AERODYNAMIC STATIC STABILITY CHARACTERISTICS OF THE MSFC 33-FOOT PUMP FED BOOSTER AT HIGH ANGLES OF ATTACK

by

Thomas Hamilton, NSI

MSFC 14X14-INCH TRISONIC WIND TUNNEL

Marshall Space Flight Center

SADSAC SPACE SHUTTLE AEROTHERMODYNAMIC DATA MANAGEMENT SYSTEM

CONTRACT NAS8-4016

MARSHALL SPACE FLIGHT CENTER

SPACE DIVISION

CHRYSLER CORPORATION

This document should be referenced as NASA CR-120,051
CONFIGURATION: 0.00340 Scale MSFC 33-Foot Pump Fed Booster
TEST PURPOSE: To Determine the Aerodynamic Static Stability Characteristics of the MSFC 33-Foot Pump Fed Booster at High Angles of Attack
TEST FACILITY: NASA-MSFC 14 x 14 Inch Trisonic Wind Tunnel
TESTING AGENCY: Northrop Services, Inc., Huntsville, Alabama
TEST NO. & DATE: MSFC TWT 529; 10 February 1972
FACILITY COORDINATOR: Jim Weaver, NASA/MSFC
PROJECT ENGINEER(S): Thomas Hamilton, NSI

DATA MANAGEMENT SERVICES

LIAISON: V. W. Sparks
DATA OPERATIONS: Martin J. Lenfranco
Aero-Thermo Data Group

RELEASE APPROVAL: D. Kempp Supervisory
Aero-Thermo Data Group

CONTRACT NAS 8-4016 AMENDMENT 153 DRL 184-58

This report has been prepared by Chrysler Corporation Space Division under a Data Management Contract to the NASA. Chrysler assumes no responsibility for the data presented herein other than its display characteristics.
FACILITY COORDINATOR:

Mr. Jim Weaver
Marshall Space Flight Center
Mail Stop S&E-AERO-AAE
Marshall Space Flight Center, Alabama 35812
Phone: (205) 453-2512

PROJECT ENGINEER:

Mr. Thomas Hamilton
Northrop Services, Inc.
6025 Technology Drive
P. O. Box 1484
Huntsville, Alabama 35807
Phone (205) 837-0580 (Ext. 301)

SADSAC LIAISON:

Mr. V. W. Sparks
Chrysler Corp., Huntsville Division
102 Wynn Drive
Huntsville, Alabama 35805
Phone: (205) 895-1560

SADSAC OPERATIONS:

Mr. M. J. Lenfranco
Chrysler Space Division
P. O. Box 29200
Department 2780
New Orleans, Louisiana 70129
Phone: (504) 255-2304
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AERODYNAMIC STATIC STABILITY CHARACTERISTICS OF THE
MSFC 33-FOOT PUMP FED BOOSTER AT HIGH ANGLES OF ATTACK

By: Thomas Hamilton

ABSTRACT

Experimental aerodynamic investigations were conducted in the NASA/MSFC 14 x 14 Inch Trisonic Wind Tunnel during early February 1972 on a 0.00340 scale model of the MSFC 33-foot diameter space shuttle pump fed booster configuration. The basic configuration tested was a 40° cone/cylinder designated the MSFC 33-foot pump fed booster. Six component aerodynamic force and moment data were recorded over a Mach number range from 0.6 to 5.0, angles-of-attack from 50° to 90° at 0° sideslip and over a sideslip range from -10° to +10° at 60° and 80° angles-of-attack. Primary configuration variables were fin area and body cutout size.
### NOMENCLATURE

**General**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SADSAC SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(C_p)</td>
<td>speed of sound; m/sec, ft/sec</td>
</tr>
<tr>
<td>(C_p)</td>
<td>(M)</td>
<td>pressure coefficient; ((p_1 - p_\infty)/q)</td>
</tr>
<tr>
<td>(M)</td>
<td>MACH</td>
<td>Mach number; (V/a)</td>
</tr>
<tr>
<td>(p)</td>
<td>(q)</td>
<td>pressure; (N/m^2, \text{psf})</td>
</tr>
<tr>
<td>(q)</td>
<td>(Q(NSM))</td>
<td>dynamic pressure; (1/2 \rho V^2, \text{N/m}^2, \text{psf})</td>
</tr>
<tr>
<td>(RN/L)</td>
<td>RN/L</td>
<td>unit Reynolds number; per m, per ft</td>
</tr>
<tr>
<td>(V)</td>
<td>(v)</td>
<td>velocity; m/sec, ft/sec</td>
</tr>
<tr>
<td>(\alpha)</td>
<td>(\alpha)</td>
<td>angle of attack, degrees</td>
</tr>
<tr>
<td>(\beta)</td>
<td>(\beta)</td>
<td>angle of sideslip, degrees</td>
</tr>
<tr>
<td>(\psi)</td>
<td>(\psi)</td>
<td>angle of yaw, degrees</td>
</tr>
<tr>
<td>(\phi)</td>
<td>(\phi)</td>
<td>angle of roll, degrees</td>
</tr>
<tr>
<td>(\rho)</td>
<td>(\rho)</td>
<td>mass density; kg/m(^3), slugs/ft(^3)</td>
</tr>
</tbody>
</table>

