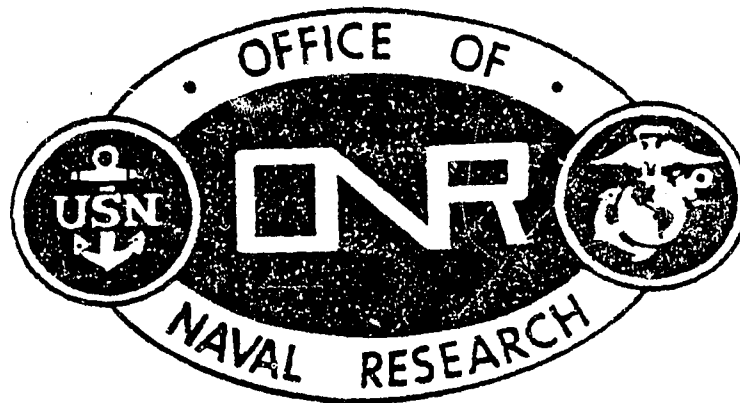




LOW-SPEED WIND TUNNEL TEST ON JOINED WING
AND MONOPLANE CONFIGURATIONS

Volume II. Test Data

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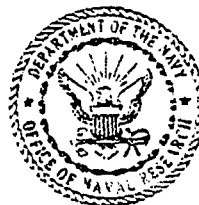
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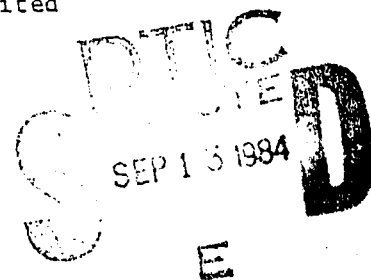


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20. ABSTRACT (Concluded)

and spans. Long and short fuselages were tested, and the effect of adding canard surfaces to the joined wing was investigated. Test Reynolds numbers were typically 0.22 million. The present report (Volume II) presents the test data, which are analyzed in Volume I. ⚡

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FOREWORD

The research described in this report was supported by the Office of Naval Research under Contract N00014-79-C-0953 with Dr. Robert E. Whitehead as ONR Contract Technical Monitor.

The text of this report is essentially the same as the wind tunnel test report issued by the California Institute of Technology Guggenheim Aeronautical Laboratory (GALCIT Report No. 1062). The only significant change is that a few paragraphs have been added to the Introduction to explain the relationship of the work described here to related research under Contract N00014-79-C-0953 which has been reported in other volumes.

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NOTATION

Model Configuration

Model scale dimensions given.

- A " Ailerons on aft wing of joined wing configuration.
Ailerons were made from 0.04 in. thick sheet metal and attached to the pressure side of the left and right hand wing panels. See Photo Nos. 26 and 27 and Figs. 4 and 8.
- B " Basic body of revolution with a 10.0 in. dia. constant area section and a length of 84.62 in. See Photo Nos. 11, 12 and 19, Figs. 2 and 3, and Table II.
- C₃₀ = Canard surfaces, left and right hand, with a L.E. sweep of 30°. The canard incidence angle was adjustable. See Photo Nos. 22 and 23, and Table II, Fig. 6 and Appendix.
- C₆₀ = Canard surfaces, left and right hand, with a L.E. sweep of 60°. The canard incidence angle was adjustable. See Photo Nos. 24 and 25, Table II, Fig. 7 and Appendix.
- D " Dorsal or upper body surface mounted vertical stabilizer. See Photo No. 14, Fig. 2, Table II and Appendix.
- E = Elevons on forward wing of joined wing configuration. Elevons were made from 0.04 in. thick sheet metal and attached to the pressure side of the left and right hand wing panels. See Figs. 4, 8 and Table II.
- F = Forward wing of the joined wing configuration with a 0.25 c aft sweep angle of 29.17°. See Photo Nos. 18, 19 and 21, Fig. 3, Tables I and II and Appendix.
- H = Horizontal stabilizer. See Photo Nos. 13, 14 and 15, Fig. 2, Table II and Appendix.

NOTATION (CONT'D.)

- N = Constant area section, 22.5 in. long, added to basic body B, to increase body length from 84.62 in. to 107.12 in. See Photo Nos 17 and 22, and Table II.
- R = Aft or rear wing of the joined wing configuration with a 0.25 c forward sweep angle of 20.03°. R includes the vertical airfoil section mounted on the body upper surface and to which the rear wing is attached. See Photo Nos. 18, 19 and 21, Fig. 3, Tables I and II and Appendix.
- S = Strakes. Triangular forward-wing L.E. extension made of sheet metal. See Photo Nos. 28 and 29, and Figs. 5 and 8.
- T_s = Boundary layer transition strips made from masking tape with the leading edge of the tape pinked. 0.015 in. thick strips were located on both surfaces of the wing and tail components along the 5% chord line and at the 1.0 in. radius station on the model nose. See Photo Nos. 14, 28 and 29.
- T_{s1} = Same as T_s except no strips on the wing and tail surfaces; i.e., strip around model nose only.
- T_{s2} = Same as T_s except 0.010 in. thick strips at the 5% chord line on both surfaces of the wings, canards and vertical airfoil between rear wing and body, and a 0.015 in. thick strip around the model nose at the 1.0 in. radius station.
- T_{s3} = Same as T_s except 0.005 in. thick strips at the 5% chord line on both surfaces of the wings and vertical airfoil between the rear wing and body, and a 0.015 in. thick strip around the model nose at the 1.0 in. radius station.

NOTATION (CONT'D.)

- Tufts = Strands of standard cotton attached to the model surfaces with 3/4 in. wide Scotch Magic Tape such that 3/4 in. lengths of the cotton were exposed to the airstream on each side of the tape. See Photo Nos. 1 - 10.
- V = Ventral or lower body surface mounted vertical stabilizer. See Photo Nos. 14 and 15, Fig. 2, Table II and Appendix.
- W = Conventional, straight tapered monoplane wing. See Photo Nos. 11 and 12, Fig. 2, Tables I and II, and Appendix.

Airflow Parameters

In the following, the "equivalent free airstream" conditions are defined by the pressure, density, and temperature which an observer at rest at infinity would measure if the model were moving with a uniform velocity V through an infinite fluid at rest at infinity.

- p = Static pressure of the equivalent free airstream.
- q = Dynamic pressure of the equivalent free airstream
= $\rho V^2/2$.
- R = Reynolds number
= $\rho c V/\mu$.
- V = Velocity of the equivalent free airstream.
- ρ = Mass density of air.
- μ = Absolute viscosity of air.

Angular Measurements

- α_g = Geometrical angle of attack of the fuselage reference plane (FRP) relative to a horizontal plane through the wind tunnel test section axis.

NOTATION (CONT'D.)

- α = Angle of attack of the FRP relative to a horizontal plane through the equivalent free airstream (cf. Definition of Airflow Parameters).
- ψ = Geometrical angle of yaw of the model plane of symmetry relative to a vertical plane through the wind tunnel test section axis.
- β = Angle of sideslip
= $-\psi$; i.e., model nose left is positive.
- i_C = Angle of incidence of the canard surfaces, relative to the FRP.
- i_H = Angle of incidence of the horizontal stabilizers, relative to the FRP.
- δ_L = Angle of deflection of sheet metal plates added to the trailing edge of the left hand panel of the forward or rear wing which represents elevons or ailerons, respectively. The hinge line for these control surfaces was at the wing trailing edge with the angle of deflection measured relative to the wing chord plane.
- δ_R = Same as δ_L except plates mounted on right hand wing panels.

All angular displacements about a spanwise axis are positive when the nose is raised, trailing edge lowered; angular displacements about a vertical axis (with the exception of β) are positive when the nose is turned right, trailing edge left. Directions are defined as the pilot would see them.

Geometrical Parameters

- S = Model wing projected area (projected on plane containing B.L. and W.L.).

NOTATION (CONT'D.)

b	=	Model wing span measured normal to the plane of symmetry.
c	=	Model wing mean geometric chord.
B.L.	=	Butt line denoted in inches, model scale.
FRP	=	Fuselage reference plane taken as the fuselage horizontal plane of symmetry, parallel with the water lines.
F.S.	=	Fuselage station denoted in inches, model scale.
L.E.	=	Leading edge.
C_L	=	Centerline.
T.E.	=	Trailing edge.
W.L.	=	Water line denoted in inches, model scale.

Definition of Tests

P_6	=	Polar test; i.e., angle of attack variation at a constant angle of yaw. The subscript 6 indicates that complete six-component force and moment data were recorded.
P_3	=	Same as P_6 except only lift, drag and pitching moment data were recorded.
Y_6	=	Yaw test; i.e., angle of yaw variation at a constant angle of attack. The subscript 6 indicates that complete six-component force and moment data were recorded.
SP	=	Pressure test; i.e., static pressure measurements from flush orifices located on the base of the fuselage were recorded.
TP	=	Flow visualization test; i.e., data recorded as still photographs of the behavior of tufts, attached to the model surface.

NOTATION (CONT'D.)

TW = Flow visualization test; i.e., data recorded as still photographs of the behavior of a 3 ft. long strand of standard darning cotton attached to the end of a hand-held pole.

Force and Moment Coefficients

The following coefficients are referred to the wind axes system. Wind axes are defined as orthogonal axes which remain fixed with respect to the relative wind. Directions are defined as the pilot would see them.

C_L, CL = Lift Coefficient = $\frac{\text{lift}}{qS}$ (positive upward).

C_D, CD = Drag Coefficient = $\frac{\text{drag}}{qS}$ (positive in the direction of the relative wind).

C_C, CC = Cross-wind Force Coefficient = $\frac{\text{cross-wind force}}{qS}$ (positive to the right).

C_l, C_lCG = Rolling Moment Coefficient = $\frac{\text{rolling moment}}{qSb}$ (positive when it tends to lower the right wing).

$C_m, CMCG$ = Pitching Moment Coefficient = $\frac{\text{pitching moment}}{qSc}$ (positive when it tends to raise the nose).

$C_n, CNCG$ = Yawing Moment Coefficient = $\frac{\text{yawing moment}}{qSb}$ (positive when it tends to move the right wing aft).

For C_l , C_m and C_n the subscript "c.g." is used to denote that the moments are referred to the assumed c.g. (center of gravity) position on the full scale airplane.

In addition to the wind axes coefficients, body axes coefficients have been calculated as in the defining equations below. Body axes are

NOTATION (CONT'D.)

described as orthogonal axes, having at zero yaw, the same directions and signs as the wind axes, but differing from the latter in that they rotate with the airplane in pitch, yaw and roll, while wind axes remain fixed with respect to the relative wind. The body axes coefficients are calculated from wind axes coefficients as follows.

$$\begin{aligned}
 C_{N,CN} &= \text{Normal force coefficient} = C_D \cdot \cos \psi \cdot \sin \alpha_g \\
 &\quad - C_C \cdot \sin \psi \cdot \sin \alpha_g \\
 &\quad + C_L \cdot \cos \alpha_g \\
 C_{X,CX} &= \text{Axial force coefficient} = C_D \cdot \cos \psi \cdot \cos \alpha_g \\
 &\quad - C_C \cdot \sin \psi \cdot \cos \alpha_g \\
 &\quad - C_L \cdot \sin \alpha_g \\
 C_{Y,CY} &= \text{Side force coefficient} = C_D \cdot \sin \psi + C_C \cdot \cos \psi \\
 C_{p,CPCG} &= \text{Pitching moment coefficient} = C_{m_{c.g.}} \cdot \cos \psi - \frac{b}{c} \cdot C_{l_{c.g.}} \cdot \sin \psi \\
 C_{r,CRCG} &= \text{Rolling moment coefficient} = C_{l_{c.g.}} \cdot \cos \psi \cdot \cos \alpha_g \\
 &\quad + \frac{c}{b} \cdot C_{m_{c.g.}} \cdot \sin \psi \cdot \cos \alpha_g \\
 &\quad - C_{n_{c.g.}} \cdot \sin \alpha_g \\
 C_{y,CYCG} &= \text{Yawing moment coefficient} = C_{l_{c.g.}} \cdot \cos \psi \cdot \sin \alpha_g \\
 &\quad + \frac{c}{b} \cdot C_{m_{c.g.}} \cdot \sin \psi \cdot \sin \alpha_g \\
 &\quad + C_{n_{c.g.}} \cdot \cos \alpha_g
 \end{aligned}$$

For C_p , C_r and C_y the subscript c.g. is used as defined for the wind axes notation.

Corrections to the Observed Data

1) Blocking Correction (see Table III)

The wind tunnel airstream velocity settings have been corrected for the increase in air velocity over the model due to Bernoulli's principle. This correction, which accounts for the increased velocity due to the reduced test section area, is called "solid blocking"

NOTATION (CONT'D.)

and is given by the following formula in terms of the tunnel airstream setting parameter q :

$$q = q_u(1 + 2\epsilon)$$

where ϵ is the solid blockage factor dependent upon model shape and volume and on tunnel test-section shape and cross-sectional area; q_u is the dynamic pressure of the airstream through the test section without a model present.

The wake blockage correction factor, which accounts for the increase in airstream velocity downstream of the model due to the velocity defect in the wake of the model, was found to be negligibly small, and therefore not applied.

2) Horizontal Buoyancy Correction (see Table III)

The buoyancy correction, which accounts for the effects of static pressure gradients in the test section without the model present, have been applied to all data presented in this report. This correction is dependent upon the axial static pressure gradients, dp/dx , in the clear test section and the model cross-sectional area distribution. The correction is given as δC_D in the following formula which is added to the measured values of wind axes drag coefficients:

$$\delta C_D = \frac{1}{qS} \int_{\text{model}} \bar{A} \frac{dp}{dx} dx$$

where $\bar{A}$ is model local cross-sectional area and x is the axial distance along the tunnel test section.

3) Streamline Curvature Corrections (see Table III)

The streamline curvature corrections, which account for the alteration of the normal curvature of the airflow about a wing due to the presence of the wind tunnel walls, have been applied to the data presented in this report.

NOTATION (CONT'D.)

The corrections used are based upon calculations presented in reference 1, and are of the following form, where C_L is treated as the independent variable:

$$\Delta\alpha = f(C_L) \text{ and added to the observed } \alpha_g$$

$$\Delta C_D = f(C_L^2) \text{ and added to the observed } C_D$$

$$\Delta C_m = f(C_L) \text{ and added to the observed } C_m.$$

The following wall corrections were applied only when aileron or elevon deflection angles were asymmetrical resulting in asymmetrical wing loading. These corrections are based on calculations presented in reference 2:

$$\Delta C_\ell = f(C_\ell) \text{ and added to the observed } C_\ell$$

$$\Delta C_n = f(C_\ell, C_L) \text{ and added to the observed } C_n$$

4) Aerodynamic Tare Corrections (see Table III)

Aerodynamic tare corrections, which account for the effects of the model support system on the measured data, have been applied to the data presented in this report. The tare values used for these tests were measured during the previous testing of a similar model fuselage and corrected for the reference dimensions used for the present tests. The form of the corrections are:

$$\alpha_T = \text{Tare angle of attack or effective airstream inclination and subtracted from the observed } \alpha_g.$$

$$C_{D_T} = \text{Tare drag coefficient and subtracted from the measured } C_D$$

$$C_{m_T} = \text{Tare pitching moment coefficient and subtracted from the measured } C_m.$$

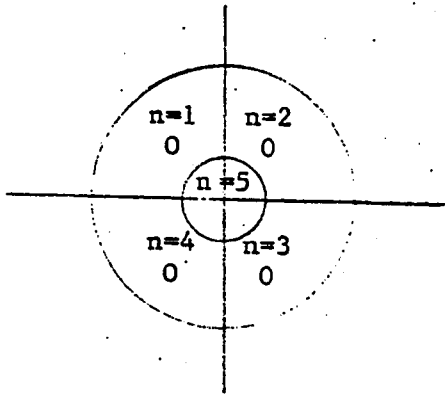
NOTATION (CONT'D.)

5) Base Pressure Corrections (see Table III)

Base pressure corrections, which account for the static pressure acting on the blunt base of the model in the wind tunnel, have been applied to all force and moment data presented in this report. The blunt base of the model is therefore assumed to have zero base drag, as in the case where the base area is the exhaust from the power plant. The base drag coefficient is defined as follows for a wind axes system:

$$C_{D_b} = \frac{\cos \alpha_g \cdot \cos \psi}{S} \left[C_{P_1} \cdot A_1 + C_{P_2} \cdot A_2 + C_{P_3} \cdot A_3 + C_{P_4} \cdot A_4 + C_{P_5} \cdot A_5 \right]$$

where $C_{P_n} = \frac{P_n - P}{q}$ and A_n = base area associated with the measured pressure on the base, P_n .



O = static pressure orifice

$A_1 = A_2 = A_3 = A_4 = 0.0321 \text{ ft}^2$

$A_5 = 0.0218 \text{ ft}^2$

INTRODUCTION

The present report is Volume II of a 2-volume set which describes wind tunnel tests of a new type of airplane and missile wing, known as the joined wing. Volume I analyzes the data presented in the present volume and draws conclusions regarding the relative merits of the joined versus the conventional wing. Volume II is limited to presenting the data, without analysis. For ease of reference certain data are repeated in both volumes, but both reports should be read to obtain a complete account of the tests and the significance of their results.

The joined wing concept comprises the combination of two wings so that they form diamond shapes in both front and plan views (see Fig. 3). The advantages of this arrangement are summarized in Volume I, and are explained fully in Ref. 4. That reference describes competitive designs for advanced cruise missiles. Three of these designs formed the basis for the configurations tested, as follows:

- (1) Baseline conventional wing configuration
- (2) Joined wing configuration
- (3) Hybrid configuration (joined wing plus canard)

(1) and (2) were tested with alternative fuselages: (i) a short fuselage representing an airplane-like configuration, and (ii) an extended fuselage of similar fineness ratio to that employed in current Tomahawk cruise missiles. The hybrid configuration was tested with the long fuselage only (see Figs. 3 and 6).

The purpose of the present tests was to obtain data for use in evaluating the aerodynamic performance of the joined wing concept and to compare this performance with that of a conventional monoplane wing configuration.

DISCUSSION OF TESTS

The tests described herein were conducted in the closed test section of the GALCIT* 10-Foot Wind Tunnel during the period July 22-31, 1981. The tunnel layout is shown on Fig. 1.

Model Description and Support

The 6.46 foot span joined wing and conventional wing configurations were each tested using the same body of revolution representative of an aircraft fuselage. The two wing configurations were also tested on this body of revolution after a 22.5 inch long constant area section was added, representative of an advanced cruise missile fuselage. For the conventional wing configuration, cruciform horizontal and vertical stabilizers were used on the aft portion of the body for longitudinal and lateral stability, while for the joined wing configuration these stabilizers were not present, since stability is achieved through the geometry of the joined wing system itself. With the extended nose (missile) body however, two configurations of canard surfaces were tested with the joined wing in order to determine their effectiveness for augmenting longitudinal stability and control.

Both types of wing surfaces were constructed from wood. The body was fabricated from aluminum and fiberglass. Five flush orifices were provided in the blunt base of the body. These orifices were connected to a multimanometer board using Tygon tubing and were used to measure the model base pressure. The horizontal surfaces of the cruciform tail were adjustable in incidence angle as were the canard surfaces used with the extended body-joined wing configuration. Body surface discontinuities and areas such as the joined wing juncture were either taped over or faired smooth with clay.

Sketches of the two basic model configurations are presented on Figs. 2 and 3. Photographs of the model configurations installed in

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the wind tunnel are presented as Photo Nos. 11 and 18, and model configuration notation is given in the Notation section of this report. In addition, dimensional data for the model is given in Table II and details of the airfoil surfaces are presented in the Appendix.

The model was supported in the wind tunnel using a two point support system connected to the external, mechanical, six-component balance system located above the wind tunnel test section. This support system consists of a single main, windshielded strut and a windshielded tail strut. A bayonet with a two inch chord and a one inch maximum thickness connected the main strut to a trunnion fitting located within the model body. A tail bayonet connected the tail strut to a clevis fitting mounted externally on the aft portion of the fuselage. The clevis fitting was faired smooth with clay. This support permitted remotely controlled pitch and yaw angle changes for the model in the tunnel. The six-component balance and support systems are described in Reference 3. Photographs of the model, showing the support system, are presented as Photo Nos. 12 and 19.

It will be noted that the model is installed upside down in the wind tunnel. This is standard practice at the GALCIT Tunnel since the model support bayonets enter the model from the tunnel ceiling and the bayonet interference is lessened with the bayonets entering the pressure side of the model.

Data Acquisition and Reduction

Complete six-component force and moment data resulting from airloads acting on the various test configurations were measured, except where only longitudinal characteristics were of interest and the lateral data could be assumed to be constant and near zero. In this latter case only lift, drag and pitching moment data were measured. All force and moment data were acquired using the GALCIT mechanical, external balance system. Each of the forces and moments are read independently from automatic balancing beam-type balances. The raw moments are measured relative to

the balance resolving center which is located at the intersection of the wind tunnel vertical centerplane and a line through the center of the main trunnion (model attach point for main support strut), and about which the model angles of attack and yaw are varied (see Fig. 6).

The raw data were reduced by electronic computer to the non-dimensional coefficient forms defined in the Notation using the dimensional constants given in Table I. The moments were transferred to the appropriate moment reference center shown on Fig. 9.

The longitudinal data have all been corrected for the effects of streamline curvature (wall-induced upwash) as described in the Notation. The lateral components, C_l and C_n , are also affected when the wing loading is asymmetrical due to aileron deflections, and these corrections have been applied as well. The streamline curvature correction constant values are given in Table III.

Model solid blocking corrections, as defined in the Notation, were applied to the wind tunnel airstream setting values used for these tests. Changes in model configuration, from the smallest model volume tested to the largest, resulted in differences in the solid blockage corrections which would change the airstream dynamic pressure level by no more than 0.1%. Since the accuracy of the dynamic pressure settings, at the levels used for these tests is 0.2%, a single average value of the blocking correction was used for all tests and is given in Table III. The wake blocking correction was found to be negligibly small and therefore not applied.

Horizontal buoyancy corrections, as defined in the Notation, have been applied to the data presented in this report. The magnitudes of these corrections are given in Table III.

Aerodynamic tare corrections, which account for the presence of the model support system, were measured using a mirror image of the complete support system during previous tests of a model of similar basic geometry and using the same model support system used for the present tests. These measured tare values were corrected for the differences in geometry between the previous and present test models

and are presented in Table III. The aerodynamic tares are defined in the Notation.

Base pressure corrections, which assume that zero base drag would act on the flying prototype as in the case of a jet exit at the base, have been applied to the data presented in this report. This correction is defined in the Notation and the applied correction values given in Table III.

Static tares, which account for the effects of gravity on model and balance, were measured each time the model weight or weight center was changed. All data have been corrected for the effects of gravity by subtracting balance readings obtained over the model α_g or ψ range with the tunnel airstream at zero from readings obtained during the airstream-on runs.

Test Limitations

The wooden construction of the joined wing panels, without the benefit of metal wing spars to carry the bending and torsion loads, limited the strength of these panels and hence the airload they were capable of carrying. It was considered desirable to avoid the unsteady wing airloads associated with incipient stall at the highest airstream dynamic pressure level of 15 lb/ft² used during these tests. For the joined wing configurations the model attitude was limited to approximately $-7^\circ \leq \alpha_g \leq 7^\circ$ for $q = 15 \text{ lb/ft}^2$. Because of the smaller chords of the front and rear joined wing compared to the conventional or monoplane wing, it was necessary to run a few of the tests on the monoplane wing at $q = 3.75 \text{ lb/ft}^2$ for comparison at approximately equal Reynolds numbers with joined wing data obtained at $q = 15 \text{ lb/ft}^2$.

Data Reliability

Based on the calibration of the GALCIT external balance system and the accuracy of the airstream dynamic pressure level settings, together with an analysis of the repeatability of the data collected during the present tests as well as from previous tests conducted at

the lower airstream dynamic pressure level settings, the force and moment data, relative to the wind axes, were found to be generally within the following limits:

$$\Delta C_L \sim \pm 0.0020$$

$$\Delta C_{\ell} \sim \pm 0.0005$$

$$\Delta C_D \sim \pm 0.0004$$

$$\Delta C_C \sim \pm 0.0010$$

$$\Delta C_m \sim \pm 0.0015$$

$$\Delta C_n \sim \pm 0.0004$$

The settings for α_g and ψ are accurate to within ± 0.03 degrees.

TEST RESULTS

Results of these tests are presented as tabular wind axes coefficients in Table V and as tabular body axes coefficients in Table VI. Note that wind and body axes data are identical when $\alpha = \beta = 0$. The Index of Runs, which identifies the test and model configuration as a function of run number, is presented at the end of this section.

The complete wind axes force and moment data are presented in plotted form on Figs. 10 - 31. In addition, flow visualization data, in the form of a representative selection of still photographs of the behavior of tufts attached to the joined wing panels, are presented as Photo Nos. 1 - 10.

Results of tests on the conventional wing configuration are presented on Figs. 11 - 16 and results of the joined wing configuration tests are presented on Figs. 17-31. Letter subscripts are used with the figure numbers to designate the various force and moment components plotted. The List of Figures indicates the number of pages of plotted data for a given figure number and the data components presented. Thus, the subscripts a, b, and c indicate that only lift, drag and pitching moment data were recorded and plotted while the subscripts a - f indicate that complete six-component data were recorded and plotted.

It should be noted that the scales used for the plotted data were selected to fit within a 6 in. x 9 in. format. This necessitated compressing the scales by a factor of at least two over the standard plotting practice at GALCIT. Incremental data, taken from the plots in this report, are therefore not as clear as they could be. However, the complete tabular data are presented, and where necessary can be used to clarify the plotted data.

The effects of Reynolds number, over the limited Reynolds number range covered during these tests (see Table IV), are presented on Fig. 10 for the body alone and Fig. 13 for the conventional wing configuration. For the joined wing configuration it is necessary to compare the data of run 20 on Fig. 17 with that of run 19 on Fig. 18 to determine the

effects of Reynolds number. The results of these tests are similar for body alone, conventional wing and joined wing. That is, C_L increases while C_D decreases with increasing R , although for the body alone C_L no longer showed an increase as the dynamic pressure of the airstream was increased from 7.5 lb/ft² to 15 lb/ft² (for $0.38 \times 10^6 < R < 0.54 \times 10^6$, based on body diameter). The pitching moment tended to increase in absolute value with increasing R for all these configurations.

The effects of transition strips, used to force a turbulent boundary layer at the 5% chord on the airfoil sections and around the model nose, are presented on Fig. 11 for the conventional wing configurations and on Figs. 17 through 19 for the joined wing configurations. The transition strips used for these tests incorporated pinked leading edges which force a series of turbulent wedges in the boundary layer that coalesce immediately downstream of the strip, avoiding the typical two-dimensional separation associated with straight leading edge strips. It should be noted that the form drag of the strips has not been removed from the data presented in this report. Data from a series of trip thicknesses on the joined wing are presented on Fig. 18 which can be used to estimate the form drag of the trips, if required.

Model build-up data for the conventional wing configuration are presented on Figs. 11 and 12. Model build-up data for the joined wing are found using the basic body data on Fig. 12 with that of the complete joined wing configuration on Fig. 17.

General characteristics of the conventional wing configuration are given on Figs. 12 and 14 for the model in pitch and yaw, respectively. Effects of horizontal stabilizer incidence angle for this configuration are given on Fig. 13. Characteristics of the conventional wing on the body with an extended nose are given on Figs. 15 and 16 for the model in pitch and yaw, respectively.

General characteristics of the joined wing configuration are presented on Figs. 17 and 18 for the model in pitch and on Fig. 25 for the model in yaw. The effects of strakes on this configuration are given on Figs. 19 - 21 for the model in pitch and yaw. The

effectiveness of the elevon and aileron control surfaces on the joined wing configuration are given on Figs. 20, 22, 23 and 24.

The effects of the nose extension on the joined wing configuration are given on Figs. 25 and 26 for the model in yaw and pitch, respectively. The effects of the 30° and 60° canards on this configuration and canard effectiveness are presented on Figs. 27 - 30. A comparison of the two canard configurations is shown on Fig. 31. It should be noted that the moment data for canard and non-canard configurations on Figs. 28 and 29 are not directly comparable since the reference centers differ between the two configurations, as shown on Fig. 9.

A representative selection of the photographs of the behavior of tufts, attached to the joined wing surfaces, are presented as Photo Nos. 1 - 10. Flow separation, beginning along the forward wing trailing edge, is apparent at $\alpha_g = 3^\circ$ on the forward wing with this panel completely separated aft of the 50% chord at $\alpha_g = 12^\circ$, except near the forward wing-fuselage intersection. Flow separation over the aft wing begins along the trailing edge when $\alpha_g = 10^\circ$ and still retains a substantial amount of attached flow near the root and tip at $\alpha_g = 12^\circ$.

Airflow over the fuselage was checked using a 3-foot long strand of darning cotton with an end attached to a hand-held wand. There was no sign of flow separation off the fuselage and nose section throughout the test Reynolds number range up to $\alpha_g = 10^\circ$. At $\alpha_g = 12^\circ$ local flow separations were found at $q = 3.75 \text{ lb/ft}^2$.

During runs 51, 52 and 54 the three foot long tuft wand was used to trace the tip vortices from the joined wing configuration to determine if the trailing vortices from the two canard configurations would impinge on the front or rear joined wing. No impingements were found, although the photographs taken of the wand behavior to depict the vortex trajectories did not exhibit sufficient contrast for inclusion in this report.

INDEX OF RUNS

Run No.	Model Configuration	Test	q, lb/ft ²	Settings, Deg.					
				α_g	ψ	i_H	i_C	δ_L	δ_R
1	BWHDV	P ₆ + SP	3.75	Vary	0	0	--	--	--
2	" + T _s	"	"	"	"	"	--	--	--
3	" + "	" + SP	7.50	"	"	"	--	--	--
4	" + "	Y ₆	"	0	Vary	"	--	--	--
5	" + "	" + SP	"	10	"	"	--	--	--
6	" + "	P ₃	"	Vary	0	10	--	--	--
7	" + "	"	"	"	"	-10	--	--	--
8	BNWHDV + "	" + SP	"	"	"	0	--	--	--
9	" + "	Y ₆	"	0	Vary	"	--	--	--
10	" + "	"	"	10	"	"	--	--	--
11	BWDV + "	P ₃	"	Vary	0	--	--	--	--
12	BW + "	"	"	"	"	--	--	--	--
13	" + "	"	3.75	"	"	--	--	--	--
14	B + "	" + SP	7.50	"	"	--	--	--	--
15	" + "	"	3.75	"	"	--	--	--	--
16	" + "	" + SP	15.00	"	"	--	--	--	--
17	BFR + T _{s1}	"	"	"	"	--	--	--	--
18	" + T _s	"	"	"	"	--	--	--	--
19	" + T _{s2}	" + SP	"	"	"	--	--	--	--
20	" + "	"	7.50	"	"	--	--	--	--
21	" + "	Y ₆	15.00	0	Vary	--	--	--	--
22	" + "	"	"	5	"	--	--	--	--
23	" + " + Tufts	TP	7.50	Vary	"	--	--	--	--

INDEX OF RUNS (CONT'D.)

Run No.	Model Configuration	Test	q, lb/ft ²	Settings, Deg.					
				α_g	ψ	i_H	i_C	δ_L	δ_R
24	BNFR + T _{s2}	P ₆	15.00	Vary	0	--	--	--	--
25	" + "	Y ₆	"	0	Vary	--	--	--	--
26	" + "	"	"	5	"	--	--	--	--
27	BNFRC ₃₀ + "	P ₃	"	Vary	0	--	0	--	--
28	" + "	Y ₆	"	0	Vary	--	"	--	--
29	" + "	"	"	5	"	--	"	--	--
30	" + "	P ₃	"	Vary	0	--	10	--	--
31	" + "	"	"	"	"	--	-5	--	--
32	BNFRC ₆₀ + "	"	"	"	"	--	0	--	--
33	" + "	"	"	"	"	--	10	--	--
34	" + "	"	"	"	"	--	-5	--	--
35	" + "	"	7.50	"	"	--	0	--	--
36	BFR + T _{s3}	"	15.00	"	"	--	--	--	--
37	BFRS + T _{s2}	"	"	"	"	--	--	--	--
38	" + "	Y ₆	"	5	Vary	--	--	--	--
39	BFRSE + "	P ₃	"	Vary	0	--	--	-10	-10
40	" + "	"	"	"	"	--	--	10	"
41	" + "	"	"	"	"	--	--	"	10
42	" + "	"	"	"	"	--	--	-10	"
43	" + "	"	"	"	"	--	--	0	0
44	" + "	P ₆	"	"	"	--	--	10	-10
45	" + "	"	"	"	"	--	--	-10	10
46	BFRSA + "	"	"	"	"	--	--	10	-10

INDEX OF RUNS (CONT'D.)

Run No.	Model Configuration	Test	q, lb/ft ²	Settings, Deg.					
				α_g	ψ	i_H	i_C	δ_L	δ_R
47	BFRSA + T _{s2}	P ₆	15.00	Vary	0	--	--	-10	10
48	" + "	P ₃	"	"	"	--	--	0	0
49	BFRS + "	"	7.50	"	"	--	--	--	--
50	" + "	SP	"	"	"	--	--	--	--
51	" + "	TW	4.00	"	"	--	--	--	--
52	BNFRSC ₆₀ + "	"	"	"	"	--	0	--	--
53	" + "	P ₃	7.50	"	"	--	"	--	--
54	BNFRSC ₃₀ + "	TW	4.00	"	"	--	"	--	--
55	" + "	P ₃	7.50	"	"	--	"	--	--
56	BFR	"	"	"	"	--	--	--	--

REFERENCES

1. Eisenstadt, B.J. "Boundary-Induced Upwash for Yawed and Swept Wings in Closed Circular Wind Tunnels." NASA TN1265, May 1947.
2. Biot, M. "Correction for the Measured Rolling Moment of a Wing in a Circular Wind Tunnel." ZFM, August 1933.
3. Klein, Serrell and Millikan. "A New Two-Parameter Model Suspension System for the GALCIT 10-Ft. Wind Tunnel." Journal of the Aeronautical Sciences, June 1942.
4. Wolkovitch, J., "Application of the Joined Wing to Cruise Missiles." ONR Rept. 212-266-1, Contract N00014-79-C-0953. Aeronautical Consultant Associates (now ACA Industries Inc.), November 1980.

TABLE I

Dimensional Data Used for Data Reduction

	<u>Conventional Wing</u>	<u>Joined Wing</u>	<u>Joined Wing With Canards</u>
Projected Wing Area, S, (ft ²)	3.9998	3.9998	3.9998
Wing span, b, (ft.)	6.4625	6.4625	6.4625
Wing mean geometric chord, c, (ft.)	0.6189	0.6189	0.6189
Moment reference center location: F.S. (in.)	66.5800	73.0070	67.2306
W.L. (in.)	0	0	0
B.L. (in.)	0	0	0

TABLE II

General Model Dimensional Data

Conventional Wing, W

Total projected wing area	(ft ²)	3.9977
Exposed wing area	(ft ²)	3.3407
Wetted wing area	(ft ²)	6.8266
Wing mean geometric chord	(ft)	0.6186
Wing mean aerodynamic chord	(ft)	0.6415
Mean geometric chord of exposed area	(ft)	0.5964
Wing span (measured normal to fuselage plane of symmetry)	(ft)	6.4625
Aspect ratio, b^2/S		10.4415
Sweep: at L.E.	(deg)	3.65
at 0.25 chord	(deg)	1.83
at 0.50 chord	(deg)	0
Dihedral (measured at wing T.E.)	(deg)	3.0
Root chord, C_R	(ft)	0.8248
Tip chord, C_T	(ft)	0.4124
Taper ratio, C_T/C_R		0.50
Wing location on fuselage:		
Root chord L.E.	(F.S., in)	63.9887
0.25 MAC	(F.S., in)	64.8134
0.25 MAC	(B.L., in)	17.240

TABLE II (CONT'D.)Joined Wing, F.R. (excluding fin)

		<u>F</u>	<u>R</u>
Total projected wing area	(ft ²)	2.4000	1.6000
Exposed wing area	(ft ²)	2.0431	1.6208
Wetted wing area	(ft ²)	4.1782	3.3145
Wing mean geometric chord	(ft)	0.3714	0.2476
Wing mean aerodynamic chord	(ft)	0.3851	0.2568
Wing span (excluding tip joint and measured normal to fuselage plane of symmetry), b	(ft)	6.4625	6.4625
Mean geometric chord of exposed area	(ft)	0.3552	0.2471
Wing span including tip joint, b _T	(ft)	6.5258	6.5258
Aspect ratio, b ² /S		17.4004	26.1006
Aspect ratio, b _T ² /S		17.7442	26.6163
Sweep: at L.E.	(deg)	30.00	-19.38
at 0.25 chord	(deg)	29.17	-20.03
at 0.50 chord	(deg)	28.33	-20.68
Dihedral (measured at wing T.E.)	(deg)	10.8	- 9.2
Root chord, C _R	(ft)	0.4952	0.3301
Tip chord, C _T	(ft)	0.2476	0.1651
Taper ratio, C _T /C _R		0.50	0.50
Wing location on fuselage:			
Root chord L.E.	(F.S., in)	46.500	85.500
0.25 MAC	(F.S., in)	57.6051	80.2069
0.25 MAC	(B.L., in)	17.2335	17.2335

TABLE II (CONT'D.)

Joined Wing Vertical Airfoil Section

Exposed area	(ft ²)	0.2433
Wetted area	(ft ²)	0.4975
Mean geometric chord	(ft)	0.4700
Mean aerodynamic chord	(ft)	0.4820
Span (height), H	(ft)	0.5176
Aspect ratio, $H^2/\text{exposed area}$		1.1011
Sweep: at L.E.	(deg)	30.0
at 0.25 chord	(deg)	40.395
Root chord (at fuselage intersection), C_R	(ft)	0.600
Tip chord (at wing junction), C_T	(ft)	0.340
Taper ratio, C_T/C_R		0.567
Location on fuselage:		
Root chord L.E.	(F.S., in)	93.224
Tip chord L.E.	(F.S., in)	96.810
0.25 MAC	(F.S., in)	96.298
Root chord	(W.L., in)	5.000
Tip chord	(W.L., in)	11.211

TABLE II (CONT'D.)

Horizontal and Vertical Stabilizers, H,V,D

		<u>H</u>	<u>V + D</u>
Total projected area	(ft ²)	0.9601	0.9601
Exposed area	(ft ²)	0.5781	0.5781
Wetted area	(ft ²)	1.1822	1.1822
Mean geometric chord	(ft)	0.4500	0.4500
Mean aerodynamic chord	(ft)	0.4667	0.4667
Mean geometric chord of exposed area	(ft)	0.4467	0.4467
Span (between tips)	(ft)	2.1335	2.1335
Aspect ratio		4.741	4.741
Sweep: at L.E.	(deg)	30.0	30.0
at 0.25 chord	(deg)	32.930	32.930
at 0.50 chord	(deg)	35.677	35.677
Dihedral	(deg)	0	0
Root chord on fuselage C_L, C_R	(ft)	0.600	0.600
Tip chord, C_T	(ft)	0.300	0.300
Taper ratio, C_T/C_R		0.500	0.500
Location on fuselage:			
Pivot for incidence angle change	(F.S., in)	113.96	--
Root chord L.E.	(F.S., in)	109.00	109.00
0.25 MAC	(F.S., in)	115.327	115.327
0.25 MAC	(W.L., in)	--	± 8.534
0.25 MAC	(B.L., in)	± 8.534	--

TABLE II (CONT'D.)

Canard Surfaces

		<u>C₃₀</u>	<u>C₈₀</u>
Total projected area	(ft ²)	0.9601	1.3482
Exposed area	(ft ²)	0.5188	0.4690
Wetted area	(ft ²)	1.0609	0.9509
Mean geometric chord	(ft)	0.4500	0.7946
Mean aerodynamic chord	(ft)	0.4667	0.7695
Mean geometric chord of exposed area	(ft)	0.3958	1.0959
Span	(ft)	2.1335	1.6967
Aspect ratio		4.741	2.1353
Sweep: at L.E.	(deg)	30.0	60.0
at 0.25 chord	(deg)	32.930	57.50
at 0.50 chord	(deg)	35.677	45.00
Dihedral	(deg)	0	0
Root chord, C _R	(ft)	0.600	1.013
Tip chord, C _T	(ft)	0.300	0.300*
Taper ratio, C _T /C _R		0.500	0.296
Location on fuselage:			
Pivot for incidence angle change	(F.S., in)	32.88	32.88
Root chord L.E.	(F.S., in)	27.92	19.22
0.25 MAC	(F.S., in)	38.448	28.85

* measured at 30° relative to aircraft plane of symmetry neglecting
tip radius

TABLE II (CONT'D.)Body

		<u>B</u>	<u>B + N</u>
Overall length	(ft)	7.052	8.927
Body diameter (constant area section)	(ft)	0.8333	0.8333
Body diameter at base	(ft)	0.4375	0.4375
Leading edge	(F.S., in)	35.38	12.88
Trailing edge	(F.S., in)	120.00	120.00
Tapered aft body L.E.	(F.S., in)	109.00	109.00
Constant area section L.E.	(F.S., in)	50.42	27.92
Nose shape: semi-elliptical			
Semi major axis	(in)	15.04	15.04
Minor axis	(in)	10.00	10.00
Body wetted area	(ft ²)	18.7262	21.5362

Ailerons and Elevons

Dimensions given on Fig. 4

Increase in wing wetted area due to addition of two ailerons or elevons	(ft ²)	0.4416
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Strakes

Dimensions given on Fig. 5

Increase in wing wetted area due to addition of two strakes	(ft ²)	0.1862
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TABLE III

Corrections Applied to the Data

Reference Corrections to the Observed Data in the Notation.

Blocking Correction

$$\begin{aligned} 1 - 2\epsilon &= 0.992 && \text{for all short body configurations, B} \\ 1 - 2\epsilon &= 0.990 && \text{for all long body configurations, BN} \end{aligned}$$

Horizontal Buoyancy Corrections

$$\begin{aligned} \delta C_D &= -0.0028 && \text{for all short body configurations, B} \\ \delta C_D &= -0.0062 && \text{for all long body configurations, BN} \end{aligned}$$

Streamline Curvature Corrections

	<u>Conventional Wing, W</u>	<u>Joined Wing, FR</u>
$\Delta\alpha/C_L =$	0.406	0.409
$\Delta C_D/C_L^2 =$	0.00666	0.00671
$\Delta C_m/C_L =$	0.00157 (H on)	--
$\Delta C_m/C_L =$	0.00034 (H off)	0.00063

Lateral Corrections for Asymmetric Wing Loadings

	<u>E, $\delta_L \neq \delta_R$</u>	<u>A, $\delta_L \neq \delta_R$</u>
$\Delta C_{\ell}/C_{\ell} =$	-0.0098	-0.0115
$\Delta C_n/C_{\ell} \cdot C_L =$	-0.0088	-0.0088

TABLE III (CONT'D.)

Aerodynamic Tare Corrections - All Configurations

$\alpha_T = 0.25^\circ$		
α_g, deg	C_{D_T}	C_{m_T}
-6	0.0049	-0.0105
-3	0.0049	-0.0102
0	0.0049	-0.0099
3	0.0049	-0.0097
6	0.0046	-0.0095
9	0.0043	-0.0093
12	0.0039	-0.0092
15	0.0038	-0.0091
16	0.0038	-0.0091
18	0.0039	-0.0091
21	0.0041	-0.0091

Base Pressure Corrections - All Configurations

$q, \text{lb/ft}^2$	C_{D_b}
3.75	0.0024
7.50 ($\alpha_g \leq 12^\circ$)	0.0019
7.50 ($\alpha_g > 12^\circ$)	0.0011
15.00	0.0021

TABLE IV

Reynolds Number and Air Velocity versus Dynamic Pressure

<u>q, lb/ft²</u>	<u>V, mph</u>	<u>R x 10⁻⁶</u>		
		<u>W</u>	<u>F</u>	<u>R</u>
3.75	39.93	0.20	*	*
7.50	56.47	0.28	0.17	0.11
15.00	79.86	*	0.24	0.16

The Reynolds numbers are based on the mean geometric chords of the wings indicated. The table was computed assuming the following wind tunnel airstream conditions: Temperature = 90°F, barometric pressure = 739 mm Hg, and water vapor pressure = 12 mm Hg. Note that the Reynolds number per foot is 0.32×10^6 , 0.45×10^6 and 0.65×10^6 at $q = 3.75$, 7.50 and 15 lb/ft², respectively.

* Not tested

TABLE V

Tabulated Force and Moment Coefficients - Wind Axes

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TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 1 C= 3.75 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-4.17	0.2058	0.0449	0.2733	0.1029	1.0059	-0.0038
-2.09	0.3935	0.0451	0.1974	0.0037	1.0	0.0007
-1.04	0.5174	0.0470	0.1370	0.0027	0.0015	-0.0027
-0.00	0.5997	0.0505	0.0984	0.0007	-1.0015	-0.0017
1.05	0.7231	0.0552	0.0508	0.0026	0.0	0.0
2.08	0.8055	0.0607	-0.0017	0.0009	-1.0044	-0.0026
3.10	0.8642	0.0684	-0.0456	-0.0021	-0.0044	0.0019
4.15	0.9877	0.0747	-0.1173	-0.0029	-0.0059	-0.0010
6.22	1.1347	0.0952	-0.2975	-0.0038	-1.0103	0.0031
8.23	1.1641	0.1416	-0.3758	-0.0082	-0.0191	0.0002
10.21	1.1229	0.2246	-0.5142	-0.0075	-0.0220	0.0038
12.20	1.1053	0.3139	-0.6914	-0.0028	-0.0176	0.0031
14.20	1.0877	0.3594	-0.7803	-0.0033	-0.0118	0.0003

WIND AXES COEFFICIENTS

RUN 2 C= 3.75 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.27	-0.0470	0.0529	0.3857	-0.0002	0.0029	0.0031
-4.18	0.1646	0.0495	0.3015	0.0038	0.0015	-0.0012
-3.14	0.2646	0.0498	0.2757	0.0016	0.0015	-0.0001
-2.10	0.3586	0.0514	0.2224	-0.0004	0.0	0.0
-1.05	0.4997	0.0545	0.1441	-0.0008	-0.0015	0.0031
-0.02	0.5703	0.0585	0.1314	0.0019	-0.0015	-0.0010
1.03	0.6761	0.0624	0.0793	0.0014	-0.0015	0.0039
2.08	0.8055	0.0677	-0.0022	0.0001	-0.0059	0.0027
4.14	0.9583	0.0814	-0.0726	-0.0014	-0.0059	0.0027
6.19	1.0759	0.0990	-0.1844	-0.0075	-0.0103	0.0035
8.24	1.1994	0.1337	-0.4171	-0.0073	-1.0162	0.0066
10.23	1.1641	0.2159	-0.5595	-0.0068	-0.0235	0.0077
12.20	1.0994	0.3132	-0.6549	-0.0028	-0.0191	0.0043

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 3 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.27	-0.0559	0.0477	0.3742	0.0044	0.0015	-0.0018
-4.18	0.1823	0.0464	0.2876	0.0046	-0.0007	0.0001
-3.14	0.2675	0.0467	0.2582	0.0038	0.0015	-0.0012
-2.10	0.3733	0.0480	0.1988	0.0033	-0.0015	-0.0017
-1.05	0.4792	0.0509	0.1500	0.0021	-0.0022	0.0004
-0.01	0.5879	0.0541	0.1027	0.0021	-0.0037	-0.0010
1.03	0.6820	0.0587	0.0668	0.0022	-0.0037	-0.0001
2.07	0.7849	0.0635	0.0119	0.0007	-0.0044	-0.0011
4.15	0.9848	0.0795	-0.1084	-0.0011	-0.0081	0.0009
6.20	1.1053	0.0948	-0.2456	-0.0026	-0.0081	0.0016
8.24	1.1876	0.1245	-0.3786	-0.0058	-0.0147	0.0015
10.22	1.1523	0.2014	-0.5380	-0.0033	-0.0257	0.0030
12.22	1.1347	0.3068	-0.6199	0.0032	-0.0536	0.0041

WIND AXES COEFFICIENTS

RUN 4 C= 7.50 LB/FT**2

ALPHA = -0.03 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.5468	0.0752	0.1868	-0.0236	-0.0977	0.0618
0.0	0.5909	0.0544	0.0965	0.0035	-0.0044	0.0015
10.00	0.5926	0.0814	0.1481	0.0263	0.1896	-0.0571

WIND AXES COEFFICIENTS

RUN 5 C= 7.50 LB/FT**2

ALPHA = 10.26 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	1.2346	0.2150	-0.5280	-0.0291	-0.1587	0.0509
0.0	1.1758	0.2041	-0.5029	-0.0049	-0.0287	0.0025
10.00	1.2405	0.2119	-0.5599	0.0301	0.1132	-0.0503

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TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 6 Q = 7.50 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.22	0.0647	0.0474	-0.2936	0.0	0.0	0.0
-4.14	0.2734	0.0484	-0.3694	0.0	0.0	0.0
-3.10	0.3704	0.0512	-0.4042	0.0	0.0	0.0
-2.06	0.4674	0.0544	-0.4583	0.0	0.0	0.0
-1.02	0.5585	0.0582	-0.4836	0.0	0.0	0.0
0.03	0.6579	0.0634	-0.5463	0.0	0.0	0.0
1.07	0.7849	0.0703	-0.6003	0.0	0.0	0.0
2.12	0.8907	0.0767	-0.6541	0.0	0.0	0.0
4.19	1.0788	0.0940	-0.7598	0.0	0.0	0.0
6.24	1.2023	0.1201	-0.8951	0.0	0.0	0.0
8.27	1.2640	0.1592	-0.9395	0.0	0.0	0.0
10.26	1.2405	0.2451	-0.9762	0.0	0.0	0.0
12.23	1.1700	0.3432	-0.9142	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 7 Q = 7.50 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.30	-0.1176	0.0815	0.8152	0.0	0.0	0.0
-4.22	0.0764	0.0724	0.8459	0.0	0.0	0.0
-3.18	0.1617	0.0696	0.8681	0.0	0.0	0.0
-2.14	0.2734	0.0652	0.8405	0.0	0.0	0.0
-1.10	0.3675	0.0638	0.8176	0.0	0.0	0.0
-0.05	0.4792	0.0639	0.7807	0.0	0.0	0.0
0.98	0.5703	0.0648	0.7464	0.0	0.0	0.0
2.03	0.6732	0.0656	0.6963	0.0	0.0	0.0
4.10	0.8525	0.0749	0.6008	0.0	0.0	0.0
6.16	0.9965	0.0898	0.4620	0.0	0.0	0.0
8.19	1.0788	0.1164	0.2906	0.0	0.0	0.0
10.17	1.0347	0.1932	0.1598	0.0	0.0	0.0
12.17	1.0142	0.2872	0.0869	0.0	0.0	0.0

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TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 8 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.27	-0.0470	0.0545	0.2954	0.0	0.0	0.0
-4.15	0.1470	0.0526	0.2613	0.0	0.0	0.0
-3.15	0.2557	0.0523	0.2320	0.0	0.0	0.0
-2.09	0.3821	0.0543	0.1774	0.0	0.0	0.0
-1.05	0.4792	0.0566	0.1570	0.0	0.0	0.0
-0.01	0.5732	0.0608	0.1440	0.0	0.0	0.0
1.03	0.6791	0.0646	0.1210	0.0	0.0	0.0
2.07	0.7731	0.0709	0.0779	0.0	0.0	0.0
4.15	0.9701	0.0838	-0.0135	0.0	0.0	0.0
6.21	1.1112	0.1024	-0.1191	0.0	0.0	0.0
8.24	1.1876	0.1331	-0.2174	0.0	0.0	0.0
10.22	1.1553	0.2116	-0.3267	0.0	0.0	0.0
12.22	1.1347	0.3175	-0.3985	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 9 Q= 7.50 LB/FT**2

ALPHA = -0.02 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.5526	0.0824	0.2207	-0.0256	-0.2021	0.0449
0.0	0.5732	0.0594	0.1413	-0.0008	-0.0015	-0.0001
10.00	0.5468	0.0885	0.1781	0.0267	0.1992	-0.0414

WIND AXES COEFFICIENTS

RUN 10 Q= 7.50 LB/FT**2

ALPHA = 10.26 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	1.2464	0.2323	-0.2813	-0.0260	-0.2205	0.0346
0.0	1.1817	0.2149	-0.3287	-0.0005	-0.0691	0.0043
10.00	1.2523	0.2292	-0.3287	0.0308	0.0522	-0.0320

WIND AXES COEFFICIENTS

RUN 11 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.23	0.0382	0.0427	-0.1666	0.0	0.0	0.0
-3.12	0.3087	0.0439	-0.0814	0.0	0.0	0.0
-0.01	0.5938	0.0521	-0.0307	0.0	0.0	0.0
3.11	0.8789	0.0672	-0.0444	0.0	0.0	0.0
6.19	1.0730	0.0894	-0.0194	0.0	0.0	0.0
9.20	1.0906	0.1598	0.0111	0.0	0.0	0.0

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TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 12 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.24	0.0235	0.0406	-0.1737	0.0	0.0	0.0
-4.16	0.2264	0.0412	-0.1429	0.0	0.0	0.0
-3.12	0.3234	0.0422	-0.1237	0.0	0.0	0.0
-2.08	0.4204	0.0447	-0.1133	0.0	0.0	0.0
-1.04	0.5144	0.0474	-0.0925	0.0	0.0	0.0
0.00	0.6144	0.0513	-0.0720	0.0	0.0	0.0
1.03	0.6879	0.0555	-0.0478	0.0	0.0	0.0
2.07	0.7508	0.0603	-0.0619	0.0	0.0	0.0
4.15	0.9642	0.0724	-0.0556	0.0	0.0	0.0
6.19	1.0759	0.0890	-0.0402	0.0	0.0	0.0
8.21	1.1171	0.1137	-0.0118	0.0	0.0	0.0
10.20	1.0877	0.1916	-0.0153	0.0	0.0	0.0
12.17	1.0171	0.2821	0.1010	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 13 C= 3.75 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.23	0.0470	0.0446	-0.1804	0.0	0.0	0.0
-4.17	0.2058	0.0443	-0.1286	0.0	0.0	0.0
-3.12	0.3234	0.0453	-0.1300	0.0	0.0	0.0
-2.08	0.4115	0.0481	-0.0927	0.0	0.0	0.0
-1.04	0.5056	0.0510	-0.0737	0.0	0.0	0.0
-0.00	0.5997	0.0541	-0.0447	0.0	0.0	0.0
1.03	0.6937	0.0578	-0.0364	0.0	0.0	0.0
2.06	0.7584	0.0626	-0.0427	0.0	0.0	0.0
4.13	0.9248	0.0752	-0.0324	0.0	0.0	0.0
6.19	1.0641	0.0918	-0.0301	0.0	0.0	0.0
8.20	1.1053	0.1255	-0.0219	0.0	0.0	0.0
10.19	1.0700	0.1992	-0.0159	0.0	0.0	0.0
12.15	0.9760	0.2851	0.0662	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 14 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.25	-0.0235	0.0271	-0.1058	0.0	0.0	0.0
-3.25	-0.0029	0.0256	-0.0304	0.0	0.0	0.0
-0.25	0.0	0.0244	0.0507	0.0	0.0	0.0
2.75	0.0059	0.0236	0.1141	0.0	0.0	0.0
5.75	0.0059	0.0202	0.2093	0.0	0.0	0.0
8.75	0.0323	0.0297	0.2433	0.0	0.0	0.0
11.75	0.0500	0.0354	0.2753	0.0	0.0	0.0

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 15 C = 3.75 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.25	-0.0294	0.0282	-0.0549	0.0	0.0	0.0
-3.25	-0.0059	0.0264	-0.0456	0.0	0.0	0.0
-0.25	0.0	0.0252	0.0334	0.0	0.0	0.0
2.75	0.0059	0.0247	0.0530	0.0	0.0	0.0
5.75	0.0176	0.0267	0.1832	0.0	0.0	0.0
8.75	0.0294	0.0305	0.2383	0.0	0.0	0.0
11.75	0.0470	0.0350	0.2641	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 16 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.25	-0.0147	0.0270	-0.1487	0.0	0.0	0.0
-3.25	-0.0029	0.0249	-0.0507	0.0	0.0	0.0
-0.25	0.0015	0.0235	0.0407	0.0	0.0	0.0
2.75	0.0073	0.0236	0.1387	0.0	0.0	0.0
5.75	0.0103	0.0254	0.2282	0.0	0.0	0.0
8.75	0.0294	0.0287	0.2996	0.0	0.0	0.0
11.75	0.0441	0.0346	0.3587	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 17 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.20	0.1235	0.0513	-0.1231	0.0	0.0	0.0
-5.15	0.2425	0.0454	-0.1998	0.0	0.0	0.0
-4.11	0.3425	0.0442	-0.2481	0.0	0.0	0.0
-3.07	0.4336	0.0447	-0.3056	0.0	0.0	0.0
-2.04	0.5159	0.0461	-0.3655	0.0	0.0	0.0
-1.00	0.6100	0.0490	-0.4193	0.0	0.0	0.0
0.03	0.6923	0.0525	-0.4657	0.0	0.0	0.0
1.07	0.7790	0.0569	-0.5484	0.0	0.0	0.0
2.10	0.8558	0.0618	-0.6138	0.0	0.0	0.0
3.14	0.9451	0.0675	-0.6862	0.0	0.0	0.0
4.17	1.0142	0.0736	-0.7411	0.0	0.0	0.0
5.19	1.0730	0.0807	-0.7983	0.0	0.0	0.0
6.20	1.1097	0.0886	-0.8407	0.0	0.0	0.0
7.22	1.1450	0.0965	-0.8681	0.0	0.0	0.0

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TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 18 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CE	CMCG	CICG	CC	CNCG
-6.21	0.0897	0.0544	-0.1434	0.0	0.0	0.0
-5.17	0.1984	0.0490	-0.1763	0.0	0.0	0.0
-4.13	0.2925	0.0486	-0.2202	0.0	0.0	0.0
-3.10	0.3704	0.0498	-0.2706	0.0	0.0	0.0
-2.06	0.4600	0.0521	-0.3215	0.0	0.0	0.0
-1.03	0.5335	0.0545	-0.3724	0.0	0.0	0.0
0.00	0.6203	0.0584	-0.4277	0.0	0.0	0.0
1.04	0.6952	0.0623	-0.4933	0.0	0.0	0.0
2.07	0.7702	0.0668	-0.5620	0.0	0.0	0.0
3.09	0.8319	0.0722	-0.6187	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 19 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CE	CMCG	CICG	CC	CNCG
-6.20	0.1102	0.0526	-0.1409	0.0	0.0	0.0
-5.16	0.2161	0.0474	-0.1829	0.0	0.0	0.0
-4.12	0.3072	0.0469	-0.2369	0.0	0.0	0.0
-3.09	0.3866	0.0484	-0.2726	0.0	0.0	0.0
-2.05	0.4924	0.0508	-0.3250	0.0	0.0	0.0
-1.02	0.5571	0.0536	-0.3840	0.0	0.0	0.0
0.01	0.6320	0.0570	-0.4263	0.0	0.0	0.0
1.04	0.7129	0.0612	-0.5152	0.0	0.0	0.0
2.07	0.7834	0.0658	-0.5743	0.0	0.0	0.0
3.10	0.8491	0.0710	-0.6342	0.0	0.0	0.0
4.13	0.9157	0.0772	-0.6959	0.0	0.0	0.0
5.15	0.9671	0.0844	-0.7509	0.0	0.0	0.0
6.17	1.0142	0.0925	-0.7936	0.0	0.0	0.0
7.18	1.0436	0.1009	-0.8147	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 20 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CE	CMCG	CICG	CC	CNCG
-6.21	0.1058	0.0545	-0.1460	0.0	0.0	0.0
-3.10	0.3675	0.0503	-0.2742	0.0	0.0	0.0
0.00	0.6173	0.0581	-0.4053	0.0	0.0	0.0
3.09	0.8260	0.0701	-0.5884	0.0	0.0	0.0
6.16	0.9565	0.0913	-0.7788	0.0	0.0	0.0
9.20	1.1053	0.1204	-0.8299	0.0	0.0	0.0
12.21	1.1229	0.1669	-0.6624	0.0	0.0	0.0
13.21	1.1318	0.2168	-0.6229	0.0	0.0	0.0
14.20	1.1024	0.2584	-0.5427	0.0	0.0	0.0

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 21 C= 15.00 LB/FT**2

ALPHA = 0.01 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.6129	0.0741	-0.3360	-0.0382	-0.1547	-0.0010
-5.00	0.6247	0.0616	-0.4006	-0.0197	-0.0786	-0.0013
0.0	0.6261	0.0569	-0.4420	0.0013	-0.0073	-0.0002
5.00	0.6129	0.0596	-0.4106	0.0217	0.0614	0.0027
10.00	0.5894	0.0735	-0.3425	0.0413	0.1411	0.0016

WIND AXES COEFFICIENTS

RUN 22 C= 15.00 LB/FT**2

ALPHA = 5.14 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.9274	0.1017	-0.6740	-0.0415	-0.1462	0.0029
-5.00	0.9495	0.0892	-0.7259	-0.0214	-0.0783	0.0012
0.0	0.9583	0.0837	-0.7490	-0.0016	-0.0107	0.0013
5.00	0.9436	0.0865	-0.7256	0.0195	0.0492	0.0025
10.00	0.9201	0.0998	-0.6728	0.0395	0.1249	0.0003

WIND AXES COEFFICIENTS

RUN 24 C= 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.20	0.1102	0.0589	-0.2156	0.0011	-0.0110	-0.0004
-3.09	0.3792	0.0551	-0.2928	0.0003	-0.0110	-0.0007
0.01	0.6261	0.0637	-0.4210	0.0002	-0.0107	-0.0004
3.10	0.8510	0.0775	-0.5676	-0.0011	-0.0114	-0.0008
6.17	1.0142	0.0994	-0.6713	-0.0029	-0.0162	-0.0023
7.18	1.0568	0.1094	-0.6766	-0.0025	-0.0176	-0.0003

WIND AXES COEFFICIENTS

RUN 25 C= 15.00 LB/FT**2

ALPHA = 0.01 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.6320	0.0834	-0.3075	-0.0399	-0.1657	-0.0165
0.0	0.6379	0.0832	-0.4045	0.0009	-0.0121	-0.0003
10.00	0.6173	0.0813	-0.3331	0.0421	0.1499	0.0176

TABLATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 26 C = 15.00 LB/FT**2 ALPHA = 5.15 DEG PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.9289	0.1121	-0.5226	-0.0395	-0.1569	-0.0140
0.0	0.9671	0.0900	-0.6380	-0.0010	-0.0132	-0.0003
10.00	0.9216	0.1077	-0.5607	0.0405	0.1297	0.0164

WIND AXES COEFFICIENTS

RUN 27 C = 15.00 LB/FT**2 PSI = 0.0 DEG PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.22	0.0647	0.0612	-0.6232	0.0	0.0	0.0
-3.11	0.3454	0.0570	-0.7405	0.0	0.0	0.0
0.01	0.6320	0.0665	-0.8855	0.0	0.0	0.0
3.11	0.8745	0.0826	-1.0246	0.0	0.0	0.0
6.19	1.0671	0.1082	-1.0457	0.0	0.0	0.0
7.20	1.1038	0.1197	-0.9978	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 28 C = 15.00 LB/FT**2 ALPHA = 0.01 DEG PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.6375	0.0867	-0.7458	-0.0468	-0.1631	-0.0032
0.0	0.6247	0.0663	-0.8704	0.0023	-0.0073	-0.0004
10.00	0.5953	0.0844	-0.7830	0.0503	0.1491	0.0046

WIND AXES COEFFICIENTS

RUN 29 C = 15.00 LB/FT**2 ALPHA = 5.17 DEG PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.9936	0.1194	-0.9225	-0.0482	-0.1477	0.0002
0.0	1.0142	0.0978	-1.0495	0.0002	-0.0103	-0.0004
10.00	0.9671	0.1151	-0.9793	0.0497	0.1308	0.0031

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 30 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.20	0.1161	0.0628	-0.1948	0.0	0.0	0.0
-3.07	0.4292	0.0597	-0.3360	0.0	0.0	0.0
0.04	0.7070	0.0712	-0.4789	0.0	0.0	0.0
3.13	0.9319	0.0966	-0.6280	0.0	0.0	0.0
6.19	1.0847	0.1249	-0.7495	0.0	0.0	0.0
7.21	1.1244	0.1486	-0.7474	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 31 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.24	0.0250	0.0678	-0.8300	0.0	0.0	0.0
-3.12	0.3219	0.0581	-0.9505	0.0	0.0	0.0
-0.00	0.5012	0.0658	-1.0835	0.0	0.0	0.0
3.10	0.8466	0.0798	-1.2327	0.0	0.0	0.0
6.18	1.0377	0.1046	-1.2609	0.0	0.0	0.0
7.19	1.0774	0.1140	-1.2300	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 32 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.21	0.0897	0.0612	-0.4839	0.0	0.0	0.0
-3.09	0.3851	0.0568	-0.6899	0.0	0.0	0.0
0.02	0.6511	0.0663	-0.8916	0.0	0.0	0.0
3.11	0.8789	0.0818	-1.0879	0.0	0.0	0.0
6.18	1.0480	0.1057	-1.1636	0.0	0.0	0.0
7.20	1.1024	0.1195	-1.1232	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 33 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.20	0.1235	0.0619	-0.2414	0.0	0.0	0.0
-3.08	0.4248	0.0592	-0.4460	0.0	0.0	0.0
0.03	0.6849	0.0705	-0.6338	0.0	0.0	0.0
3.12	0.9127	0.0937	-0.7906	0.0	0.0	0.0
6.20	1.1053	0.1303	-0.7995	0.0	0.0	0.0
7.22	1.1406	0.1445	-0.7323	0.0	0.0	0.0

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 34 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.23	0.0529	0.0662	-0.6255	0.0	0.0	0.0
-3.11	0.3498	0.0576	-0.7852	0.0	0.0	0.0
0.01	0.6276	0.0656	-0.9870	0.0	0.0	0.0
3.10	0.8554	0.0792	-1.1933	0.0	0.0	0.0
6.17	1.0362	0.1025	-1.3054	0.0	0.0	0.0
7.19	1.0788	0.1132	-1.2838	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 35 C = 7.50 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.22	0.0823	0.0634	-0.4783	0.0	0.0	0.0
-3.10	0.3733	0.0578	-0.6708	0.0	0.0	0.0
0.00	0.6114	0.0668	-0.8200	0.0	0.0	0.0
3.10	0.8495	0.0826	-1.0057	0.0	0.0	0.0
6.18	1.0454	0.1075	-1.1289	0.0	0.0	0.0
9.23	1.1758	0.1458	-0.9956	0.0	0.0	0.0
12.25	1.2199	0.2379	-0.5335	0.0	0.0	0.0
13.26	1.2464	0.2734	-0.4789	0.0	0.0	0.0
14.27	1.2611	0.3113	-0.3270	0.0	0.0	0.0
15.28	1.2846	0.3534	-0.2605	0.0	0.0	0.0
16.29	1.3111	0.3923	-0.2026	0.0	0.0	0.0
17.29	1.3111	0.4310	-0.1127	0.0	0.0	0.0
18.30	1.3522	0.4825	-0.0881	0.0	0.0	0.0
19.33	1.4257	0.5446	-0.0856	0.0	0.0	0.0
20.34	1.4492	0.5829	-0.0438	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 36 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.20	0.1264	0.0524	-0.1360	0.0	0.0	0.0
-5.16	0.2308	0.0473	-0.2025	0.0	0.0	0.0
-4.11	0.3307	0.0464	-0.2505	0.0	0.0	0.0
-3.08	0.4174	0.0474	-0.2981	0.0	0.0	0.0
-2.05	0.4997	0.0495	-0.3449	0.0	0.0	0.0
-1.01	0.5791	0.0522	-0.3979	0.0	0.0	0.0
0.02	0.6570	0.0557	-0.4509	0.0	0.0	0.0
3.11	0.8834	0.0695	-0.6355	0.0	0.0	0.0
6.18	1.0436	0.0904	-0.7921	0.0	0.0	0.0
7.19	1.0759	0.0987	-0.8311	0.0	0.0	0.0

