AERODYNAMIC STABILITY AND DRAG CHARACTERISTICS OF THE MSFC PRESSURE FED BOOSTER CONFIGURATIONS AT MACH NUMBERS FROM 0.9 TO 5.0

by

John Baker, LMSC/HREC

MSFC 14-INCH TRISONIC WIND TUNNEL

Marshall Space Flight Center

NASA

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WIND TUNNEL TEST DATA REPORT

CONFIGURATION: 0.003366 AND 0.00419 SCALE MSFC PRESSURE FED BOOSTER CONFIGURATIONS

TEST PURPOSE: DETERMINE AERODYNAMIC CHARACTERISTICS OF THE PRESSURE FED BOOSTER CONFIGURATIONS.

TEST FACILITY: NASA/MSFC 14-INCH TRISONIC WIND TUNNEL

TESTING AGENCY: LOCKHEED MISSILES AND SPACE COMPANY - HUNTSVILLE

TEST NO. & DATE: MSFC 521; January 1972

FACILITY COORDINATOR: Jim Weaver - NASA/MSFC

PROJECT ENGINEER(S): John Baker - LMSC/HREC

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RELEASE APPROVAL: D. Kemp, Supervisor
Aero Thermo Data Group

CONTRACT NAS 8-4016 AMENDMENT 158 DRL 297-84

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AERODYNAMIC STABILITY AND DRAG CHARACTERISTICS OF THE MSFC PRESSURE FED BOOSTER CONFIGURATIONS AT MACH NUMBERS FROM 0.9 TO 5.0

By John Baker

ABSTRACT

Experimental aerodynamic investigations were conducted in the NASA/MSFC 14 x 14 Inch Trisonic Wind Tunnel during January 1972 on 0.003366 and 0.00419 scale models of the MSFC space shuttle pressure fed booster configurations. The configurations tested were a 40° cone/cylinder/13° flare with and without fins, a 40° cone/cylinder/13° flare/9° flare with and without fins, a 35° cone/cylinder with and without fins, a 35° cone/cylinder/7° flare and a 35° cone/cylinder with straight extension. Six component aerodynamic force and moment data were recorded over a Mach number range of 0.9 to 5.0. Model angle of attack range was -10° to +10° and +20° to 80° at 0° sideslip. Model sideslip range was -10° to +10° at nominal angles of attack of 0°, 30° and 51°.
# NOMENCLATURE

## General

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SADSSAC SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>CP</td>
<td>speed of sound; m/sec, ft/sec</td>
</tr>
<tr>
<td>Cp</td>
<td>MACH</td>
<td>pressure coefficient; ((p_1 - p_\infty)/q)</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>Mach number; (V/a)</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>pressure; (N/m^2, \text{psf})</td>
</tr>
<tr>
<td>q</td>
<td>Q(NSM)</td>
<td>dynamic pressure; (\frac{1}{2} \rho V^2), (N/m^2, \text{psf})</td>
</tr>
<tr>
<td></td>
<td>Q(PSF)</td>
<td></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></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></td>
<td>mass density; (kg/m^3, \text{slugs/ft}^3)</td>
</tr>
</tbody>
</table>

## Reference & C.G. Definitions

- \(A_b\): base area; \(m^2, \text{ft}^2\)
- \(b\): wing span or reference span; \(m, \text{ft}\)
- \(c.g.\): center of gravity
- \(l_{\text{REF}}\): reference length or wing mean aerodynamic chord; \(m, \text{ft}\)
- \(S\): wing area or reference area; \(m^2, \text{ft}^2\)
- \(M_{\text{RP}}\): moment reference point
- \(X_{\text{MRP}}\): moment reference point on X axis
- \(Y_{\text{MRP}}\): moment reference point on Y axis
- \(Z_{\text{MRP}}\): moment reference point on Z axis

## Subscripts

- \(b\): base
- \(l\): local
- \(s\): static conditions
- \(t\): total conditions
- \(\infty\): free stream
<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>$C_{A_f}$</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; $\frac{\text{pitching moment}}{q_S}$</td>
</tr>
<tr>
<td>$C_n$</td>
<td>CYN</td>
<td>yawing-moment coefficient; $\frac{\text{yawing moment}}{q_{Sb}}$</td>
</tr>
<tr>
<td>$C_l$</td>
<td>CBL</td>
<td>rolling-moment coefficient; $\frac{\text{rolling moment}}{q_{Sb}}$</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; $\frac{\text{pitching moment}}{q_S}$</td>
</tr>
<tr>
<td>$C_n$</td>
<td>CYN</td>
<td>yawing-moment coefficient; $\frac{\text{yawing moment}}{q_{Sb}}$</td>
</tr>
<tr>
<td>$C_l$</td>
<td>CBL</td>
<td>rolling-moment coefficient; $\frac{\text{rolling moment}}{q_{Sb}}$</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
MSFC TWT TEST NO. 521

