.4001	-.4048	-.4293	-1.2037	-.4616	-.4812	.9130	.9325
23		-.4095	-.4048	-.4636	-.9561	-.4665	-.4665		
24		-.4190	-.4214	-.5215	-.8086	-.4837	-.4763		
25		-.3953	-.3811	-.4662	-.5110	-.4591	-.4542		
26		.9752	.9823	.9561	.9429	.8986	.8789		
27		.9492	.9681	.9350	.9561	.9060	.8127		

TABLE XII. - PRESSURE COEFFICIENTS FOR WING AND FLAP OF MODEL WITH METAL FLAP BEHIND LEFT ENGINE REMOVED. $C_{\mu L} = 0$, $C_{\mu R} = 1.85$.

(a) $\alpha = 1°$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.5328			-.4395	-.6447	-.7832	-.9323	-.5674	-.4315
2	-.6287				.8285	.7593	.7140	.8951	.8605
3	-.7565			.4076	.5275	.6234	.7166	.7086	.7006
4	-.8258			-.7885	-.7326	-.4582	-.3623	-.1332	-.1705
5	-.8285			-1.0708	-.8871	-.9076	-1.1890	-.8781	-.7103
6	-.7992			-1.5826	-1.4619	-1.2355	-1.3260	-1.0484	-.8368
7	-.7539			-1.7664	-1.5721	-1.4092	-1.3162	-1.1068	-.8757
8	-.7246			-1.5354	-1.4435	-1.3260	-1.2379	-1.0022	-.8368
9	-.7192		-1.0851	-1.1312	-1.1968	-1.0471	-1.0079	-.7979	-.7079
10	-.6873	-.6228	-.8374	-.8189	-.8871	-.8342	-.7975	-.6349	-.5595
11	-.6793	-.5048	-.5709	-.5748	-.6299	-.5774	-.5896	-.4938	-.5157
12	-.6633	-.3868	-.4246	-.4908	-.5013	-.4673	-.4673	-.4354	-.4597
13			.5967	.6036	.5485	.4991	.4281	-.4038	-.3843
14			.5661	.5721	.5354	.5064	.4208	-.3357	-.2676
15				-.7008	-.8687	-1.2868	-1.1107	-.0414	-.0073
16				-.7139	-.9265	-.9248	-1.0642	.0438	.0341
17		-.8256	.0731		-.9685	-.8391	-.9346	.1314	.1070
18			-.6982	-.6929		-.8269	-.8220	.1970	.1484
19		.5614	.6321	.4436	.4383	.3792	.4086	.3357	.1678
20		.9246	1.0001	.9894	.9815	.9541	.9443	-.1751	-.4281
21		.9340	.9812	.9238	.9395	.8832	.8440	-.6033	-.4452
22		-.5001	-.4293	-.3727	-.7611	-.4257	-.4917	-.6106	-.4500
23		-.5614	-.4222	-.3622	-.8268	-.4330	-.4379		
24		-.5307	-.4104	-.3806	-.7690	-.4404	-.4624		
25		-.4529	-.3939	-.3701	-.4934	-.4502	-.4820		
26		.9670	1.0024	.9605	.9684	.9247	.9003		
27		.9199	.9293	.9002	.9107	.8905	.7829		

(b) $\alpha = 16°$.

WING STATIONS

TUBE	0	1	2	3	4	5	6	7	8
1	-.9532			.9667	.9640	.8888	.7707	.3544	.0725
2	-1.2378				-.6122	-.4565	-.2578	.3464	.6149
3	-1.5144			-1.6325	-1.8796	-1.5439	-1.3613	-.6041	-.4672
4	-1.5744			-2.3468	-2.7146	-2.4380	-2.2608	-1.5976	-1.3721
5	-1.5036			-2.4471	-2.4048	-2.9838	-2.9912	-3.0722	-1.9713
6	-1.3103			-2.8122	-3.2593	-3.5313	-3.4129	-3.1041	-2.3170
7	-1.1250			-2.3016	-2.8651	-2.9394	-2.8852	-2.5402	-1.9762
8	-.9639			-1.4709	-2.1746	-2.2613	-2.2268	-1.8757	-1.5177
9	-.8638		-1.2341	-1.1402	-1.5318	-1.5905	-1.5338	-1.3657	-1.0911
10	-.8512	-1.0082	-1.1437	-1.1243	-1.0609	-1.1146	-1.1171	-.9955	-.9268
11	-.7867	-.8465	-.9772	-1.0952	-.8386	-.7299	-.7743	-.7307	-.7944
12	-.7572	-.7418	-.9226	-1.0159	-.7196	-.5869	-.6017	-.5639	-.6914
13			.6776	.6904	.6428	.5943	.5302	-.5198	-.6154
14			.7132	.7275	.6957	.6559	.5795	-.4217	-.4928
15				-.8307	-1.0397	-.7669	-.9790	-.0785	-.1128
16				-.8572	-1.0635	-.7891	-.9445	.0515	-.0343
17		-.3393	-.0048		-1.0820	-.8261	-.9075	.1324	.0221
18			-.8346	-.7778		-.7866	-.8360	.2207	.0736
19		.6918	.6110	.4259	.4550	.4858	.4735	.3555	.1765
20		.9724	.9890	.9682	.9708	.9420	.9420	.5664	.3972
21		.9581	.9581	.9365	.9285	.8803	.8335	.8336	.7282
22		-.4113	-.4256	-.5159	-1.0106	-.5154	-.5400	.8949	.9194
23		-.4351	-.4280	-.5529	-.9312	-.5080	-.5179		
24		-.4422	-.4470	-.5000	-.8122	-.5080	-.5376		
25		-.4161	-.4113	-.4762	-.5873	-.4957	-.5179		
26		.9529	.9557	.9497	.9100	.8976	.8507		
27		.9462	.9438	.9312	.9338	.9099	.7891		

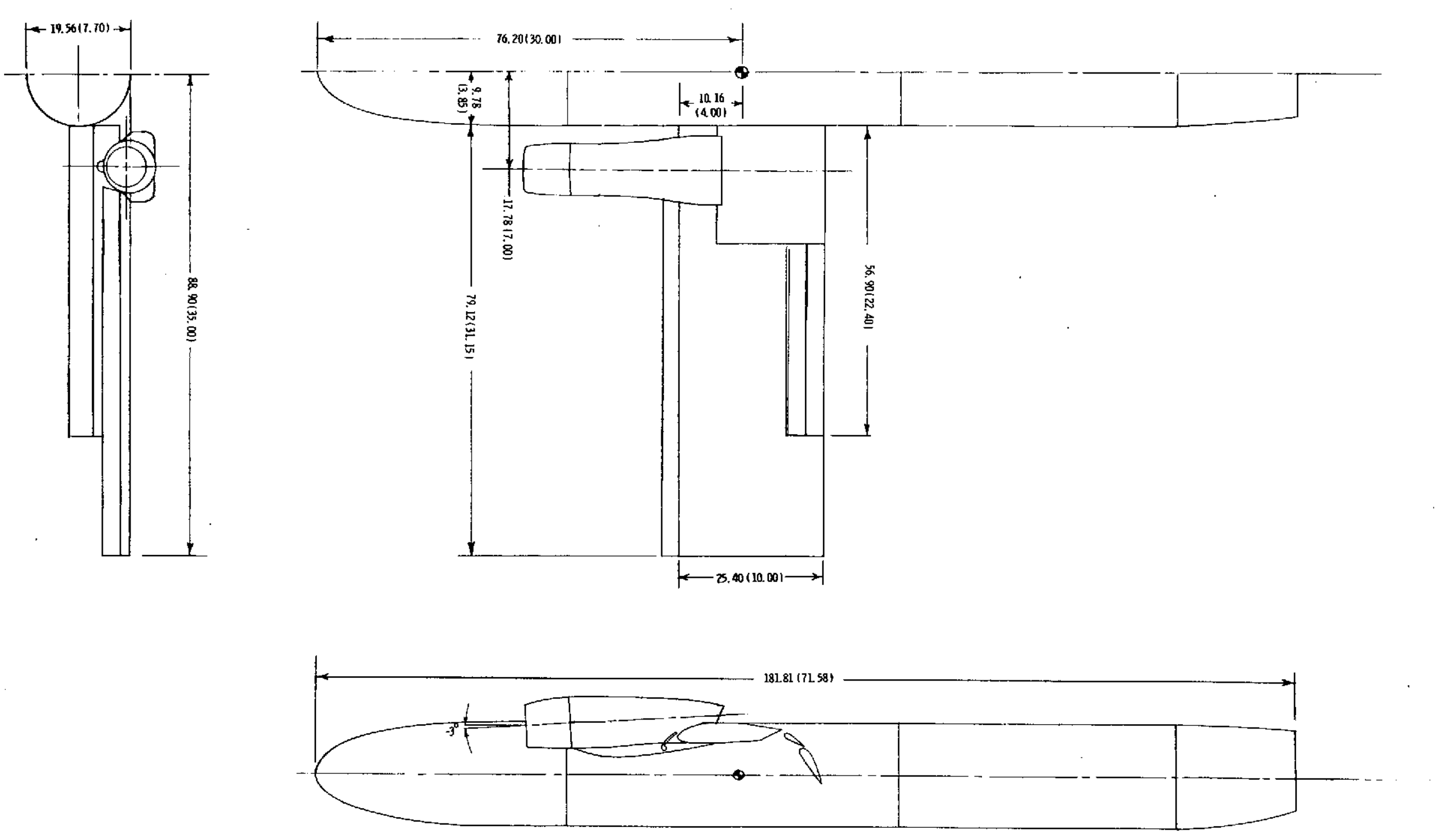


Figure 1. - Three-view drawing of model used in investigation.
Dimensions are in centimeters (inches).

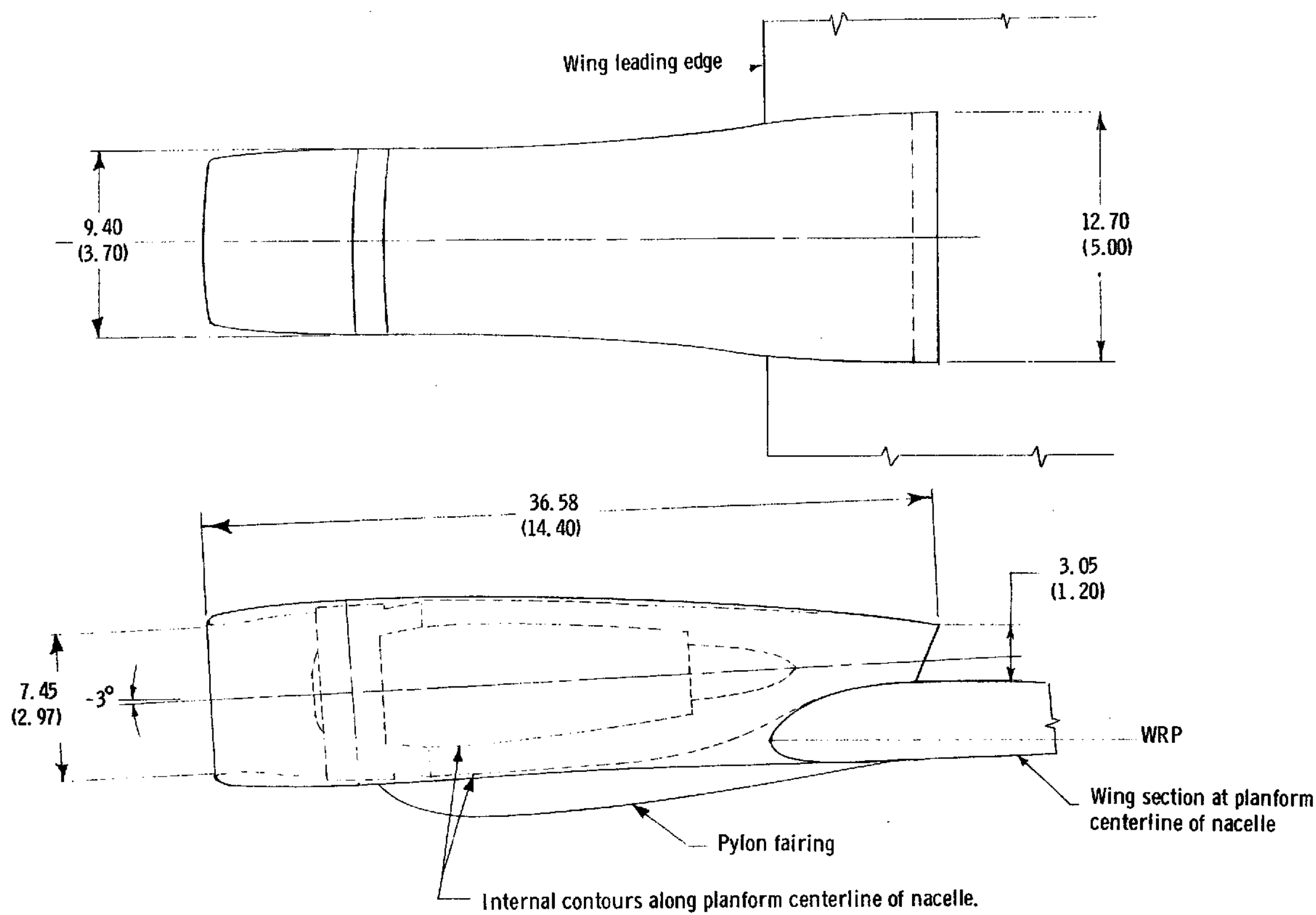


Figure 2. - Sketch of basic nacelle showing typical installation on wing.

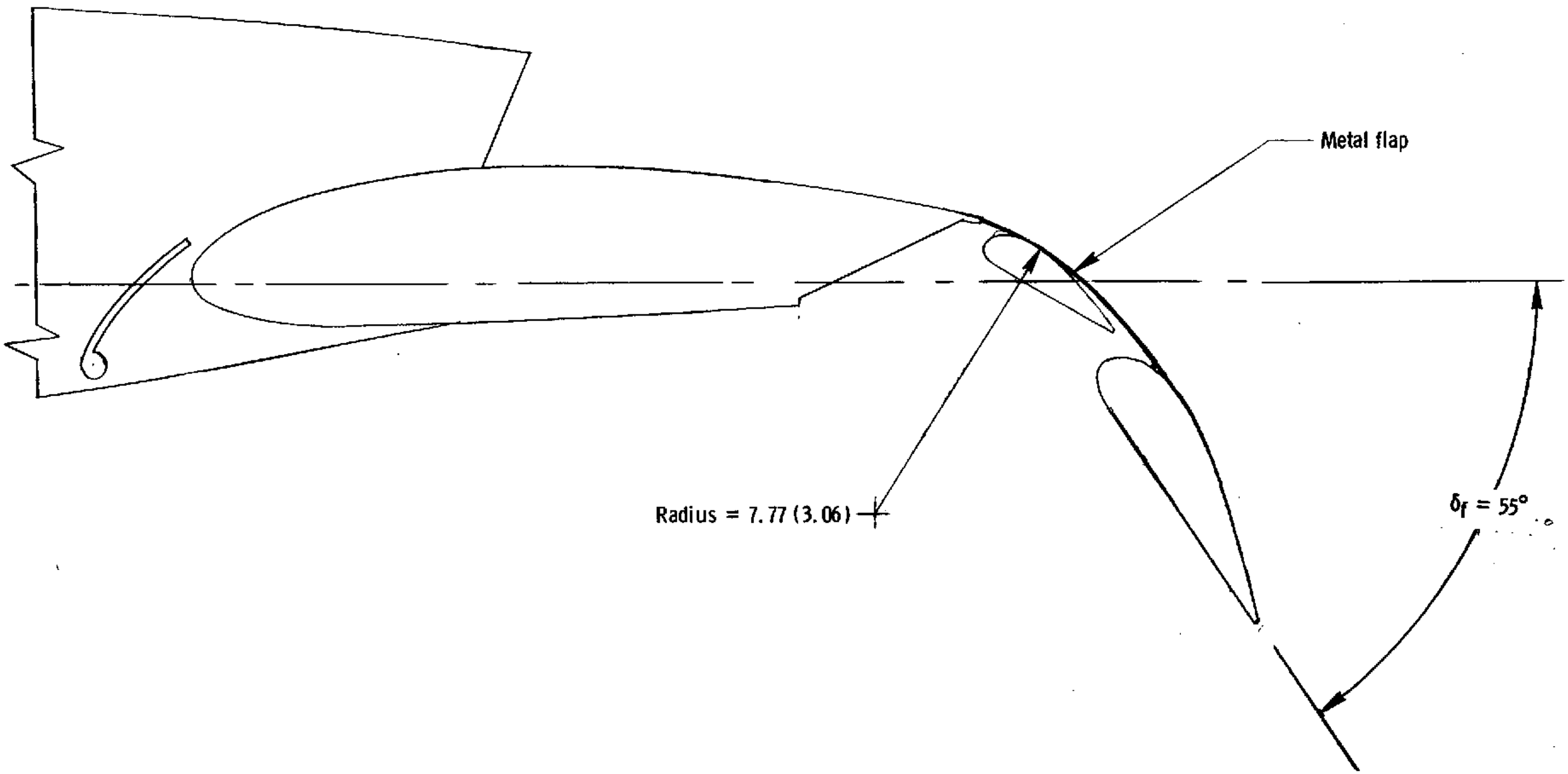


Figure 3. - Details of plain metal flap. Dimensions are in centimeters (inches).