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 37 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.21	0.1029	0.0544	-0.1454	0.0	0.0	0.0
-3.09	0.3880	0.0493	-0.2818	0.0	0.0	0.0
0.01	0.6379	0.0575	-0.4328	0.0	0.0	0.0
3.10	0.8584	0.0720	-0.6192	0.0	0.0	0.0
6.18	1.0377	0.0965	-0.7644	0.0	0.0	0.0
7.19	1.0730	0.1075	-0.7856	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 38 C= 15.00 LB/FT**2

ALPHA = 5.16 DEG

PHI = 0.0 DEG

PSI DEG	CL	CC	CMCG	CICG	CC	CNCG
-10.00	0.9671	0.1064	-0.6271	-0.0423	-0.1514	0.0025
0.0	0.9951	0.0867	-0.7254	-0.0021	-1.0147	0.0003
10.00	0.9539	0.1018	-0.6456	0.0413	0.1249	-0.0007

WIND AXES COEFFICIENTS

RUN 39 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.27	-0.0456	0.0611	-0.2236	0.0	0.0	0.0
-3.14	0.2616	0.0437	-0.3537	0.0	0.0	0.0
-0.02	0.5615	0.0553	-0.4768	0.0	0.0	0.0
3.09	0.8275	0.0705	-0.6419	0.0	0.0	0.0
6.17	1.0274	0.0965	-0.7620	0.0	0.0	0.0
7.19	1.0671	0.1081	-0.7830	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 40 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.21	0.0955	0.0597	-0.1500	0.0	0.0	0.0
-3.09	0.3998	0.0547	-0.2571	0.0	0.0	0.0
0.03	0.6835	0.0644	-0.3750	0.0	0.0	0.0
3.12	0.9069	0.0811	-0.5432	0.0	0.0	0.0
6.21	1.1126	0.1103	-0.7118	0.0	0.0	0.0
7.22	1.1523	0.1237	-0.7269	0.0	0.0	0.0

TABLATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 41 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.15	0.2410	0.0525	-0.0382	0.0	0.0	0.0
-3.04	0.5218	0.0550	-0.1574	0.0	0.0	0.0
0.07	0.7878	0.0674	-0.3098	0.0	0.0	0.0
3.17	1.0215	0.0867	-0.4973	0.0	0.0	0.0
6.24	1.1935	0.1198	-0.6238	0.0	0.0	0.0
7.25	1.2243	0.1342	-0.6484	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 42 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.21	0.0926	0.0599	-0.1293	0.0	0.0	0.0
-3.08	0.4027	0.0557	-0.2574	0.0	0.0	0.0
0.03	0.6791	0.0649	-0.3904	0.0	0.0	0.0
3.13	0.9201	0.0814	-0.5540	0.0	0.0	0.0
6.20	1.1038	0.1112	-0.6798	0.0	0.0	0.0
7.22	1.1406	0.1233	-0.7021	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 43 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CMCG	CICG	CC	CNCG
-6.21	0.0911	0.0546	-0.1431	0.0	0.0	0.0
-3.09	0.3968	0.0498	-0.2685	0.0	0.0	0.0
0.03	0.6717	0.0603	-0.3831	0.0	0.0	0.0
3.13	0.9304	0.0776	-0.5785	0.0	0.0	0.0
6.21	1.1229	0.1076	-0.6894	0.0	0.0	0.0
7.23	1.1597	0.1200	-0.7175	0.0	0.0	0.0

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 44 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.21	0.0970	0.0597	-0.1548	0.0172	-0.0217	0.0064
-3.09	0.3954	0.0545	-0.2593	0.0163	-0.0169	0.0045
0.03	0.6849	0.0647	-0.3992	0.0147	-0.0140	0.0030
3.13	0.9274	0.0914	-0.5755	0.0096	-0.0151	0.0020
6.21	1.1141	0.1096	-0.7152	0.0077	-0.0125	0.0002
7.22	1.1464	0.1236	-0.7345	0.0069	-0.0129	-0.0004

WIND AXES COEFFICIENTS

RUN 45 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.21	0.0941	0.0602	-0.1537	-0.0120	-0.0007	-0.0060
-3.09	0.4057	0.0553	-0.2643	-0.0120	-0.0066	-0.0029
0.03	0.6820	0.0657	-0.3909	-0.0126	-0.0118	-0.0020
3.13	0.9274	0.0824	-0.5721	-0.0123	-0.0158	-0.0001
6.20	1.1068	0.1139	-0.6923	-0.0115	-0.0195	0.0013
7.22	1.1523	0.1254	-0.7065	-0.0101	-0.0213	0.0024

WIND AXES COEFFICIENTS

RUN 46 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.22	0.0691	0.0537	-0.0530	0.0299	-0.0239	0.0031
-3.11	0.3498	0.0525	-0.1882	0.0320	-0.0231	0.0029
0.00	0.6179	0.0606	-0.3681	0.0307	-0.0250	0.0015
3.10	0.3525	0.0759	-0.5772	0.0234	-0.0246	-0.0000
6.13	1.0392	0.1016	-0.7501	0.0220	-0.0250	-0.0009
7.20	1.0862	0.1139	-0.7937	0.0202	-0.0250	-0.0011

WIND AXES COEFFICIENTS

RUN 47 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.22	0.0661	0.0583	-0.0418	-0.0236	0.0055	-0.0045
-3.11	0.3483	0.0516	-0.1703	-0.0273	0.0029	-0.0017
0.00	0.6217	0.0601	-0.3810	-0.0236	0.0	-0.0013
3.10	0.3642	0.0752	-0.5306	-0.0204	-0.0044	0.0004
6.13	1.0509	0.1017	-0.7749	-0.0258	-0.0038	0.0015

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 43 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.22	0.0661	0.0552	-0.0549	0.0	0.0	0.0
-3.11	0.3483	0.0501	-0.1895	0.0	0.0	0.0
0.00	0.6144	0.0535	-0.3800	0.0	0.0	0.0
3.10	0.8623	0.0738	-0.5930	0.0	0.0	0.0
6.18	1.0494	0.0999	-0.7894	0.0	0.0	0.0
7.20	1.0877	0.1114	-0.8243	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 49 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.21	0.1029	0.0556	-0.1242	0.0	0.0	0.0
-3.10	0.3704	0.0503	-0.2605	0.0	0.0	0.0
0.00	0.6144	0.0581	-0.3976	0.0	0.0	0.0
3.09	0.8319	0.0726	-0.5542	0.0	0.0	0.0
6.17	1.0200	0.0960	-0.7189	0.0	0.0	0.0
9.21	1.1259	0.1316	-0.7945	0.0	0.0	0.0
12.21	1.1313	0.2076	-0.5689	0.0	0.0	0.0
15.20	1.1024	0.3092	-0.3930	0.0	0.0	0.0
18.20	1.1082	0.3952	-0.2438	0.0	0.0	0.0
21.20	1.1082	0.4940	-0.2168	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 53 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CD	CMCG	CICG	CC	CNCG
-6.22	0.0794	0.0634	-0.4589	0.0	0.0	0.0
-3.09	0.3792	0.0582	-0.5672	0.0	0.0	0.0
0.01	0.6370	0.0667	-0.8403	0.0	0.0	0.0
3.10	0.8642	0.0816	-1.0062	0.0	0.0	0.0
6.18	1.0524	0.1075	-1.1113	0.0	0.0	0.0
9.24	1.1994	0.1497	-0.8982	0.0	0.0	0.0
12.26	1.2346	0.2458	-0.5005	0.0	0.0	0.0
15.28	1.2964	0.3613	-0.2371	0.0	0.0	0.0
18.32	1.3846	0.4852	0.0222	0.0	0.0	0.0
21.33	1.4198	0.5913	0.2096	0.0	0.0	0.0

TABULATED FORCE AND MOMENT DATA

WIND AXES COEFFICIENTS

RUN 55 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CNCG	CICG	CC	CNCG
-6.23	0.0500	0.0640	-0.6111	0.0	0.0	0.0
-3.10	0.3616	0.0578	-0.7460	0.0	0.0	0.0
0.00	0.6203	0.0674	-0.8381	0.0	0.0	0.0
3.10	0.8455	0.0826	-0.9298	0.0	0.0	0.0
6.15	1.0818	0.1085	-1.0010	0.0	0.0	0.0
9.25	1.2082	0.1524	-0.8565	0.0	0.0	0.0
12.26	1.2405	0.2500	-0.5255	0.0	0.0	0.0
15.26	1.2376	0.3582	-0.3583	0.0	0.0	0.0
18.28	1.2875	0.4646	-0.1873	0.0	0.0	0.0
21.25	1.3228	0.5716	0.0316	0.0	0.0	0.0

WIND AXES COEFFICIENTS

RUN 56 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CL	CC	CNCG	CICG	CC	CNCG
-6.20	0.1235	0.0542	-0.1015	0.0	0.0	0.0
-3.08	0.4145	0.0494	-0.1860	0.0	0.0	0.0
0.01	0.6350	0.0583	-0.2917	0.0	0.0	0.0
3.09	0.8378	0.0712	-0.4452	0.0	0.0	0.0
6.16	1.0024	0.0893	-0.5903	0.0	0.0	0.0
9.21	1.1318	0.1191	-0.6403	0.0	0.0	0.0
12.22	1.1347	0.1882	-0.4649	0.0	0.0	0.0
15.20	1.0994	0.2921	-0.2865	0.0	0.0	0.0
18.17	1.0318	0.2727	-0.2816	0.0	0.0	0.0
21.20	1.0935	0.4673	-0.2715	0.0	0.0	0.0

TABLE VI

Tabulated Force and Moment Coefficients - Body Axes

TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 1 C= 3.75 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-4.17	0.2021	0.0591	0.0059	0.2733	0.0027	-0.0040
-2.09	0.3921	0.0588	0.0	0.1974	0.0038	0.0006
-1.04	0.5165	0.0560	0.0015	0.1370	0.0026	-0.0028
-0.00	0.5997	0.0505	-0.0015	0.0984	0.0007	-0.0017
1.05	0.7240	0.0425	0.0	0.0508	0.0026	0.0000
2.08	0.8071	0.0325	-0.0044	-0.0017	0.0010	-0.0026
3.10	0.8666	0.0231	-0.0044	-0.0456	-0.0022	0.0018
4.15	0.9905	0.0056	-0.0059	-0.1173	-0.0028	-0.0012
6.22	1.1384	-0.0239	-0.0103	-0.2975	-0.0041	0.0027
8.23	1.1725	-0.0217	-0.0191	-0.3758	-0.0081	-0.0010
10.21	1.1449	0.0262	-0.0220	-0.5142	-0.0060	0.0025
12.20	1.1464	0.0773	-0.0176	-0.6914	-0.0034	0.0024
14.20	1.1423	0.0656	-0.0118	-0.7803	-0.0033	-0.0005

BODY AXES COEFFICIENTS

RUN 2 C= 3.75 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.27	-0.0523	0.0478	0.0029	0.3857	0.0001	0.0031
-4.18	0.1808	0.0609	0.0015	0.3015	0.0037	-0.0015
-3.14	0.2616	0.0636	0.0015	0.2757	0.0016	-0.0002
-2.10	0.3566	0.0638	0.0	0.2224	-0.0004	0.0000
-1.05	0.4987	0.0632	-0.0015	0.1441	-0.0008	0.0031
-0.02	0.5703	0.0585	-0.0015	0.1214	0.0018	-0.0010
1.03	0.6771	0.0505	-0.0015	0.0793	0.0014	0.0039
2.08	0.8073	0.0396	-0.0059	-0.0022	0.0000	0.0027
4.14	0.9617	0.0143	-0.0059	-0.0726	-0.0016	0.0026
6.19	1.0804	-0.0140	-0.0103	-0.1844	-0.0078	0.0027
8.24	1.2070	-0.0256	-0.0162	-0.4171	-0.0082	0.0056
10.23	1.1239	0.0105	-0.0235	-0.5595	-0.0080	0.0064
12.20	1.1405	0.0778	-0.0191	-0.6549	-0.0037	0.0036

TABLATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 3 C= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.27	-0.0605	0.0416	0.0015	0.3742	0.0042	-0.0021
-4.18	0.1786	0.0590	-0.0007	0.2876	0.0046	-0.0003
-3.14	0.2647	0.0606	0.0015	0.2582	0.0037	-0.0014
-2.10	0.3714	0.0610	-0.0015	0.1988	0.0032	-0.0019
-1.05	0.4782	0.0593	-0.0022	0.1500	0.0021	0.0003
-0.01	0.5879	0.0541	-0.0037	0.1027	0.0021	-0.0010
1.03	0.6829	0.0468	-0.0037	0.0668	0.0032	-0.0000
2.07	0.7866	0.0361	-0.0044	0.0119	0.0008	-0.0011
4.15	0.9879	0.0106	-0.0051	-0.1084	-0.0012	0.0008
6.20	1.1092	-0.0212	-0.0051	-0.2456	-0.0027	0.0012
8.24	1.1934	-0.0420	-0.0147	-0.3786	-0.0059	0.0007
10.22	1.1698	-0.0018	-0.0257	-0.5380	-0.0038	0.0024
12.22	1.1737	0.0642	-0.0536	-0.6199	0.0022	0.0046

BODY AXES COEFFICIENTS

RUN 4 C= 7.50 LB/FT**2

ALPHA = -0.03 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.5468	0.0397	-0.2077	0.1411	-0.0264	0.0618
0.0	0.5909	0.0544	-0.0044	0.0965	0.0035	0.0015
10.00	0.5526	0.0472	0.2009	0.0981	0.0234	-0.0571

BODY AXES COEFFICIENTS

RUN 5 C= 7.50 LB/FT**2

ALPHA = 10.26 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	1.2479	-0.0330	-0.1937	-0.5728	-0.0285	0.0467
0.0	1.1934	-0.0032	-0.0287	-0.5629	-0.0053	0.0016
10.00	1.2545	-0.0293	0.1482	-0.6055	0.0287	-0.0460

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TABLULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS
RUN 6 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCC	CYCG
-6.22	0.0594	0.0539	0.0	-0.2936	0.0	0.0
-4.14	0.2693	0.0674	0.0	-0.3694	0.0	0.0
-3.10	0.3672	0.0705	0.0	-0.4042	0.0	0.0
-2.06	0.4652	0.0707	0.0	-0.4583	0.0	0.0
-1.02	0.5574	0.0680	0.0	-0.4836	0.0	0.0
0.03	0.6879	0.0634	0.0	-0.5463	0.0	0.0
1.07	0.7860	0.0565	0.0	-0.6003	0.0	0.0
2.12	0.8926	0.0456	0.0	-0.6541	0.0	0.0
4.19	1.0828	0.0185	0.0	-0.7598	0.0	0.0
6.24	1.2083	-0.0062	0.0	-0.8951	0.0	0.0
8.27	1.2739	-0.0183	0.0	-0.9395	0.0	0.0
10.26	1.2642	0.0260	0.0	-0.9762	0.0	0.0
12.23	1.2166	0.0573	0.0	-0.9142	0.0	0.0

BODY AXES COEFFICIENTS
RUN 7 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCC	CYCG
-6.30	-0.1255	0.0688	0.0	0.8152	0.0	0.0
-4.22	0.0712	0.0775	0.0	0.8459	0.0	0.0
-3.18	0.1578	0.0779	0.0	0.8681	0.0	0.0
-2.14	0.2709	0.0747	0.0	0.8485	0.0	0.0
-1.10	0.3663	0.0702	0.0	0.8176	0.0	0.0
-0.05	0.4792	0.0639	0.0	0.7807	0.0	0.0
0.98	0.5713	0.0548	0.0	0.7464	0.0	0.0
2.03	0.6751	0.0421	0.0	0.6963	0.0	0.0
4.10	0.8556	0.0153	0.0	0.6008	0.0	0.0
6.16	1.0005	-0.0149	0.0	0.4620	0.0	0.0
8.19	1.0845	-0.0349	0.0	0.2906	0.0	0.0
10.17	1.0526	0.0106	0.0	0.1506	0.0	0.0
12.17	1.0517	0.0700	0.0	0.0869	0.0	0.0

TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 8 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.27	-0.0525	0.0493	0.0	0.2954	0.0	0.0
-4.19	0.1430	0.0627	0.0	0.2613	0.0	0.0
-3.15	0.2527	0.0656	0.0	0.2320	0.0	0.0
-2.09	0.3800	0.0676	0.0	0.1774	0.0	0.0
-1.05	0.4781	0.0650	0.0	0.1570	0.0	0.0
-0.01	0.5732	0.0608	0.0	0.1440	0.0	0.0
1.03	0.6601	0.0528	0.0	0.1210	0.0	0.0
2.07	0.7751	0.0429	0.0	0.0779	0.0	0.0
4.15	0.9736	0.0159	0.0	-0.0135	0.0	0.0
6.21	1.1158	-0.0143	0.0	-0.1191	0.0	0.0
8.24	1.1946	-0.0335	0.0	-0.2174	0.0	0.0
10.22	1.1745	0.0077	0.0	-0.3267	0.0	0.0
12.22	1.1759	0.0747	0.0	-0.3905	0.0	0.0

BODY AXES COEFFICIENTS

RUN 9 Q= 7.50 LB/FT**2

ALPHA = -0.02 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.5526	0.0460	-0.2133	0.1705	-0.0289	0.0449
0.0	0.5732	0.0594	-0.0015	0.1413	-0.0008	-0.0001
10.00	0.5468	0.0526	0.2115	0.1270	0.0292	-0.0414

BODY AXES COEFFICIENTS

RUN 10 Q= 7.50 LB/FT**2

ALPHA = 10.26 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	1.2605	-0.0288	-0.2575	-0.3242	-0.0267	0.0304
0.0	1.2011	0.0064	-0.0691	-0.3287	-0.0013	0.0041
10.00	1.2709	-0.0041	0.0912	-0.3776	0.0300	-0.0271

BODY AXES COEFFICIENTS

RUN 11 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.23	0.0335	0.0464	0.0	-0.1666	0.0	0.0
-3.12	0.3059	0.0600	0.0	-0.0814	0.0	0.0
-0.01	0.5538	0.0521	0.0	-0.0307	0.0	0.0
3.11	0.8813	0.0211	0.0	-0.0444	0.0	0.0
6.19	1.0764	-0.0233	0.0	-0.0194	0.0	0.0

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TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS
RUN 12 C= 7.50 LB/FT**2

PSI= 0.0 DEG PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.24	0.0191	0.0428	0.0	-0.1737	0.0	0.0
-4.16	0.2229	0.0569	0.0	-0.1429	0.0	0.0
-3.12	0.3207	0.0590	0.0	-0.1237	0.0	0.0
-2.08	0.4185	0.0594	0.0	-0.1133	0.0	0.0
-1.04	0.5139	0.0583	0.0	-0.0925	0.0	0.0
0.00	0.6144	0.0513	0.0	-0.0720	0.0	0.0
1.03	0.6887	0.0439	0.0	-0.0478	0.0	0.0
2.07	0.7924	0.0327	0.0	-0.0619	0.0	0.0
4.15	0.9669	0.0050	0.0	-0.0556	0.0	0.0
6.19	1.0792	-0.0250	0.0	-0.0402	0.0	0.0
8.21	1.1220	-0.0429	0.0	-0.0118	0.0	0.0
10.20	1.1044	-0.0012	0.0	-0.0153	0.0	0.0
12.17	1.0537	0.0655	0.0	0.1010	0.0	0.0

BODY AXES COEFFICIENTS
RUN 13 C= 3.75 LB/FT**2

PSI= 0.0 DEG PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.23	0.0421	0.0493	0.0	-0.1804	0.0	0.0
-4.17	0.2022	0.0586	0.0	-0.1286	0.0	0.0
-3.12	0.3205	0.0622	0.0	-0.1300	0.0	0.0
-2.08	0.4096	0.0624	0.0	-0.0927	0.0	0.0
-1.04	0.5046	0.0598	0.0	-0.0737	0.0	0.0
-0.00	0.5997	0.0541	0.0	-0.0447	0.0	0.0
1.03	0.6947	0.0457	0.0	-0.0364	0.0	0.0
2.06	0.7601	0.0360	0.0	-0.0427	0.0	0.0
4.13	0.9378	0.0098	0.0	-0.0324	0.0	0.0
6.19	1.0679	-0.0199	0.0	-0.0301	0.0	0.0
8.20	1.1120	-0.0296	0.0	-0.0219	0.0	0.0
10.19	1.0884	0.0104	0.0	-0.0159	0.0	0.0
12.15	1.0139	0.0760	0.0	0.0662	0.0	0.0

BODY AXES COEFFICIENTS
RUN 14 C= 7.50 LB/FT**2

PSI= 0.0 DEG PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.25	-0.0262	0.0245	0.0	-0.1058	0.0	0.0
-3.25	-0.0043	0.0254	0.0	-0.0364	0.0	0.0
-0.25	0.0	0.0244	0.0	0.0507	0.0	0.0
2.75	0.0071	0.0232	0.0	0.1141	0.0	0.0
5.75	0.0086	0.0254	0.0	0.2893	0.0	0.0
8.75	0.0266	0.0243	0.0	0.2493	0.0	0.0

TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 15 Q = 3.75 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CFCG	CRCG	CYCG
-6.25	-0.0322	0.0249	0.0	-0.0549	0.0	0.0
-3.25	-0.0073	0.0261	0.0	-0.0456	0.0	0.0
-0.25	0.0	0.0252	0.0	0.0334	0.0	0.0
2.75	0.0072	0.0243	0.0	0.0930	0.0	0.0
5.75	0.0203	0.0247	0.0	0.1832	0.0	0.0
8.75	0.0338	0.0255	0.0	0.2383	0.0	0.0
11.75	0.0533	0.0245	0.0	0.2641	0.0	0.0

BODY AXES COEFFICIENTS

RUN 16 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CFCG	CRCG	CYCG
-6.25	-0.0174	0.0253	0.0	-0.1487	0.0	0.0
-3.25	-0.0042	0.0248	0.0	-0.0507	0.0	0.0
-0.25	0.0015	0.0235	0.0	0.0407	0.0	0.0
2.75	0.0086	0.0232	0.0	0.1387	0.0	0.0
5.75	0.0129	0.0242	0.0	0.2282	0.0	0.0
8.75	0.0335	0.0238	0.0	0.2996	0.0	0.0
11.75	0.0503	0.0246	0.0	0.3587	0.0	0.0

BODY AXES COEFFICIENTS

RUN 17 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CFCG	CRCG	CYCG
-6.20	0.1174	0.0639	0.0	-0.1231	0.0	0.0
-5.15	0.2376	0.0664	0.0	-0.1998	0.0	0.0
-4.11	0.3385	0.0680	0.0	-0.2481	0.0	0.0
-3.07	0.4307	0.0673	0.0	-0.3056	0.0	0.0
-2.04	0.5140	0.0641	0.0	-0.3695	0.0	0.0
-1.00	0.6090	0.0597	0.0	-0.4193	0.0	0.0
0.03	0.6923	0.0525	0.0	-0.4697	0.0	0.0
1.07	0.7759	0.0433	0.0	-0.5484	0.0	0.0
2.10	0.8615	0.0317	0.0	-0.6138	0.0	0.0
3.14	0.9473	0.0179	0.0	-0.6862	0.0	0.0
4.17	1.0168	0.0027	0.0	-0.7411	0.0	0.0
5.19	1.0759	-0.0121	0.0	-0.7983	0.0	0.0
6.20	1.1125	-0.0275	0.0	-0.8407	0.0	0.0
7.22	1.1482	-0.0437	0.0	-0.8681	0.0	0.0

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TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 18 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0635	0.0634	0.0	-0.1434	0.0	0.0
-5.17	0.1934	0.0661	0.0	-0.1763	0.0	0.0
-4.13	0.2884	0.0685	0.0	-0.2202	0.0	0.0
-3.10	0.3673	0.0691	0.0	-0.2706	0.0	0.0
-2.06	0.4580	0.0681	0.0	-0.3215	0.0	0.0
-1.03	0.5325	0.0638	0.0	-0.3724	0.0	0.0
0.00	0.6203	0.0584	0.0	-0.4277	0.0	0.0
1.04	0.6962	0.0501	0.0	-0.4933	0.0	0.0
2.07	0.7720	0.0399	0.0	-0.5620	0.0	0.0
3.09	0.8345	0.0285	0.0	-0.6187	0.0	0.0

BODY AXES COEFFICIENTS

RUN 19 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.20	0.1041	0.0639	0.0	-0.1405	0.0	0.0
-5.16	0.2111	0.0661	0.0	-0.1829	0.0	0.0
-4.12	0.3032	0.0682	0.0	-0.2369	0.0	0.0
-3.09	0.3835	0.0686	0.0	-0.2726	0.0	0.0
-2.05	0.4503	0.0675	0.0	-0.3250	0.0	0.0
-1.02	0.5560	0.0633	0.0	-0.3840	0.0	0.0
0.01	0.6320	0.0570	0.0	-0.4263	0.0	0.0
1.04	0.7138	0.0488	0.0	-0.5152	0.0	0.0
2.07	0.7852	0.0384	0.0	-0.5743	0.0	0.0
3.10	0.8506	0.0265	0.0	-0.6342	0.0	0.0
4.13	0.9188	0.0132	0.0	-0.6959	0.0	0.0
5.15	0.9708	-0.0002	0.0	-0.7509	0.0	0.0
6.17	1.0183	-0.0140	0.0	-0.7936	0.0	0.0
7.18	1.0481	-0.0270	0.0	-0.8147	0.0	0.0

BODY AXES COEFFICIENTS

RUN 20 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0996	0.0652	0.0	-0.1460	0.0	0.0
-3.10	0.3643	0.0695	0.0	-0.2742	0.0	0.0
0.00	0.6173	0.0581	0.0	-0.4053	0.0	0.0
3.09	0.8286	0.0268	0.0	-0.5884	0.0	0.0
6.16	1.0006	-0.0134	0.0	-0.7788	0.0	0.0
9.20	1.1105	-0.0535	0.0	-0.8255	0.0	0.0
12.21	1.1372	-0.0507	0.0	-0.6624	0.0	0.0
15.21	1.1515	-0.0422	0.0	-0.6229	0.0	0.0

TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 21 Q = 15.00 LB/FT**2 ALPHA = 0.01 DEG PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.6129	0.0461	-0.1652	-0.4003	-0.0321	-0.0010
-5.00	0.6247	0.0545	-0.0837	-0.4171	-0.0163	-0.0013
0.0	0.6261	0.0565	-0.0073	-0.4420	0.0013	-0.0002
5.00	0.6129	0.0540	0.0663	-0.4288	0.0182	0.0027
10.00	0.5854	0.0479	0.1517	-0.4122	0.0350	0.0016

BODY AXES COEFFICIENTS

RUN 22 Q = 15.00 LB/FT**2 ALPHA = 5.14 DEG PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.9304	-0.0064	-0.1617	-0.7291	-0.0298	0.0003
-5.00	0.9529	-0.0021	-0.0857	-0.7426	-0.0153	-0.0002
0.0	0.9620	-0.0001	-0.0107	-0.7490	-0.0018	0.0012
5.00	0.9472	-0.0007	0.0566	-0.7406	0.0131	0.0036
10.00	0.9233	-0.0039	0.1404	-0.7342	0.0276	0.0027

BODY AXES COEFFICIENTS

RUN 24 Q = 15.00 LB/FT**2 PSI = 0.0 DEG PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.20	0.1035	0.0701	-0.0110	-0.2156	0.0011	-0.0005
-3.09	0.3758	0.0749	-0.0110	-0.2928	0.0003	-0.0007
0.01	0.6261	0.0637	-0.0107	-0.4210	0.0002	-0.0004
3.10	0.8539	0.0329	-0.0114	-0.5676	-0.0011	-0.0009
6.17	1.0190	-0.0072	-0.0162	-0.6713	-0.0029	-0.0006
7.18	1.0623	-0.0202	-0.0176	-0.6765	-0.0024	-0.0006

BODY AXES COEFFICIENTS

RUN 25 Q = 15.00 LB/FT**2 ALPHA = 0.01 DEG PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.6320	0.0533	-0.1777	-0.3751	-0.0341	-0.0165
0.0	0.6379	0.0632	-0.0121	-0.4045	0.0009	-0.0003
10.00	0.6173	0.0541	0.1618	-0.4061	0.0369	0.0176

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TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 26 Q = 15.00 LB/FT**2

ALPHA = 5.15 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.9326	0.0018	-0.1740	-0.5863	-0.0289	-0.0166
0.0	0.9713	0.0053	-0.0132	-0.6380	-0.0010	-0.0004
10.00	0.9253	0.0029	0.1464	-0.6256	0.0290	0.0190

BODY AXES COEFFICIENTS

RUN 27 Q = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.22	0.0579	0.0677	0.0	-0.6232	0.0	0.0
-3.11	0.3419	0.0750	0.0	-0.7405	0.0	0.0
0.01	0.6320	0.0665	0.0	-0.8895	0.0	0.0
3.11	0.8777	0.0368	0.0	-1.0246	0.0	0.0
6.19	1.0725	-0.0039	0.0	-1.0457	0.0	0.0
7.20	1.1102	-0.0157	0.0	-0.9978	0.0	0.0

BODY AXES COEFFICIENTS

RUN 28 Q = 15.00 LB/FT**2

ALPHA = 0.01 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.6379	0.0570	-0.1757	-0.8193	-0.0337	-0.0032
0.0	0.6247	0.0663	-0.0073	-0.8704	0.0023	-0.0004
10.00	0.5953	0.0574	0.1605	-0.8632	0.0370	0.0046

BODY AXES COEFFICIENTS

RUN 29 Q = 15.00 LB/FT**2

ALPHA = 5.17 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.9978	0.0050	-0.1662	-0.9959	-0.0320	-0.0026
0.0	1.0188	0.0091	-0.0103	-1.0455	0.0002	-0.0004
10.00	0.9714	0.0060	0.1468	-1.0545	0.0322	0.0060

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TABLELATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 30 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.20	0.1089	0.0746	0.0	-0.1948	0.0	0.0
-3.07	0.4255	0.0820	0.0	-0.3360	0.0	0.0
0.04	0.7070	0.0712	0.0	-0.4785	0.0	0.0
3.13	0.9356	0.0477	0.0	-0.6280	0.0	0.0
6.19	1.0929	0.0208	0.0	-0.7495	0.0	0.0
7.21	1.1341	0.0105	0.0	-0.7474	0.0	0.0

BODY AXES COEFFICIENTS

RUN 31 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.24	0.0178	0.0701	0.0	-0.8300	0.0	0.0
-3.12	0.3184	0.0749	0.0	-0.9505	0.0	0.0
-0.00	0.6012	0.0658	0.0	-1.0835	0.0	0.0
3.10	0.8496	0.0354	0.0	-1.2327	0.0	0.0
6.18	1.0429	-0.0045	0.0	-1.2609	0.0	0.0
7.19	1.0832	-0.0181	0.0	-1.2306	0.0	0.0

BODY AXES COEFFICIENTS

RUN 32 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0828	0.0703	0.0	-0.4839	0.0	0.0
-3.09	0.3816	0.0758	0.0	-0.6899	0.0	0.0
0.02	0.6511	0.0663	0.0	-0.8916	0.0	0.0
3.11	0.8820	0.0357	0.0	-1.0879	0.0	0.0
6.18	1.0533	-0.0044	0.0	-1.1636	0.0	0.0
7.20	1.1087	-0.0157	0.0	-1.1232	0.0	0.0

BODY AXES COEFFICIENTS

RUN 33 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.20	0.1163	0.0745	0.0	-0.2414	0.0	0.0
-3.08	0.4211	0.0813	0.0	-0.4460	0.0	0.0
0.03	0.6849	0.0705	0.0	-0.6338	0.0	0.0
3.12	0.9164	0.0458	0.0	-0.7906	0.0	0.0
6.20	1.1129	0.0141	0.0	-0.7995	0.0	0.0
-	-	-	0.0	-0.7323	0.0	0.0

TABULATED FORCE AND MOMENT DATA

ECGY AXES COEFFICIENTS

RUN 34 G= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.23	0.0457	0.0714	0.0	-0.6295	0.0	0.0
-3.11	0.3463	0.0759	0.0	-0.7892	0.0	0.0
0.01	0.6276	0.0656	0.0	-0.9870	0.0	0.0
3.10	0.8584	0.0343	0.0	-1.1933	0.0	0.0
6.17	1.0412	-0.0004	0.0	-1.3054	0.0	0.0
7.19	1.0846	-0.0192	0.0	-1.2838	0.0	0.0

ECGY AXES COEFFICIENTS

RUN 35 G= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.22	0.0752	0.0717	0.0	-0.4783	0.0	0.0
-3.10	0.3698	0.0773	0.0	-0.6708	0.0	0.0
0.00	0.6114	0.0668	0.0	-0.8200	0.0	0.0
3.10	0.8527	0.0380	0.0	-1.0057	0.0	0.0
6.18	1.0549	-0.0028	0.0	-1.1289	0.0	0.0
9.23	1.1842	-0.0400	0.0	-0.9956	0.0	0.0
12.25	1.2427	-0.0209	0.0	-0.5335	0.0	0.0
13.26	1.2760	-0.0140	0.0	-0.4789	0.0	0.0
14.27	1.2989	-0.0031	0.0	-0.3270	0.0	0.0
15.28	1.3323	0.0089	0.0	-0.2605	0.0	0.0
16.29	1.3684	0.0158	0.0	-0.2026	0.0	0.0
17.29	1.3798	0.0289	0.0	-0.1127	0.0	0.0
18.30	1.4351	0.0411	0.0	-0.0881	0.0	0.0
19.33	1.5254	0.0508	0.0	-0.0856	0.0	0.0
20.34	1.5612	0.0521	0.0	-0.0438	0.0	0.0

ECGY AXES COEFFICIENTS

RUN 36 G= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.20	0.1202	0.0653	0.0	-0.1360	0.0	0.0
-3.16	0.2258	0.0672	0.0	-0.2025	0.0	0.0
-4.11	0.3267	0.0693	0.0	-0.2505	0.0	0.0
-3.08	0.4144	0.0692	0.0	-0.2981	0.0	0.0
-2.05	0.4977	0.0669	0.0	-0.3449	0.0	0.0
-1.01	0.5781	0.0623	0.0	-0.3979	0.0	0.0
0.02	0.6570	0.0557	0.0	-0.4509	0.0	0.0
3.11	0.8858	0.0232	0.0	-0.6355	0.0	0.0
6.18	1.0473	-0.0192	0.0	-0.7921	0.0	0.0
7.19	1.0799	-0.0321	0.0	-0.8311	0.0	0.0

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TABLELATED FORCE AND MOMENT DATA

ECGY AXES CCEFFICIENTS

RUN 37 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0966	0.0648	0.0	-0.1454	0.0	0.0
-3.09	0.3849	0.0695	0.0	-0.2818	0.0	0.0
0.01	0.6379	0.0575	0.0	-0.4328	0.0	0.0
3.10	0.8610	0.0270	0.0	-0.6192	0.0	0.0
6.18	1.0421	-0.0125	0.0	-0.7644	0.0	0.0
7.19	1.0781	-0.0241	0.0	-0.7856	0.0	0.0

ECGY AXES CCEFFICIENTS

RUN 38 C= 15.00 LB/FT**2

ALPHA = 5.16 DEG

PHI = 0.0 DEG

PSI DEG	CN	CX	CY	CPCG	CRCG	CYCG
-10.00	0.9703	-0.0061	-0.1676	-0.6952	-0.0318	-0.0003
0.0	0.9988	-0.0004	-0.0147	-0.7254	-0.0021	0.0001
10.00	0.9571	-0.0048	0.1407	-0.7107	0.0299	0.0019

ECGY AXES CCEFFICIENTS

RUN 39 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.27	-0.0517	0.0560	0.0	-0.2236	0.0	0.0
-3.14	0.2587	0.0624	0.0	-0.3537	0.0	0.0
-0.02	0.5615	0.0553	0.0	-0.4768	0.0	0.0
3.09	0.8301	0.0271	0.0	-0.6419	0.0	0.0
6.17	1.0318	-0.0114	0.0	-0.7620	0.0	0.0
7.19	1.0723	-0.0227	0.0	-0.7830	0.0	0.0

ECGY AXES CCEFFICIENTS

RUN 40 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0888	0.0693	0.0	-0.1500	0.0	0.0
-3.09	0.3964	0.0755	0.0	-0.2571	0.0	0.0
0.03	0.6835	0.0644	0.0	-0.3750	0.0	0.0
3.12	0.9099	0.0336	0.0	-0.5432	0.0	0.0
6.21	1.1181	-0.0066	0.0	-0.7118	0.0	0.0
7.22	1.1588	-0.0177	0.0	-0.7269	0.0	0.0

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TABULATED FORCE AND MOMENT DATA

ECCY AXES COEFFICIENTS

RUN 41 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.15	0.2342	0.0774	0.0	-0.0382	0.0	0.0
-3.04	0.5182	0.0822	0.0	-0.1574	0.0	0.0
0.07	0.7678	0.0674	0.0	-0.3098	0.0	0.0
3.17	1.0247	0.0331	0.0	-0.4973	0.0	0.0
6.24	1.1995	-0.0056	0.0	-0.6238	0.0	0.0
7.25	1.2316	-0.0160	0.0	-0.6484	0.0	0.0

ECCY AXES COEFFICIENTS

RUN 42 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0858	0.0693	0.0	-0.1293	0.0	0.0
-3.08	0.3993	0.0767	0.0	-0.2574	0.0	0.0
0.03	0.6791	0.0449	0.0	-0.3904	0.0	0.0
3.13	0.9231	0.0332	0.0	-0.5540	0.0	0.0
6.20	1.1094	-0.0047	0.0	-0.6798	0.0	0.0
7.22	1.1471	-0.0166	0.0	-0.7021	0.0	0.0

ECCY AXES COEFFICIENTS

RUN 43 C= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0849	0.0639	0.0	-0.1431	0.0	0.0
-3.09	0.3937	0.0705	0.0	-0.2685	0.0	0.0
0.03	0.6717	0.0603	0.0	-0.3831	0.0	0.0
3.13	0.9332	0.0288	0.0	-0.5785	0.0	0.0
6.21	1.1280	-0.0104	0.0	-0.6894	0.0	0.0
7.23	1.1657	-0.0223	0.0	-0.7175	0.0	0.0

TABULATED FORCE AND MOMENT DATA

EDDY AXES COEFFICIENTS

RUN 44 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0902	0.0695	-0.0217	-0.1548	0.0178	0.0045
-3.09	0.3920	0.0751	-0.0169	-0.2593	0.0165	0.0037
0.03	0.6649	0.0647	-0.0140	-0.3992	0.0147	0.0030
3.13	0.9304	0.0327	-0.0151	-0.5755	0.0095	0.0025
6.21	1.1195	-0.0074	-0.0125	-0.7152	0.0076	0.0010
7.22	1.1930	-0.0171	-0.0129	-0.7345	0.0068	0.0004

EDDY AXES COEFFICIENTS

RUN 45 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0873	0.0697	-0.0007	-0.1537	-0.0135	-0.0046
-3.08	0.4022	0.0764	-0.0066	-0.2643	-0.0121	-0.0022
0.03	0.6820	0.0657	-0.0118	-0.3909	-0.0120	-0.0020
3.13	0.9305	0.0338	-0.0158	-0.5721	-0.0123	-0.0007
6.20	1.1126	-0.0025	-0.0195	-0.6923	-0.0116	0.0001
7.22	1.1990	-0.0159	-0.0213	-0.7065	-0.0103	0.0012

EDDY AXES COEFFICIENTS

RUN 46 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.22	0.0626	0.0656	-0.0239	-0.0530	0.0301	-0.0061
-3.11	0.3466	0.0709	-0.0231	-0.1882	0.0321	0.0012
0.00	0.6129	0.0606	-0.0250	-0.3661	0.0307	0.0015
3.10	0.8553	0.0312	-0.0246	-0.5772	0.0284	0.0015
6.18	1.0441	-0.0075	-0.0250	-0.7501	0.0220	0.0014
7.20	1.0920	-0.0194	-0.0250	-0.7937	0.0202	0.0014

EDDY AXES COEFFICIENTS

RUN 47 C = 15.00 LB/FT**2

PSI = 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.22	0.0597	0.0649	0.0055	-0.0418	-0.0289	-0.0015
-3.11	0.3452	0.0698	0.0029	-0.1703	-0.0274	-0.0002
0.00	0.6217	0.0601	0.0	-0.3810	-0.0296	-0.0013
3.10	0.8670	0.0300	-0.0044	-0.5806	-0.0303	-0.0012
6.18	1.0658	-0.0097	-0.0088	-0.7749	-0.0258	-0.0012

TABLATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 48 Q= 15.00 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.22	0.0600	0.0621	0.0	-0.0549	0.0	0.0
-3.11	0.3452	0.0683	0.0	-0.1895	0.0	0.0
0.00	0.6144	0.0585	0.0	-0.3800	0.0	0.0
3.10	0.8655	0.0286	0.0	-0.5930	0.0	0.0
6.18	1.0541	-0.0104	0.0	-0.7894	0.0	0.0
7.20	1.0931	-0.0220	0.0	-0.8243	0.0	0.0

BODY AXES COEFFICIENTS

RUN 49 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.21	0.0565	0.0661	0.0	-0.1242	0.0	0.0
-3.10	0.3672	0.0696	0.0	-0.2605	0.0	0.0
0.00	0.6144	0.0531	0.0	-0.3976	0.0	0.0
3.09	0.8346	0.0235	0.0	-0.5542	0.0	0.0
6.17	1.0245	-0.0111	0.0	-0.7189	0.0	0.0
9.21	1.1326	-0.0461	0.0	-0.7945	0.0	0.0
12.21	1.1502	-0.0323	0.0	-0.5689	0.0	0.0
15.20	1.1448	0.0134	0.0	-0.3930	0.0	0.0
18.20	1.1761	0.0334	0.0	-0.2428	0.0	0.0
21.20	1.2081	0.0547	0.0	-0.2108	0.0	0.0

BODY AXES COEFFICIENTS

RUN 53 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.22	0.0723	0.0713	0.0	-0.4588	0.0	0.0
-3.09	0.3756	0.0779	0.0	-0.6672	0.0	0.0
0.01	0.6379	0.0667	0.0	-0.8403	0.0	0.0
3.10	0.8673	0.0362	0.0	-1.0062	0.0	0.0
6.18	1.0579	-0.0031	0.0	-1.1118	0.0	0.0
9.24	1.2080	-0.0398	0.0	-0.9982	0.0	0.0
12.26	1.2588	-0.0163	0.0	-0.5005	0.0	0.0
15.28	1.3458	0.0140	0.0	-0.2371	0.0	0.0
18.32	1.4667	0.0336	0.0	0.0222	0.0	0.0
21.33	1.5374	0.0433	0.0	0.2096	0.0	0.0

TABULATED FORCE AND MOMENT DATA

BODY AXES COEFFICIENTS

RUN 55 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

PHI = 0.0 DEG

ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.23	0.0430	0.0688	0.0	-0.6111	0.0	0.0
-3.10	0.3581	0.0766	0.0	-0.7460	0.0	0.0
0.00	0.6203	0.0674	0.0	-0.8381	0.0	0.0
3.10	0.8527	0.0380	0.0	-0.9298	0.0	0.0
6.19	1.0872	-0.0052	0.0	-1.0010	0.0	0.0
9.25	1.2172	-0.0384	0.0	-0.8565	0.0	0.0
12.26	1.2654	-0.0134	0.0	-0.5255	0.0	0.0
15.26	1.2881	0.0257	0.0	-0.3583	0.0	0.0
18.28	1.3681	0.0440	0.0	-0.1873	0.0	0.0
21.29	1.4398	0.0596	0.0	0.0316	0.0	0.0

BODY AXES COEFFICIENTS

RUN 56 Q= 7.50 LB/FT**2

PSI= 0.0 DEG

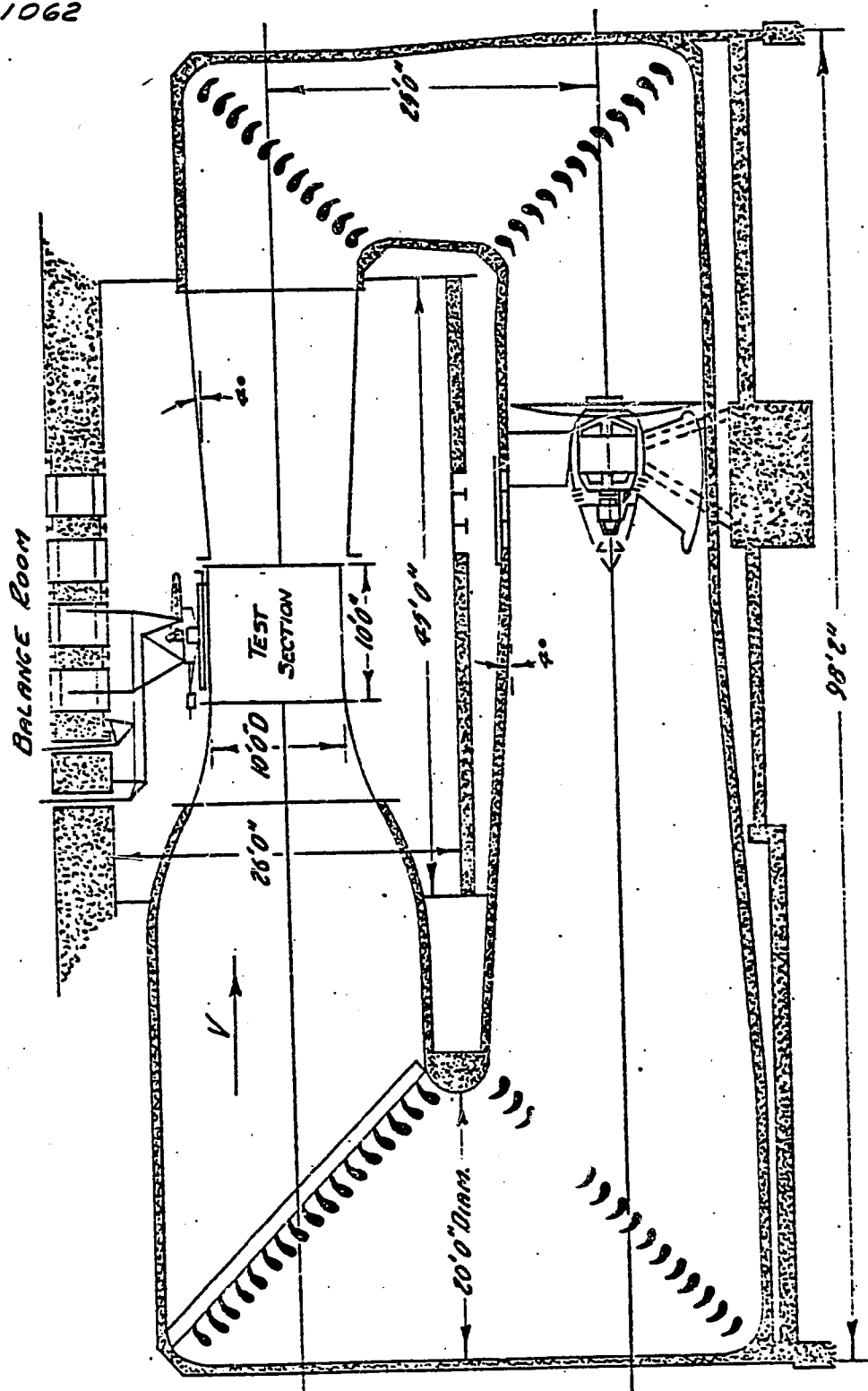
PHI = 0.0 DEG

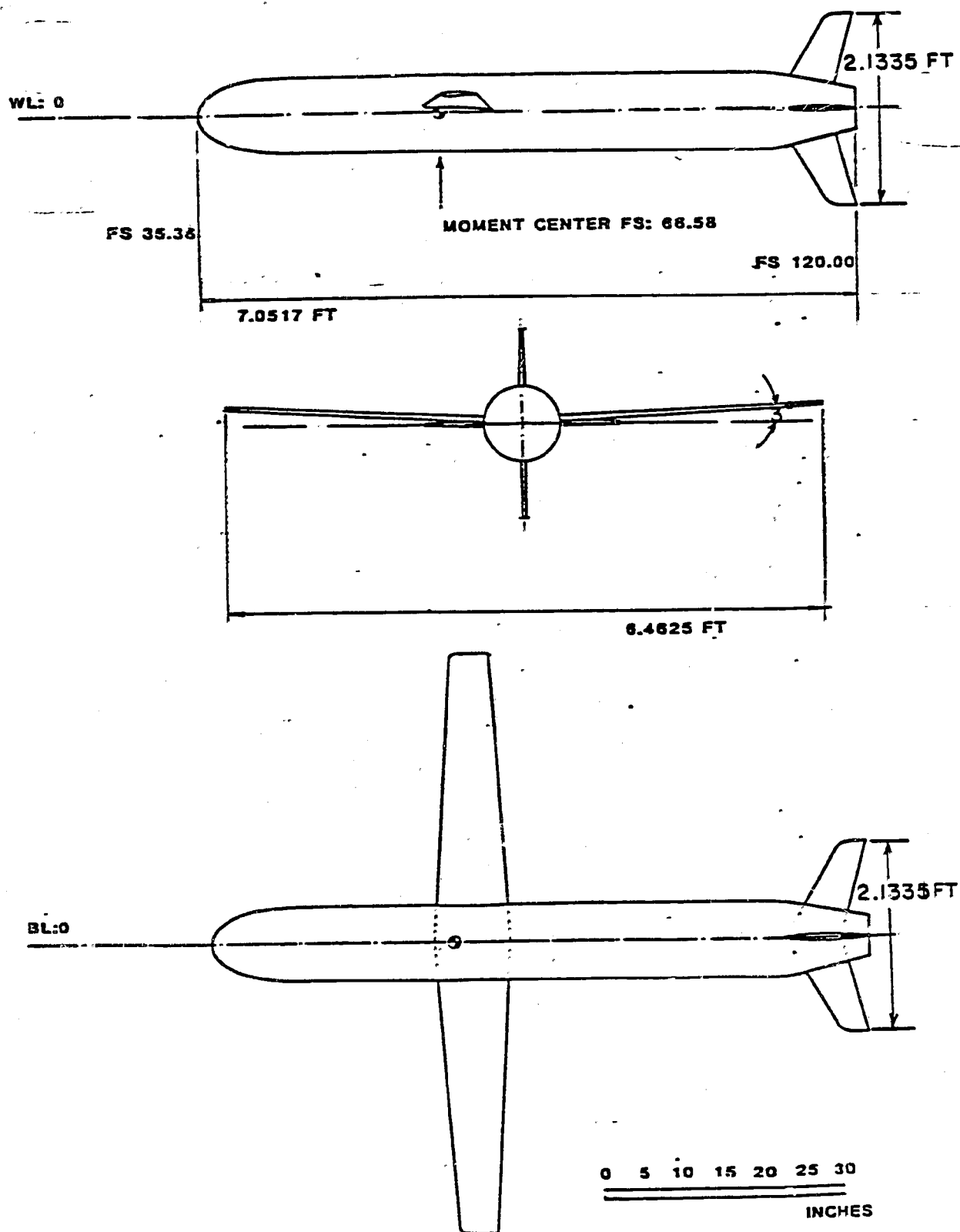
ALPHA DEG	CN	CX	CY	CPCG	CRCG	CYCG
-6.20	0.1171	0.0668	0.0	-0.1015	0.0	0.0
-3.08	0.4113	0.0710	0.0	-0.1860	0.0	0.0
0.01	0.6350	0.0583	0.0	-0.2917	0.0	0.0
3.09	0.8404	0.0272	0.0	-0.4452	0.0	0.0
6.16	1.0063	-0.0159	0.0	-0.5903	0.0	0.0
9.21	1.1364	-0.0594	0.0	-0.6403	0.0	0.0
12.22	1.1490	-0.0518	0.0	-0.4649	0.0	0.0
15.20	1.1376	-0.0024	0.0	-0.2869	0.0	0.0
18.17	1.0965	0.0356	0.0	-0.2816	0.0	0.0
21.20	1.1884	0.0444	0.0	-0.2715	0.0	0.0

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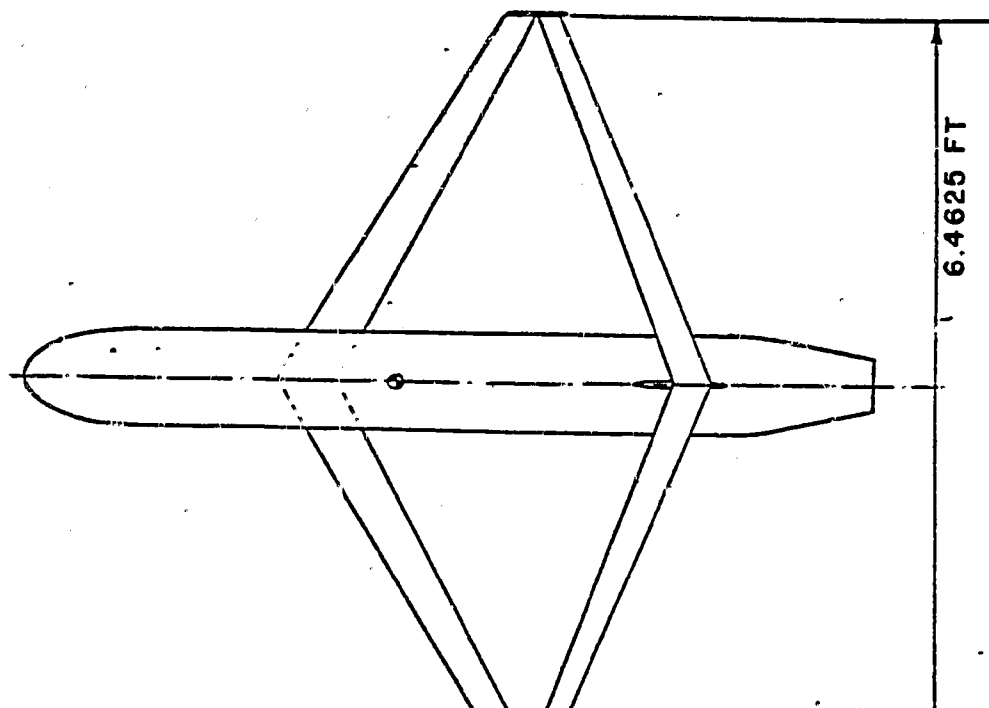
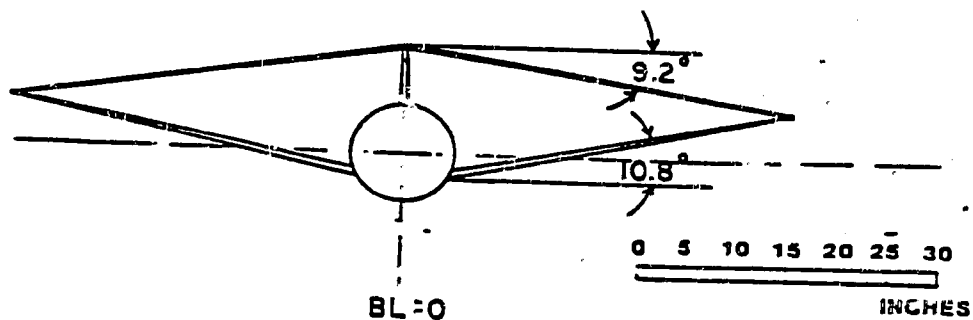
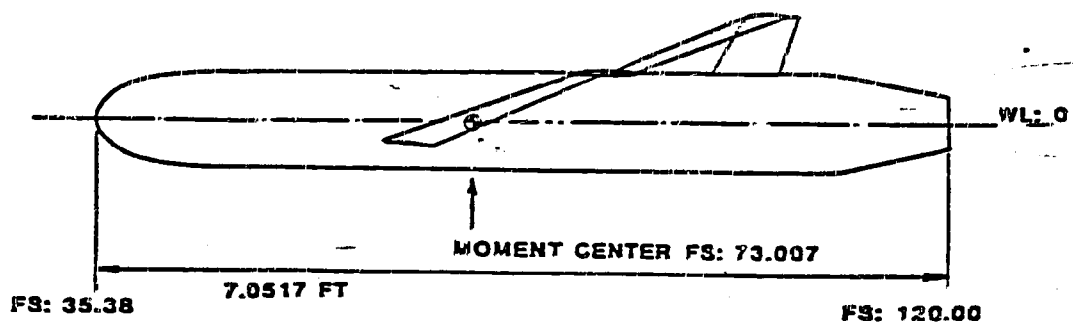
PAGE 58

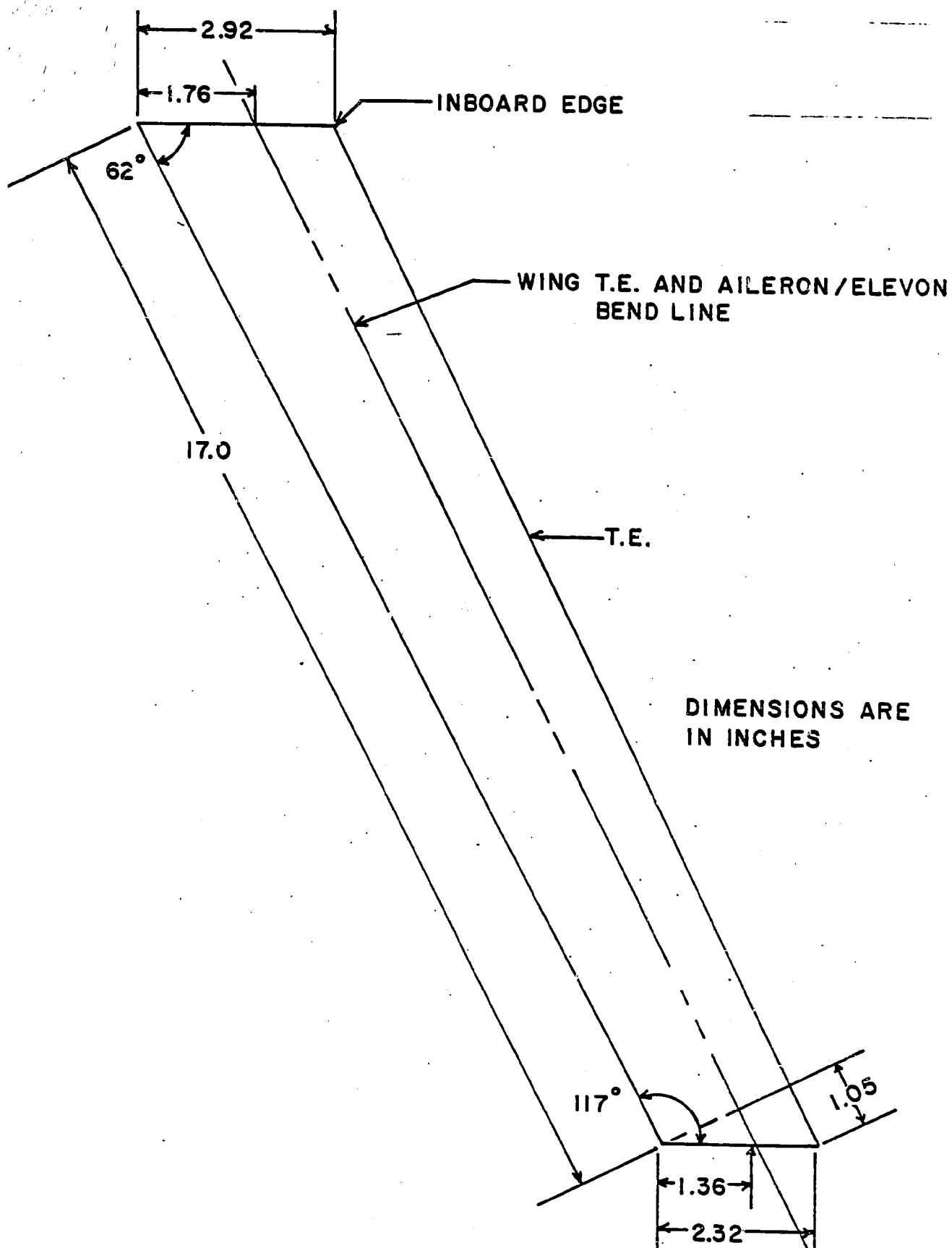
VERTICAL SECTION THROUGH 10-FT. WIND TUNNEL
2 PARAMETER 6 COMPONENT SUSPENSION SYSTEM
GUGGENHEIM AERONAUTICS LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY

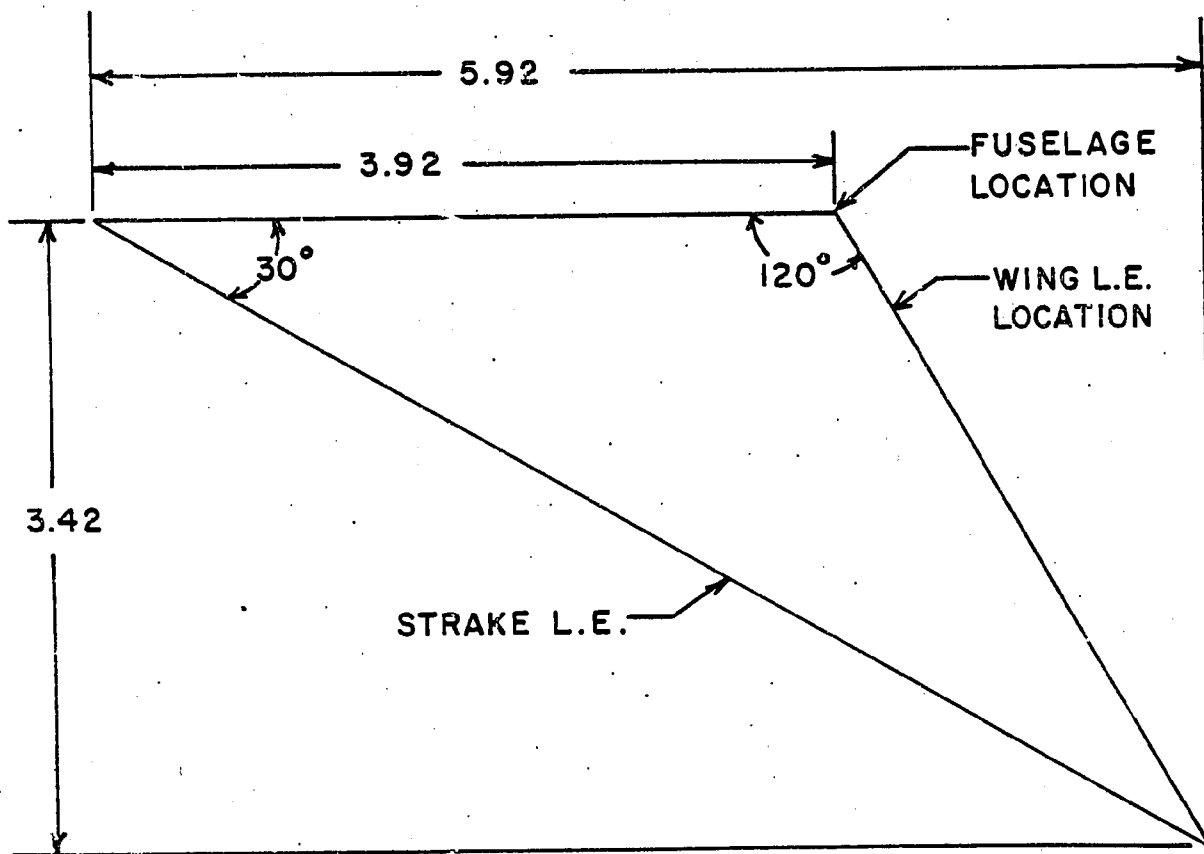




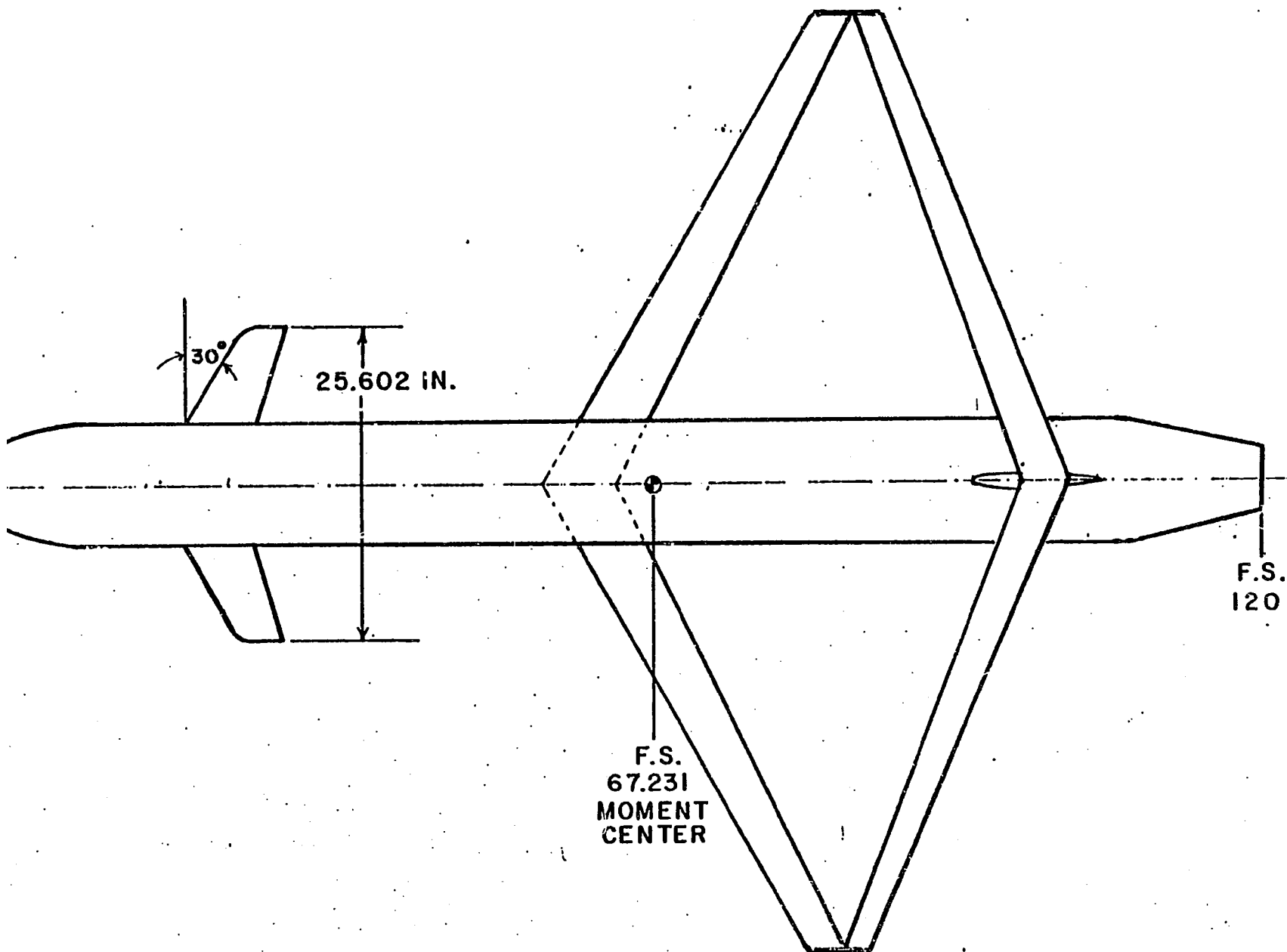
MODEL WITHOUT EXTENDED NOSE



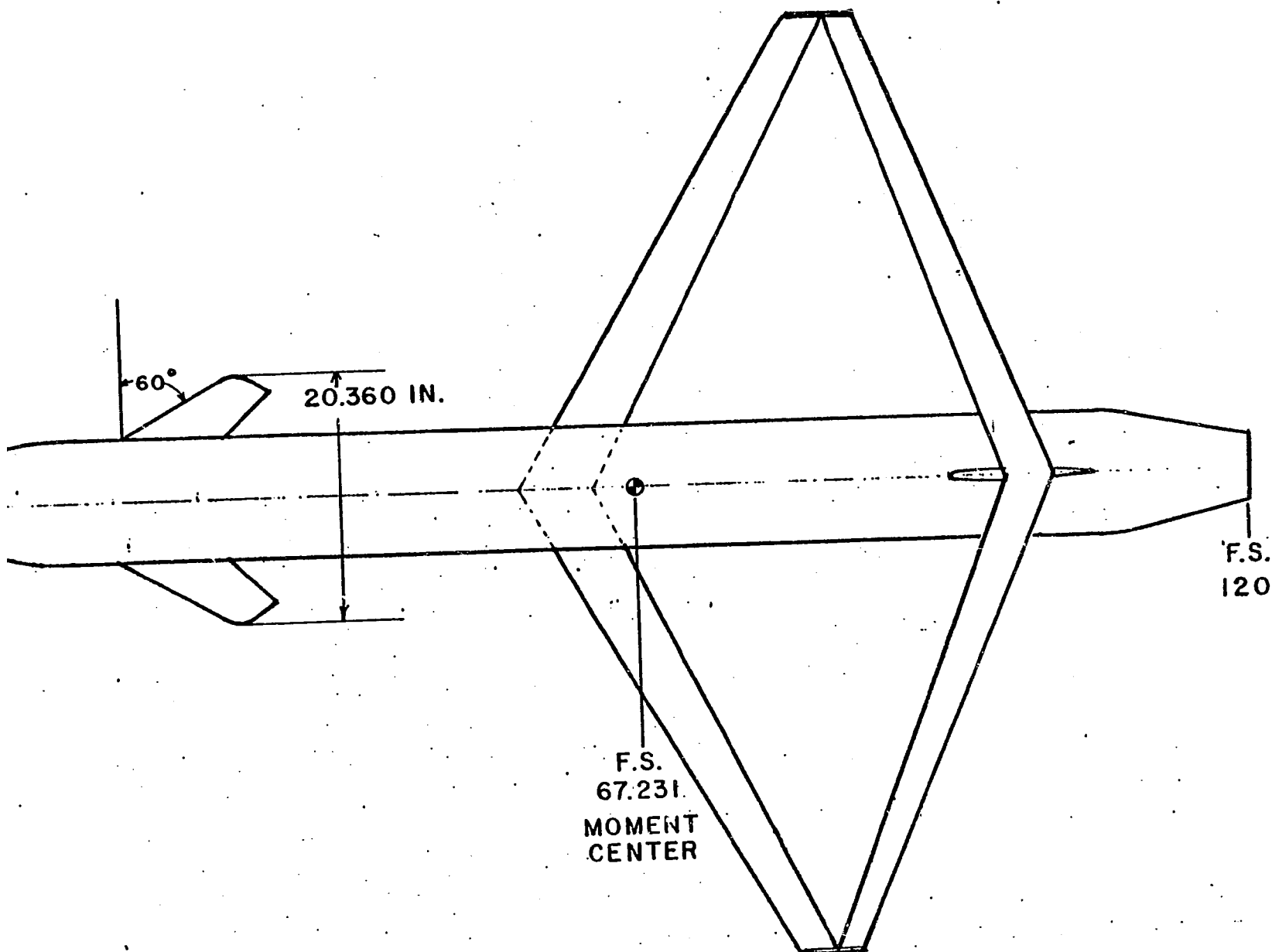




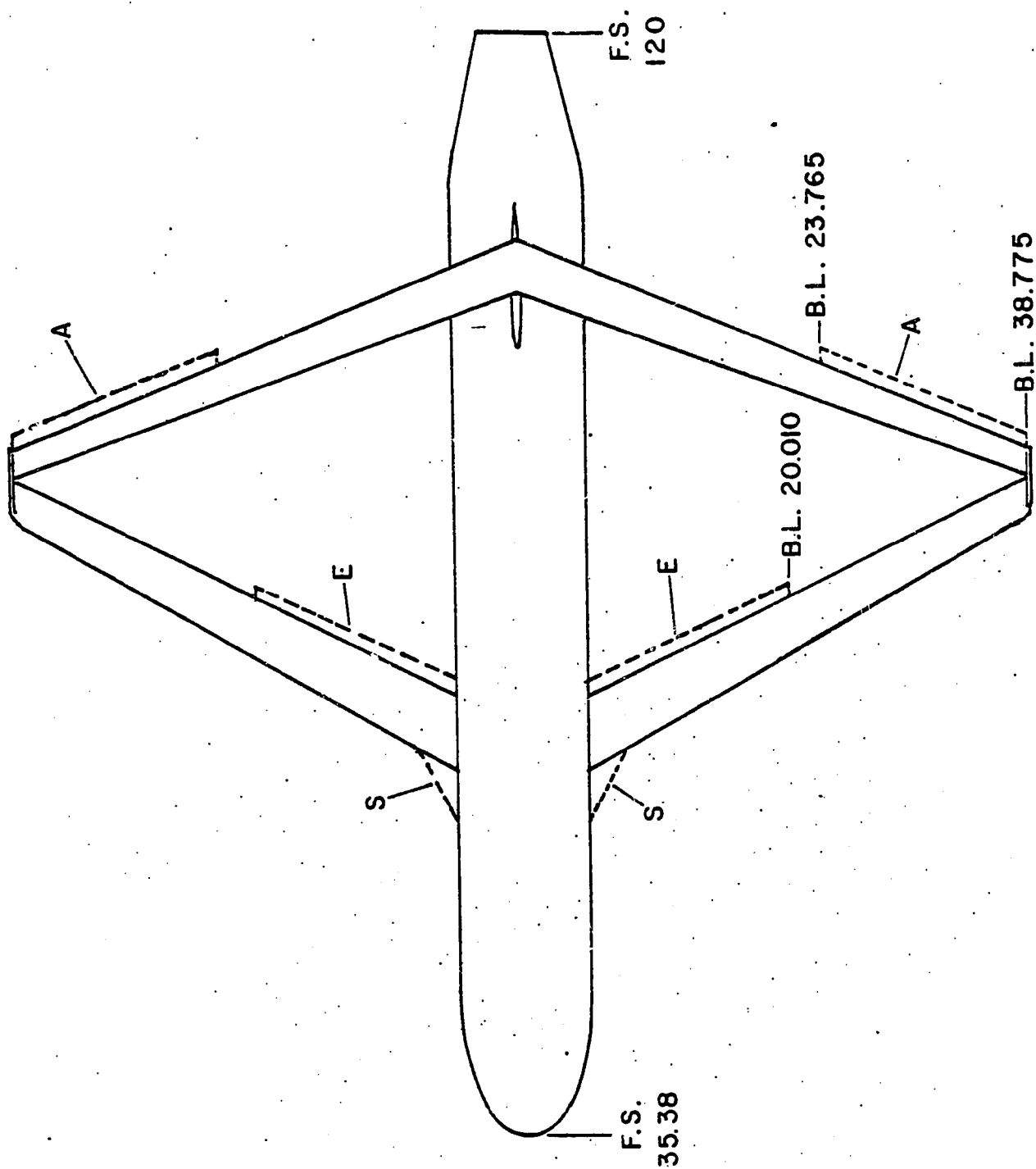
DIMENSIONS ARE IN INCHES



PLANVIEW SKETCH OF JOINED WING CONFIGURATION WITH
30° SWEEP CANARD



PLANVIEW SKETCH OF JOINED WING CONFIGURATION WITH 60 SWEPT CANARD

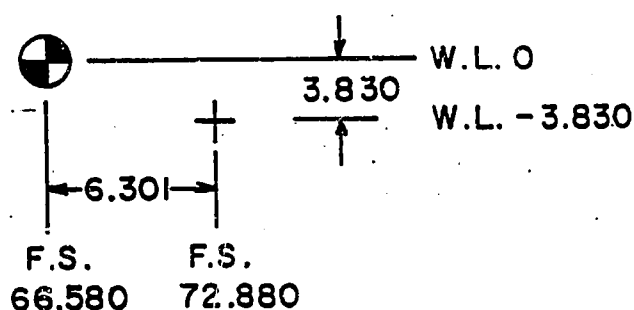


JOINED WING CONFIGURATION WITH STRAKES, ELEVONS & AILERONS

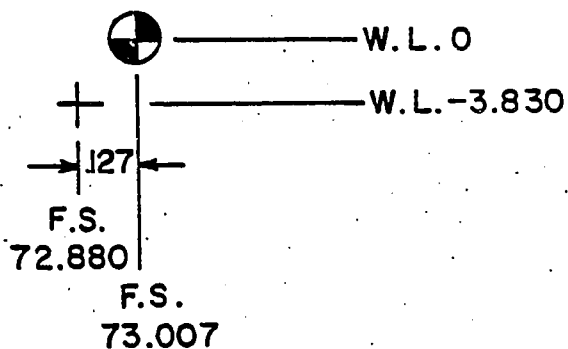


DIMENSIONS ARE
IN INCHES

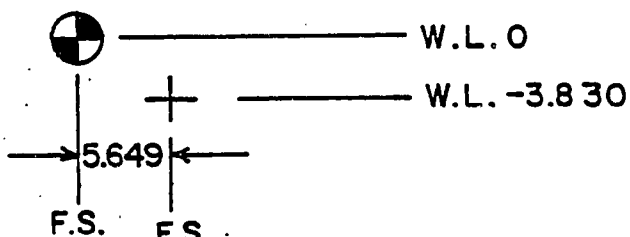
ALL CONVENTIONAL WING CONFIGURATIONS :