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SADSAC SYMBOL</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Gamma )</td>
<td>DIHDL</td>
<td>Fin dihedral angle, measured from horizontal.</td>
</tr>
</tbody>
</table>

### CONFIGURATIONS INVESTIGATED

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N_1B_1 )</td>
<td>MSFC pressure fed booster body with 40° conical nose, 27 ft. diameter full scale cylindrical body and 13° aft flare. Full scale length is 178.8 ft. Five rocket engines located on the base.</td>
</tr>
<tr>
<td>( F_2 )</td>
<td>Two 250 sq. ft. full scale fins located on the flare of ( N_1B_1 ).</td>
</tr>
<tr>
<td>( F_6 )</td>
<td>Two 600 sq. ft. full scale fins located on the flare of ( N_1B_1 ).</td>
</tr>
<tr>
<td>( N_1B_3 )</td>
<td>MSFC pressure fed booster body with 40° conical nose, 27 ft. diameter full scale cylindrical body, and a 13° flare followed by a 9° flare. Full scale length is 202.3 ft.</td>
</tr>
<tr>
<td>( F_{12} )</td>
<td>Two 1200 sq. ft. fins located on the flare of ( N_1B_3 ).</td>
</tr>
<tr>
<td>( N_2B_2 )</td>
<td>MSFC pressure fed booster body with 35° conical nose and 41 ft. diameter full scale cylindrical body. Full scale length is 145 ft.</td>
</tr>
<tr>
<td>( F_7 )</td>
<td>Two 672 sq. ft. full scale fins located on the aft end of ( N_2B_2 ).</td>
</tr>
<tr>
<td>( N_2B_4 )</td>
<td>MSFC pressure fed booster body with 35° conical nose, 33 ft. diameter full scale cylindrical body and 7° aft flare. Full scale length is 152.3 ft. Five rocket engines located on the base.</td>
</tr>
<tr>
<td>( N_2B_5 )</td>
<td>MSFC pressure fed booster body with 35° conical nose and 33 ft. full scale cylindrical body. Full scale length is 152.3 ft. Five rocket engines located on the base.</td>
</tr>
</tbody>
</table>
TEST FACILITY DESCRIPTION

The Marshall Space Flight Center 14" x 14" 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 .2 to 5.85 is covered by utilizing two interchangeable test sections. The transonic section permits testing at Mach 0.20 through 2.50, and the supersonic section permits testing at Mach 2.74 through 5.85. Mach numbers between .2 and .9 are obtained by using a controllable diffuser. The range from .95 to 1.3 is achieved through the use of plenum suction and perforated walls. Mach numbers of 1.44, 1.93 and 2.50 are produced by interchangeable sets of fixed contour nozzle blocks. Above Mach 2.50 a set of fixed contour nozzle blocks are tilted and translated automatically to produce any desired Mach number in .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 correction to the balance recorded data. Base and cavity pressures were measured for model angle of attack schedules below 60° to determine base axial force and a sting cavity axial force correction. The model reference dimensions utilized in reducing the data are listed below for the basic booster configurations along with the model scale.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Reference Area in²</th>
<th>Reference Length ( L_{ref} ) and ( b_{ref} ) in.</th>
<th>Model Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1B1</td>
<td>0.933</td>
<td>7.223</td>
<td>0.003366</td>
</tr>
<tr>
<td>N1B3</td>
<td>0.933</td>
<td>8.172</td>
<td>0.003366</td>
</tr>
<tr>
<td>N2B2</td>
<td>2.159</td>
<td>5.859</td>
<td>0.003366</td>
</tr>
<tr>
<td>N2B4</td>
<td>2.159</td>
<td>7.659</td>
<td>0.00419</td>
</tr>
<tr>
<td>N2B5</td>
<td>2.159</td>
<td>7.659</td>
<td>0.00419</td>
</tr>
</tbody>
</table>

The moment reference center (MRC) is on a line coincident with the body longitudinal centerline. The distance of the MRC aft of the body nose is given below for each of the basic booster configurations.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>MRC Location – Percent Body Length Aft of Nose</th>
<th>MRC Location – Distance Aft of Nose – in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1B1</td>
<td>64</td>
<td>4.623</td>
</tr>
<tr>
<td>N1B3</td>
<td>64</td>
<td>5.230</td>
</tr>
<tr>
<td>N2B2</td>
<td>60</td>
<td>3.515</td>
</tr>
<tr>
<td>N2B4</td>
<td>60</td>
<td>4.595</td>
</tr>
<tr>
<td>N2B5</td>
<td>60</td>
<td>4.595</td>
</tr>
</tbody>
</table>
Two base pressures and one cavity pressure were recorded and used to determine base axial force $C_{AB}$ and a cavity correction to total axial force $C_{AT}$.