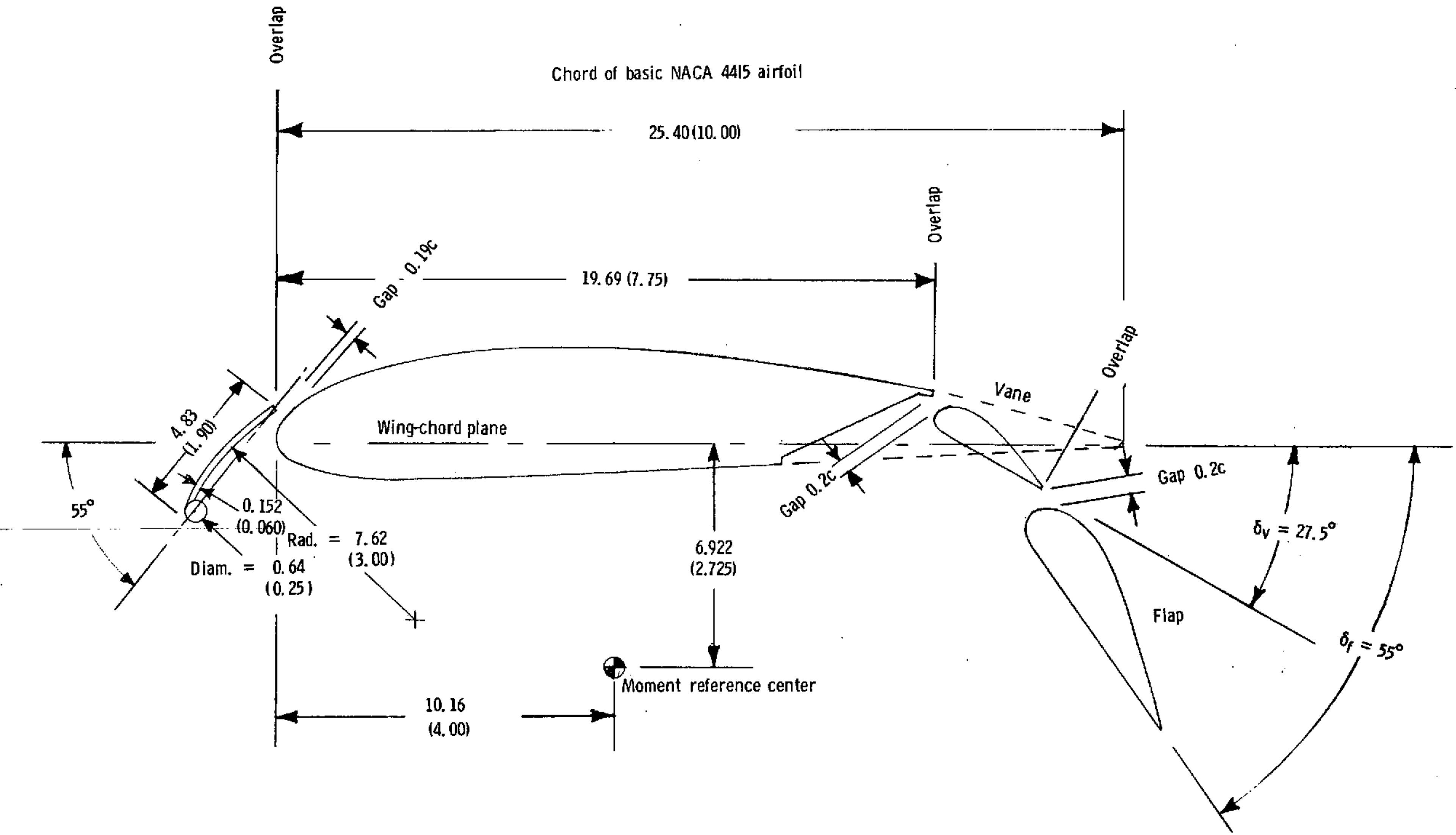


Figure 4. - Details of slats and flaps. Dimensions are in centimeters (inches).

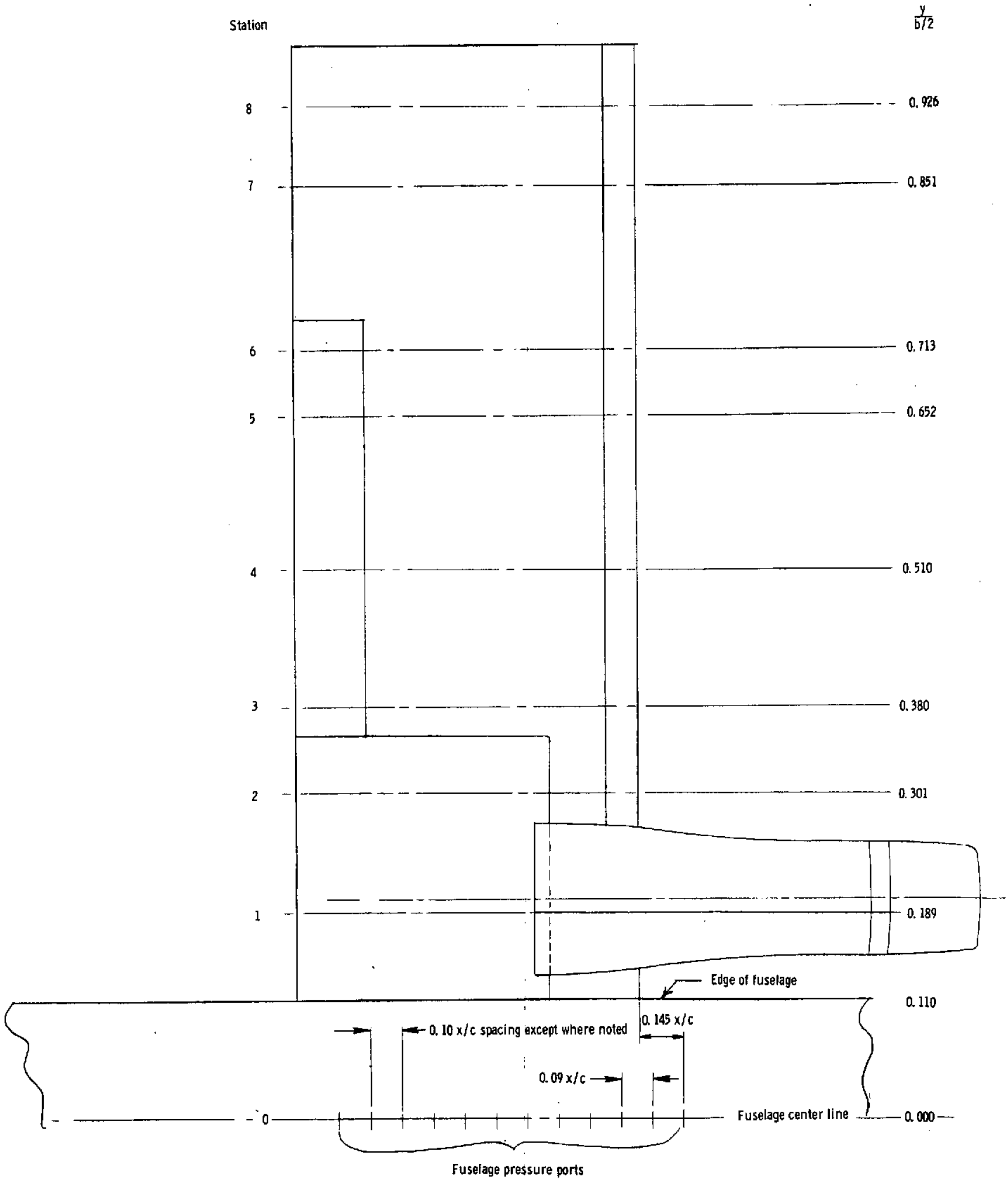
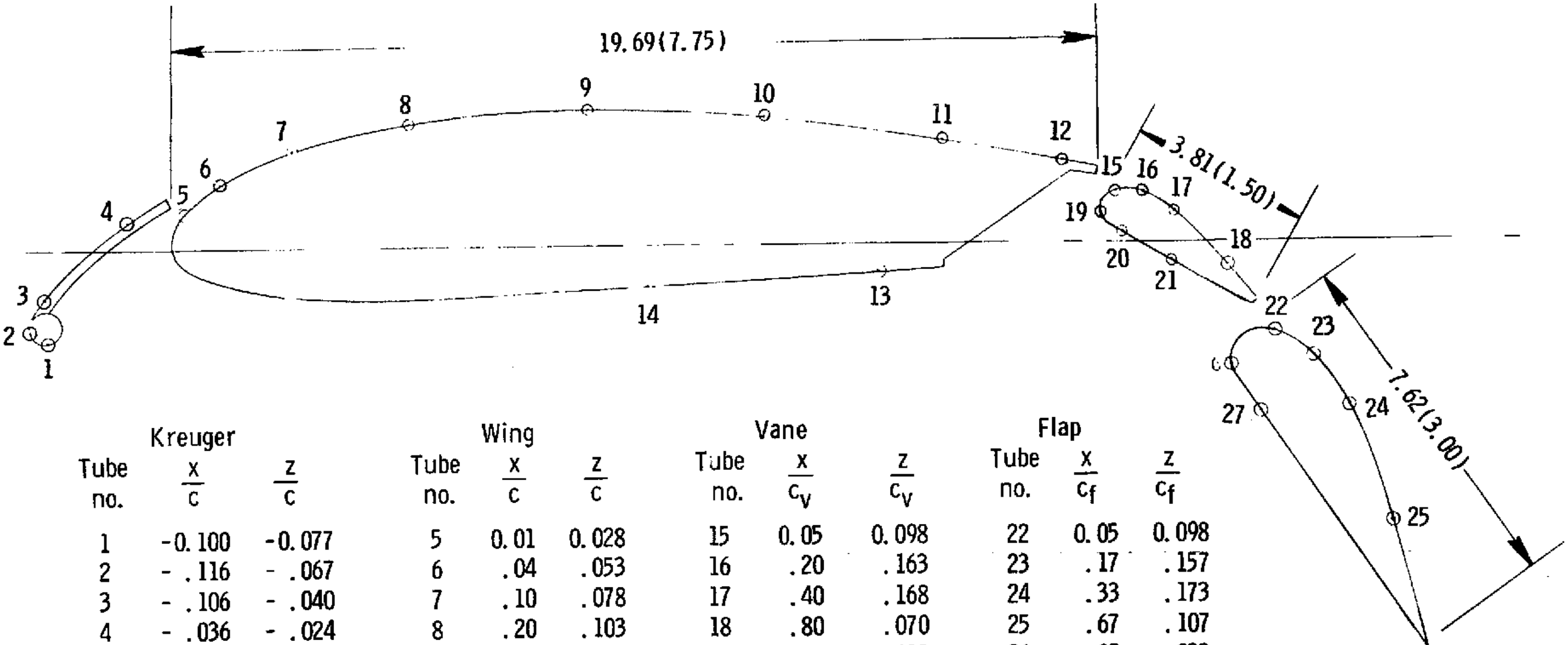


Figure 5. - Spanwise location of pressure orifices.



Kreuger

Tube no.	$\frac{x}{c}$	$\frac{z}{c}$
1	-0.100	-0.077
2	-.116	-.067
3	-.106	-.040
4	-.036	-.024

Wing

Tube no.	$\frac{x}{c}$	$\frac{z}{c}$
5	0.01	0.028
6	.04	.053
7	.10	.078
8	.20	.103
9	.35	.112
10	.50	.105
11	.65	.084
12	.75	.066
13	.60	-.021
14	.40	-.033

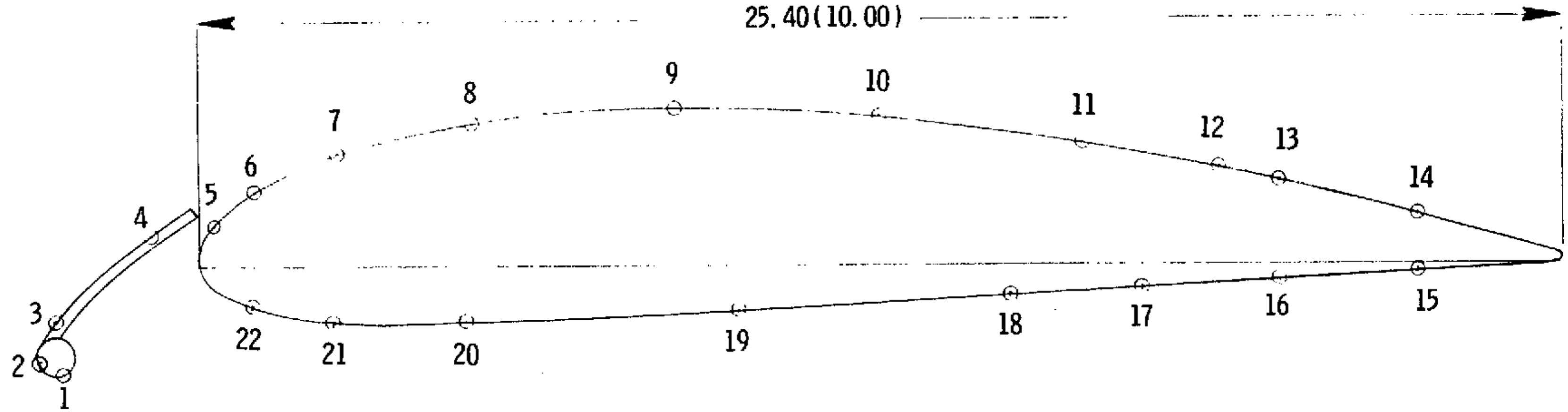
Vane

Tube no.	$\frac{x}{c_v}$	$\frac{z}{c_v}$
15	0.05	0.098
16	.20	.163
17	.40	.168
18	.80	.070
19	.05	-.033
20	.20	-.037
21	.50	-.024

Flap

Tube no.	$\frac{x}{c_f}$	$\frac{z}{c_f}$
22	0.05	0.098
23	.17	.157
24	.33	.173
25	.67	.107
26	.05	-.033
27	.20	-.037

Figure 6.- Chordwise location of pressure orifices. Dimensions are in centimeters (inches).