ALL JOINED WING CONFIGURATIONS WITHOUT CANARDS :

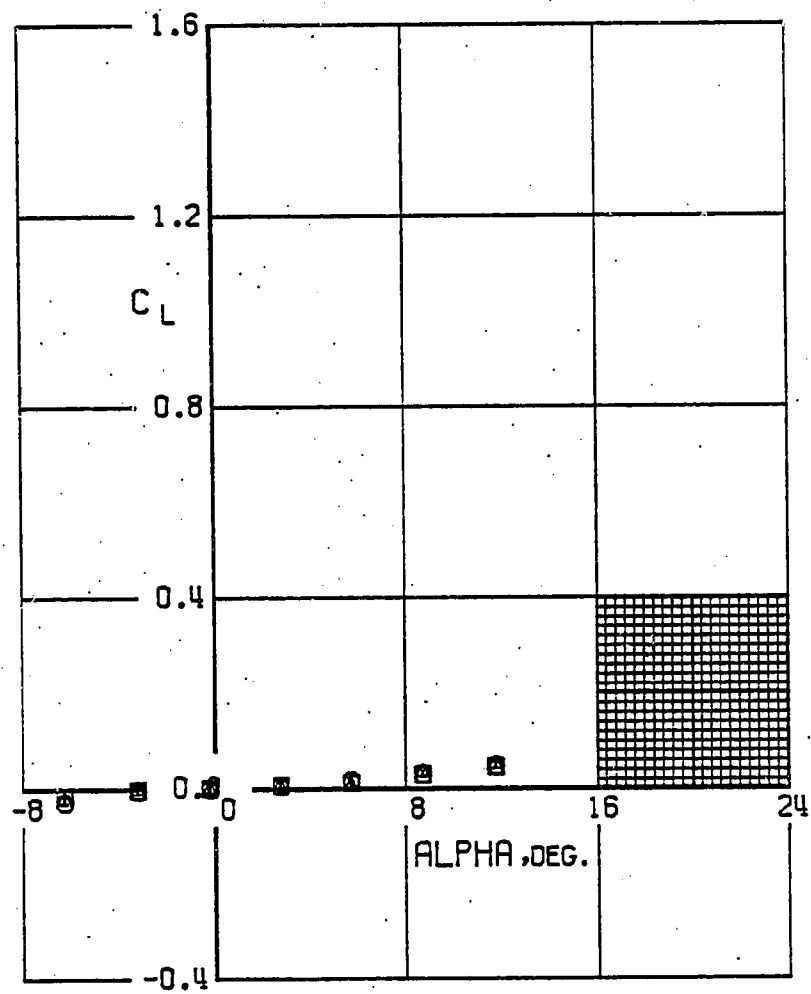


ALL JOINED WING CONFIGURATIONS WITH CANARDS :



$B+T_S$, BETA = 0 DEG.

- $Q = 3.75 \text{ LB/FT}^2$, RUN 15
- ▲ $Q = 7.50 \text{ LB/FT}^2$, RUN 14
- ◻ $Q = 15.00 \text{ LB/FT}^2$, RUN 16



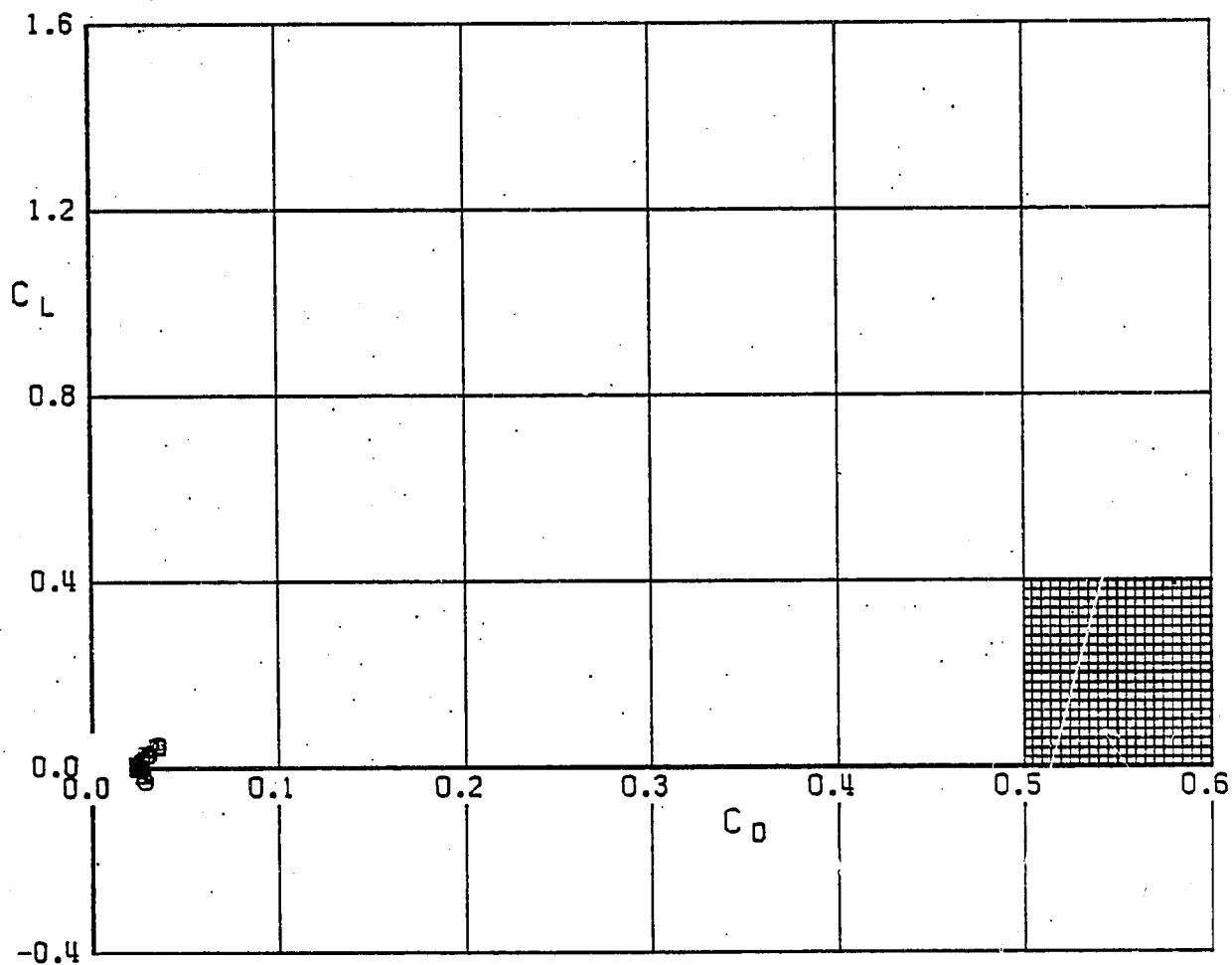
EFFECTS OF REYNOLDS NUMBER ON
THE BASIC BODY ALONE

$B+T_S$, BETA = 0 DEG.

○ $Q = 3.75 \text{ LB/FT}^2$, RUN 15

▲ $Q = 7.50 \text{ LB/FT}^2$, RUN 14

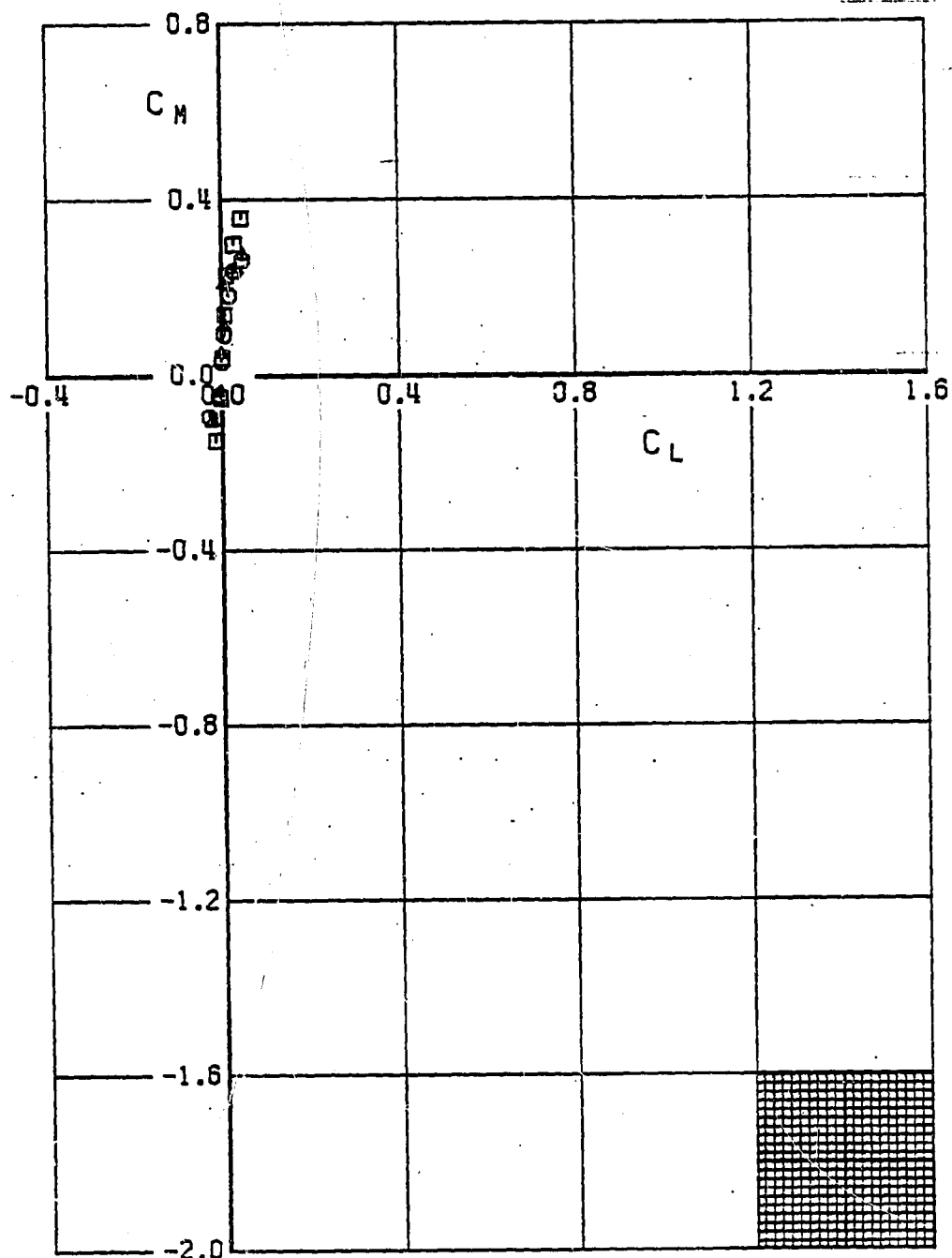
□ $Q = 15.00 \text{ LB/FT}^2$, RUN 16



EFFECTS OF REYNOLDS NUMBER ON
THE BASIC BODY ALONE

B+T_S, BETA = 0 DEG.

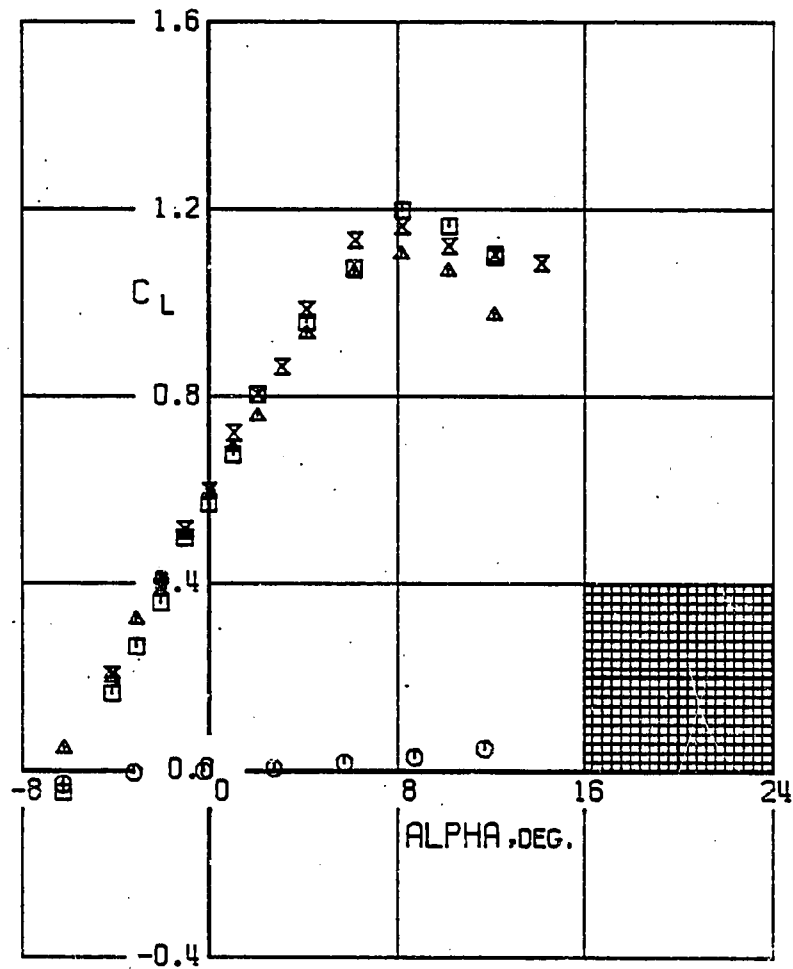
- Q = 3.75 LB/FT**2, RUN 15
- △ Q = 7.50 LB/FT**2, RUN 14
- Q = 15.00 LB/FT**2, RUN 16



EFFECTS OF REYNOLDS NUMBER ON

$Q = 3.75 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

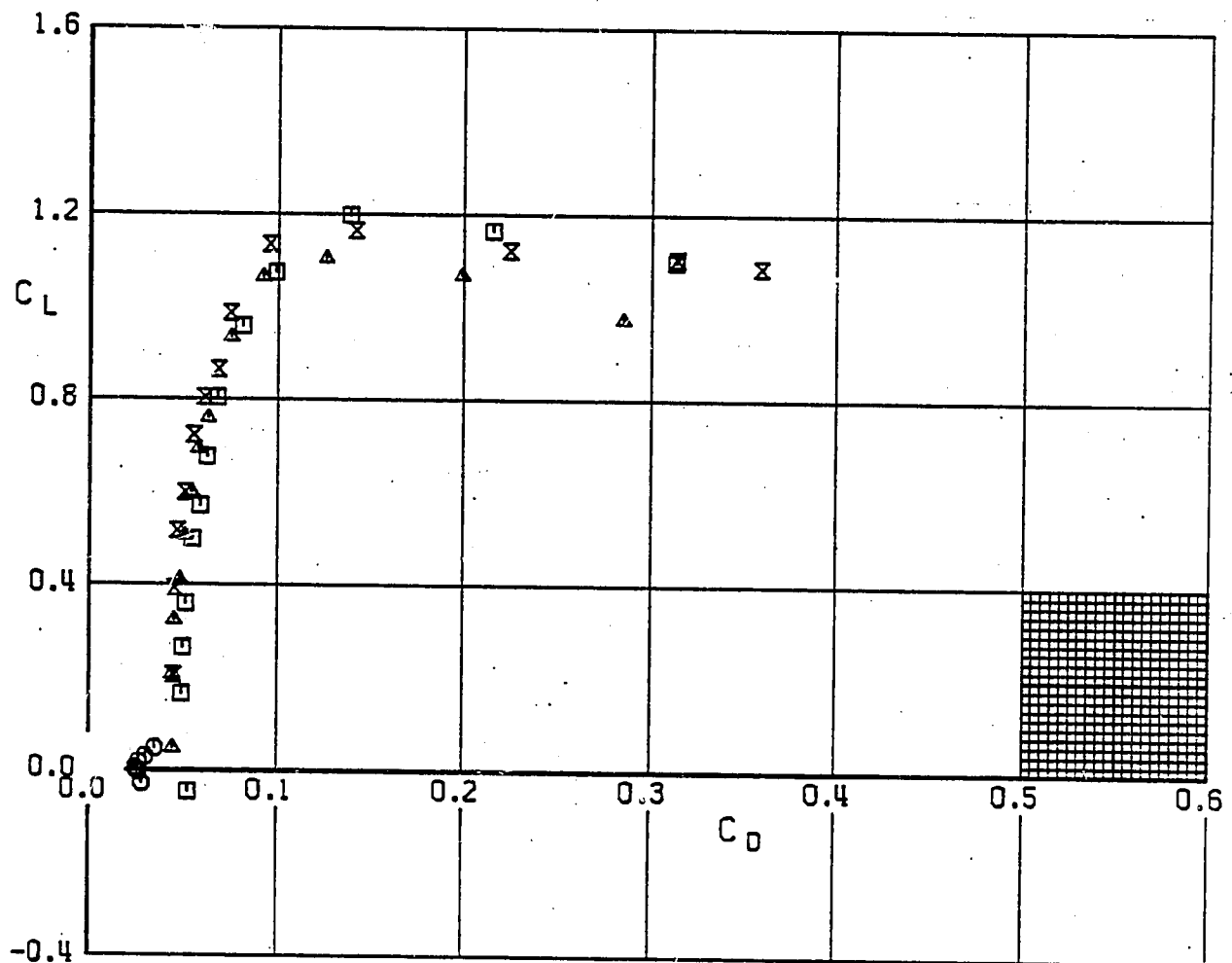
○ B +TS1 . RUN 15
 ▲ BW +TS . RUN 13
 □ BWHDV+TS , $I_H = 0 \text{ DEG.}$, RUN 2
 x BWHDV , $I_H = 0 \text{ DEG.}$, RUN 1



MODEL BUILD-UP AT $Q = 3.75 \text{ LB/FT}^2$
 AND EFFECTS OF TRANSITION STRIPS
 ON THE CONVENTIONAL CONFIGURATION

$Q = 3.75 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

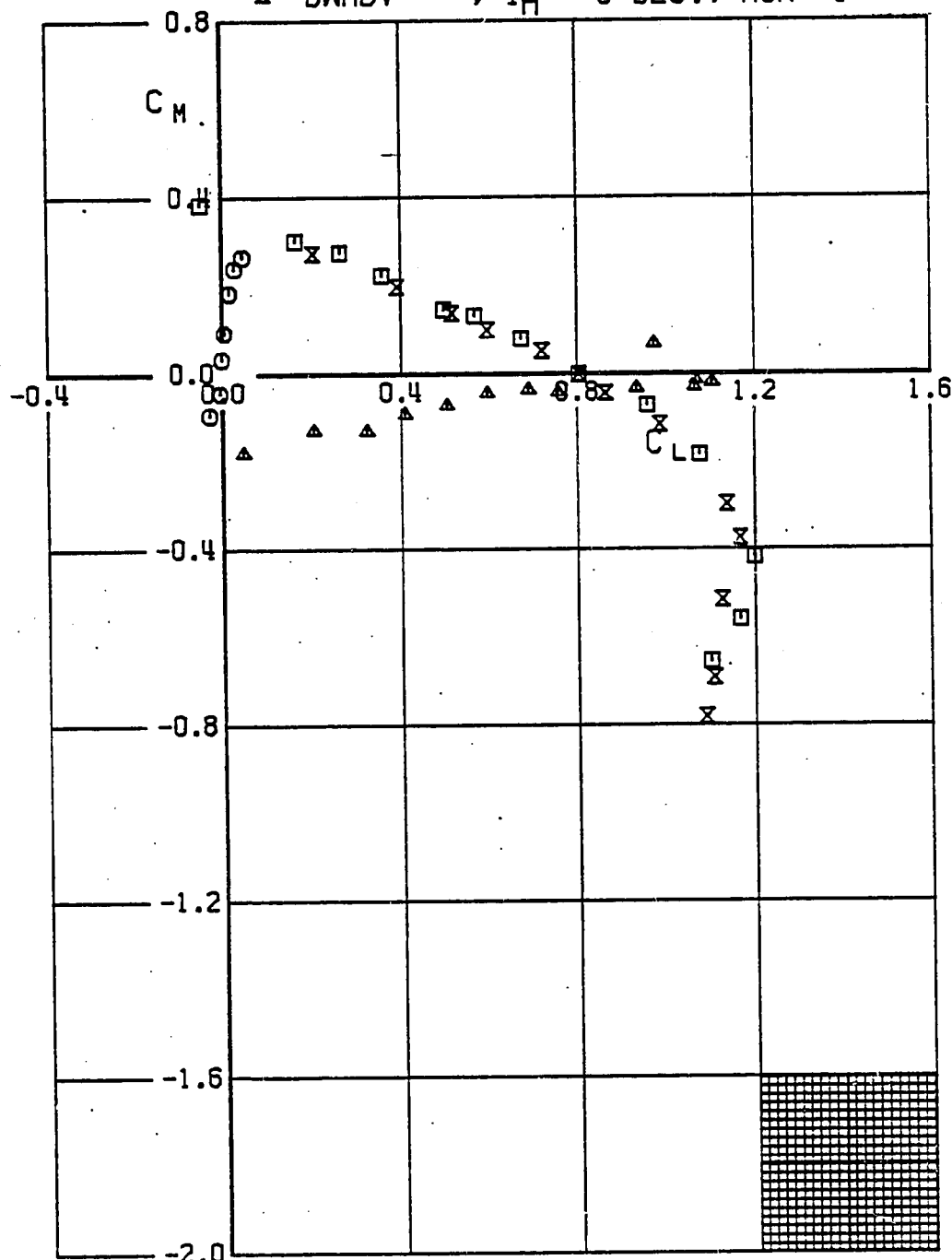
$\circ$ B + T_{S1} , RUN 15
 $\triangle$ BW + T_S , RUN 13
 $\square$ BWHDV + T_S , $I_H = 0 \text{ DEG.}$, RUN 2
 $\times$ BWHDV , $I_H = 0 \text{ DEG.}$, RUN 1



MODEL BUILD-UP AT $Q = 3.75 \text{ LB/FT}^2$
 AND EFFECTS OF TRANSITION STRIPS
 ON THE CONVENTIONAL CONFIGURATION

$Q = 3.75 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

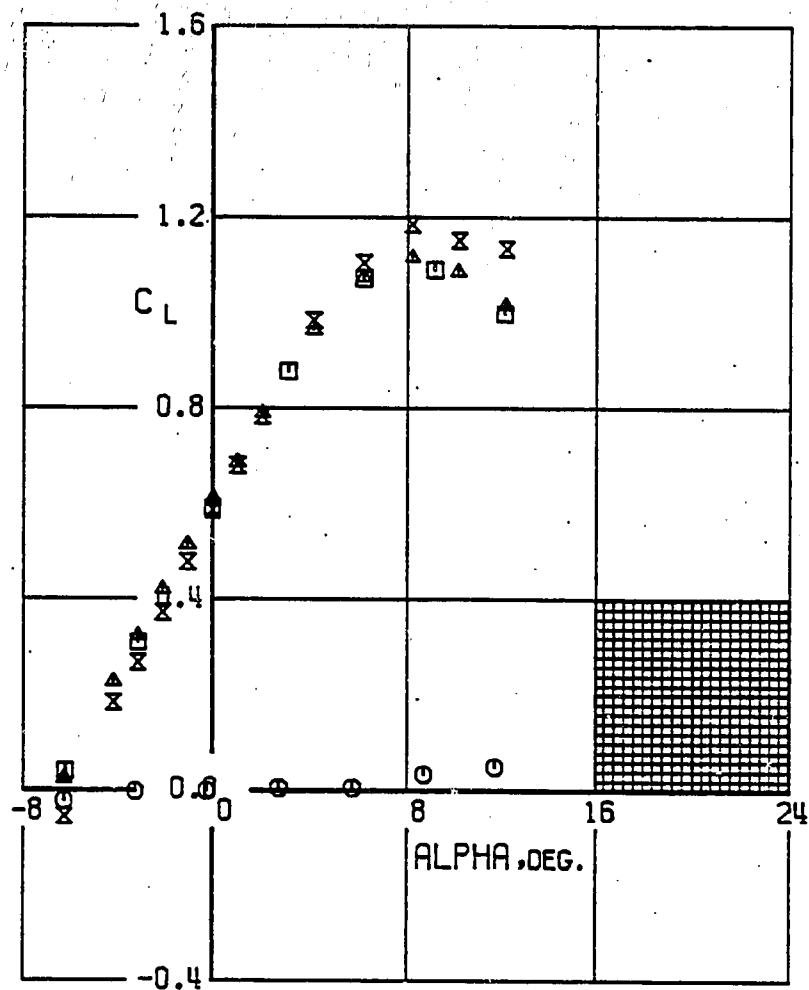
$\circ$ B + T_{S1} , RUN 15
 $\triangle$ BW + T_S , RUN 13
 $\square$ BWHDV + T_S , $I_H = 0 \text{ DEG.}$, RUN 2
 $\times$ BWHDV, $I_H = 0 \text{ DEG.}$, RUN 1



MODEL BUILD-UP AT $Q = 3.75 \text{ LB/FT}^2$
AND EFFECTS OF TRANSITION STRIPS

$Q = 7.5 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

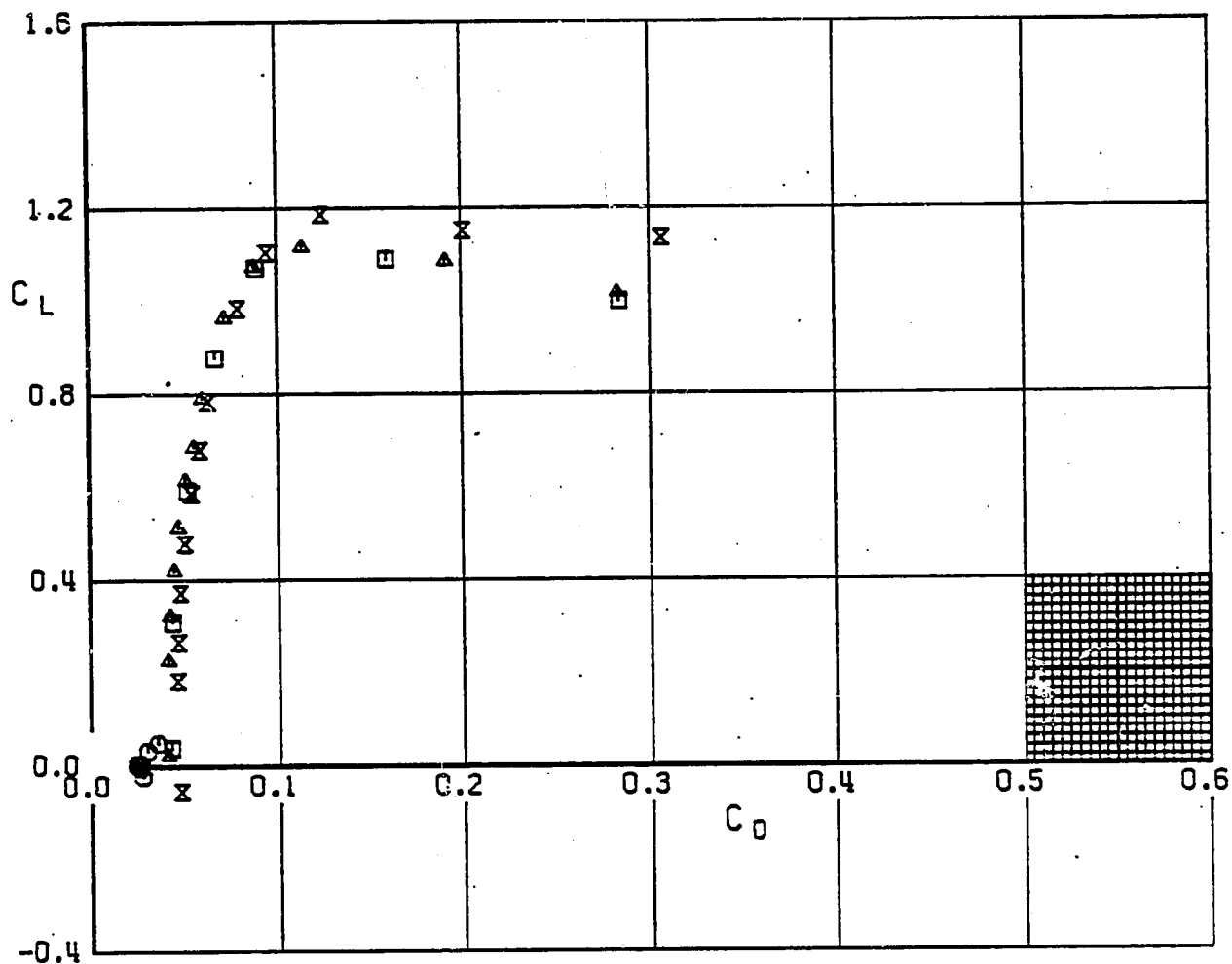
○ B + T_S , RUN 14
 ▲ BW + T_S , RUN 12
 □ BWDV + T_S , RUN 11
 x BWDV+ T_S , $I_H = 0 \text{ DEG.}$, RUN 3



MODEL BUILD-UP AT $Q = 7.5 \text{ LB/FT}^2$
 FOR THE CONVENTIONAL CONFIGURATION

$Q = 7.5 \text{ LB/FT}^{**2}$, $BETA = 0 \text{ DEG.}$

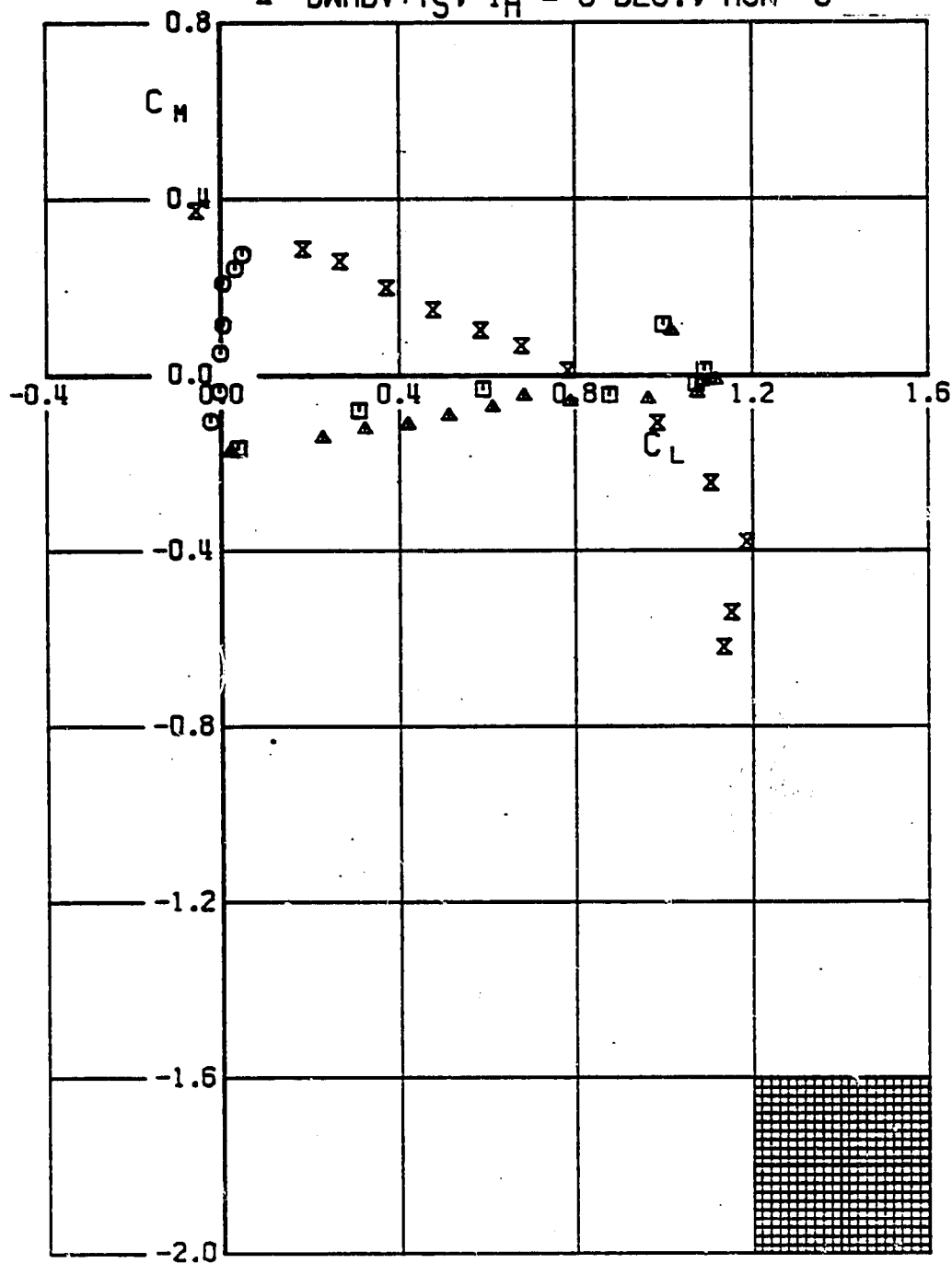
○ B + T_S , RUN 14
△ BW + T_S , RUN 12
□ BWDV + T_S , RUN 11
x BWHDV+ T_S , $I_H = 0 \text{ DEG.}$, RUN 3



MODEL BUILD-UP AT $Q = 7.5 \text{ LB/FT}^{**2}$
FOR THE CONVENTIONAL CONFIGURATION

$Q = 7.5 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

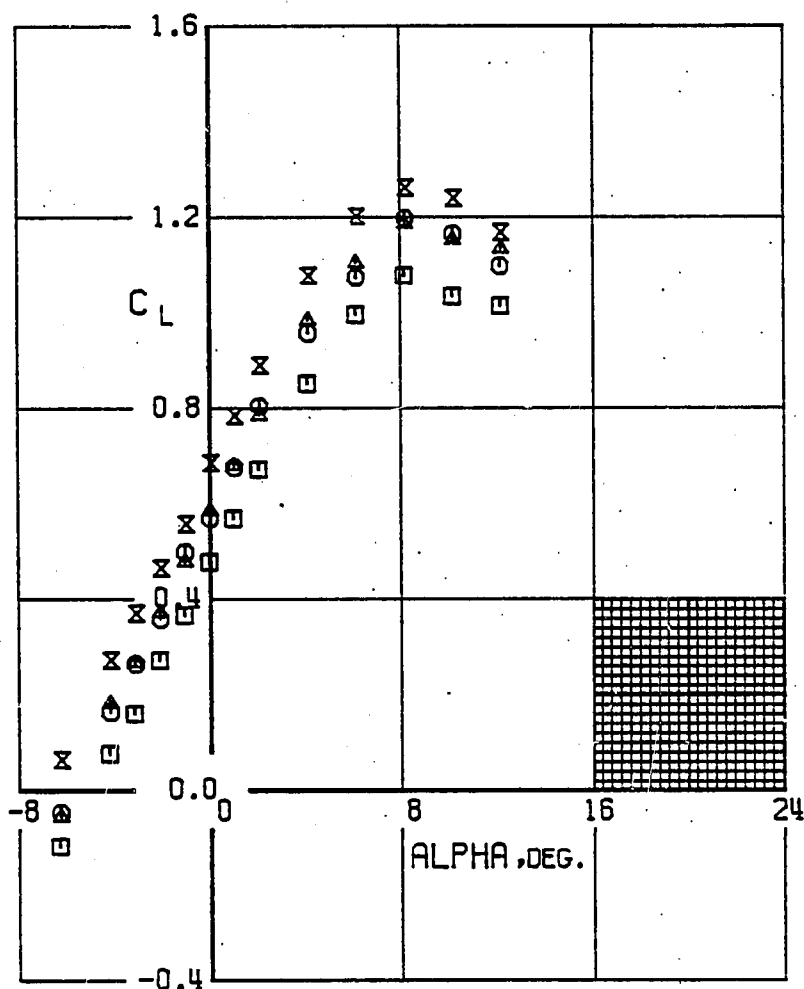
$\circ$ B $+T_S$, RUN 14
 $\triangle$ BW $+T_S$, RUN 12
 $\square$ BWDV $+T_S$, RUN 11
 $\times$ BWHDV $+T_S$, $I_H = 0 \text{ DEG.}$, RUN 3



MODEL BUILD-UP AT $Q = 7.5 \text{ LB/FT}^2$

BWHDV+T_S, BETA = 0 DEG.

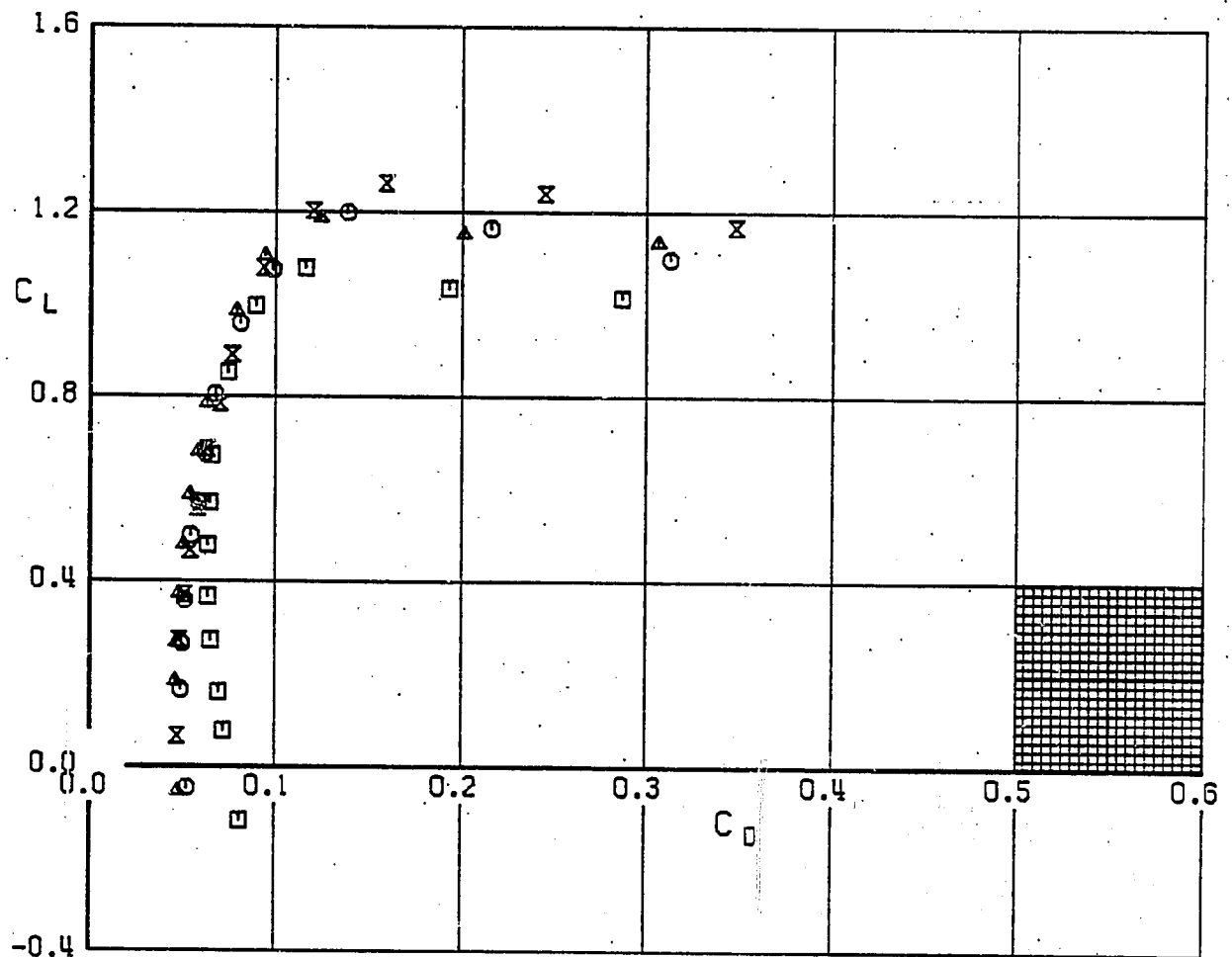
- Q = 3.75 LB/FT**2, I_H = 0 DEG., RUN 2
- △ Q = 7.5 LB/FT**2, I_H = 0 DEG., RUN 3
- Q = 7.5 LB/FT**2, I_H = -10 DEG., RUN 7
- × Q = 7.5 LB/FT**2, I_H = 10 DEG., RUN 6



EFFECTS OF REYNOLDS NUMBER AND
HORIZONTAL STABILIZER INCIDENCE ANGLE
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, BETA = 0 DEG.

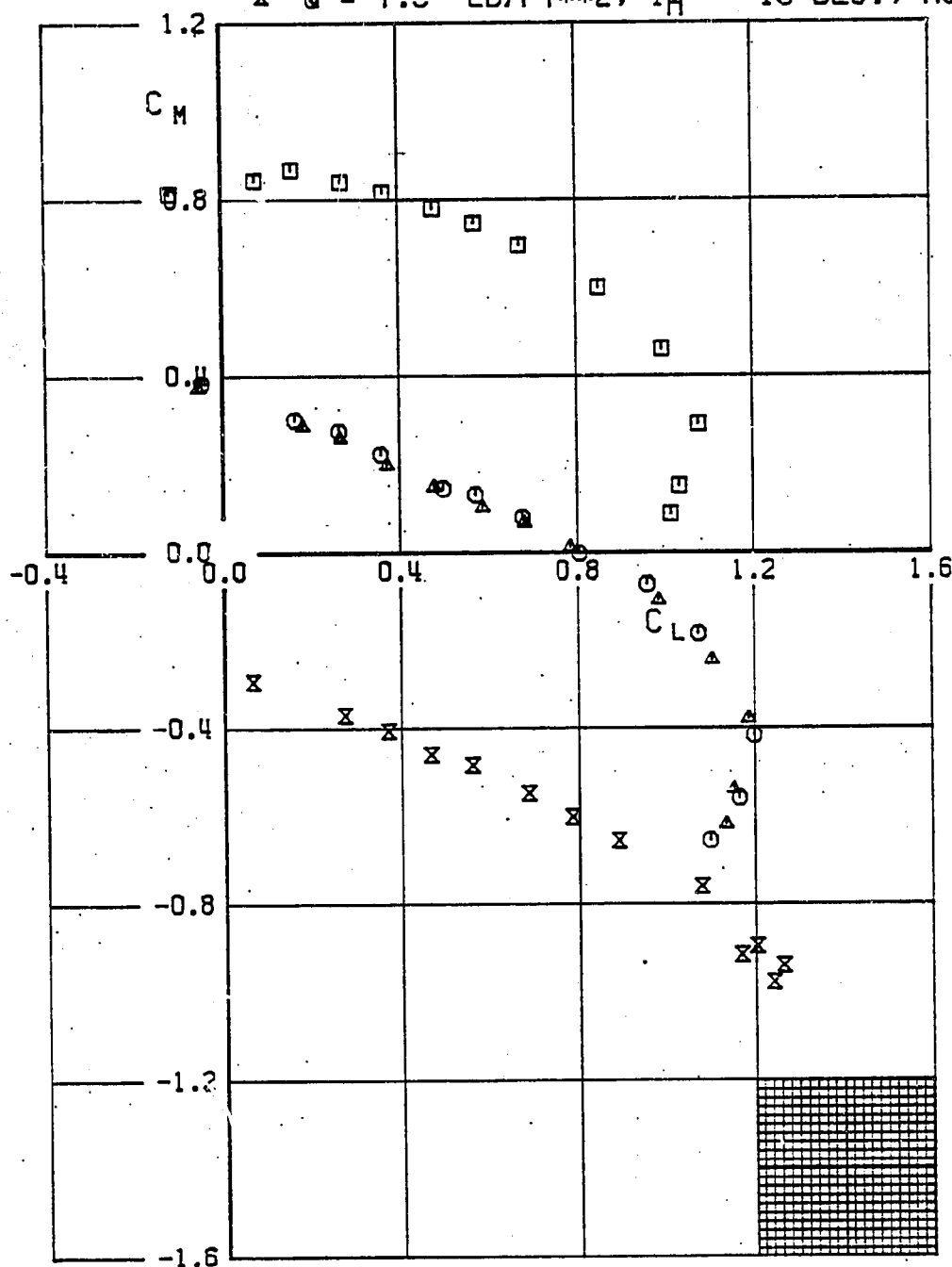
- Q = 3.75 LB/FT**2, I_H = 0 DEG., RUN 2
- ▲ Q = 7.5 LB/FT**2, I_H = 0 DEG., RUN 3
- Q = 7.5 LB/FT**2, I_H = -10 DEG., RUN 7
- × Q = 7.5 LB/FT**2, I_H = 10 DEG., RUN 6



EFFECTS OF REYNOLDS NUMBER AND
HORIZONTAL STABILIZER INCIDENCE ANGLE
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, BETA = 0 DEG.

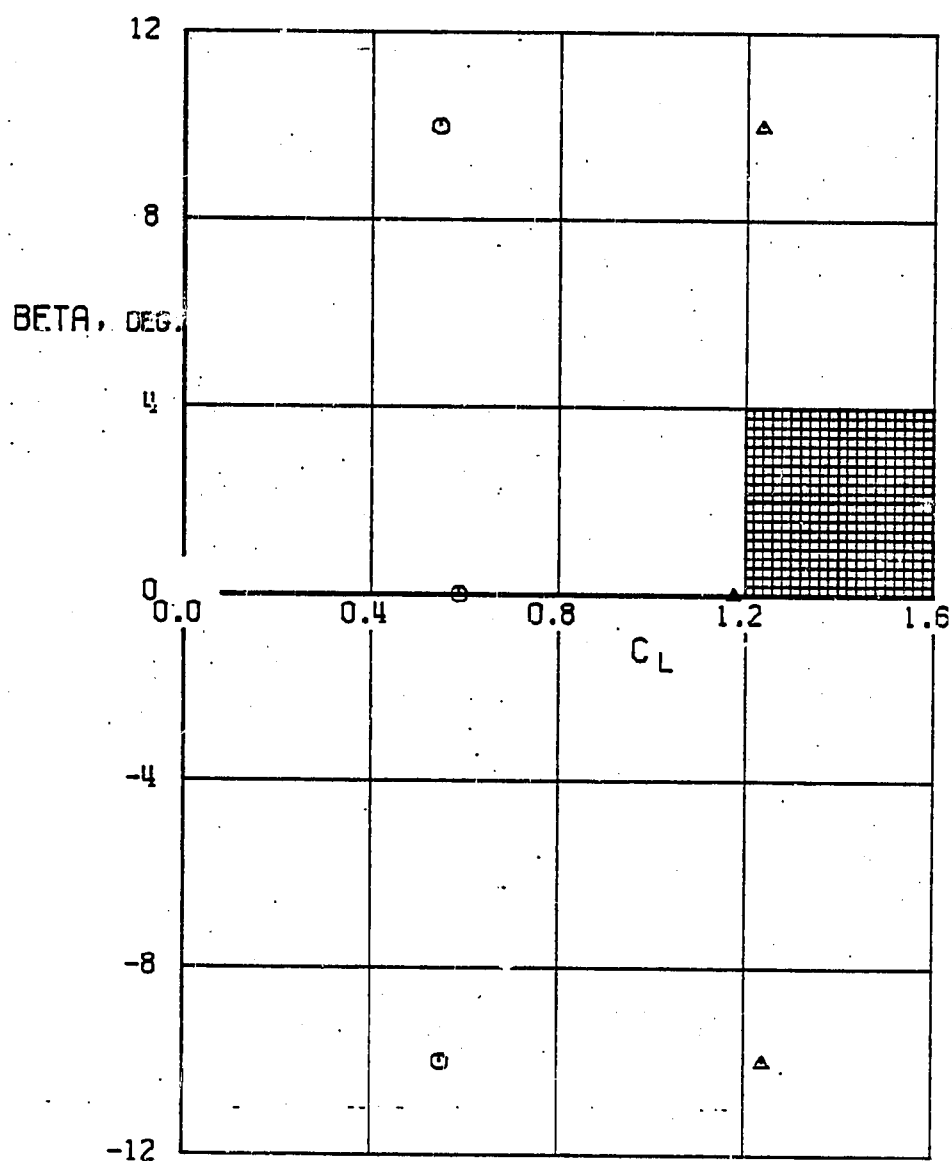
- Q = 3.75 LB/FT**2, I_H = 0 DEG., RUN 2
- ▲ Q = 7.5 LB/FT**2, I_H = 0 DEG., RUN 3
- Q = 7.5 LB/FT**2, I_H = -10 DEG., RUN 7
- × Q = 7.5 LB/FT**2, I_H = 10 DEG., RUN 6



BWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = - 0.03 DEG., RUN 4

▲ ALPHA = 10.26 DEG., RUN 5

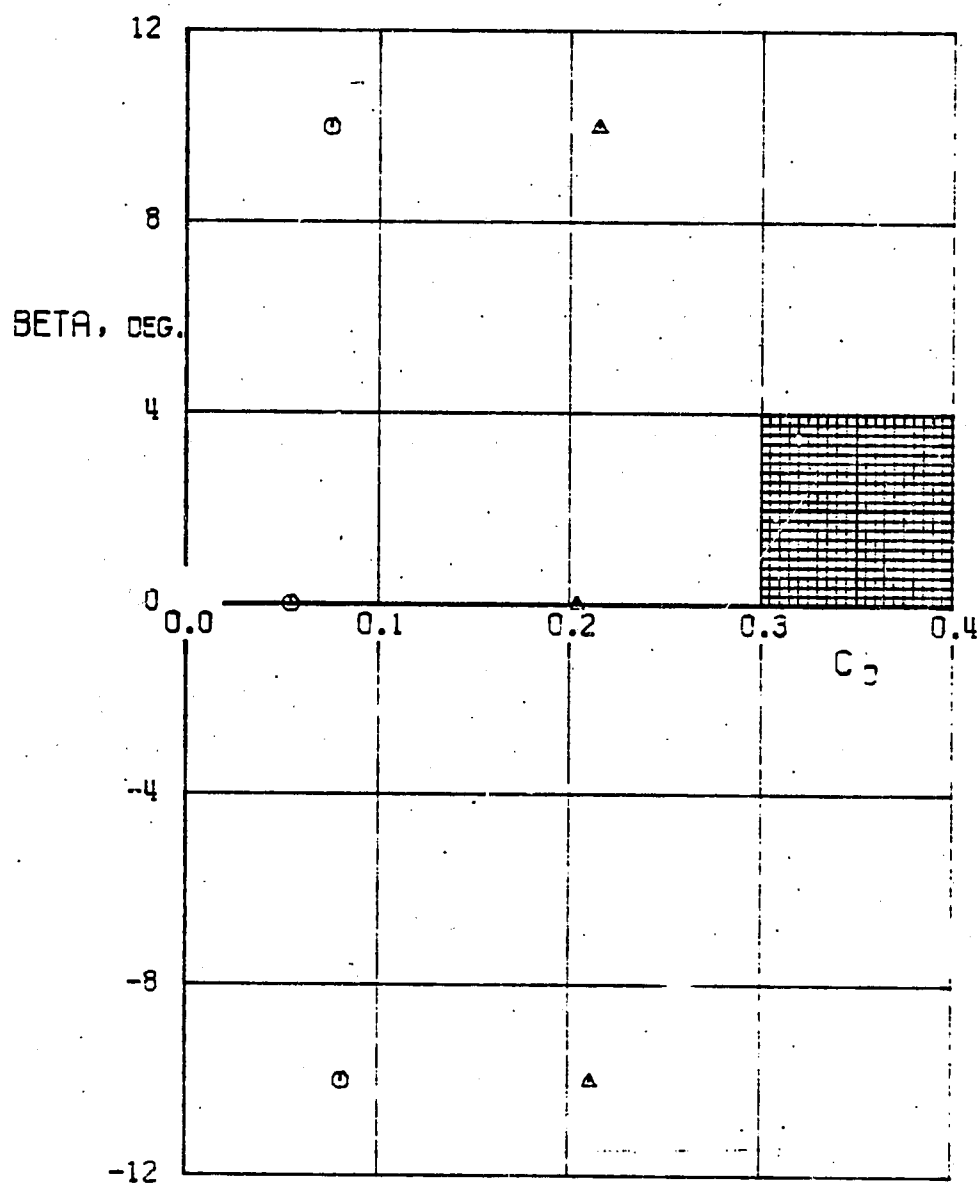


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

⊙ ALPHA = - 0.03 DEG., RUN 4

▲ ALPHA = 10.26 DEG., RUN 5

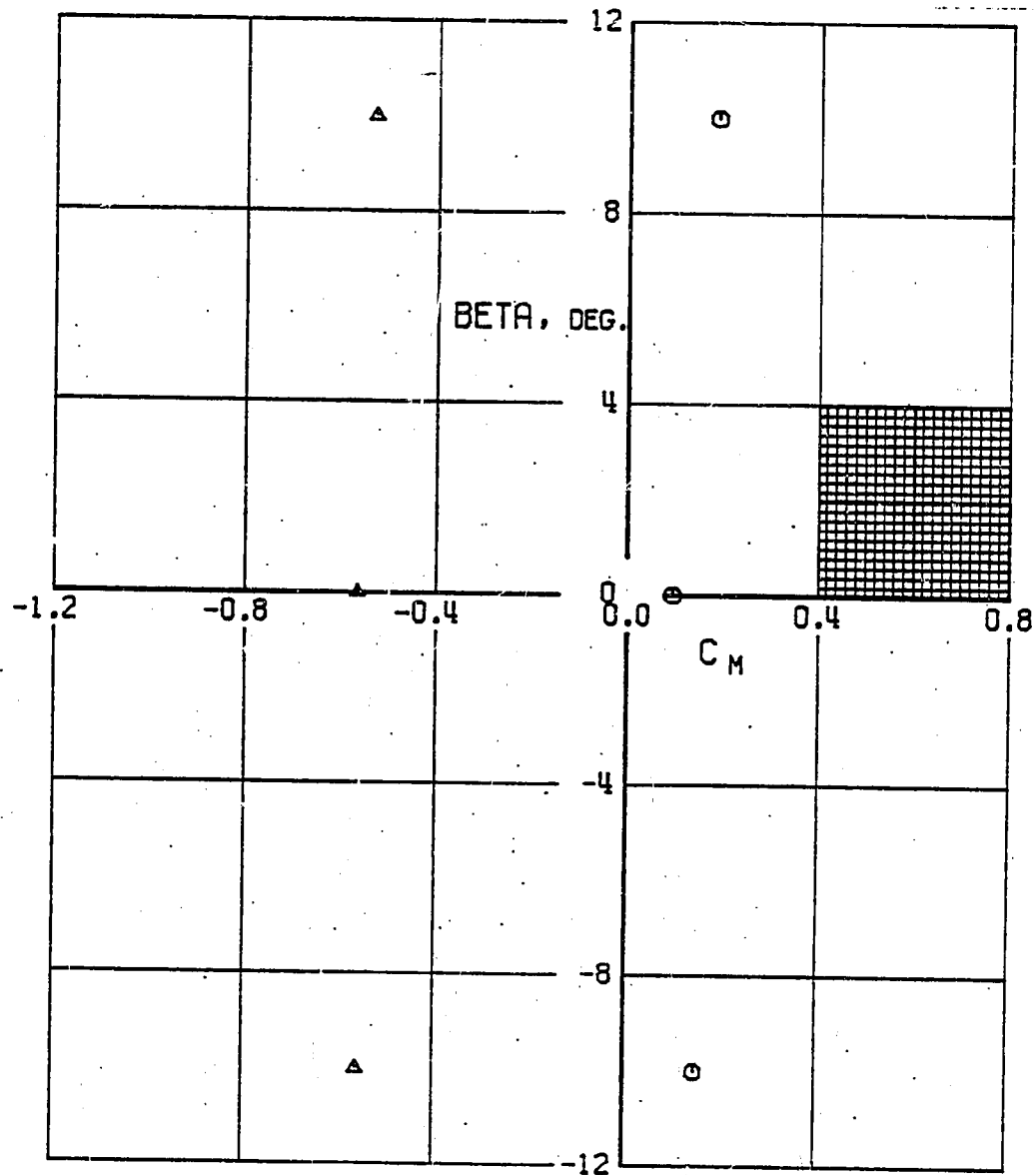


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = - 0.03 DEG., RUN 4

▲ ALPHA = 10.26 DEG., RUN 5

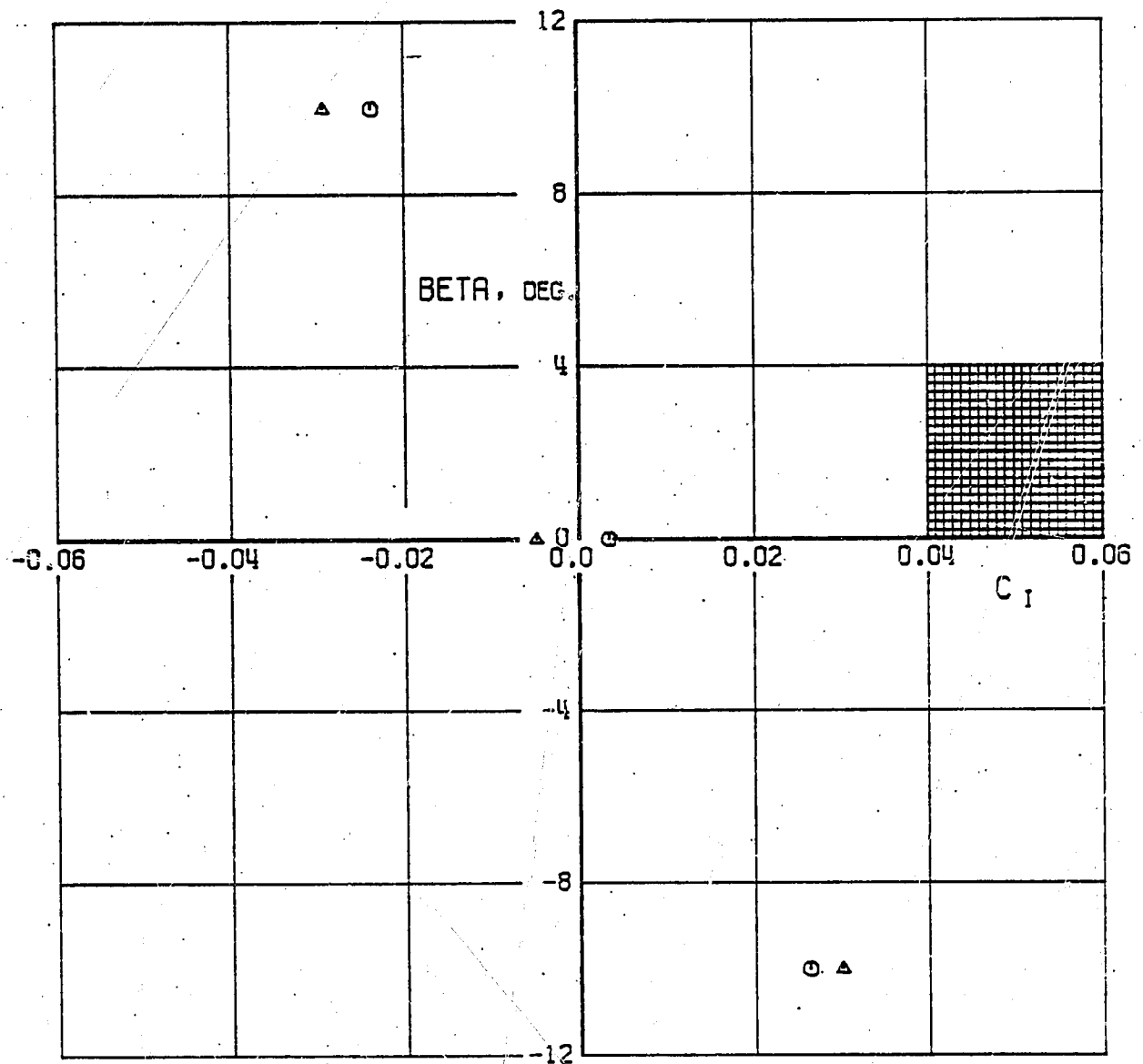


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = - 0.03 DEG., RUN 4

▲ ALPHA = 10.26 DEG., RUN 5

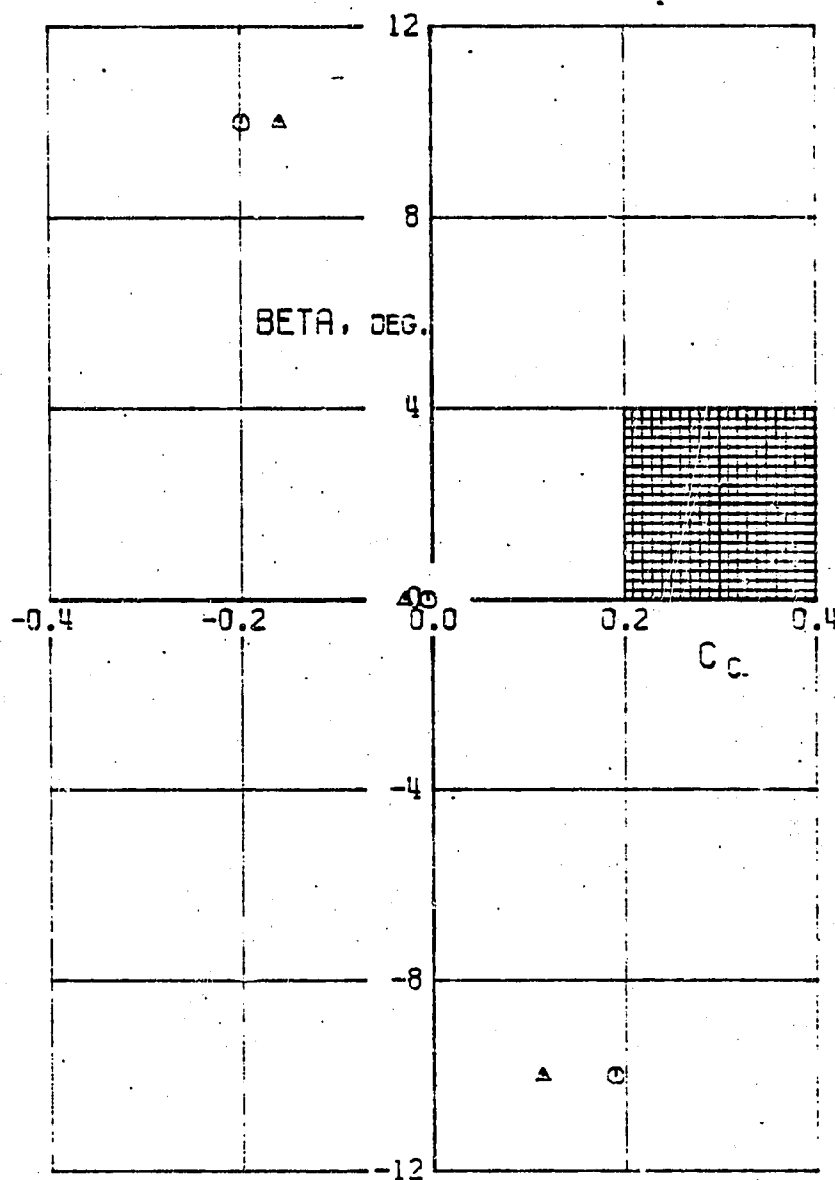


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = - 0.03 DEG., RUN 4

▲ ALPHA = 10.26 DEG., RUN 5

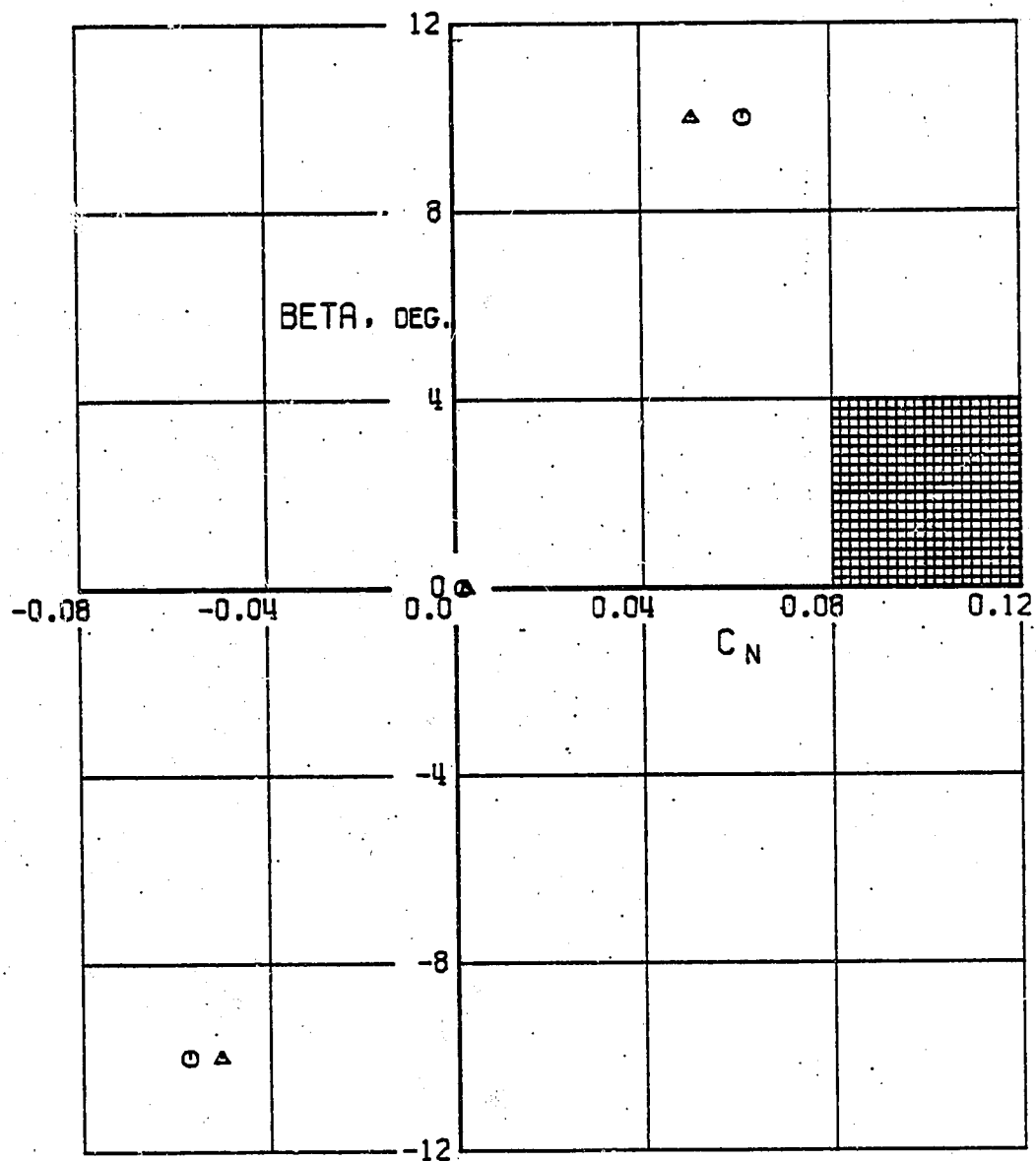


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION

BWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = - 0.03 DEG., RUN 4

▲ ALPHA = 10.26 DEG., RUN 5

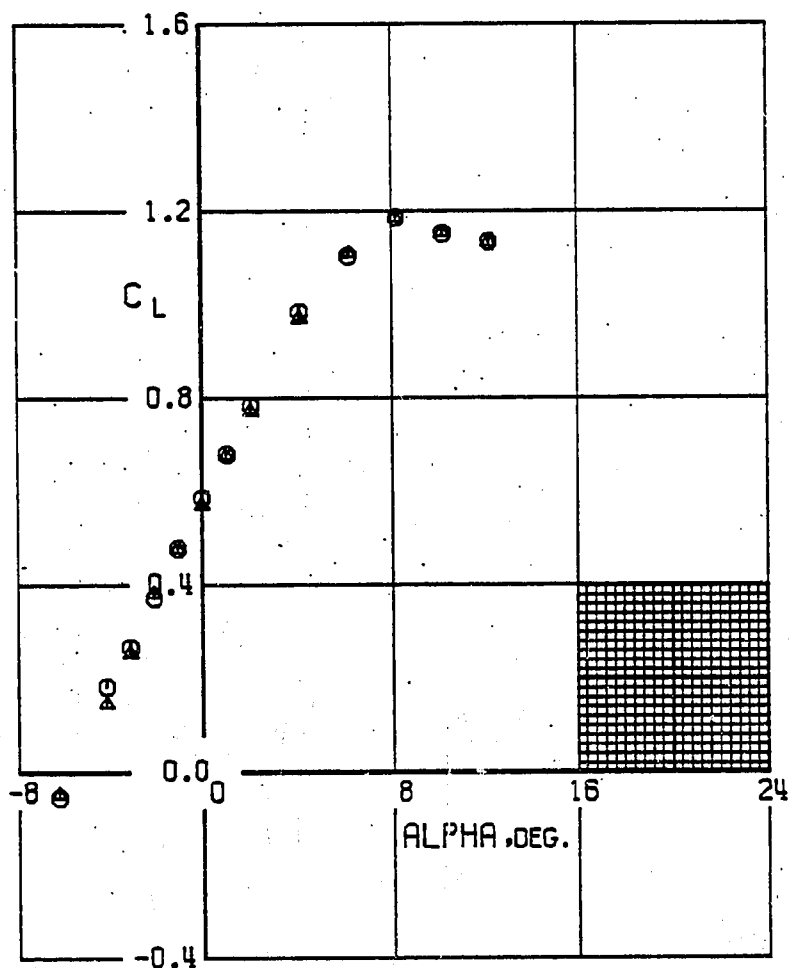


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION

$I_H = 0 \text{ DEG.}$, $Q = 7.5 \text{ LB/FT**2}$, $BETA = 0 \text{ DEG.}$

○ BWHOV + T_S , RUN 3

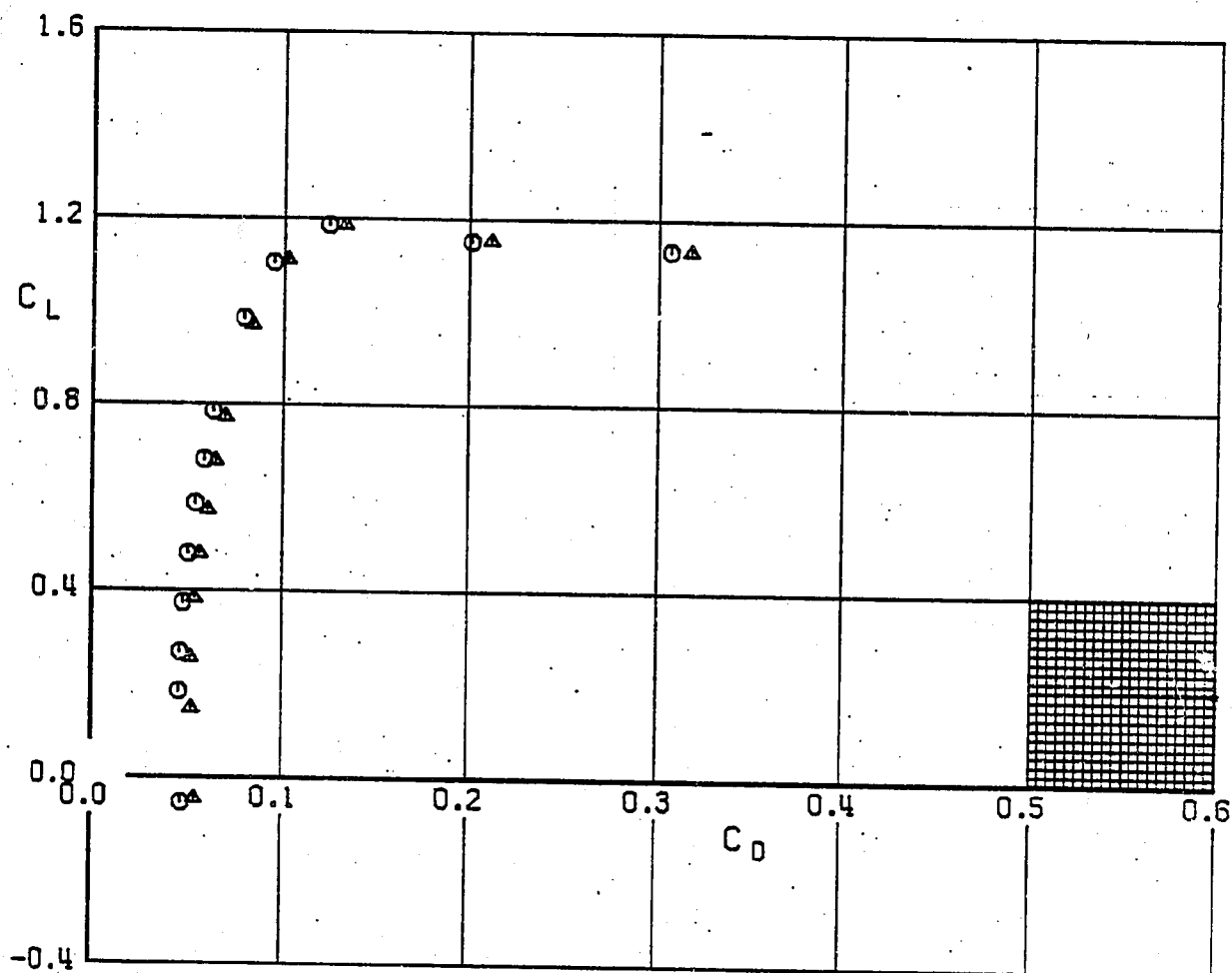
▲ BNWHDV + T_S , RUN 8



EFFECTS OF EXTENDED NOSE
ON THE CONVENTIONAL CONFIGURATION

$I_H = 0 \text{ DEG.}$, $Q = 7.5 \text{ LB/FT**2}$, $BETA = 0 \text{ DEG.}$

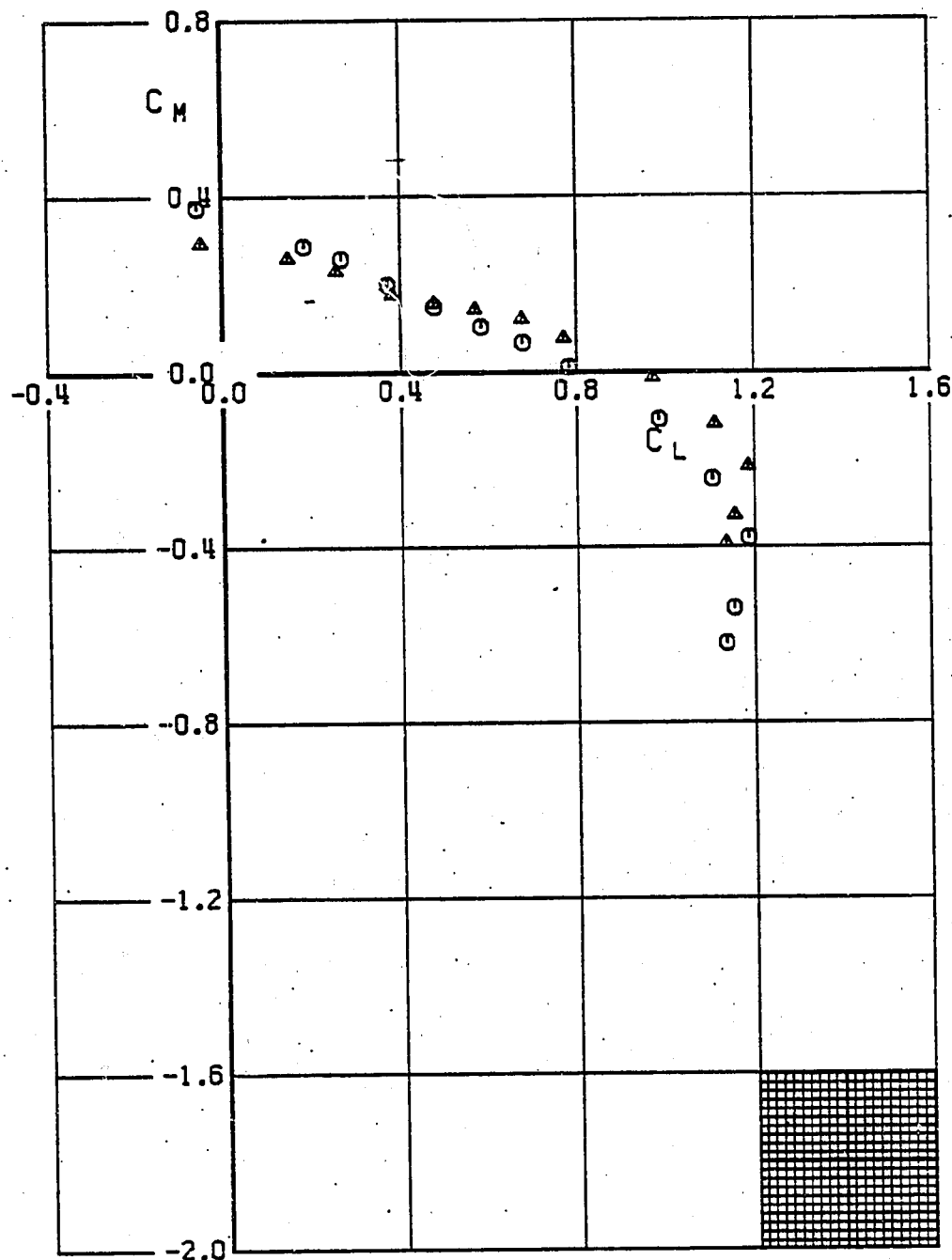
○ BWHDV + T_S , RUN 3
▲ BNWHDV + T_S , RUN 8



EFFECTS OF EXTENDED NOSE
ON THE CONVENTIONAL CONFIGURATION

$I_H = 0 \text{ DEG.}$, $Q = 7.5 \text{ LB/FT**2}$, $BETA = 0 \text{ DEG.}$

- BWHDV + T_S , RUN 3
- ▲ BNWHDV + T_S , RUN 8

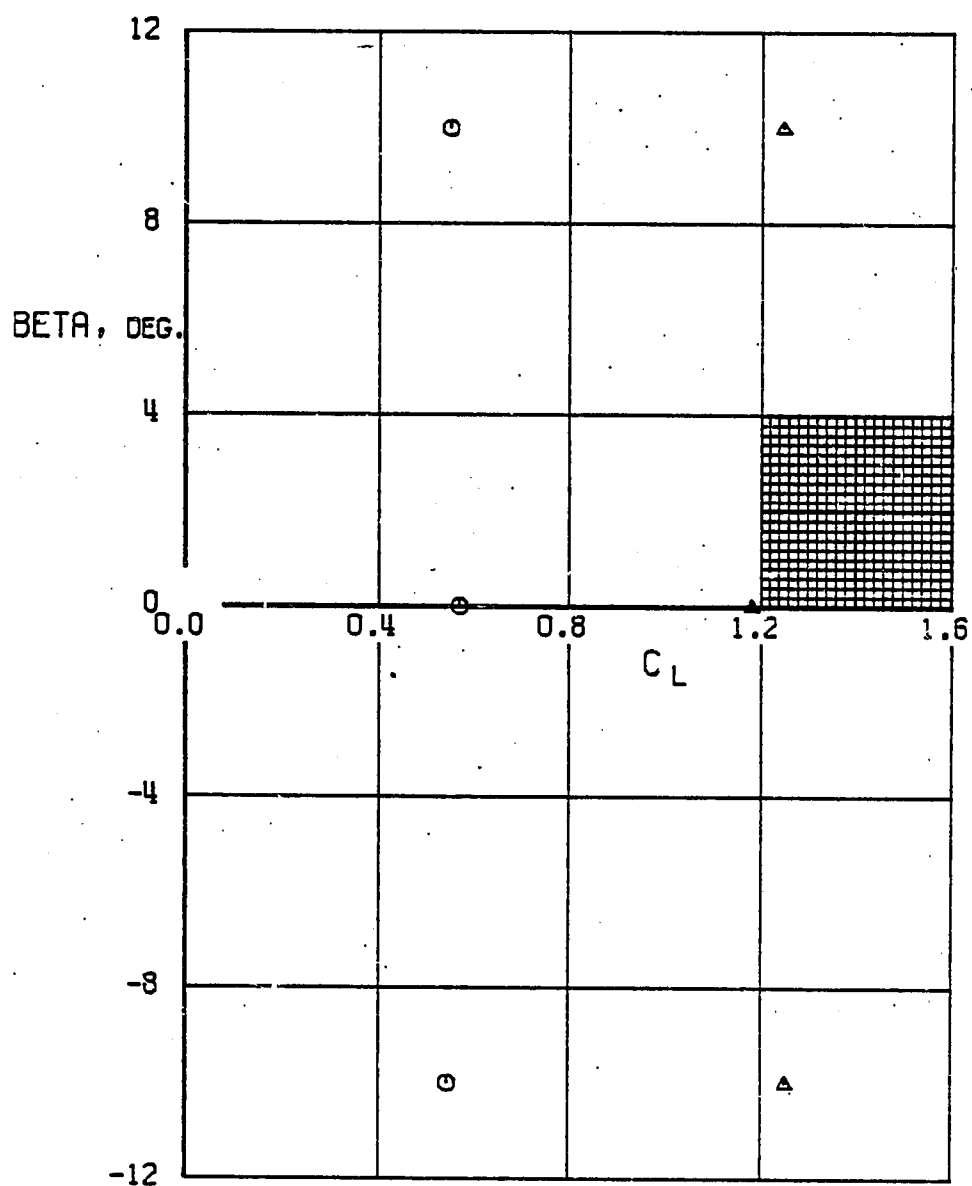


EFFECTS OF EXTENDED NOSE
ON THE CONVENTIONAL CONFIGURATION

BNWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

⊖ ALPHA = -0.02 DEG., RUN 9

▲ ALPHA = 10.26 DEG., RUN 10

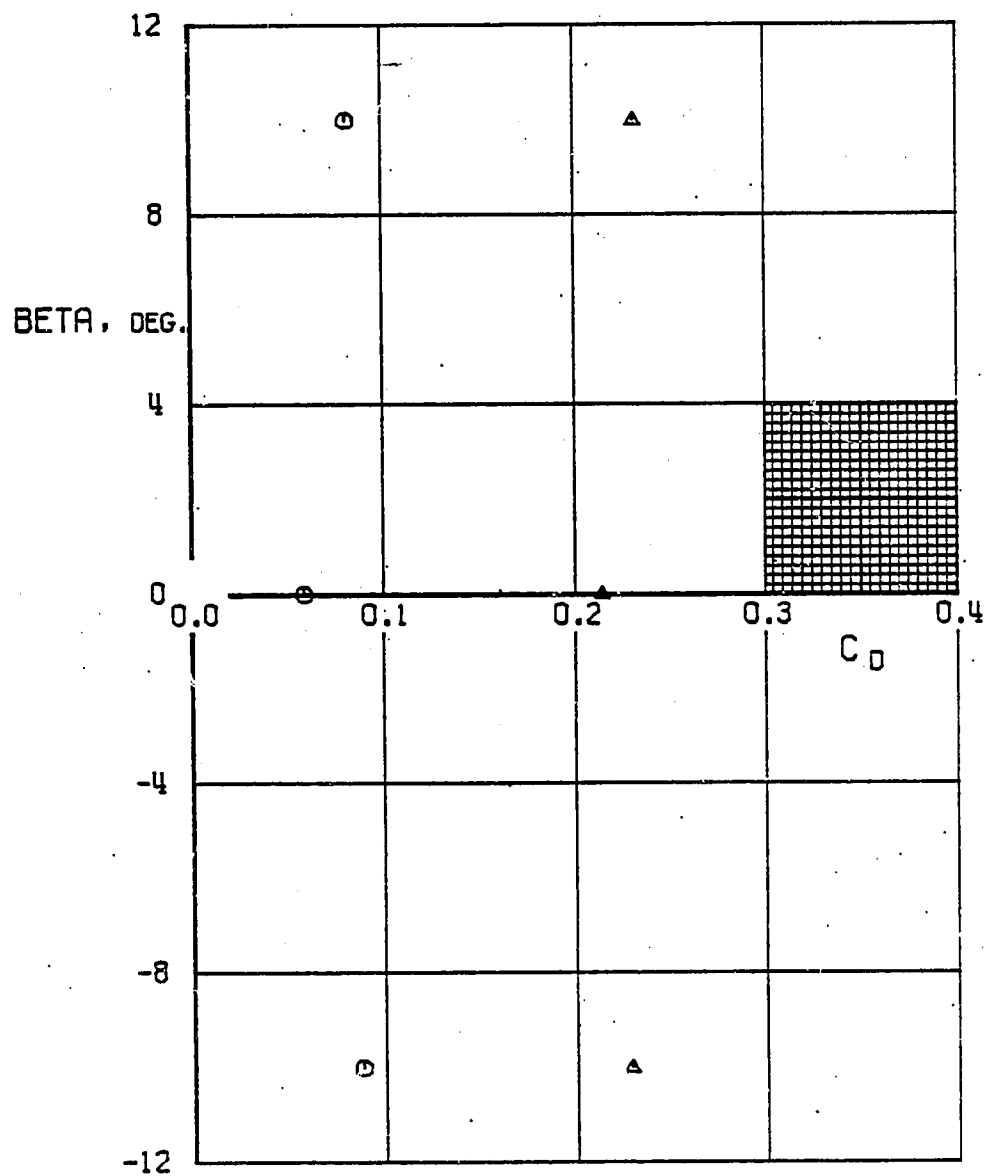


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION
WITH AN EXTENDED NOSE

BNWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = -0.02 DEG., RUN 9

▲ ALPHA = 10.26 DEG., RUN 10

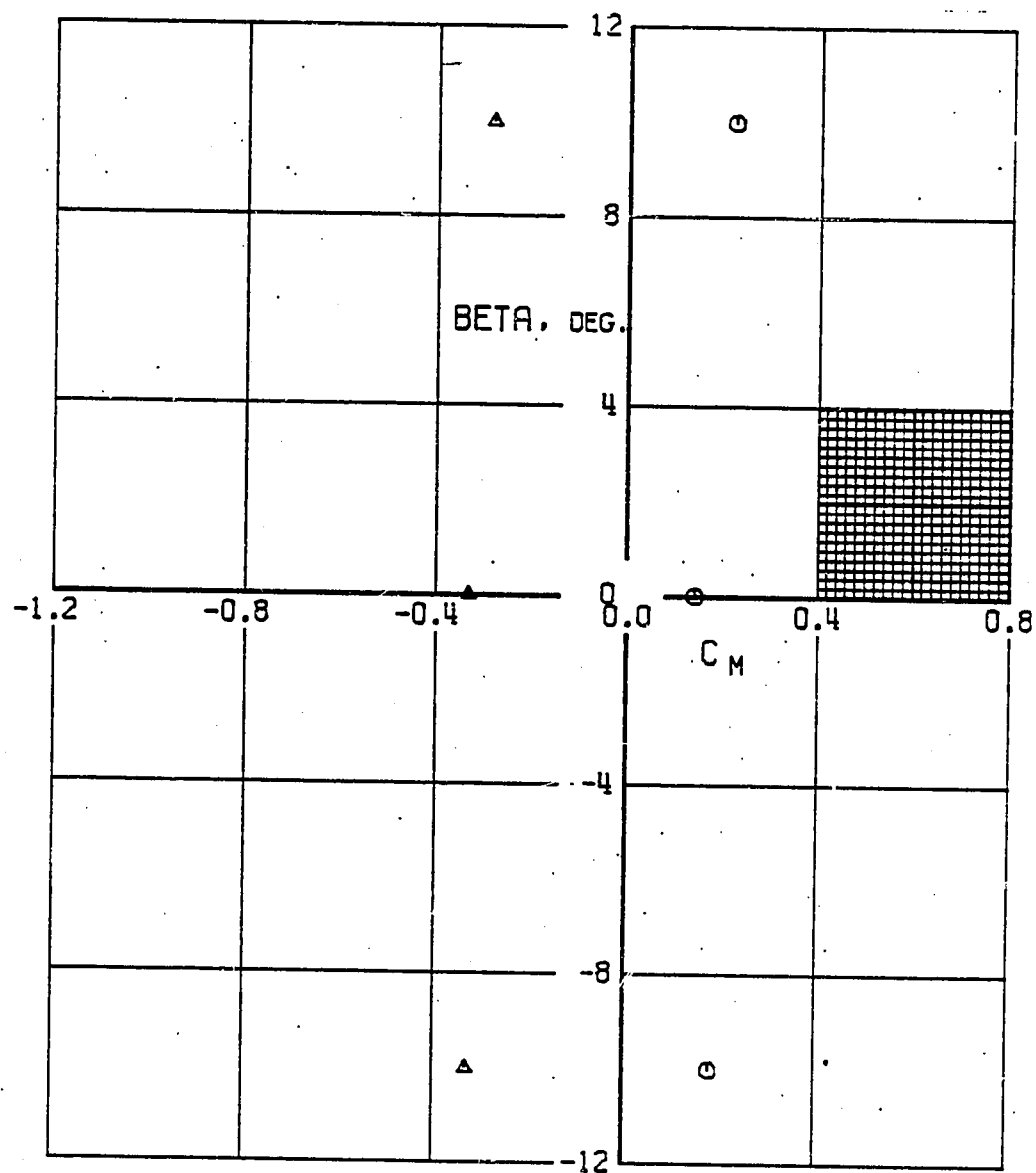


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION
WITH AN EXTENDED NOSE

BNWHDV+TS, $I_H = 0$ DEG., $Q = 7.5$ LB/FT**2

○ ALPHA = -0.02 DEG., RUN 9

▲ ALPHA = 10.26 DEG., RUN 10

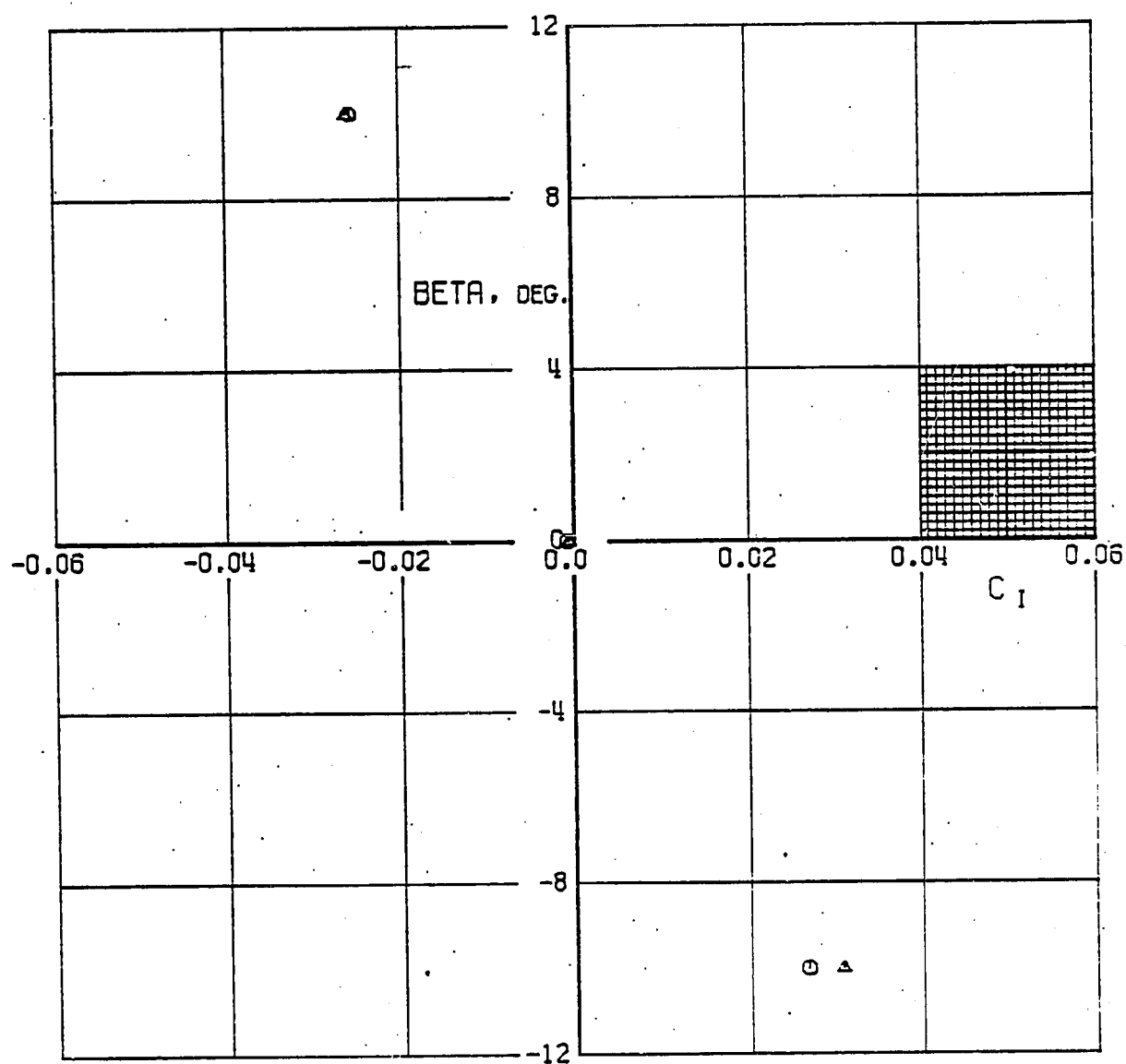


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION
WITH AN EXTENDED NOSE

BNWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = -0.02 DEG., RUN 9

▲ ALPHA = 10.26 DEG., RUN 10

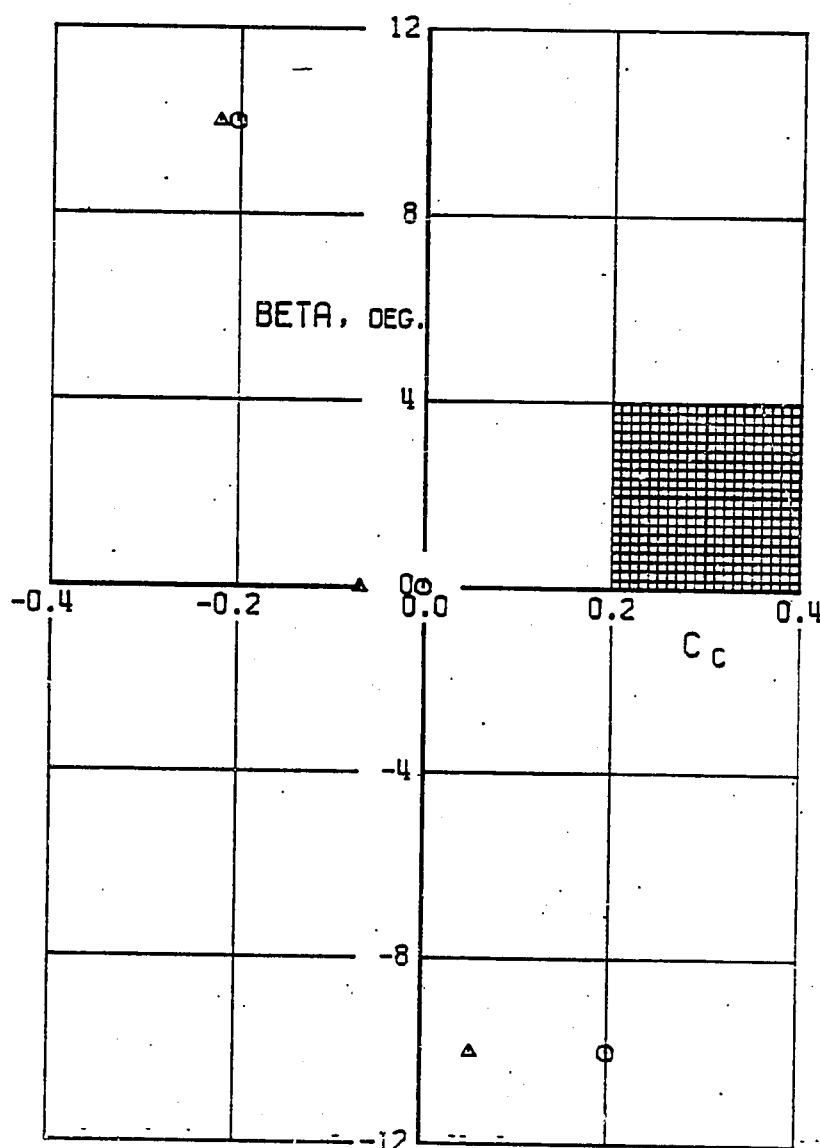


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION
WITH AN EXTENDED NOSE

BNWHDV+TS, $I_H = 0$ DEG., $Q = 7.5$ LB/FT**2

○ ALPHA = -0.02 DEG., RUN 9

▲ ALPHA = 10.26 DEG., RUN 10

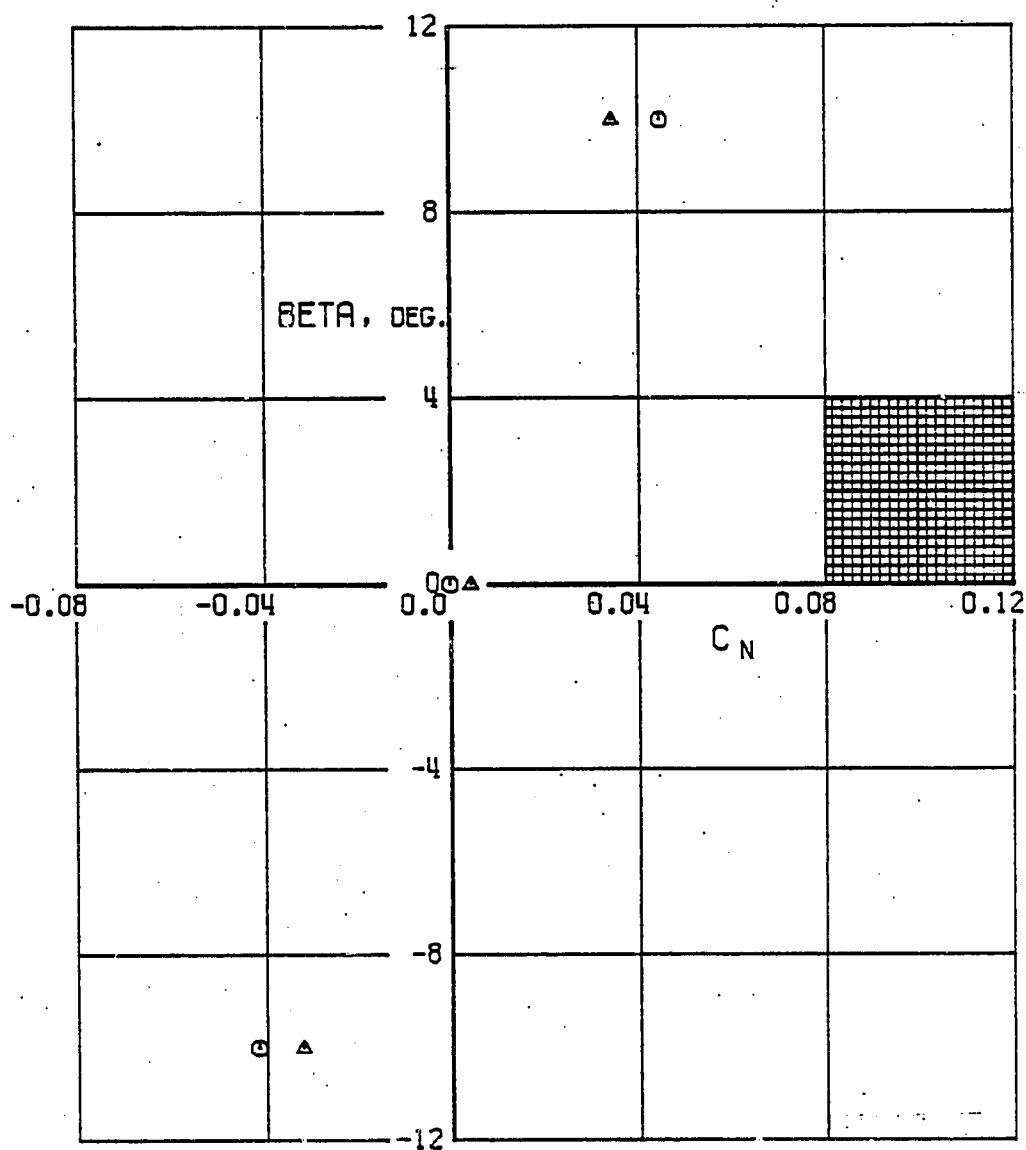


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION
WITH AN EXTENDED NOSE

BNWHDV+T_S, I_H = 0 DEG., Q = 7.5 LB/FT**2

○ ALPHA = -0.02 DEG., RUN 9

▲ ALPHA = 10.26 DEG., RUN 10

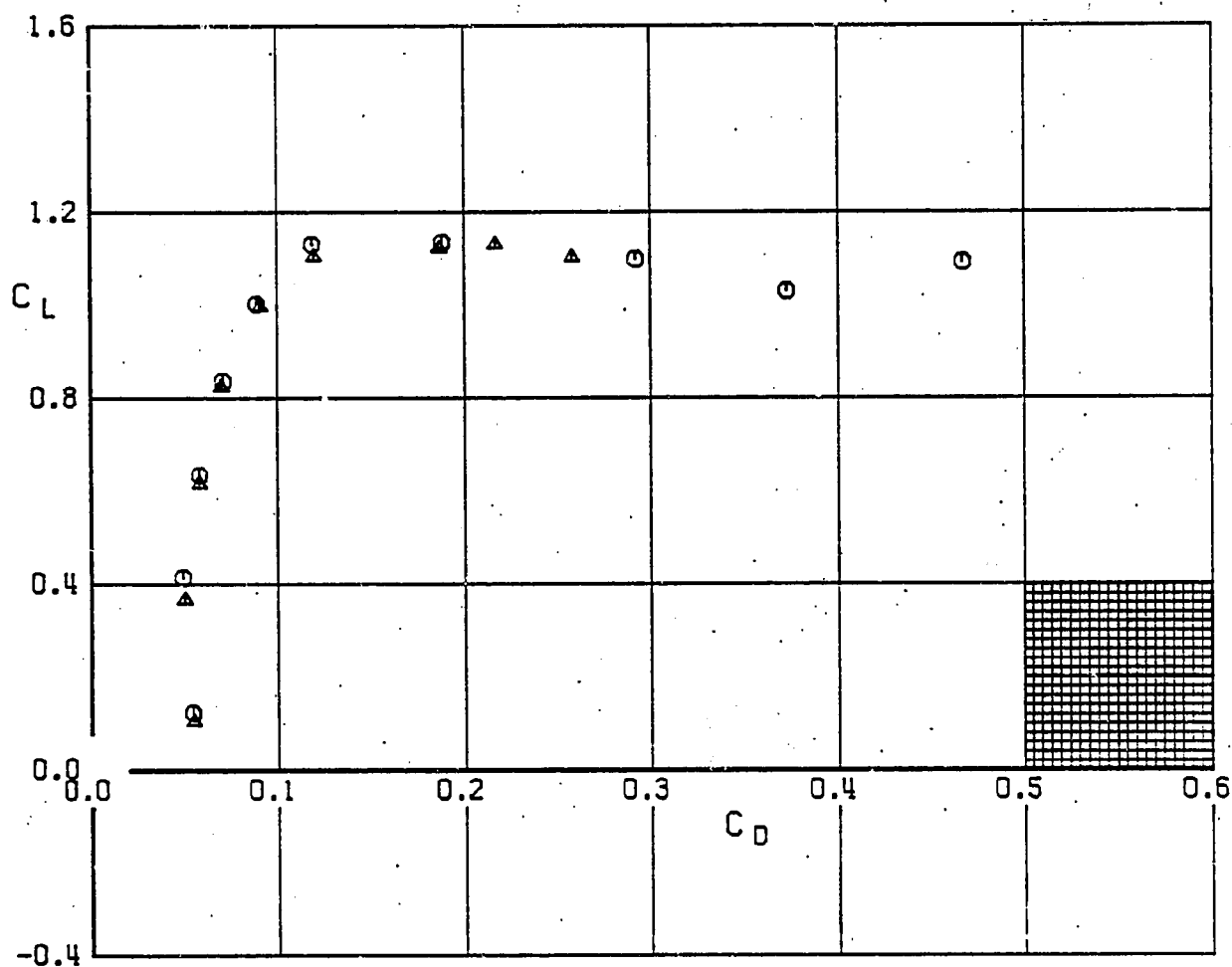


EFFECTS OF SIDESLIP
ON THE CONVENTIONAL CONFIGURATION
WITH AN EXTENDED NOSE

$Q = 7.5 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

○ BFR, RUN 56

△ BFR+TS₂, RUN 20

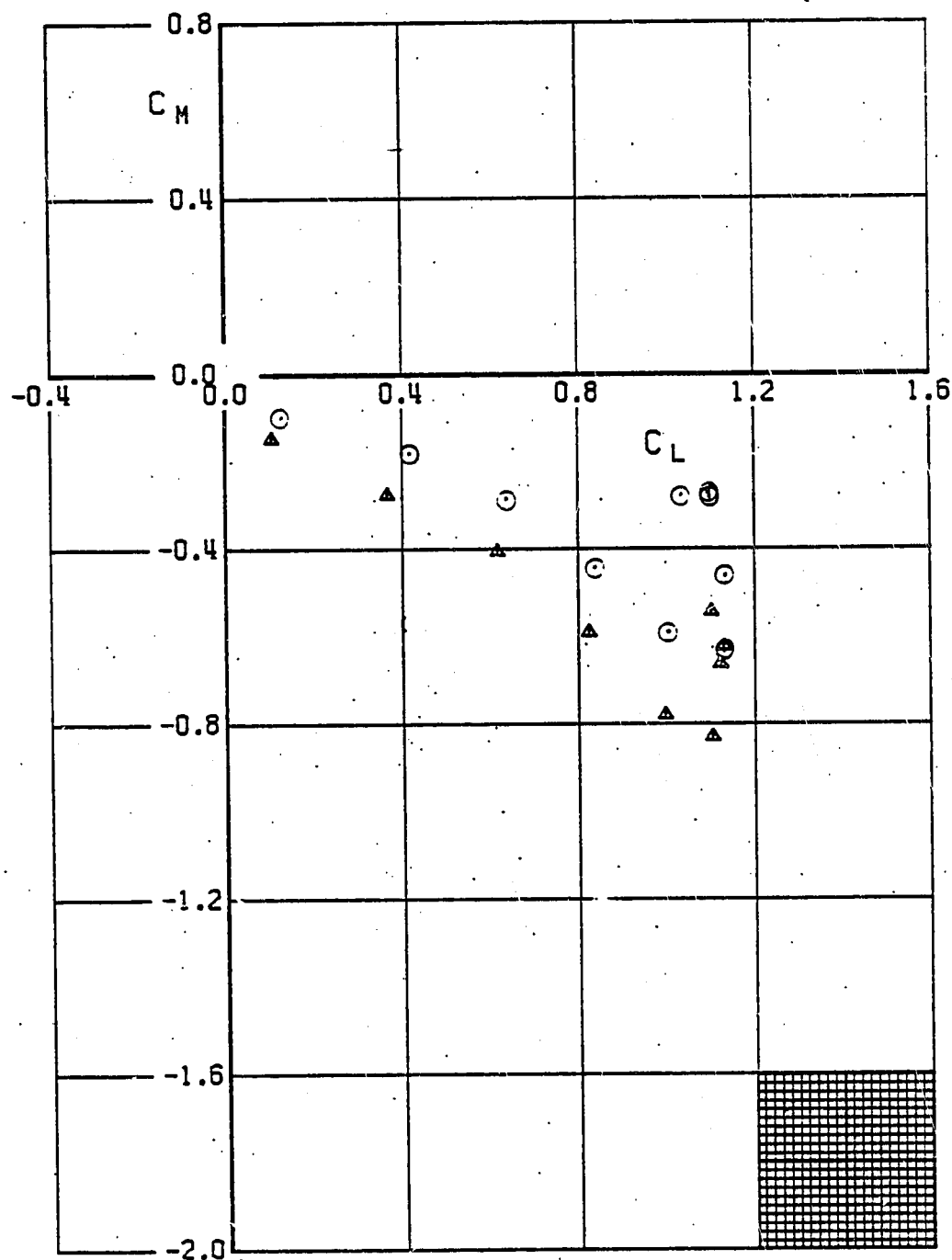


EFFECTS OF TRANSITION STRIPS
ON THE JOINED WING CONFIGURATION

$Q = 7.5 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

○ BFR, RUN 56

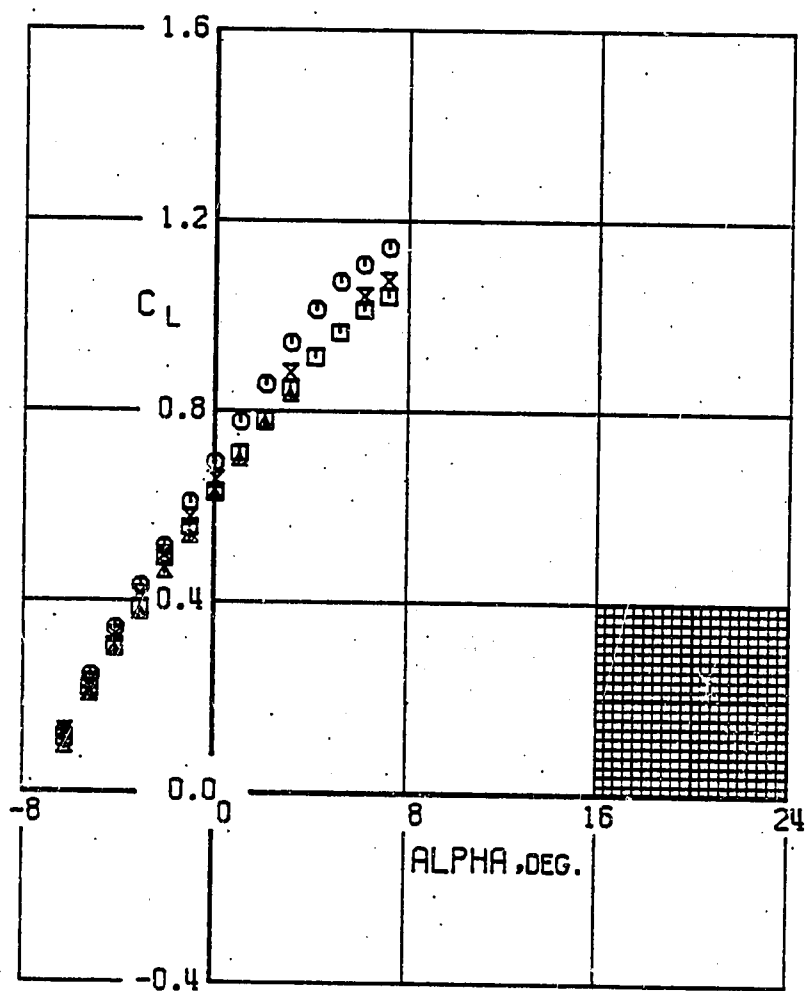
▲ BFR+TS2, RUN 20



EFFECTS OF TRANSITION STRIPS
ON THE JOINED WING CONFIGURATION

$Q = 15 \text{ LB/FT}^2$, $BETA = 0 \text{ DEG.}$

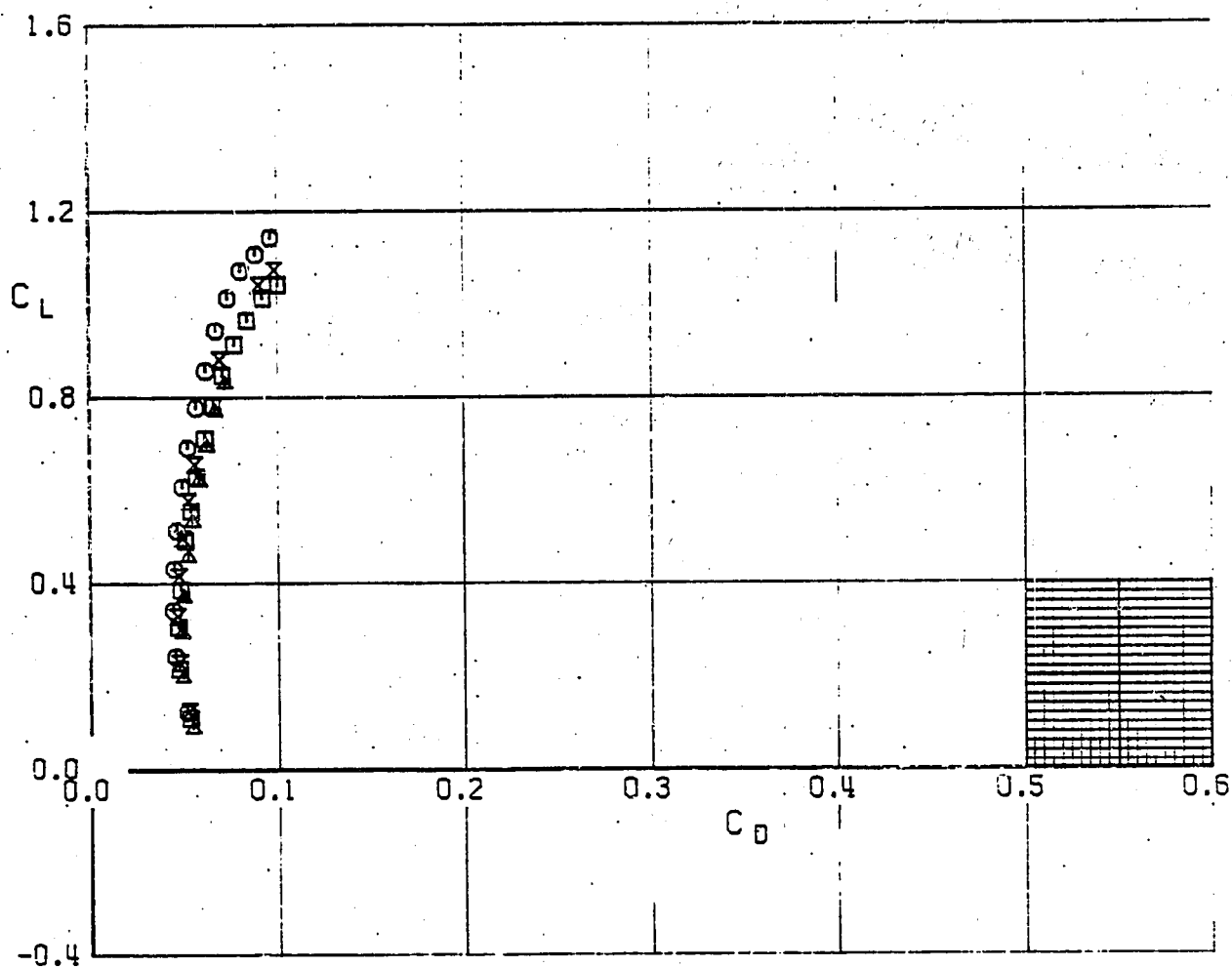
- BFR+TS₁, RUN 17
- ▲ BFR+TS, RUN 18
- ▣ BFR+TS₂, RUN 19
- × BFR+TS₃, RUN 36



EFFECTS OF TRANSITION STRIPS ON THE WINGS
AND TRANSITION STRIP THICKNESS
ON THE JOINED WING CONFIGURATION

$Q = 15 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

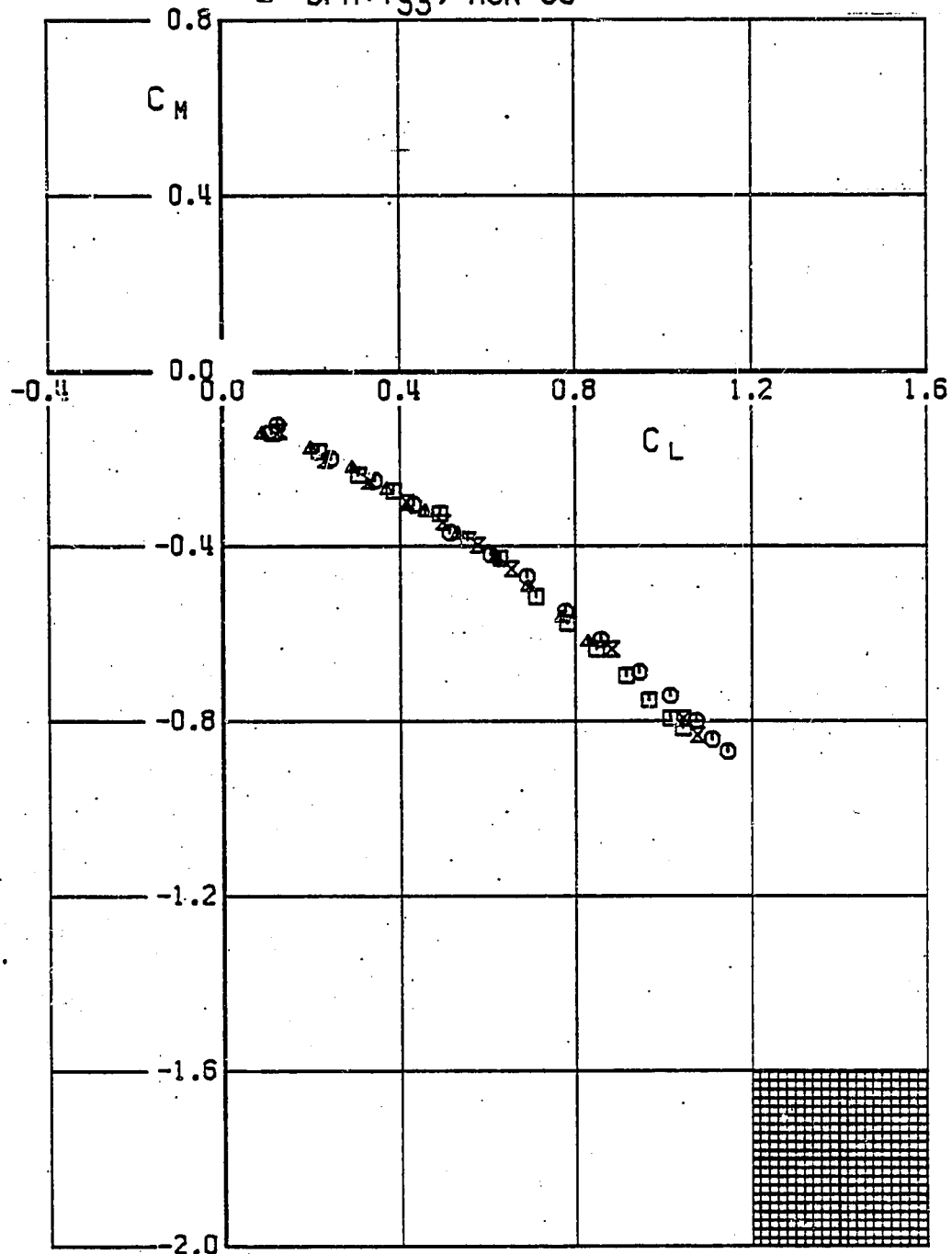
- BFR+TS₁, RUN 17
- △ BFR+TS₂, RUN 18
- BFR+TS₂, RUN 19
- × BFR+TS₃, RUN 36



EFFECTS OF TRANSITION STRIPS ON THE WINGS
AND TRANSITION STRIP THICKNESS
ON THE JOINED WING CONFIGURATION

$Q = 15 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

- BFR+TS₁, RUN 17
- ▲ BFR+TS, RUN 18
- BFR+TS₂, RUN 19
- ⊗ BFR+TS₃, RUN 36



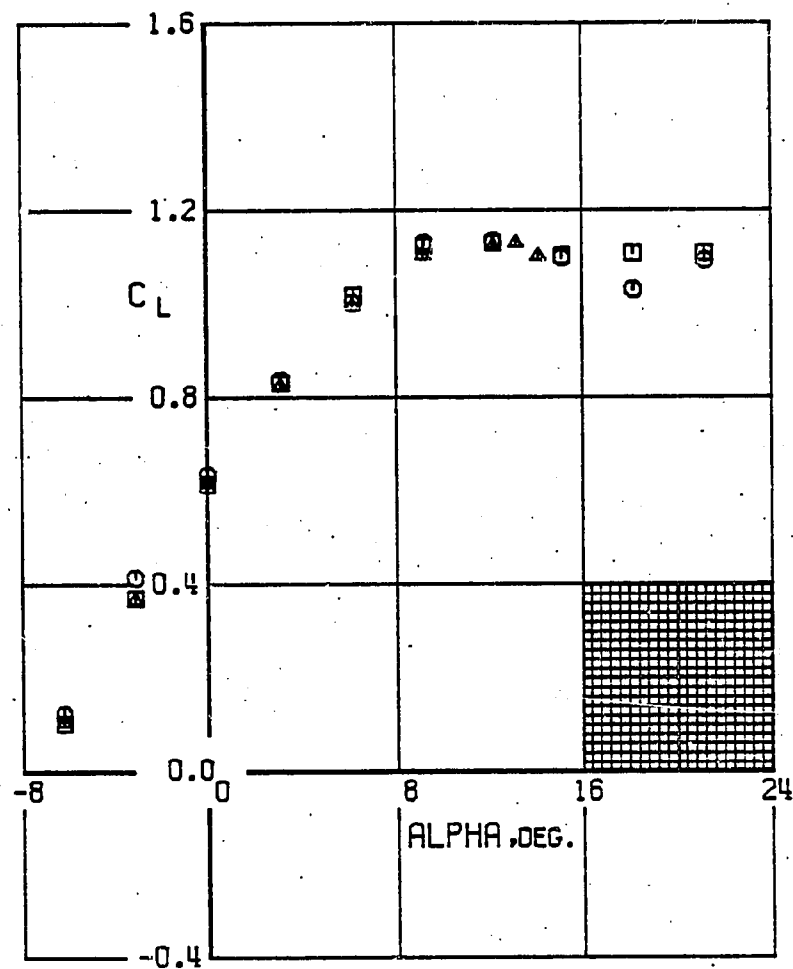
EFFECTS OF TRANSITION STRIPS ON THE WINGS
AND TRANSITION STRIP THICKNESS
ON THE JOINED WING CONFIGURATION

$Q = 7.5 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

○ BFR, RUN 56

▲ BFR + T_{S2} , RUN 20

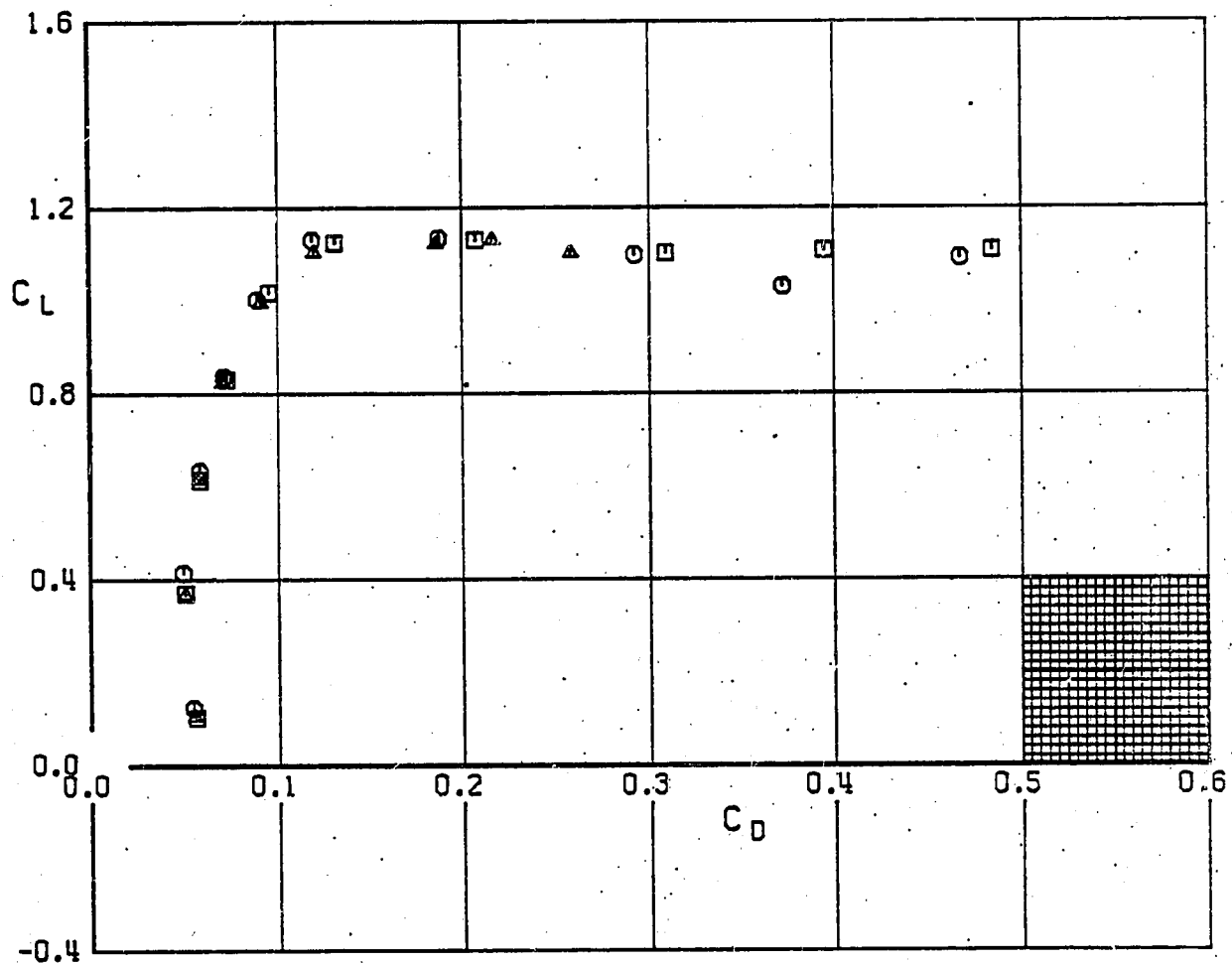
▣ BFRS + T_{S2} , RUN 49



EFFECTS OF TRANSITION STRIPS AND STRAKES
ON THE JOINED WING CONFIGURATION
WITH $Q = 7.5 \text{ LB/FT}^2$

$Q = 7.5 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

- BFR, RUN 56
- ▲ BFR + T_{S2} , RUN 20
- BFRS + T_{S2} , RUN 49



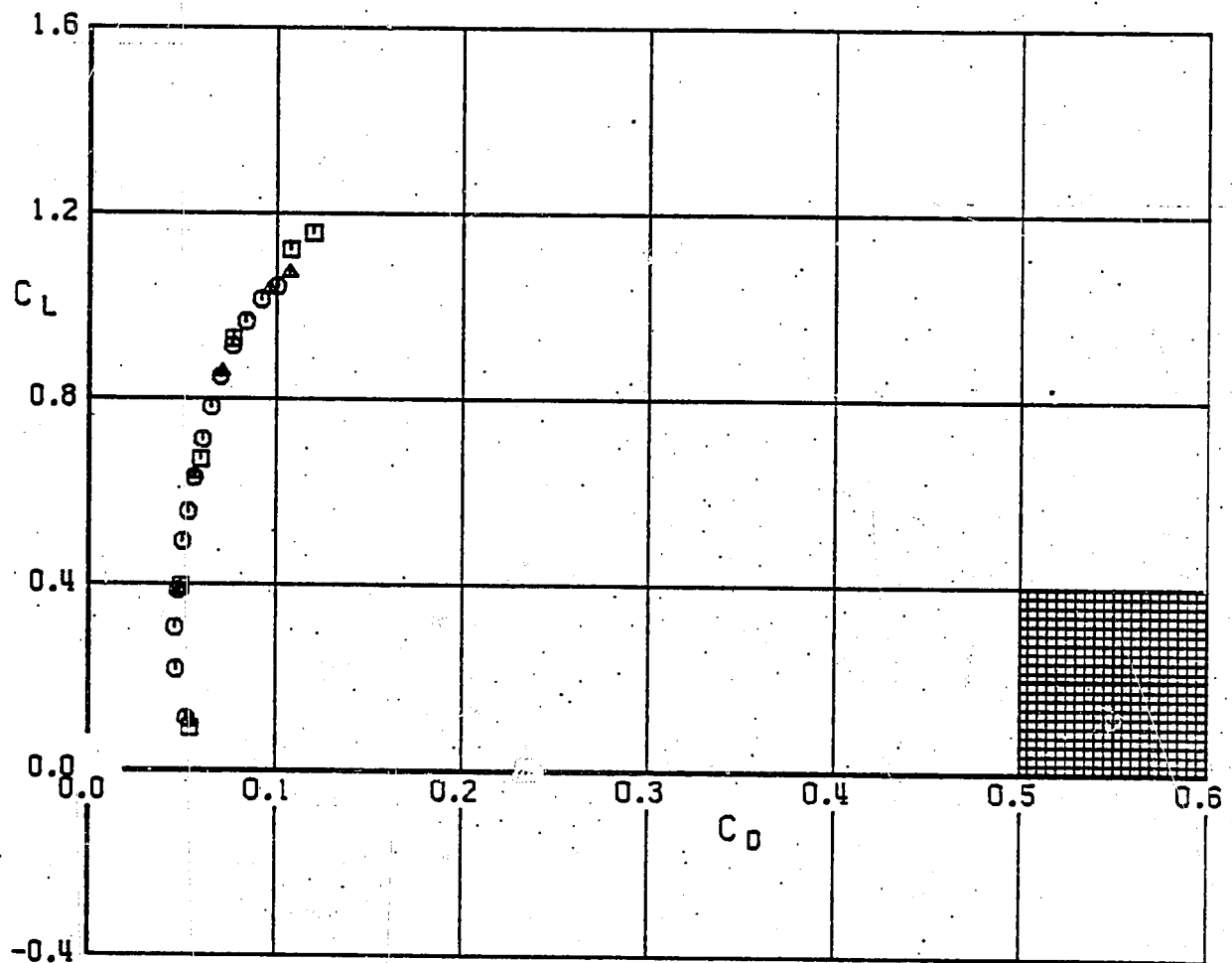
EFFECTS OF TRANSITION STRIPS AND STRAKES
ON THE JOINED WING CONFIGURATION
WITH $Q = 7.5 \text{ LB/FT}^2$

Q = 15 LB/FT**2, BETA = 0 DEG.