$$C_{AB} = -\frac{C_{P_1} A_{B_1}}{S_{ref}} - \frac{C_{P_2} A_{B_2}}{S_{ref}} - \left(\frac{C_{P_1} + C_{P_2}}{2}\right) \frac{A_C}{S_{ref}}$$

$$C_{AT} = C_{A_{bal}} + \left[C_{PC} - \left(\frac{C_{P_1} + C_{P_2}}{2}\right)\right] \frac{A_C}{S_{ref}}$$

Base and cavity areas for the basic booster configurations are listed below.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>$A_{B_1}$ (in²)</th>
<th>$A_{B_2}$ (in²)</th>
<th>$A_C$ (in²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N1B1</td>
<td>0.5466</td>
<td>0.6525</td>
<td>0.3673</td>
</tr>
<tr>
<td>N1B3</td>
<td>0.9162</td>
<td>1.0702</td>
<td>0.3673</td>
</tr>
<tr>
<td>N2B2</td>
<td>0.7250</td>
<td>0.7250</td>
<td>0.4069</td>
</tr>
<tr>
<td>N2B4</td>
<td>1.1657</td>
<td>1.3817</td>
<td>0.5396</td>
</tr>
<tr>
<td>N2B5</td>
<td>0.5923</td>
<td>0.7250</td>
<td>0.5396</td>
</tr>
</tbody>
</table>

*Base pressures were not measured for N2B2 because the angle of attack schedule for all runs was above 60°.

The base areas listed were used for all configurations fins on and fins off. Base pressure 1 was located on the upper half of the body base and base pressure 2 was located on the lower half of the body base.
<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>0.9</td>
<td>$6.9 \times 10^6$/ft.</td>
<td>8.05</td>
<td>94</td>
</tr>
<tr>
<td>1.2</td>
<td>$6.7 \times 10^6$/ft.</td>
<td>9.14</td>
<td>98</td>
</tr>
<tr>
<td>1.46</td>
<td>$7.5 \times 10^6$/ft.</td>
<td>10.77</td>
<td>96</td>
</tr>
<tr>
<td>1.96</td>
<td>$7.1 \times 10^6$/ft.</td>
<td>10.20</td>
<td>98</td>
</tr>
<tr>
<td>2.74</td>
<td>$5.2 \times 10^6$/ft.</td>
<td>6.39</td>
<td>99</td>
</tr>
<tr>
<td>3.48</td>
<td>$7.1 \times 10^6$/ft.</td>
<td>6.87</td>
<td>100</td>
</tr>
<tr>
<td>4.96</td>
<td>$5.8 \times 10^6$/ft.</td>
<td>3.24</td>
<td>97</td>
</tr>
</tbody>
</table>

BALANCE UTILIZED: MSFC No. 232 Balance

CAPACITY:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>NF</td>
<td>300 lbs.</td>
</tr>
<tr>
<td>SF</td>
<td>143 lbs.</td>
</tr>
<tr>
<td>AF</td>
<td>50 lbs.</td>
</tr>
<tr>
<td>PM</td>
<td>400 in-lbs.</td>
</tr>
<tr>
<td>YM</td>
<td>192 in-lbs.</td>
</tr>
<tr>
<td>RM</td>
<td>100 in-lbs.</td>
</tr>
</tbody>
</table>

ACCURACY:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NF</td>
<td></td>
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<tr>
<td>SF</td>
<td></td>
</tr>
<tr>
<td>AF</td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td></td>
</tr>
<tr>
<td>YM</td>
<td></td>
</tr>
<tr>
<td>RM</td>
<td></td>
</tr>
</tbody>
</table>

COMMENTS:
<table>
<thead>
<tr>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>V4</th>
<th>V5</th>
<th>V6</th>
<th>V7</th>
<th>V8</th>
<th>V9</th>
<th>V10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Column headers are not clearly visible due to the image quality.
- The table appears to be part of a larger data set, possibly related to some form of analysis or experiment.
### TABLE III.
**DIMENSIONAL DATA**

**MODEL COMPONENT:** BODY - N1B1

**GENERAL DESCRIPTION:** MSFC Pressure-Fed Booster Body with 40 degree conical nose, cylindrical body, and 13 degree aft flare.