**Reference & C.G. Definitions**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ab)</td>
<td>base area; (m^2, \text{ft}^2)</td>
</tr>
<tr>
<td>(b)</td>
<td>wing span or reference span; m, ft</td>
</tr>
<tr>
<td>c.g.</td>
<td>center of gravity</td>
</tr>
<tr>
<td>(\ell)</td>
<td>LREF</td>
</tr>
<tr>
<td>(S)</td>
<td>SREF</td>
</tr>
<tr>
<td>MRP</td>
<td>moment reference point</td>
</tr>
<tr>
<td>XMRP</td>
<td>moment reference point on X axis</td>
</tr>
<tr>
<td>YMRP</td>
<td>moment reference point on Y axis</td>
</tr>
<tr>
<td>ZMRP</td>
<td>moment reference point on Z axis</td>
</tr>
</tbody>
</table>

**SUBSCRIPTS**

<table>
<thead>
<tr>
<th>SUBSCRIPT</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>base</td>
</tr>
<tr>
<td>(l)</td>
<td>local</td>
</tr>
<tr>
<td>(s)</td>
<td>static conditions</td>
</tr>
<tr>
<td>(t)</td>
<td>total conditions</td>
</tr>
<tr>
<td>(\infty)</td>
<td>free stream</td>
</tr>
</tbody>
</table>
### NOMENCLATURE (Continued)

#### Body-Axis System

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SADSAC SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_N$</td>
<td>CN</td>
<td>normal-force coefficient; $\frac{\text{normal force}}{q_S}$</td>
</tr>
<tr>
<td>$C_A$</td>
<td>CA</td>
<td>axial-force coefficient; $\frac{\text{axial force}}{q_S}$</td>
</tr>
<tr>
<td>$C_Y$</td>
<td>CY</td>
<td>side-force coefficient; $\frac{\text{side force}}{q_S}$</td>
</tr>
<tr>
<td>$C_{A_b}$</td>
<td>CAB</td>
<td>base-force coefficient; $\frac{\text{base force}}{q_S}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$-A_b(p_b - p_e)/q_S$</td>
</tr>
<tr>
<td>$C_{A_f}$</td>
<td>CAF</td>
<td>forebody axial force coefficient, $C_A - C_{A_b}$</td>
</tr>
<tr>
<td>$C_m$</td>
<td>CLM</td>
<td>pitching-moment coefficient; $\frac{\text{pitching moment}}{q_S/l_{\text{REF}}}$</td>
</tr>
<tr>
<td>$C_n$</td>
<td>CYN</td>
<td>yawing-moment coefficient; $\frac{\text{yawing moment}}{q_S}$</td>
</tr>
<tr>
<td>$C_l$</td>
<td>CBL</td>
<td>rolling-moment coefficient; $\frac{\text{rolling moment}}{q_S}$</td>
</tr>
</tbody>
</table>

#### Stability-Axis System

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SADSAC SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_L$</td>
<td>CL</td>
<td>lift coefficient; $\frac{\text{lift}}{q_S}$</td>
</tr>
<tr>
<td>$C_D$</td>
<td>CD</td>
<td>drag coefficient; $\frac{\text{drag}}{q_S}$</td>
</tr>
<tr>
<td>$C_{D_b}$</td>
<td>CDB</td>
<td>base-drag coefficient; $\frac{\text{base drag}}{q_S}$</td>
</tr>
<tr>
<td>$C_{D_f}$</td>
<td>CDF</td>
<td>forebody drag coefficient; $C_D - C_{D_b}$</td>
</tr>
<tr>
<td>$C_Y$</td>
<td>CY</td>
<td>side-force coefficient; $\frac{\text{side force}}{q_S}$</td>
</tr>
<tr>
<td>$C_m$</td>
<td>CLM</td>
<td>pitching-moment coefficient; $\frac{\text{pitching moment}}{q_S/l_{\text{REF}}}$</td>
</tr>
<tr>
<td>$C_n$</td>
<td>CLN</td>
<td>yawing-moment coefficient; $\frac{\text{yawing moment}}{q_S}$</td>
</tr>
<tr>
<td>$C_l$</td>
<td>CSL</td>
<td>rolling-moment coefficient; $\frac{\text{rolling moment}}{q_S}$</td>
</tr>
<tr>
<td>L/D</td>
<td>L/D</td>
<td>lift-to-drag ratio; $\frac{C_L}{C_D}$</td>
</tr>
</tbody>
</table>
### ADDITIONS TO SADSAC NOMENCLATURE
### FOR
### TEST MSFC TWT 529

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SADSAC SYMBOL</th>
<th>DEFINITION</th>
<th></th>
</tr>
</thead>
</table>
| $\Gamma$ | Fin dihedral angle, degrees. 
See Figure 6. |  |  |
| LOC    | Fin location on booster.  
See Figure 2. |  |  |
CONFIGURATION DESCRIPTION