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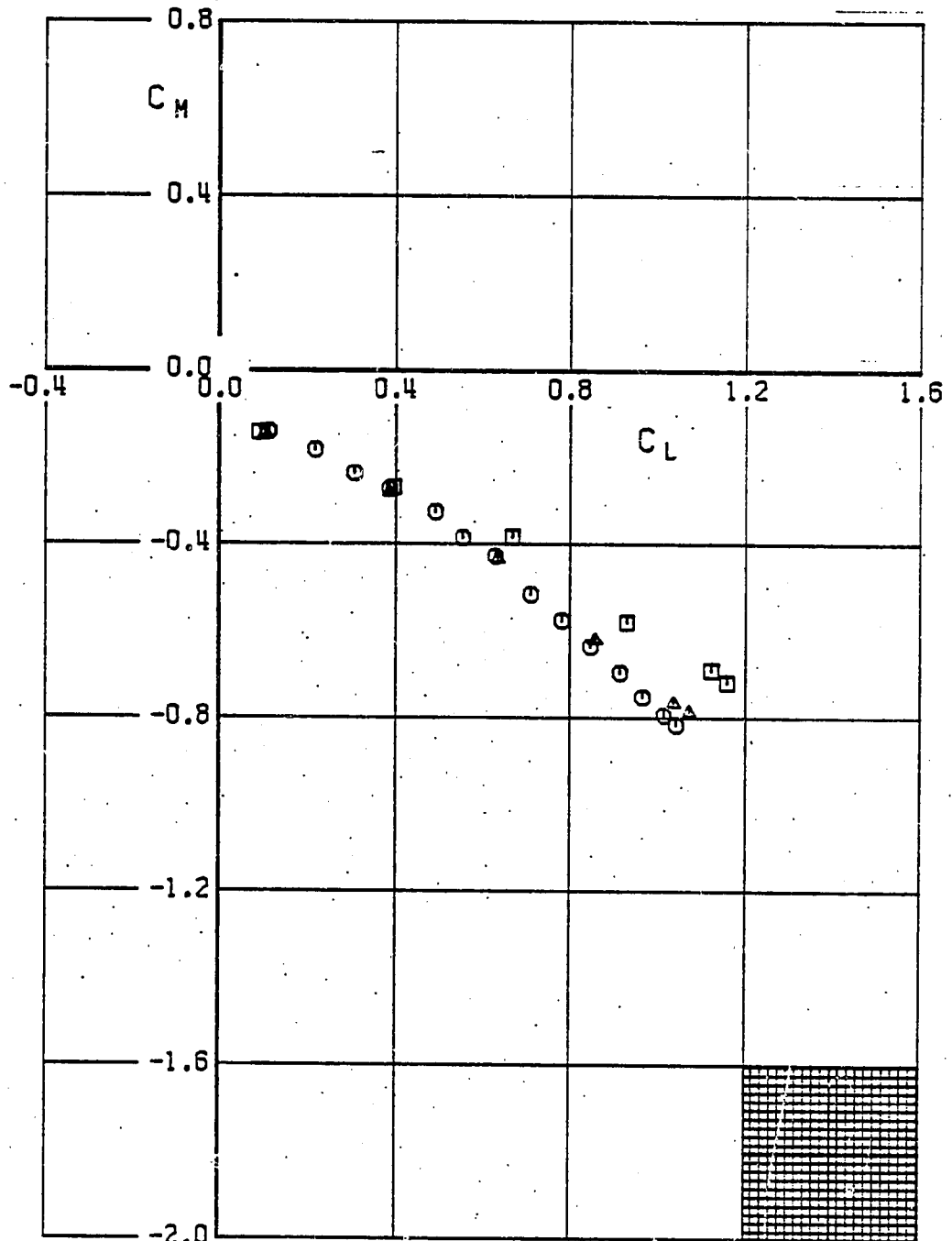
O  BFR +TS2, . RUN 19
A  BFRS +TS2, . RUN 37
W  BFRSE+TS2, L = R = 0 DEG., RUN 43

```

EFFECTS OF STRAKES AND ELECONS ON THE
JOINED WING CONFIGURATION

$Q = 15 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

- BFR + T_{S2} , , RUN 19
- ▲ BFRS + T_{S2} , , RUN 37
- BFRSE + T_{S2} , $\delta_L = \delta_R = 0 \text{ DEG.}$, RUN 43

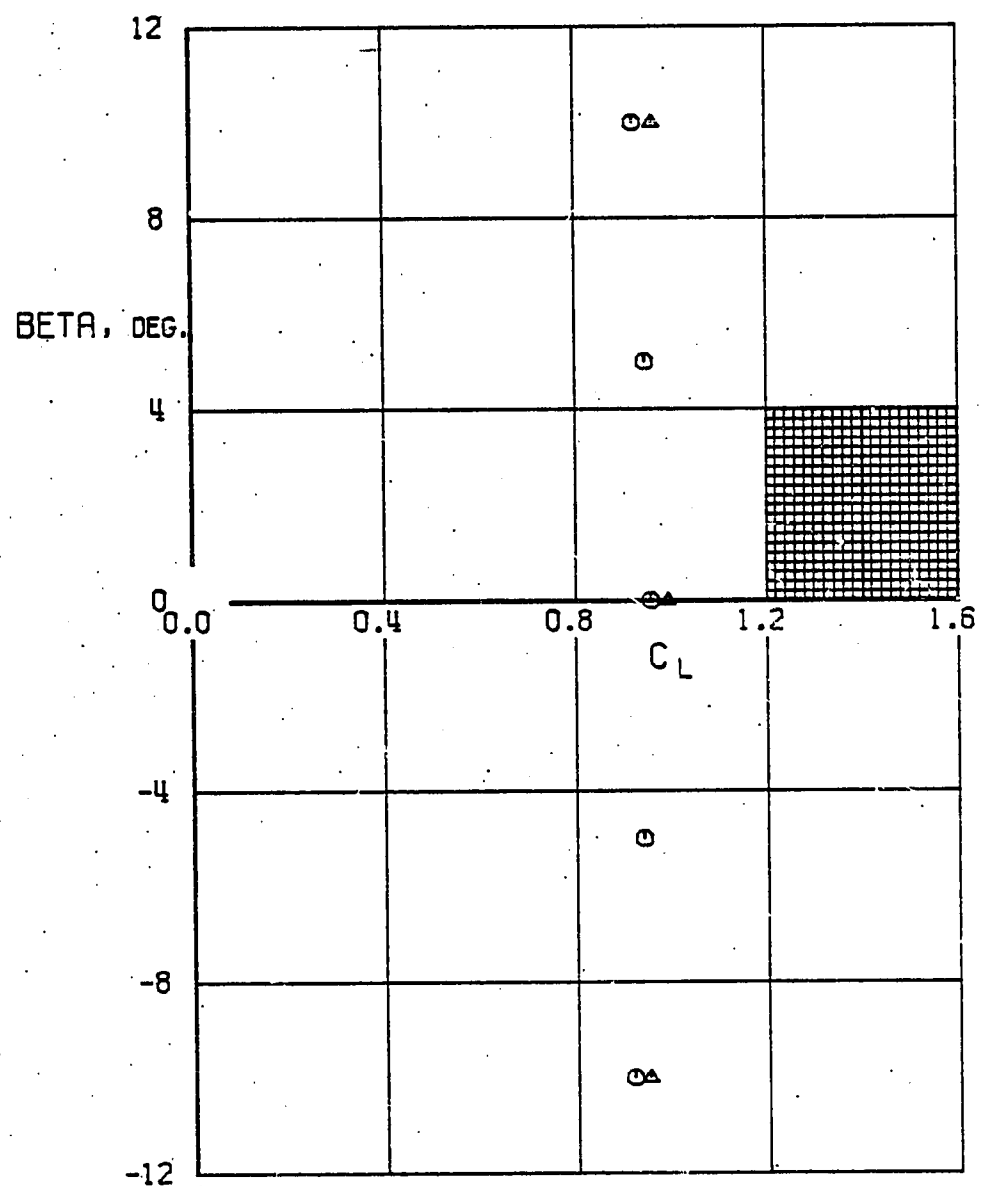


EFFECTS OF STRAKES AND ELEVONS ON THE
JOINED WING CONFIGURATION

$Q = 15 \text{ LB/FT}^2$, $\text{ALPHA} = 5.15 \text{ DEG.}$

○ BFR +TS₂, RUN 22

▲ BFRS+TS₂, RUN 38

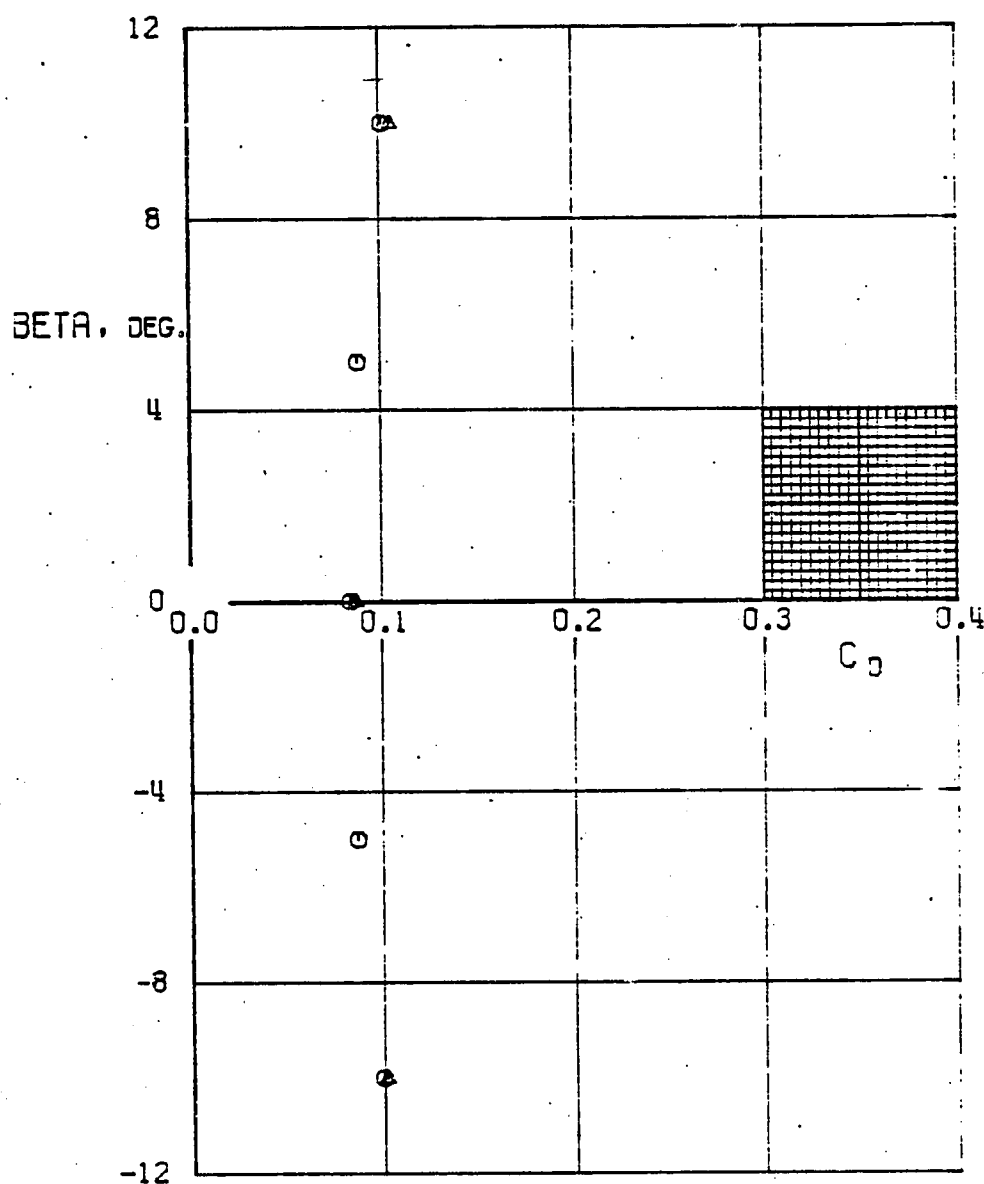


EFFECTS OF STRAKES ON THE JOINED WING
CONFIGURATION IN SIDESLIP

$Q = 15 \text{ LB/FT}^2$, $\text{ALPHA} = 5.15 \text{ DEG.}$

○ BFR + T_{S2} , RUN 22

▲ BFRS + T_{S2} , RUN 38

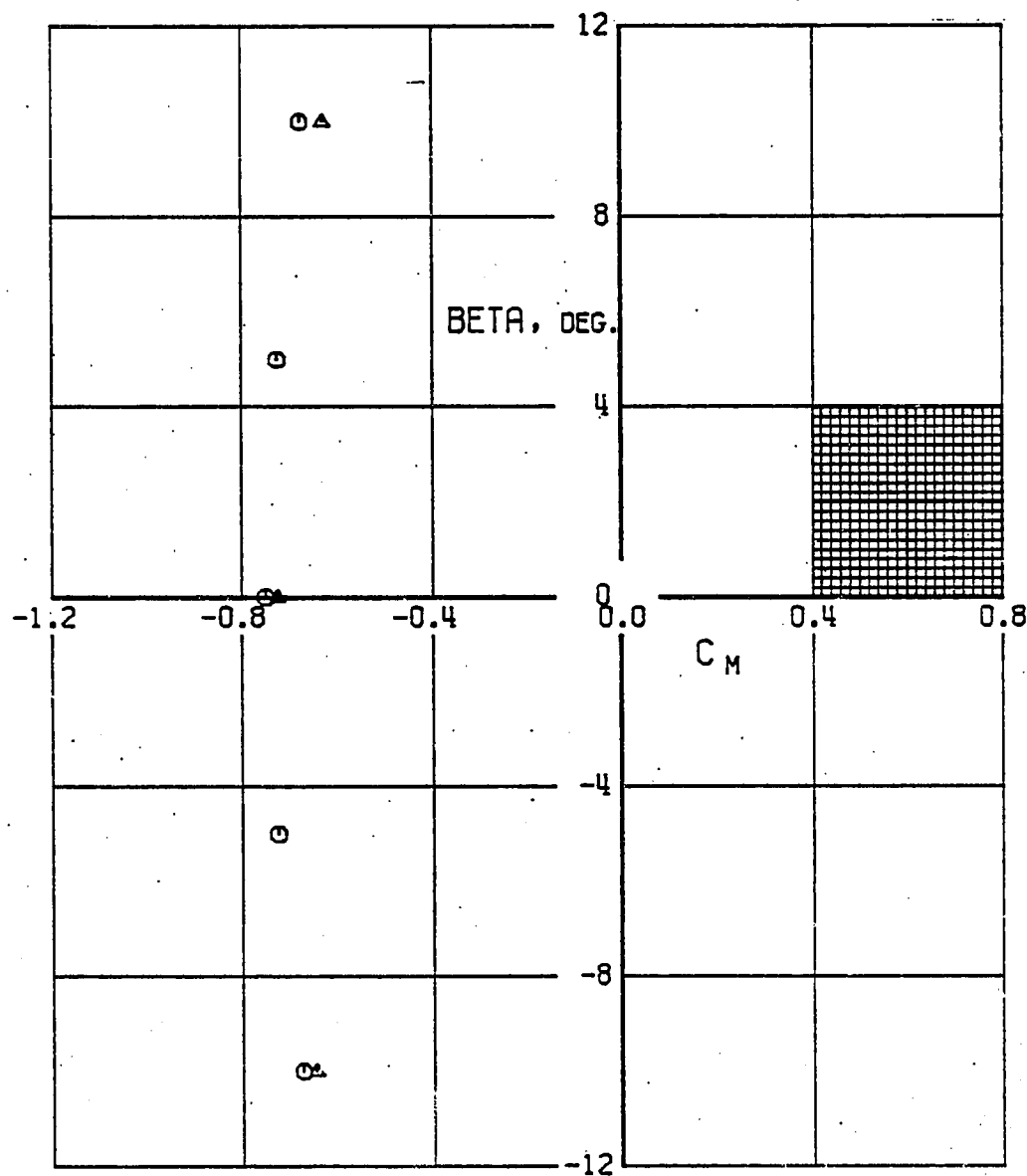


EFFECTS OF STRAKES ON THE JOINED WING
CONFIGURATION IN SIDESLIP

$Q = 15 \text{ LB/FT}^2$, $\alpha = 5.15 \text{ DEG.}$

○ BFR + T_{S2} , RUN 22

△ BFRS + T_{S2} , RUN 38

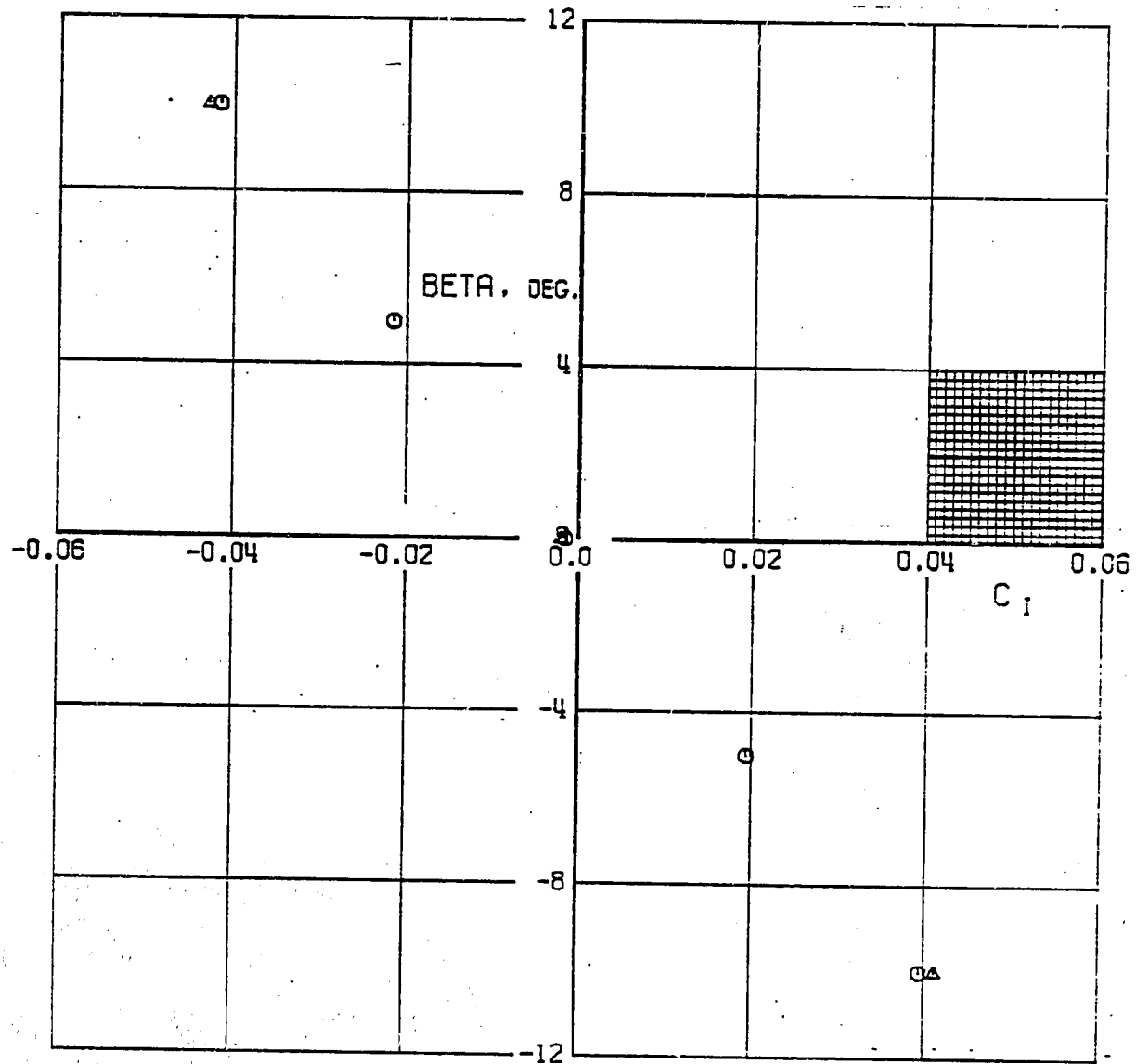


EFFECTS OF STRAKES ON THE JOINED WING
CONFIGURATION IN SIDESLIP

$Q = 15 \text{ LB/FT}^2$, $\text{ALPHA} \doteq 5.15 \text{ DEG.}$

○ BFR + T_{S2} , RUN 22

▲ BFRS + T_{S2} , RUN 38

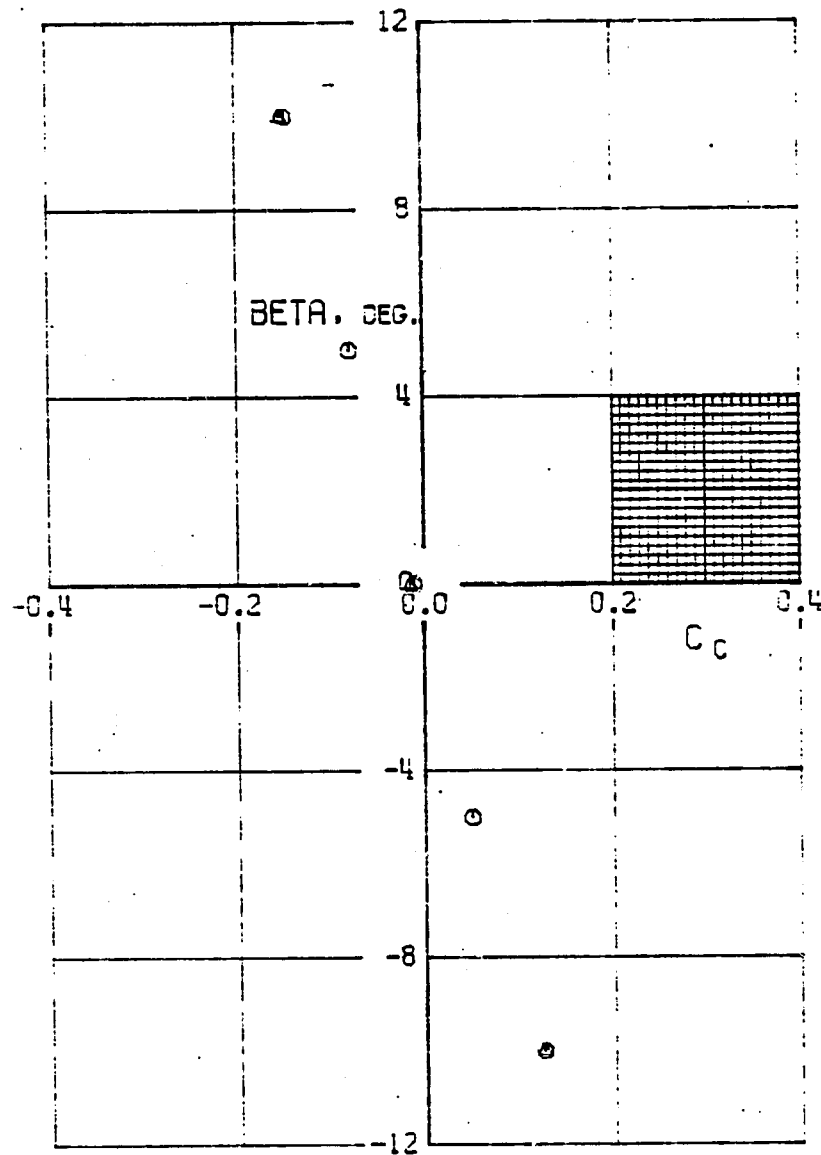


EFFECTS OF STRAKES ON THE JOINED WING
CONFIGURATION IN SIDESLIP

$Q = 15 \text{ LB/FT}^2$, $\text{ALPHA} = 5.15 \text{ DEG.}$

○ BFA + T_{S2} , RUN 22

▲ BFRS + T_{S2} , RUN 38

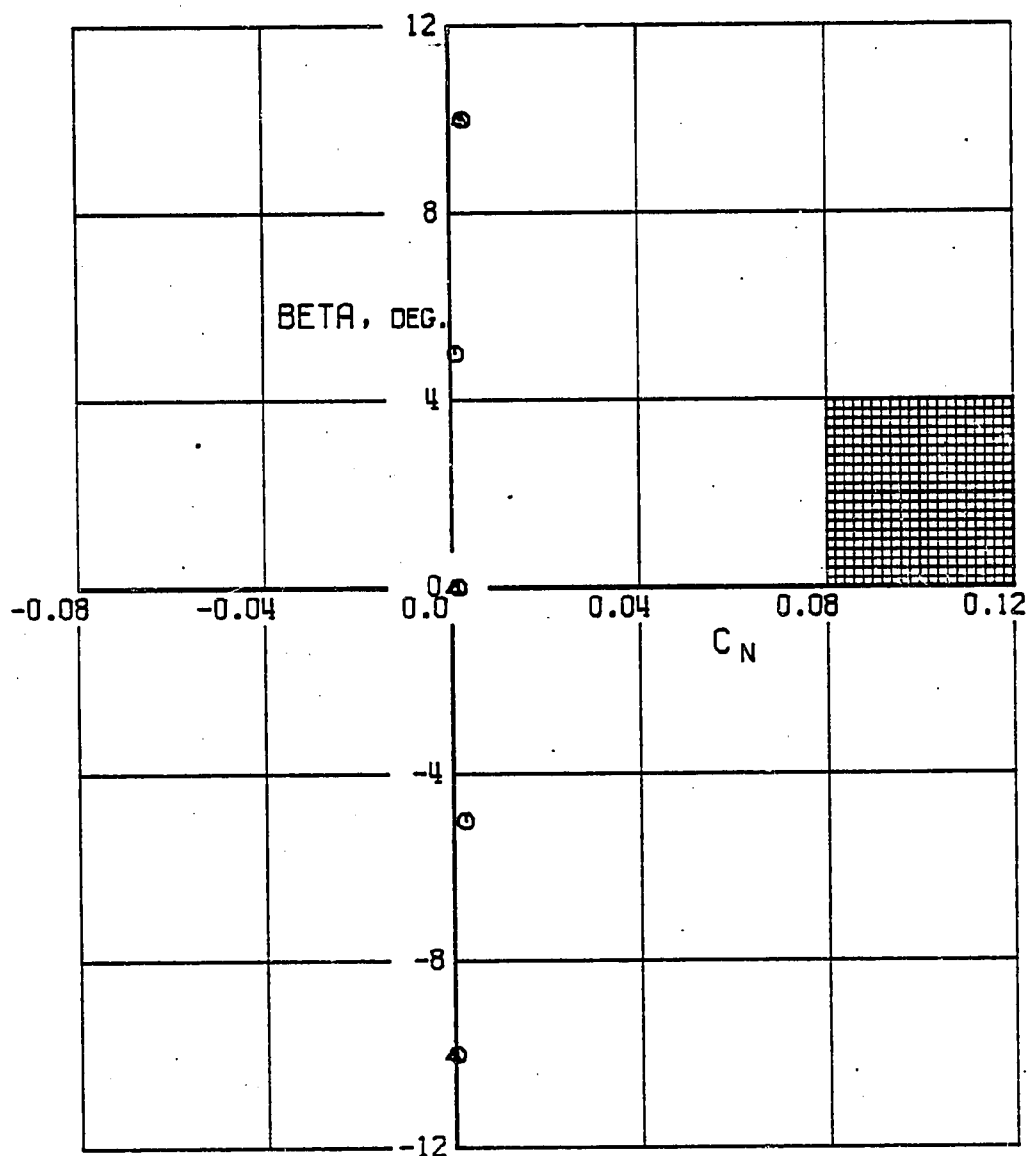


EFFECTS OF STRAKES ON THE JOINED WING
 CONFIGURATION IN SIDESLIP

$Q = 15 \text{ LB/FT}^2$, $\text{ALPHA} = 5.15 \text{ DEG.}$

○ BFR + T_{S2} , RUN 22

▲ BFRS + T_{S2} , RUN 38



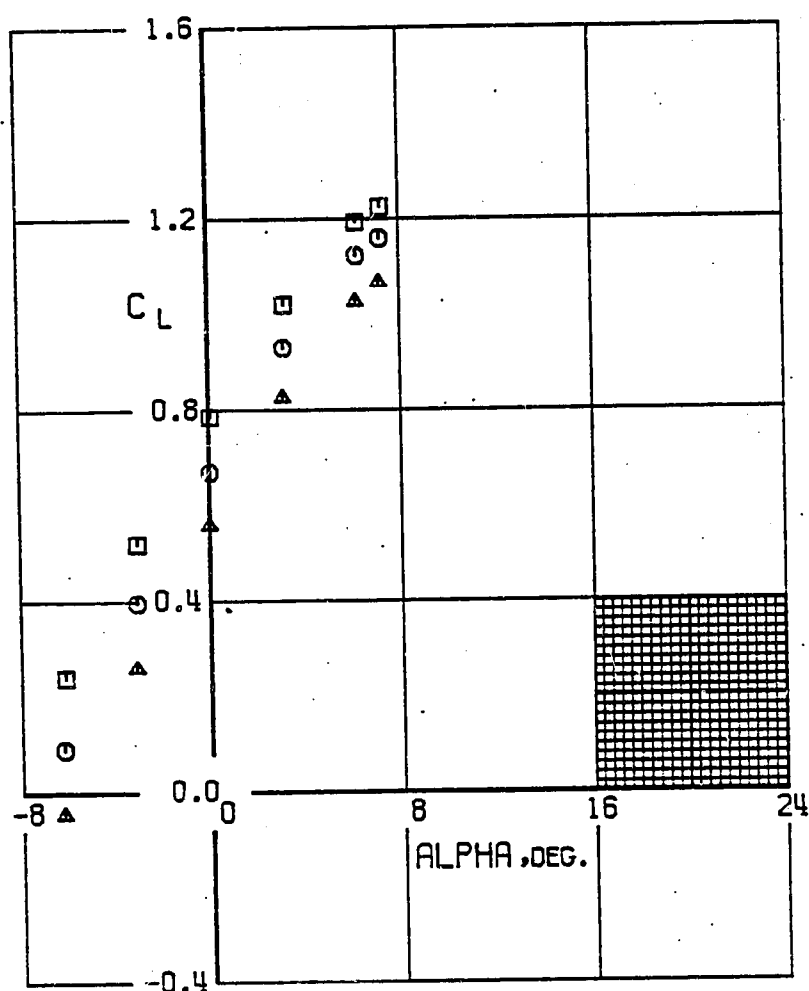
EFFECTS OF STRAKES ON THE JOINED WING
CONFIGURATION IN SIDESLIP

BFRSE+TS2, $Q = 15 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

$\circ \delta_L = \delta_R = 0 \text{ DEG.}, \text{ RUN 43}$

$\triangle \delta_L = \delta_R = -10 \text{ DEG.}, \text{ RUN 39}$

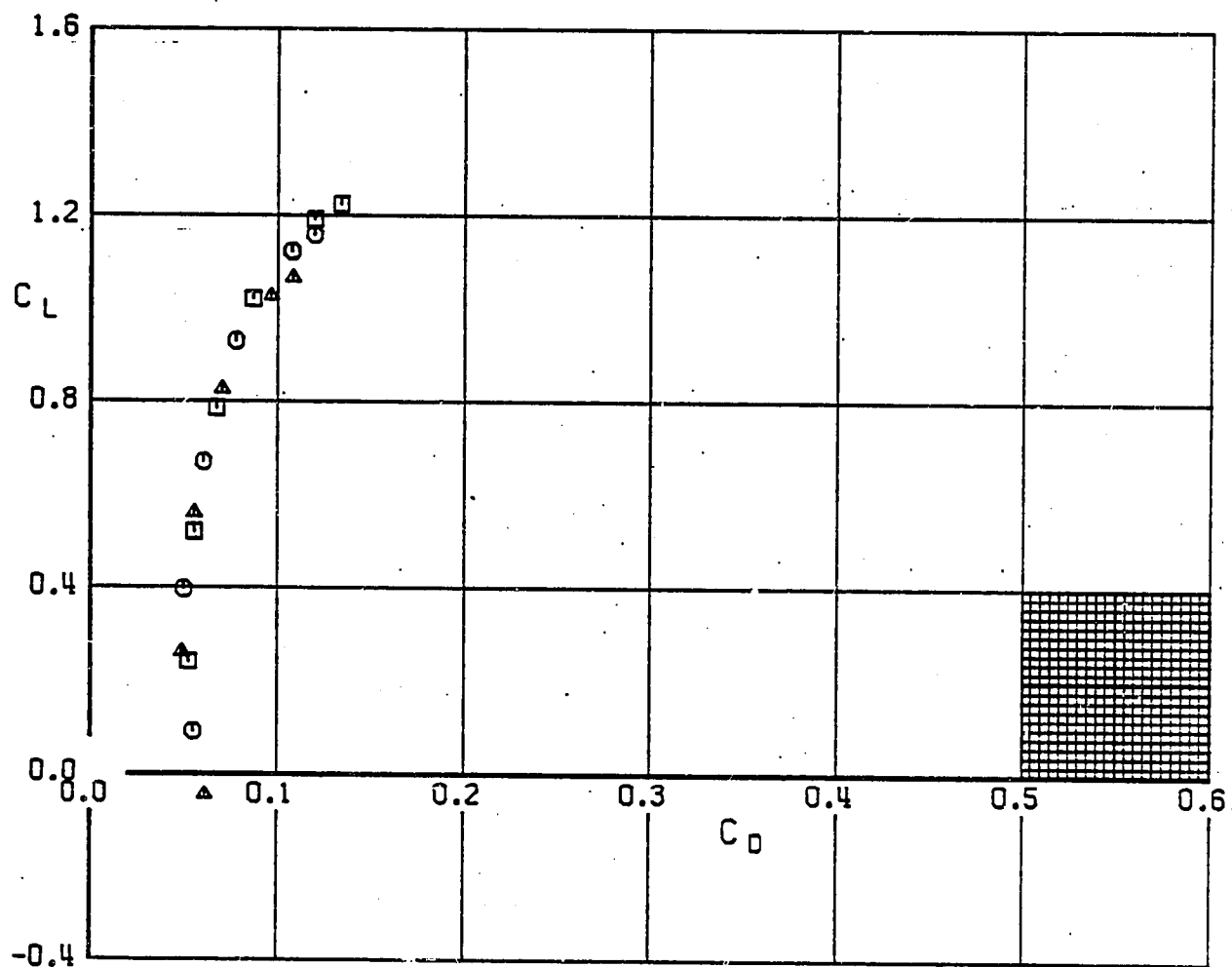
$\square \delta_L = \delta_R = 10 \text{ DEG.}, \text{ RUN 41}$



EFFECTS OF SYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BFRSE+T₉₂, Q = 15 LB/FT**2, BETA = 0 DEG.

○ L = R = 0 DEG., RUN 43
▲ L = R = -10 DEG., RUN 39
□ L = R = 10 DEG., RUN 41



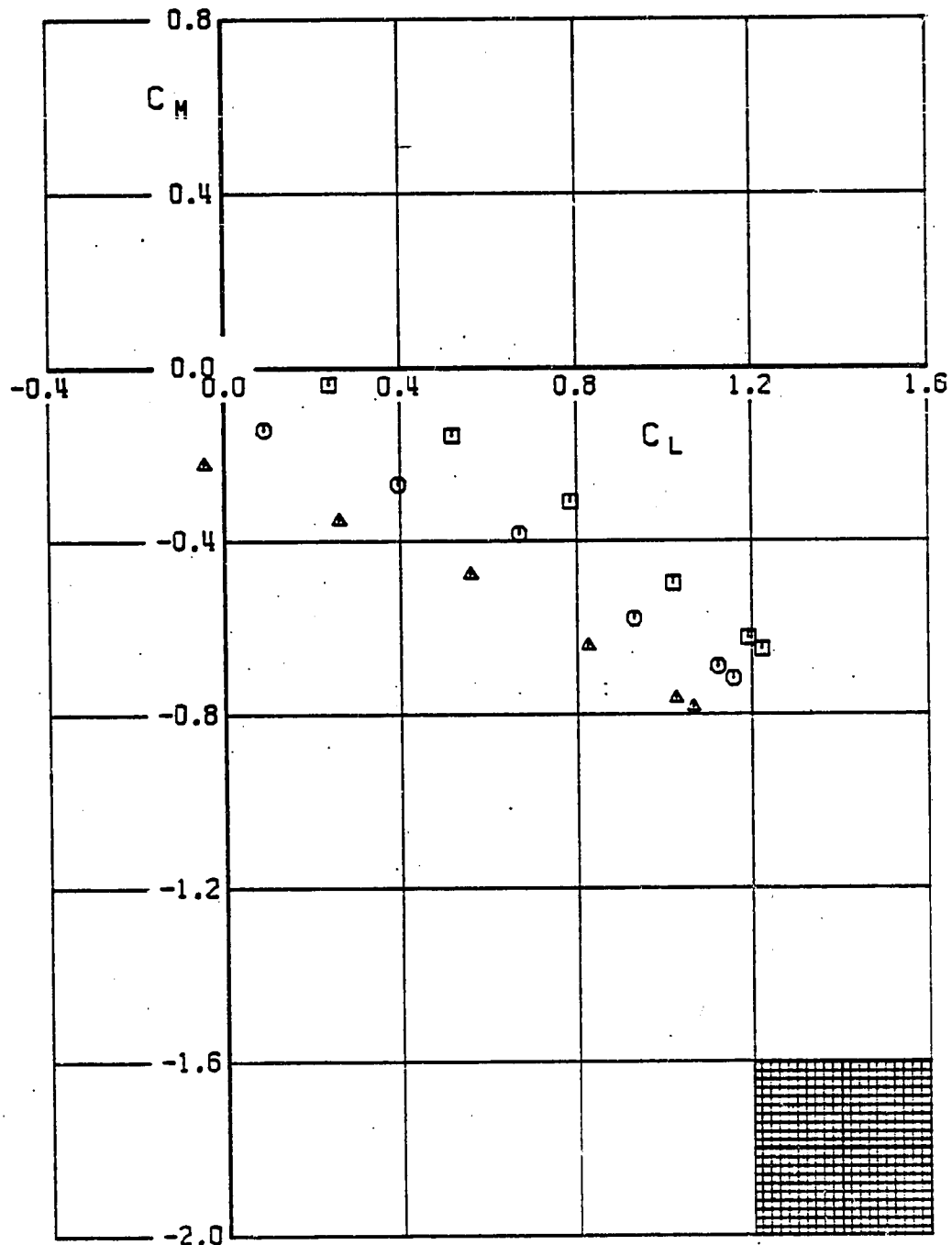
EFFECTS OF SYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BFRSE+TS2, Q = 15 LB/FT**2, BETA = 0 DEG.

○ $\delta_L = \delta_R = 0$ DEG., RUN 43

▲ $\delta_L = \delta_R = -10$ DEG., RUN 39

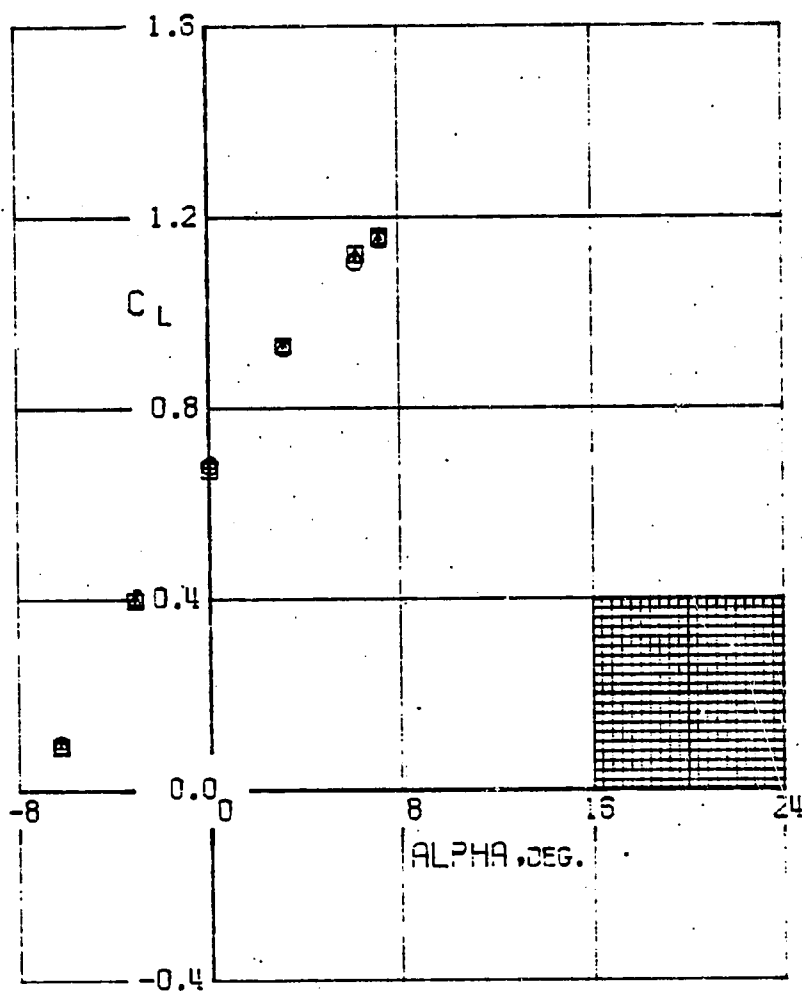
□ $\delta_L = \delta_R = 10$ DEG., RUN 41



EFFECTS OF SYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BFRSE+TS2, Q = 15 LB/FT**2, BETA = 0 DEG.

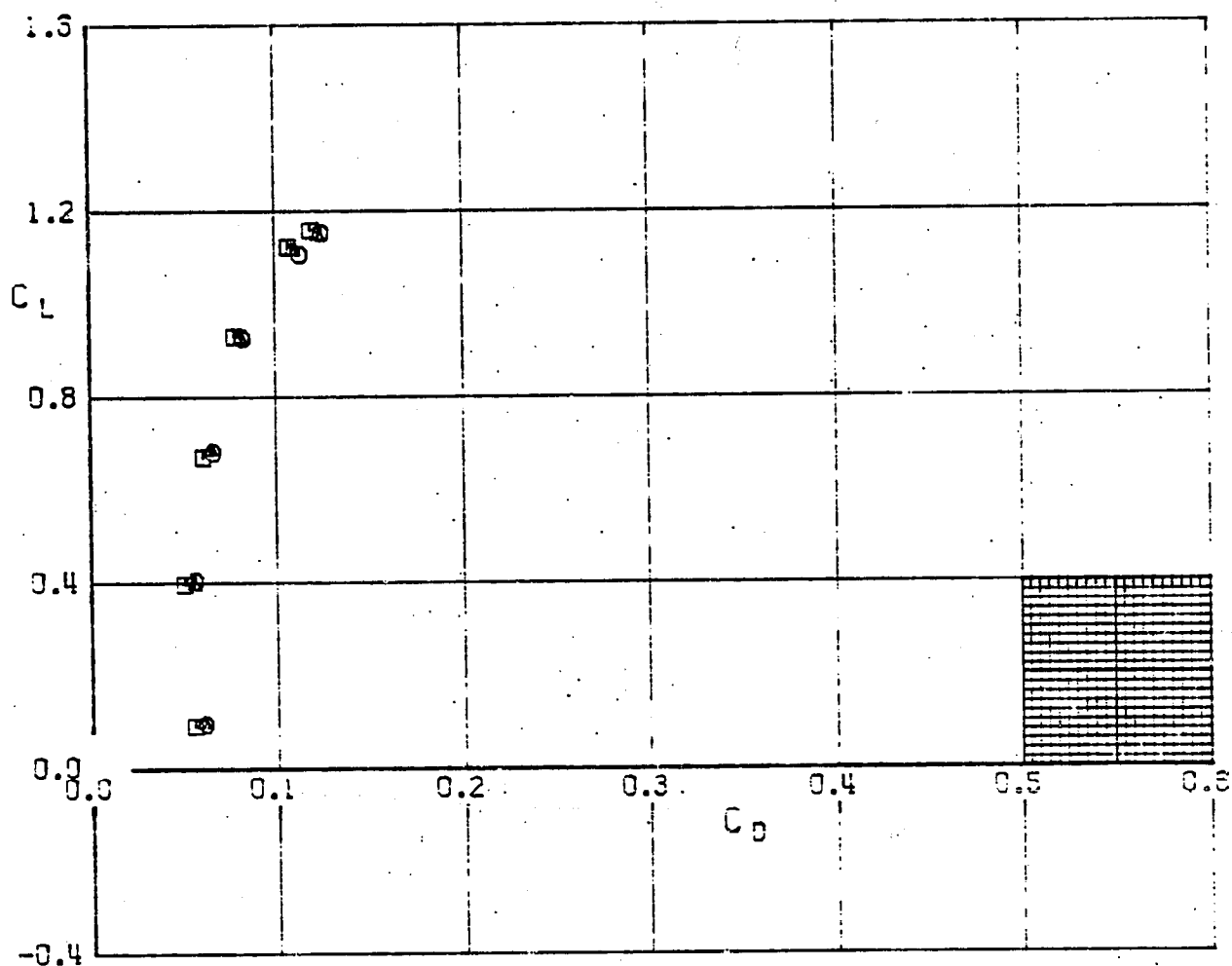
○ $\delta_L = -10$ DEG., $\delta_R = 10$ DEG., RUN 45
 ▲ $\delta_L = 10$ DEG., $\delta_R = -10$ DEG., RUN 44
 □ $\delta_L = 0$ DEG., $\delta_R = 0$ DEG., RUN 43



EFFECTS OF ASYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BFRSE+TS₂, Q = 15 LB/FT**2, BETA = 0 DEG.

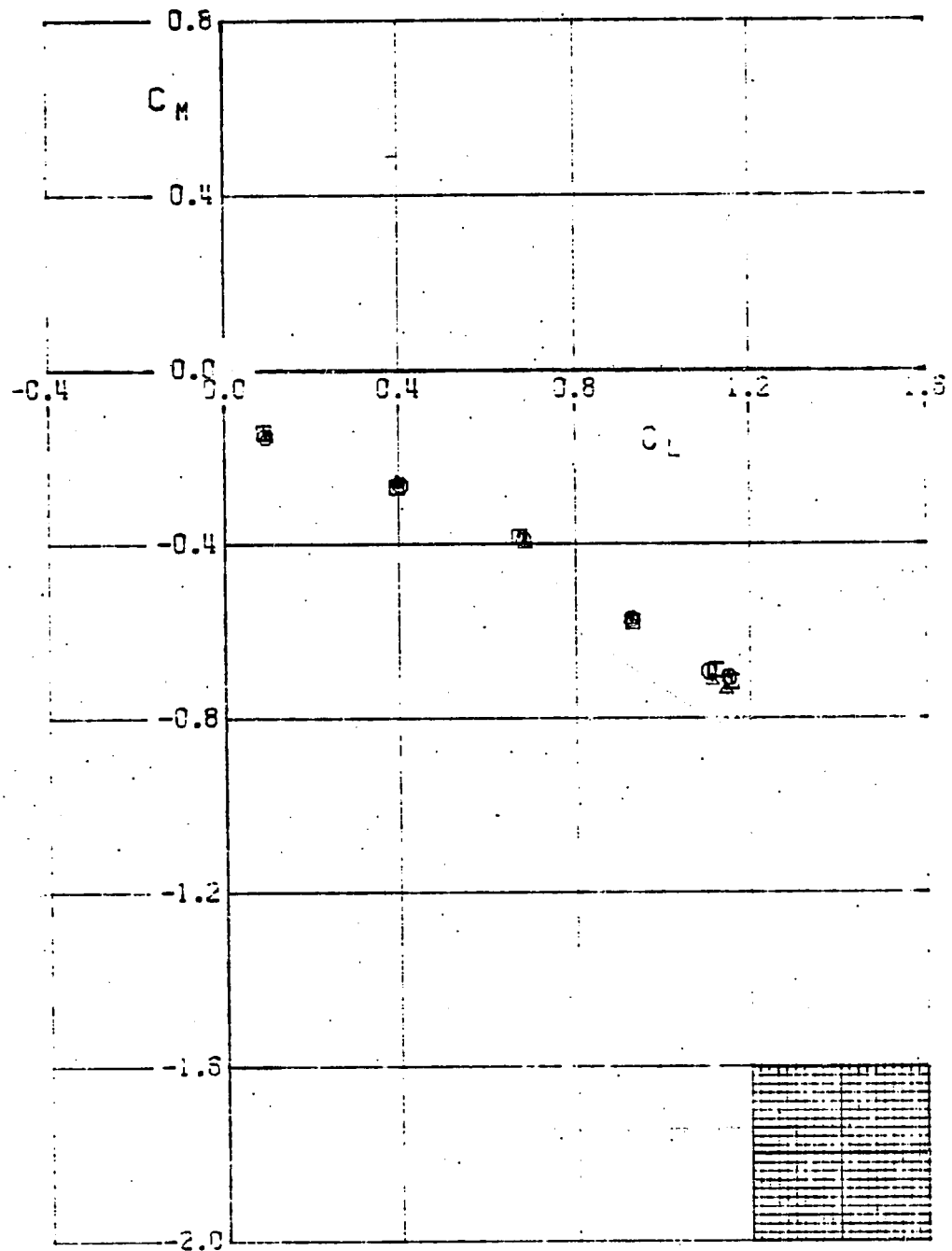
- $\delta_L = -10$ DEG., $\delta_R = 10$ DEG., RUN 45
- ▲ $\delta_L = 10$ DEG., $\delta_R = -10$ DEG., RUN 44
- $\delta_L = 0$ DEG., $\delta_R = 0$ DEG., RUN 43



EFFECTS OF ASYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

3FRSE+TS2, Q = 15 LB/FT**2, BETA = 0 DEG.

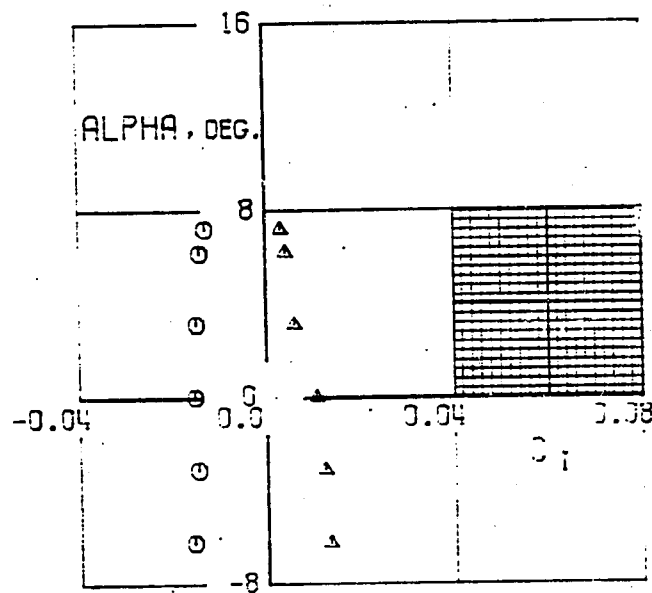
○ $\delta_L = -10$ DEG., $\delta_H = 10$ DEG., RUN 45
 ▲ $\delta_L = 10$ DEG., $\delta_H = -10$ DEG., RUN 44
 □ $\delta_L = 0$ DEG., $\delta_H = 0$ DEG., RUN 43



EFFECTS OF ASYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BFRSE+TS2, $Q = 15 \text{ LB/FT}^2$, $\beta = 0 \text{ DEG.}$

$\circ \delta_L = -10 \text{ DEG.}, \delta_R = 10 \text{ DEG.}, \text{RUN 45}$
 $\Delta \delta_L = 10 \text{ DEG.}, \delta_R = -10 \text{ DEG.}, \text{RUN 44}$



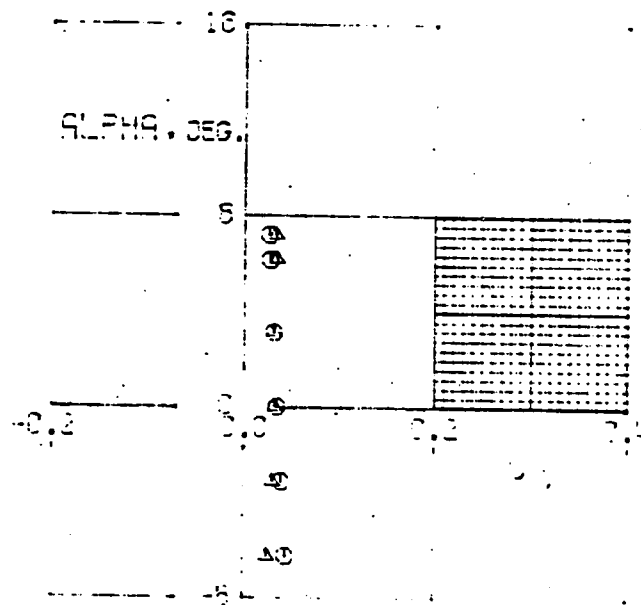
EFFECTS OF ASYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BASE-T₃₂. $\alpha = 17.5 \text{ DEG}$. $\delta = 0 \text{ DEG}$.

$\delta_1 = -10 \text{ DEG}$, $\delta_2 = 10 \text{ DEG}$, $\delta_3 = 0$

$\delta_4 = 10 \text{ DEG}$, $\delta_5 = -10 \text{ DEG}$, $\delta_6 = 0$

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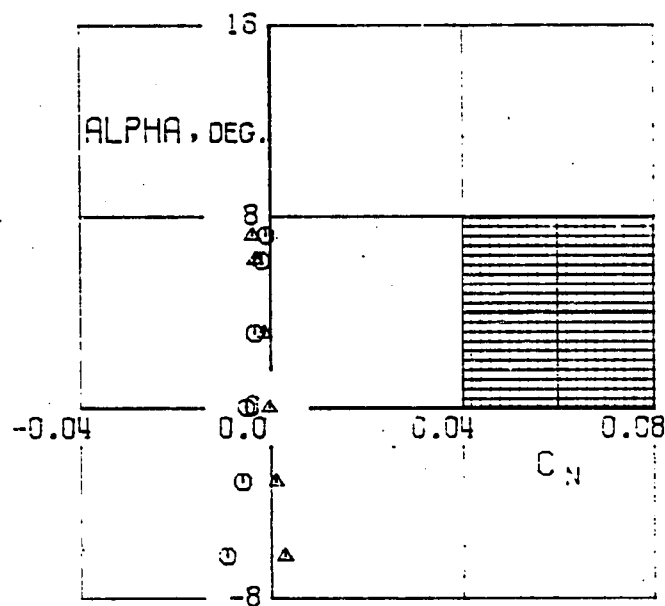
EFFECTS OF ASYMMETRIC ELEMENT DEFLECTIONS
ON THE JOINED WING CONFIGURATION

BFRSE+TS2, $Q = 15 \text{ LB/FT}^2$, $\beta = 0 \text{ DEG.}$

○ $\delta_L = -10 \text{ DEG.}$, $\delta_R = 10 \text{ DEG.}$, RUN 45

△ $\delta_L = 10 \text{ DEG.}$, $\delta_R = -10 \text{ DEG.}$, RUN 44

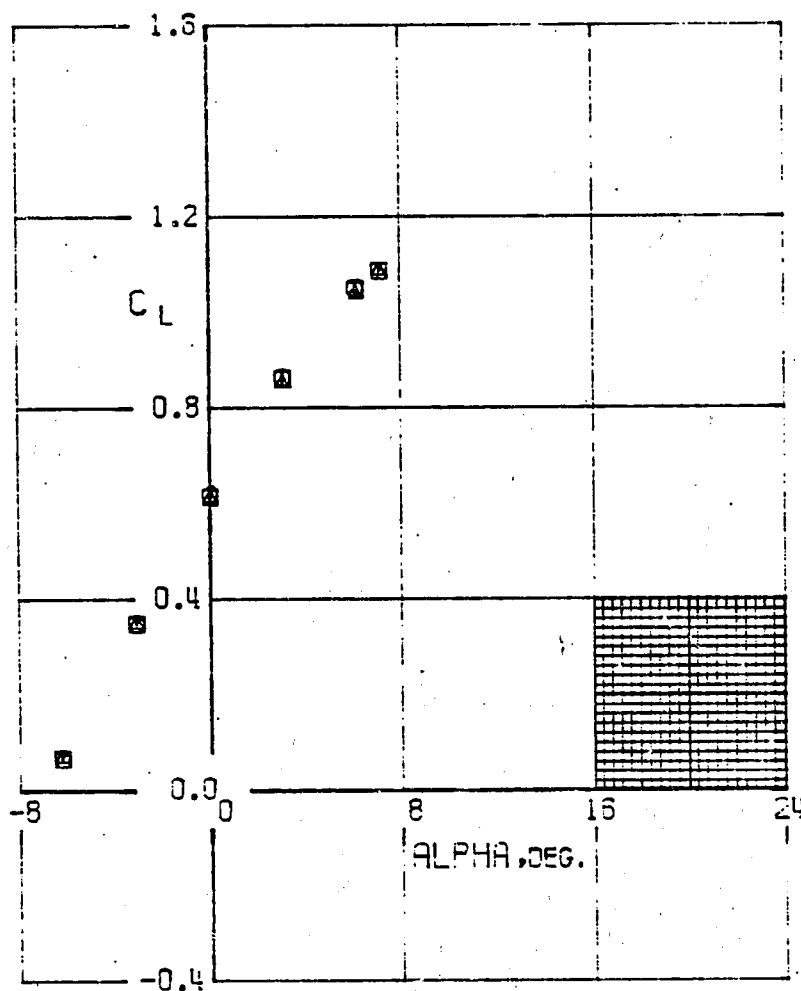
Reproduced from
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EFFECTS OF ASYMMETRIC ELEVON DEFLECTIONS
ON THE JOINED WING CONFIGURATION

3FRSA+TS2. $Q = 15 \text{ LB/FT}^2$, $\beta = 0 \text{ DEG.}$

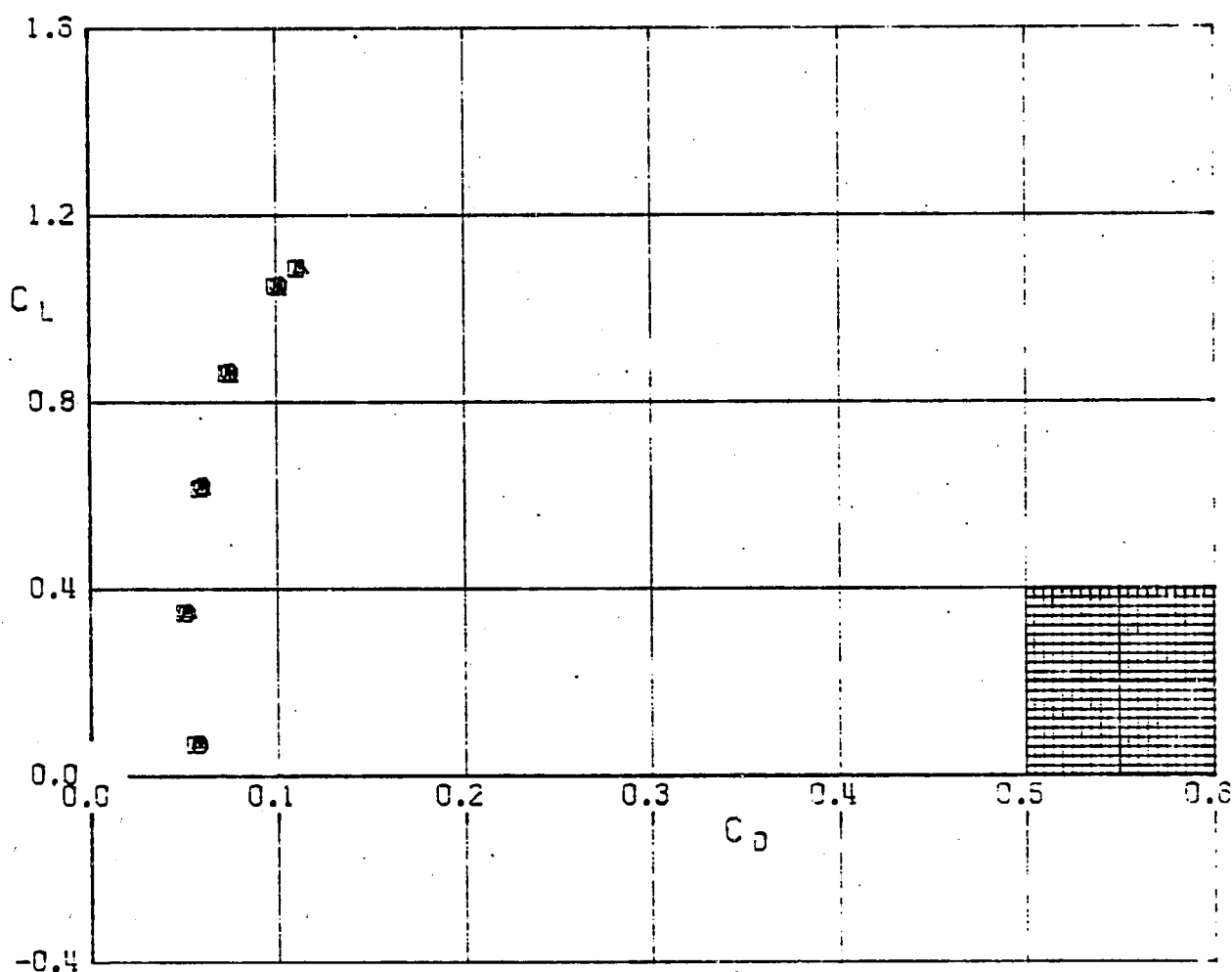
- $\delta_L = -10 \text{ DEG.}$, $\delta_R = 10 \text{ DEG.}$, RUN 47
- △ $\delta_L = 10 \text{ DEG.}$, $\delta_R = -10 \text{ DEG.}$, RUN 46
- $\delta_L = 0 \text{ DEG.}$, $\delta_R = 0 \text{ DEG.}$, RUN 48



EFFECTS OF AILERON DEFLECTIONS ON THE
JOINED WING CONFIGURATION

BFRSA+TS₂, Q = 15 LB/FT**2, BETA = 0 DEG.

- $\delta_L = -10$ DEG.. $\delta_R = 10$ DEG.. RUN 47
- △ $\delta_L = 10$ DEG.. $\delta_R = -10$ DEG.. RUN 46
- $\delta_L = 0$ DEG.. $\delta_R = 0$ DEG.. RUN 48



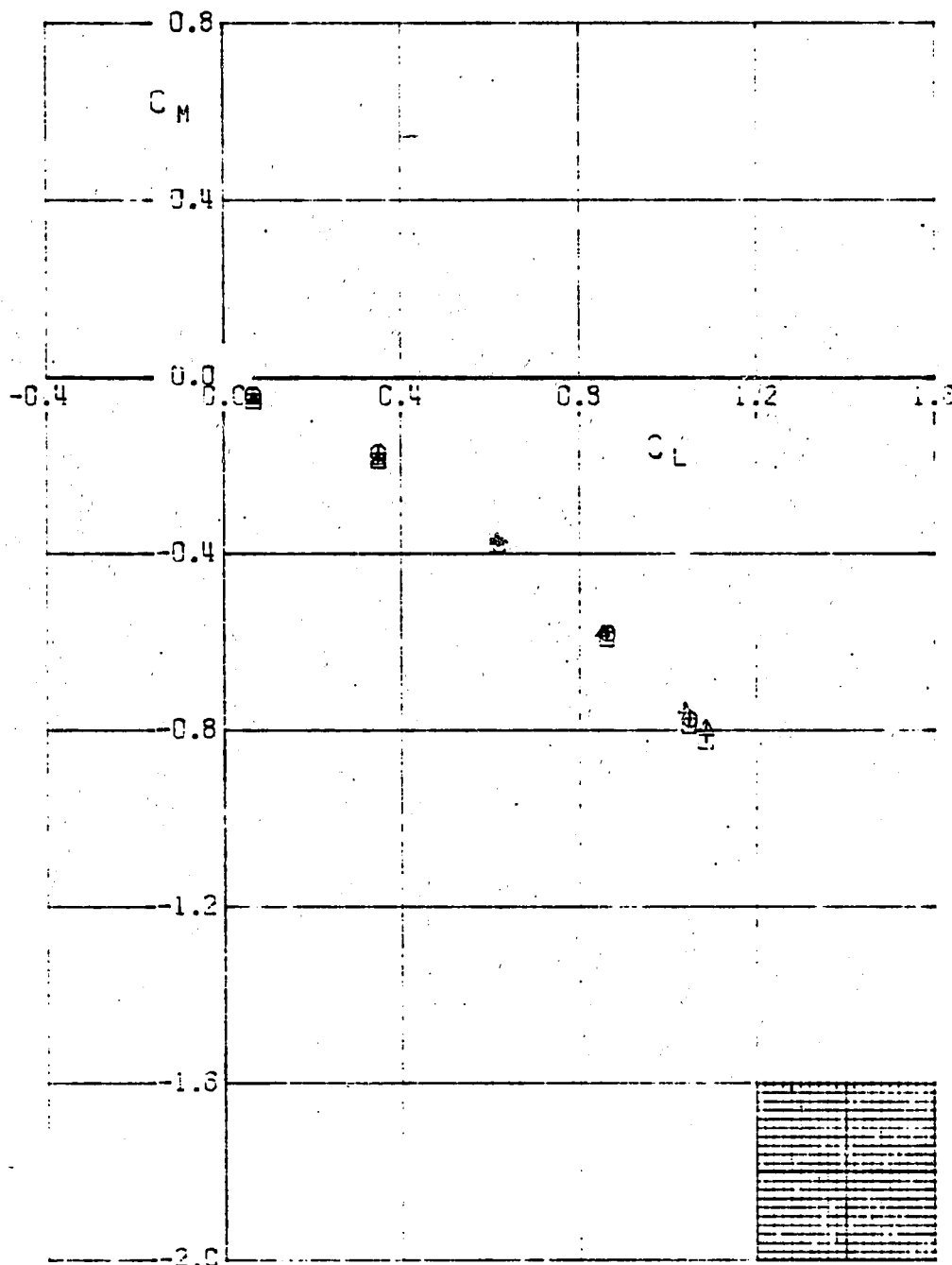
EFFECTS OF AILERON DEFLECTIONS ON THE
JOINED WING CONFIGURATION

5FFSA-TS2, $Q = 15 \text{ LB/FT}^2$, $\beta = 0 \text{ DEG.}$

○ $\delta_L = -10 \text{ DEG.}, \delta_R = 10 \text{ DEG.}, \text{RUN 47}$

△ $\delta_L = 10 \text{ DEG.}, \delta_R = -10 \text{ DEG.}, \text{RUN 48}$