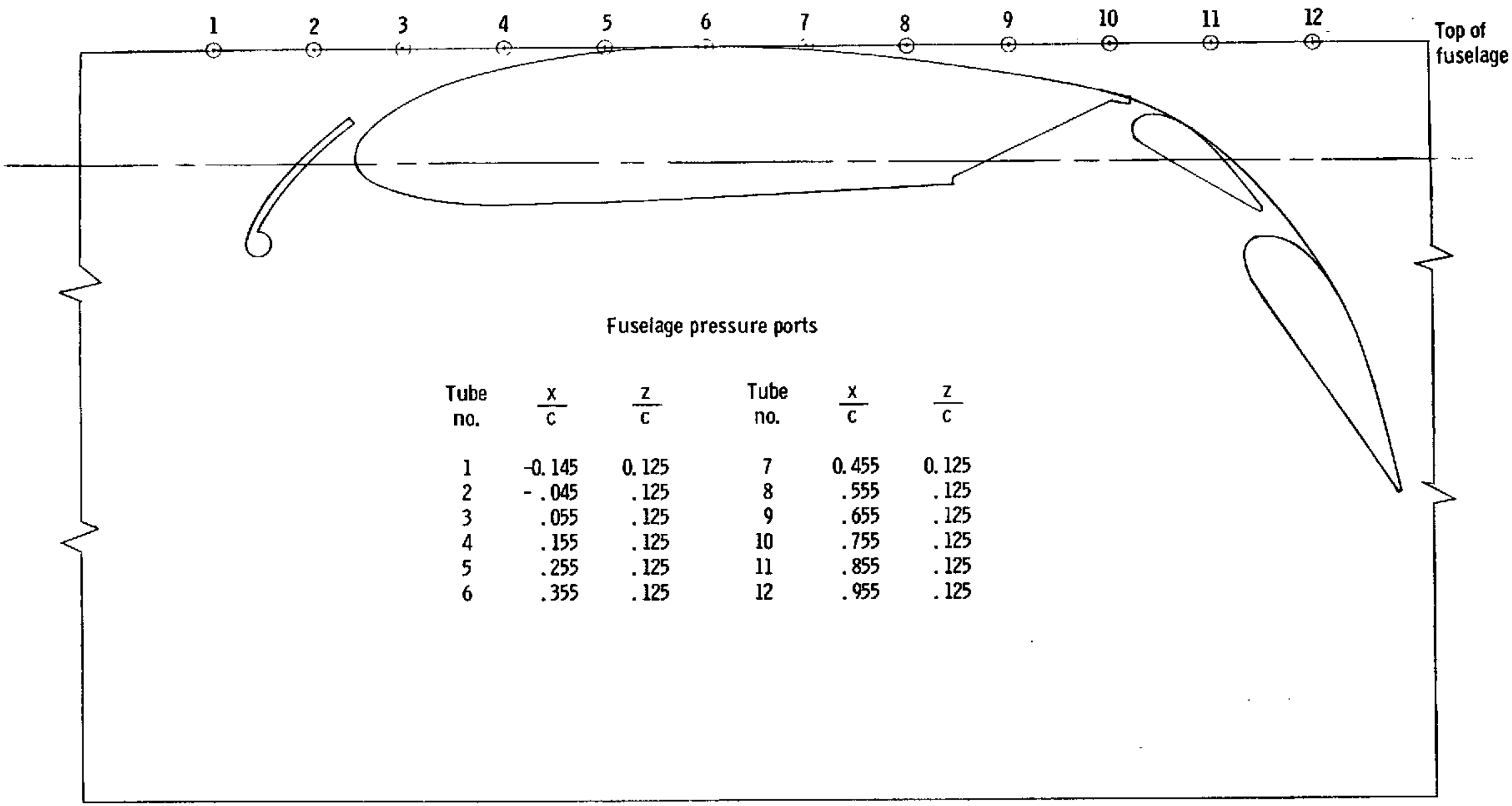


Kreuger Tube no.	$\frac{x}{c}$	$\frac{z}{c}$
1	-0.100	-0.077
2	-.116	-.067
3	-.106	-.040
4	-.036	-.024

Wing Tube no.	$\frac{x}{c}$	$\frac{z}{c}$
5	0.01	0.028
6	.04	.053
7	.10	.078
8	.20	.103
9	.35	.112
10	.50	.105
11	.65	.084
12	.75	.066
13	.796	.061
14	.896	.036

Wing Tube no.	$\frac{x}{c}$	$\frac{z}{c}$
15	0.896	-0.006
16	.796	-.010
17	.693	-.017
18	.596	-.021
19	.396	-.033
20	.196	-.040
21	.096	-.040
22	.036	-.029

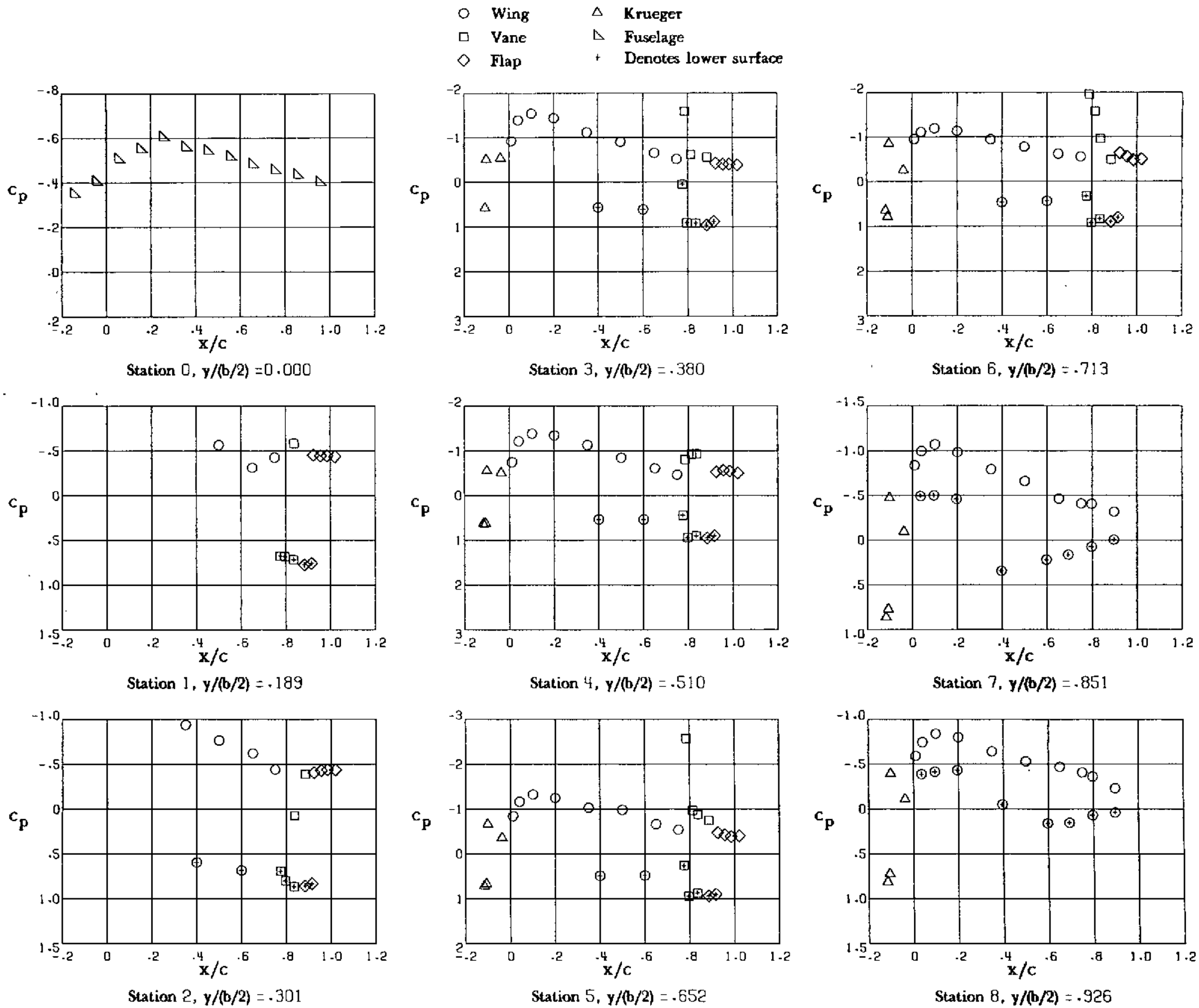
Figure 7. - Chordwise location of pressure orifices at wingtip.
Dimensions are in centimeters (inches)



Fuselage pressure ports

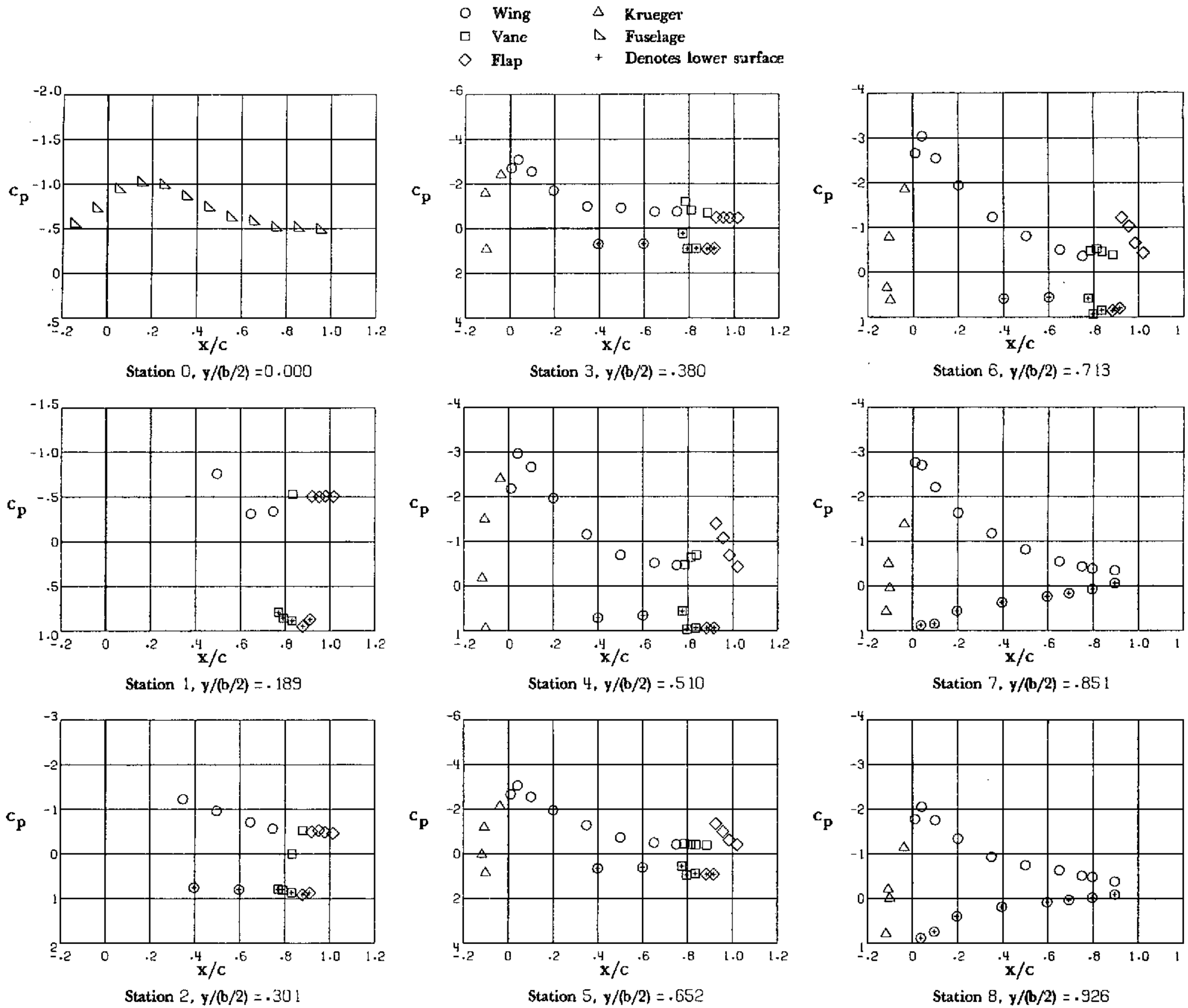
Tube no.	$\frac{x}{c}$	$\frac{z}{c}$	Tube no.	$\frac{x}{c}$	$\frac{z}{c}$
1	-0.145	0.125	7	0.455	0.125
2	-.045	.125	8	.555	.125
3	.055	.125	9	.655	.125
4	.155	.125	10	.755	.125
5	.255	.125	11	.855	.125
6	.355	.125	12	.955	.125

Figure 8. - Chordwise location of pressure orifices on fuselage.



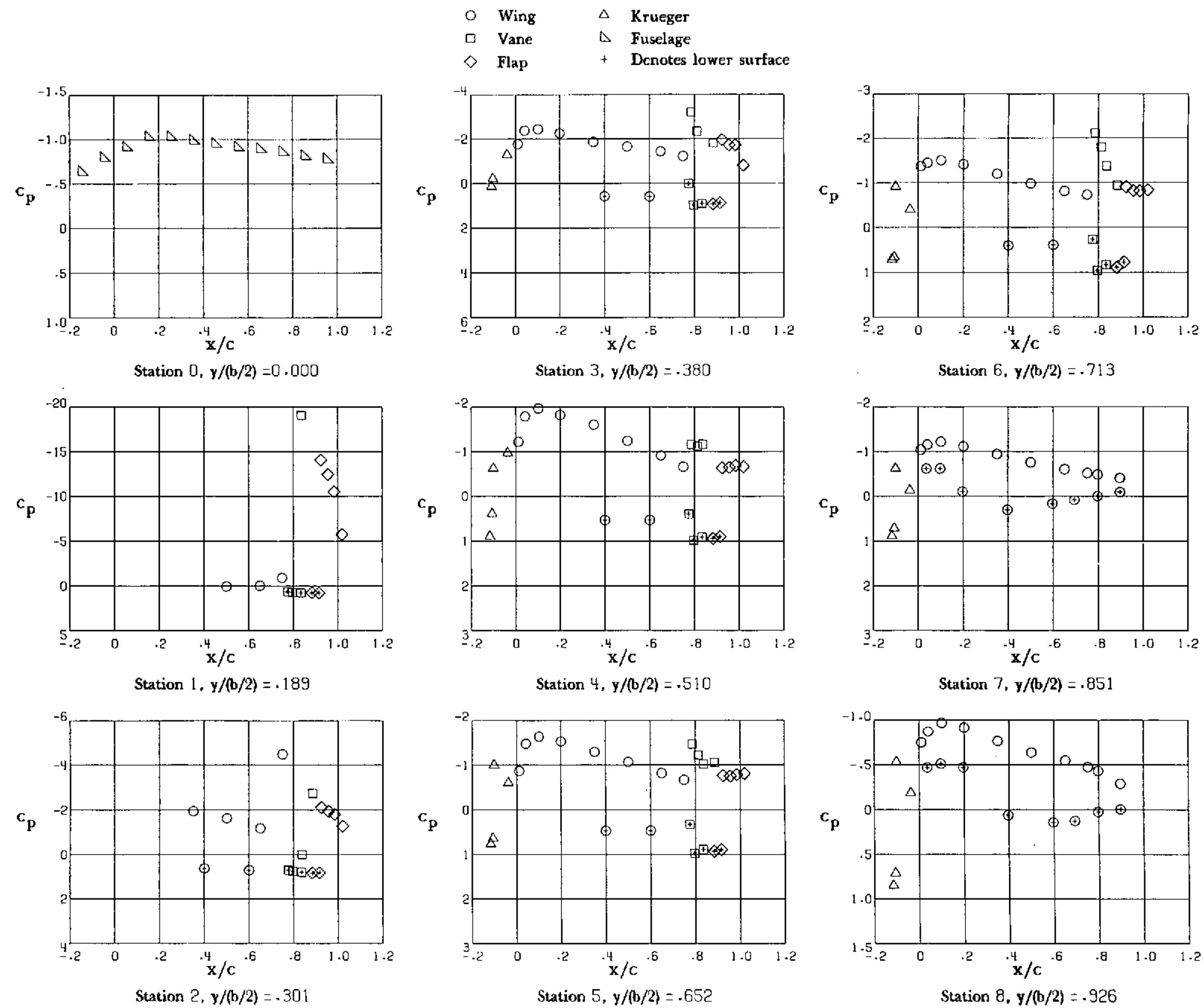
(A) ALPHA = 1 DEG.