The basic pump fed booster configuration was a 40° cone/cylinder with a flat at the end of the cylinder on the bottom. The configuration is designated the MSFC 33-foot pump fed booster. Component configuration symbols and descriptions are listed as follows:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>N_{1B_6}</td>
<td>MSFC 33-foot pump fed booster body with a 40° conical nose and a 33-foot diameter full scale cylindrical body.</td>
</tr>
<tr>
<td>N_{1B_7}</td>
<td>MSFC 33-foot pump fed booster body with a 40° conical nose and a 33-foot diameter full scale cylindrical body.</td>
</tr>
<tr>
<td>F_2</td>
<td>Two 508 sq. ft. full scale fins located at the end of and in the mid position on the cylindrical body. Fin incidence was zero degrees.</td>
</tr>
<tr>
<td>F_3</td>
<td>Two 339 sq. ft. full scale fins mounted like F_2.</td>
</tr>
</tbody>
</table>

Model dimensional information for these components is given in the model component description sheets.
TEST FACILITY DESCRIPTION

The MSFC 14 x 14 Inch Trisonic Wind Tunnel is an intermittent blowdown tunnel which operates by high pressure air flowing from storage to either vacuum or atmospheric conditions. A Mach number range from 0.2 to 5.85 is covered by utilizing two interchangeable test sections. The transonic section permits testing at Mach 0.20 to 2.50, and the supersonic section permits testing at Mach 2.75 to 5.85. Mach numbers between 0.2 and 0.9 are obtained by using a controllable diffuser. The range from 0.95 to 1.3 is achieved through the use of plenum suction and perforated walls. Mach numbers of 1.46, 1.96 and 2.48 are produced by interchangeable sets of fixed contour nozzle blocks. Above Mach 2.48 a set of fixed contour nozzle blocks are tilted and translated automatically to produce any desired Mach number in 0.25 increments.

Air is supplied to a 6000 cubic foot storage tank at approximately -40°F dew point and 500 psi. The compressor is a three-stage reciprocating unit driven by a 1500 hp motor.

The tunnel flow is established and controlled with a servo actuated gate valve. The controlled air flows through the valve diffuser into the stilling chamber and heat exchanger where the air temperature can be controlled from ambient to approximately 180°F. The air then passes through the test section which contains the nozzle blocks and test region.

Downstream of the test section is a hydraulically controlled pitch sector that provides a total angle of attack range of 20° (±10°). Sting offsets and extensions are available for obtaining various maximum angles of attack up to 90°.
DATA REDUCTION

Six component force and moment data were recorded using an internal strain gage balance. Aerodynamic coefficients were calculated for the body and stability axis reference systems. Data reduction included an axial force static tare. No base or cavity pressures were recorded. The model reference dimensions utilized in reducing the data are listed below:

\[ S_{\text{ref}} = \text{Booster Body (N}_1\text{B}_6\text{ or N}_1\text{B}_7) \]

Cylinder cross section area = 1.423 sq. in.

\[ l_{\text{ref}} = b_{\text{ref}} = \text{Booster Body (N}_1\text{B}_6\text{ or N}_1\text{B}_7) \]

Length (from nose to aft end of cylinder) = 5.443 in.

The moment reference center (MRC) is on a line coincident with the body longitudinal centerline 60 per cent of the body length aft of the nose.

\[ \text{MRC} = 60\% l_{\text{ref}} = 3.266 \text{ in.} \]

The moment reference center location is shown in Figure 2.
<table>
<thead>
<tr>
<th>MACH NUMBER</th>
<th>REYNOLDS NUMBER per unit length</th>
<th>DYNAMIC PRESSURE (pounds/sq. inch)</th>
<th>STAGNATION TEMPERATURE (degrees Fahrenheit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6</td>
<td>4.9</td>
<td>4.33</td>
<td>104.6</td>
</tr>
<tr>
<td>0.9</td>
<td>6.3</td>
<td>7.38</td>
<td>102.7</td>
</tr>
<tr>
<td>1.2</td>
<td>6.7</td>
<td>9.15</td>
<td>102.8</td>
</tr>
<tr>
<td>1.46</td>
<td>6.5</td>
<td>9.35</td>
<td>100.8</td>
</tr>
<tr>
<td>2.74</td>
<td>4.7</td>
<td>6.37</td>
<td>138.1</td>
</tr>
<tr>
<td>4.96</td>
<td>5.0</td>
<td>3.07</td>
<td>131.2</td>
</tr>
</tbody>
</table>

BALANCE UTILIZED: MSFC No. 201 Balance

CAPACITY:  
NF 120 lb  
SF 20 lb  
AF 30 lb  
PM 60 in-lb  
YM 20 in-lb  
RM 25 in-lb  

ACCURACY:  

COEFFICIENT TOLERANCE:  

COMMENTS:
<table>
<thead>
<tr>
<th>Schedule</th>
<th>Independent Variables</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule 1</td>
<td>Var1, Var2</td>
<td>Pretest Value</td>
<td>Posttest Value</td>
</tr>
<tr>
<td>Schedule 2</td>
<td>Var3, Var4</td>
<td>Pretest Value</td>
<td>Posttest Value</td>
</tr>
</tbody>
</table>
TABLE III.
DIMENSIONAL DATA

MODEL COMPONENT: BODY - N4B6

GENERAL DESCRIPTION: MSFC Pump Fed Booster Body with Short Cutout on Bottom of Aft End.