**DRAWING NUMBER:**

**DIMENSIONS:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Full-Scale</th>
<th>Model Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>178.8 ft.</td>
<td>7.223 in.</td>
</tr>
<tr>
<td>Max. Width</td>
<td>38.6 ft.</td>
<td>1.558 in.</td>
</tr>
<tr>
<td>Max. Depth</td>
<td>38.6 ft.</td>
<td>1.558 in.</td>
</tr>
<tr>
<td>Fineness Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-Sectional Planform</td>
<td>572 ft²</td>
<td>0.933 in²</td>
</tr>
<tr>
<td>Wetted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>1168 ft²</td>
<td>1.906 in²</td>
</tr>
<tr>
<td>Body Diameter</td>
<td>27 ft.</td>
<td>1.091 in.</td>
</tr>
<tr>
<td>Base Diameter</td>
<td>38.6 ft.</td>
<td>1.558 in.</td>
</tr>
<tr>
<td>Base Flare Angle, Degrees</td>
<td>13.05</td>
<td>13.05</td>
</tr>
<tr>
<td>Conical Nose Angle, Degrees</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>MODEL COMPONENT:</td>
<td>BODY - N1B3</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>GENERAL DESCRIPTION:</td>
<td>MSFC Pressure Fed Booster Body with 40° Conical Nose, Cylindrical Body, and 13°3' Flare Followed by a 9° 10' Flare.</td>
<td></td>
</tr>
<tr>
<td>DRAWING NUMBER:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIMENSIONS:</td>
<td>FULL-SCALE</td>
<td>MODEL SCALE</td>
</tr>
<tr>
<td>Length</td>
<td>202.3 ft.</td>
<td>8.172 in.</td>
</tr>
<tr>
<td>Max. Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fineness Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-Sectional Planform</td>
<td>572 ft.²</td>
<td>0.933 in.²</td>
</tr>
<tr>
<td>Wetted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Diameter</td>
<td>27 ft.</td>
<td>1.091 in.</td>
</tr>
<tr>
<td>Base Diameter</td>
<td>46.3 ft.</td>
<td>1.869 in.</td>
</tr>
<tr>
<td>Base Flare Angle, Degrees</td>
<td>13°3'/9°10'</td>
<td>13°3'/9°10'</td>
</tr>
<tr>
<td>Conical Nose Angle, Degrees</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
### TABLE III. (CONTINUED)

**MODEL COMPONENT:**  **BODY - N2B2**

**GENERAL DESCRIPTION:**  **MSFC Pressure-Fed Booster body**
with 35 degree conical nose and cylindrical body.

**DRAWING NUMBER:**

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>FULL-SCALE</th>
<th>MODEL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>145 ft.</td>
<td>5.859 in.</td>
</tr>
<tr>
<td>Max. Width</td>
<td>41 ft.</td>
<td>1.658 in.</td>
</tr>
<tr>
<td>Max. Depth</td>
<td>41 ft.</td>
<td>1.658 in.</td>
</tr>
<tr>
<td>Fineness Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Cross-Sectional</td>
<td>1320 ft²</td>
<td>2.159 in²</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>1320 ft²</td>
<td>2.159 in²</td>
</tr>
<tr>
<td>Body Diameter</td>
<td>41 ft.</td>
<td>1.658 in.</td>
</tr>
<tr>
<td>Conical Nose Angle, Degrees</td>
<td>35</td>
<td>35</td>
</tr>
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</table>
TABLE III. (CONTINUED)

MODEL COMPONENT: **BODY - N2B4**

GENERAL DESCRIPTION: **MSFC Pressure Fed Booster Body with 35° Conical Nose, Cylindrical Body and 7° Aft Flare**

**DRAWING NUMBER:**

**DIMENSIONS:**

<table>
<thead>
<tr>
<th></th>
<th>FULL-SCALE</th>
<th>MODEL SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td>152.3 ft.</td>
<td>7,659 in.</td>
</tr>
<tr>
<td><strong>Max. Width</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max. Depth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fineness Ratio</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cross-Sectional</strong></td>
<td>854 ft.$^2$</td>
<td>2,159 in.$^2$</td>
</tr>
<tr>
<td><strong>Planform</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wetted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Base</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Body Diameter</strong></td>
<td>33 ft.</td>
<td>1.658 in.</td>
</tr>
<tr>
<td><strong>Base Diameter</strong></td>
<td>41.8 ft.</td>
<td>2.102 in.</td>
</tr>
<tr>
<td><strong>Base Flare Angle, Degrees</strong></td>
<td>7°</td>
<td>7°</td>
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<tr>
<td><strong>Conical Nose Angle</strong></td>
<td>35</td>
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14
TABLE III. (CONTINUED)

MODEL COMPONENT: BODY - NZB5

GENERAL DESCRIPTION: MSFC Pressure Fed Booster Body with 35° Conical Nose and Cylindrical body

DRAWING NUMBER:

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<tr>
<th>DIMENSIONS</th>
<th>FULL-SCALE</th>
<th>MODEL SCALE</th>
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</thead>
<tbody>
<tr>
<td>Length</td>
<td>152.3 ft.</td>
<td>7.659 in.</td>
</tr>
<tr>
<td>Max. Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. Depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fineness Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-Sectional Area</td>
<td>854 ft.²</td>
<td>2,159 in.²</td>
</tr>
<tr>
<td>Planform</td>
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<td></td>
<td></td>
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<tr>
<td>Base</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Diameter</td>
<td>33 ft.</td>
<td>1.658 in.</td>
</tr>
<tr>
<td>Base Diameter</td>
<td>33 ft.</td>
<td>1.658 in.</td>
</tr>
<tr>
<td>Conical Nose Angle, Degrees</td>
<td>35</td>
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TABLE III. (CONTINUED)

