Locally Linearized Longitudinal and Lateral-Directional Aerodynamic Stability and Control Derivatives for the X-29A Aircraft

Gerald D. Budd
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SUMMARY

The locally linearized longitudinal and lateral-directional aerodynamic stability and control derivatives for the X-29A aircraft were calculated for altitudes ranging from sea level to 50,000 ft, Mach numbers from 0.2 to 1.5, and angles of attack from -5° to 25°. Several other parameters were also calculated, including aerodynamic force and moment coefficients, control surface position, normal acceleration, static margin, and reference angle of attack.

INTRODUCTION

The unusual aerodynamic configuration and high degree of longitudinal instability of the X-29A aircraft make it desirable to have linear aerodynamic stability and control data for analysis purposes. Typically, aerodynamic simulation data packages are formatted with higher-order terms and nonlinear increment corrections.

A local, total-force-and-moment coefficient perturbation technique was used to linearize the aerodynamic stability and control derivatives. This technique was implemented on the batch simulation computer system at the NASA Dryden Flight Research Facility.

The nonlinear aerodynamic data were taken from reference 1 and subsequent updates. This data base has been active on Dryden's batch simulation since February 1983. Reference 1 was based on references 2 to 9. Reference 2 was the primary transonic wind tunnel data set. The wind tunnel tests are described in references 10 and 11.

This linearized plot package is interim because of anticipated revisions to the simulation data package.

NOMENCLATURE

\[ a_n \] normal acceleration, \( g \)

\[ b \] (wing) span, \( ft \)

\[ \bar{c} \] mean aerodynamic (geometric) chord, \( ft \)

\[ C_A \] axial force coefficient, \( \text{deg}^{-1} \)

\[ C_{A_q} = \frac{3C_A}{q} \] variation of axial force coefficient with pitch rate, \( \text{rad}^{-1} \)

\[ C_{A\alpha} = \frac{3C_A}{\alpha} \] variation of axial force coefficient with angle of attack, \( \text{deg}^{-1} \)
\[ C_{A_d} = \frac{\partial C_A}{\partial \alpha} \]
variation of axial force coefficient with rate of change of angle of attack, rad\(^{-1}\)

\[ C_{A\delta_c} = \frac{\partial C_A}{\partial \delta_c} \]
variation of axial force coefficient with canard angle, deg\(^{-1}\)

\[ C_{A\delta_f} = \frac{\partial C_A}{\partial \delta_f} \]
variation of axial force coefficient with flap angle, deg\(^{-1}\)

\[ C_{A\delta_s} = \frac{\partial C_A}{\partial \delta_s} \]
variation of axial force coefficient with strake angle, deg\(^{-1}\)

\[ C_D = \frac{D}{\frac{1}{2} \rho U^2} \]
drag coefficient (airplane)

\[ C_{Dq} = \frac{\partial C_D}{\partial q} \]
variation of drag coefficient with pitch rate, rad\(^{-1}\)

\[ C_{D\alpha} = \frac{\partial C_D}{\partial \alpha} \]
variation of drag coefficient with angle of attack, deg\(^{-1}\)

\[ C_{D\dot{\alpha}} = \frac{\partial C_D}{\partial \dot{\alpha}} \]
variation of drag coefficient with rate of change of angle of attack, rad\(^{-1}\)

\[ C_{D\delta_c} = \frac{\partial C_D}{\partial \delta_c} \]
variation of drag coefficient with canard angle, deg\(^{-1}\)

\[ C_{D\delta_f} = \frac{\partial C_D}{\partial \delta_f} \]
variation of drag coefficient with flap angle, deg\(^{-1}\)

\[ C_{D\delta_s} = \frac{\partial C_D}{\partial \delta_s} \]
variation of drag coefficient with strake angle, deg\(^{-1}\)

\[ C_L = \frac{L}{\frac{1}{2} \rho U^2} \]
lift coefficient (airplane)

\[ C_{Lq} = \frac{\partial C_L}{\partial q} \]
variation of lift coefficient with pitch rate, rad\(^{-1}\)
\[ C_{L_d} = \frac{\partial C_L}{\partial a} \] airplane lift curve slope, deg\(^{-1}\)

\[ C_{L_d} = \frac{\partial C_L}{\partial \frac{\delta c}{2U}} \] variation of lift coefficient with rate of change of angle of attack, rad\(^{-1}\)

\[ C_{L_{\delta c}} = \frac{\partial C_L}{\partial \delta_c} \] variation of lift coefficient with canard angle, deg\(^{-1}\)

\[ C_{L_{\delta f}} = \frac{\partial C_L}{\partial \delta_f} \] variation of lift coefficient with flap angle, deg\(^{-1}\)

\[ C_{L_{\delta s}} = \frac{\partial C_L}{\partial \delta_s} \] variation of lift coefficient with strake angle, deg\(^{-1}\)

\[ C_{l} = \frac{L}{\delta S_b} \] rolling moment coefficient

\[ C_{l_p} = \frac{\partial C_l}{\partial \frac{pb}{2U}} \] variation of rolling moment coefficient with roll rate

\[ C_{l_r} = \frac{\partial C_l}{\partial \frac{rb}{2U}} \] variation of rolling moment coefficient with yaw rate

\[ C_{l_{\beta}} = \frac{\partial C_l}{\partial \beta} \] variation of rolling moment coefficient with sideslip angle (i.e., dihedral angle), deg\(^{-1}\)

\[ C_{l_{\delta A}} = \frac{\partial C_l}{\partial \delta A} \] variation of rolling moment coefficient with aileron angle (i.e., lateral control power), deg\(^{-1}\)

\[ C_{l_{\delta r}} = \frac{\partial C_l}{\partial \delta r} \] variation of rolling moment coefficient with rudder angle, deg\(^{-1}\)

\[ C_{m} = \frac{M}{\delta S\bar{c}} \] pitching moment coefficient (airplane, planform)

\[ C_{m_q} = \frac{\partial C_m}{\partial \frac{\delta c}{2U}} \] variation of pitching moment coefficient with pitch rate, rad\(^{-1}\)
\[
\begin{align*}
C_{m\alpha} &= \frac{\partial C_m}{\partial \alpha} \quad \text{variation of pitching moment coefficient with angle of attack (i.e., static longitudinal stability), deg}^{-1} \\
C_{m\dot{\alpha}} &= \frac{\partial C_m}{\partial \frac{\partial \alpha}{2U}} \quad \text{variation of pitching moment coefficient with rate of change of angle of attack, rad}^{-1} \\
C_{m\delta_c} &= \frac{\partial C_m}{\partial \delta_c} \quad \text{variation of pitching moment coefficient with canard angle (i.e., longitudinal control power), deg}^{-1} \\
C_{m\delta_f} &= \frac{\partial C_m}{\partial \delta_f} \quad \text{variation of pitching moment coefficient with flap angle (i.e., longitudinal control power)} \\
C_{m\delta_s} &= \frac{\partial C_m}{\partial \delta_s} \quad \text{variation of pitching moment coefficient with strake angle (i.e., longitudinal control power), deg}^{-1} \\
C_N &= \text{normal force coefficient} \\
C_n &= \frac{N}{qSb} \quad \text{yawing moment coefficient} \\
C_{N\phi} &= \frac{\partial C_N}{\partial \frac{\partial \phi}{2U}} \quad \text{variation of normal force coefficient with pitch roll, rad}^{-1} \\
C_{n\phi} &= \frac{\partial C_n}{\partial \frac{\partial \phi}{2U}} \quad \text{variation of yawing moment coefficient with roll rate} \\
C_{n\psi} &= \frac{\partial C_n}{\partial \frac{\partial \psi}{2U}} \quad \text{variation of yawing moment coefficient with yaw rate} \\
C_{N\alpha} &= \frac{\partial C_N}{\partial \alpha} \quad \text{variation of normal force coefficient with angle of attack, deg}^{-1} \\
C_{N\dot{\alpha}} &= \frac{\partial C_N}{\partial \frac{\partial \alpha}{2U}} \quad \text{variation of normal force coefficient with rate of change of angle of attack, rad}^{-1} \\
C_{N\delta_c} &= \frac{\partial C_N}{\partial \delta_c} \quad \text{variation of normal force coefficient with canard angle, deg}^{-1}
\end{align*}
\]
\( C_{N\delta_f} = \frac{\partial C_N}{\partial \delta_f} \) variation of normal force coefficient with flap angle, deg\(^{-1}\)

\( C_{N\delta_s} = \frac{\partial C_N}{\partial \delta_s} \) variation of normal force coefficient with strake angle, deg\(^{-1}\)

\( C_{n\beta} = \frac{\partial C_n}{\partial \beta} \) variation of yawing moment coefficient with sideslip angle, deg\(^{-1}\)

\( C_{n\beta\text{DYNAMIC}} = C_{n\beta} \cos \alpha - C_{\beta a} \sin \alpha \frac{I_{zz}}{I_{xx}} \) (dutch roll stability parameter)

\( C_{n\delta_a} = \frac{\partial C_n}{\partial \delta_a} \) variation of yawing moment coefficient with aileron angle, deg\(^{-1}\)

\( C_{n\delta_r} = \frac{\partial C_n}{\partial \delta_r} \) variation of yawing moment coefficient with rudder angle, deg\(^{-1}\)

\( C_y = \frac{F_y}{q_s} \) side force coefficient

\( C_{y\rho} = \frac{\partial C_y}{\partial \rho} \) variation of side force coefficient with roll rate

\( C_{y\beta} = \frac{\partial C_y}{\partial \beta} \) variation of side force coefficients with sideslip angle, deg\(^{-1}\)

\( C_{y\delta_a} = \frac{\partial C_y}{\partial \delta_a} \) variation of side force coefficient with aileron angle, deg\(^{-1}\)

\( C_{y\delta_r} = \frac{\partial C_y}{\partial \delta_r} \) variation of side force coefficient with rudder angle, deg\(^{-1}\)

\( D \) drag, lb

\( F_y \) side force along Y-axis, lb

\( g \) acceleration of gravity, ft/sec\(^2\)

\( I_{xx}, I_{yy}, I_{zz} \) moments of inertia about X, Y, Z axes, respectively, slug*ft\(^2\)
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<td>XCG</td>
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DISCUSSION AND RESULTS

The X-29A longitudinal and lateral-directional aerodynamic stability and control derivatives presented may be used for linear analysis purposes. It must be emphasized that the derivatives have been locally linearized about the trim points. All the data points presented are at a trim condition.