DRAWING NUMBER:

DIMENSIONS:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Full-Scale</th>
<th>Model Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, ft</td>
<td>133.4</td>
<td>0.453</td>
</tr>
<tr>
<td>Max. Width, in.</td>
<td>395.9</td>
<td>1.346</td>
</tr>
<tr>
<td>Max. Depth, in.</td>
<td>395.9</td>
<td>1.346</td>
</tr>
<tr>
<td>Fineness Ratio</td>
<td>4.044</td>
<td>4.044</td>
</tr>
<tr>
<td>Area, ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Cross-Sectional Planform</td>
<td>854.8</td>
<td>1.423</td>
</tr>
<tr>
<td>Wetted Base</td>
<td>854.8</td>
<td>1.423</td>
</tr>
<tr>
<td>Body Diameter, In.</td>
<td>395.6</td>
<td>1.346</td>
</tr>
<tr>
<td>Base Diameter, in.</td>
<td>395.6</td>
<td>1.346</td>
</tr>
<tr>
<td>Conical Nose Angle, degrees</td>
<td>40.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Cutout Angle, degrees</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Cutout Length, in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutout Height, in.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE III. (CONTINUED)

MODEL COMPONENT: BODY - N1B7

GENERAL DESCRIPTION: MSFC Pump Fed Booster Body with Long Cutout on Bottom of Aft End

DRAWING NUMBER:

<table>
<thead>
<tr>
<th>DIMENSIONS:</th>
<th>FULL-SCALE</th>
<th>MODEL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, ft.</td>
<td>133.4</td>
<td>0.453</td>
</tr>
<tr>
<td>Max. Width, inches</td>
<td>395.9</td>
<td>1.346</td>
</tr>
<tr>
<td>Max. Depth, inches</td>
<td>395.9</td>
<td>1.346</td>
</tr>
<tr>
<td>Fineness Ratio</td>
<td>4.044</td>
<td>4.044</td>
</tr>
<tr>
<td>Area, ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Cross-Sectional</td>
<td>854.8</td>
<td>1.423</td>
</tr>
<tr>
<td>Planform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wetted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>854.8</td>
<td>1.423</td>
</tr>
<tr>
<td>Body Diameter, inches</td>
<td>395.6</td>
<td>1.346</td>
</tr>
<tr>
<td>Base Diameter, inches</td>
<td>395.6</td>
<td>1.346</td>
</tr>
<tr>
<td>Conical Nose Angle, degrees</td>
<td>40.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Cutout Angle, degrees</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Cutout Length, inches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutout Height, inches</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE III. (CONTINUED)

**MODEL COMPONENT:** Fin - $F_2$

**GENERAL DESCRIPTION:** Fins for MSFC Pump Fed Booster, Dihedral = 30°

**DRAWING NUMBER:**

<table>
<thead>
<tr>
<th>DIMENSIONS:</th>
<th>FULL-SCALE</th>
<th>MODEL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>508.7</td>
<td>0.0059</td>
</tr>
<tr>
<td>Span (equivalent)</td>
<td>310.3</td>
<td>1.055</td>
</tr>
<tr>
<td>Inb'd equivalent chord</td>
<td>354.1</td>
<td>1.204</td>
</tr>
<tr>
<td>Outb'd equivalent chord</td>
<td>117.9</td>
<td>0.401</td>
</tr>
<tr>
<td>Ratio movable surface chord/total surface chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Inb'd equiv. chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Outb'd equiv. chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweep Back Angles, degrees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leading Edge</td>
<td>45°</td>
<td>45°</td>
</tr>
<tr>
<td>Tailing Edge</td>
<td>13.45°</td>
<td>13.45°</td>
</tr>
<tr>
<td>Hingeline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area Moment (Normal to hinge line)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE III. (CONTINUED)

**MODEL COMPONENT:** Fin - F3

**GENERAL DESCRIPTION:** Fins for MSFC Pump Fed Rosater, Dihedral = 30°

**DRAWING NUMBER:**

<table>
<thead>
<tr>
<th>DIMENSIONS:</th>
<th>FULL-SCALE</th>
<th>MODEL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>339.1</td>
<td>0.00392</td>
</tr>
<tr>
<td>Span (equivalent)</td>
<td>206.8</td>
<td>0.703</td>
</tr>
<tr>
<td>Inb'd equivalent chord</td>
<td>354.1</td>
<td>1.204</td>
</tr>
<tr>
<td>Outb'd equivalent chord</td>
<td>117.9</td>
<td>0.401</td>
</tr>
<tr>
<td>Ratio movable surface chord/total surface chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Inb'd equiv. chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Outb'd equiv. chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweep Back Angles, degrees</td>
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INDEX OF MODEL FIGURES

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TABLE V. INDEX OF DATA FIGURES
Notes:
1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrows.
2. For clarity, origins of wind and stability axes have been displaced from the center of gravity.
FIGURE 2. MSFC PUMP FED BOOSTER

SCALE = 0.0094 FULL SCALE

CONG. L/B 1/2
NOTES:

1/\ EXCEPT AS SHOWN
2/\ WITHIN .001 T.I.R.

0.250 Dia Nom. Then, provide light P.F. w/existing Pan. Locate 2 Assy w/ Balance Block

FIGURE 3. NOSE N1

Nose N1

All or Cross Type Opt

± 1/16 ± .005 ± .05

Figure 3. NOSE N1
FIGURE 6

FIN

NOTES:
1. 32/
2. BREAK SHARP EDGES.