⊞ $\delta_L = 0 \text{ DEG.}, \delta_R = 0 \text{ DEG.}, \text{RUN 49}$

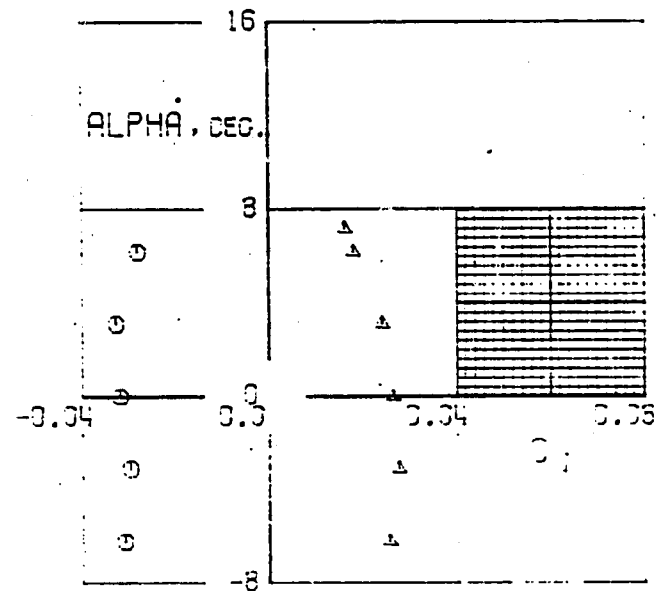


EFFECTS OF AILERON DEFLECTIONS ON THE
 JOINTED WING CONFIGURATION

BFRSA+T₃₂, Q = 15 LB/FT**2, BETA = 0 DEG.

○ $\delta_L = -10$ DEG., $\delta_R = 10$ DEG., RUN 47

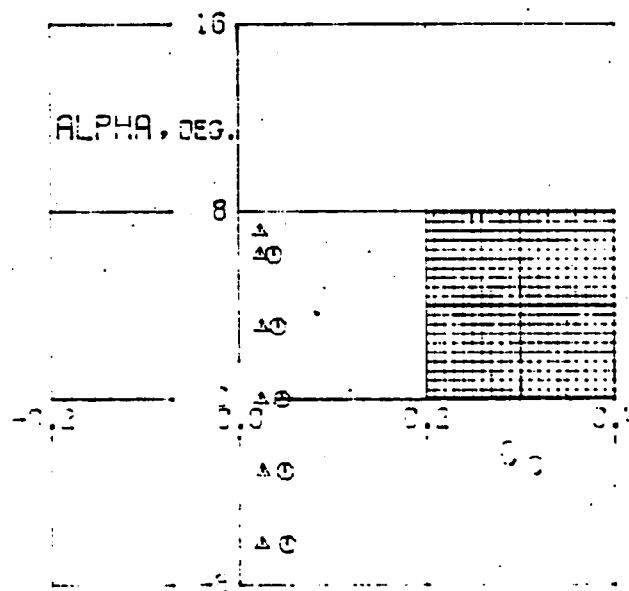
△ $\delta_L = 10$ DEG., $\delta_R = -10$ DEG., RUN 48



EFFECTS OF AILERON DEFLECTIONS ON THE
JOINED WING CONFIGURATION

55439+Tg2, $\beta = 15 \text{ LB/FT}^2 \times 2$, $\beta \text{ETA} = 1 \text{ DEG.}$

$$\begin{aligned} \delta_{\text{L}} &= -10 \text{ DEG.} & \delta_{\text{R}} &= 10 \text{ DEG.} & \text{A. 41} \\ \delta_{\text{L}} &= 10 \text{ DEG.} & \delta_{\text{R}} &= -10 \text{ DEG.} & \text{A. 42} \end{aligned}$$

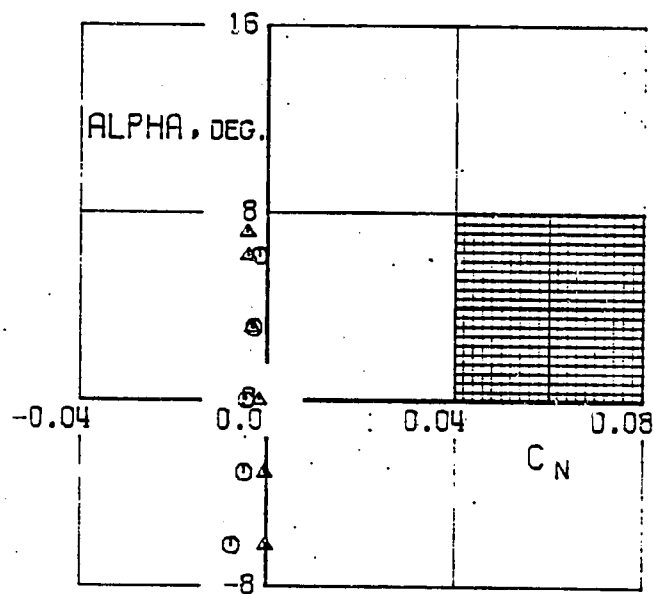


EFFECTS OF AIRCRAFT DEFLECTIONS ON THE
 JOINED WING CONFIGURATION.

BFRSA+TS₂, $Q = 15 \text{ LB/FT}^2$, $\beta = 0 \text{ DEG.}$

$\circ \delta_L = -10 \text{ DEG.}, \delta_R = 10 \text{ DEG.}, \text{RUN 47}$

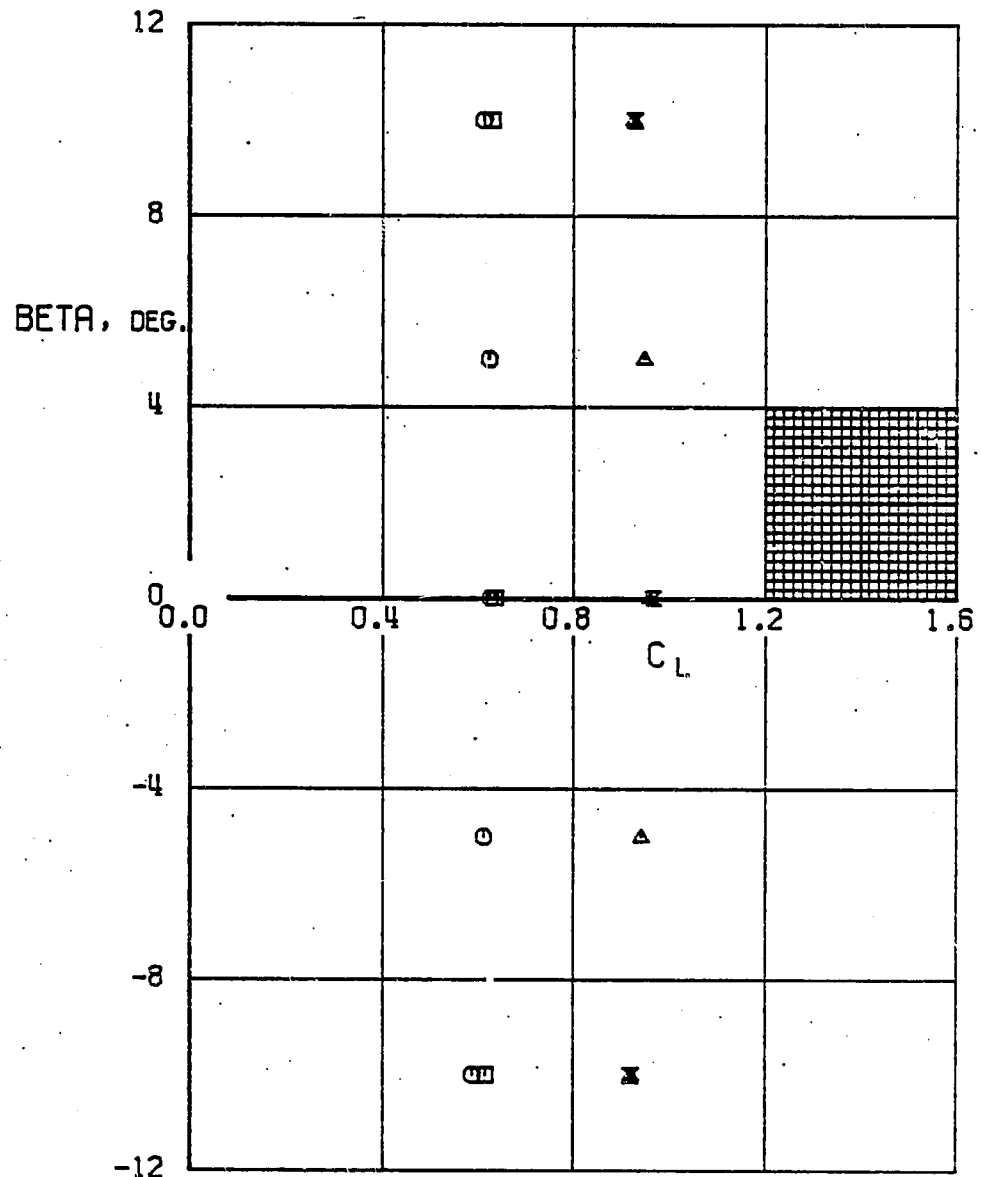
$\Delta \delta_L = 10 \text{ DEG.}, \delta_R = -10 \text{ DEG.}, \text{RUN 46}$



EFFECTS OF AILERON DEFLECTIONS ON THE
JOINED WING CONFIGURATION

$Q = 15 \text{ LB/FT}^{**2}$

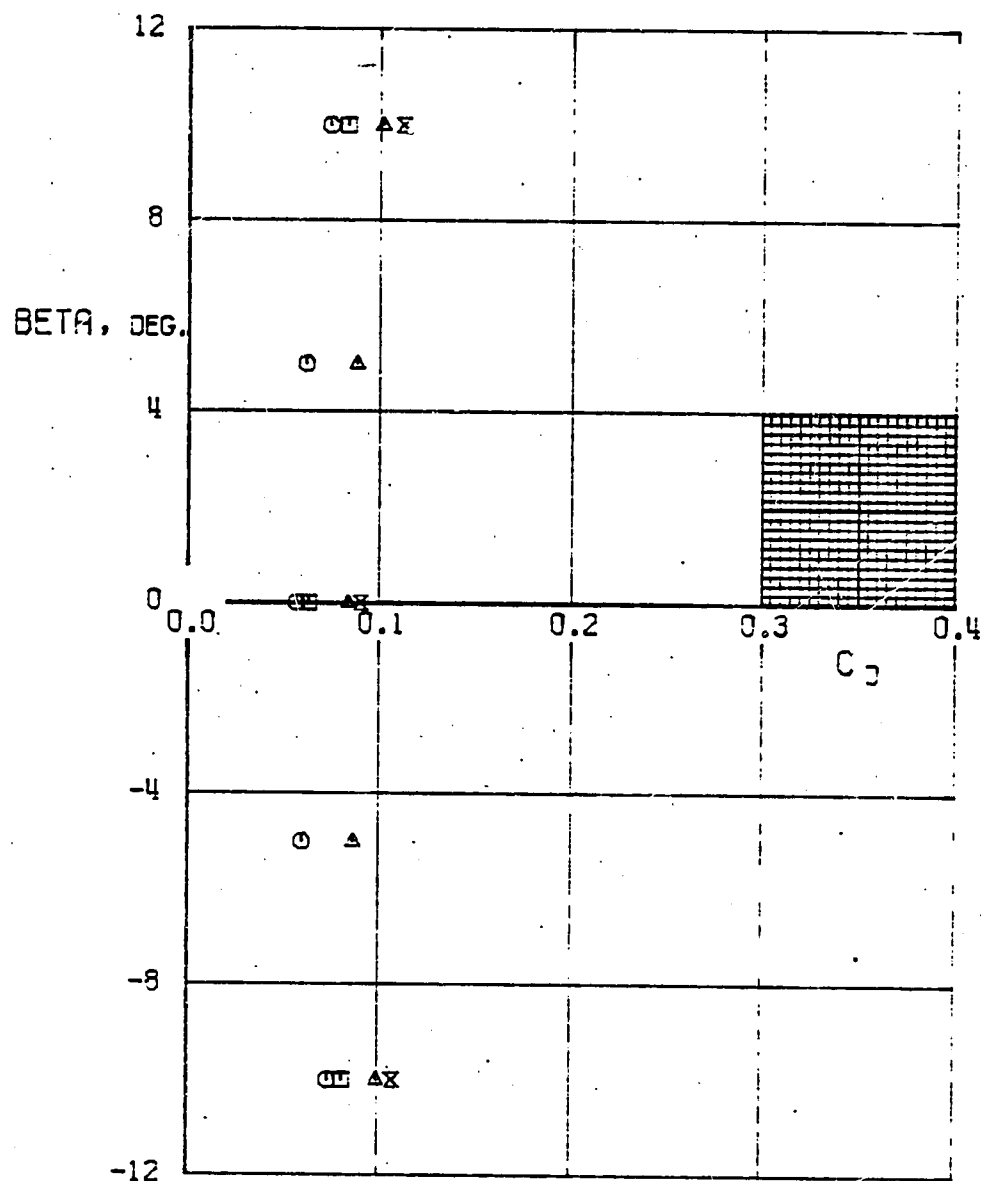
- BFR +T_{S2}, ALPHA = 0.01 DEG., RUN 21
- △ BFR +T_{S2}, ALPHA = 5.14 DEG., RUN 22
- BNFR+T_{S2}, ALPHA = 0.01 DEG., RUN 25
- × BNFR+T_{S2}, ALPHA = 5.15 DEG., RUN 26



EFFECTS OF SIDESLIP
ON THE JOINED WING CONFIGURATION
WITH AND WITHOUT EXTENDED NOSE

$$Q = 15 \text{ LB/FT}^2$$

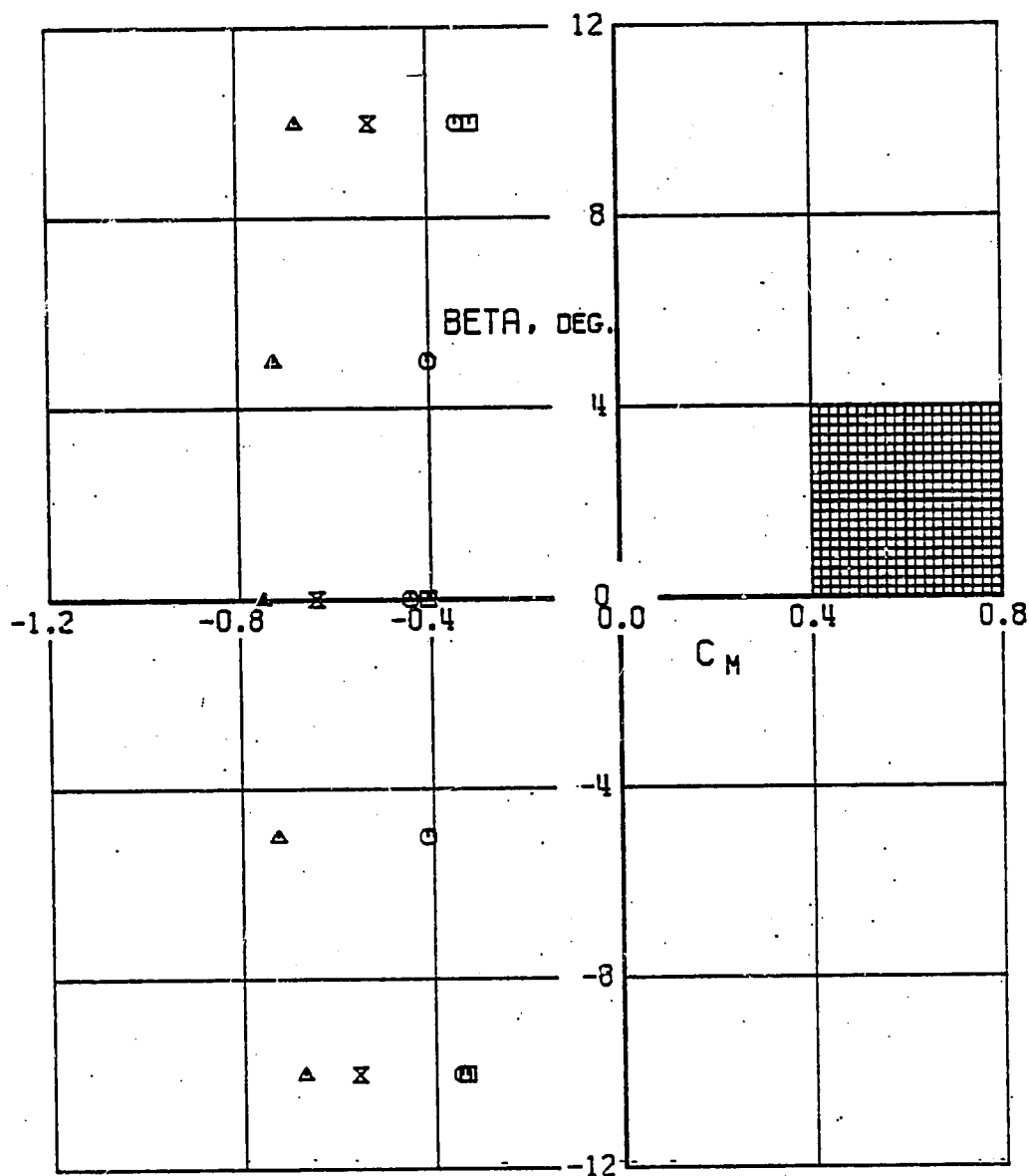
- BFR +TS₂, ALPHA = 0.01 DEG., RUN 21
- △ BFR +TS₂, ALPHA = 5.14 DEG., RUN 22
- BNFR+TS₂, ALPHA = 0.01 DEG., RUN 25
- × BNFR+TS₂, ALPHA = 5.15 DEG., RUN 26



EFFECTS OF SIDESLIP
ON THE JOINED WING CONFIGURATION
WITH AND WITHOUT EXTENDED NOSE

$$Q = 15 \text{ LB/FT}^2$$

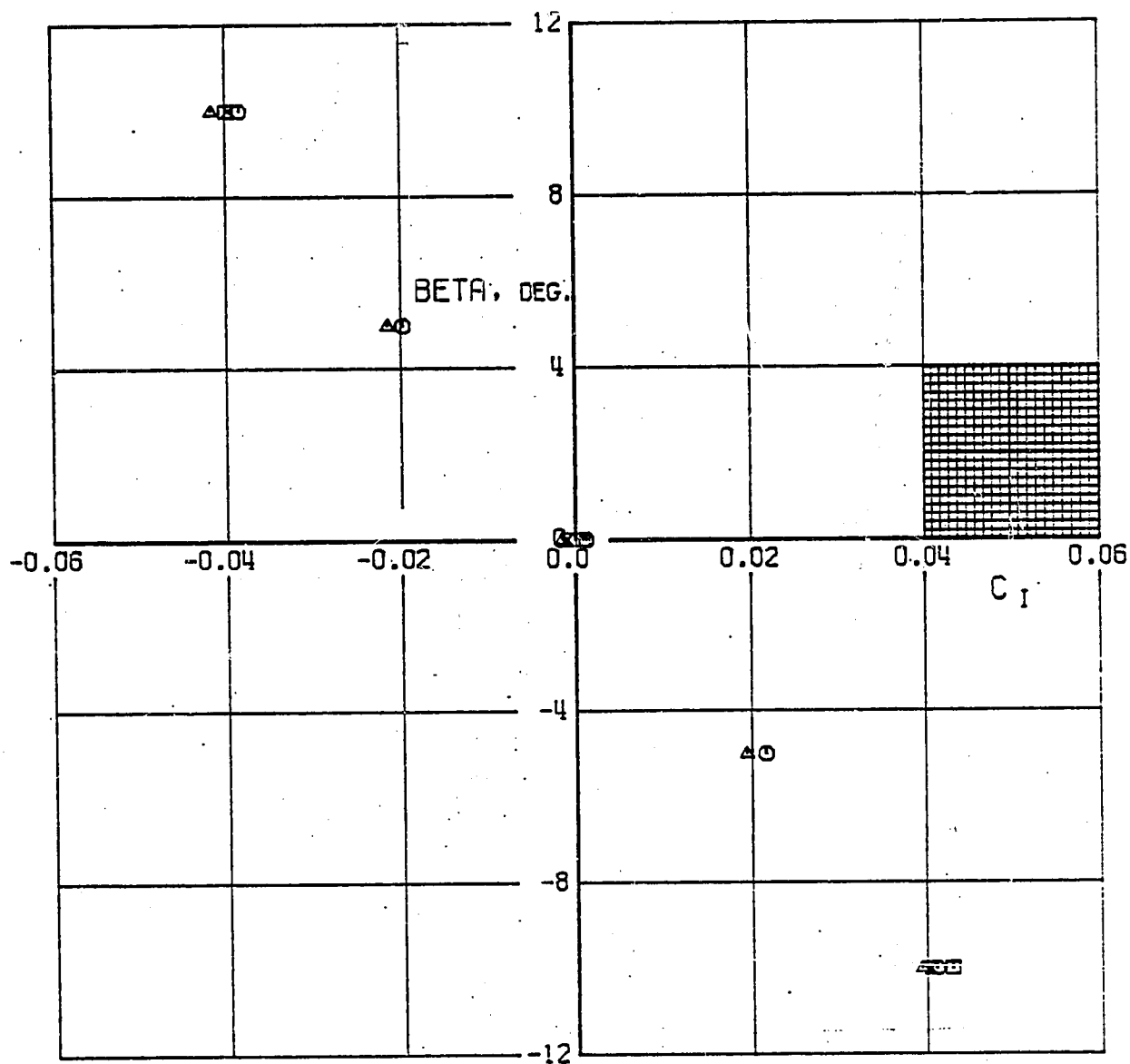
- BFR +TS₂, ALPHA = 0.01 DEG., RUN 21
- ▲ BFR +TS₂, ALPHA = 5.14 DEG., RUN 22
- ◻ BNFR+TS₂, ALPHA = 0.01 DEG., RUN 25
- × BNFR+TS₂, ALPHA = 5.15 DEG., RUN 26



EFFECTS OF SIDESLIP
ON THE JOINED WING CONFIGURATION
WITH AND WITHOUT EXTENDED NOSE

$Q = 15 \text{ LB/FT}^2$

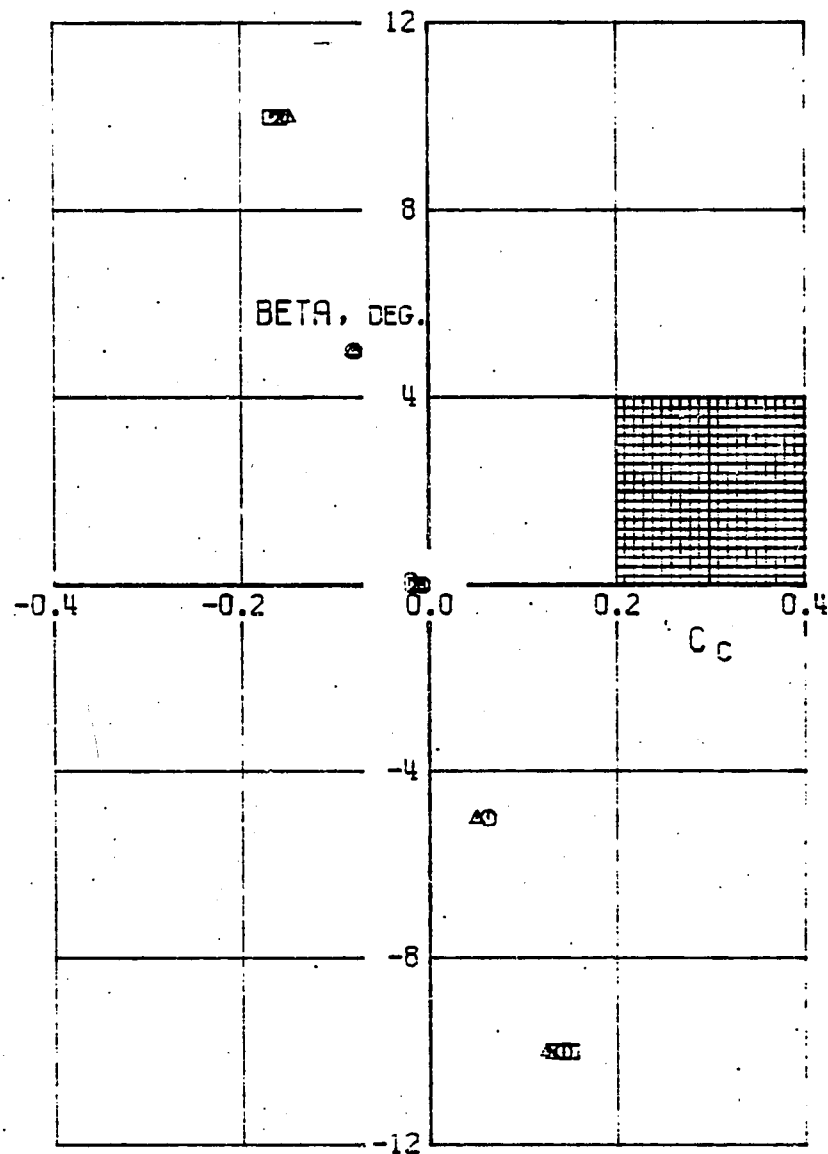
- BFR + T_{S2} , ALPHA = 0.01 DEG., RUN 21
- ▲ BFR + T_{S2} , ALPHA = 5.14 DEG., RUN 22
- BNFR + T_{S2} , ALPHA = 0.01 DEG., RUN 25
- × BNFR + T_{S2} , ALPHA = 5.15 DEG., RUN 26



EFFECTS OF SIDESLIP
ON THE JOINED WING CONFIGURATION
WITH AND WITHOUT EXTENDED NOSE

$$Q = 15 \text{ LB/FT}^2$$

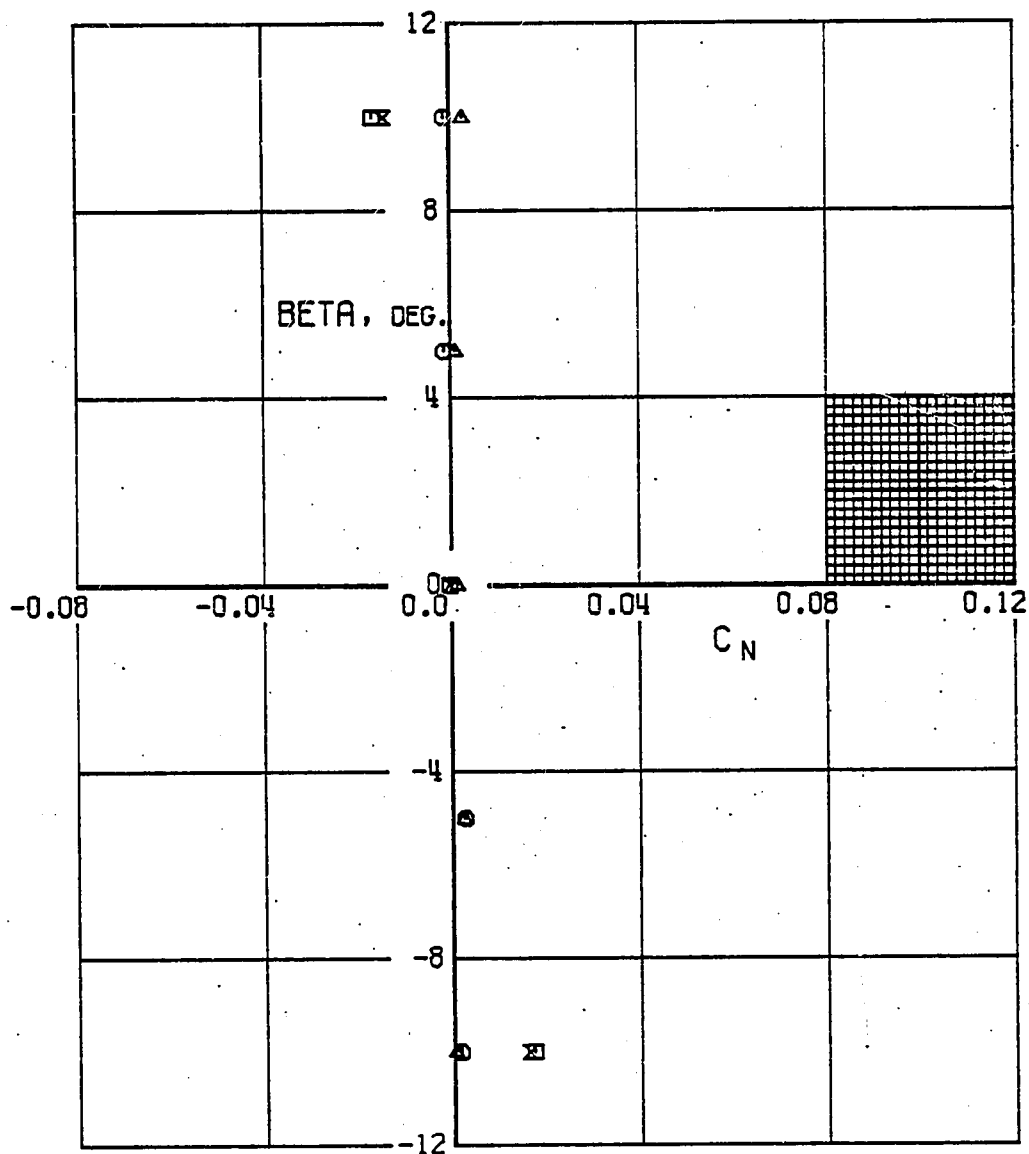
- BFR +TS2. ALPHA = 0.01 DEG.. RUN 21
- ▲ BFR +TS2. ALPHA = 5.14 DEG.. RUN 22
- BNFR+TS2. ALPHA = 0.01 DEG.. RUN 25
- ⊗ BNFR+TS2. ALPHA = 5.15 DEG.. RUN 26



EFFECTS OF SIDESLIP
ON THE JOINED WING CONFIGURATION
WITH AND WITHOUT EXTENDED NOSE

$Q = 15 \text{ LB/FT}^2$

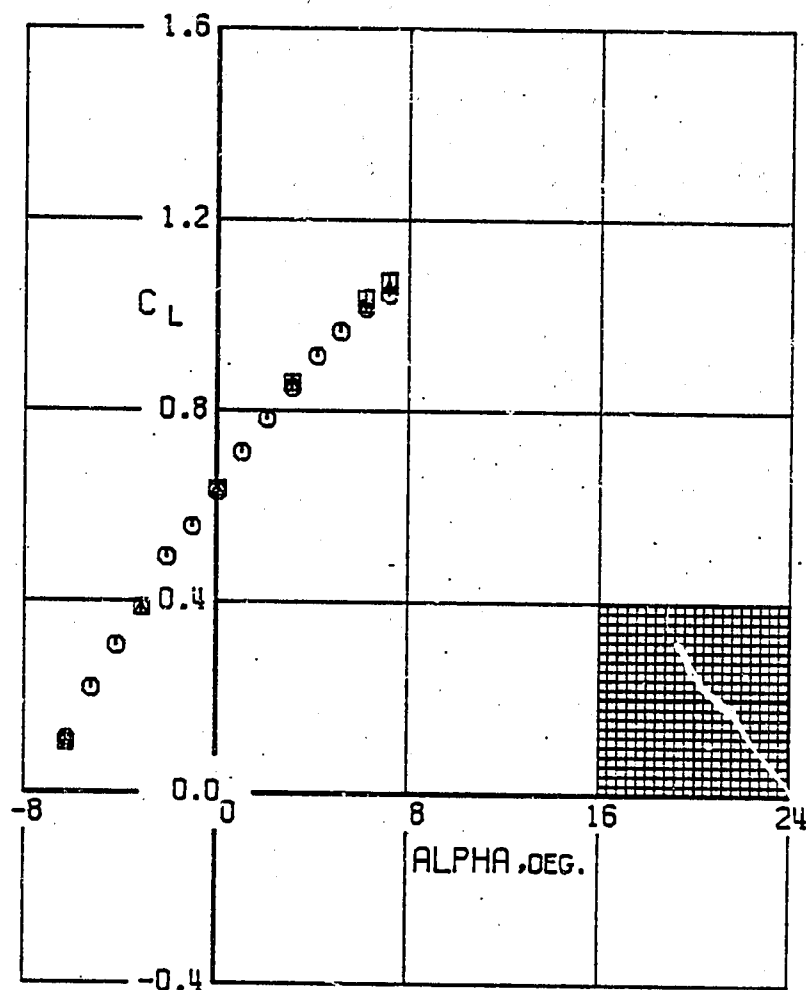
- BFR + T_{S2} , ALPHA = 0.01 DEG., RUN 21
- ▲ BFR + T_{S2} , ALPHA = 5.14 DEG., RUN 22
- BNFR + T_{S2} , ALPHA = 0.01 DEG., RUN 25
- × BNFR + T_{S2} , ALPHA = 5.15 DEG., RUN 26



EFFECTS OF SIDESLIP
ON THE JOINED WING CONFIGURATION
WITH AND WITHOUT EXTENDED NOSE

$Q = 15 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

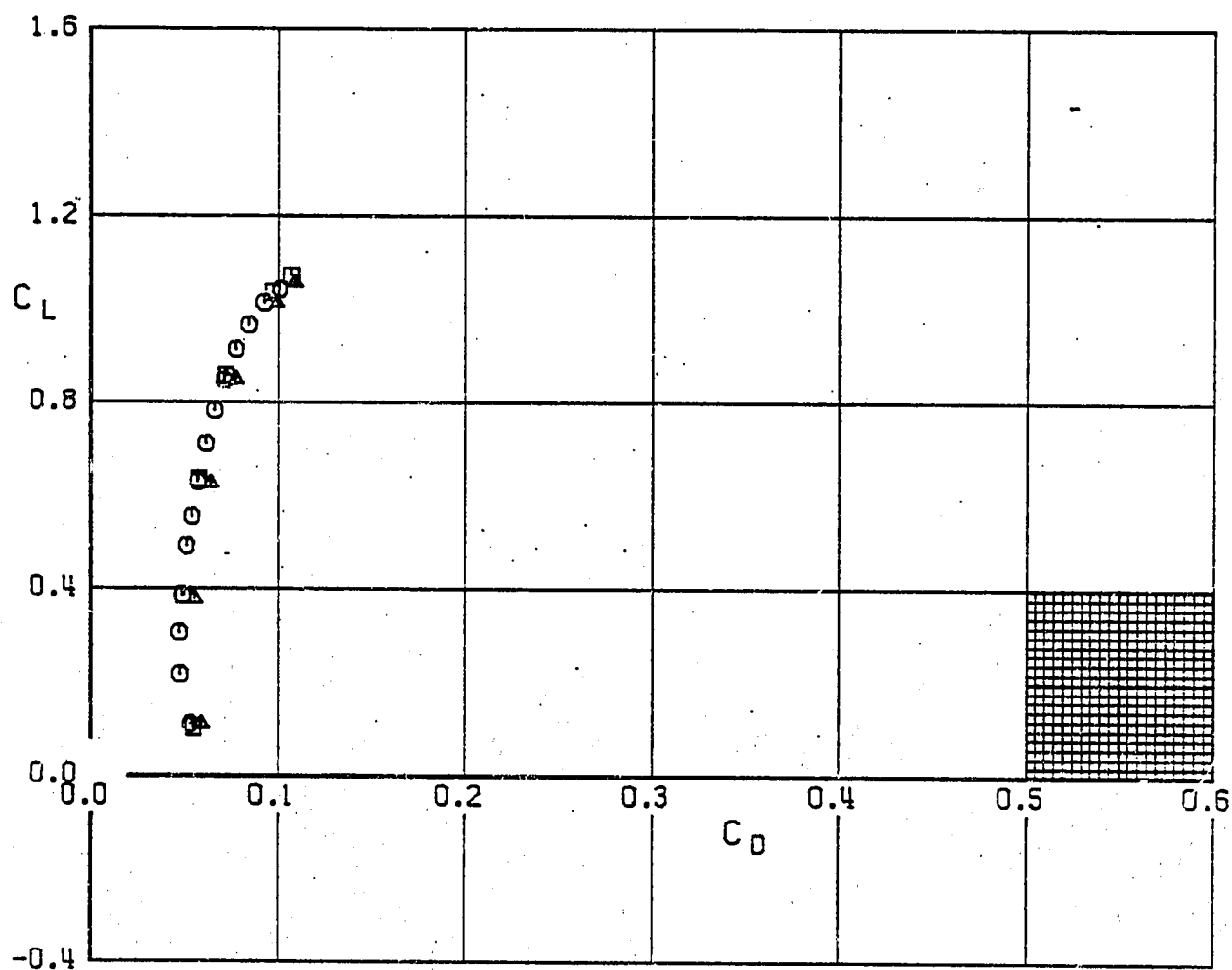
- BFR + T_{S2} , RUN 19
- ▲ BNFR + T_{S2} , RUN 24
- ▣ BFRS + T_{S2} , RUN 37



EFFECTS OF A NOSE EXTENSION
AND STRAKES ON THE
BASIC JOINED WING CONFIGURATION
WITH $Q = 15 \text{ LB/FT}^2$

$Q = 15 \text{ LB/FT}^2$, $\text{BETA} = 0 \text{ DEG.}$

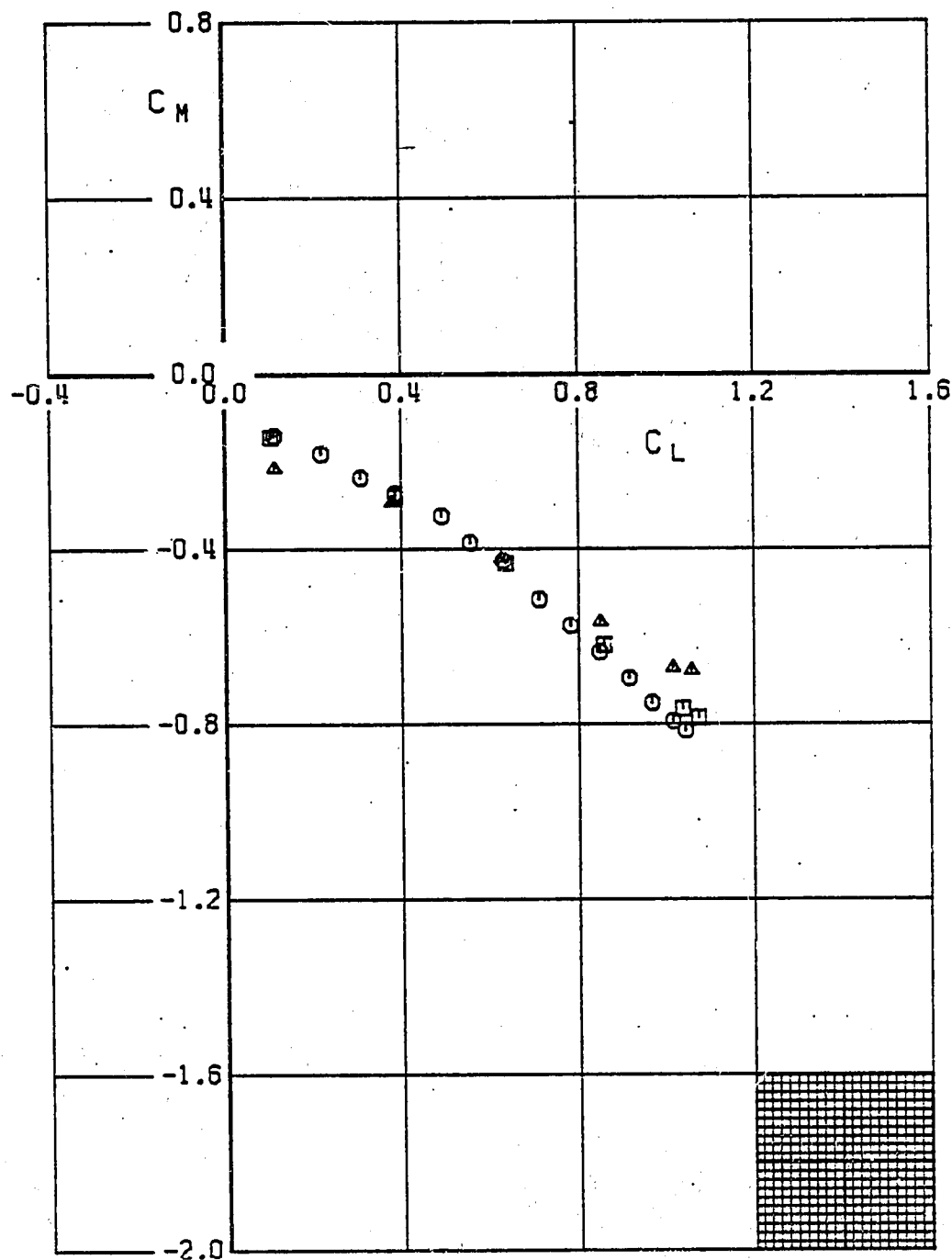
- BFR + T_{S2} , RUN 19
- ▲ BNFR + T_{S2} , RUN 24
- BFRS + T_{S2} , RUN 37



EFFECTS OF A NOSE EXTENSION
AND STRAKES ON THE
BASIC JOINED WING CONFIGURATION
WITH $Q = 15 \text{ LB/FT}^2$

$Q = 15 \text{ LB/FT}^{**2}$, $\text{BETA} = 0 \text{ DEG.}$

- BFR + T_{S2} , RUN 19
- △ BNFR + T_{S2} , RUN 24
- BFRS + T_{S2} , RUN 37



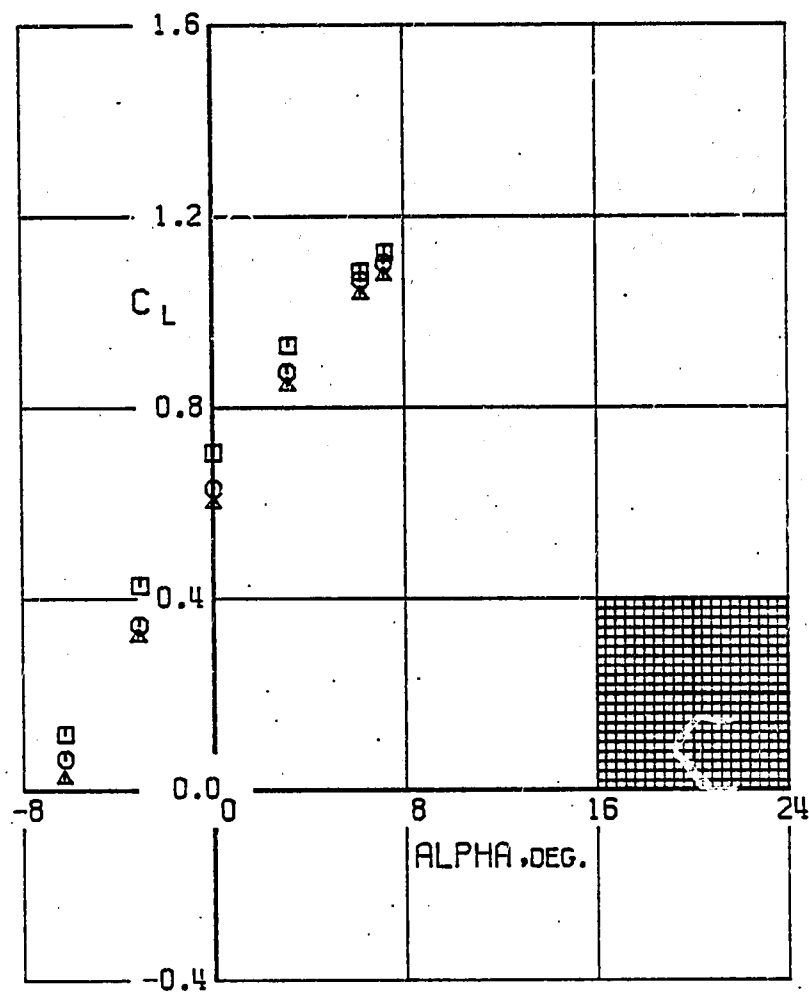
EFFECTS OF A NOSE EXTENSION
AND STRAKES ON THE
BASIC JOINED WING CONFIGURATION
WITH $Q = 15 \text{ LB/FT}^{**2}$

BNFRC₃₀+T_{S2}, Q = 15 LB/FT**2, BETA = 0 DEG.

○ I_C = 0 DEG., RUN 27

▲ I_C = - 5 DEG., RUN 31

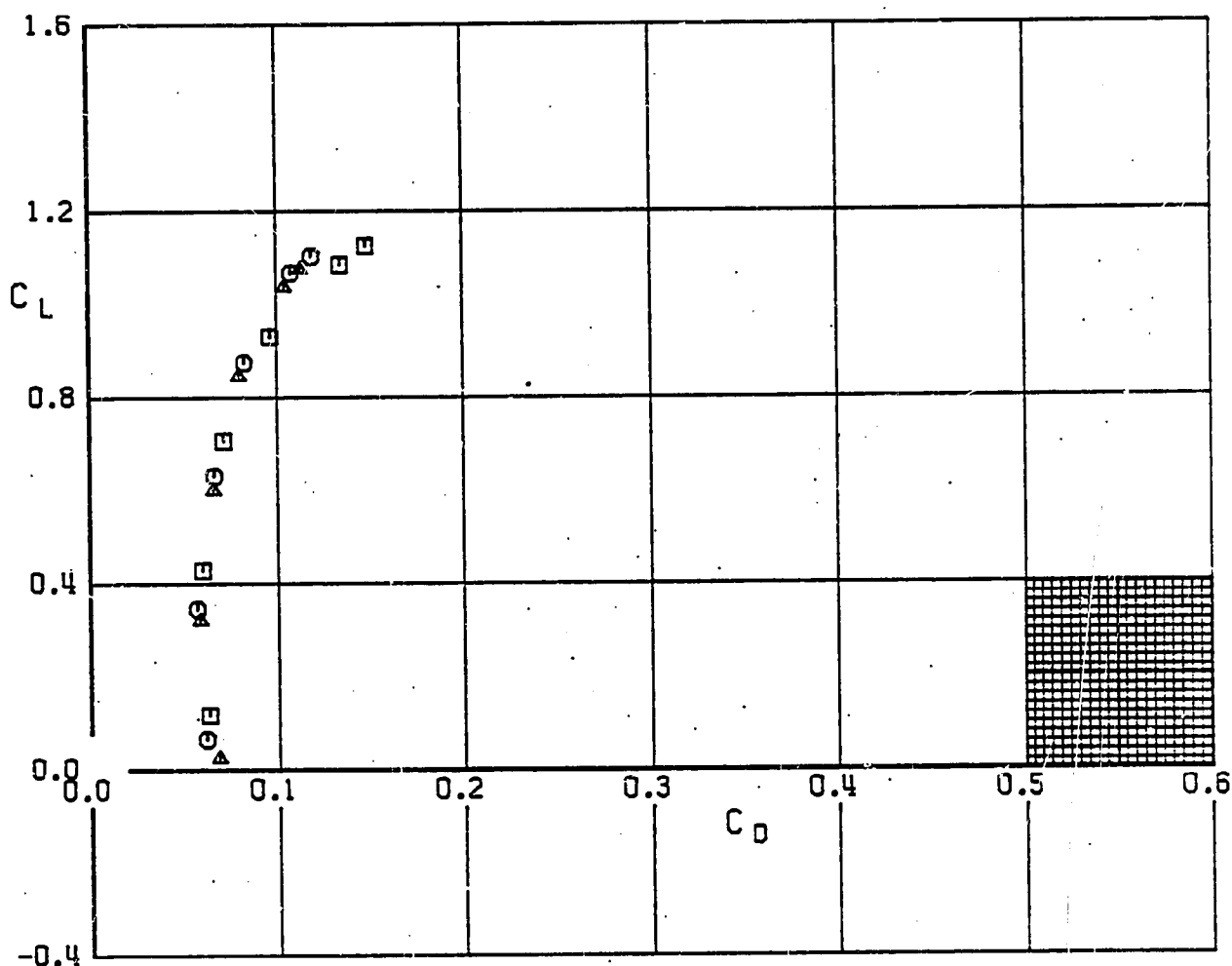
□ I_C = 10 DEG., RUN 30



EFFECTS OF THE 30 DEGREE SWEPT CANARD
INCIDENCE ANGLE
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

BNFRC₃₀+TS₂, Q = 15 LB/FT**2, BETA = 0 DEG.

- I_C = 0 DEG., RUN 27
- ▲ I_C = - 5 DEG., RUN 31
- I_C = 10 DEG., RUN 30



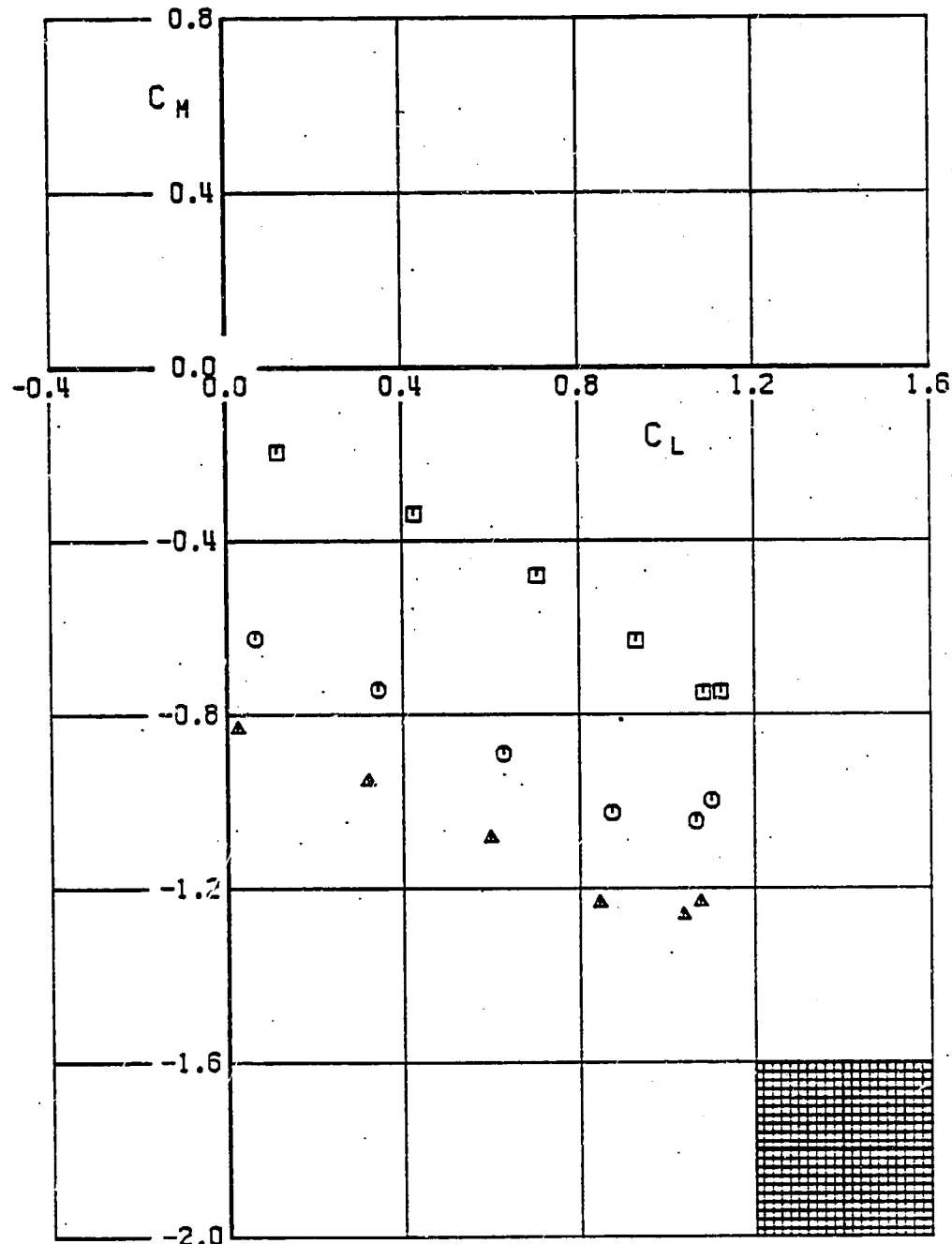
EFFECTS OF THE 30 DEGREE SWEPT CANARD
INCIDENCE ANGLE
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

BNFRC₃₀+T_{S2}, Q = 15 LB/FT**2, BETA = 0 DEG.

○ I_C = 0 DEG., RUN 27

▲ I_C = - 5 DEG., RUN 31

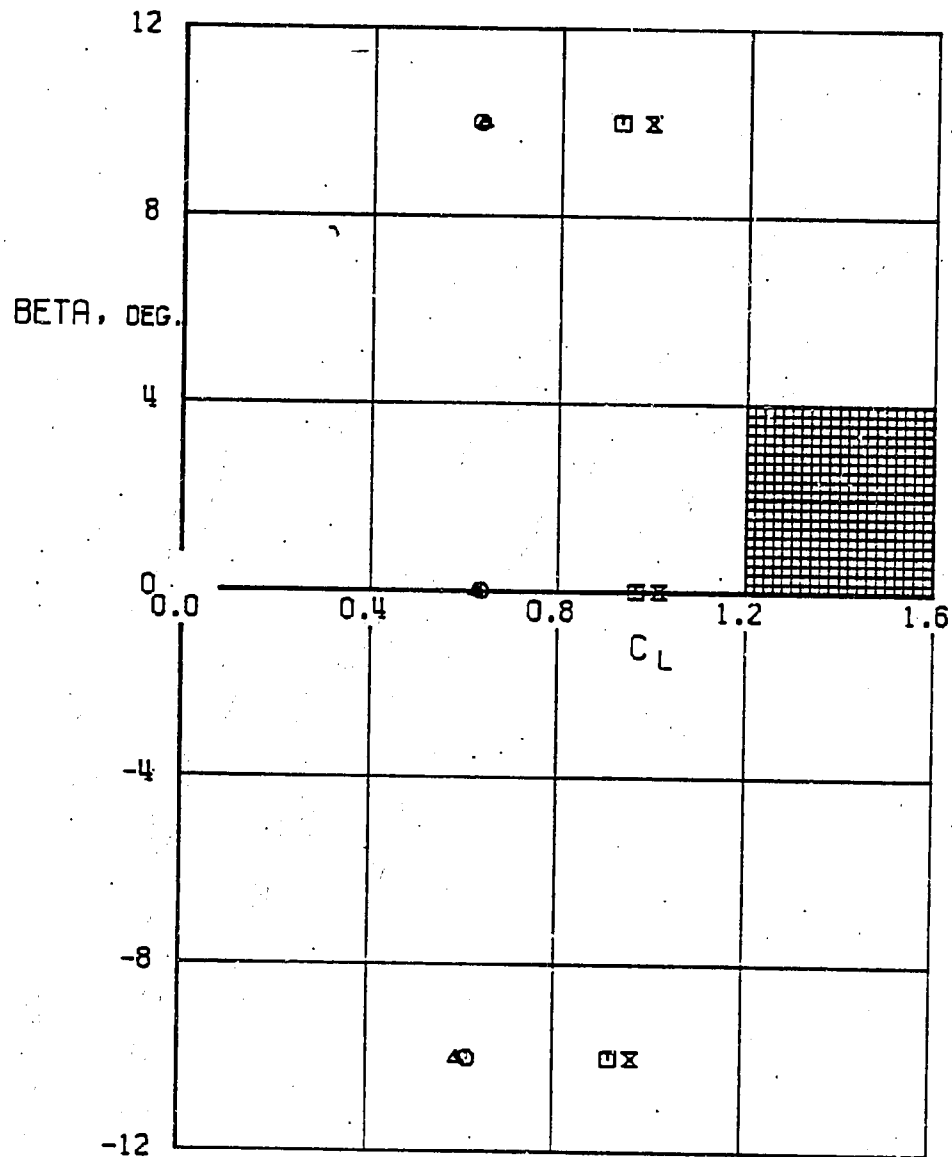
□ I_C = 10 DEG., RUN 30



EFFECTS OF THE 30 DEGREE SWEPT CANARD
INCIDENCE ANGLE
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

$Q = 15 \text{ LB/FT}^2$

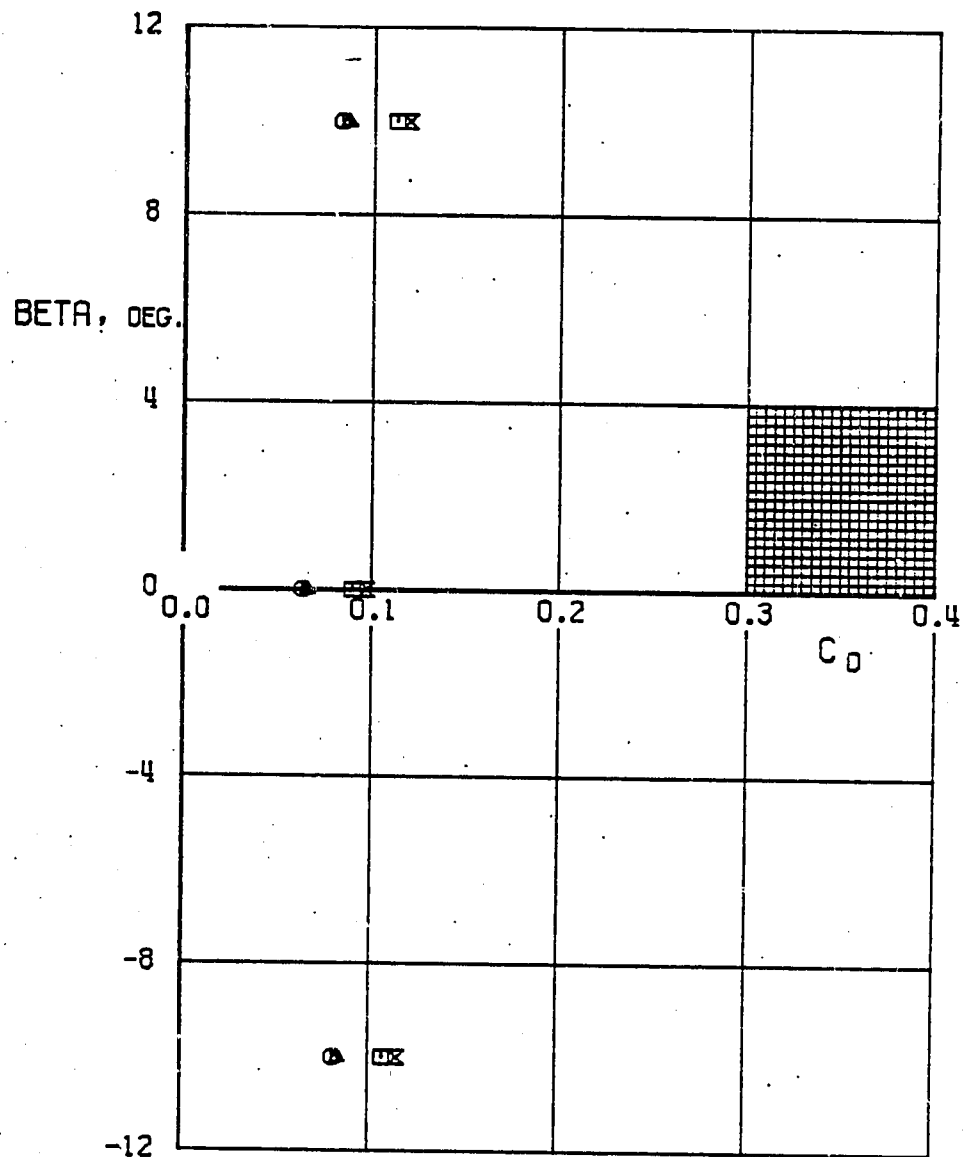
- BNFR +T_{S2}, ALPHA = 0.01 DEG., RUN 25
- ▲ BNFR₃₀+T_{S2}, ALPHA = 0.01 DEG., I_C = 0 DEG., RUN 28
- BNFR +T_{S2}, ALPHA = 5.14 DEG., RUN 26
- × BNFR₃₀+T_{S2}, ALPHA = 5.17 DEG., I_C = 0 DEG., RUN 29



EFFECTS OF A 30 DEGREE SWEPT CANARD
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE IN SIDESLIP

$$Q = 15 \text{ LB/FT**2}$$

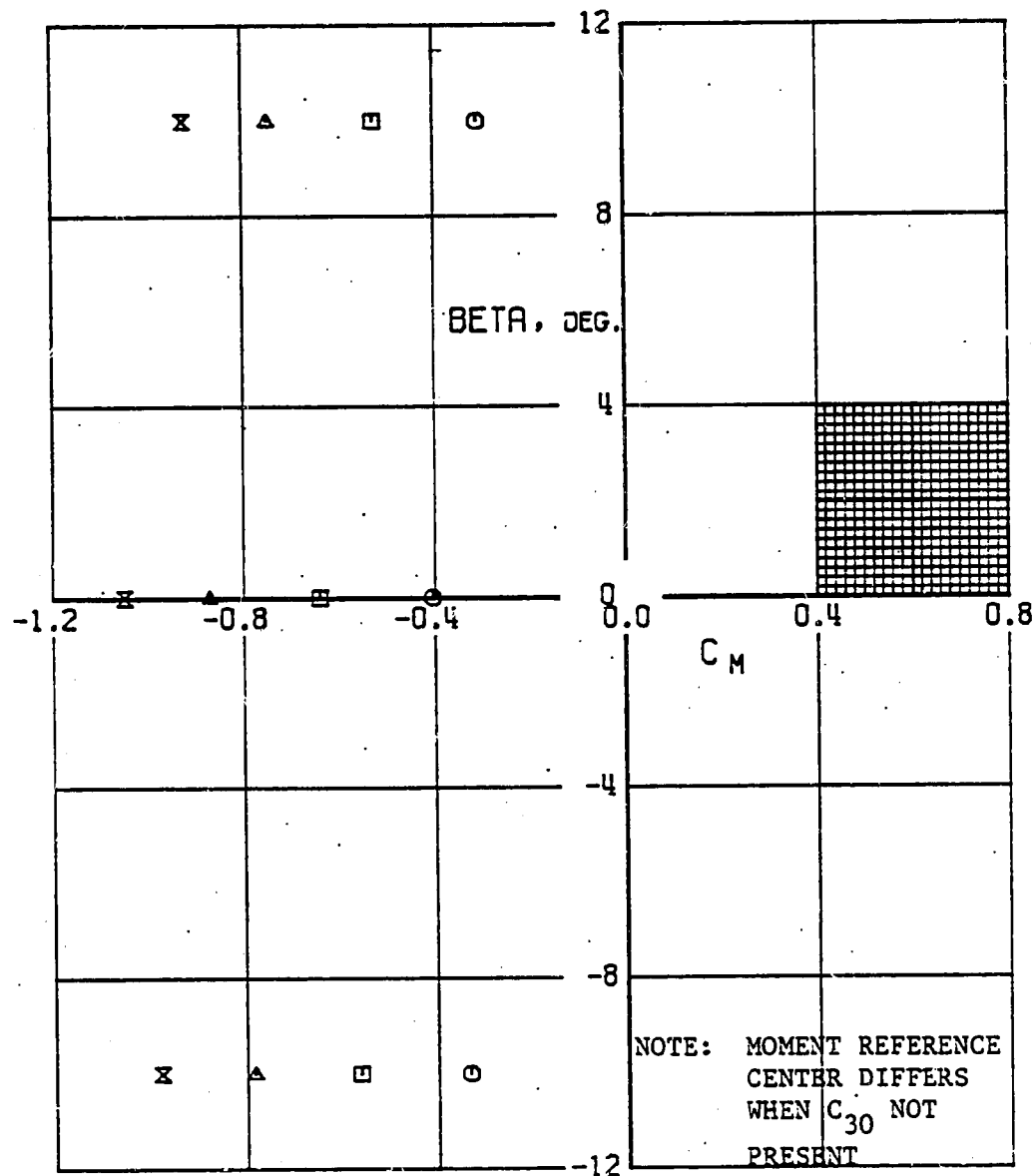
- BNFR +T_{S2}, ALPHA = 0.01 DEG., RUN 25
- ▲ BNFR₃₀+T_{S2}, ALPHA = 0.01 DEG., I_C = 0 DEG., RUN 28
- BNFR +T_{S2}, ALPHA = 5.14 DEG., RUN 26
- ⊗ BNFR₃₀+T_{S2}, ALPHA = 5.17 DEG., I_C = 0 DEG., RUN 29



EFFECTS OF A 30 DEGREE SWEPT CANARD
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE IN SIDESLIP

$$Q = 15 \text{ LB/FT}^2$$

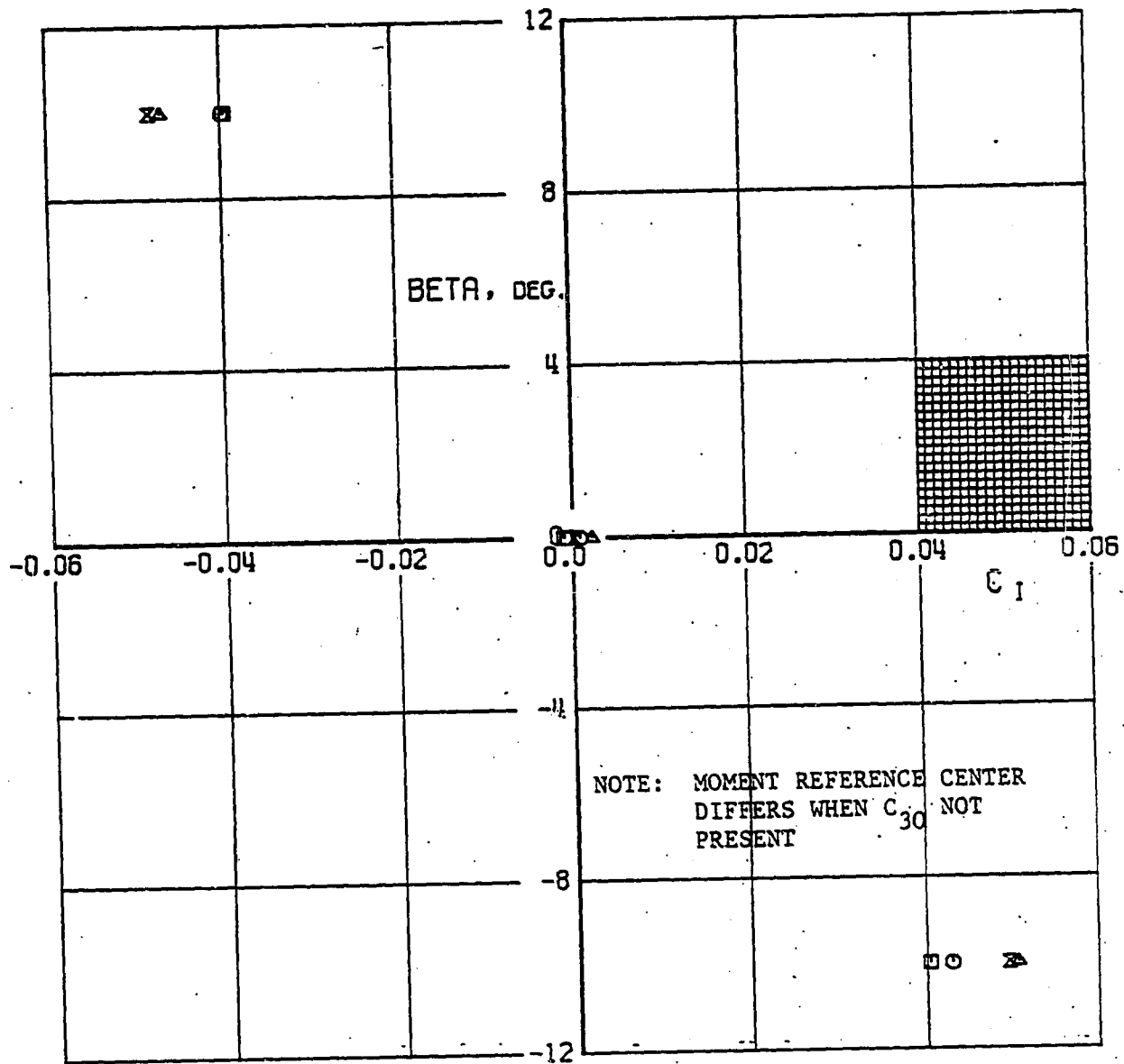