MODEL COMPONENT: FINS - F2

GENERAL DESCRIPTION: Fins for MSFC Pressure Fed Booster

DRAWING NUMBER:

DIMENSIONS:  

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<tr>
<th></th>
<th>FULL-SCALE</th>
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<tbody>
<tr>
<td>Area</td>
<td>250 ft$^2$</td>
<td>0.408 in$^2$</td>
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<tr>
<td>Span (equivalent)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inb'd equivalent chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outb'd equivalent chord</td>
<td>8.34 ft.</td>
<td>0.337 in.</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>40.75</td>
<td>40.75</td>
</tr>
<tr>
<td>Tailing Edge</td>
<td>0.0</td>
<td>0.0</td>
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<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>

16
### TABLE III. (CONTINUED)

**MODEL COMPONENT:** FINS - F6

**GENERAL DESCRIPTION:** Fins for MSFC Pressure Fed Booster

**DRAWING NUMBER:**

**DIMENSIONS:**

<table>
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<th>Description</th>
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<tr>
<td>Area</td>
<td>600 ft.²</td>
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<tr>
<td>Inb'd equivalent chord</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outb'd equivalent chord</td>
<td>12.0 ft.</td>
<td>0.485 in.</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>40.75</td>
<td>40.75</td>
</tr>
<tr>
<td>Leading Edge</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Tailing Edge</td>
<td></td>
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<tr>
<td>Hingeline</td>
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<tr>
<td>Area Moment (Normal to hinge line)</td>
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## TABLE III. (CONTINUED)

**MODEL COMPONENT:** FINS - F7  

**GENERAL DESCRIPTION:** Fins for MSFC Pressure Fed Booster  
Body N2B2  

**DRAWING NUMBER:**  

**DIMENSIONS:**  

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<td>1.100 in$^2$</td>
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<td><strong>Span (equivalent)</strong></td>
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<td></td>
</tr>
<tr>
<td><strong>Inb'd equivalent chord</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outb'd equivalent chord</strong></td>
<td>12.0 ft.</td>
<td>0.485 in.</td>
</tr>
<tr>
<td><strong>Ratio movable surface chord/total surface chord</strong></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><strong>Sweep Back Angles, degrees</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leading Edge</td>
<td>40.75</td>
<td>40.75</td>
</tr>
<tr>
<td>Tailing Edge</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hingeline</td>
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<tr>
<td><strong>Area Moment (Normal to hinge line)</strong></td>
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18
<table>
<thead>
<tr>
<th>TABLE III. (CONCLUDED)</th>
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<td>MODEL COMPONENT:</td>
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<td>Ratio movable surface chord/total surface chord</td>
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<tr>
<td>At Inb'd equiv. chord</td>
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<tr>
<td>At Outb'd equiv. chord</td>
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<tr>
<td>Sweep Back Angles, degrees</td>
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<td>Leading Edge</td>
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<td>Hingeline</td>
</tr>
<tr>
<td>Area Moment (Normal to hinge line)</td>
</tr>
<tr>
<td>Figure</td>
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<tr>
<td>Mach</td>
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<tr>
<td>------</td>
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<tr>
<td>17-35</td>
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<td>9-17</td>
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<td>87-95</td>
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<td>79-66</td>
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<td>69-74</td>
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<td>37-42</td>
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<td>31-36</td>
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<tr>
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<tr>
<td>22-20</td>
</tr>
<tr>
<td>11-20</td>
</tr>
<tr>
<td>1-10</td>
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</tbody>
</table>

Title: Characteristic, Mach Number on Longitudinal Characteristics, Mach Number on Inter-Taper Direction.

Characteristics: Alpha = 0 Degrees.
Characteristics: Alpha = 25 Degrees.
Characteristics: Alpha = 30 Degrees.
Characteristics: Alpha = 35 Degrees.
Characteristics: Alpha = 40 Degrees.
Characteristics: Alpha = 45 Degrees.
Characteristics: Alpha = 50 Degrees.
Characteristics: Alpha = 55 Degrees.
Characteristics: Alpha = 60 Degrees.
Characteristics: Alpha = 65 Degrees.
Characteristics: Alpha = 70 Degrees.
Characteristics: Alpha = 75 Degrees.
Characteristics: Alpha = 80 Degrees.
Characteristics: Alpha = 85 Degrees.
Characteristics: Alpha = 90 Degrees.
Characteristics: Alpha = 95 Degrees.
Characteristics: Alpha = 100 Degrees.
<table>
<thead>
<tr>
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<th>Characteristics</th>
<th>Mach</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.18</td>
<td>NSB - Bee Axial Force, Mach Number = 1.96</td>
<td>0.6-2</td>
<td>NSB - Longitudinal Characteristics</td>
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<tr>
<td>2.17</td>
<td>NSB - Effect of Mach Number on Bee Axial Force</td>
<td>1.99-2.07</td>
<td>NSB - Effect of Mach Number on Longitudinal Characteristics</td>
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<tr>
<td>1.99-1.99</td>
<td>NSB - Effect of Mach Number on Longitudinal Characteristics</td>
<td>1.81-1.89</td>
<td>NSB - Effect of Mach Number on Longitudinal Characteristics</td>
</tr>
<tr>
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<td>Mach</td>
<td>Mach</td>
<td>Mach</td>
</tr>
<tr>
<td>1.97-1.80</td>
<td>Mach</td>
<td>Mach</td>
<td>Mach</td>
</tr>
<tr>
<td>1.95-1.95</td>
<td>Mach</td>
<td>Mach</td>
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<tr>
<td>1.83-1.82</td>
<td>Mach</td>
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</table>