Two types of trimming procedures were used in the calculation of these derivatives: (1) straight-and-level trim, which is steady-state 1g trim at a specified altitude and Mach number; and (2) alpha trim which is steady-state trim to a specified angle of attack at a given altitude and Mach number.

Care should be exercised when using this interim data set to avoid confusion. Occasionally a trim data point was perturbated about a breakpoint in the nonlinear simulation aerodynamic data base. An example of this is figure 48(b), Cm-delta strake as a function of alpha for Mach 0.6 and an altitude of 10,000 ft. The perturbation caused the 14° alpha trim point to be displaced downward an extreme amount.

In addition, the scaling of the dependent variables (Y-axis) was not always consistent because of the automatic scaling procedure used.

CONCLUDING REMARKS

Locally linearized longitudinal and lateral-directional aerodynamic stability and control derivatives were calculated for the X-29A aircraft, along with several other parameters. Data were obtained for altitudes of sea level to 50,000 ft, Mach numbers from 0.2 to 1.5, and angles of attack ranging from -5° to 25°.

The aerodynamic characteristics of the aircraft appear to be consistent and reasonable, indicating that the linearization technique used was acceptable.

National Aeronautics and Space Administration
Ames Research Center
Dryden Flight Research Facility
Edwards, Calif., August 24, 1983
REFERENCES


CL VS CD

7-14-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L. M# = .2 TO 1.05
- ALT = 10K M# = .2 TO 1.2
- ALT = 20K M# = .3 TO 1.4

Figure 1(a)
CL VS CD

7-14-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 1(b)
CL VS CD

7-12-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 1(c)
CL vs CD
7-12-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

Figure 1(d)
CL VS CD

7-12-83 X-29A M\# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 10K ALP: 0 TO 10
- ○ ALT = 20K ALP: -4 TO 12
- ▲ ALT = 30K ALP: -4 TO 14
- ☆ ALT = 40K ALP: -4 TO 18
- × ALT = 50K ALP: -4 TO 22

Figure 1(e)
CL VS CD

7-14-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 16

Figure 1(f)
CL VS CD
7-14-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 1(g)
CL VS CD

7-14-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 1(h)
CM VS CL
7-14-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L.  $M_\infty = 0.2$ TO 1.05
- ○ ALT = 10K  $M_\infty = 0.2$ TO 1.2
- △ ALT = 20K  $M_\infty = 0.3$ TO 1.4

Figure 2(a)
CM VS CL

7-14-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = 30K M* = .3 TO 1.5
- ○ ALT = 40K M* = .6 TO 1.5
- △ ALT = 50K M* = .6 TO 1.5

AERODYNAMIC PITCHING MOMENT, CM, NECESSARY TO OFFSET THRUST PITCHING MOMENT

LIFT COEFF., CL

Figure 2(b)
CM VS CL
7-12-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

Figure 2(c)
CM VS CL

7-12-83 X-29A M# = 0.6  NORMAL MODE
XCG = 451.0 WT = 15K  ALPHA TRIM

- Alt = 10K  ALP: -4 TO 16
- Alt = 20K  ALP: -4 TO 20

Figure 2(d)
CM VS CL
7-12-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 2(e)
CM VS CL
7-14-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 16

Figure 2(f)
CM VS CL
7-14-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 2(g)
CM VS CL
7-14-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

Figure 2(h)
AN VS ALPHA
7-12-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 3(a)
AN V S ALPHA
7-12-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 3(b)
AN VS ALPHA
7-12-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - ALT = 10K ALP: 0 TO 10
- - ALT = 20K ALP: -4 TO 12
- - ALT = 30K ALP: -4 TO 14
* - ALT = 40K ALP: -4 TO 18
X - ALT = 50K ALP: -4 TO 22

Figure 3(c)
AN VS ALPHA
7-14-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: 0 TO 10
- ○ ALT = 30K ALP: -2 TO 12
- △ ALT = 40K ALP: -4 TO 14
- ★ ALT = 50K ALP: -4 TO 16

Figure 3(d)
AN VS ALPHA

7-14-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 3(e)
AN VS ALPHA

7-14-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = 30K ALP: -4 TO 8
- Alt = 40K ALP: -4 TO 10
- Alt = 50K ALP: -4 TO 12

Figure 3(f)
ALPHA VS MACH #
7-5-83: X-29A 1-G TRIM NORMAL MODE
XCG = 451.0  WT = 15K

- ALT = S.L.  $\text{M}_*$ = .2 TO 1.05
- ALT = 10K  $\text{M}_*$ = .2 TO 1.2
- ALT = 20K  $\text{M}_*$ = .3 TO 1.4

Figure 4(a)
ALPHA VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K  M# = .3 TO 1.5
ALT = 40K  M# = .6 TO 1.5
ALT = 50K  M# = .6 TO 1.5

Figure 4(b)
STATIC MARGIN VS MACH
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 5(a)
STATIC MARGIN VS MACH
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K  M# = .3 TO 1.5
ALT = 40K  M# = .6 TO 1.5
ALT = 50K  M# = .6 TO 1.5

Figure 5(b)
STATIC MARGIN VS ALPHA
7-15-83  X-29A  M# = 0.4  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = S.L.  ALP: -4 TO 22
ALT = 10K  ALP: -4 TO 22

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Figure 6(a)
STATIC MARGIN VS ALPHA
7-15-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

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STATIC MARGIN VS ALPHA
7-15-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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<td>30K</td>
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<tr>
<td>40K</td>
<td>-4 TO 16</td>
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<tr>
<td>50K</td>
<td>-4 TO 22</td>
</tr>
</tbody>
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Figure 6(c)
STATIC MARGIN VS ALPHA
7-15-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

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STATIC MARGIN VS ALPHA
7-15-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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STATIC MARGIN VS ALPHA
7-15-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \text{ALT} = 30K \quad \text{ALP}: -4 \text{ TO } 8 \]
\[ \text{ALT} = 40K \quad \text{ALP}: -4 \text{ TO } 10 \]
\[ \text{ALT} = 50K \quad \text{ALP}: -4 \text{ TO } 12 \]
DELT CANARD VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 7(a)
DELTA CANARD VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 7(b)
DELTAR CANARD VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 8(a)
DELTA CANARD VS ALPHA

6-16-83  X-29A  M# = 0.6  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = 10K  ALP: -4 TO 16
ALT = 20K  ALP: -4 TO 20

Figure 8(b)
DELTA CANARD VS ALPHA
6-17-83 X-29A M=- 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - ALT = 10K ALP: 0 TO 10
- - ALT = 20K ALP: -4 TO 12
- - ALT = 30K ALP: -4 TO 14
- - ALT = 40K ALP: -4 TO 18
- - ALT = 50K ALP: -4 TO 22

Figure 8(c)
DELTA CANARD VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 8(d)
DELTA CANARD VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ■ ALT = 20K ALP: 0 TO 8
- • ALT = 30K ALP: 0 TO 10
- • ALT = 40K ALP: 0 TO 12
- • ALT = 50K ALP: 0 TO 14

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Figure 8(e)
DELTA CANARD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 TO 8
- ○ ALT = 40K ALP: -4 TO 10
- ▲ ALT = 50K ALP: -4 TO 12

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Figure 8(f)
DELTA FLAP VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L. M# = .2 TO 1.05
- ○ ALT = 10K M# = .2 TO 1.2
- △ ALT = 20K M# = .3 TO 1.4

Figure 9(a)
DELTAFLAP VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0 WT = 15K

▪▪▪ ALT = 30K M# = .3 TO 1.5
▪▪▪ ALT = 40K M# = .6 TO 1.5
▪▪▪ ALT = 50K M# = .6 TO 1.5

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Figure 9(b)
DELTA FLAP VS ALPH.A
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 10(a)
DELTA FLAP VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALP: -4 TO 16
ALT = 10K

ALP: -4 TO 20
ALT = 20K

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Figure 10(b)
DELTA FLAP VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

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Figure 10(c)
DELTA FLAP VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

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 Figure 10(d)
DELTA FLAP VS ALPHA

7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 10(e)
DELTA FLAP VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- [ ] ALT = 30K ALP: -4 TO 8
- [ ] ALT = 40K ALP: -4 TO 10
- [ ] ALT = 50K ALP: -4 TO 12

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Figure 10(f)
DELTA STRAKE VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 11(a)
DELTA STRAKE VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 11(b)
DELTA STRIKE VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 12(a)
DELTA STRAKE VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 12(b)
DELTA STRIKE VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 12(c)
DELTA STRAKE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 12(d)
DELTA STRAKE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ■ ALT = 20K ALP: -4 TO 8
- ○ ALT = 30K ALP: -4 TO 10
- ▲ ALT = 40K ALP: -4 TO 12
- ★ ALT = 50K ALP: -4 TO 14

Figure 12(e)
DELTA STRIKE VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 TO 8
- ○ ALT = 40K ALP: -4 TO 10
- ▲ ALT = 50K ALP: -4 TO 12

Figure 12(f)
CL-LIFT VS MACH #
7-5 83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L. M# = .2 to 1.0
- ○ ALT = 10K M# = .2 to 1.2
- △ ALT = 20K M# = .3 to 1.4

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Figure 13(a)
CL-LIFT VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ □ □ ALT = 30K M# = .3 TO 1.5
- ○ ○ ○ ALT = 40K M# = .6 TO 1.5
- △ △ △ ALT = 50K M# = .6 TO 1.5

Figure 13(b)
CL-LIFT VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP; 4 TO 22
ALT = 10K ALP; 4 TO 22