Figure 9.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu,L} = 0$, $C_{\mu,R} = 0$



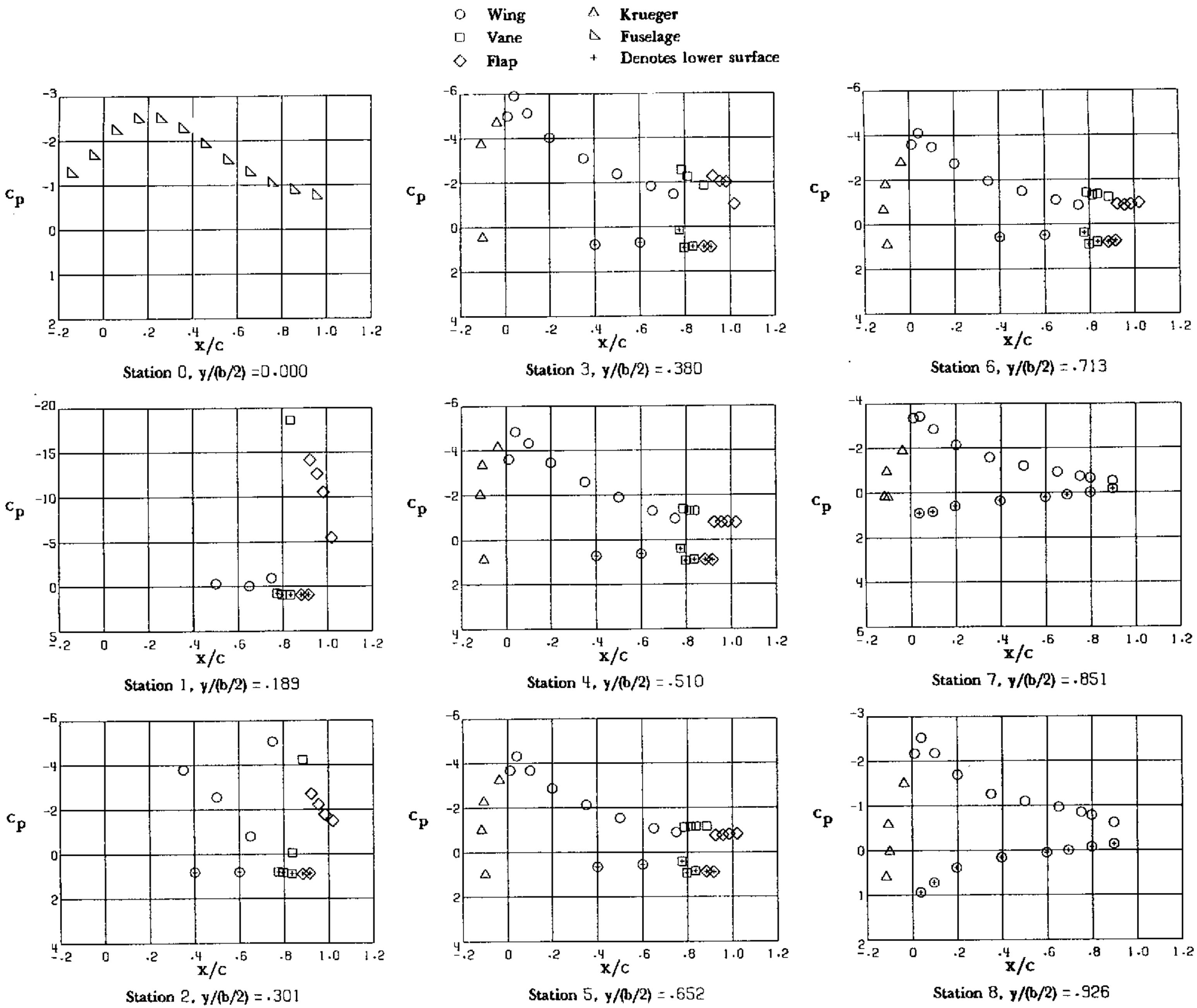
(B) ALPHA = 16 DEG.

FIGURE 9.- CONCLUDED.



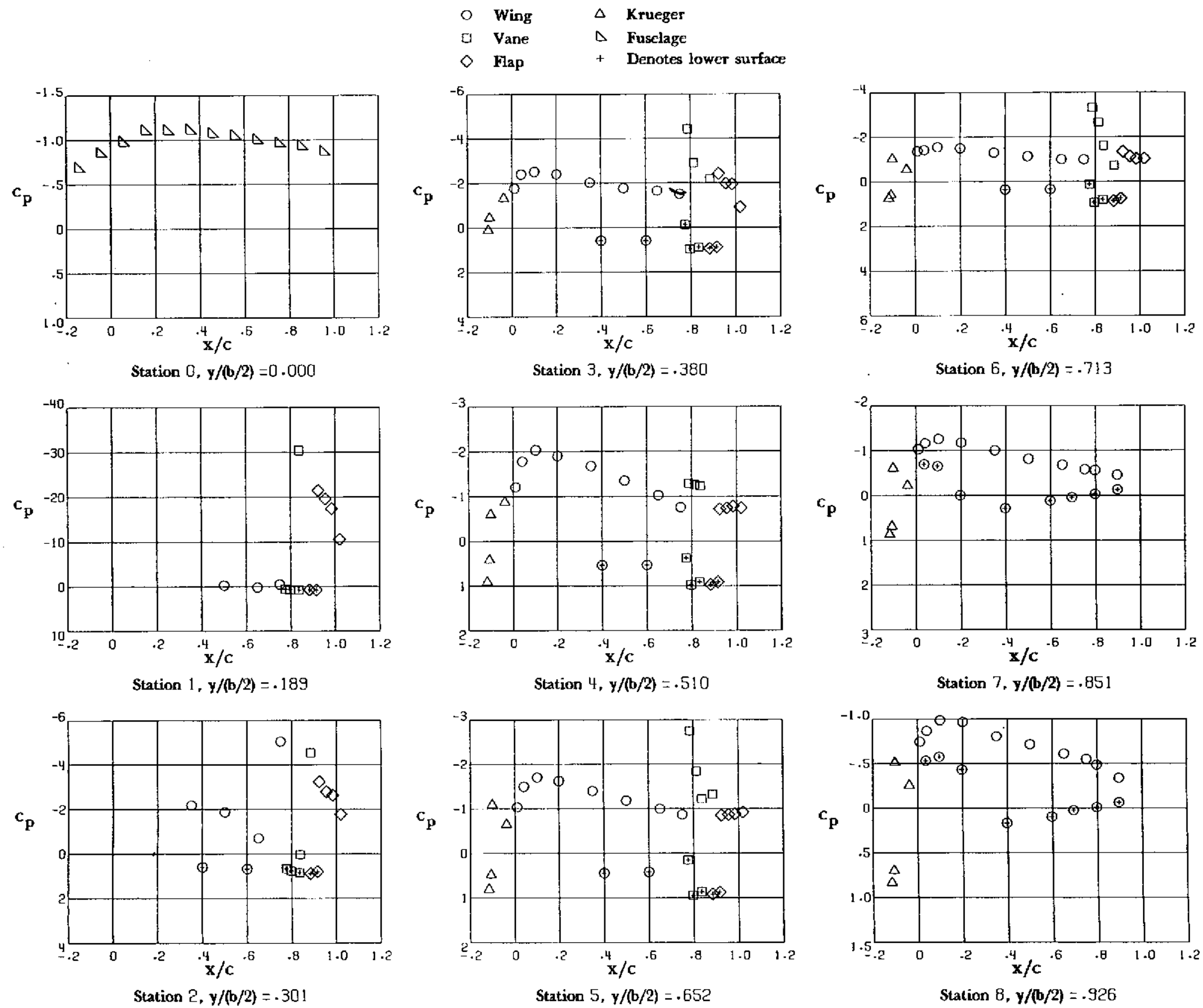
(B) ALPHA = 1 DEG.

Figure 10. - PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu L} = 0.925$, $C_{\mu R} = 0.925$.



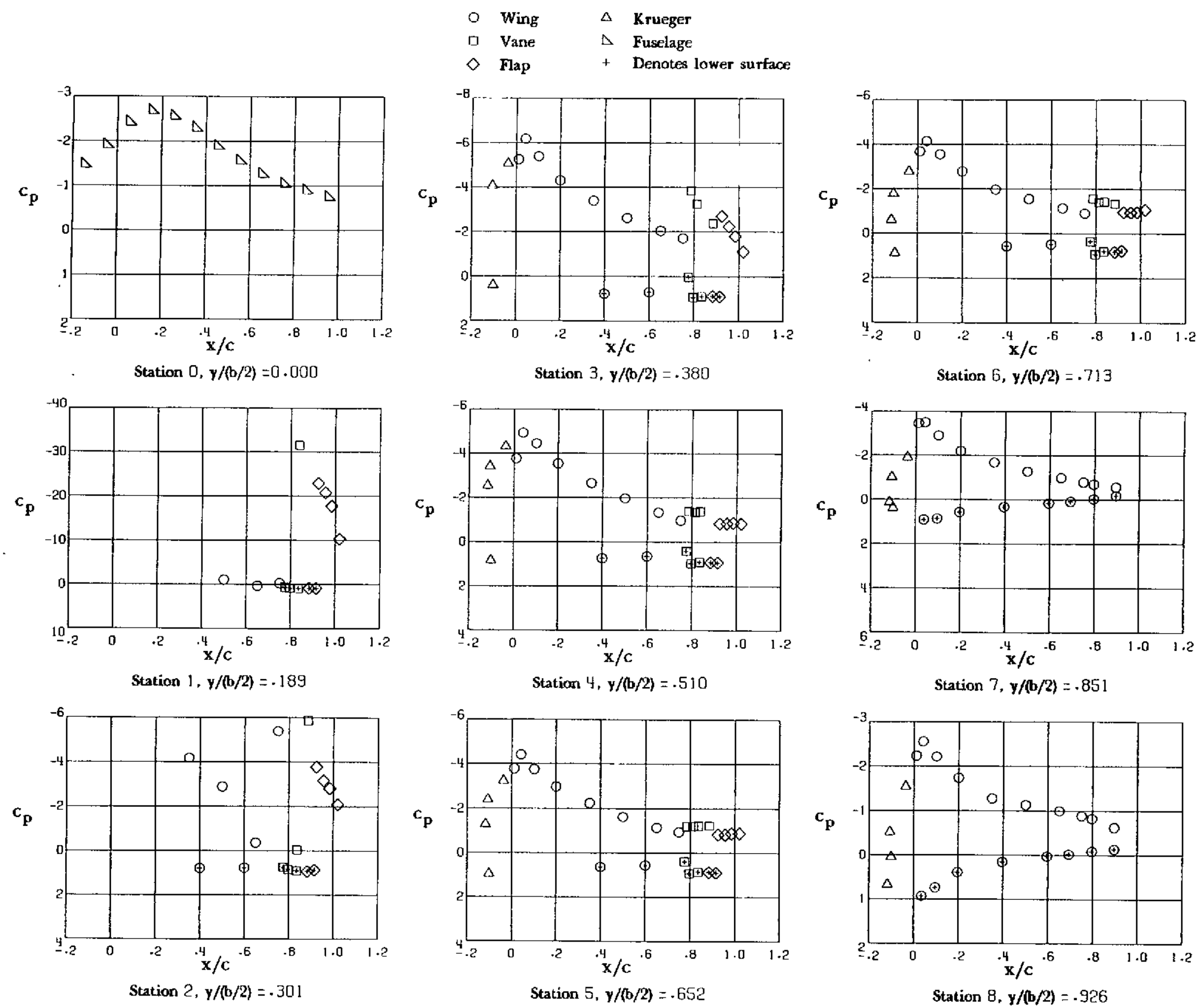
(B) ALPHA = 16 DEG.

Figure 10. - CONCLUDED.



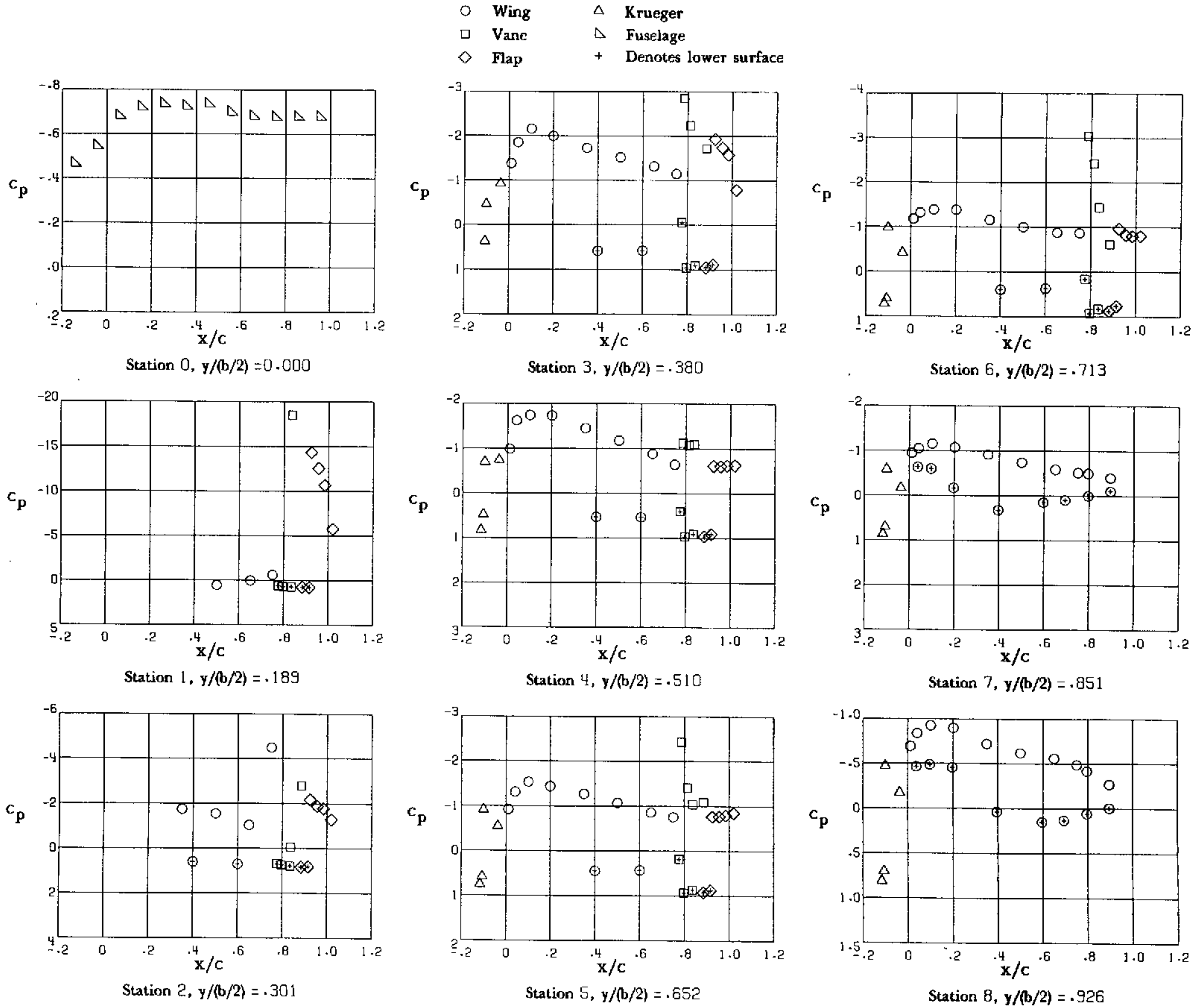
(A) ALPHA = 1 DEG.