**Table A**: Index of Data Plotted
TABLE V. INDEX OF DATA FIGURES  
(CONCLUDED)

PLOTTED COEFFICIENTS SCHEDULE:

(A) CN, CLM, CA, CL, CD, L/D, CAB vs. ALPHA
    CN, CL vs. CLM
    CL vs. CD
(B) All plots of Schedule (A) except CAB vs. ALPHA
(C) CAB vs. ALPHA
(D) CY, CYN, CBL vs. BETA
    CYN vs. CY
(E) All plots of Schedule (D) except CBL vs. BETA
MODEL FIGURES
Figure 1. Axes systems showing direction and sense of force and moment coefficients, angle of attack, and sideslip angle of gravity. Axes have been displaced from the center.

1. Positive directions of force coefficients and angles are indicated by arrows.
2. For clarity, origins of wind and stability axes have been moved.
FIG. 4 - MSFC Pressure Fed Booster N2B2P7 Moment Reference Center Location
FIG. 5 - MSFC Pressure Red Booster N2B4 Moment Reference Center Location
FIGURE 7. FINS F2
FIGURE 9. FINS F7
Fig. 10- Fins Fl2
Fig. 11: Rocket Engines for N1B1, N2B4 and N2B5
Tabulations of the plotted data and corresponding source data are available from SADSAC Operations.
N1B1F2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL  MACH  PARAMETRIC VALUES  REFERENCE INFORMATION
  □  1.000  BETA  0.000  OINCHRL  30.000
  □  2.740
  □  3.480
  □  4.059

DATA MIST. CODE  #E

MSFC TWT 521  BOOSTER  N1B1F2  (E55004)  02.FEB 72  PAGE 1
N1B1F2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL MACH PARAMETRIC VALUES

△ 1.903 △ BETA 0.000 D1HORL 30.000

△ 2.740

△ 3.480

△ 4.999

REFERENCE INFORMATION

SREF 0.9330 36. IN

LREF 7.2230 IN.

BREF 7.2230 IN.

XMRP 4.6230 IN.

YMRP 0.0000 IN.

ZMRP 0.0000 IN.

SCALE 0.0034 IN.

DATA HIST. CODE #E

MSFC TWT 521 BOOSTER N1B1F2 (E55004) 02 FEB 72 PAGE 5
### NIB1F2-Effect of Mach No. on Longitudinal Characteristics

**Diagram:**

- **Title:** NIB1F2-Effect of Mach No. on Longitudinal Characteristics
- **Axes:**
  - Y-axis: Lift-Drag Ratio, L/D
  - X-axis: Angle of Attack, Alpha, Degrees
- **Data Points:**
  - Symbol: MACH
  - Parametric Values:
    - Mach: 1.903, Beta: 0.00, DiHDL: 30.00
  - Reference Information:
    - SREF: 0.9330
    - LREF: 7.2230
    - BREF: 7.2230
    - XMRP: 4.6230
    - YMRP: 0.0000
    - ZMRP: 0.0000
    - SCALE: 0.0034

**Graph:**

- Scatter plot showing the relationship between Mach number and lift-drag ratio.

**Additional Information:**

- **Data Hist. Code:** #E
- **MSFC TWT:** 521
- **Booster:** NIB1F2
- **Date:** 02 Feb 72
- **Page:** 7
NIBIF2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PARAMETRIC VALUES

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<th>BETA</th>
<th>DIHORL</th>
<th>CLM</th>
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</thead>
<tbody>
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<td>0.000</td>
<td>30.000</td>
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<tr>
<td>4.899</td>
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REFERENCE INFORMATION

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<th>LREF</th>
<th>BREF</th>
<th>XMRP</th>
<th>YMRP</th>
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DATA HIST. CODE #E

MSFC TWT 521 BOOSTER NIBIF2 (E55004) 02 FEB 72 PAGE 9
NIB1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