Figure 14(a)
CL-LIFT VS ALPHA

6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 14(b)
CL-LIFT VS ALPHA

6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 14(c)
CL-LIFT VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALTA = 20K ALP: 0 TO 10
- ALTA = 30K ALP: -2 TO 12
- ALTA = 40K ALP: -4 TO 14
- ALTA = 50K ALP: -4 TO 16

Figure 14(d)
CL-LIFT VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Figure 14(e)
CL-LIFT VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \text{ALT = 30K ALP: -4 TO 6} \]
\[ \text{ALT = 40K ALP: -4 TO 10} \]
\[ \text{ALT = 50K ALP: -4 TO 12} \]

Figure 14(f)
CD VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M = .2 TO 1.05
- ALT = 10K  M = .2 TO 1.2
- ALT = 20K  M = .3 TO 1.4

Figure 15(a)
CD VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 15(b)
CD VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = S.L. ALP: -4 TO 22
- Alt = 10K ALP: -4 TO 22

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Figure 16(a)
CD VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHATRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

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Figure 16(b)
CD VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 16(c)
CD VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

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Figure 16(d)
CD VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

* ALT = 20K ALP: -4 TO 8
* ALT = 30K ALP: -4 TO 10
* ALT = 40K ALP: -4 TO 12
* ALT = 50K ALP: -4 TO 14

Figure 16(e)
CD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 16(f)
CM VS MACH 
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L. M# = .2 TO 1.05
- ALT = 10K M# = .2 TO 1.2
- ALT = 20K M# = .3 TO 1.4

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Figure 17(a)
CM VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = 30K M# = .3 TO 1.5
- ○ ALT = 40K M# = .6 TO 1.5
- ▲ ALT = 50K M# = .6 TO 1.5

AERODYNAMIC PITCHING MOMENT, CM, NEEDED TO OFFSET THRUST PITCHING MOMENT

Figure 17(b)
CM VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 18(a)
CM VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 18(b)
CM VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

Figure 18(c)
CM VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = 20K ALP: 0 TO 10
- Alt = 30K ALP: -2 TO 12
- Alt = 40K ALP: -4 TO 14
- Alt = 50K ALP: -4 TO 18

Figure 18(d)
CM VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 18(e)
CM VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 18(f)

AERODYNAMIC PITCHING MOMENT, CM, NECESSARY TO OFFSET THRUST PITCHING MOMENT

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CA VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L. M* = .2 TO 1.05
- ALT = 10K M* = .2 TO 1.2
- ALT = 20K M* = .3 TO 1.4

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Figure 19(a)
CA VS MACH 

7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- Alt = 30K M* = 0.3 to 1.5
- Alt = 40K M* = 0.6 to 1.5
- Alt = 50K M* = 0.6 to 1.5

Figure 19(b)
CA VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

Figure 20(a)
CA VS ALPHA

6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 20(b)
CA VS ALPHA
7-28-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 20(c)
CA VS ALPHA

7-28-83  X-29A  M# = 0.9  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- □ ALT = 20K  ALP: 0 TO 10
- ○ ALT = 30K  ALP: -2 TO 12
- △ ALT = 40K  ALP: -4 TO 14
- ★ ALT = 50K  ALP: -4 TO 18

Figure 20(d)
CA VS ALPHA

7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

□ — ALT = 20K ALP: -4 TO 6
⊙ — ALT = 30K ALP: -4 TO 10
△ — ALT = 40K ALP: -4 TO 12
★ — ALT = 50K ALP: -4 TO 14

Figure 20(e)
CN-NORMAL VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L. M# = .2 TO 1.05
ALT = 10K M# = .2 TO 1.2
ALT = 20K M# = .3 TO 1.4

Figure 21(a)
CN-NORMAL VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = 30K M# = .3 TO 1.5
- ○ ALT = 40K M# = .6 TO 1.5
- △ ALT = 50K M# = .6 TO 1.5

Figure 21(b)
CN-NORMAL VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

Figure 22(a)
CN-NORMAL VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALP = -4 TO 16
ALT = 10K

ALP = -4 TO 20
ALT = 20K

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Figure 22(b)
CN-NORMAL VS ALPHA
7-28-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

<table>
<thead>
<tr>
<th>ALT</th>
<th>ALP</th>
</tr>
</thead>
<tbody>
<tr>
<td>10K</td>
<td>0 TO 10</td>
</tr>
<tr>
<td>20K</td>
<td>-4 TO 12</td>
</tr>
<tr>
<td>30K</td>
<td>-4 TO 14</td>
</tr>
<tr>
<td>40K</td>
<td>-4 TO 18</td>
</tr>
<tr>
<td>50K</td>
<td>-4 TO 22</td>
</tr>
</tbody>
</table>

Figure 22(c)
CN-NORMAL VS ALPHA
7-28-83. X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = 20K ALP: 0 TO 10
- Alt = 30K ALP: -2 TO 12
- Alt = 40K ALP: -4 TO 14
- Alt = 50K ALP: -4 TO 16

Figure 22(d)

107
CN-NORMAL VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
△ ALT = 40K ALP: -4 TO 12
★ ALT = 50K ALP: -4 TO 14

Figure 22(e)
CN-NORMAL VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 TO 6
- ○ ALT = 40K ALP: -4 TO 10
- ▲ ALT = 50K ALP: -4 TO 12

Figure 22(f)
CL-CANARD VS MACH #

7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L. M# = .2 TO 1.05
- ALT = 10K M# = .2 TO 1.2
- ALT = 20K M# = .3 TO 1.4

Figure 23(a)
CL-CANARD VS MACH #
7-7-83 X-29A 1-G' TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ □ ALT = 30K M# = .3 TO 1.5
- ○ ○ ALT = 40K M# = .6 TO 1.5
- ▲ ▲ ALT = 50K M# = .6 TO 1.5

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Figure 23(b)
CL-CANARD VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 24(a)
CL-CANARD VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALP: -4 TO 16
- ALP: -4 TO 20

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Figure 24(b)
CL-CANARD VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALP = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

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Figure 24(c)
CL-CANARD VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

-\[ \text{ALT} = 20\text{K}\text{ ALP: 0 TO 10} \]
-\[ \text{ALT} = 30\text{K}\text{ ALP: -2 TO 12} \]
-\[ \text{ALT} = 40\text{K}\text{ ALP: -4 TO 14} \]
-\[ \text{ALT} = 50\text{K}\text{ ALP: -4 TO 18} \]

Figure 24(d)
CL-CANARD VS ALPHA
7-1-83  X-29A  M# = 1.2  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- ALT = 20K  ALP: -4 TO 6
- ALT = 30K  ALP: -4 TO 10
- ALT = 40K  ALP: -4 TO 12
- ALT = 50K  ALP: -4 TO 14

Figure 24(e)
CL-CANARD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 24(f)
Figure 25(a)
CD-CANARD VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0  WT = 15K

- ALT = 30K  M# = .3 TO 1.5
- ALT = 40K  M# = .6 TO 1.5
- ALT = 50K  M# = .6 TO 1.5

Figure 25(b)
CD-CANARD VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 26(a)
CD-CANARD VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALP: 10K ALP = -4 TO 16
ALP: 20K ALP = -4 TO 20

Figure 26(b)
CD-CANARD VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K. ALPHA TRIM

- - ALT = 10K ALP: 0 TO 10
- - ALT = 20K ALP: -4 TO 12
△ △ ALT = 30K ALP: -4 TO 14
☆ ☆ ALT = 40K ALP: -4 TO 18
X - X ALT = 50K ALP: -4 TO 22

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Figure 26(c)
CD-CANARD VS ALPHA
7-1-83 X-29A M= 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \begin{align*}
\text{ALT} = 20K & \quad \text{ALP: 0 TO 10} \\
\text{ALT} = 30K & \quad \text{ALP: -2 TO 12} \\
\text{ALT} = 40K & \quad \text{ALP: -4 TO 14} \\
\text{ALT} = 50K & \quad \text{ALP: -4 TO 18}
\end{align*} \]

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Figure 26(d)
CD-CANARD VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- AL$T = 20K$ ALP: -4 TO 8
- AL$T = 30K$ ALP: -4 TO 10
- AL$T = 40K$ ALP: -4 TO 12
- AL$T = 50K$ ALP: -4 TO 14

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Figure 26(e)
CD-CANARD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

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Figure 26(f)
CM-CANARD VS MACH

7-5-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0 WT = 15K

□ □ ALT = S.L.  Ma = 0.2 TO 1.05
○ ○ ALT = 10K  Ma = 0.2 TO 1.2
△ △ ALT = 20K  Ma = 0.3 TO 1.4

Figure 27(a)
CM-CANARD VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 27(b)
CM-CANARD VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

© ALT = S.L. ALP: -4 TO 22
☐ ALT = 10K ALP: -4 TO 22

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Figure 28(a)
CM-CANARD VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 28(b)
CM-CANARD VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 10K ALP: 0 TO 10
- ○ ALT = 20K ALP: -4 TO 12
- △ ALT = 30K ALP: -4 TO 14
- ★ ALT = 40K ALP: -4 TO 18
- × ALT = 50K ALP: -4 TO 22

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Figure 28(c)
CM-CANARD VS ALPHA
7-1-83 'X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 28(d)
CM-CANARD VS ALPHA
7-1-83 X-29A M* = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 28(e)
CM-CANARD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

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Figure 28(f)
CA-CANARD VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

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Figure 29(a)
CA-CANARD VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

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CA-CANARD VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

Figure 30(a)
CA-CANARD VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

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Figure 30(b)
CA-CANARD VS ALPHA

6-30-83  X-29A  M# = 0.8  NORMAL MODE

XCG = 451.0  WT = 15K  ALPHA TRIM

- ALT = 10K  ALP: 0 TO 10
- ALT = 20K  ALP: -4 TO 12
△ ALT = 30K  ALP: -4 TO 14
☆ ALT = 40K  ALP: -4 TO 16
× ALT = 50K  ALP: -4 TO 22

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CA-CANARD VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL Mode
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 30(d)

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CA-CANARD VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