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Tabulations of the plotted data and corresponding source data are available from SADSAC Operations.
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63001) MSFC TWT 529 33 FOOT BOOSTER N186 0.000
(C63004) MSFC TWT 529 33 FOOT BOOSTER N187 0.000
(C63008) MSFC TWT 529 33 FOOT BOOSTER N187F2 0.000
(C63012) MSFC TWT 529 33 FOOT BOOSTER N187F3 0.000

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LREF 5.4330 IN.
BREF 0.0000 IN.
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YHRRP 0.0000 IN.
ZHRP 0.0000 IN.
SCALE 0.0004

MACH 0.596
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

PITCHING MOMENT COEFFICIENT, CLM

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MACH  0.897

PAGE 2
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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MACH 1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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MACH 1.456
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

ANGLE OF ATTACK, ALPHA, DEGREES

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SCALE 0.0034

MACH 2.740

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

PITCHING MOMENT COEFFICIENT, CLM

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
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SCALE 0.0034

MACH 4.959

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

NORMAL FORCE COEFFICIENT, CN

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MACH 0.506

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

NORMAL FORCE COEFFICIENT, CN

ANGLE OF ATTACK, ALPHA, DEGREES

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MACH  1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

NORMAL FORCE COEFFICIENT, Cn.

ANGLE OF ATTACK, ALPHA, DEGREES

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MACH  1.456

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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MACH  2.740
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

NORMAL FORCE COEFFICIENT, CN

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MACH 4.959

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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MACH  1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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ZHRP 0.0000 IN.
SCALE 0.0034

MACH 1.456
EFFECT OF CONFIGURATION ON LONGITUINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
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SCALE 0.0034

MACH 2.740

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

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MACH  4.959

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

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MACH 1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

LIFT COEFFICIENT, CL

ANGLE OF ATTACK, ALPHA, DEGREES

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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                     BETA  0.0000  IN.
                     ZHRP  0.0000  IN.
                     SCALE  0.0034

MACH  2.740

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

ANGLE OF ATTACK, ALPHA, DEGREES

EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
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(C63012) MSFC TWT 529 33 FOOT BOOSTER N1B7F3 0.000

REFERENCE INFORMATION
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LREF 5.4330 IN.
BREF 5.4330 IN.
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YMRP 0.0000 IN.
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MACH 4.999

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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Reference Information
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BREF  5.4330  in.
XHREF  3.2660  in.
YHREF  0.0000  in.
ZHREF  0.0000  in.
Scale  0.0034

Mach  0.596

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA
(C63001)  MSFC TWT 529 33 FOOT BOOSTER N1B6  0.000
(C63004)  MSFC TWT 529 33 FOOT BOOSTER N1B7  0.000
(C63008)  MSFC TWT 529 33 FOOT BOOSTER N1B7F2  0.000
(C63012)  MSFC TWT 529 33 FOOT BOOSTER N1B7F3  0.000

REFERENCE INFORMATION
SREF  1.4230 SQ. IN.
LREF  5.4330 IN.
BREF  5.4330 IN.
XHPR  3.2660 IN.
YHPR  0.0000 IN.
ZHPR  0.0000 IN.
SCALE  0.0034

MACH  0.897

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA REFERENCE INFORMATION
(C63001) ○ MSFC TWT 529 33 FOOT BOOSTER N186 0.000 SREF 1.4230 sq. in.
(C63004) × MSFC TWT 529 33 FOOT BOOSTER N187 0.000 LREF 5.4330 in.
(C63008) ○ MSFC TWT 529 33 FOOT BOOSTER N187F2 0.000 BREF 5.4330 in.
(C63012) ○ MSFC TWT 529 33 FOOT BOOSTER N187F3 0.000 XMRP 3.2660 in.

MACH 1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | BETA | REFERENCE INFORMATION
---|---|---|---
(C63001) | MSFC TWT 529 33 FOOT BOOSTER N1B6 | 0.000 | SREF 1.4230 SQ. IN.
(C63002) | MSFC TWT 529 33 FOOT BOOSTER N1B7 | 0.000 | LREF 5.4330 IN.
(C63003) | MSFC TWT 529 33 FOOT BOOSTER N1B7F2 | 0.000 | BREF 5.4330 IN.
(C63004) | MSFC TWT 529 33 FOOT BOOSTER N1B7F3 | 0.000 | HXR 3.2660 IN.
(MACH) | 1.456 | | YNR 0.0000 IN.
(ZNRP) | 0.0034 | | SCALE 0.0034
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63001) ○ MSFC TWT 529 33 FOOT BOOSTER N1B6 0.000
(C63004) Δ MSFC TWT 529 33 FOOT BOOSTER N1B7 0.000
(C63008) ◯ MSFC TWT 529 33 FOOT BOOSTER N1BF2 0.000
(C63012) ▲ MSFC TWT 529 33 FOOT BOOSTER N1BF3 0.000

REFERENCE INFORMATION
SREF 1.4230 SQ.IN.
LREF 5.4330 IN.
BREF 5.4330 IN.
XHRP 3.2660 IN.
YHHP 0.0000 IN.
ZHRP 0.0000 IN.
SCALE 0.0034