SYMBOL MACH PARAMETRIC VALUES
O 0.899 BETA 0.000 DIIHDL 30.000
A 1.199
O 1.402

REFERENCE INFORMATION
SREF 0.9330 50. IN.
LREF 7.0230 IN.
BREF 7.0230 IN.
XHRRP 4.6230 IN.
YHRRP 0.0000 IN.
ZHRRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #4E
MSFC TWT 521 BOOSTER NIB1F6 (E55007) 02-FEB 72 PAGE 11
NIB1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

ANGLE OF ATTACK, ALPHA, DEGREES

AXIAL FORCE COEFFICIENT, CA

SYMBOL MACH PARAMETRIC VALUES
@ 0.899 BETA 0.000 DIHORL 30.000
O 1.199
O 1.492

REFERENCE INFORMATION

SREF 0.8330 SQ. IN.
LREF 7.6220 IN.
BREF 7.2230 IN.
ZMRP 4.0230 IN.
YMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E

MSFC TWT 521 BOOSTER NIB1F6 (ES5007) 02 FEB 72 PAGE 13
N1B1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW AlPHAS

PARAMETRIC VALUES

DIHORL 30.000

REFERENCE INFORMATION

SREF 0.0330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XMRP 4.6230 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E

MSFC TWT 521 BOOSTER N1B1F6 (E55007) 02 FEB 72 PAGE 15
NIB1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

DRAG COEFFICIENT, CD

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARANOMIC VALUES

REFERENCE INFORMATION

BREF 0.0330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XNR 4.6230 IN.
YNRP 0.0000 IN.
ZNR 0.0000 IN.
SCALE 0.0034

DATA NIST. CODE #E

MSFC TWT 521 BOOSTER NIB1F6 (E55007) 02 FEB 72 PAGE 16
N1B1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

SYMBOL  MACH  PARAMETRIC VALUES

O  0.899  BETA  0.000  DIHORL  30.000
▲  1.199
◇  1.442

REFERENCE INFORMATION
SREF  0.9530  sq. in
LREF  7.6230  in
BREF  7.6230  in
XMRP  4.6230  in
YMRP  0.0000  in
ZMRP  0.0000  in
SCALE  0.0034

DATA HIST. CODE  #E
MSFC TWT 521  BOOSTER  N1B1F6  (E55007)  02 FEB 72  PAGE 17
N1BIF6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

SYMBOL | MACH | PARAMETRIC VALUES
-------|------|-------------------
O      | 0.899| BETA 0.000 OTHRRL 30.000
D      | 1.199|                  
O      | 1.462|                  

REFERENCE INFORMATION
SREF 0.9230 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XHRL 4.6230 IN.
YHRL 0.0000 IN.
ZHRL 0.0000 IN.
SCALE 0.0034

DATA MISC. CODE
MSFC TWT 521 BOOSTER N1BIF6 (ES5007) 02 FEB 72 PAGE 18
PARAMETRIC VALUES

0.000 DIHDFL
0.6  0.4  0.2  0.0  -0.2  -0.4  -0.6 -0.8 -1.0 -1.2 -1.4 -1.6

PITCHING MOMENT COEFFICIENT, CLM

REFERENCE INFORMATION
SREF  0.9330  36. IN
LREF  7.2230  IN.
XREF  4.6230  IN.
YMRP  0.0000  IN.
ZMRP  0.0000  IN.
SCALE 0.0034

MACH  BETA  DIHDFL
0.899  0.000
1.199
1.462

SYMBOL

MSFC TWT 521  BOOSTER  NIB1F6  (E55007)  02 FEB 72  PAGE 19

NIB1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS
N1B1F6-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

BASE AXIAL FORCE COEFFICIENT, CAB

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B1F6 (E55007) 02 FEB 72 PAGE 20
N1B1F6-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

NORM FORCOEFICIENT, CN

REFERENCE INFORMATION
SREF 0.0330 SQ. IN
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NREF 7.2230 IN.
XNRP 4.0250 IN.
YNRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B1F6 (E55008) 02 FEB 72 PAGE 21
N1B1F6-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL  MACH  PARAMETRIC VALUES  REFERENCE INFORMATION

1.963  BETA  0.000  DIMORL  30.000

SREF  0.0030  Sq. In.

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XMEP  4.6230  In.

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ZMEP  0.0000  In.

SCALE  0.0034

DATA HIST. CODE  #E

MSFC TWT 521  BOOSTER  N1B1F6  (E55008)  02 FEB 72  PAGE 22
N1B1FG-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

AXIAL FORCE COEFFICIENT, CA.