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Figure 30(e)
CA-CANARD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALPHA = -4 TO 8
ALT = 40K ALPHA = -4 TO 10
ALT = 50K ALPHA = -4 TO 12

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CN-CANARD VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L.  M# = .2 TO 1.05
- ○ ALT = 10K  M# = .2 TO 1.2
- ◇ ALT = 20K  M# = .3 TO 1.4

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Figure 31(a)
CN-CANARD VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

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CN-CANARD VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

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Figure 32(a)
CN-CANARD VS ALPHA

6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \boxed{\begin{align*}
\text{ALT} &= 10K \quad \text{ALP: } -4 \text{ TO } 16 \\
\text{ALT} &= 20K \quad \text{ALP: } -4 \text{ TO } 20
\end{align*}} \]

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Figure 32(b)
CN-CANARD VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALP = 30K ALP: -4 TO 14
- ALP = 40K ALP: -4 TO 18
- ALP = 50K ALP: -4 TO 22

Figure 32(c)
CN-CANARD VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 32(d)
CN-CANARD VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: -4 TO 6
- ○ ALT = 30K ALP: -4 TO 10
- ▲ ALT = 40K ALP: -4 TO 12
- ▼ ALT = 50K ALP: -4 TO 14

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Figure 32(e)
CN-CANARD VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 32(f)
CL-FLAP VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ■ ALT = S.L. M# = .2 TO 1.05
- ○ ALT = 10K M# = .2 TO 1.2
- △ ALT = 20K M# = .3 TO 1.4

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Figure 33(a)
CL-FLAP VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 33(b)

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CL-FLAP VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 34(a)
CL-FLAP VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 34(b)
CL-FLAP VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- O ALT = 10K ALP: 0 TO 10
- O ALT = 20K ALP: -4 TO 12
- ▲ ALT = 30K ALP: -4 TO 14
- ★ ALT = 40K ALP: -4 TO 18
- X ALT = 50K ALP: -4 TO 22

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CL-FLAP VS ALPHA
7-1-83  X-29A  M# = 0.9  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

\[ \begin{align*}
\text{ALT} = 20K & \quad \text{ALP: 0 TO 10} \\
\text{ALT} = 30K & \quad \text{ALP: -2 TO 12} \\
\text{ALT} = 40K & \quad \text{ALP: -4 TO 14} \\
\text{ALT} = 50K & \quad \text{ALP: -4 TO 18}
\end{align*} \]

Figure 34(d)
CL-FLAP VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA Trim

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 34(e)
CL-FLAP VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

<table>
<thead>
<tr>
<th>ALT</th>
<th>ALP:</th>
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</thead>
<tbody>
<tr>
<td>30K</td>
<td>-4</td>
</tr>
<tr>
<td>40K</td>
<td>-4</td>
</tr>
<tr>
<td>50K</td>
<td>-4</td>
</tr>
</tbody>
</table>

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Figure 34(f)
CD-FLAP VS MACH 

7-6-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0  WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

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Figure 35(a)
CD-FLAP VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

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Figure 35(b)
CD-FLAP VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 36(a)
CD-FLAP VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 36(b)
CD-FLAP VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 16
ALT = 50K ALP: -4 TO 22

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CD-FLAP VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = 20K ALP: 0 TO 10
- Alt = 30K ALP: -2 TO 12
- Alt = 40K ALP: -4 TO 14
- Alt = 50K ALP: -4 TO 16

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Figure 36(d)
CD-FLAP VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

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Figure 36(e)
CD-FLAP VS ALPHA
7-1-83 X-29A \( M\# = 1.5 \) NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 TO 8
- ○ ALT = 40K ALP: -4 TO 10
- △ ALT = 50K ALP: -4 TO 12

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Figure 36(f)
CM-FLAP VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L. M\# = .2 TO 1.05
- ○ ALT = 10K M\# = .2 TO 1.2
- △ ALT = 20K M\# = .3 TO 1.4

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Figure 37(a)
CM-FLAP VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0 WT = 15K

- ALT = 30K M* = .3 TO 1.5
- ALT = 40K M* = .6 TO 1.5
- ALT = 50K M* = .6 TO 1.5

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Figure 37(b)
CM-FLAP VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCg = 451.0 WT = 15K ALPHA TRIM

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CM-FLAP VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 38(b)
CM-FLAP VS ALPHA
6-30-83   X-29A   M# = 0.8   NORMAL MODE
XCG = 451.0   WT = 15K   ALPHA TRIM

ALT = 10K   ALP: 0 TO 10
ALT = 20K   ALP: -4 TO 12
ALT = 30K   ALP: -4 TO 14
ALT = 40K   ALP: -4 TO 18
ALT = 50K   ALP: -4 TO 22

Figure 38(c)
CM-FLAP VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

Figure 38(d)
CM-FLAP VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 38(e)
CM-FLAP VS ALPHA
7-1-83 X-29A M=1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 38(f)
CA-FLAP VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M#. = .2 TO 1.05
- ALT = 10K  M#. = .2 TO 1.2
- ALT = 20K  M#. = .3 TO 1.4

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Figure 39(a)
CA-FLAP VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

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Figure 39(b)
CA-FLAP VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 40(a)
CA-FLAP VS ALPHA

6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 40(b)
CA-FLAP VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 16
- ALT = 50K ALP: -4 TO 22

Figure 40(c)
CA-FLAP VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 16

Figure 40(d)
CA-FLAP VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 6
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Figure 40(e)
CA-FLAP VS ALPHA
7-1-83 X-29A M* = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

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Figure 40(f)
CN-FLAP VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 5 L. M# = .2 TO 1.05
- ALT = 10K M# = .2 TO 1.2
- ALT = 20K M# = .3 TO 1.4

Figure 41(a)
CN-FLAP VS MACH

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0 WT = 15K

- ALT = 30K M* = .3 TO 1.5
- ALT = 40K M* = .6 TO 1.5
- ALT = 50K M* = .6 TO 1.5

Figure 41(b)
CN-FLAP VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 42(a)
CN-FLAP VS ALPHA

6-17-83  X-29A  M# = 0.6  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

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Figure 42(b)
CN-FLAP VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

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Figure 42(c)
CN-FLAP VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 42(d)
CN-FLAP VS ALPHA

7-28-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 MT = 15K ALPHA TRIM

ALT = 20K ALP = -4 TO 8
ALT = 30K ALP = -4 TO 10
ALT = 40K ALP = -4 TO 12
ALT = 50K ALP = -4 TO 14

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CN-FLAP VS ALPHA
7-28-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CL-STRAKE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L. M# = .2 TO 1.05
ALT = 10K M# = .2 TO 1.2
ALT = 20K M# = .3 TO 1.4

Figure 43(a)
CL-STRAKE VS MACH #
7-7-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT = 15K

ALT = 30K  M# = .3 TO 1.5
ALT = 40K  M# = .6 TO 1.5
ALT = 50K  M# = .6 TO 1.5

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Figure 43(b)
CL-STRAKE VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 44(a)
CL-STRAKE VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - ALT = 10K ALP: -4 TO 16
- - ALT = 20K ALP: -4 TO 20

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Figure 44(b)
CL-STRAKE VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

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Figure 44(c)
CL-STRAKE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- RLT = 20K ALP: 0 TO 10
- RLT = 30K ALP: -2 TO 12
- RLT = 40K ALP: -4 TO 14
- RLT = 50K ALP: -4 TO 18

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Figure 44(d)
CL-STRAKE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: -4 TO 6
- ○ ALT = 30K ALP: -4 TO 10
- △ ALT = 40K ALP: -4 TO 12
- ★ ALT = 50K ALP: -4 TO 14

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Figure 44(e)
CL-STRAKE VS ALPHA

7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

Figure 44(f)
CD-STRAKE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

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Figure 45(a)
CD-STRAKE VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO .5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 45(b)
CD-STRAKE VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 5.00 ALT = 10.00
ALP: -4 TO 22 ALP: -4 TO 22

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Figure 46(a)
CD-STRAKE VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALP = -4 TO 16
ALT = 10K

ALP = -4 TO 20
ALT = 20K

Figure 46(b)
CD-STRAKE VS ALPHA
6-30-83 X-29A Mₘ = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALP = 30K ALP: -4 TO 14
- ALP = 40K ALP: -4 TO 18
- ALP = 50K ALP: -4 TO 22

Figure 46(c)
CD-STRAKE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CD-STRAKE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 6
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Figure 46(e)
CD-STRAKE VS ALPHA
7-1-83  X-29A  M* = 1.5  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- □ ALT = 30K  ALP: -4 TO 8
- ○ ALT = 40K  ALP: -4 TO 10
- △ ALT = 50K  ALP: -4 TO 12

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Figure 46(f)
CM-STRAKE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 47(a)
CM-STRAKE VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M* = .3 TO 1.5
ALT = 40K M* = .6 TO 1.5
ALT = 50K M* = .6 TO 1.5

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Figure 47(b)
CM-STRAKE VS ALPHA
7-26-83  X-29A  M# = 0.4  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = S.L.  ALP: -4 TO 22
ALT = 10K  ALP: -4 TO 22

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Figure 48(a)
CM-STRAKE VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 48(b)
CM-STRAKE VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

Figure 48(c)
CM-STRAKE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CM-STRAKE VS ALPHA
7-27-83  X-29A  M# = 1.2  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- ALT = 20K  ALP: -4 TO 8
- ALT = 30K  ALP: -4 TO 10
- ALT = 40K  ALP: -4 TO 12
- ALT = 50K  ALP: -4 TO 14

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Figure 48(e)
CM-STRAKE VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

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Figure 48(f)
CA-STRAKE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- - ALT = S.L. M* = .2 TO 1.05
- - ALT = 10K M* = .2 TO 1.2
- - ALT = 20K M* = .3 TO 1.4

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Figure 49(a)
CA-STRAKE VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = 30K M = .3 TO 1.5
- ○ ALT = 40K M = .6 TO 1.5
- ▲ ALT = 50K M = .6 TO 1.5

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Figure 49(b)
CA-STRAKE VS ALPHA
6-16-83 X-29A M# = 0.4 ALPHA TRIM
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 50(a)
CA-STRAKE VS ALPHA