MACH 2.740

DRAG COEFFICIENT, CD

ANGLE OF ATTACK, ALPHA, DEGREES
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL | CONFIGURATION DESCRIPTION  | BETA | REFERENCE INFORMATION
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(C630G1) | MSFC TWT 529 33 FOOT BOOSTER N1B6 | 0.000 | SREF 1.4230 SG. IN.
(C630G4) | MSFC TWT 529 33 FOOT BOOSTER N1B7 | 0.000 | LREF 5.4330 IN.
(C630GB) | MSFC TWT 529 33 FOOT BOOSTER N1BFF2 | 0.000 | 2REF 5.4330 IN.
(C630G1E) | MSFC TWT 529 33 FOOT BOOSTER N1BFF3 | 0.000 | 2RP 0.0000 IN.
| | | | SCALE 0.0034 IN.

MACH 4.959
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

LIFT-DRAG RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

DATA SET SYMBOL
(C63001) ○ MSFC TWT 529 33 FOOT BOOSTER N1B6 0.000
(C63004) △ MSFC TWT 529 33 FOOT BOOSTER N1B7 0.000
(C63008) □ MSFC TWT 529 33 FOOT BOOSTER N1BF2 0.000
(C63012) ○ MSFC TWT 529 33 FOOT BOOSTER N1BF3 0.000

REFERENCE INFORMATION
SREF 1.4230 SQ.IN.
LREF 5.4330 IN.
BREF 5.4330 IN.
XMRP 3.2660 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH 0.596

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

LIFT-DRAG RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA  REFERENCE INFORMATION
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(C63004)  MSFC TWT 529 33 FOOT BOOSTER  N1B7  0.000  LREF  5.4330 IN.
(C63008)  MSFC TWT 529 33 FOOT BOOSTER  N1B7F2  0.000  BREF  5.4330 IN.
(C63012)  MSFC TWT 529 33 FOOT BOOSTER  N1B7F3  0.000  XMRP  3.2460 IN.
                      REFERENCE INFORMATION  YMRP  0.0000 IN.
        MACH  0.897  ZNRP  0.0000 IN.
        SCALE  0.0034
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, \( \alpha \), DEGREES

LIFT-DRAG RATIO, \( L/D \)

DATA SET SYMBOL CONFIGURATION DESCRIPTION  BETA  REFERENCE INFORMATION
(C63001)  
(C63004)  
(C63008)  
(C63012)  

MACH 1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA  REFERENCE INFORMATION
(C630D1)  MSFC TWT 529 33 FOOT BOOSTER  N186  0.000  SREF 1.4230 SQ. IN.
(C630D4)  MSFC TWT 529 33 FOOT BOOSTER  N187  0.000  LREF 5.4330 IN.
(C630D8)  MSFC TWT 529 33 FOOT BOOSTER  N187F2  0.000  BREF 5.4330 IN.
(C630D12) MSFC TWT 529 33 FOOT BOOSTER  N187F3  0.000  XMRP 3.2660 IN.
                           ZMRP 0.0000 IN.
                           SCALE 0.0034 IN.

MACH 1.456
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

LIFT-DRAG RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA

(C63001)  MSFC TWT 529 33 FOOT BOOSTER  N186  0.000
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(C63012)  MSFC TWT 529 33 FOOT BOOSTER  N187F3  0.000

REFERENCE INFORMATION
SREF  1.4230 SQ. IN.
LREF  5.4350 IN.
BREF  5.4350 IN.
XHRP  3.2660 IN.
YHRP  0.0000 IN.
ZHRP  0.0000 IN.
SCALE  0.0034

MACH  2.740

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT-DRAG RATIO, L/D

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA  REFERENCE INFORMATION
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(C63008)  MSFC TWT 529 33 FOOT BOOSTER N187F2  0.000  BREF  5.4530 IN.
(C63012)  MSFC TWT 529 33 FOOT BOOSTER N187F3  0.000  ZNRP  3.2660 IN.
(MACH 4.959)

SCALE 0.0034

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

NORMAL FORCE COEFFICIENT, CN

PITCHING MOMENT COEFFICIENT, CLM

EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA  REFERENCE INFORMATION
(C63001)  MSFC TWT 329 33 FOOT BOOSTER N186  0.000  SREF 1.4020 SQ.IN.
(C63004)  MSFC TWT 329 33 FOOT BOOSTER N187  0.000  LREF 5.4330 IN.
(C63004)  MSFC TWT 329 33 FOOT BOOSTER N187F2  0.000  BREF 5.4330 IN.
(C63012)  MSFC TWT 329 33 FOOT BOOSTER N187F3  0.000  XMRP 3.2660 IN.

MACH 0.596

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### Data Set Symbol

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- SREF: 1.4250 SQ. IN.
- LREF: 5.4330 IN.
- BREF: 5.4330 IN.
- ZMRP: 0.0000 IN.
- ZMRP: 0.0000 IN.
- SCALE: 0.0034 IN.