Figure 11.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu,L} = 1.85$, $C_{\mu,R} = 1.85$.



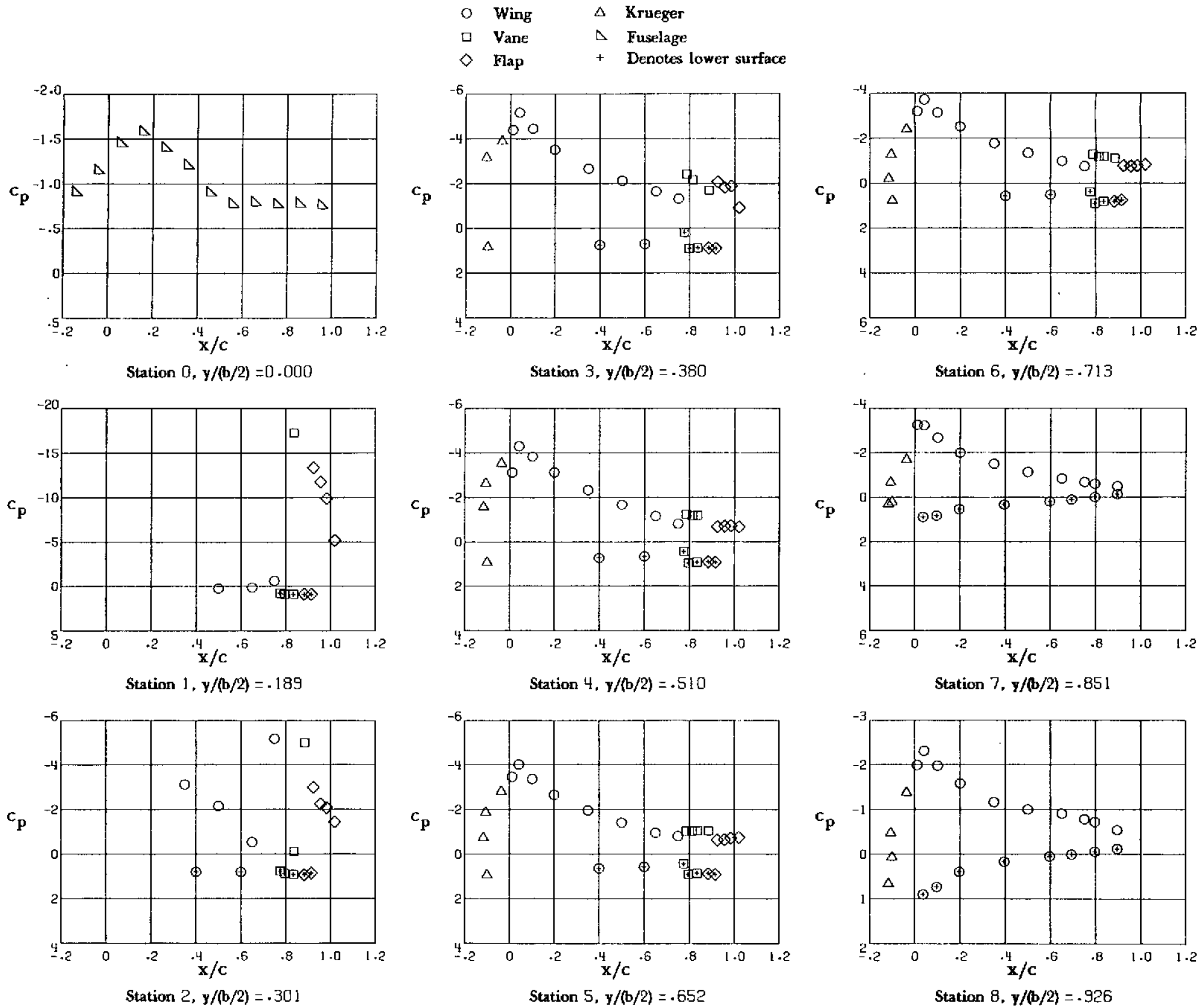
(B) ALPHA = 16 DEG.

Figure 11. - CONCLUDED.



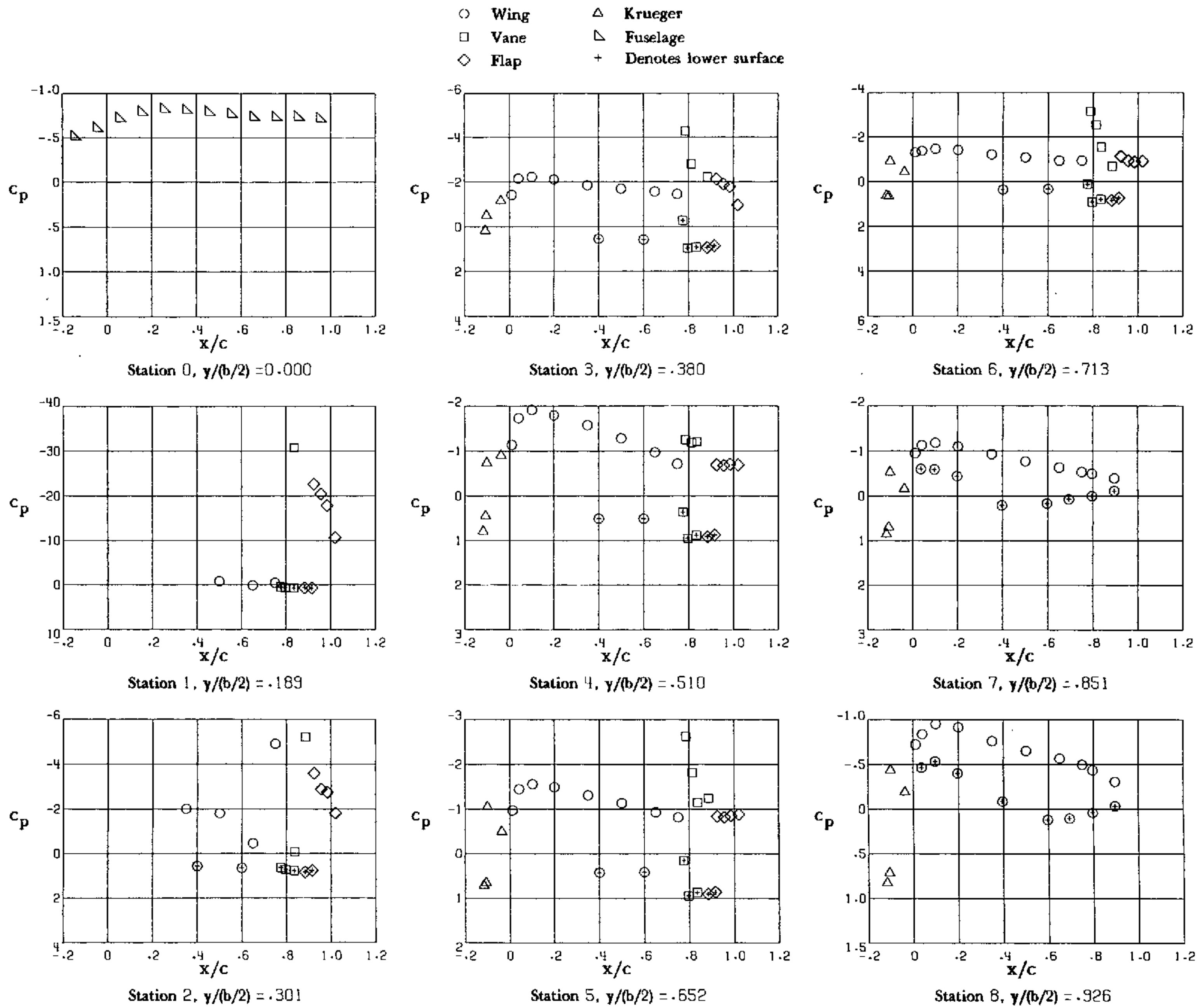
(A) ALPHA = 1 DEG.

Figure 12.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu,L} = 0.925$, $C_{\mu,R} = 0$.



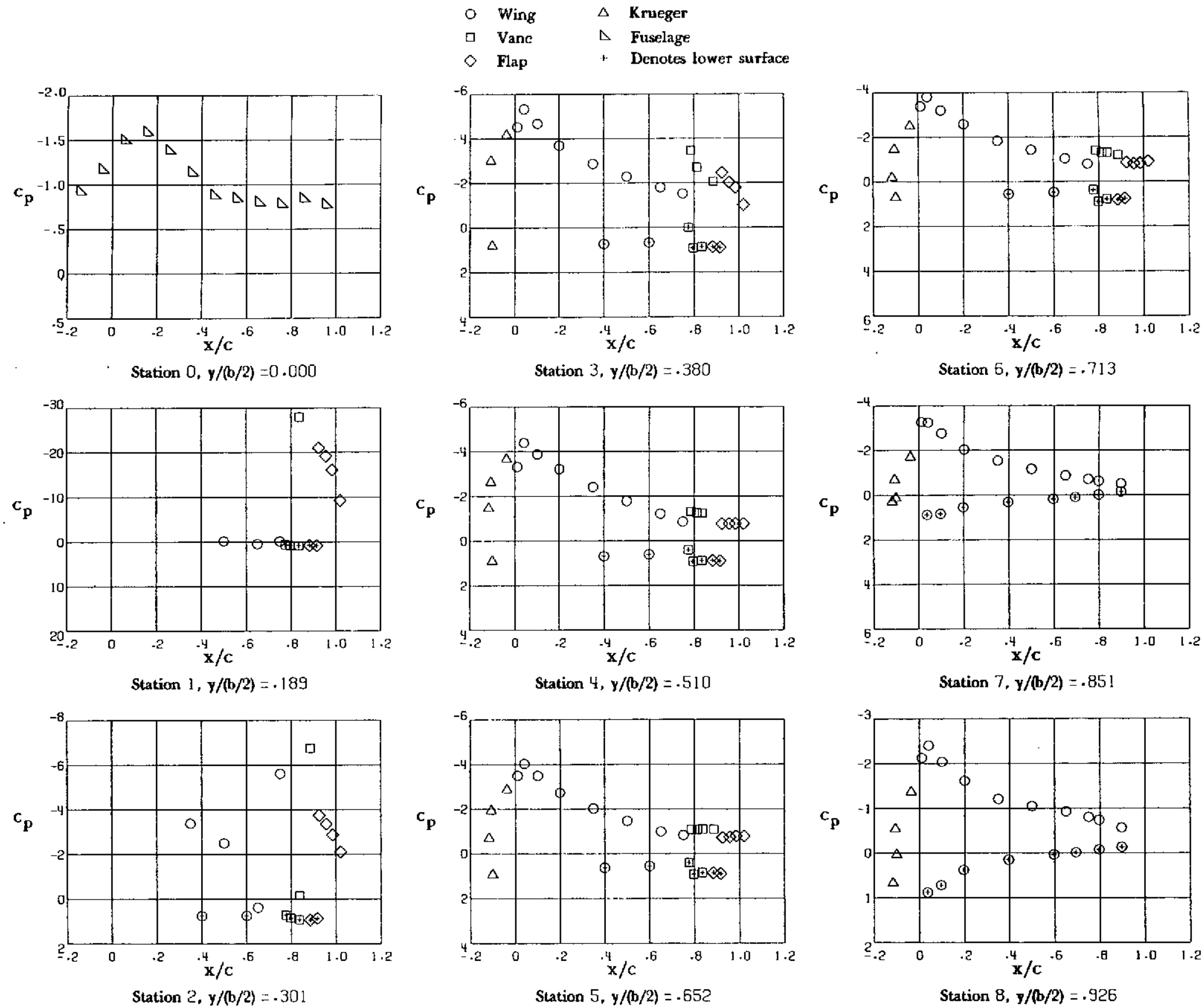
(B) ALPHA = 16 DEG.

Figure 12.- CONCLUDED.



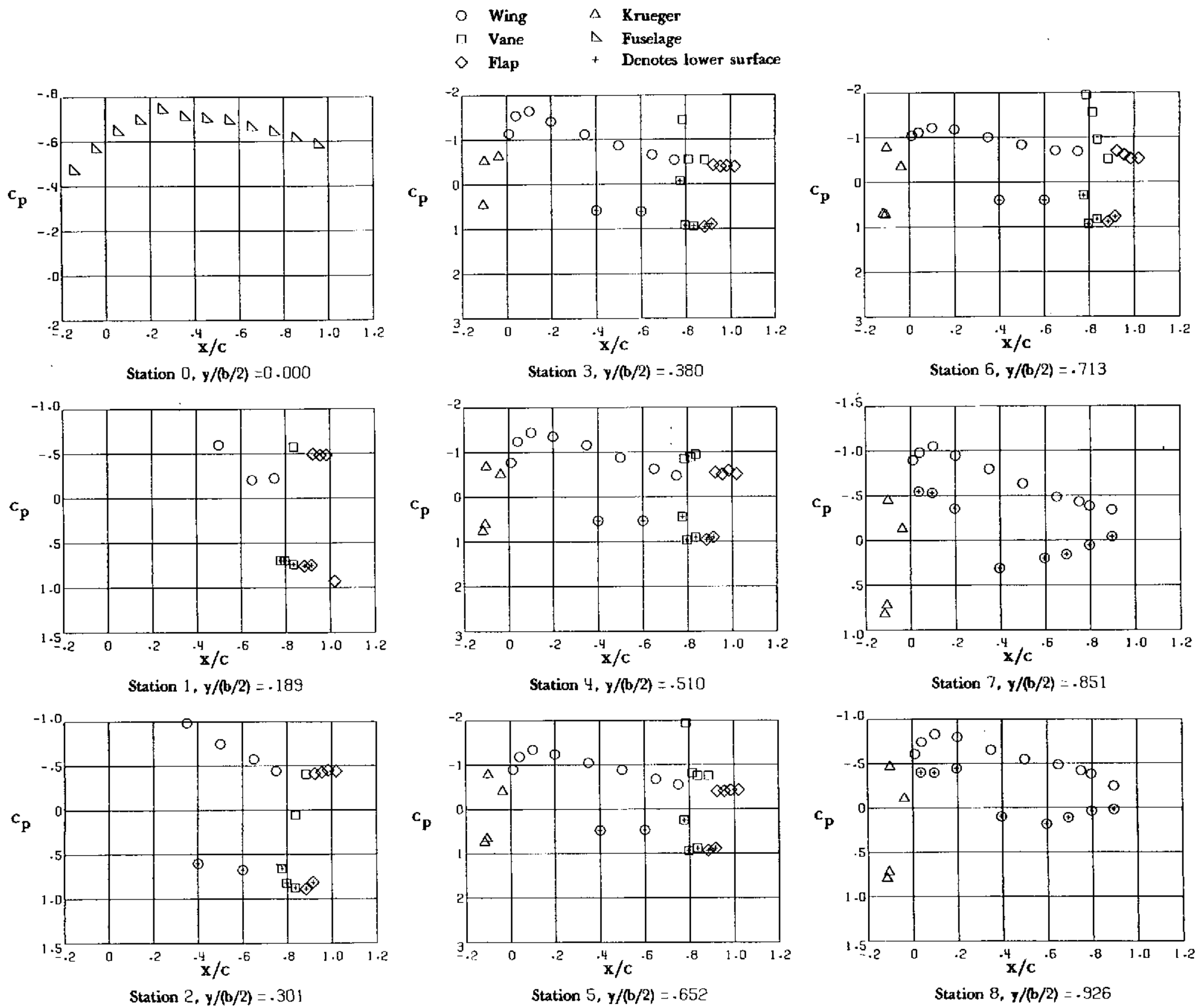
(A) ALPHA = 1 DEG.