6-17-83 X-29A M* = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 50(b)
CA-STRAKE VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALP: 0 TO 10
- ALP: -4 TO 12
- ALP: -4 TO 14
- ALP: -4 TO 16
- ALP: -4 TO 22

Figure 50(c)
**CA-STRAKE VS ALPHA**

7-1-83 X-29A M# = 0.9 NORMAL MODE

XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

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![Graph](Image)
CA-STRAKE VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - ALT = 20K ALP: -4 TO 6
- - ALT = 30K ALP: -4 TO 10
- - ALT = 40K ALP: -4 TO 12
- - ALT = 50K ALP: -4 TO 14

Figure 50(e)
CA-STRATE VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 50(f)

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CN-STRAKE VS MACH

7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L. M* = .2 TO 1.05
ALT = 10K M* = .2 TO 1.2
ALT = 20K M* = .3 TO 1.4

Figure 51(a)
CN-STRAKE VS MACH 
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

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Figure 51(b)
CN-STRAKE VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

□ ALT = S.L. ALP: -4 TO 22
○ ALT = 10K ALP: -4 TO 22

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Figure 52(a)
CN-STRAKE VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 52(b)
CN-STRAKE VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
* ALT = 40K ALP: -4 TO 18
* ALT = 50K ALP: -4 TO 22

Figure 52(c)
CN-STRAKE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

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Figure 52(d)
CN-STRAKE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

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Figure 52(e)
CN-STRAKE VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 6
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Cy - AILERON VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L. M# = .2 TO 1.05
ALT = 10K M# = .2 TO 1.2
ALT = 20K M# = .3 TO 1.4

Figure 53(a)
Cy—AILERON VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 53(b)

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Cy - AILERON VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 54(a)
Cy - AILERON VS ALPHA

7-26-83 X-29A M\# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \text{ALP:} -4 \text{ TO } 16 \]
\[ \text{ALT = 10K} \]
\[ \text{ALT = 20K} \]

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Figure 54(b)
Cy - AILERON VS ALPHA
7-26-83 X-29A M* = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- D ALT = 10K ALP: 0 TO 10
- O ALT = 20K ALP: -4 TO 12
- ▲ ALT = 30K ALP: -4 TO 14
- ★ ALT = 40K ALP: -4 TO 18
- X ALT = 50K ALP: -4 TO 22

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Figure 54(c)
Cy - AILERON VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 16

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Figure 54(d)
Cy - AILERON VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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$C_y$ - AILERON VS ALPHA

7-27-83 X-29A $M_\# = 1.5$ NORMAL MODE

$XCG = 451.0$ WT = 15K ALPHA TRIM

- $\bigcirc$ ALT = 30K ALP: -4 TO 6
- $\bigcirc$ ALT = 40K ALP: -4 TO 10
- $\bigtriangleup$ ALT = 50K ALP: -4 TO 12

Figure 54(f)
CL - AILERON VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

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Cl - AILERON VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

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CL - AILERON VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 56(a)
CI—AILERON VS ALPHA
6-17-83 X-29A M\# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \begin{align*}
\text{ALT} &= 10K \quad \text{ALP: -4 TO 16} \\
\text{ALT} &= 20K \quad \text{ALP: -4 TO 20}
\end{align*} \]

Figure 56(b).
CI - AILERON VS ALPHA

6-30-83 X-29A M# = 0.8 NORMAL MODE

XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

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Cl - AILERON VS ALPHA
7-1-83 X-29A M* = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = 20K ALP: 0 TO 10
- Alt = 30K ALP: -2 TO 12
- Alt = 40K ALP: -4 TO 14
- Alt = 50K ALP: -4 TO 18

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Figure 56(d)
C1 - AILERON VS. ALPHA
7-1-83  X-29A  M* = 1.2  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

\begin{itemize}
  \item ALT = 20K  ALP: -4 TO 8
  \item ALT = 30K  ALP: -4 TO 10
  \item ALT = 40K  ALP: -4 TO 12
  \item ALT = 50K  ALP: -4 TO 14
\end{itemize}

Figure 56(e)
CI - AILERON VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM
ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

Figure 56(f)
Cn - AILERON VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L. M* = .2 TO 1.05
- ALT = 10K M* = .2 TO 1.2
- ALT = 20K M* = .3 TO 1.4

Figure 57(a)
Cn - AILERON VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M* = .3 TO 1.5
- ALT = 40K M* = .6 TO 1.5
- ALT = 50K M* = .6 TO 1.5

Figure 57(b)
Cn - AILERON VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 58(a)
Cn - AILERON VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 58(b)
Figure 58(c)
Cn – AILERON VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Cn - AILERON VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

Figure 58(e)

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Cn — AILERON VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8

ALT = 40K ALP: -4 TO 10

ALT = 50K ALP: -4 TO 12

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Figure 58(f)
Cy – RUDDER VS MACH #

7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ □ ALT = S.L. M# = .2 TO 1.05
- ○ ○ ALT = 10K M# = .2 TO 1.2
- △ △ ALT = 20K M# = .3 TO 1.4

Figure 59(a)
Cy—RUDDER VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K  M# = .3 TO 1.5
ALT = 40K  M# = .6 TO 1.5
ALT = 50K  M# = .6 TO 1.5

Figure 59(b)

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Cy - RUDDER VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 60(a)
Cy - RUDDER VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 60(b)
Cy - RUDDER VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

Figure 60(c)
Cy—RUDDER VS ALPHA

7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

Figure 60(d)
Cy - RUDDER VS ALPHA
7-27-83  X-29A  M# = 1.2  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- ALT = 20K  ALP: -4 TO 8
- ALT = 30K  ALP: -4 TO 10
- ALT = 40K  ALP: -4 TO 12
- ALT = 50K  ALP: -4 TO 14

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Figure 60(e)

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Cy - RUDDER VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 60(f)
CI - RUDDER VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- - - ALT = S.L.  M* = .2 TO 1.05
- - - ALT = 10K  M* = .2 TO 1.2
- - - ALT = 20K  M* = .3 TO 1.4

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Figure 61(a)
**Cl - RUDDER VS MACH #**

7-7-83  X-29A  1-G TRIM  NORMAL MODE

XCG = 451.0  WT = 15K

- □  ALT = 30K  M# = .3 TO 1.5
- □  ALT = 40K  M# = .6 TO 1.5
- △  ALT = 50K  M# = .6 TO 1.5

Figure 61(b)
Cl – RUDDER VS ALPHA

7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 T0 22
ALT = 10K ALP: -4 T0 22

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Figure 62(a)
Cl—Rudder vs Alpha
7-26-83 X-29A M# = 0.6 Normal Mode
XCG = 451.0 WT = 15K Alpha Trim

• ALT = 10K ALP: -4 TO 16
• ALT = 20K ALP: -4 TO 20

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CI - RUDDER VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

Γ ALT = 10K ALP: 0 TO 10
Ο ALT = 20K ALP: -4 TO 12
▲ ALT = 30K ALP: -4 TO 14
★ ALT = 40K ALP: -4 TO 18
× ALT = 50K ALP: -4 TO 22

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CI - RUDDER VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

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Figure 62(d)
CL - RUDDER VS ALPHA

7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: -4 TO 8
- ○ ALT = 30K ALP: -4 TO 10
- △ ALT = 40K ALP: -4 TO 12
- ★ ALT = 50K ALP: -4 TO 14

Figure 62(e)

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CL – RUDDER VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

Square: ALT = 30K ALP: -4 TO 8
Circle: ALT = 40K ALP: -4 TO 10
Triangle: ALT = 50K ALP: -4 TO 12

Figure 62(f)
Figure 63(a)
Cn - RUDDER VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = 30K M# = .3 TO 1.5
- ○ ALT = 40K M# = .6 TO 1.5
- △ ALT = 50K M# = .6 TO 1.5

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Figure 63(b)
Cn—RUDDER VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = S.L. ALP: -4 TO 22
- ○ ALT = 10K ALP: -4 TO 22

Figure 64(a)
Cn—RUDDER VS ALPHA
7-26-83 X-29A M* = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 64(b)
Cn - RUDDER VS ALPHA

7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

Figure 64(c)
Cn -- RUDDER VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

Figure 64(d)
Cn - RUDDER VS ALPHA
7-27-83 X-29A M = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 64(e)
Cn—RUDDER VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 64(f)
CL-ALPHA VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 65(a)
CL-ALPHA VS MACH 
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 65(b)

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CL-ALPHA VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 66(a)
CL-ALPHA VS ALPHA
6-16-83  X-29A  M# = 0.6  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

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CL-ALPHA VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CL-ALPHA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- [ ] ALTM: 20K ALP: 0 TO 10
- [ ] ALTM: 30K ALP: -2 TO 12
- [ ] ALTM: 40K ALP: -4 TO 14
- [ ] ALTM: 50K ALP: -4 TO 18

Figure 66(d)
CL-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 6
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Figure 66(e)
CL-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 66(f)
CD-ALPHA VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L. \( M^* = 0.2 \) TO \( 1.05 \).
- ○ ALT = 10K \( M^* = 0.2 \) TO \( 1.2 \)
- △ ALT = 20K \( M^* = 0.3 \) TO \( 1.4 \)

Figure 67(a)
CD-ALPHA VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 67(b)
CD-ALPHA VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 68(a)
CD-ALPHA VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 10K ALP: -4 TO 16
- ○ ALT = 20K ALP: -4 TO 20

Figure 68(b)
CD-ALPHA VS ALPHA
6-17-83, X-29A, M# = 0.8 NORMAL MODE
XCG = 451.0, WT = 15K, ALPHA TRIM

- □ ALT = 10K, ALP: 0 TO 10
- ○ ALT = 20K, ALP: -4 TO 12
- ▲ ALT = 30K, ALP: -4 TO 14
- ☆ ALT = 40K, ALP: -4 TO 16
- × ALT = 50K, ALP: -4 TO 22