### Mach

MACH 0.697
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

NORMAL FORCE COEFFICIENT, CN

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63001) NSFC TWT 529 33 FOOT BOOSTER N1B6 0.000
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REFERENCE INFORMATION
SREF 1.4230 sq.in.
LREF 5.4330 in.
BREF 5.4330 in.
XHRP 3.2660 in.
YHRP 0.0000 in.
ZHRP 0.0000 in.
SCALE 0.0034

MACH 1.199

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

NORMAL FORCE COEFFICIENT, CN

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63001) MSFC TWT 529 35 FOOT BOOSTER N1B6 0.000
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(C6300f) MSFC TWT 529 35 FOOT BOOSTER N1B7F2 0.000
(C63012) MSFC TWT 529 35 FOOT BOOSTER N1B7F3 0.000

REFERENCE INFORMATION
SREF 1.4230 IN.
LREF 5.4330 IN.
BREF 5.4330 IN.
XMRP 3.2660 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH 1.456
EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

NORMAL FORCE COEFFICIENT, CN

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63001) MSFC TWT 529 33 FOOT BOOSTER N1B6 0.000
(C63004) MSFC TWT 529 33 FOOT BOOSTER N1B7 0.000
(C63008) MSFC TWT 529 33 FOOT BOOSTER N1B7F2 0.000
(C63012) MSFC TWT 529 33 FOOT BOOSTER N1B7F3 0.000

REFERENCE INFORMATION
BREF 1.4250 SQ. IN.
LREF 5.4330 IN.
XHREF 3.2660 IN.
YHREF 0.0000 IN.
ZHREF 0.0000 IN.
SCALE 0.0034

MACH 2.740

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

NORMAL FORCE COEFFICIENT, CN

DATA SET SYMBOL  CONFIGURATION DESCRIPTION       BETA
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(C63004)      MSFC TWT 529 53 FOOT BOOSTER N1B7       0.000
(C63008)      MSFC TWT 529 53 FOOT BOOSTER N1B7F2      0.000
(C63012)      MSFC TWT 529 53 FOOT BOOSTER N1B7F3      0.000

MACH 4.959

REFERENCE INFORMATION
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BREF 5.4330 IN.
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YREFP 0.0000 IN.
ZREFP 0.0000 IN.
SCALE 0.0034

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

LIFT COEFFICIENT, CL

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63501) MSFC TWT 529 33 FOOT BOOSTER N186 0.000
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(C63512) MSFC TWT 529 33 FOOT BOOSTER N187F3 0.000

REFERENCE INFORMATION
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LREF 5.4330 IN.
BREF 5.4330 IN.
XMRP 3.2660 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
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MACH 0.596

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### EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

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| MACH | 0.897 |

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63001) MSFC TWT 529 33 FOOT BOOSTER N186 0.000
(C63004) MSFC TWT 529 33 FOOT BOOSTER N187 0.000
(C63008) MSFC TWT 529 33 FOOT BOOSTER N187F2 0.000
(C63012) MSFC TWT 529 33 FOOT BOOSTER N187F3 0.000

REFERENCE INFORMATION
SRIF 1.4230 SQ.IN.
LREF 5.4330 IN.
SRIF 5.4330 IN.
XMRP 3.2660 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034 IN.

MACH 1.456

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA  
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N1B6  N1B7  N1B7F2  N1B7F3

REFERENCE INFORMATION:
SREF  1.4230  SQ.IN.  
LREF  5.4330  IN.  
XREF  3.2660  IN.  
YREF  0.0000  IN.  
SCALE  0.0034  

MACH  2.740  

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**EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS**

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  BETA  REFERENCE INFORMATION
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                     YMRP 0.0000 in.
                     ZMRP 0.0000 in.
                     SCALE 0.0034

MACH 0.596

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(C63021) MSFC TWT 529 33 FOOT BOOSTER N1B6 0.000
(C63024) MSFC TWT 529 33 FOOT BOOSTER N1B7 0.000
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(C63032) MSFC TWT 529 33 FOOT BOOSTER N1B7F3 0.000

REFERENCE INFORMATION
SREF 1.4230 SQ. IN.
LREF 5.4330 IN.
BREF 5.4330 IN.
XRFP 3.2660 IN.
YRFP 0.0000 IN.
ZRF 0.0000 IN.
SCALE 0.0034

MACH 0.897

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EFFECT OF CONFIGURATION ON LONGITUDINAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION BETA
(Ce3001) MSFC TWT 529 33 FOOT BOOSTER N1B6 0.000
(Ce3004) MSFC TWT 529 33 FOOT BOOSTER N1B7 0.000
(Ce3008) MSFC TWT 529 33 FOOT BOOSTER N1B7F2 0.000
(Ce3012) MSFC TWT 529 33 FOOT BOOSTER N1B7F3 0.000

REFERENCE INFORMATION
SREF 1.4230 SQ.IN.
LREF 5.4330 IN.
BREF 5.4330 IN.
XRNP 3.2660 IN.
YRNP 0.0000 IN.
ZRNP 0.0000 IN.
SCALE 0.0034

MACH 1.199

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA
(A65006) DATA NOT AVAILABLE FOR ALL CONDITIONS 60.000
(A65007) DATA NOT AVAILABLE FOR ALL CONDITIONS 80.000
(A65010) MSFC TWT 529 33 FOOT BOOSTER N187F2 60.000
(A65011) MSFC TWT 529 33 FOOT BOOSTER N187F2 80.000
(A65014) MSFC TWT 529 33 FOOT BOOSTER N187F3 60.000
(A65015) MSFC TWT 529 33 FOOT BOOSTER N187F3 80.000