Figure 13.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu,L} = 1.85$, $C_{\mu,R} = 0$.



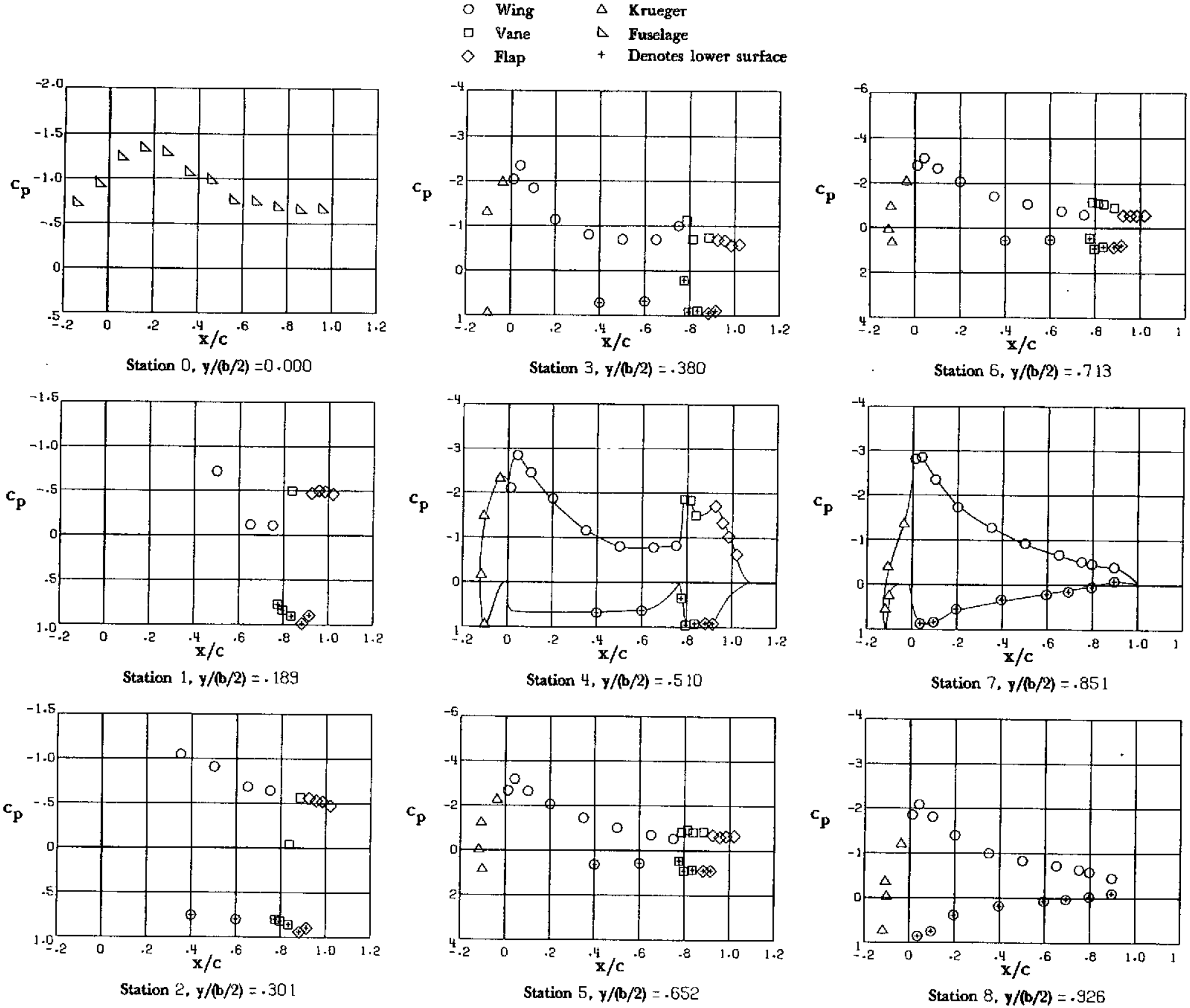
(B) ALPHA = 16 DEG.

Figure 13.- CONCLUDED.



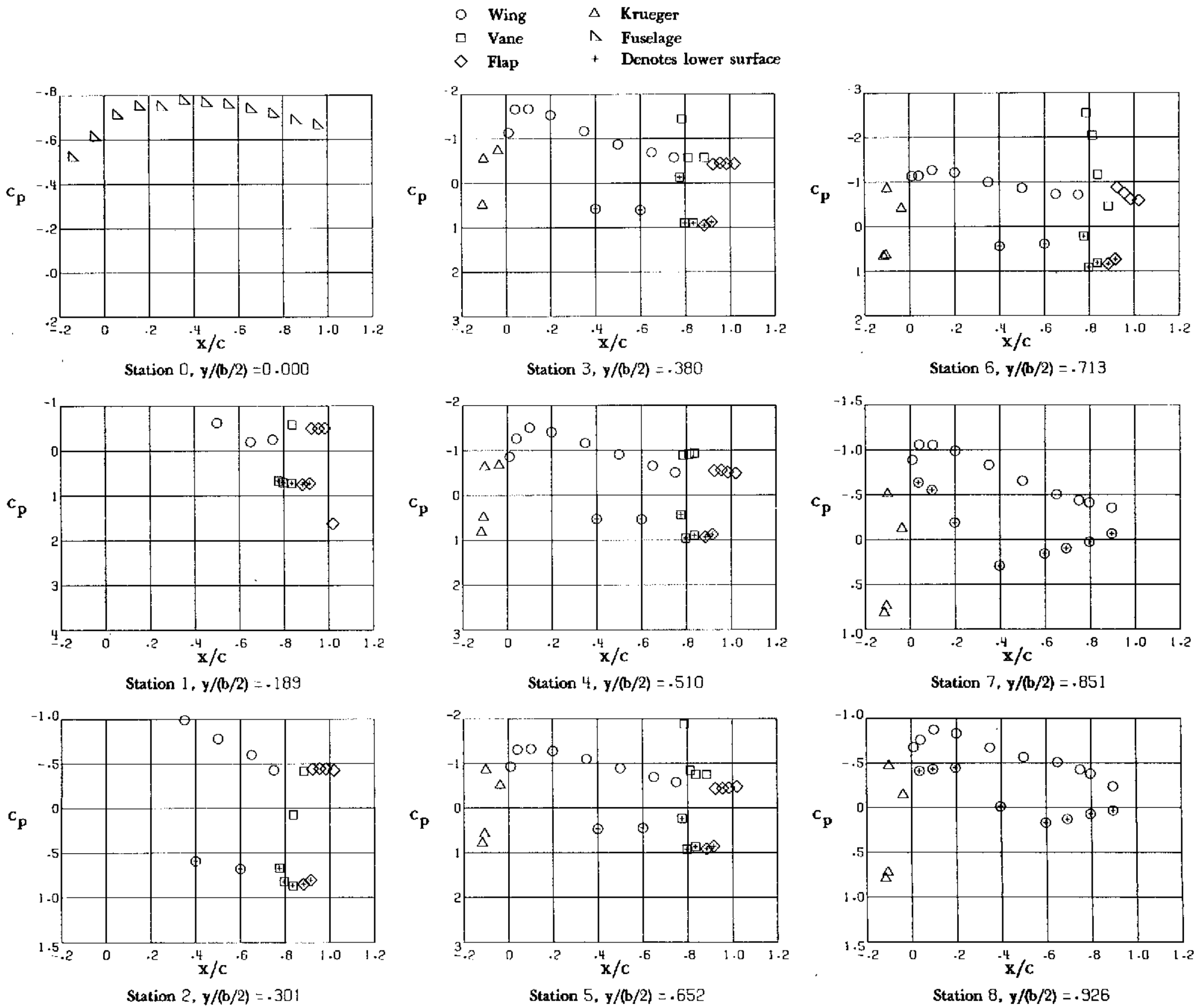
(A) ALPHA = 1 DEG.

Figure 14.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu,L} = 0$, $C_{\mu,R} = 0.925$.



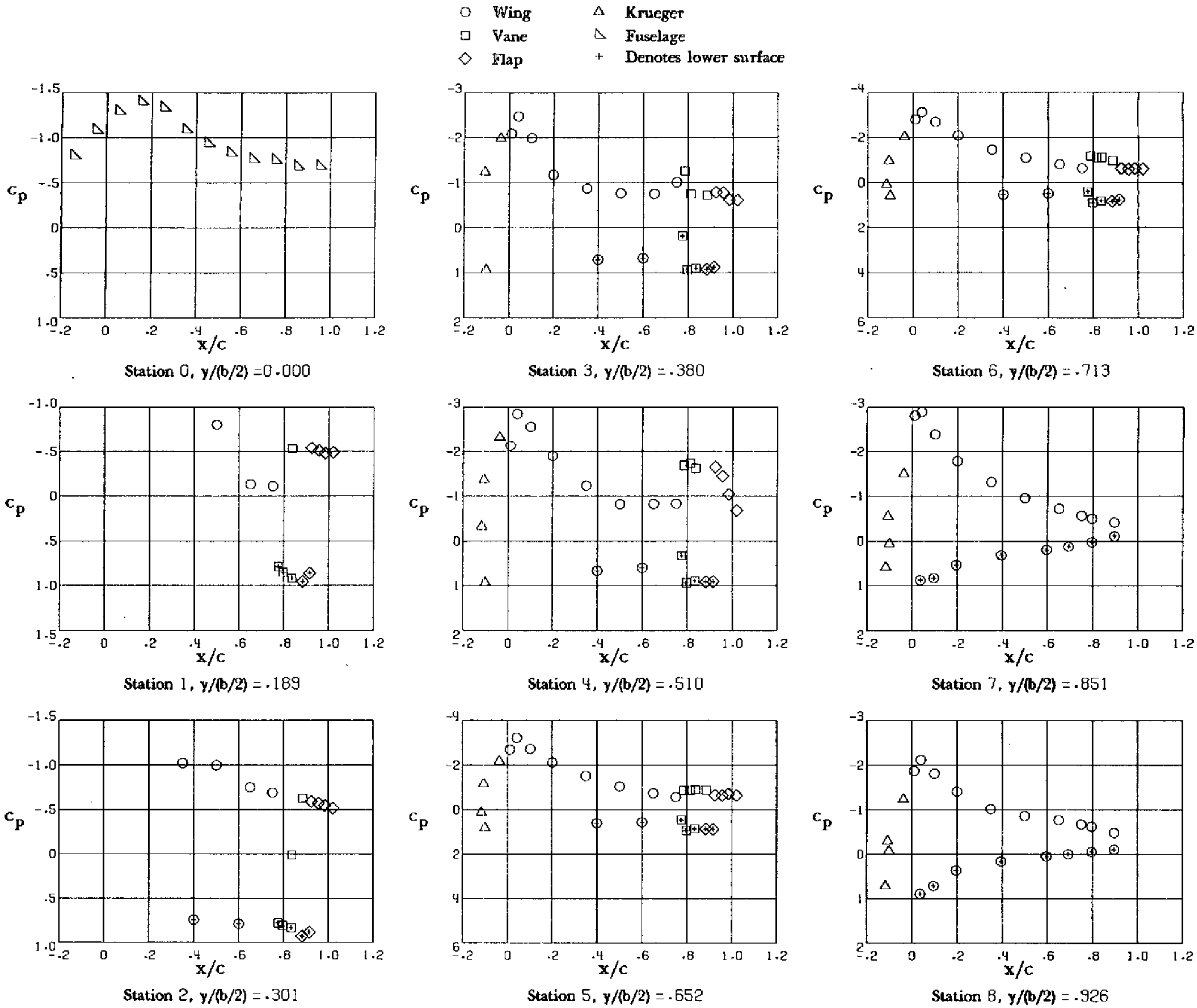
(B) ALPHA = 16 DEG.

FIGURE 14.-- CONCLUDED.



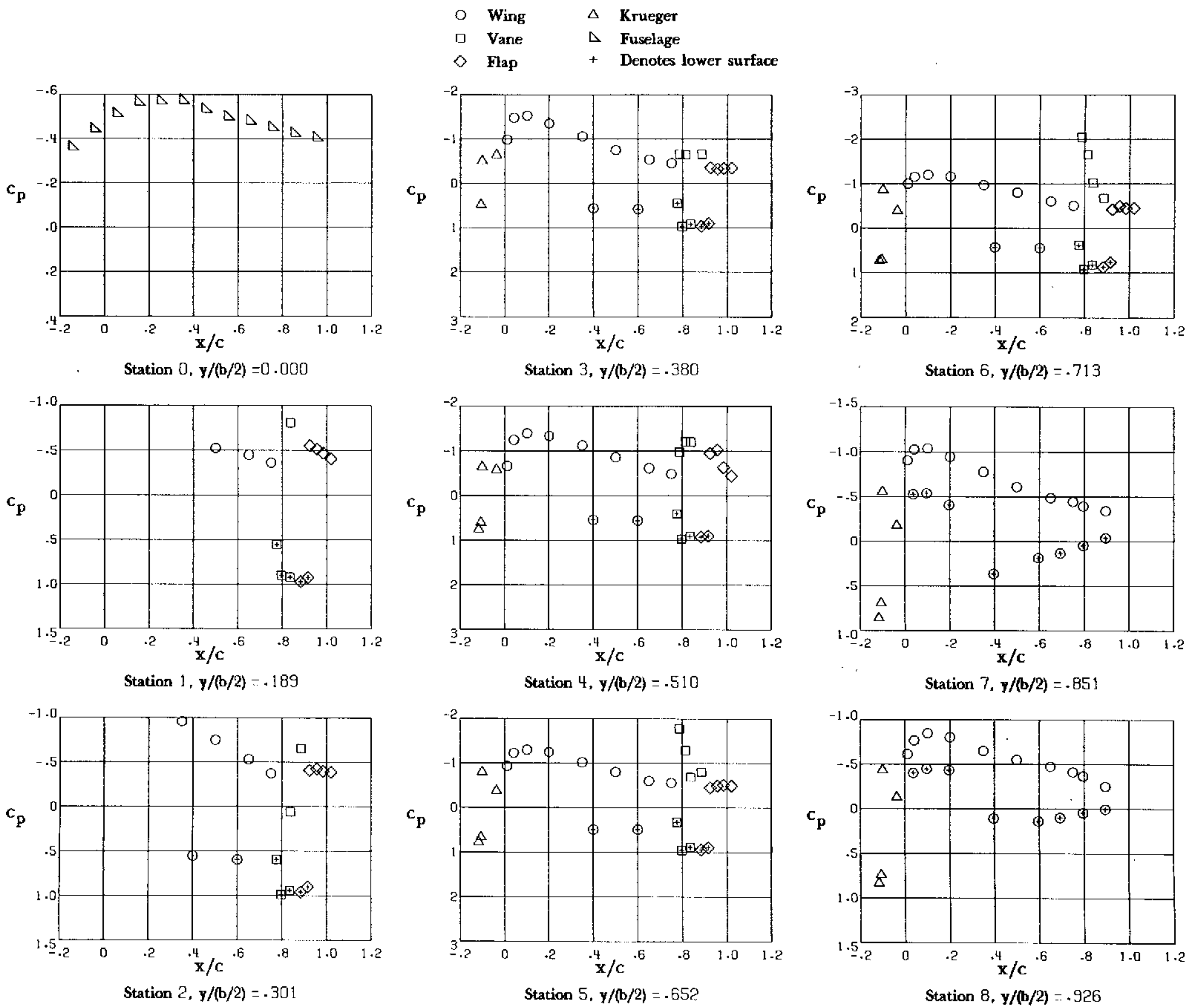
(A) ALPHA = 1 DEG.

Figure 15.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL. $C_{\mu L} = 0$, $C_{\mu R} = 1.85$.