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Figure 68(c)
CD-ALPHA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO .10
ALT = 30K ALP: -2 TO .12
ALT = 40K ALP: -4 TO .14
ALT = 50K ALP: -6 TO .16

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Figure 68(d)
CD-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

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Figure 68(e)
CD-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 TO 8
- ○ ALT = 40K ALP: -4 TO 10
- △ ALT = 50K ALP: -4 TO 12

Figure 68(f)

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CM-ALPHA VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

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CM-ALPHA VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- - ALT = 30K  M* = .3 TO 1.5
- - ALT = 40K  M* = .6 TO 1.5
- - ALT = 50K  M* = .6 TO 1.5

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Figure 69(b)
CM-ALPHA VS ALPHA
6-15-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 70(a)
CM-ALPHA VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 70(b)
CM-ALPHA VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- [ ] ALT = 10K ALP: 0 TO 10
- [ ] ALT = 20K ALP: -4 TO 12
- [ ] ALT = 30K ALP: -4 TO 14
- [ ] ALT = 40K ALP: -4 TO 18
- [ ] ALT = 50K ALP: -4 TO 22

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Figure 70(c)
CM-ALPHA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - ALT = 20K ALP: 0 TO 10
- - ALT = 30K ALP: -2 TO 12
- - ALT = 40K ALP: -4 TO 14
- - ALT = 50K ALP: -4 TO 18

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CM-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

Figure 70(e)
CM-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 6
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 70(f)
CA-ALPHA VS MACH #

7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

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CA-ALPHA VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ■ ALT = 30K M# = .3 TO 1.5
- ○ ALT = 40K M# = .6 TO 1.5
- ▲ ALT = 50K M# = .6 TO 1.5

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Figure 71(b)
CA-ALPHA VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 72(a)
CA-ALPHA VS ALPHA
7-26-83 X-29A M* = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 72(b)
CA-ALPHA VS ALPHA
6-17-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 16
ALT = 50K ALP: -4 TO 22

Figure 72(c)
CA-ALPHA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

Figure 72(d)
CA-ALPHA VS ALPHA
7-1-83  X-29A  M# = 1.2  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

Figure 72(e)
CA-ALPHA VS. ALPHA

7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

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Figure 72(f)
CN-ALPHA VS MACH #
7-5-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  \( M^* = 0.2 \) TO \( 1.05 \)
- ALT = 10K  \( M^* = 0.2 \) TO \( 1.2 \)
- ALT = 20K  \( M^* = 0.3 \) TO \( 1.4 \)

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Figure 73(a)
CN-ALPHA VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 73(b)
CN-ALPHA VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 74(a)
CN-ALPHA VS ALPHA
6-16-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

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Figure 74(b)
CN-ALPHA VS ALPHA

6-17-83 X-29A  M* = 0.8 NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

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CN-ALPHA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- Alt = 20K ALP: 0 TO 10
- Alt = 30K ALP: -2 TO 12
- Alt = 40K ALP: -4 TO 14
- Alt = 50K ALP: -4 TO 18

Figure 74(d)
CN-ALPHA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 74(e)
CN-ALPHA VS. ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 TO 8
- ◇ ALT = 40K ALP: -4 TO 10
- ◆ ALT = 50K ALP: -4 TO 12

Figure 74(f)

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Cy - BETA VS MACH #
7-6-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT. = 15K

ALT = S.L.  M# = .2 TO 1.05
ALT = 10K  M# = .2 TO 1.2
ALT = 20K  M# = .3 TO 1.4

Figure 75(a)
Cy - BETA VS MACH 

7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ○ ALT = 30K M# = .3 TO 1.5
- ○ ALT = 40K M# = .6 TO 1.5
- △ ALT = 50K M# = .6 TO 1.5

Figure 75(b)

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Cy - BETA VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

Figure 76(a)
Cy-BETA VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 76(b)
Cy - BETA VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 16
- ALT = 50K ALP: -4 TO 22

Figure 76(c)
Cy - BETA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- [] ALT = 20K ALP: 0 TO 10
- [] ALT = 30K ALP: -2 TO 12
- △ ALT = 40K ALP: -4 TO 14
- ★ ALT = 50K ALP: -4 TO 18

Figure 76(d)
Cy - BETA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Figure 76(e)
Cy - BETA VS ALPHA
7-1-83  X-29A  M* = 1.5  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = 30K  ALP: -4 TO 8
ALT = 40K  ALP: -4 TO 10
ALT = 50K  ALP: -4 TO 12

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Figure 76(f)
CI - BETA VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

□ □ ALT = S.L. M# = .2 TO 1.05
○ ○ ALT = 10K M# = .2 TO 1.2
▲ ▲ ALT = 20K M# = .3 TO 1.4

Figure 77(a)

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CI - BETA VS MACH #
7-7-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT = 15K

ALT = 30K  M# = .3 TO 1.5
ALT = 40K  M# = .6 TO 1.5
ALT = 50K  M# = .6 TO 1.5

Figure 77(b)
CI - BETA VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CI - BETA VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 78(b)
CI - BETA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALP: 0 TO 10
- ALP: -2 TO 12
- ALP: -4 TO 14
- ALP: -4 TO 16

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CI - BETA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 78(e)
CI - BETA VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 78(f)
Cn - BETA VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L.  M# = .2 TO 1.05
- ○ ALT = 10K  M# = .2 TO 1.2
- △ ALT = 20K  M# = .3 TO 1.4

Figure 79(a)
Cn - BETA VS MACH #

7-7-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT = 15K

□ ALT = 30K  M# = .3 TO 1.5
○ ALT = 40K  M# = .6 TO 1.5
▲ ALT = 50K  M# = .6 TO 1.5

Figure 79(b)
Cn - BETA VS ALPHA
6-16-83 X-29A  M# = 0.4  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- - ALT = S.L.  ALP: -4 TO 22
- - ALT = 10K  ALP: -4 TO 22

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Cn—BETA VS ALPHA

6-17-83  X-29A  M# = 0.6  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = 10K  ALP = -4 TO 16
ALT = 20K  ALP = -4 TO 20

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Cn - BETA VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALP: 0 TO 10
ALP: -4 TO 12
ALP: -4 TO 14
ALP: -4 TO 18
ALP: -4 TO 22

Figure 80(c)
Cn – BETA VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 0.451.0 WT = 15K ALPHA TRIM

Figure 80(d)
Cn — BETA VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Cn - BETA VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 30K ALP: -4 T0 8
- ○ ALT = 40K ALP: -4 T0 10
- ▲ ALT = 50K ALP: -4 T0 12

Figure 80(f)

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Cn – BETA DYNAMIC VS MACH #
7-6-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 81(a)
Cn — BETA DYNAMIC VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0  WT = 15K

- ALT = 30K  M* = .3 TO 1.5
- ALT = 40K  M* = .6 TO 1.5
- ALT = 50K  M* = .6 TO 1.5

Figure 81(b)
Cn - BETA DYNAMIC VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 82(a)
Cn - BETA DYNAMIC VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 82(b)
Cn - BETA DYNAMIC VS ALPHA
7-27-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 16
- ALT = 50K ALP: -4 TO 22

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Figure 82(c)
Cn - BETA DYNAMIC VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K  ALP: 0 TO 10
- ALT = 30K  ALP: -2 TO 12
- ALT = 40K  ALP: -4 TO 14
- ALT = 50K  ALP: -4 TO 18

Figure 82(d)
Cn—BETA DYNAMIC VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: -4 TO 8
- ● ALT = 30K ALP: -4 TO 10
- ▲ ALT = 40K ALP: -4 TO 12
- ★ ALT = 50K ALP: -4 TO 14

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Figure 82(e)
Cn - BETA DYNAMIC VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 82(f)

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CL-ALPHA DOT VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L.  M# = .2 TO 1.05
ALT = 10K  M# = .2 TO 1.2
ALT = 20K  M# = .3 TO 1.4

Figure 83(a)

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CL-ALPHA DOT VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT. = 30K M# = .3 TO 1.5
ALT. = 40K M# = .6 TO 1.5
ALT. = 50K M# = .6 TO 1.5

Figure 83(b)
CL-ALPHA DOT VS ALPHA

7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 5.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

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Figure 84(a)
CL-ALPHA DOT VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 84(b)
CL-ALPHA DOT VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 84(c)

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CL-ALPHA DOT VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

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Figure 84(d)
CL-ALPHA DOT VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

Figure 84(e)
CL-ALPHA DOT VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 84(f)
CD-ALPHA DØT VS MACH #
7-6-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT = 15K

☐ ALT = S.L.  M# = .2 TO 1.05
☐ ALT = 10K  M# = .2 TO 1.2
☐ ALT = 20K  M# = .3 TO 1.4

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Figure 85(a)
CD-ALPHA DOT VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

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Figure 85(b)
CD-ALPHA DOT VS. ALPHA
6-16-83  X-29A  M# = 0.4  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = S.L.  ALP: -4 TO 22
ALT = 10K  ALP: -4 TO 22

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Figure 86(a)
CD-ALPHA DOT VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALPHA, DEGREES

Figure 86(b)
CD-ALPHA DØT VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 86(c)
CD-ALPHA D0T VS ALPHA

7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 86(d)
CD-ALPHA DOT VS ALPHA

7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 6
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 86(e)
CD-ALPHA DOT VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

Figure 86(f)
CM-ALPHA DOT VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L.  M# = .2 TO 1.05
- ○ ALT = 10K  M# = .2 TO 1.2
- △ ALT = 20K  M# = .3 TO 1.4

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Figure 87(a)
CM-ALPHA DOT VS MACH

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0  WT = 15K

- □ ALT = 30K  M# = .3 TO 1.5
- □ ALT = 40K  M# = .6 TO 1.5
- △ ALT = 50K  M# = .6 TO 1.5

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Figure 87(b)
CM-ALPHA DOT VS ALPHA
7-26-83  X-29A  M# = 0.4  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = S.L.  ALP: -4 TO 22
ALT = 10K  ALP: -4 TO 22

Figure 88(a)
CM-ALPHA DOT VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 88(b)
CM-ALPHA DOT VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CM-ALPHA DOT VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 88(d)
CM-\(\alpha\) \(\dot{\alpha}\) VS \(\alpha\)
7-27-83 X-29A \(M^# = 1.2\) NORMAL MODE
\(XCG = 451.0\) \(WT = 15K\) \(\alpha\) TRIM

- \(\square\) ALT = 20K ALP: -4 TO 8
- \(\bigcirc\) ALT = 30K ALP: -4 TO 10
- \(\triangle\) ALT = 40K ALP: -4 TO 12
- \(\star\) ALT = 50K ALP: -4 TO 14

Figure 88(e)
CM-ALPHA DOT VS ALPHA
7-27-83  X-29A  M# = 1.5  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

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CA-ALPHA DØT VS MACH #
7-27-83 X-29A 1-G TRIM. NORMAL MODE
XCG = 451.0 WT = 15K.