REFERENCE INFORMATION
SREF 1.4230 SQ. IN.
LREF 5.4350 IN.
BREF 5.4350 IN.
XHRE 3.2660 IN.
YHRE 0.0000 IN.
ZHRE 0.0000 IN.
SCALE 0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | ALPHA
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\(\text{A63007}^\dagger\) | DATA NOT AVAILABLE FOR ALL CONDITIONS | 80.000
\(\text{A63010}\) | MSFC TWT 529 33 FOOT BOOSTER N1B7F2 | 60.000
\(\text{A63011}\) | MSFC TWT 529 33 FOOT BOOSTER N1B7F2 | 80.000
\(\text{A63014}\) | MSFC TWT 529 33 FOOT BOOSTER N1B7F3 | 60.000
\(\text{A63015}\) | MSFC TWT 529 33 FOOT BOOSTER N1B7F3 | 80.000

MACH 0.904

REFERENCE INFORMATION
SREF 1.4230 SQ. IN.
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BREF 5.4330 IN.
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ZMRP 0.0000 IN.
SCALE 0.0034
EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

LATERAL FORCE COEFFICIENT, CY

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  REFERENCE INFORMATION
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(A63015)  MSFC TWT 529 33 FOOT BOOSTER N1B7F3  60.000  ZNRP  0.0000 IN.

SCALE  0.0034

MACH  1.204

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  REFERENCE INFORMATION
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(A63010)  MSFC TWT 529 33 FOOT BOOSTER N1BF  60,000  XMRP  3.2660  IN.
(A63011)  MSFC TWT 529 33 FOOT BOOSTER N1BF  60,000  YMRP  0.0000  IN.
(A63014)  MSFC TWT 529 33 FOOT BOOSTER N1BF  60,000  SCALE  0.0034
(A63015)  MSFC TWT 529 33 FOOT BOOSTER N1BF  60,000

MACH  1.466
EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

LATERAL FORCE COEFFICIENT, CY

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA REFERENCE INFORMATION
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(A63011) MSFC TWT 529 33 FOOT BOOSTER N1B7F2 60,000 XHRP 3.2660 IN.
(A63014) MSFC TWT 529 33 FOOT BOOSTER N1B7F3 60,000 YHRP 0.0000 IN.
(A63015) MSFC TWT 529 33 FOOT BOOSTER N1B7F3 60,000 ZHRP 0.0000 IN.
MACH 2.740 SCALE 0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  REFERENCE INFORMATION
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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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MACH 0.596  SCALE 0.0034

SIDE SLIP ANGLE, BETA, DEGREES
ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)
EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

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(A63015)  MSFC TWT 529 35 FOOT BOOSTER N1B7F3  60.000  ZMRP  0.0000 IN.
MACH 0.904  SCALE 0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, \( \beta \), DEGREES

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(AE63015) | HSFC TWT 129 33 FOOT BOOSTER N187F3 | 80.000 | ZHREF 0.0000 IN.
MACH 1.204 | | | SCALE 0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA
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YMRP  0.0000  IN.
ZMRP  0.0000  IN.
SCALE  0.0034

MACH  1.466

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### EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA
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LREF 5.4330 IN.
BREF 5.4330 IN.
XNRP 3.2660 IN.
YNRP 0.0000 IN.
ZHRP 0.0000 IN.
SCALE 0.0034 IN.

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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MACH 0.596

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YHRP 0.0000 IN.
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SCALE 0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA

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MACI 0.904

REFERENCE INFORMATION

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LREF 5.4330 IN.

XREF 5.4330 IN.

XMRP 0.0000 IN.

ZMRP 0.0000 IN.

SCALE 0.0034
EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

SIDE SLIP ANGLE, \( \beta \), DEGREES

YAWING MOMENT COEFFICIENT, \( C_y \) (BODY AXIS)

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHAN

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MACH 1.204

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\( Y_{MRP} \) 0.0000 in.
\( Z_{MRP} \) 0.0000 in.
\( SCALE \) 0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

SIDE SLIP ANGLE, BET A, DEGREES

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA
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BREF  5.4330 IN.
XMRP  3.2660 IN.
YMRP  0.0000 IN.
ZMRP  0.0000 IN.
SCALE  0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

DATA SET SYMBOL CONFIGURATION DESCRIPTION
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MACH 2.740

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BREF 5.4330 IN.
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ZHPR 0.0000 IN.
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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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SCALE  0.0034  

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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REFERENCE INFORMATION
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BREF 5.4330 IN.
XMRP 3.2660 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0036

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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(A63015)  HSFC TWT 529 33 FOOT BOOSTER N1BYF3  80.000  SCALE  0.0034

MACH  1.204
EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

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(A32015)   NSFC TWT 929 33 FOOT BOOSTER N187F3  60.000  ZMYP  0.0000 IN.
NACH  1.486  SCALE  0.0034

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EFFECT OF CONFIGURATION ON DIRECTIONAL CHARACTERISTICS

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MACH 2.740

REFERENCE INFORMATION
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