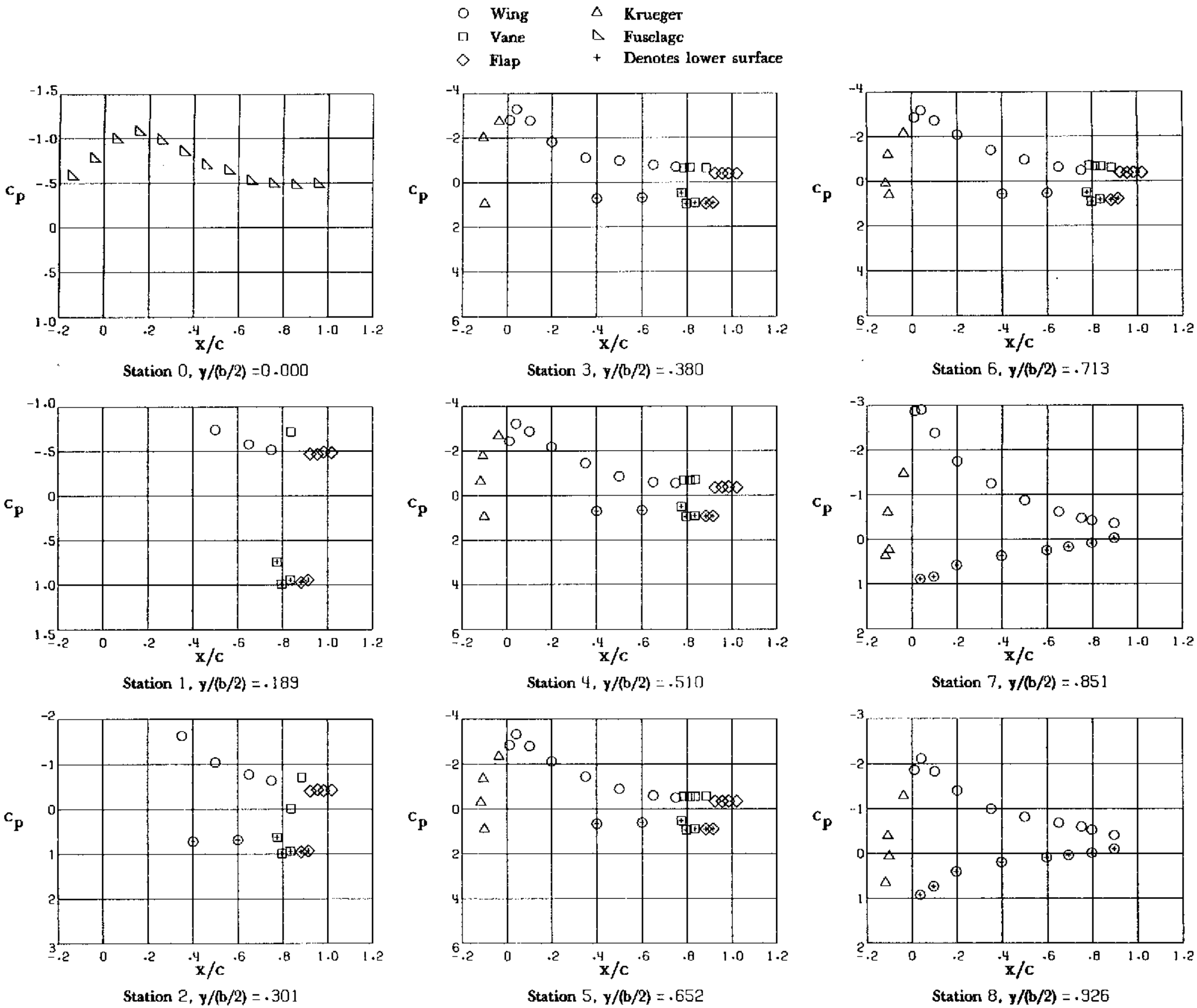
(B) ALPHA = 16 DEG.

Figure 15.- CONCLUDED.



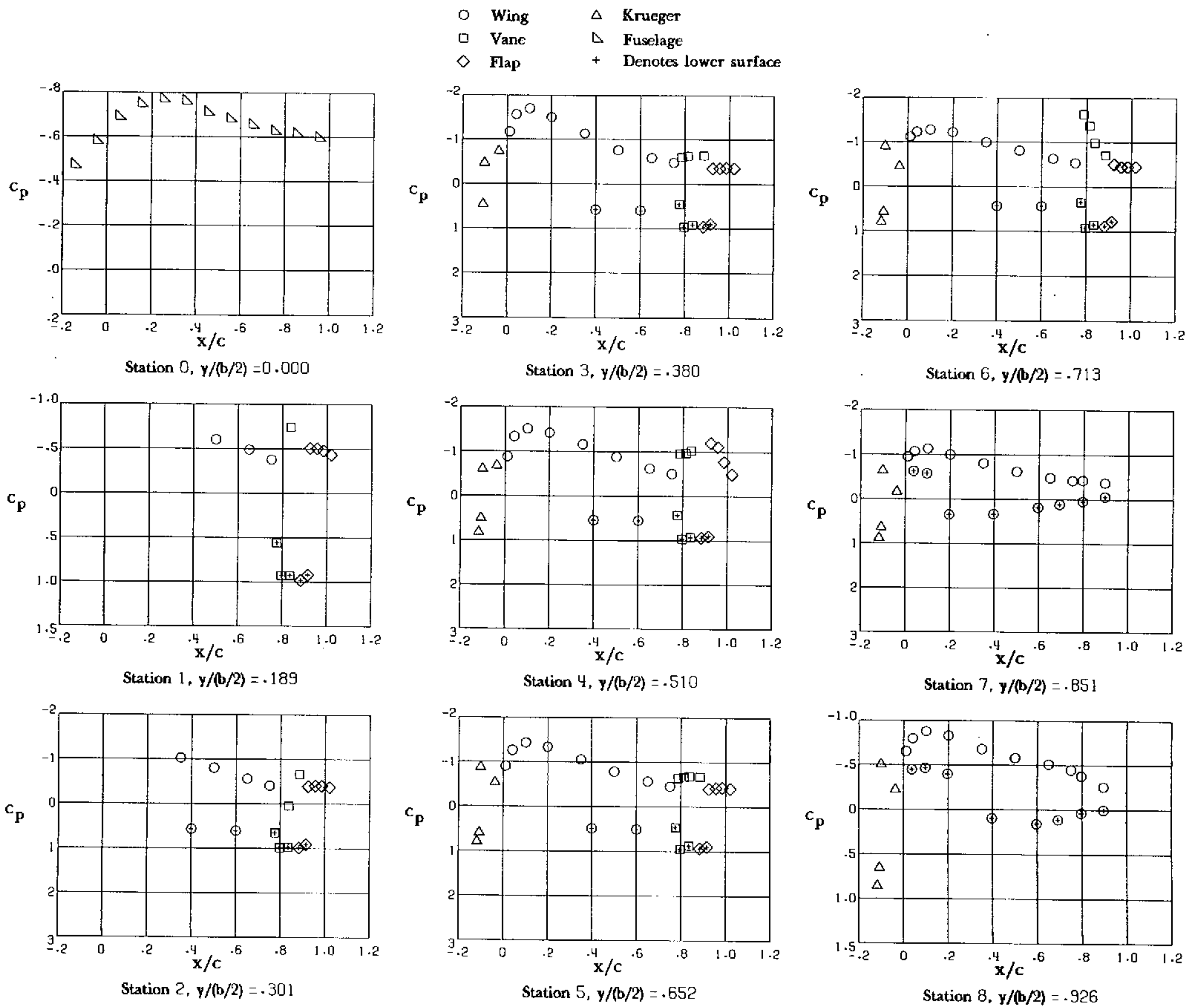
(A) ALPHA = 1 DEG.

Figure 16.- PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL WITH METAL FLAP BEHIND THE LEFT ENGINE REMOVED. $C_{\mu,L} = 0$, $C_{\mu,R} = 0$.



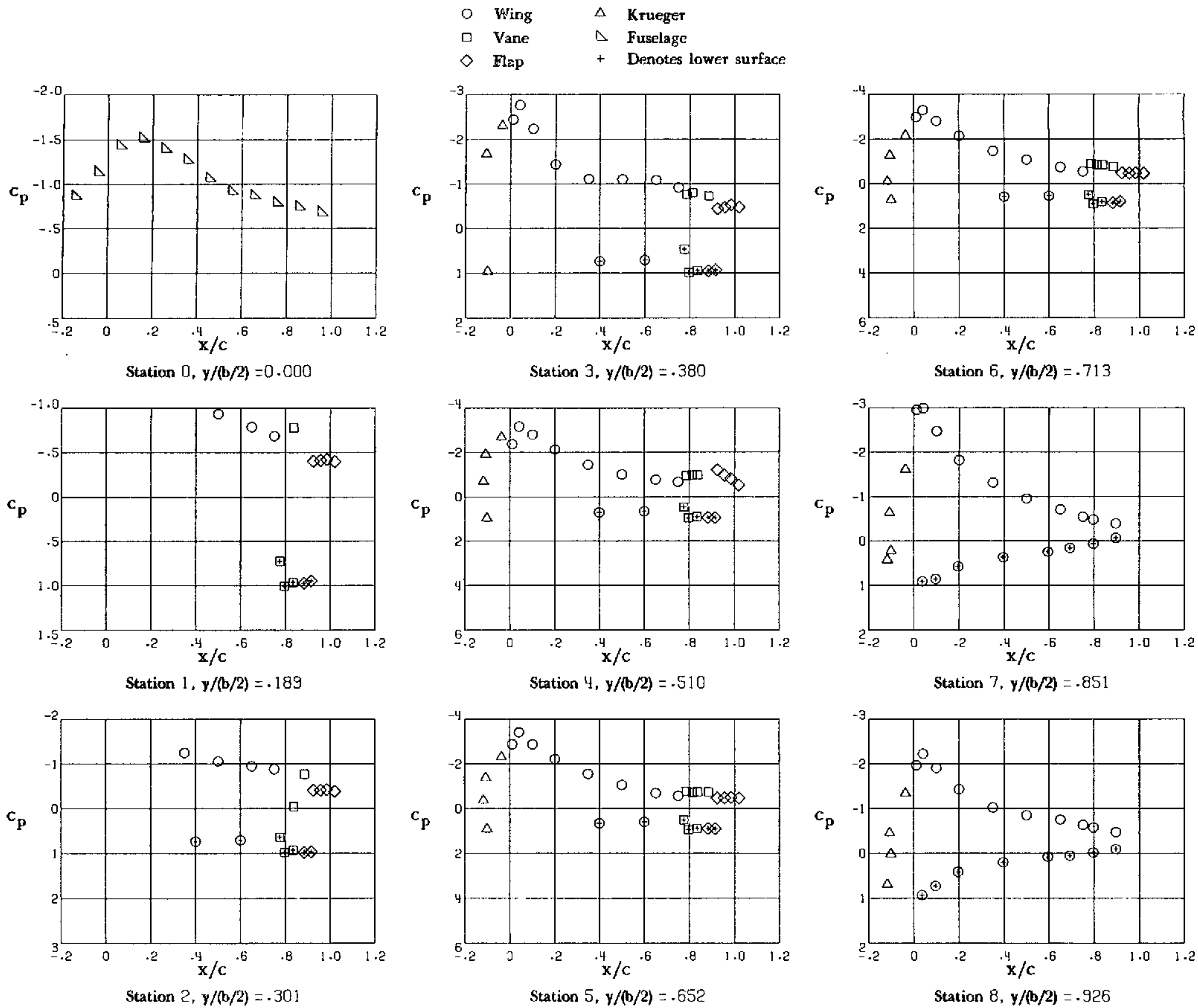
(B) ALPHA = 16 DEG.

Figure 16.- CONCLUDED.



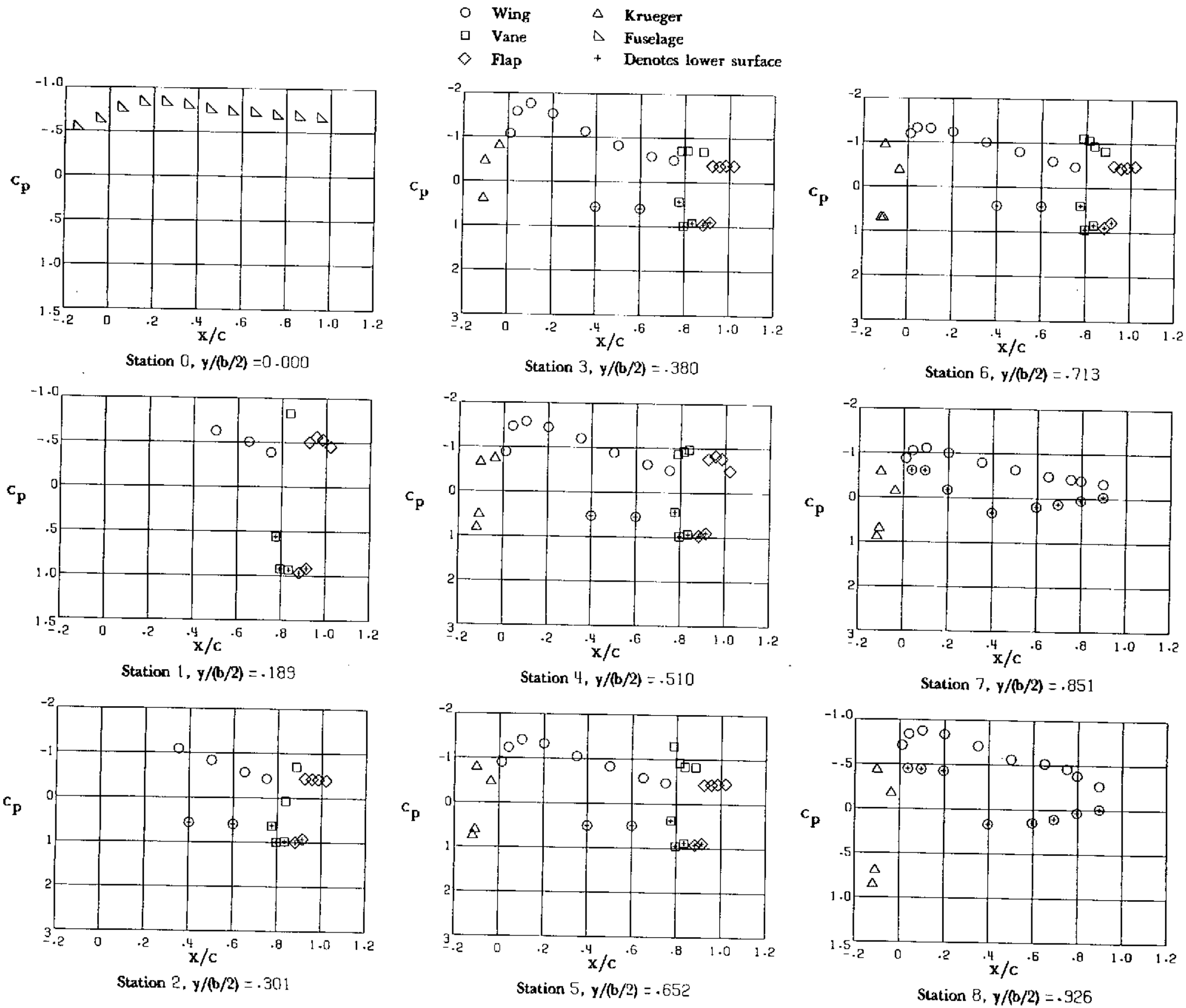
(A) ALPHA = 1 DEG.

Figure 17. - PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL WITH METAL FLAP BEHIND THE LEFT ENGINE REMOVED. $C_{\mu L} = 0$, $C_{\mu R} = 0.925$.