- [ ] ALT = S.L. M* = .2 TO 1.05
- [ ] ALT = 10K M* = .2 TO 1.2
- [ ] ALT = 20K M* = .3 TO 1.4

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Figure 89(a)
CA-ALPHA DOT VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 89(b)
CA-ALPHA DOT VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

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Figure 90(a)
CA-ALPHA DÔT VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 15
ALT = 20K ALP: -4 TO 20

Figure 90(b)
CA-ALPHA DØT VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

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Figure 90(c)
CA-ALPHA DOT VS ALPHA

7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: 0 TO 10
ALT = 30K ALP: -2 TO 12
ALT = 40K ALP: -4 TO 14
ALT = 50K ALP: -4 TO 18

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Figure 90(d)
CA-ALPHA DOT V.S ALPHA

7-27-83  X-29A  M# = 1,2  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = 20K  ALP: -4 TO 8
ALT = 30K  ALP: -4 TO 10
ALT = 40K  ALP: -4 TO 12
ALT = 50K  ALP: -4 TO 14

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Figure 90(e)
CA-ALPHA DOT VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

Figure 90(f)
CN-ALPHA DÔT VS MACH

7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L.  M# = .2 TO 1.05
ALT = 10K  M# = .2 TO 1.2
ALT = 20K  M# = .3 TO 1.4

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Figure 91(a)
CN-ALPHA D\(\dot{\theta}\) VS MACH #

7-7-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0  WT = 15K

- □ ALT = 30K  M\# = 0.3 TO 1.5
- O ALT = 40K  M\# = 0.6 TO 1.5
- △ ALT = 50K  M\# = 0.6 TO 1.5

Figure 91(b)
CN-ALPHA DOT VS ALPHA
7-26-83  X-29A  M# = 0.4  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

ALT = S.L.  ALP: -4 TO 22
ALT = 10K  ALP: -4 TO 22

Figure 92(a)
CN-ALPHA D\DOT VS ALPHA
7-26-83 X-29A M\# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 92(b)
CN-ALPHA DOT VS ALPHA

7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 10K ALP: 0 TO 10
- ○ ALT = 20K ALP: -4 TO 12
- △ ALT = 30K ALP: -4 TO 14
- ★ ALT = 40K ALP: -4 TO 16
- ✗ ALT = 50K ALP: -4 TO 22

Figure 92(c)
CN-ALPHA D\(\Phi\)T VS ALPHA
7-27-83 X-29A M\# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: 0 TO 10
- ○ ALT = 30K ALP: -2 TO 12
- △ ALT = 40K ALP: -4 TO 14
- ☆ ALT = 50K ALP: -4 TO 18

Figure 92(d)
CN-ALPHA DDT VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ □ ALT = 20K ALP: -4 TO 8
- O O ALT = 30K ALP: -4 TO 10
- △ △ ALT = 40K ALP: -4 TO 12
- ★ ★ ALT = 50K ALP: -4 TO 14

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CN-ALPHA DOT VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 92(f)
CL-q VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

□□ ALT = S.L. M# = .2 TO 1.05
○○ ALT = 10K M# = .2 TO 1.2
▲▲ ALT = 20K M# = .3 TO 1.4

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Figure 93(a)
CL-q VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 93(b)
CL–q VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL NOSE
XCG = 451.0 WT = 15K ALPHA TRI.

Figures 94(a)

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CL-q VS ALPHA
6-17-83 X-29A M# = 0.6, NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 94(b)

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CL - q VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALP = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

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Figure 94(c)
CL-q VS ALPHA
7-1-83 X-29A M= 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 94(d)
CL-q VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

Figure 94(e)
CL-\( q \) VS ALPHA

7-27-83 X-29A \( M\# = 1.5 \) NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- \( \text{ALT} = 30K \) ALP: -4 TO 6
- \( \text{ALT} = 40K \) ALP: -4 TO 10
- \( \text{ALT} = 50K \) ALP: -4 TO 12

Figure 94(f)
CD-q VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 95(a)
CD-q VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 95(b)
CD-q VS ALPHA

6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 22
ALT = 20K ALP: -4 TO 22

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Figure 96(a)
CD-q VS ALPHA
6-17-83  X-29A  M# = 0.6  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- [ ] ALT = 10K  ALP: -4 TO 16
- [ ] ALT = 20K  ALP: -4 TO 20

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Figure 96(b)
CD-q VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALP = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 16
- ALT = 50K ALP: -4 TO 22

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Figure 96(c)
CD-q VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - ALT = 20K ALP: 0 T0 10
○○ ALT = 30K ALP: -2 TO 12
△△ ALT = 40K ALP: -4 TO 14
★★ ALT = 50K ALP: -4 TO 18

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Figure 96(d)
CD-q VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 96(e)

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CD-q VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 96(f)
CM-q VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- □ ALT = S.L.  M# = .2 TO 1.05
- ○ ALT = 10K  M# = .2 TO 1.2
- △ ALT = 20K  M# = .3 TO 1.4

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Figure 97(a)
CM-q VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K  M# = .3 TO 1.5
- ALT = 40K  M# = .6 TO 1.5
- ALT = 50K  M# = .6 TO 1.5

Figure 97(b)
CM - q VS ALPHA

7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 98(a)
CM - q VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 98(b)
CM - q VS ALPHA
7-26-83  X-29A  M# = 0.8  NORMAL MODE  
XCG = 451.0  WT = 15K  ALPHA TRIM

- - ALT = 10K  ALP: 0 TO 10  
- - ALT = 20K  ALP: -4 TO 12  
- - ALT = 30K  ALP: -4 TO 14  
- - ALT = 40K  ALP: -4 TO 18  
- - ALT = 50K  ALP: -4 TO 22  

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Figure 98(c)
CM-q VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

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Figure 98(d)
CM-q VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 98(e)
CM - q VS ALPHA
7-27-83 X-29A M* = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

Figure 98(f)
CA-q VS MACH #
7-27-83  X-29A  1-G TRIM  NORMAL MODE
XCG = 451.0  WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

Figure 99(a)
CA-q VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M* = .3 TO 1.5
- ALT = 40K M* = .6 TO 1.5
- ALT = 50K M* = .6 TO 1.5

Figure 99(b)
CA - q VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 100(a)
CA-q VS ALPHA
7-26-83  X-29A  M# = 0.6  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- - - ALT = 10K  ALP: -4 TO 16
- - - ALT = 20K  ALP: -4 TO 20

Figure 100(b)
CA-q VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

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Figure 100(c)
CA-q VS ALPHA

7-27-83  X-29A  M# = 0.9  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- - ALT = 20K  ALP:  0 TO 10
- - ALT = 30K  ALP:  -2 TO 12
- - ALT = 40K  ALP:  -4 TO 14
- - ALT = 50K  ALP:  -4 TO 18

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Figure 100(d)
CA - q VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- - - ALT = 20K ALP: -4 TO 8
- - - ALT = 30K ALP: -4 TO 10
- - - ALT = 40K ALP: -4 TO 12
- - - ALT = 50K ALP: -4 TO 14

Figure 100(e)
CA-q VS ALPHA
7-27-83  X-29A  M# = 1.5  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

[Graph showing data points for different altitudes and alpha values]
CN - q VS MACH #

7-27-83 X-29A 1-G TRIM NORMAL MODE

XCG = 451.0  WT = 15K

- Alt = S.L.  M# = .2 TO 1.05
- Alt = 10K  M# = .2 TO 1.2
- Alt = 20K  M# = .3 TO 1.4

Figure 101(a)
CN - q VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 101(b)
CN-q VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

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Figure 102(a)
CN-q VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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Figure 102(b)
CN-\(q\) VS ALPHA
7-26-83 X-29A M\# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALT = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 102(c)
CN - q VS ALPHA
7-27-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

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Figure 102(d)
CN-q VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALP: -4 TO 8
- ALP: -4 TO 10
- ALP: -4 TO 12
- ALP: -4 TO 14

Figure 102(e)
**CN-q VS ALPHA**

7-27-83  X-29A  M# = 1.5  NORMAL MODE  
XCG = 451.0  WT = 15K  ALPHA TRIM

- ALT = 30K  ALP: -4 TO 8
- ALT = 40K  ALP: -4 TO 10
- ALT = 50K  ALP: -4 TO 12

![Graph](image)

Figure 102(f)

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Cy - ROLL RATE VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

ALT = S.L.  M* = .2 TO 1.05
ALT = 10K  M* = .2 TO 1.2
ALT = 20K  M* = .3 TO 1.4

Figure 103(a)
Cy - ROLL RATE VS MACH #

7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

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ALT = 30K M# = .3 TO 1.5
ALT = 40K M# = .6 TO 1.5
ALT = 50K M# = .6 TO 1.5

Figure 103(b)
Cy - ROLL RATE VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

Figure 104(a)
Cy - ROLL RATE VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 104(b)
Cy - ROLL RATE VS ALPHA

7-26-83  X-29A  M# = 0.8  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- ALTR = 10K  ALP: 0 TO 10
- ALTR = 20K  ALP: -4 TO 12
- ALTR = 30K  ALP: -4 TO 14
- ALTR = 40K  ALP: -4 TO 18
- ALTR = 50K  ALP: -4 TO 22