- BNFR +T_{S2}, ALPHA = 0.01 DEG. . RUN 25
- ▲ BNFR₃₀+T_{S2}, ALPHA = 0.01 DEG., I_C = 0 DEG., RUN 28
- BNFR +T_{S2}, ALPHA = 5.14 DEG. . RUN 26
- × BNFR₃₀+T_{S2}, ALPHA = 5.17 DEG., I_C = 0 DEG., RUN 29



EFFECTS OF A 30 DEGREE SWEPT CANARD
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE IN SIDESLIP

$$Q = 15 \text{ LB/FT}^2$$

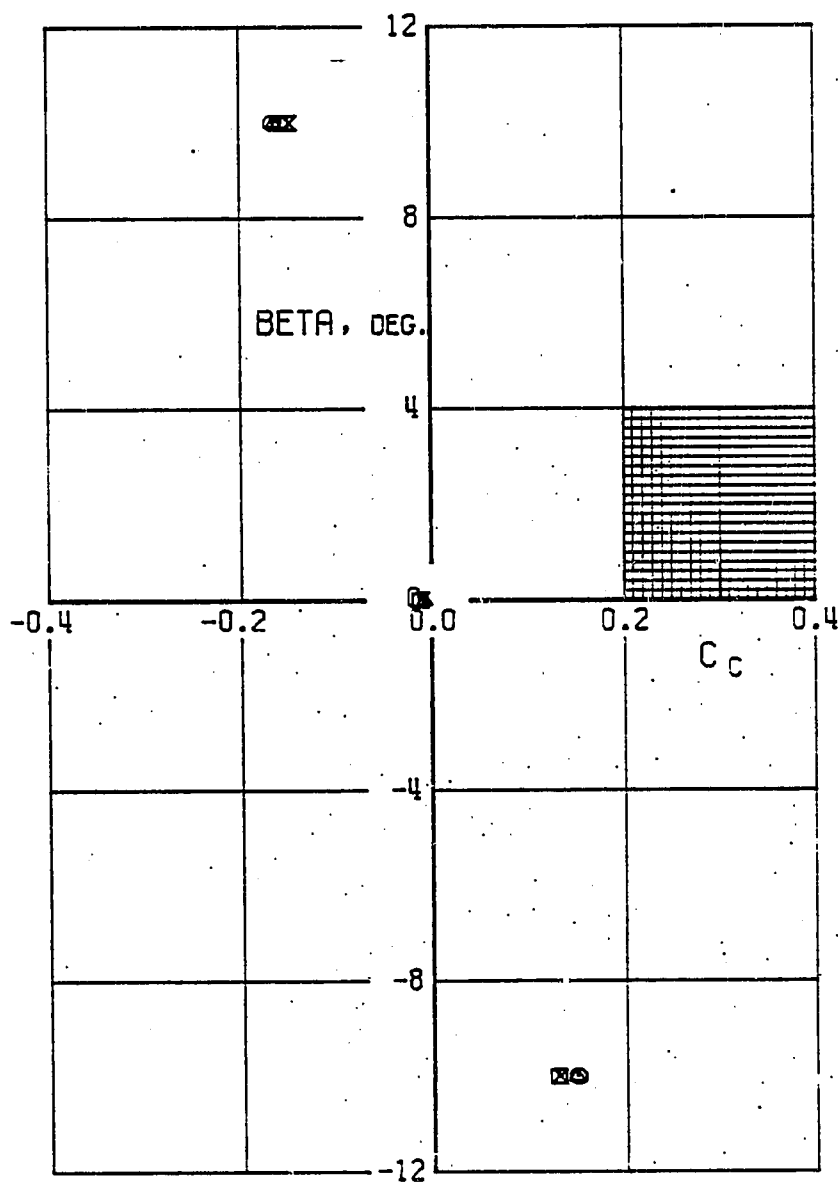
- BNFR +T_{S2}, ALPHA = 0.01 DEG., RUN 25
- ▲ BNFR₃₀+T_{S2}, ALPHA = 0.01 DEG., I_C = 0 DEG., RUN 28
- BNFR +T_{S2}, ALPHA = 5.14 DEG., RUN 26
- × BNFR₃₀+T_{S2}, ALPHA = 5.17 DEG., I_C = 0 DEG., RUN 29



EFFECTS OF A 30 DEGREE SWEPT CANARD
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE IN SIDESLIP

$Q = 15 \text{ LB/FT}^2$

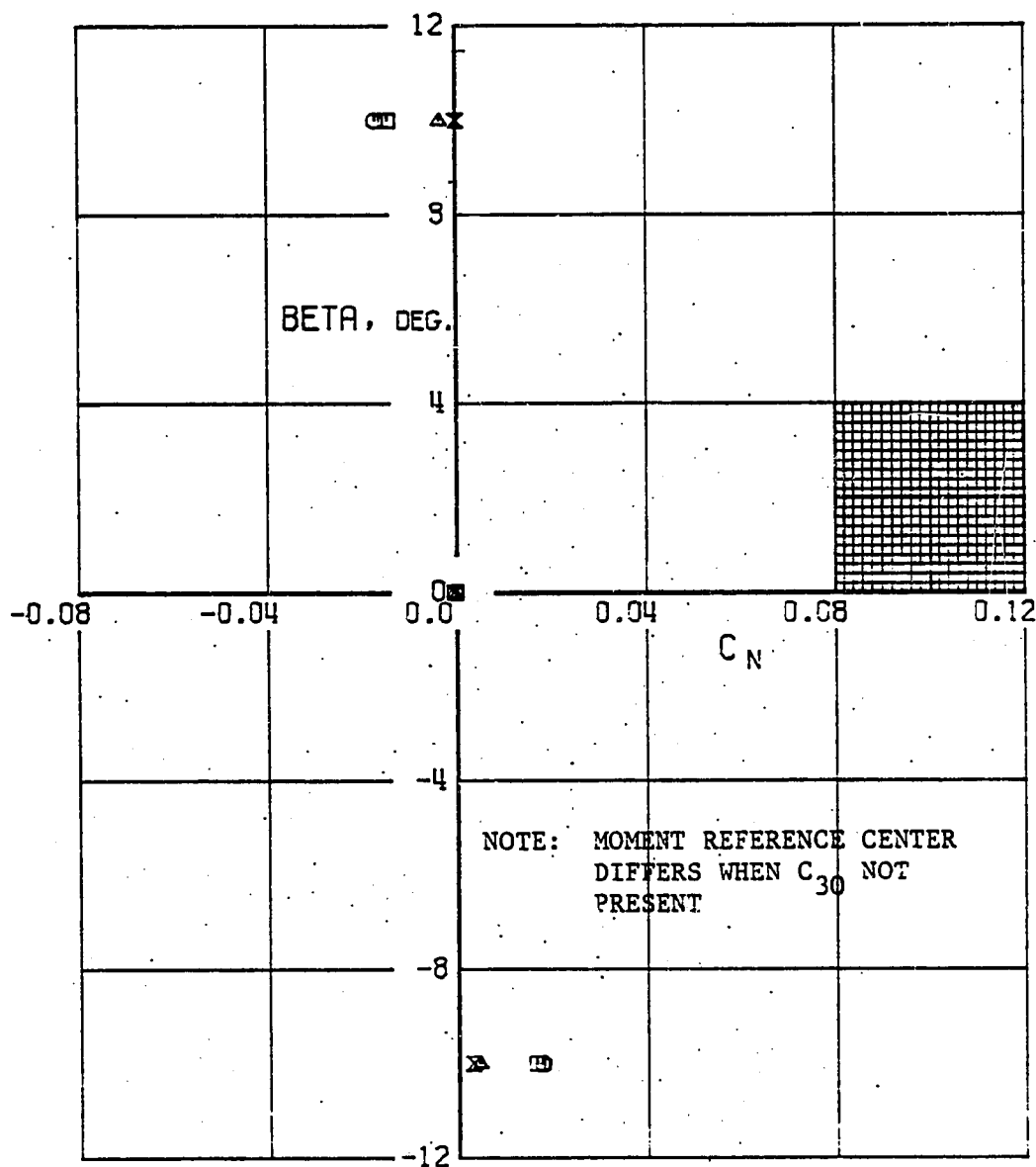
- BNFR +TS₂, ALPHA = 0.01 DEG., RUN 25
- ▲ BNFR₃₀+TS₂, ALPHA = 0.01 DEG., I_C = 0 DEG., RUN 28
- BNFR +TS₂, ALPHA = 5.14 DEG., RUN 26
- × BNFR₃₀+TS₂, ALPHA = 5.17 DEG., I_C = 0 DEG., RUN 29



EFFECTS OF A 30 DEGREE SWEPT CANARD
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE IN SIDESLIP

$$Q = 15 \text{ LB/FT}^2$$

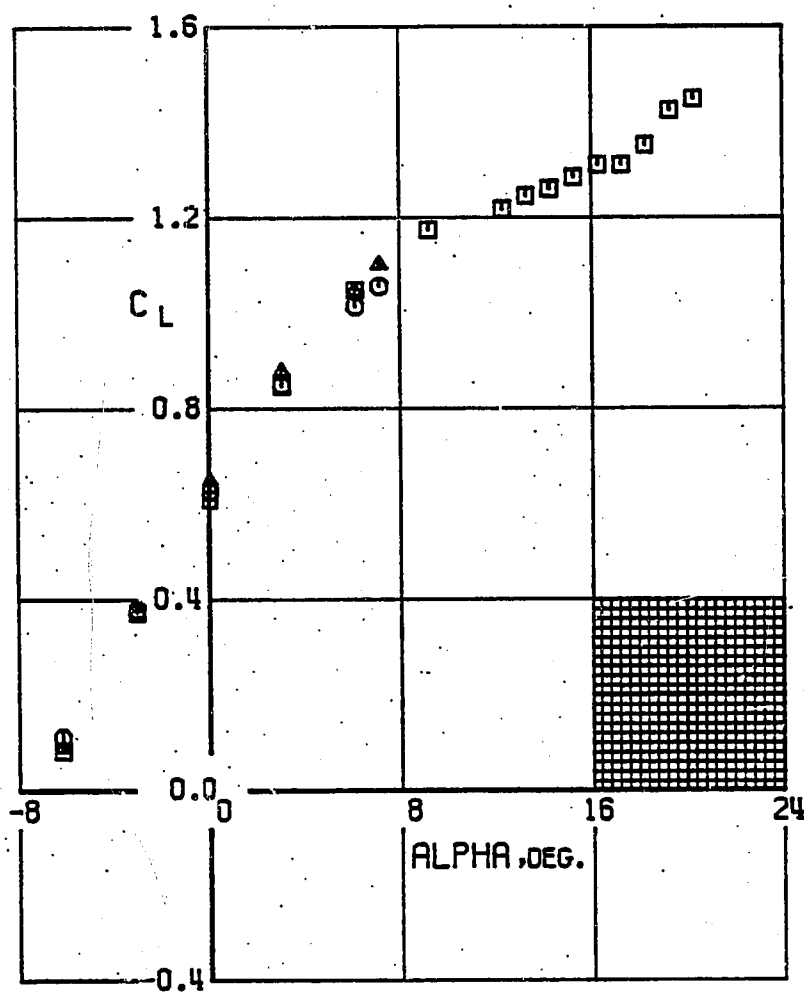
- BNFR +TS2, ALPHA = 0.01 DEG., RUN 25
- ▲ BNFR C₃₀+TS2, ALPHA = 0.01 DEG., I_C = 0 DEG., RUN 28
- BNFR +TS2, ALPHA = 5.14 DEG., RUN 26
- × BNFR C₃₀+TS2, ALPHA = 5.17 DEG., I_C = 0 DEG., RUN 29



EFFECTS OF A 30 DEGREE SWEPT CANARD
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE IN SIDESLIP

BETA = 0 DEG.

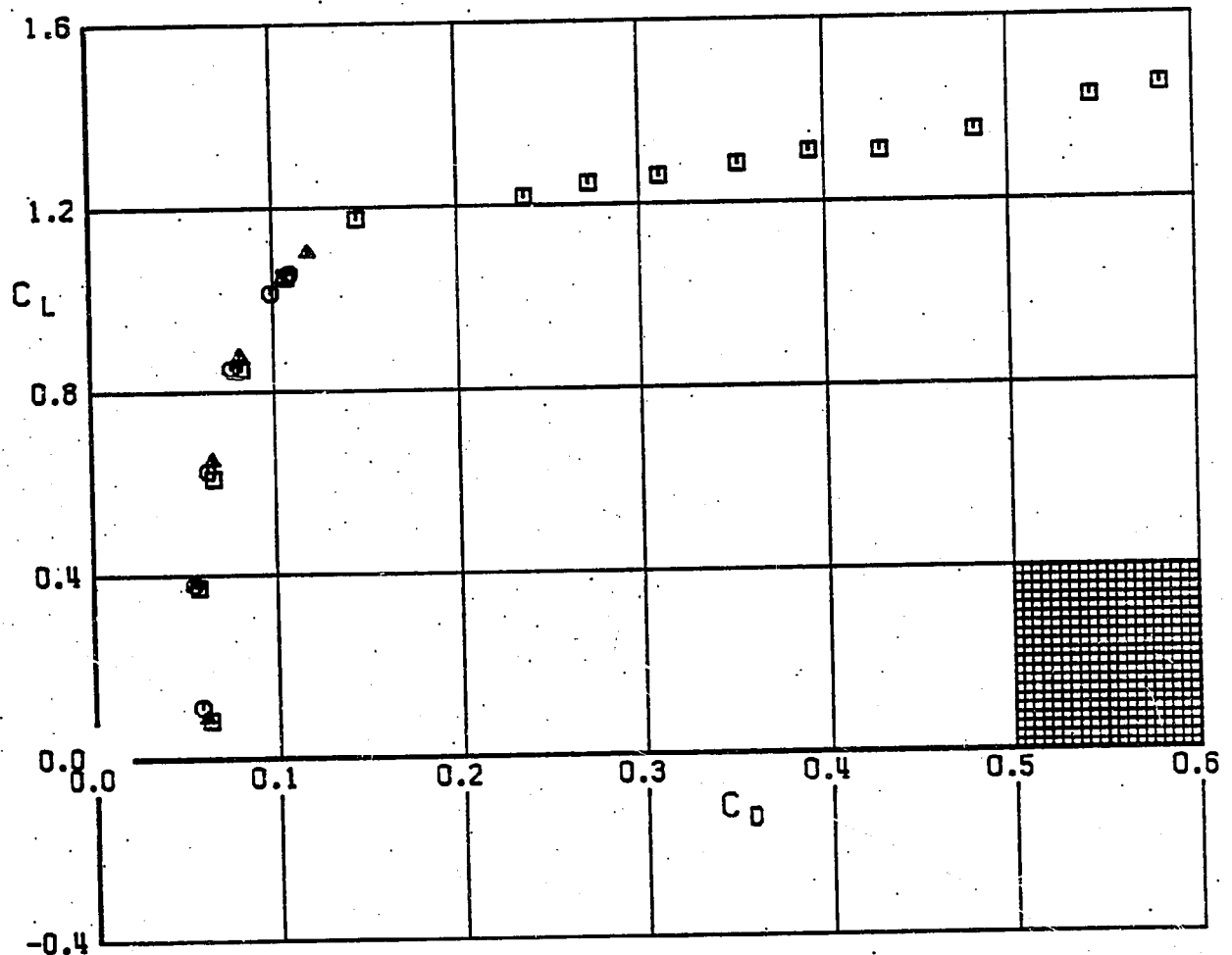
- BNFR +TS2, Q = 15 LB/FT**2, RUN 24
- ▲ BNFR60+TS2, $I_C = 0$ DEG., Q = 15 LB/FT**2, RUN 32
- BNFR60+TS2, $I_C = 0$ DEG., Q = 7.5 LB/FT**2, RUN 35



EFFECTS OF A 60 DEGREE SWEPT CANARD,
AND CANARD BEHAVIOR AT HIGHER ANGLES OF ATTACK,
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

BETA = 0 DEG.

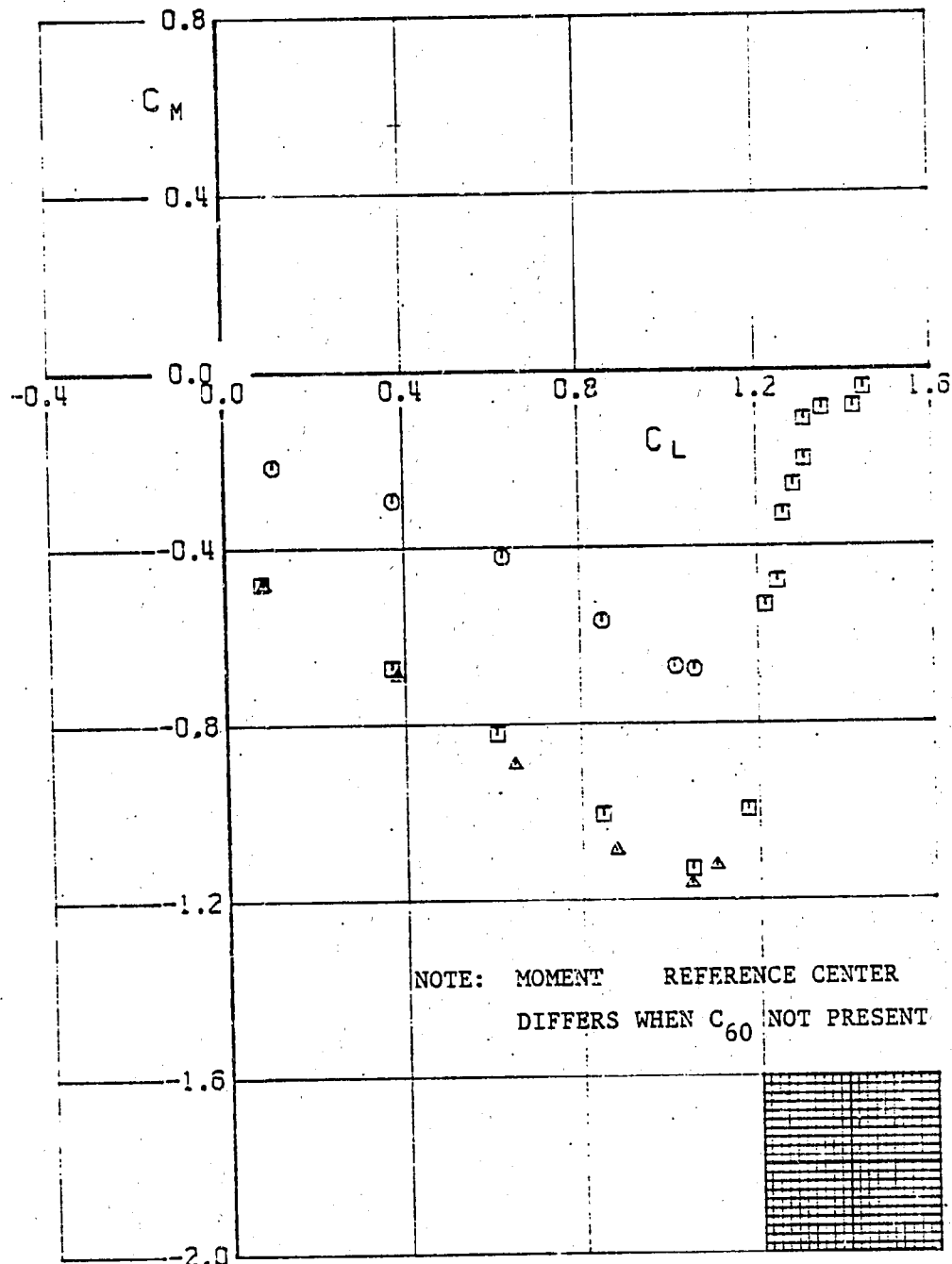
- $\circ$ BNFR +TS2, $Q = 15$ LB/FT**2, RUN 24
 Δ BNFR₆₀+TS2, $I_C = 0$ DEG., $Q = 15$ LB/FT**2, RUN 32
 $\square$ BNFR₆₀+TS2, $I_C = 0$ DEG., $Q = 7.5$ LB/FT**2, RUN 35



EFFECTS OF A 60 DEGREE SWEPT CANARD,
 AND CANARD BEHAVIOR AT HIGHER ANGLES OF ATTACK,
 ON THE JOINED WING CONFIGURATION
 WITH EXTENDED NOSE

BETA = 0 DEG.

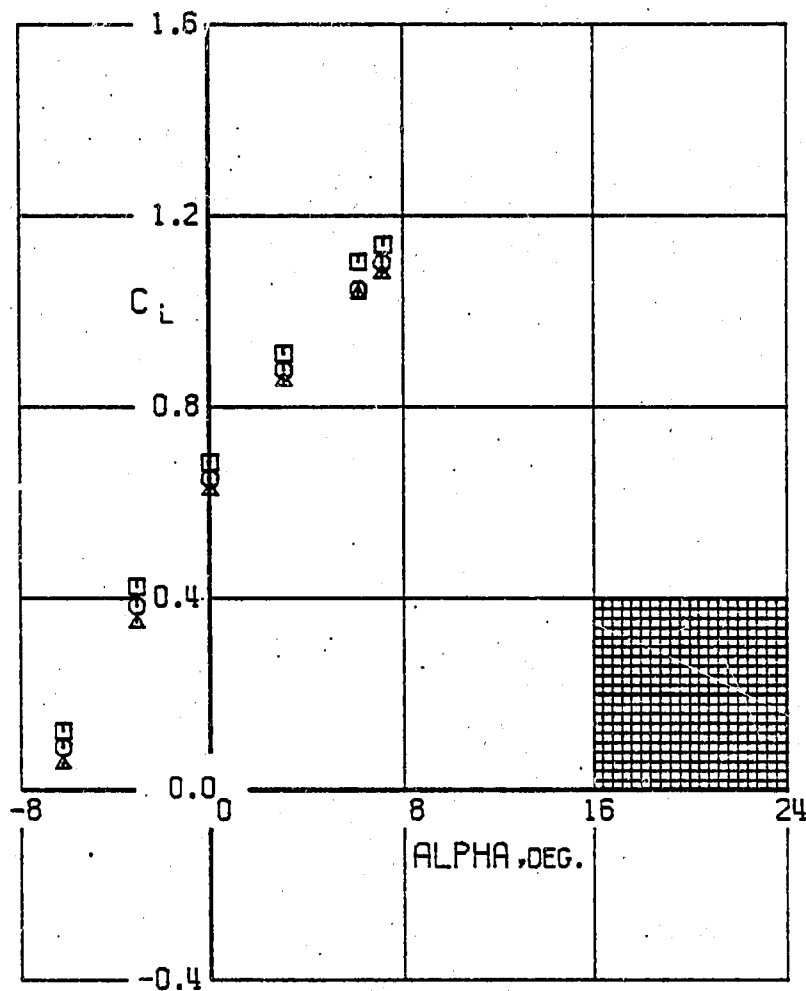
- BNFR +TS2, Q = 15 LB/FT**2, RUN 24
 ▲ BNFR C₆₀+TS2, I_C = 0 DEG., Q = 15 LB/FT**2, RUN 32
 □ BNFR C₆₀+TS2, I_C = 0 DEG., Q = 7.5 LB/FT**2, RUN 35



EFFECTS OF A 60 DEGREE SWEPT CANARD,
 AND CANARD BEHAVIOR AT HIGHER ANGLES OF ATTACK,
 ON THE JOINED WING CONFIGURATION
 WITH EXTENDED NOSE

BNFRC₆₀+TS₂, Q = 15 LB/FT², BETA = 0 DEG.

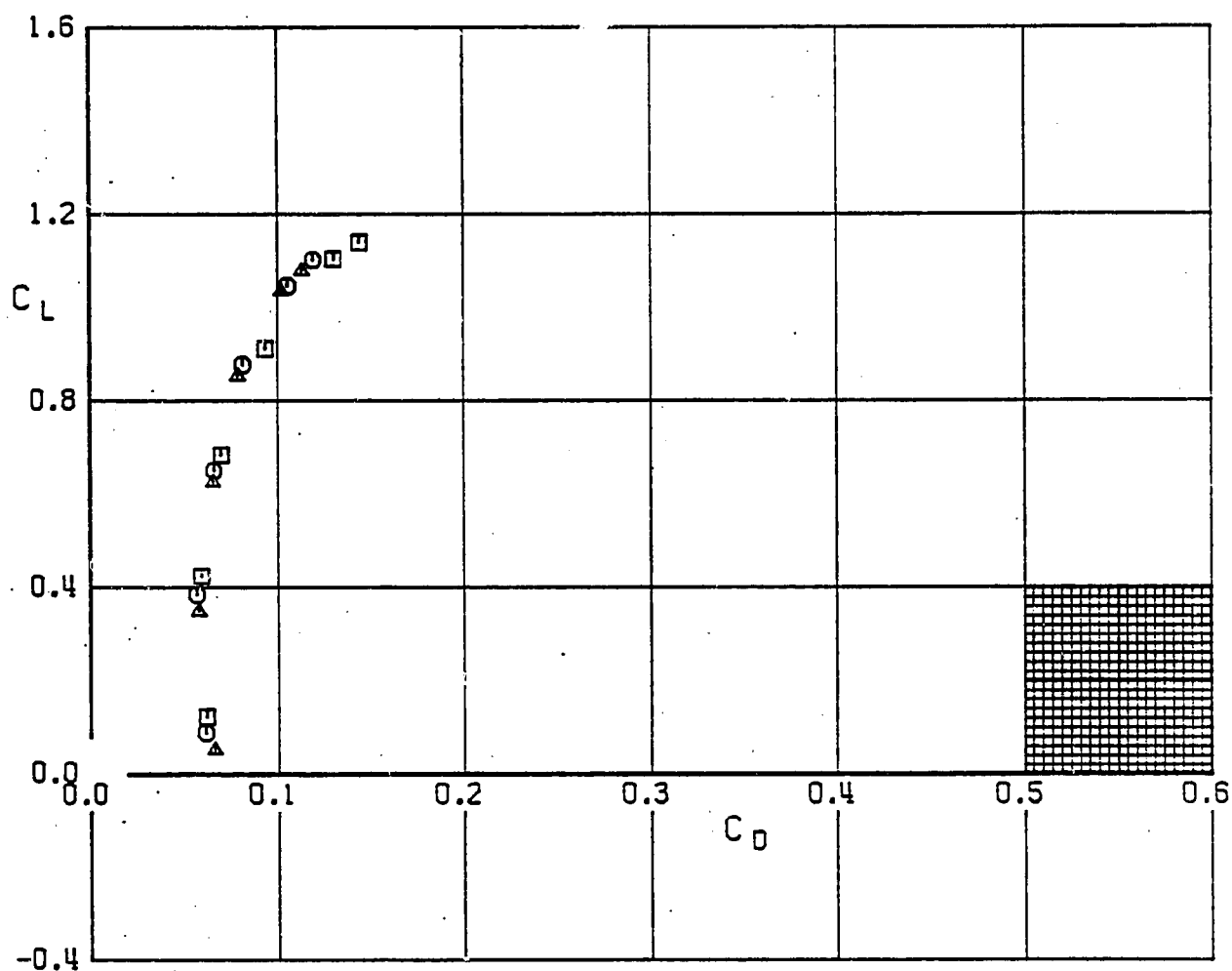
- I_C = 0 DEG., RUN 32
- △ I_C = - 5 DEG., RUN 34
- I_C = 10 DEG., RUN 33



EFFECTS OF THE 60 DEGREE SWEPT CANARD
INCIDENCE ANGLE
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

BNFRC₆₀+TS₂, Q = 15 LB/FT**2, BETA = 0 DEG.

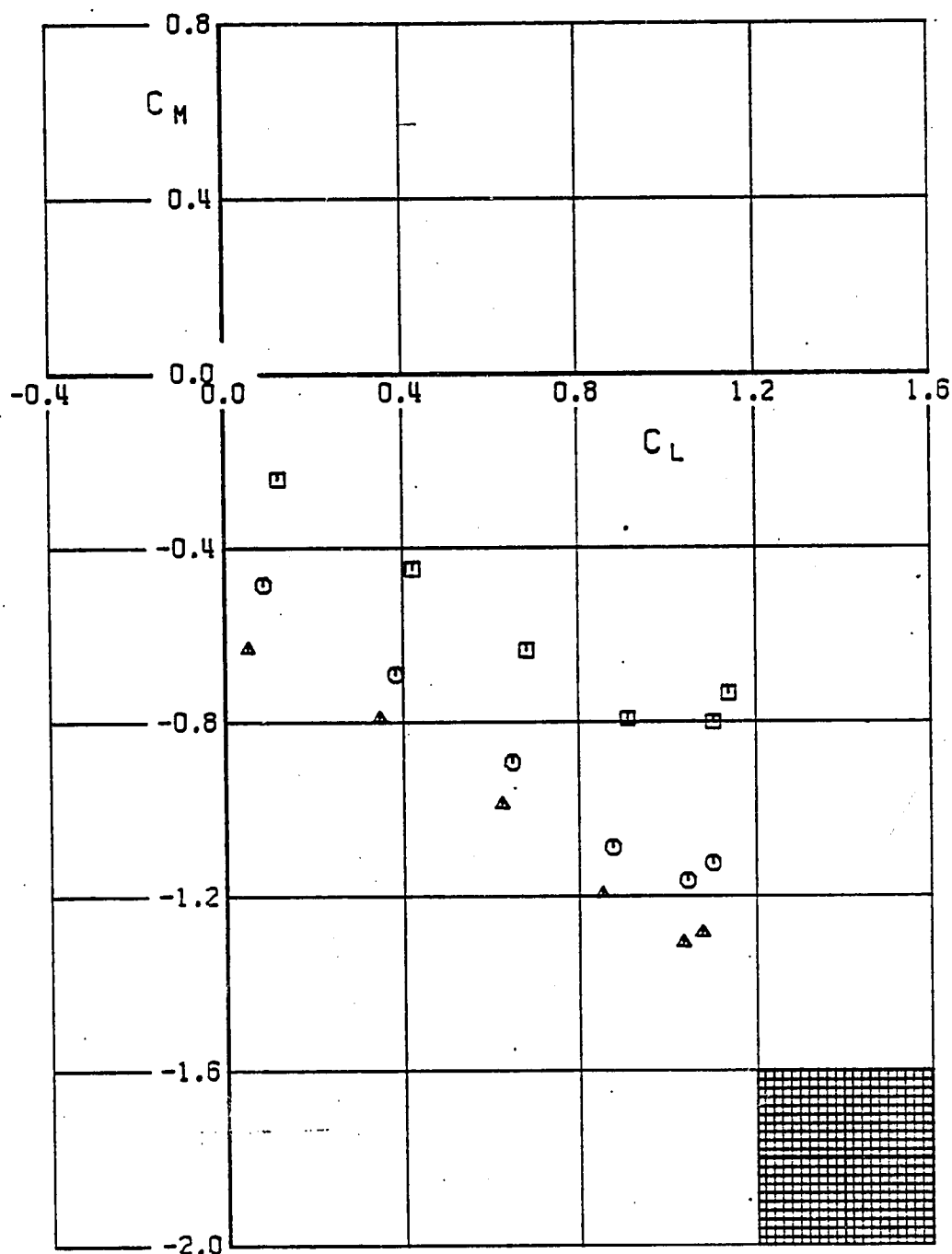
- I_C = 0 DEG., RUN 32
- ▲ I_C = - 5 DEG., RUN 34
- I_C = 10 DEG., RUN 33



EFFECTS OF THE 60 DEGREE SWEPT CANARD
INCIDENCE ANGLE
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

BNFRC₆₀+T_{S2}, Q = 15 LB/FT**2, BETA = 0 DEG.

- I_C = 0 DEG., RUN 32
- ▲ I_C = - 5 DEG., RUN 34
- I_C = 10 DEG., RUN 33

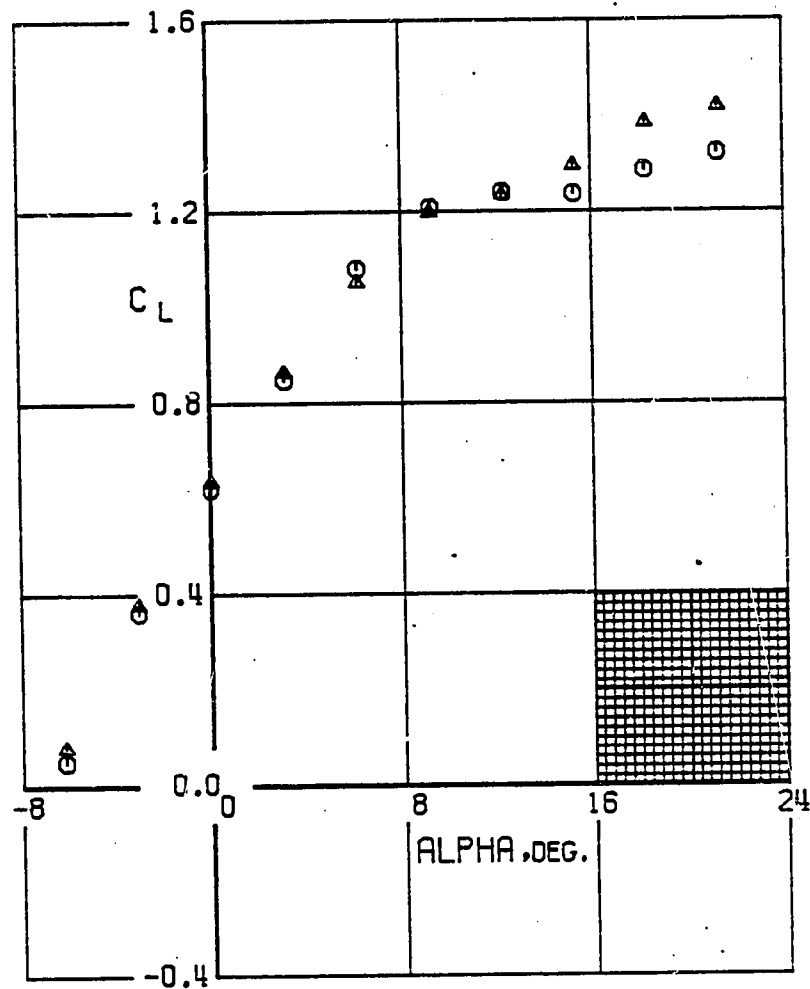


EFFECTS OF THE 60 DEGREE SWEEP CANARD
INCIDENCE ANGLE
ON THE JOINED WING CONFIGURATION
WITH EXTENDED NOSE

$Q = 7.5 \text{ LB/FT}^2$, $I_C = 0 \text{ DEG.}$, $BETA = 0 \text{ DEG.}$

○ BNFRC₃₀+T_{S2}, RUN 55

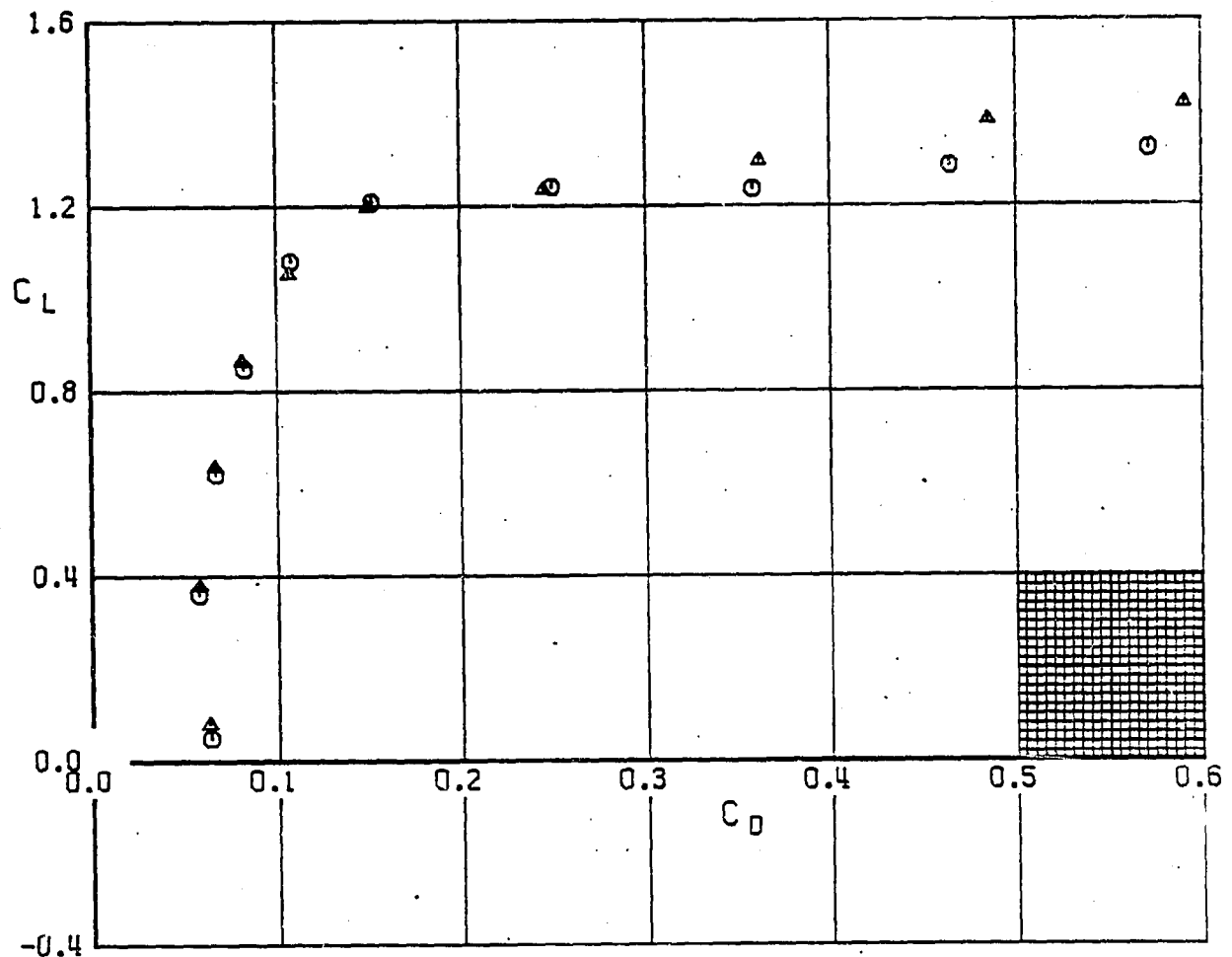
▲ BNFRC₆₀+T_{S2}, RUN 53



COMPARISON OF 30 AND 60 DEGREE SWEPT
CANARDS ON THE JOINED WING CONFIGURATION

$Q = 7.5 \text{ LB/FT}^2$, $I_C = 0 \text{ DEG.}$, $BETA = 0 \text{ DEG.}$

○ BNFRC₃₀+T_{S2}, RUN 55
▲ BNFRC₆₀+T_{S2}, RUN 53

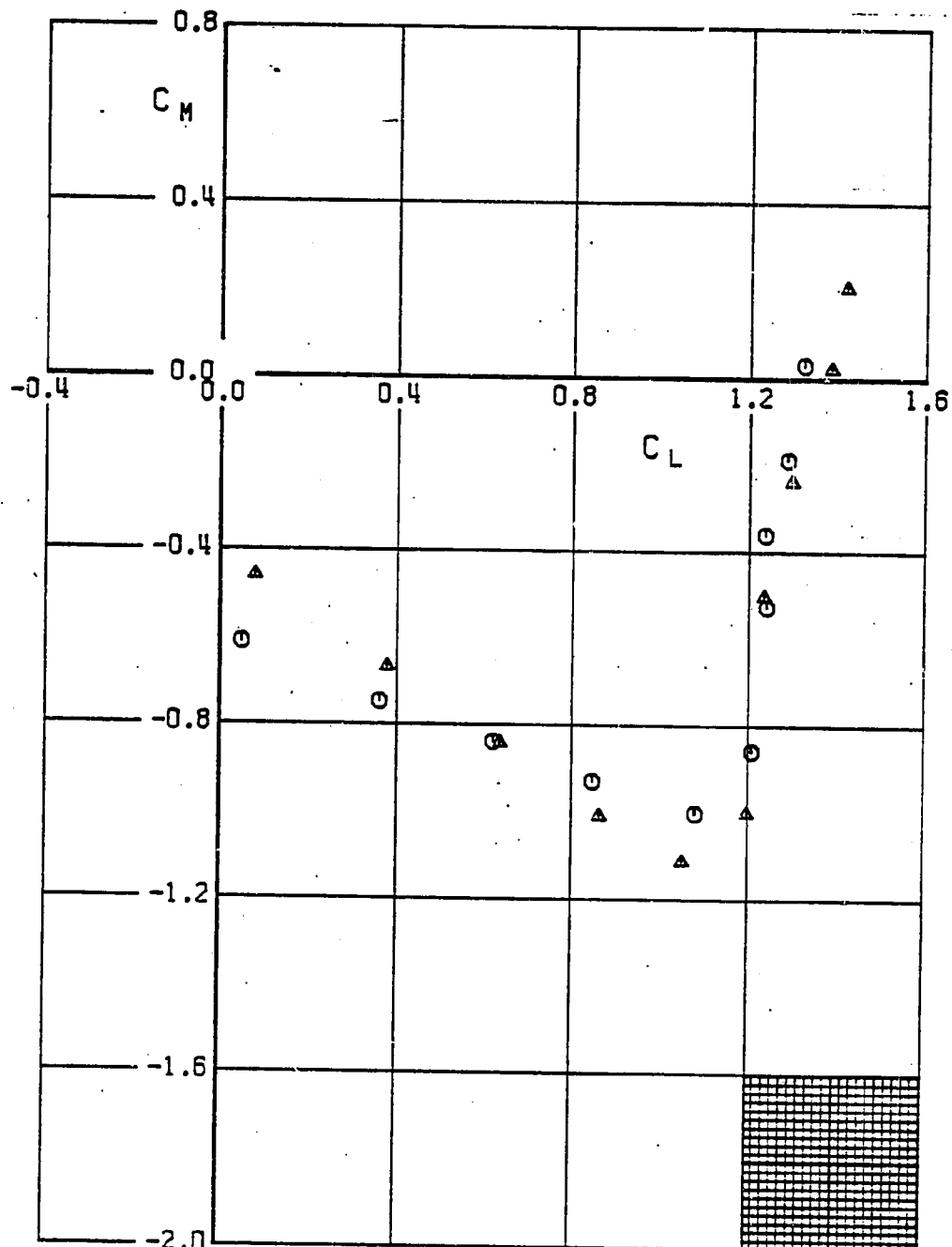


COMPARISON OF 30 AND 60 DEGREE SWEPT
CANARDS ON THE JOINED WING CONFIGURATION

$Q = 7.5 \text{ LB/FT}^2$, $I_C = 0 \text{ DEG.}$, $BETA \approx 0 \text{ DEG.}$

○ BNFRC₃₀+T_{S2}, RUN 55

▲ BNFRC₆₀+T_{S2}, RUN 53.



COMPARISON OF 30 AND 60 DEGREE SWEEP
CANARDS ON THE JOINED WING CONFIGURATION

PHOTOGRAPHS OF TUFT BEHAVIOR

BFR + T_{s_2} + Tufts, Run 23, $q = 7.5 \text{ lb/ft}^2$

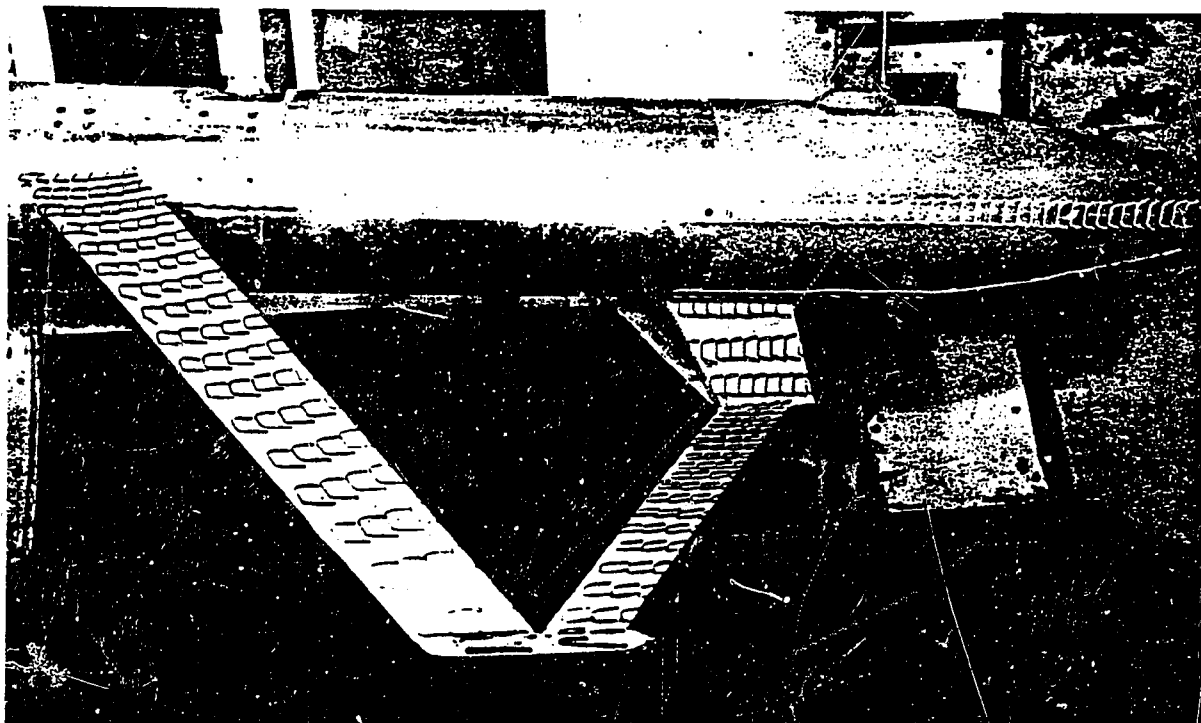


Photo No. 1

$\alpha_g = -4^\circ, \psi = 0^\circ$

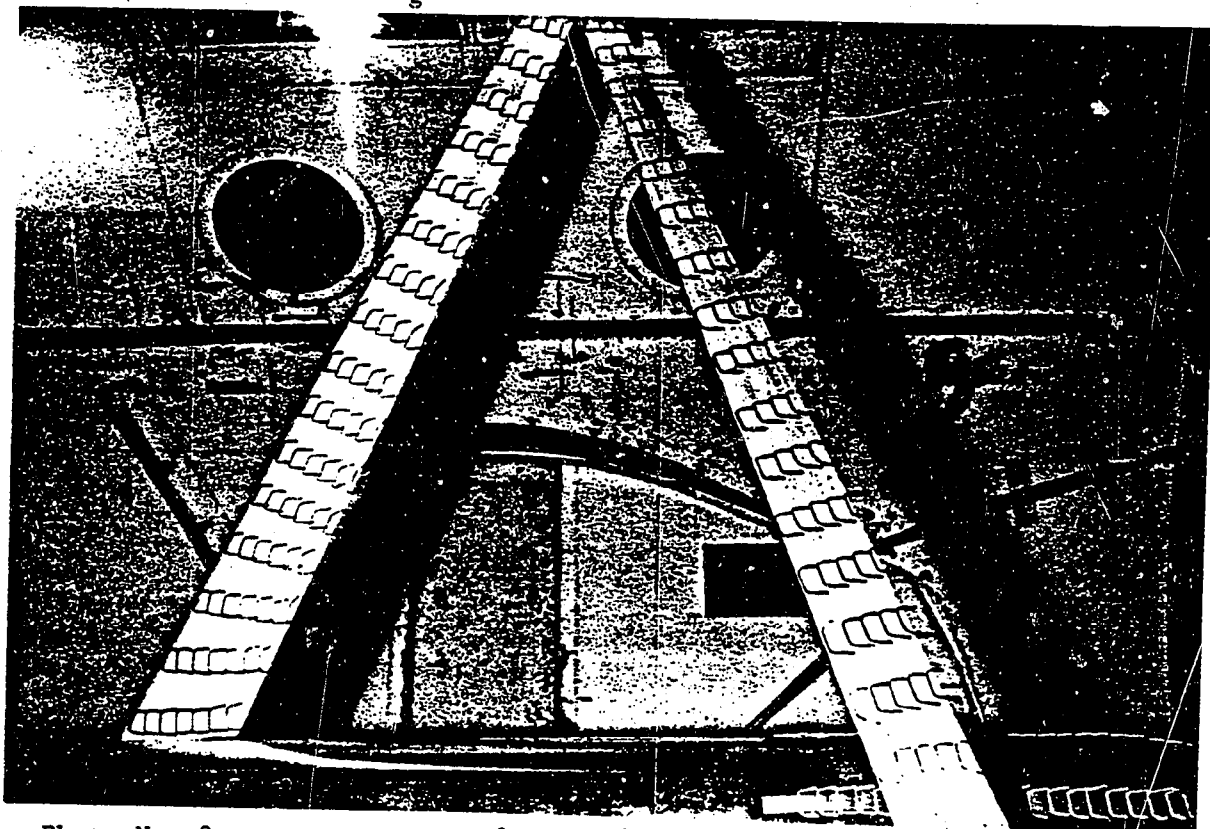


Photo No. 2

$\alpha_g = -3^\circ, \psi = 0^\circ$

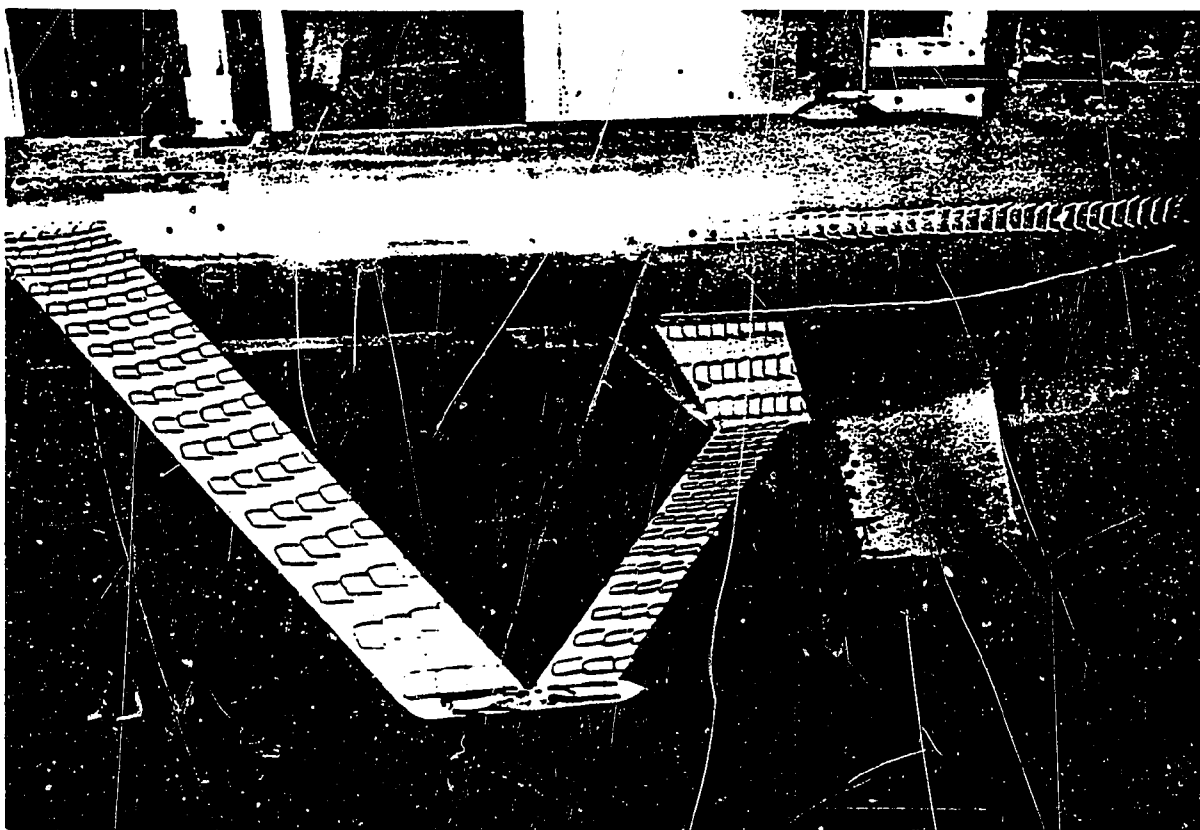
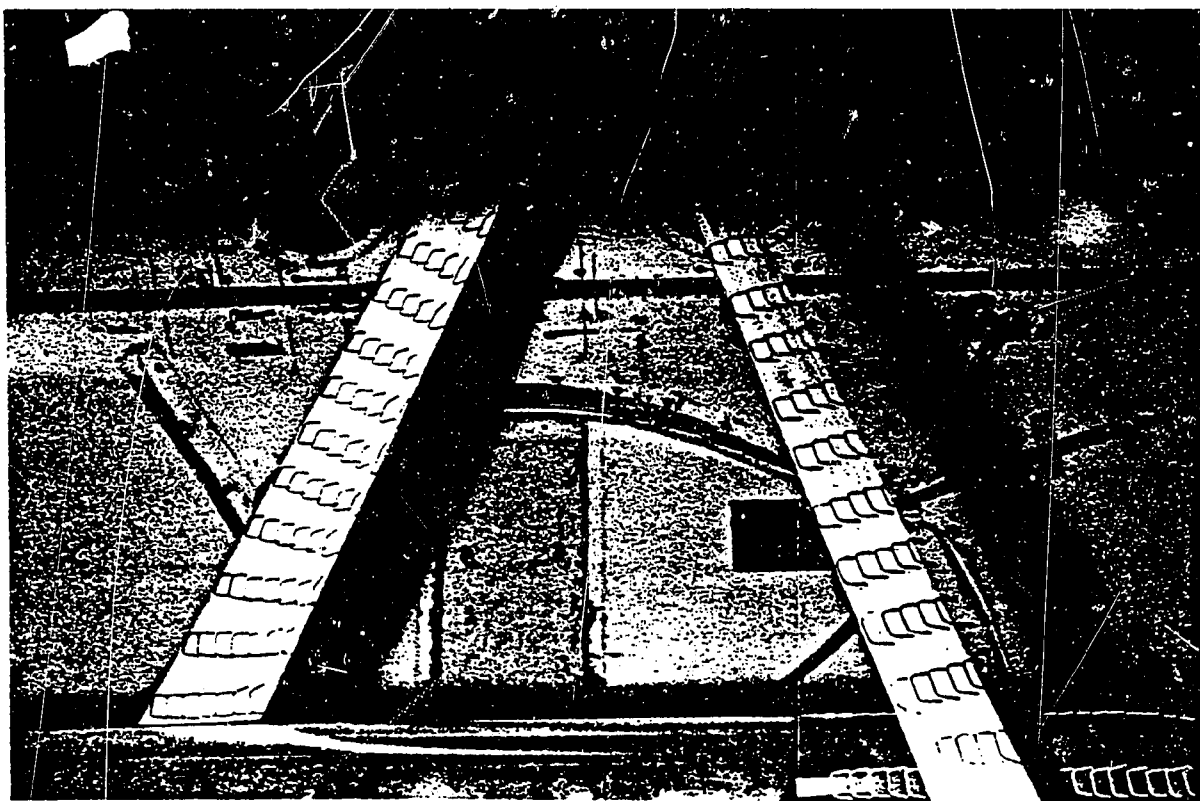


Photo No. 3

$$\alpha_g = \psi = 0^\circ$$



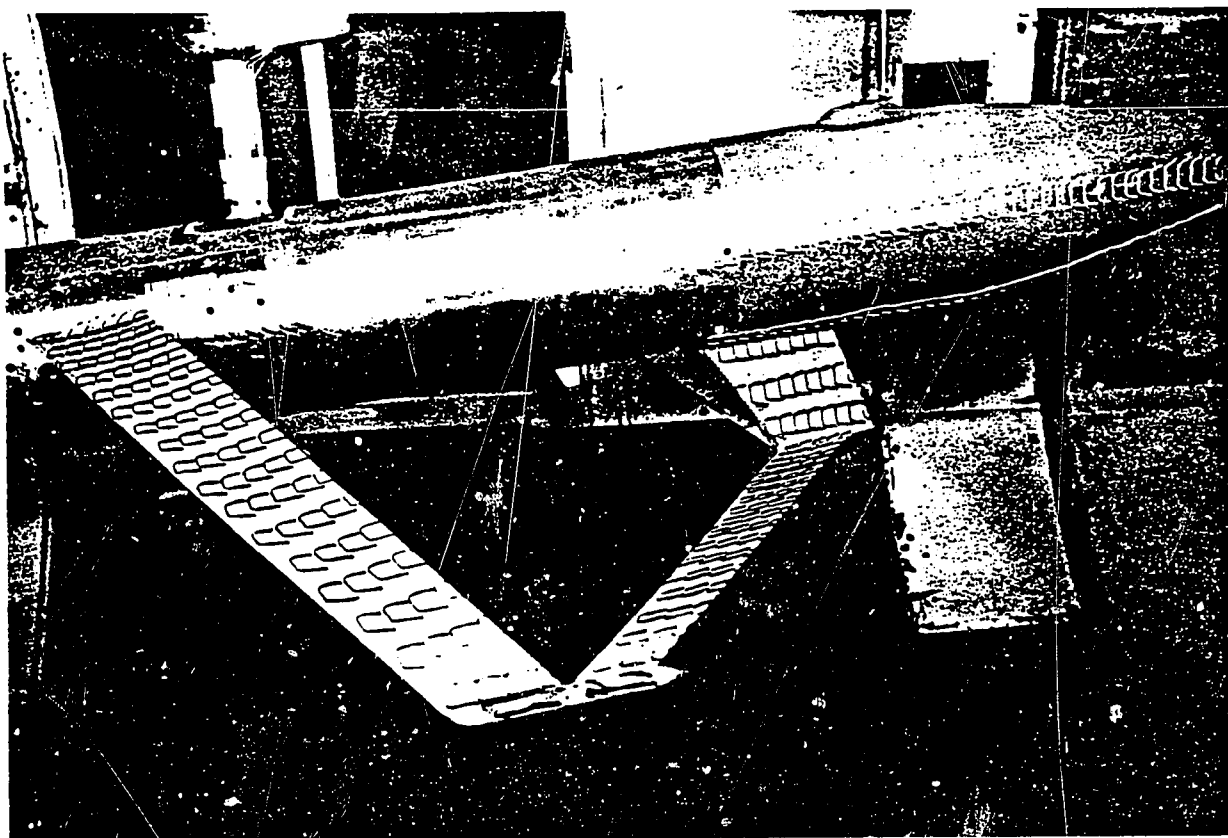


Photo No. 5

$\alpha_g = 6^\circ, \beta = 0^\circ$

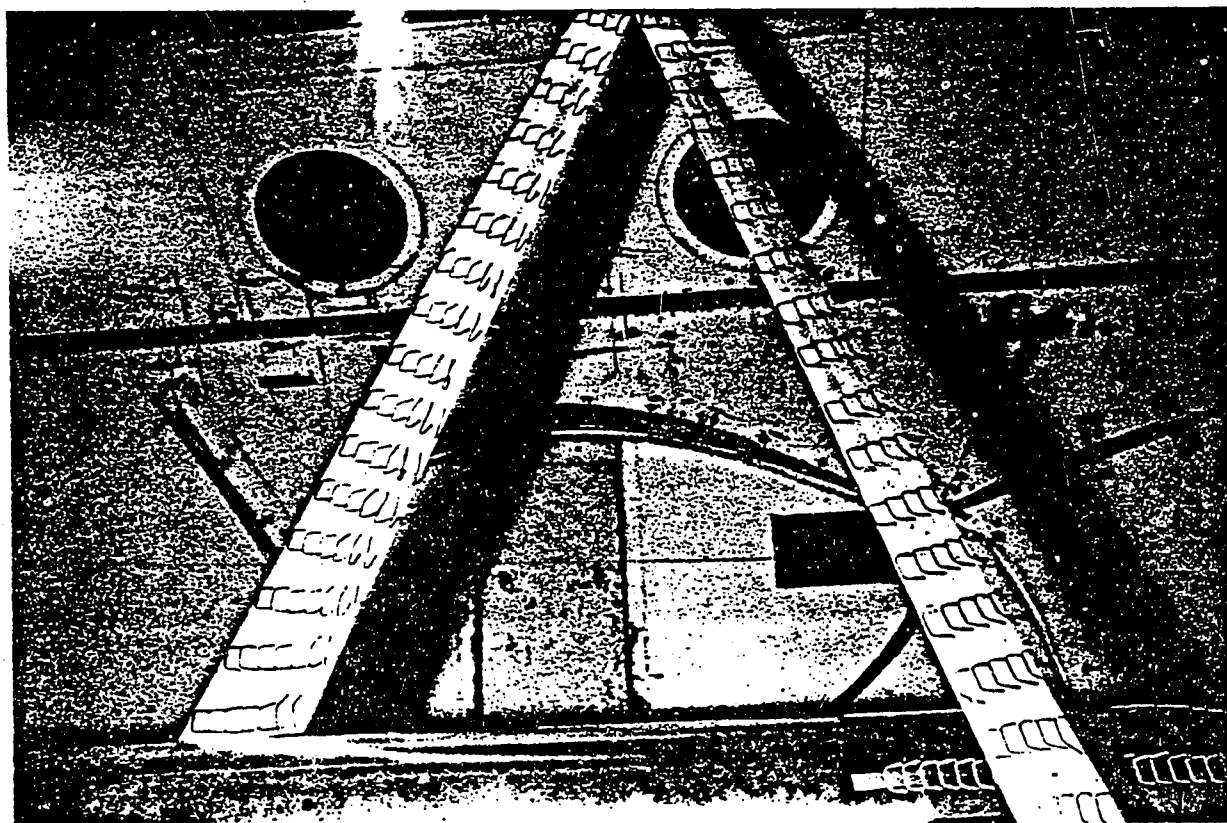


Photo No. 6

$\alpha_g = 6^\circ, \beta = 0^\circ$

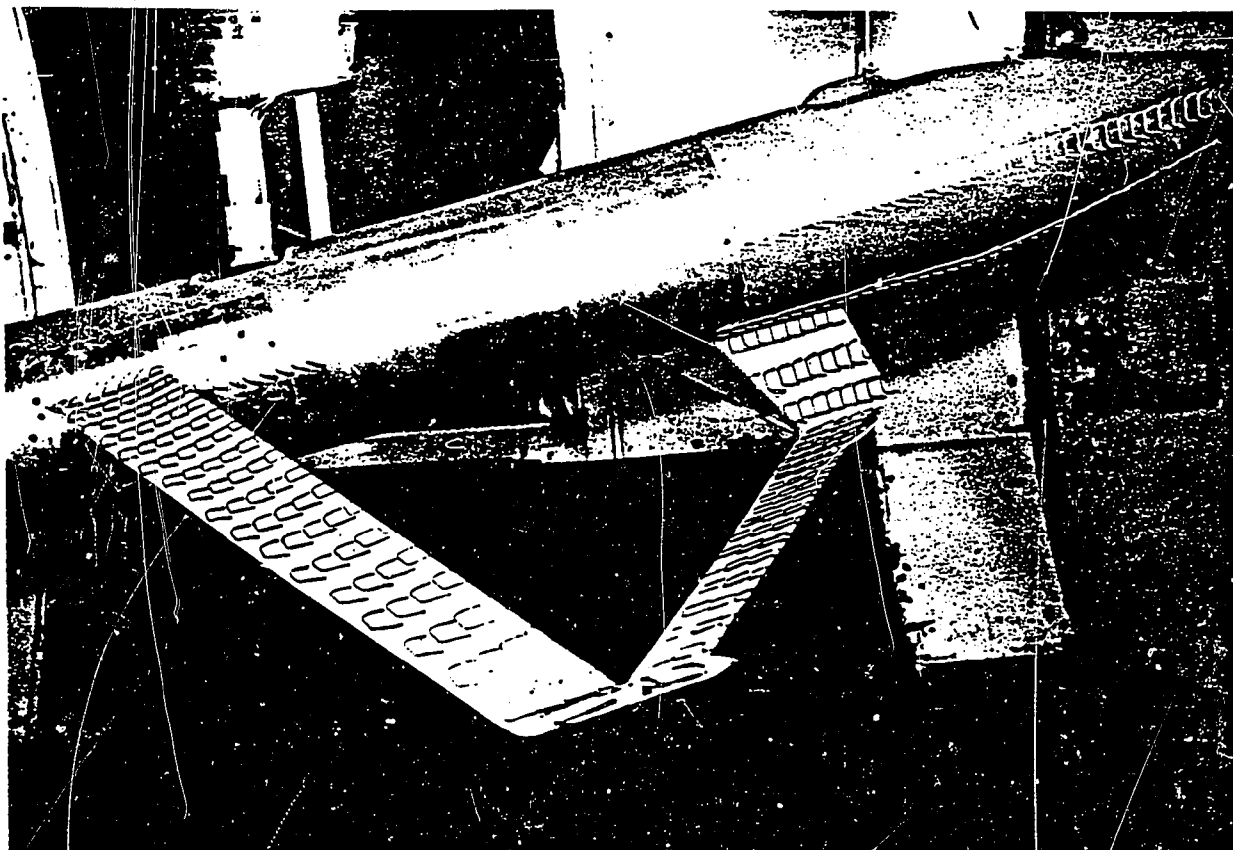
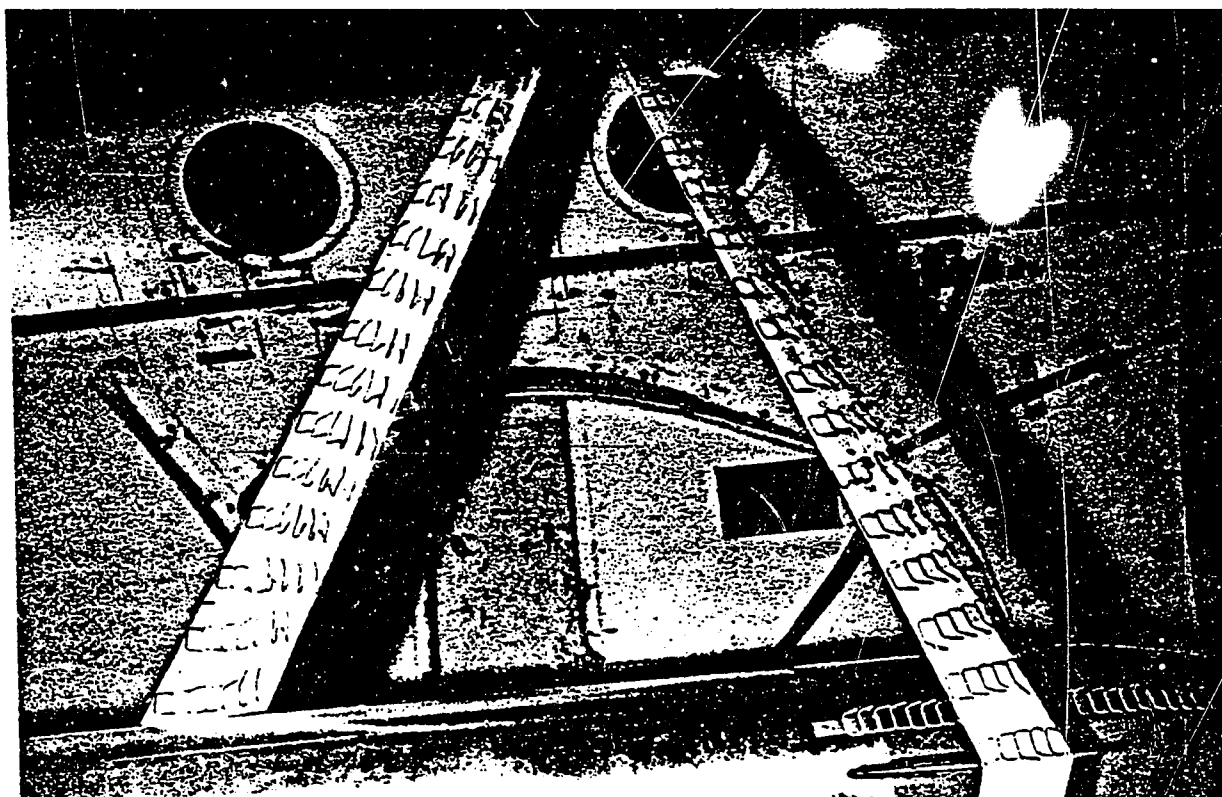


Photo No. 7.

$$\alpha_g = 12^\circ, \psi = 0^\circ$$



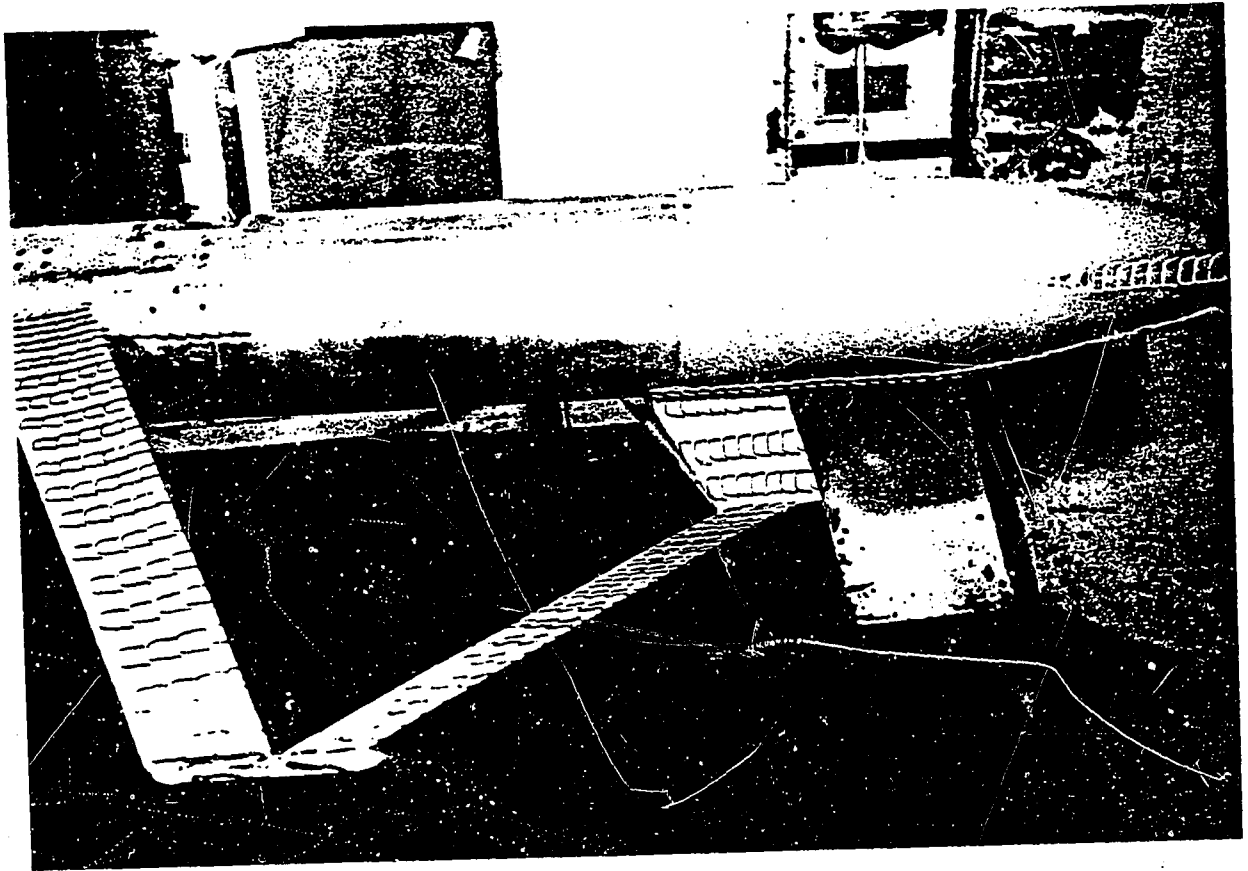


Photo No. 9

$\alpha_g = 0^\circ, \psi = -10^\circ$

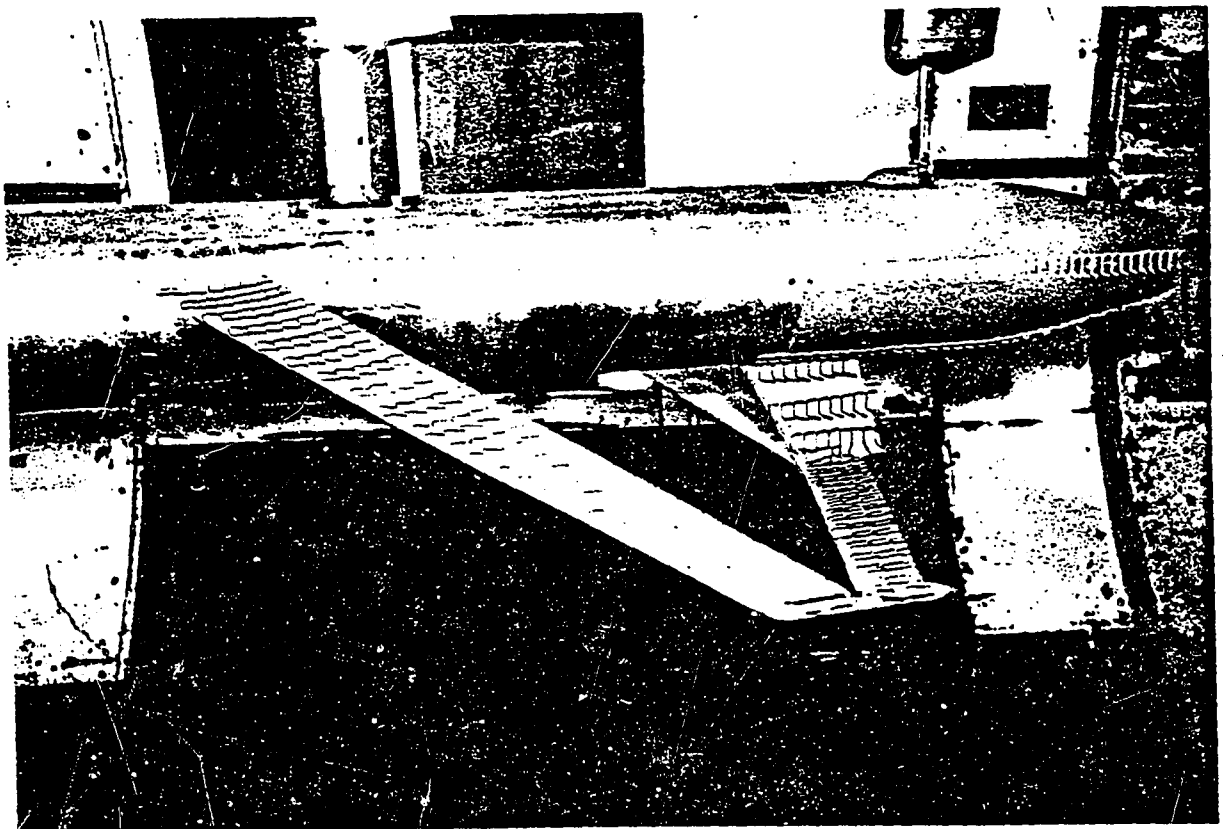


Photo No. 10

$\alpha_g = 0^\circ, \psi = 10^\circ$

MODEL CONFIGURATION PHOTOGRAPHS

Conventional Wing Configurations

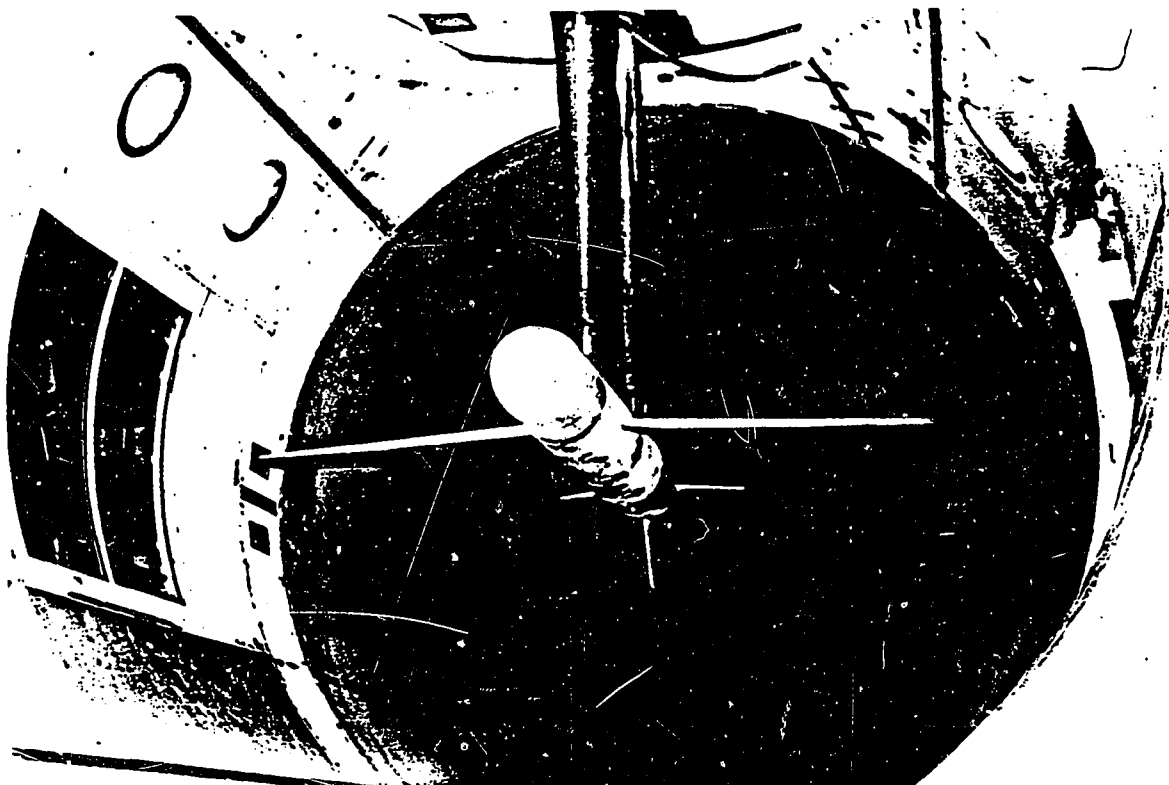


Photo No. 11

3/4 front view of BWHDV

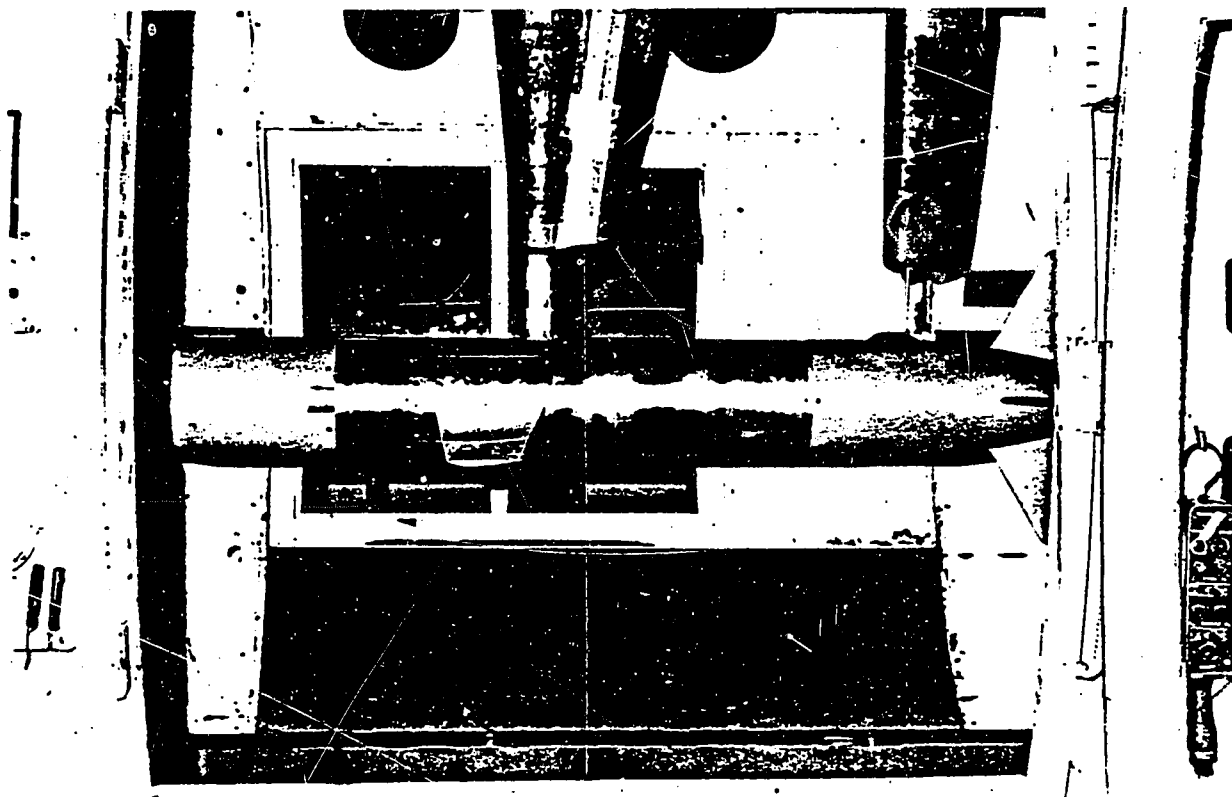


Photo No. 12

Side view of BWHDV

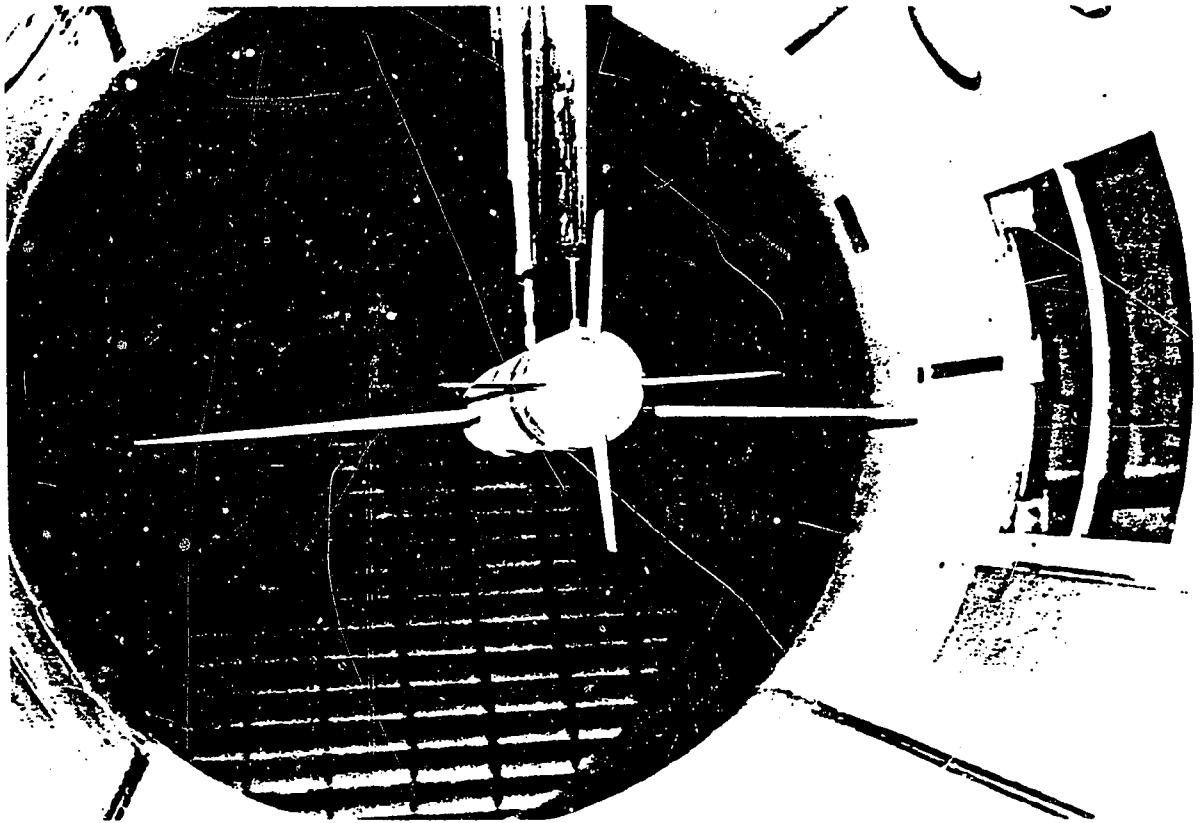


Photo No. 13

3/4 rear view of BWHDV

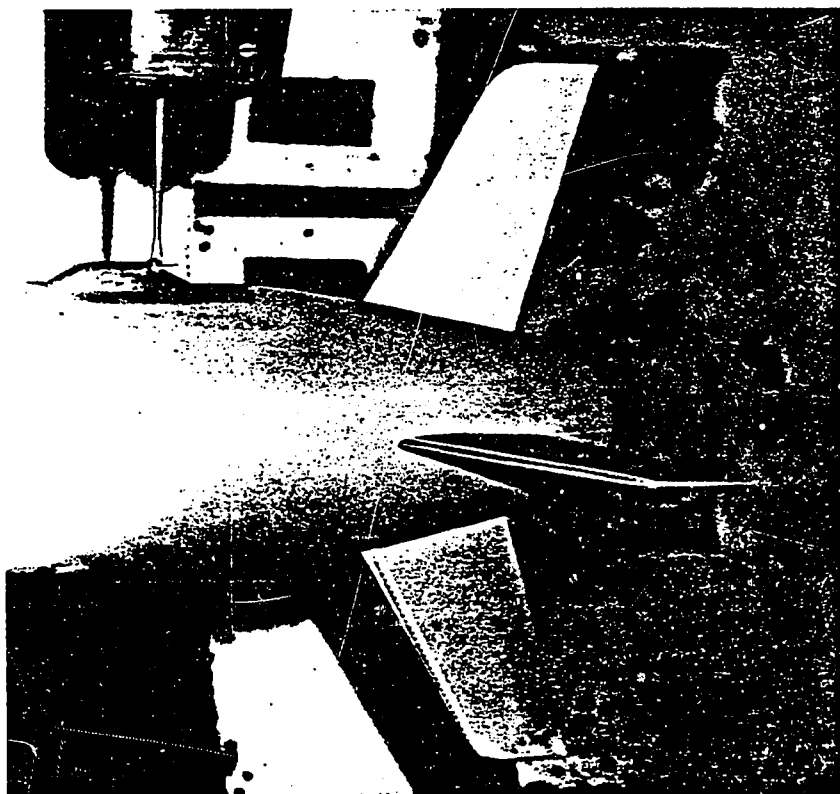


Photo No. 14

View of HDV showing T_s

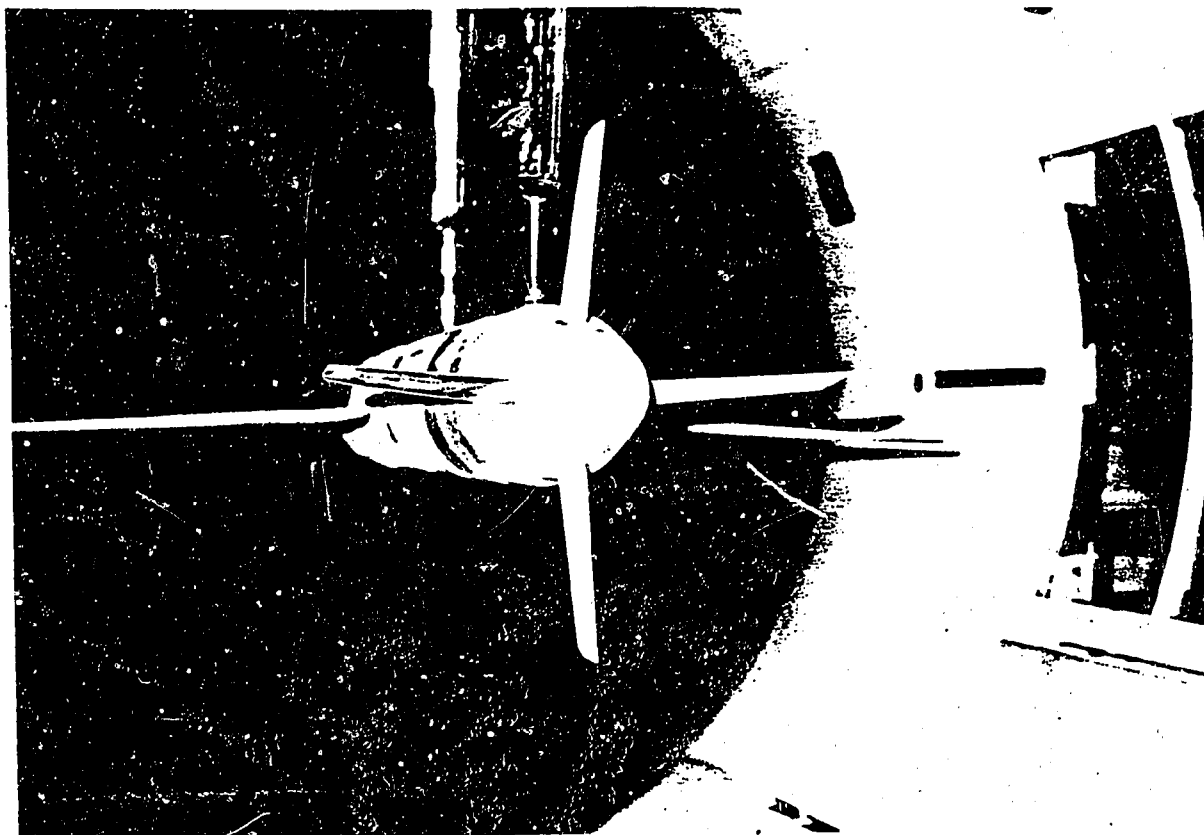


Photo No. 15

BWHDV showing $i_H = 10^\circ$

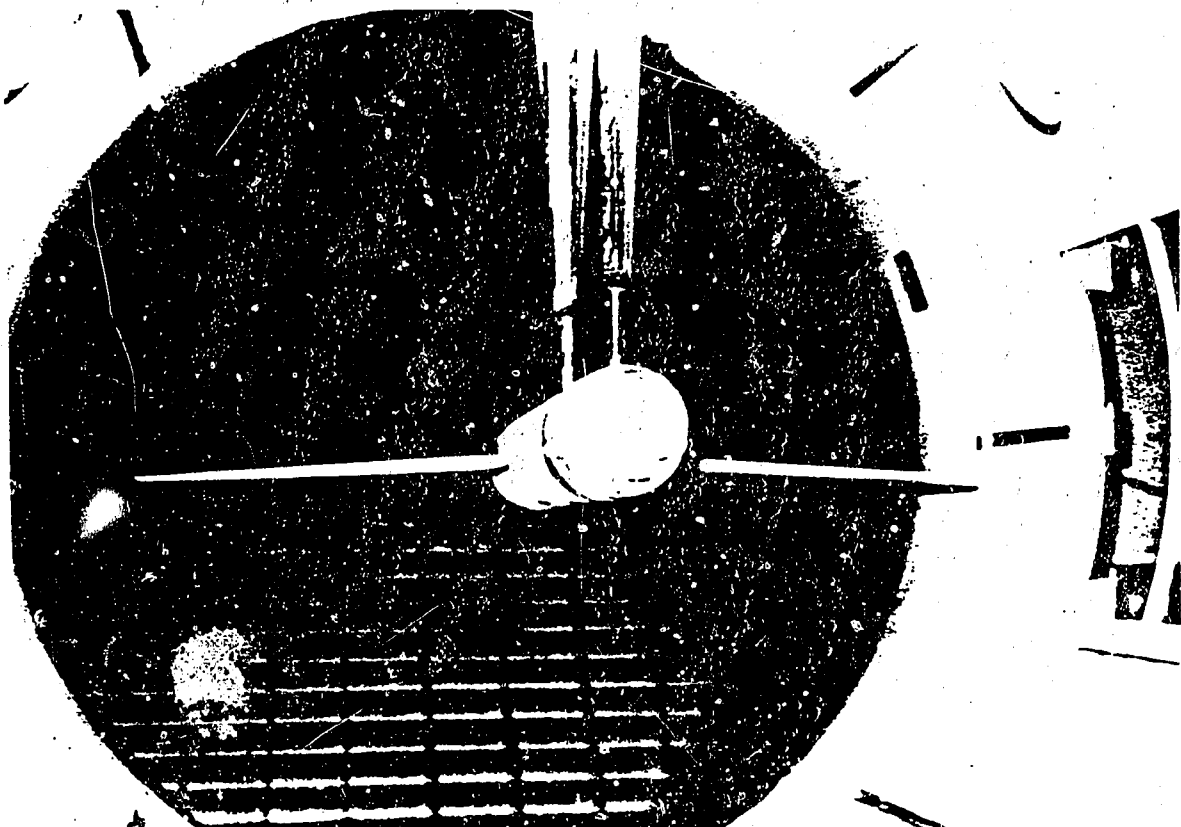


Photo No. 16

3/4 rear view of BW

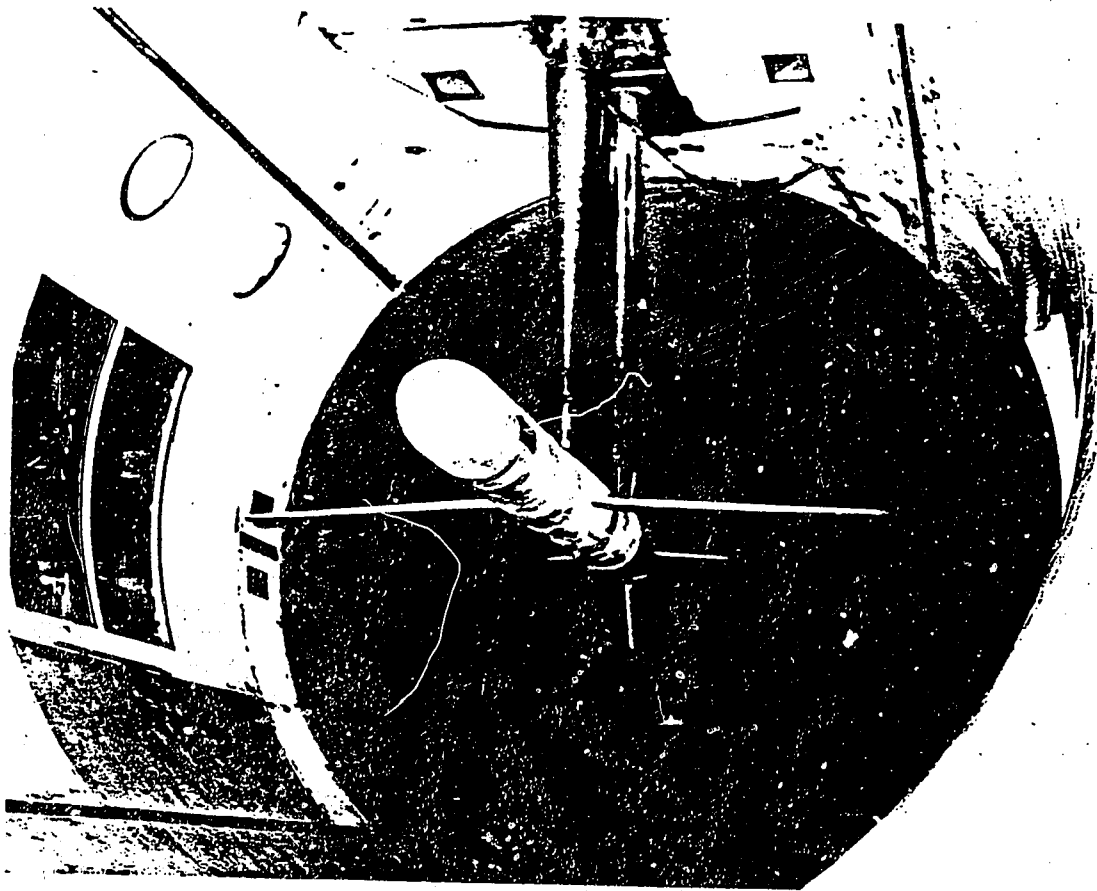


Photo No. 17

3/4 front view of BNWHDV + T_s

Joined Wing Configurations

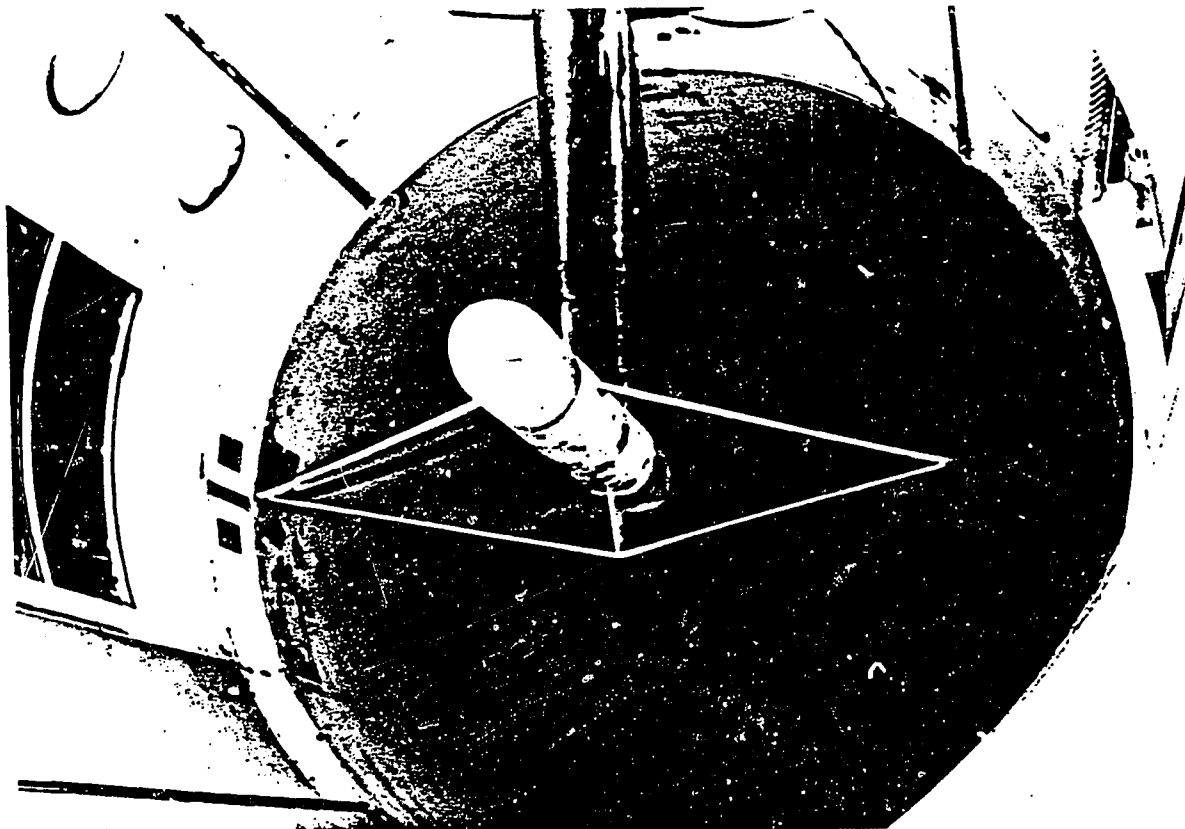