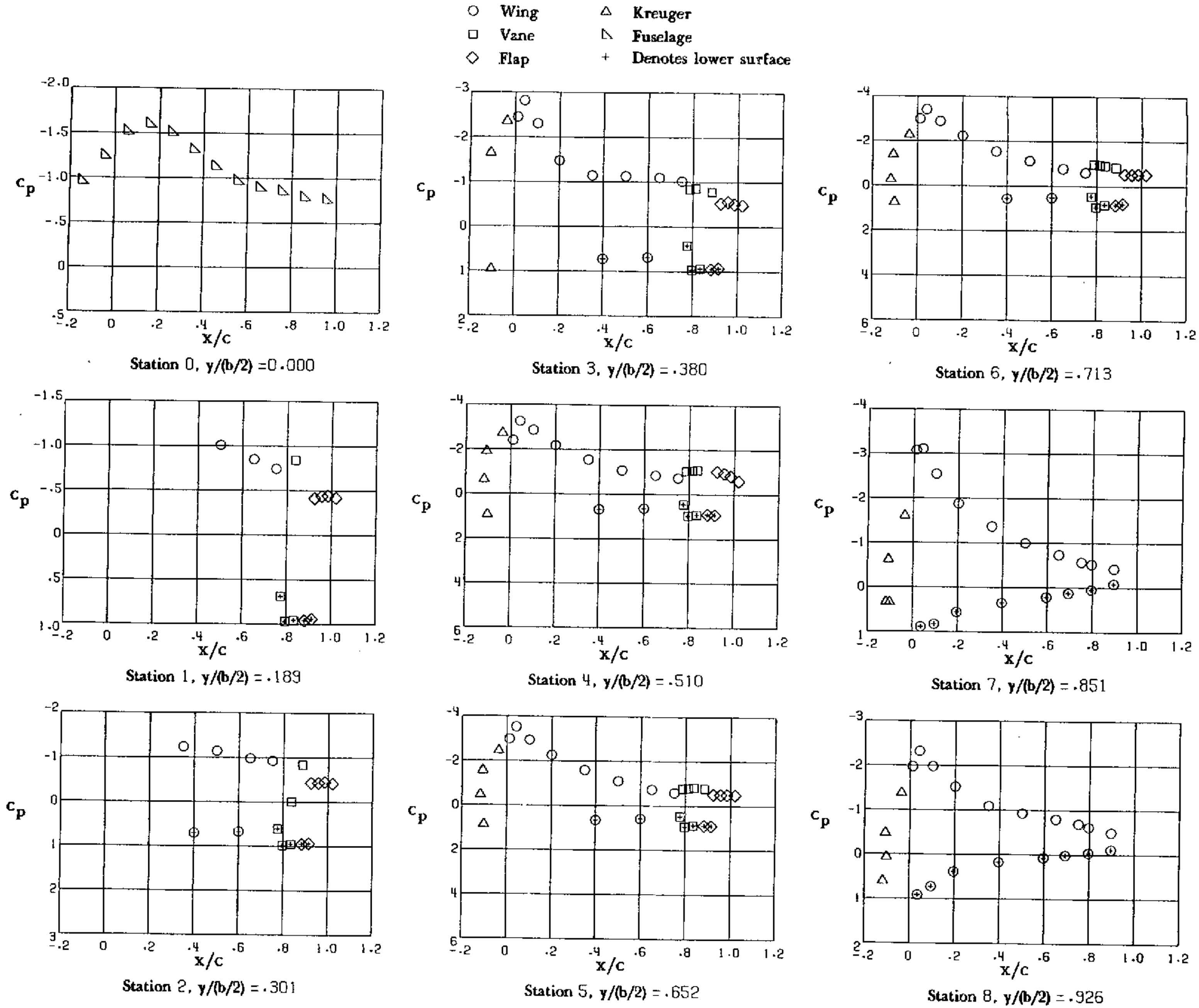
(B) ALPHA = 16 DEG.

Figure 17. - CONCLUDED.



(a) ALPHA = 1 DEG.

Figure 18. - PRESSURE DISTRIBUTIONS ON WING AND FLAP OF MODEL WITH METAL FLAP BEHIND THE LEFT ENGINE REMOVED. $C_{\mu L} = 0$, $C_{\mu R} = 1.85$.



(B) ALPHA = 16 DEG.

Figure 18.- CONCLUDED.

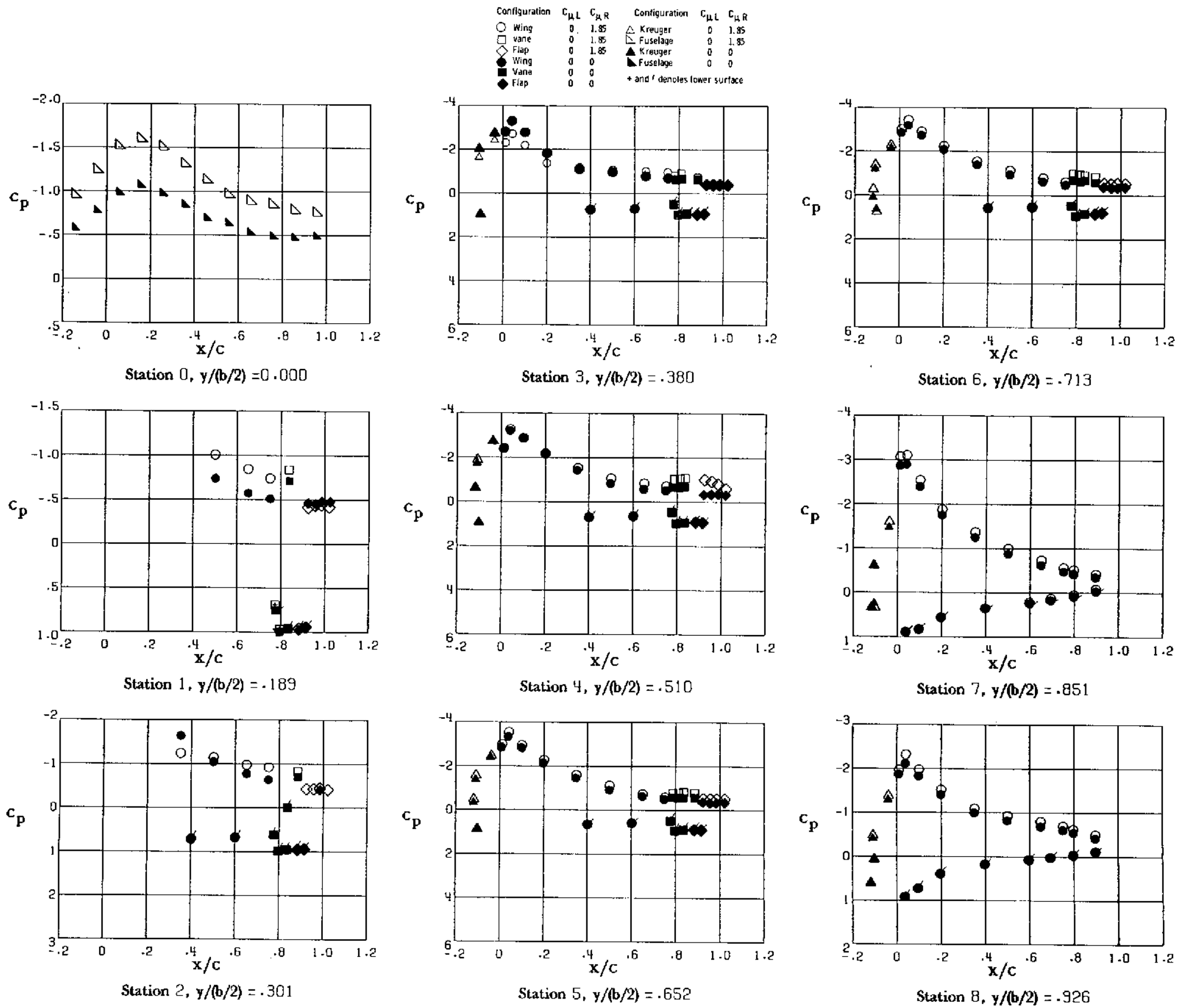


FIGURE 19. - EFFECT OF A RIGHT ENGINE INOPERATIVE ON CHORDWISE PRESSURE DISTRIBUTIONS WITH METAL FLAP BEHIND LEFT ENGINE REMOVED. ALPHA = 16 DEG.

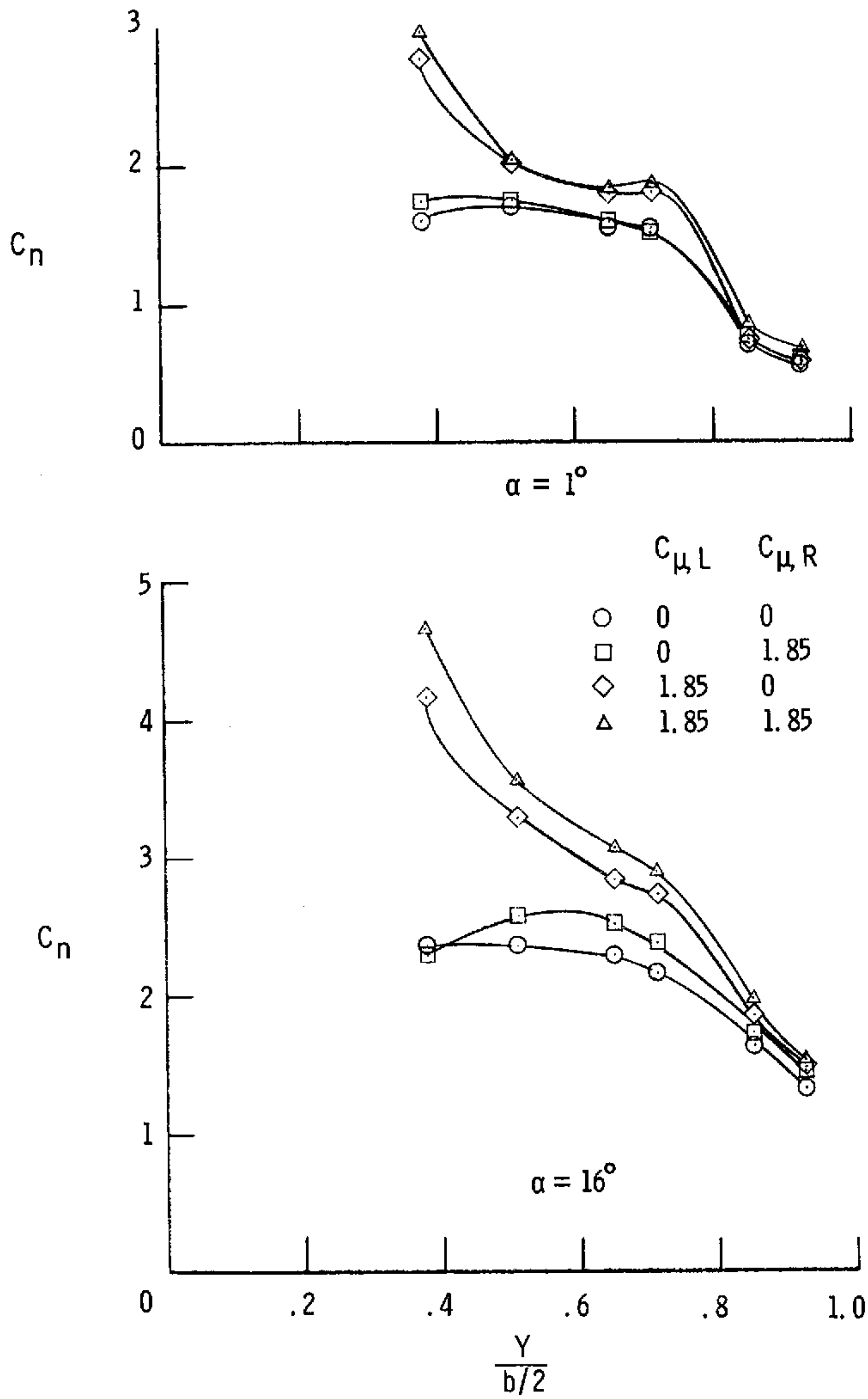


Figure 20. - Effect of an engine inoperative on span loading of the left wing.

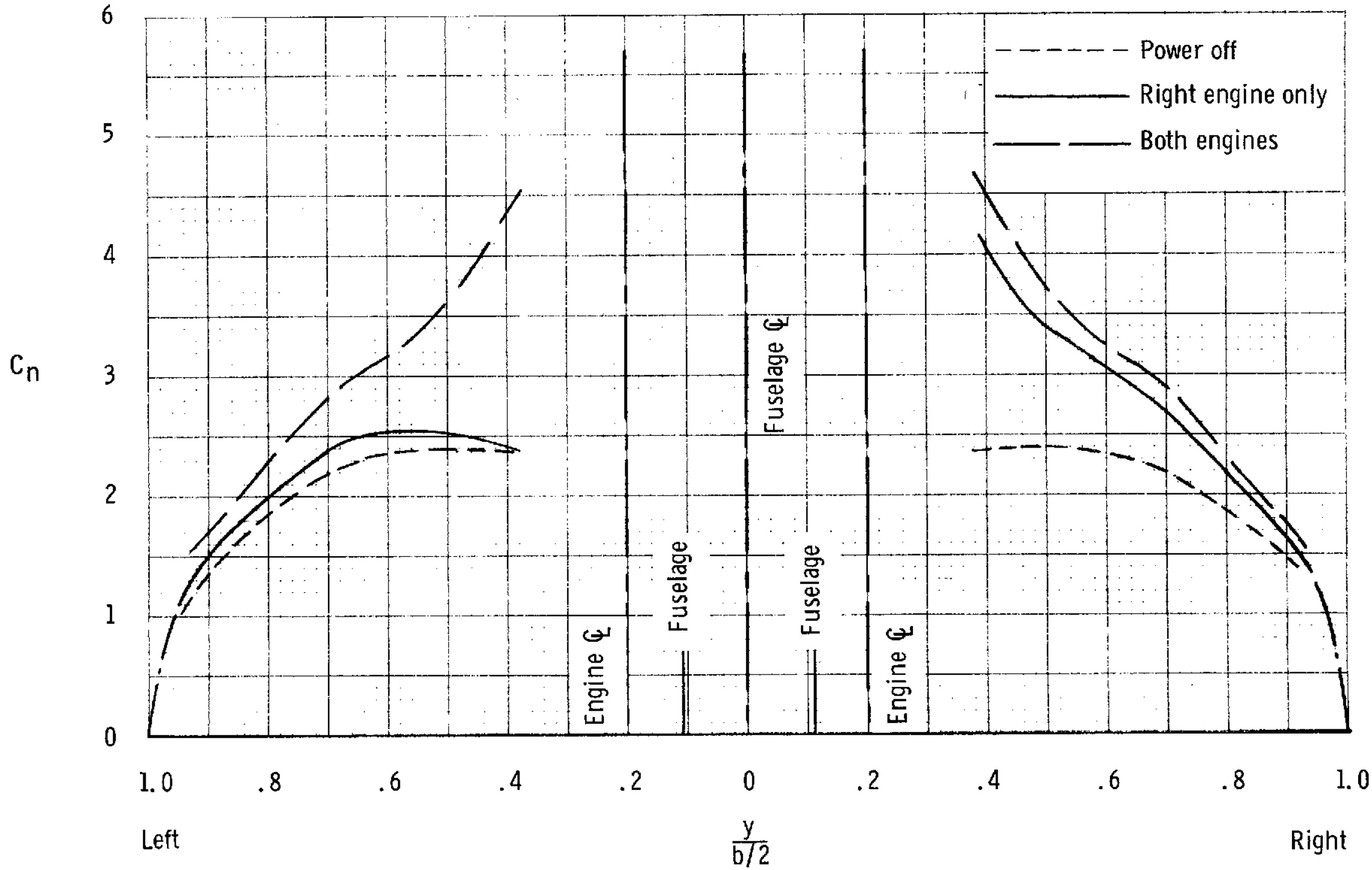


Figure 21. - Typical spanwise load distribution for the model with and without an engine inoperative. $\alpha = 16^\circ$, $\delta_f = 55^\circ$.