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Figure 104(c)
Cy - ROLL RATE VS ALPHA
7-27-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 6
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

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Figure 104(e)
C_{y} - ROLL RATE VS ALPHA
7-27-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- [ ] ALT = 30K ALP: -4 TO 8
- [ ] ALT = 40K ALP: -4 TO 10
- [ ] ALT = 50K ALP: -4 TO 12

Figure 104(f)
Cl – ROLL RATE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- [ ] ALT = S.L. M# = .2 TO 1.05
- [ ] ALT = 10K M# = .2 TO 1.2
- [ ] ALT = 20K M# = .3 TO 1.4

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Figure 105(a)
Cl - ROLL RATE VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

* ALT = 30K M# = .3 TO 1.5
* ALT = 40K M# = .6 TO 1.5
* ALT = 50K M# = .6 TO 1.5

Figure 105(b)
Cl – ROLL RATE VS ALPHA
6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 106(a)
Cl - ROLL RATE VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

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Figure 106(b)
CI - ROLL RATE VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: 0 TO 10
ALT = 20K ALP: -4 TO 12
ALT = 30K ALP: -4 TO 14
ALT = 40K ALP: -4 TO 18
ALT = 50K ALP: -4 TO 22

Figure 106(c)
Cl - ROLL RATE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 18

Figure 106(d)
CI - ROLL RATE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

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Cl - ROLL RATE VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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Figure 106(f)
Cn - ROLL RATE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

<table>
<thead>
<tr>
<th>Mode</th>
<th>M# Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.L.</td>
<td>0.2 TO 1.05</td>
</tr>
<tr>
<td>10K</td>
<td>0.2 TO 1.2</td>
</tr>
<tr>
<td>20K</td>
<td>0.3 TO 1.4</td>
</tr>
</tbody>
</table>

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Figure 107(a)
Cn - ROLL RATE VS MACH #
7-7-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = 30K M# = .3 TO 1.5
- ALT = 40K M# = .6 TO 1.5
- ALT = 50K M# = .6 TO 1.5

Figure 107(b)
Cn - ROLL RATE VS ALPHA

6-16-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 108(a)
\textbf{Cn – ROLL RATE VS ALPHA}

6-17-83 X-29A \( M^\# = 0.6 \) NORMAL MODE

\( XCG = 451.0 \) WT = 15K ALPHA TRIM

\[ RLT = 10K \]

\[ RLT = 20K \]

\[ ALT = 10K \quad ALP: \ -4 \ TO \ 16 \]

\[ ALT = 20K \quad ALP: \ -4 \ TO \ 20 \]

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\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure108b.png}
\caption{Figure 108(b)}
\end{figure}
Cn—ROLL RATE VS ALPHA
6-30-83  X-29A  M# = 0.8  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

<table>
<thead>
<tr>
<th>ALT</th>
<th>ALP:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10K</td>
<td>0-10</td>
<td></td>
</tr>
<tr>
<td>20K</td>
<td>-4-12</td>
<td></td>
</tr>
<tr>
<td>30K</td>
<td>-4-14</td>
<td></td>
</tr>
<tr>
<td>40K</td>
<td>-4-18</td>
<td></td>
</tr>
<tr>
<td>50K</td>
<td>-4-22</td>
<td></td>
</tr>
</tbody>
</table>

Figure 108(c)
Cn - ROLL RATE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: 0 TO 10
- ALT = 30K ALP: -2 TO 12
- ALT = 40K ALP: -4 TO 14
- ALT = 50K ALP: -4 TO 16

Figure 108(d)
Cn - ROLL RATE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 20K ALP: -4 TO 8
- ALT = 30K ALP: -4 TO 10
- ALT = 40K ALP: -4 TO 12
- ALT = 50K ALP: -4 TO 14

Figure 108(e)
Cn – ROLL RATE VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 30K ALP: -4 TO 8
ALT = 40K ALP: -4 TO 10
ALT = 50K ALP: -4 TO 12

Figure 108(f)
Cy – YAW RATE VS MACH #
7-27-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

 Alt = S.L. M# = .2 TO 1.05
 Alt = 10K M# = .2 TO 1.2
 Alt = 20K M# = .3 TO 1.4

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Figure 109(a)
Figure 109(b)
Cy – YAW RATE VS ALPHA
7-26-83 X-29A M# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = S.L. ALP: -4 TO 22
ALT = 10K ALP: -4 TO 22

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Figure 110(a)
Cy - YAW RATE VS ALPHA
7-26-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: -4 TO 16
- ALT = 20K ALP: -4 TO 20

Figure 110(b)
Cy - YAW RATE VS ALPHA
7-26-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

○ ALT = 10K ALP: 0 T0 10
○ ALT = 20K ALP: -4 T0 12
△ ALT = 30K ALP: -4 T0 14
★ ALT = 40K ALP: -4 T0 16
× ALT = 50K ALP: -4 T0 22

Figure 110(c)
Cy— YAW RATE VS ALPHA
7-27-83 X-29A \( M_\# = 0.9 \) NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \begin{align*}
\text{ALT} & = 20K \quad \text{ALP: 0 TO 10} \\
\text{ALT} & = 30K \quad \text{ALP: -2 TO 12} \\
\text{ALT} & = 40K \quad \text{ALP: -4 TO 14} \\
\text{ALT} & = 50K \quad \text{ALP: -4 TO 18}
\end{align*} \]

Figure 110(d)
Figure 110(e)
Gy - YAW RATE VS ALPHA
7-27-83  X-29A  M# = 1.5  NORMAL MODE
XCG = 451.0  WT = 15K  ALPHA TRIM

- ALT = 30K  ALP: -4 TO 8
- ALT = 40K  ALP: -4 TO 10
- ALT = 50K  ALP: -4 TO 12

Figure 110(f)
CI - YAW RATE VS MACH #

7-6-83  X-29A  1-G TRIM: NORMAL MODE
XCG = 451.0  WT = 15K

- - ALT = S.L.  M# = .2 TO 1.05
- - ALT = 10K  M# = .2 TO 1.2
- - ALT = 20K  M# = .3 TO 1.4

Figure 111(a)
Cl - Yaw Rate vs Mach #

7-7-83 X-29A 1-G Trim Normal Mode
XCG = 451.0 WT. = 15K

- Square □ ALT = 30K M# = .3 TO 1.5
- Circle ○ ALT = 40K M# = .6 TO 1.5
- Triangle △ ALT = .50K M# = .6 TO 1.5

Figure 111(b)
CI - YAW RATE VS ALPHA
6-16-83 X-29A M* = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = S.L. ALP: -4 TO 22
- ALT = 10K ALP: -4 TO 22

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Figure 112(a)
CI - YAW RATE VS ALPHA
6-17-83 X-29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

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CI – YAW RATE VS ALPHA
6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

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CI - YAW RATE VS ALPHA
7-1-83 X-29A M# = 0.9 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- □ ALT = 20K ALP: 0 TO 10
- ⊙ ALT = 30K ALP: -2 TO 12
- △ ALT = 40K ALP: -4 TO 14
- ★ ALT = 50K ALP: -4 TO 16

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Figure 112(d)
Cl - YAW RATE VS ALPHA

7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 20K ALP: -4 TO 8
ALT = 30K ALP: -4 TO 10
ALT = 40K ALP: -4 TO 12
ALT = 50K ALP: -4 TO 14

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Figure 112(e)
CI - YAW RATE VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 8
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 112(f)
Cn – YAW RATE VS MACH #
7-6-83 X-29A 1-G TRIM NORMAL MODE
XCG = 451.0 WT = 15K

- ALT = S.L.  M# = .2 TO 1.05
- ALT = 10K  M# = .2 TO 1.2
- ALT = 20K  M# = .3 TO 1.4

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Figure 113(a)
Figure 113(b)
Cn - YAW RATE VS ALPHA

6-16-83 X-29A M\# = 0.4 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

\[ \text{ALT = S.L. ALP: -4 TO 22} \]
\[ \text{ALT = 10K ALP: -4 TO 22} \]

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Figure 114(a)
Cn – YAW RATE VS ALPHA
6–17–83 X–29A M# = 0.6 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

ALT = 10K ALP: -4 TO 16
ALT = 20K ALP: -4 TO 20

Figure 114(b)
Cn – YAW RATE VS ALPHA

6-30-83 X-29A M# = 0.8 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 10K ALP: 0 TO 10
- ALT = 20K ALP: -4 TO 12
- ALP = 30K ALP: -4 TO 14
- ALT = 40K ALP: -4 TO 18
- ALT = 50K ALP: -4 TO 22

Figure 114(c)
Cn - Yaw Rate vs Alpha
7-1-83 X-29A M# = 0.9 Normal Mode
XCG = 451.0 WT = 15K Alpha Trim

- Alt = 20K Alp: 0 to 10
- Alt = 30K Alp: -2 to 12
- Alt = 40K Alp: -4 to 14
- Alt = 50K Alp: -4 to 18

Figure 114(d)
Cn - YAW RATE VS ALPHA
7-1-83 X-29A M# = 1.2 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

-□- ALT = 20K ALP: -4 TO 8
-○- ALT = 30K ALP: -4 TO 10
-▲- ALT = 40K ALP: -4 TO 12
-★- ALT = 50K ALP: -4 TO 14

Figure 114(e)
Cn — YAW RATE VS ALPHA
7-1-83 X-29A M# = 1.5 NORMAL MODE
XCG = 451.0 WT = 15K ALPHA TRIM

- ALT = 30K ALP: -4 TO 6
- ALT = 40K ALP: -4 TO 10
- ALT = 50K ALP: -4 TO 12

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Figure 114(f)
16. Abstract

The locally linearized longitudinal and lateral-directional aerodynamic stability and control derivatives for the X-29A aircraft were calculated for altitudes ranging from sea level to 50,000 ft, Mach numbers from 0.2 to 1.5, and angles of attack from -5° to 25°. Several other parameters were also calculated, including aerodynamic force and moment coefficients, control surface position, normal acceleration, static margin, and reference angle of attack.