Photo No. 18

3/4 front view of BFR + T_{s1}

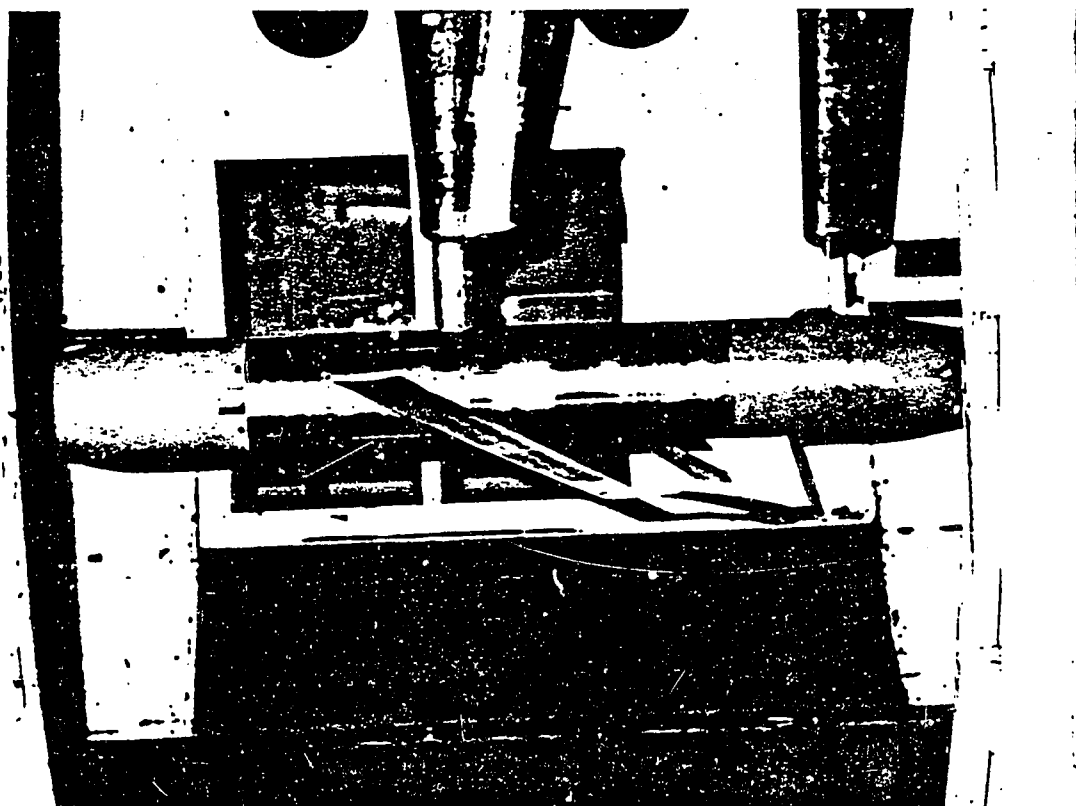


Photo No. 19

Side view of BFR + T_{s1}

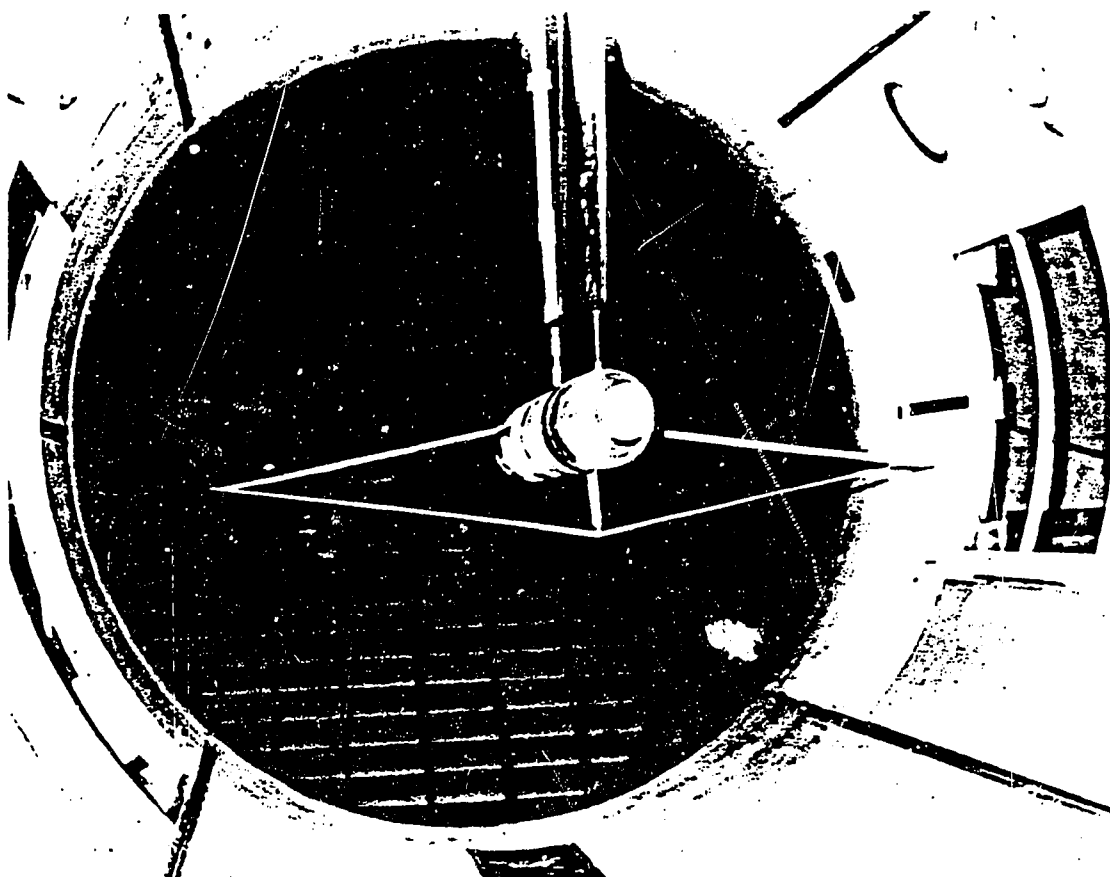


Photo No. 20

3/4 rear view of BFR + T_{s1}

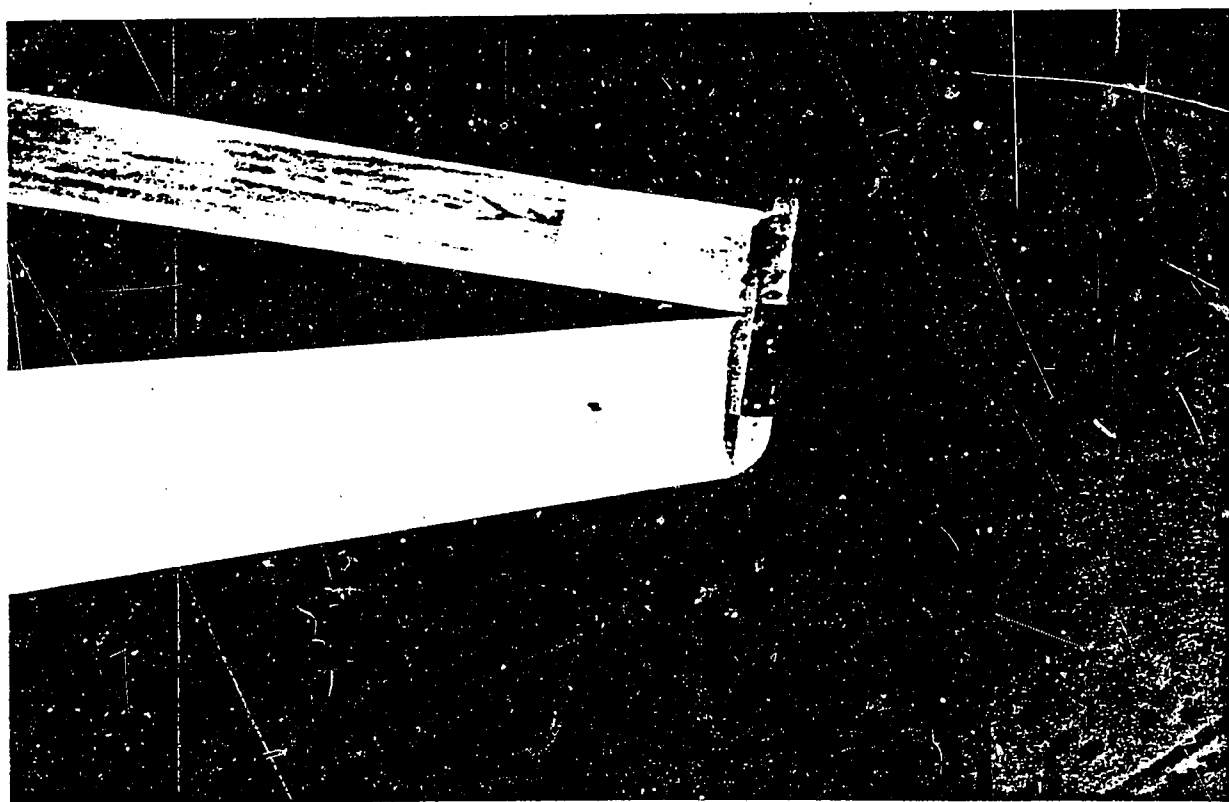


Photo No. 21

Detail of joined wing tip

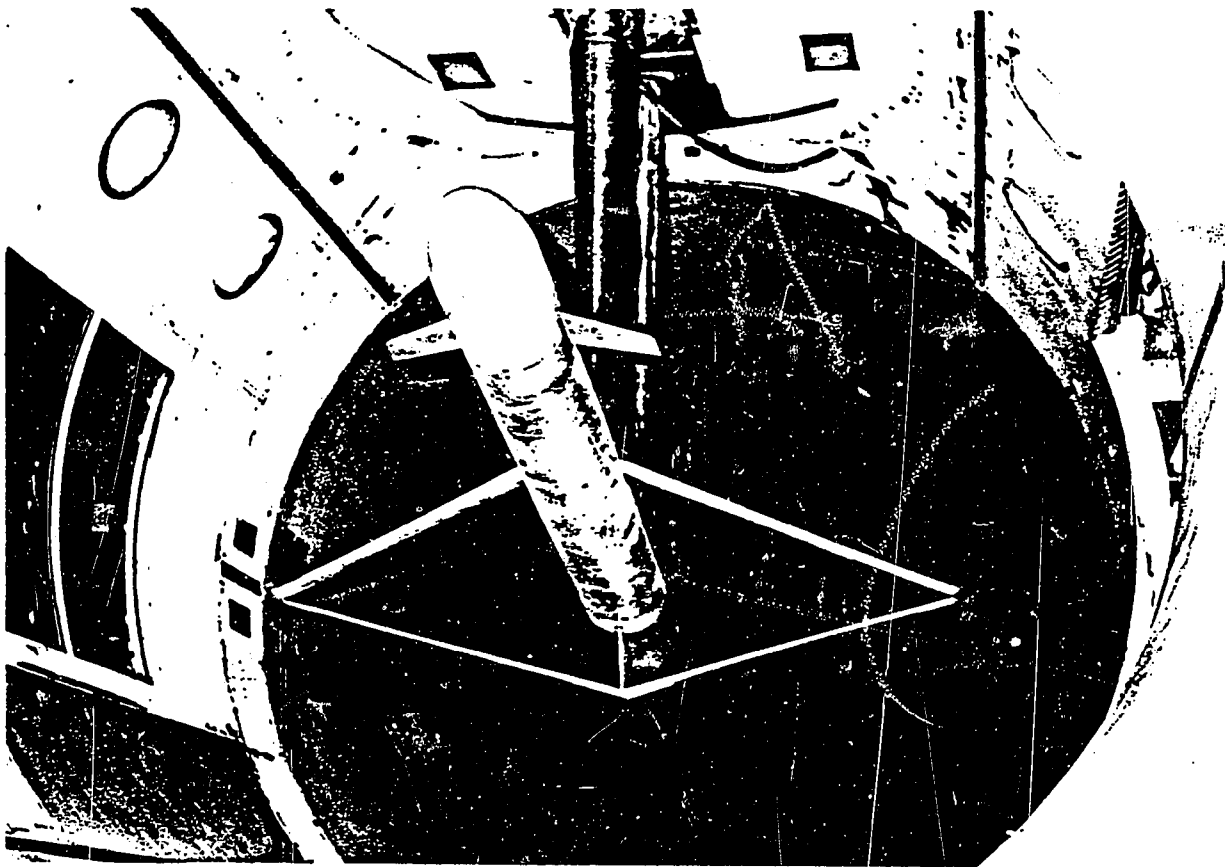


Photo No. 22

3/4 front view of BNFR₃ + T_{S2}

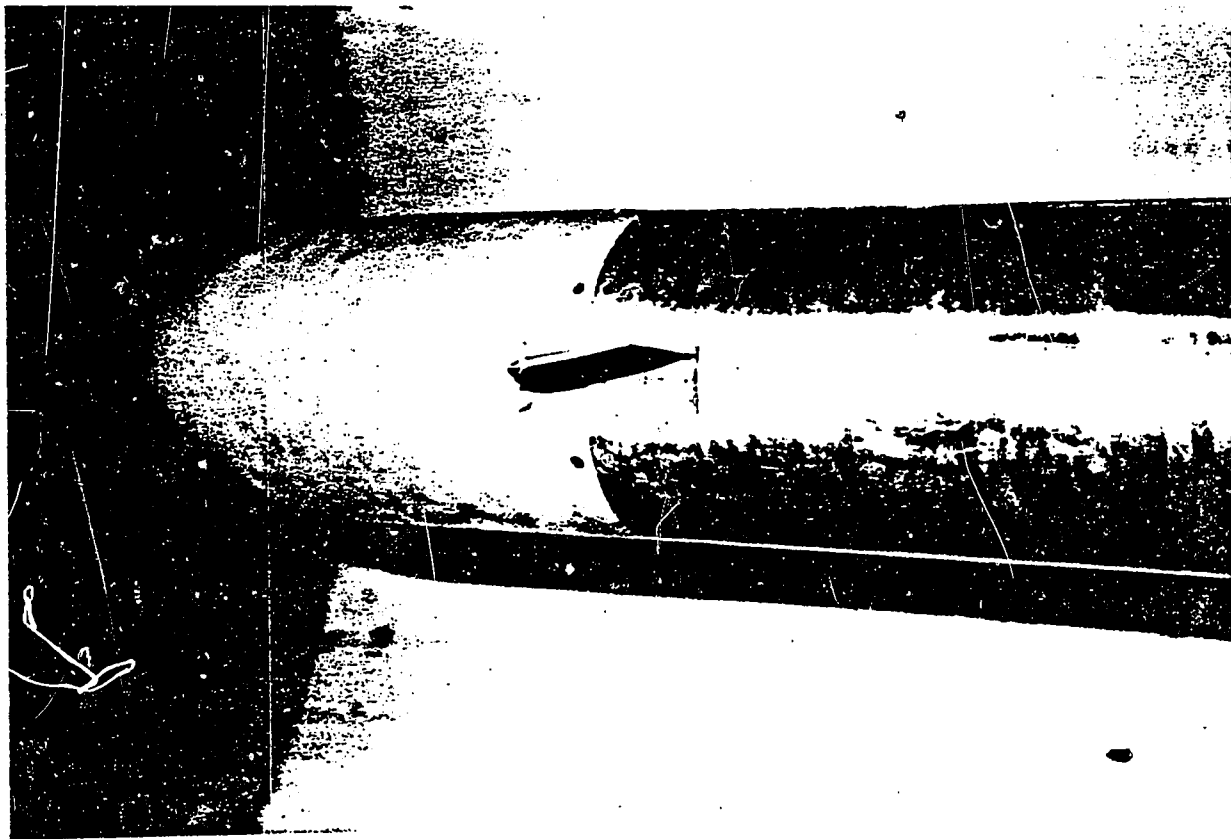


Photo No. 23

View showing C₁ with $i_C = 10^\circ$

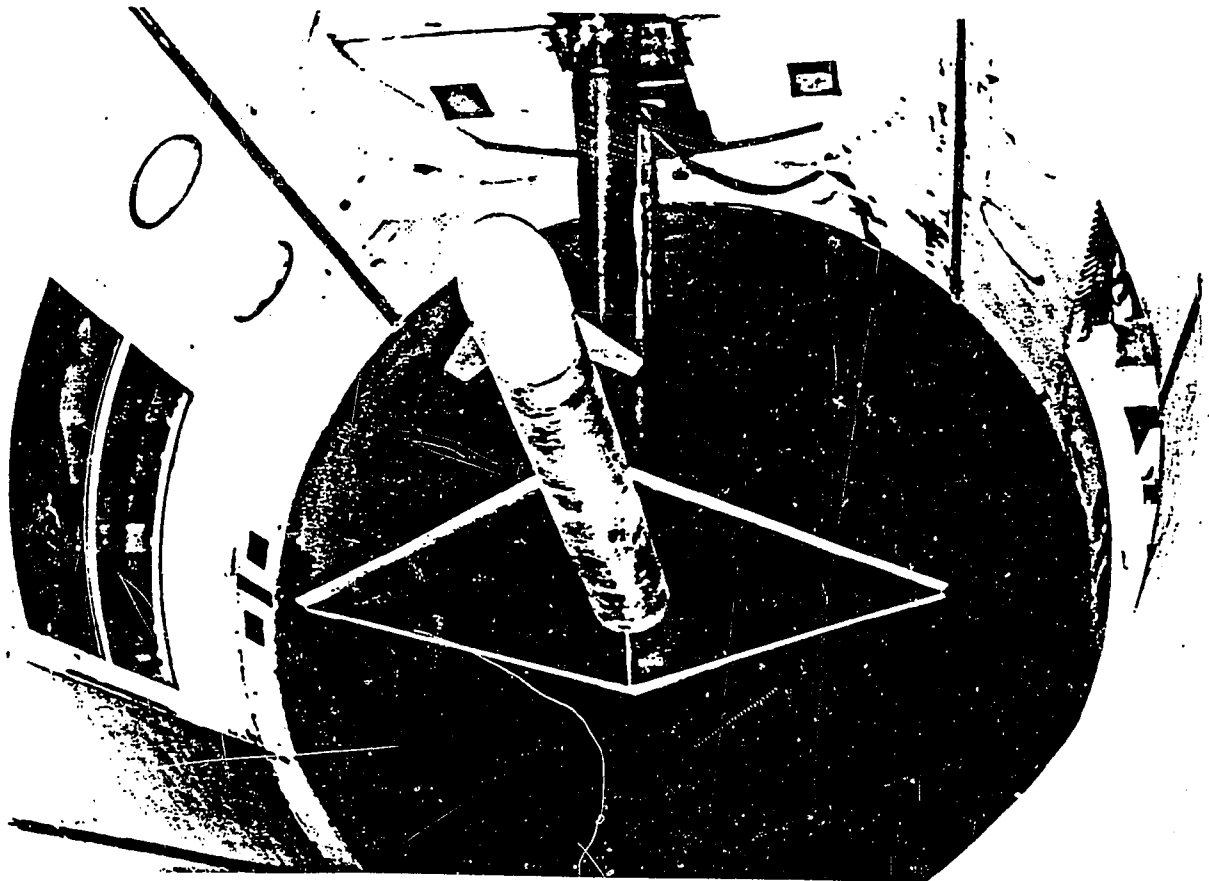


Photo No. 24

3/4 front view of BNFRCE: + T_{s2}

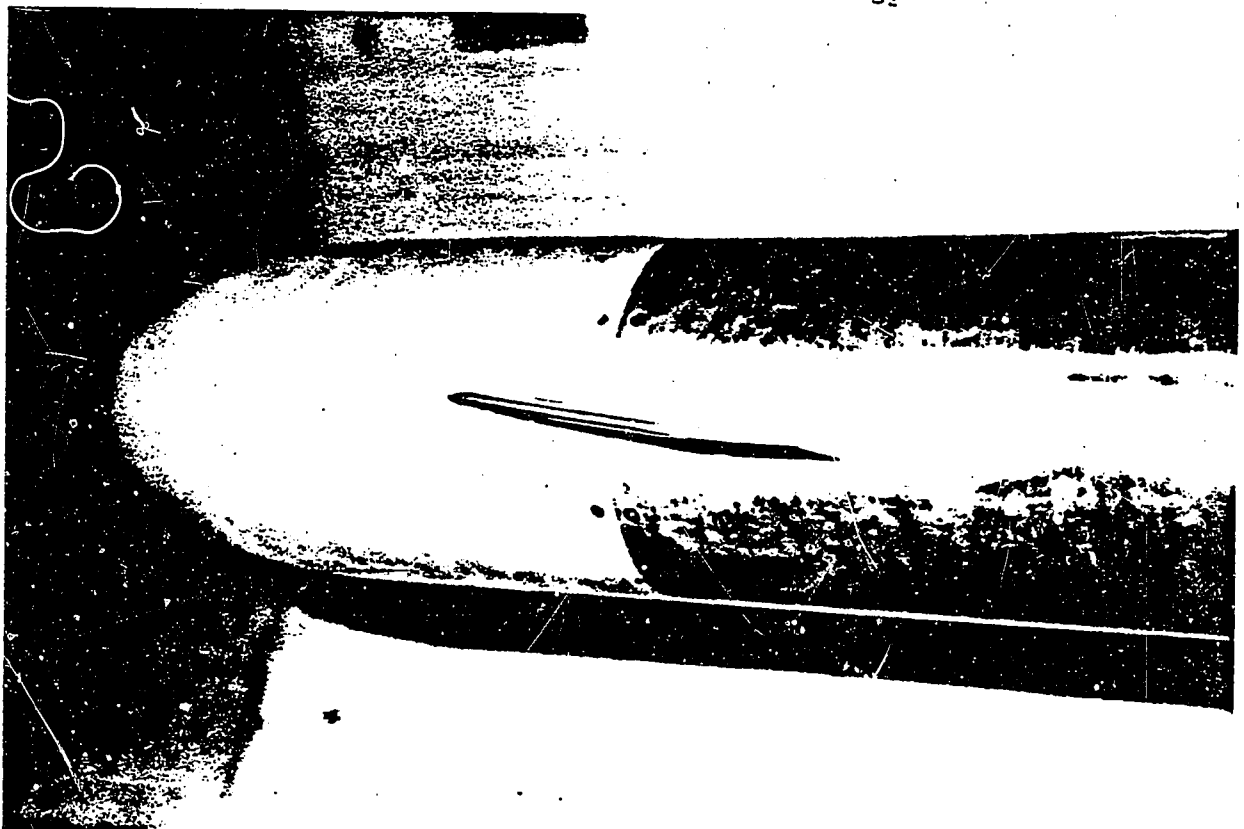


Photo No. 25

View showing C: with $i_c = -5^\circ$



Photo No. 26

Side view of A on BFRS + T_{s2}

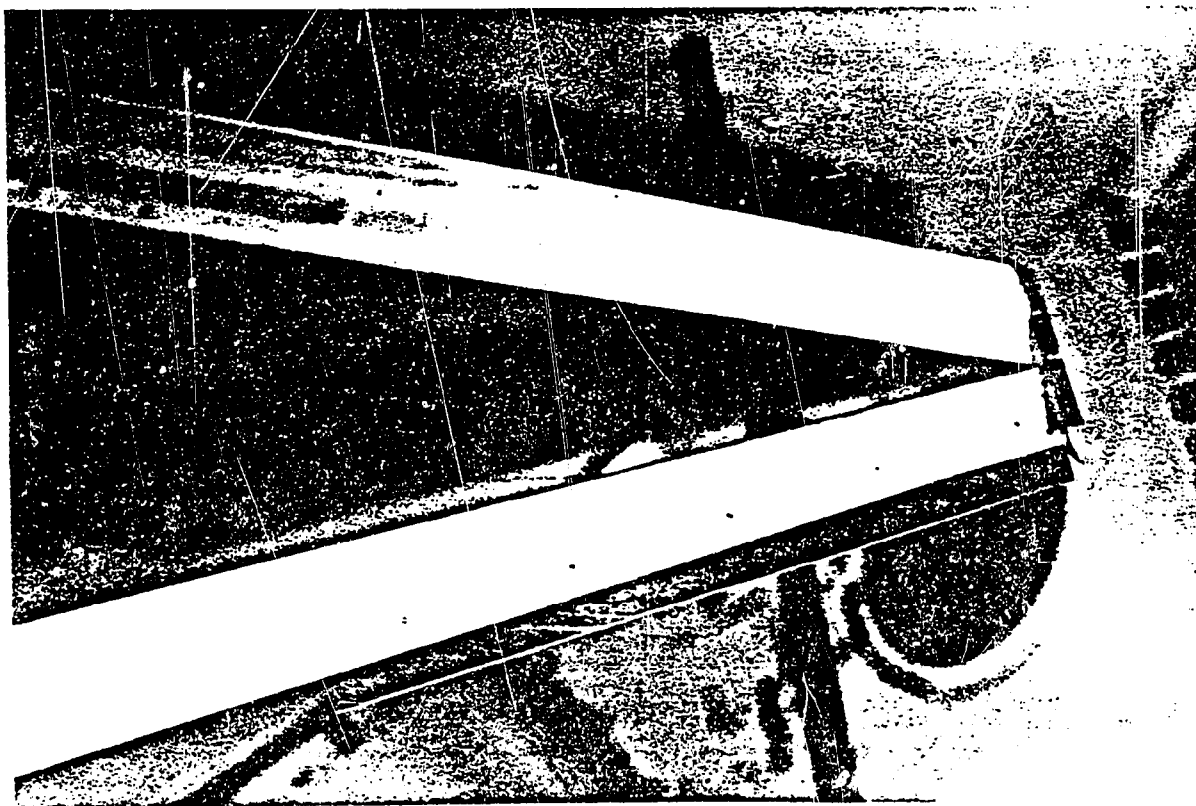


Photo No. 27

Top view of A on BFRS + T_{s2}

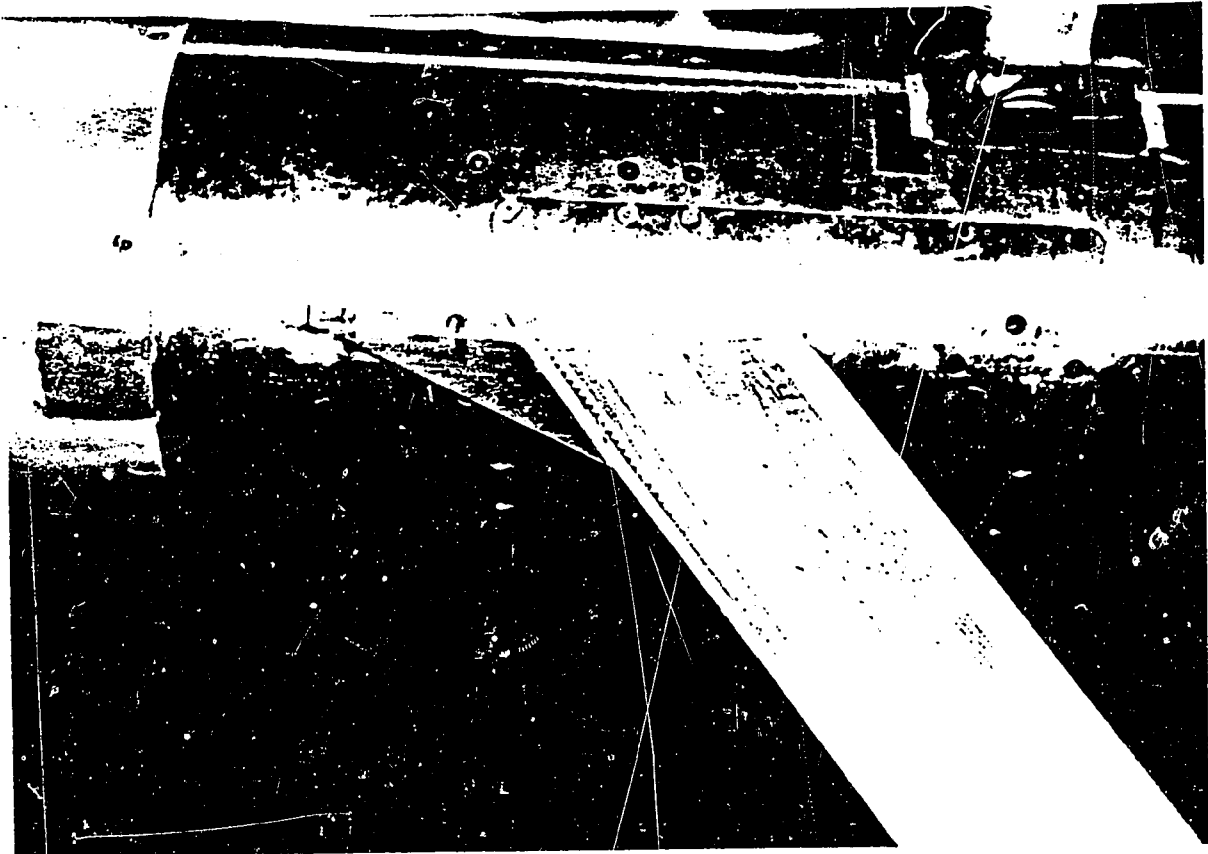


Photo No. 28

3/4 bottom view of S on BFRA + T_{S2}

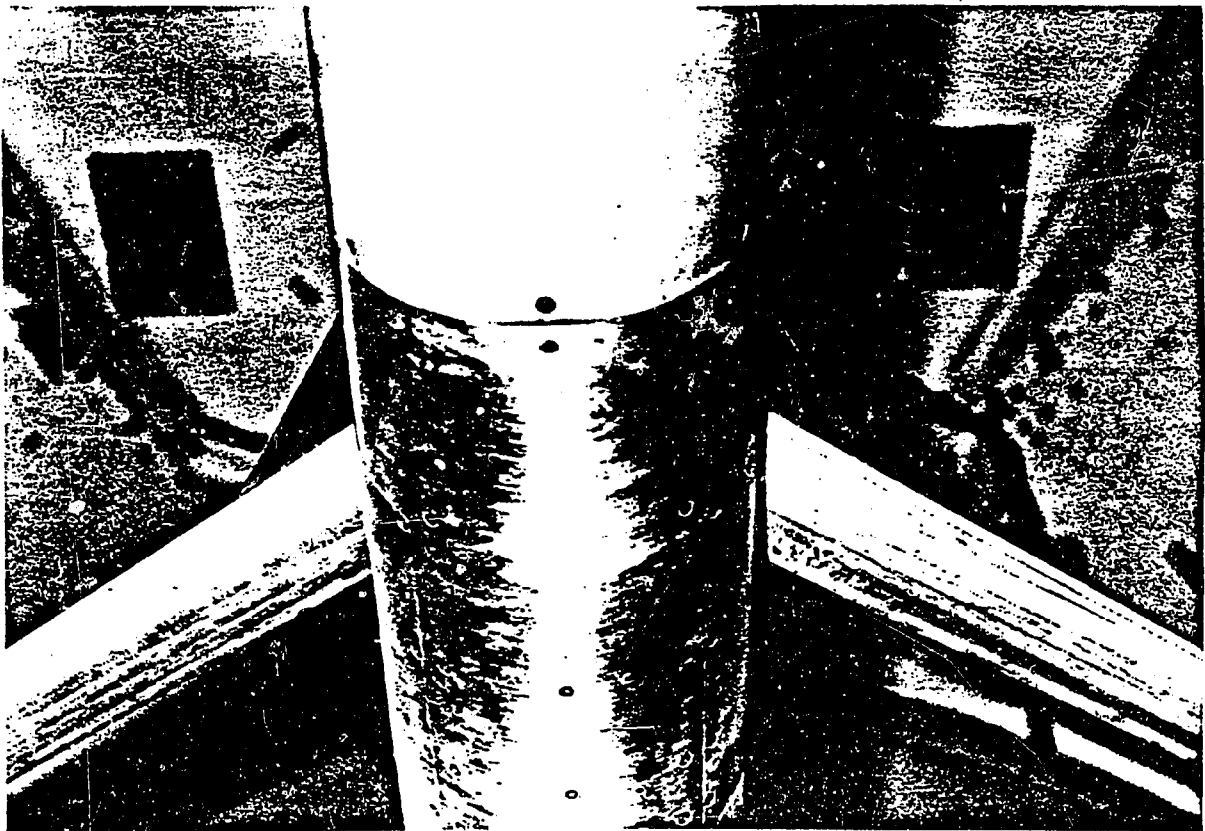


Photo No. 29

Top view of S on BFRA + T_{S2}

APPENDIX

Model Airfoil Detail

Model Airfoil Detail

Airfoils for C_{30} , D, H, V and the vertical fin portion of R are defined relative to local vertical planes (i.e., horizontal planes for D, V and the fin portion of R). These vertical planes are parallel to the airframe plane of symmetry. The horizontal planes are parallel to a plane containing the butt and water lines.

Airfoils for C_{60} are defined with respect to local vertical planes inclined at 30 degrees to the airframe plane of symmetry such that in each plane the trailing edge of any given airfoil section is inboard of the leading edge of that section.

Airfoils for the wings W, F and R are defined relative to local non-vertical planes inclined to the airframe plane of symmetry by an angle equal to the dihedral angle.

Note that except for C_{60} , all airfoils are defined in "streamwise" planes parallel to planes containing the body longitudinal axis.

All airfoils employ a NACA 0009 fairing fitted to a NACA 4 digit camber line, i.e., airfoils are of the form NACA XY09 where x and y are given in Table AI.

For C_{30} , C_{60} , D, H, V and the fin portion of R the airfoils are symmetrical, i.e., $x = y = 0$. Airfoil sections between B.L.'s quoted in Table AI are formed by varying x and y linearly between the nearest B.L.'s quoted. Incidence is measured in local vertical planes. Note that the spanwise variation of incidence resulted in a noticeable L.E. droop outboard of 70% semispan, although the T.E.'s of all lifting surfaces were straight.

Airfoil ordinates are given in Table AII.

TABLE AIAirfoil Incidence and Camber Spanwise Distribution

<u>Component</u>	<u>% Semi-Span</u>	<u>B.L.</u>	<u>Location of max. camber x, Tenths of chord</u>	<u>max.camber y,% chord</u>	<u>Incidence relative to W.L. deg.</u>
W	0	0	4.0	4.0	4.0
	70	27.14	4.0	4.0	4.0
	100	38.78	4.0	2.5	1.5
F	0	0	4.0	5.88	4.65
	70	27.14	4.0	5.88	4.65
	100	38.78	4.0	2.75	0.91
R	0	0	4.0	3.35	4.20
	70	27.14	4.0	3.35	4.20
	100	38.78	4.0	2.40	3.35

TABLE AII

Airfoil Ordinates Given as % Chord - Cambered Airfoils

% Chord from L.E.	W				F				R			
	B.L. 0 to		B.L. 38.78		B.L. 0 to		B.L. 38.78		B.L. 0 to		B.L. 38.78	
	u	ℓ	u	ℓ	u	ℓ	u	ℓ	u	ℓ	u	ℓ
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2.5000	2.6960	-1.2260	2.4204	-1.5016	3.0415	-0.8805	2.4664	-1.4556	2.5766	-1.3454	2.4020	-1.5200
5.0000	3.9188	-1.4132	3.4491	-1.8829	4.5076	-0.8244	3.5274	-1.8046	3.7152	-1.6168	3.4177	-1.9143
7.5000	4.8335	-1.4665	4.2023	-2.0977	5.6247	-0.6753	4.3075	-1.9925	4.5599	-1.7401	4.1601	-2.1399
10.0000	5.5682	-1.4558	4.7972	-2.2268	6.5345	-0.4895	4.9257	-2.0983	5.2339	-1.7901	4.7456	-2.2784
15.0000	6.6803	-1.3377	5.6787	-2.3393	7.9357	-0.0823	5.8457	-2.1723	6.2461	-1.7719	5.6117	-2.4063
20.0000	7.4550	-1.1510	6.2732	-2.3328	8.9363	0.3303	6.4702	-2.1358	6.9427	-1.6633	6.1941	-2.4119
25.0000	7.9758	-0.9362	6.6561	-2.2559	9.6300	0.7188	6.8761	-2.0359	7.4037	-1.5083	6.5677	-2.3443
30.0000	8.2859	-0.7161	6.8668	-2.1352	10.0646	1.0626	7.1033	-1.8987	7.6707	-1.3313	6.7718	-2.2302
40.0000	8.3520	-0.3520	6.8522	-1.8518	10.2318	1.5278	7.1022	-1.6018	7.7018	-1.0022	6.7518	-1.9522
50.0000	7.6967	-0.2453	6.2998	-1.6422	9.4477	1.5057	6.5327	-1.4093	7.0911	-0.8509	6.2063	-1.7357
60.0000	6.5761	-0.2699	5.3939	-1.4521	8.0579	1.2119	5.5909	-1.2551	6.0636	-0.7824	5.3147	-1.5313
70.0000	5.1542	-0.3416	4.2520	-1.2440	6.2850	0.7890	4.4024	-1.0936	4.7631	-0.7329	4.1916	-1.3044
80.0000	3.5382	-0.3958	2.9491	-0.9849	4.2765	0.3425	3.0473	-0.8867	3.2828	-0.6512	2.9096	-1.0244
90.0000	1.8178	-0.3542	1.5434	-0.6286	2.1617	-0.0103	1.5892	-0.5828	1.6989	-0.4731	1.5251	-0.6469
95.0000	0.9470	-0.2630	0.8188	-0.3912	1.1077	-0.1023	0.8401	-0.3699	0.8914	-0.3186	0.8102	-0.3998
100.0000	0.0950	-0.0950	0.0950	-0.0950	0.0950	-0.0950	0.0950	-0.0950	0.0950	-0.0950	0.0950	-0.0950

Note: Above wing airfoil sections vary linearly with span between B.L. 27.14 and B.L. 38.78. Nose radius = 0.89% chord for above airfoils.

TABLE AII (CONT'D.)Airfoil Coordinates Given as % Chord - Symmetrical Airfoils

C ₃₀ , D, H, V and fin of R		C ₆₀	
% Chord from L.E.	u & l	% Chord from L.E.	u & l
0.0000	0.0000	0.0000	0.0000
2.5000	1.9610	2.5000	1.1984
5.0000	2.6660	5.0000	1.6292
7.5000	3.1500	7.5000	1.9250
10.0000	3.5120	10.0000	2.1462
15.0000	4.0090	15.0000	2.4499
20.0000	4.3030	20.0000	2.6296
25.0000	4.4560	25.0000	2.7231
30.0000	4.5010	30.0000	2.7506
40.0000	4.3520	40.0000	2.6595
50.0000	3.9710	50.0000	2.4267
60.0000	3.4230	60.0000	2.0918
70.0000	2.7480	70.0000	1.6793
80.0000	1.9670	80.0000	1.2020
90.0000	1.0860	90.0000	0.6637
95.0000	0.6050	95.0000	0.3697
100.0000	0.0950	100.0000	0.0581

Nose radius = 0.89% chord

Nose radius = 0.54% chord