SYMBOL MACH PARAMETRIC VALUES

▲ 1.063 0.000 0.000 30.000

REFERENCE INFORMATION

SREF 0.9330 SQ. IN
LREF 7.2230 IN
BREF 7.2230 IN
ZHRP 4.6230 IN
YHRP 0.0000 IN
ZHRP 0.0000 IN
SCALE 0.0034

DATA HIST. CODE #E

MSFC TWT 521 BOOSTER N1B1FG (E55008) 02 FEB 72 PAGE 23
N1B1F6-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

NORMAL FORCE COEFFICIENT, CN

SYMBOL | MACH | BETA | DIMOL | REFERENCE INFORMATION
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     D | 1.963 | 0.000 | 30.000 | SREF 0.9330 54.0 IN
     O | 2.740 |      |        | LREF 7.2230 IN.
     O | 3.460 |      |        | XMRP 4.0230 IN.
     O | 4.059 |      |        | YMRP 0.0000 IN.

DATA HIST. CODE 4E
MSFC TWT 521 BOOSTER N1B1F6 (E55008) 02 FEB 72 PAGE 24
N1B1F6-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES
• 1.963 BETA 0.000 DIHORL 30.000
△ 2.740
□ 3.460
□ 4.998

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XMRP 4.6230 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B1F6 (E55008) 02 FEB 72 PAGE 25
NIB1F6-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

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DATA HIST. CODE #E

MSFC TWT 521 BOOSTER NIB1F6 (E55008) 02 FEB 72 PAGE 27
N1B1F6-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL MACH PARAMETRIC VALUES REFERENCE INFORMATION
D > 1.963 BETA 0.000 D/700 30.000 SREF 0.0330 36. IN
D > 2.740 LREF 7.2230 IN.
D > 3.480 BREF 7.2230 IN.
D > 4.959 XMRP 4.6230 IN.
D > 6.099 ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B1F6 (E55008) 02 FEB 72 PAGE 29
NIB1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XNRP 4.6230 IN.
YNRP 0.0000 IN.
SCALE 0.0034

SYMBOL MACH PARAMETRIC VALUES
P 0.497 ALPHA 30.000
O 1.194
A 1.981

REFERENCE FILE
MSFC TWT 521 BOOSTER NIB1 (A55002) 27 JAN 72 PAGE 31
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES
N181-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

SYMBOL

MACH  PARAMETRIC VALUES

0.897  ALPHA  30.000
1.194
1.901

REFERENCE INFORMATION

SREF  0.9330  SQ. IN
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XHPR  4.6230  IN
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REFERENCE FILE

MSFC TWT 521 BOOSTER N181 (A55002) 27 JAN 72 PAGE 33
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

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| ZNRF | 0.0000 | IN.    |
| SCALE| 0.0034 |        |

REFERENCE FILE

MSFC TWT 521 BOOSTER N1B1 (A55002) 27 JAN 72 PAGE 34
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

**PARAMETRIC VALUES**

- SREF 0.9330
- LREF 7.2230 IN.
- BREF 4.6230 IN.
- ZHRP 0.0000 IN.
- SCALE 0.0034

**REFERENCE INFORMATION**

- SREF 0.9330
- LREF 7.2230 IN.
- BREF 4.6230 IN.
- ZHRP 0.0000 IN.
- SCALE 0.0034

**REFERENCE FILE**

- MSFC TWT 521 BOOSTER N1B1

(A55002) 27 JAN 72 PAGE 35
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

SYMBOL | MACH | ALPHA | LATERAL FORCE COEFFICIENT, CY

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MSFC TWT 521 BOOSTER N1B1 (A55002) 27 JAN 72 PAGE 36
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

SYMBOL | MACH | PARAMETRIC VALUES
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DO     | 2.740 | ALPHA 51.000
      | 3.440 |
      | 4.959 |

REFERENCE INFORMATION

BREF 7.2230 IN.
LREF 7.2230 IN.
THRP 4.6230 IN.
ZHRP 0.0000 IN.
SCALE 0.0034

REFERENCE FILE

MSFC TWT 521 BOOSTER N1B1

(A55003) 27 JAN 72 PAGE 38
NIB1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

SIDE SLIP ANGLE, BETAN, DEGREES

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

SYMBOL MACH PARAMETRIC VALUES
O 0.903 ALPHA 51.000
o 1.193

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XNRP 4.0230 IN.
YNRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

REFERENCE FILE
MSFC TWT 521 BOOSTER NIB1 (A55003) 27 JAN 72 PAGE 39
N1B1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

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- BE: 7.2230 IN
- WM: 4.9230 IN
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- Z: 0.0000 IN
- S: 0.0034 IN

REFERENCE FILE
- MSFC TWT 521 BOOSTER N1B1 (A55003) 27 JAN 72 PAGE 40
NIBI-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

LATERAL FORCE COEFFICIENT, CY

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

SYMBOL  MACH  PARAMETRIC VALUES
O  0.903  ALPHA  51.000
O  1.195
O  1.943

REFERENCE INFORMATION
SREF  0.9330  SQ. IN
LREF  7.2230  IN.
BREF  7.2230  IN.
XMRP  4.6230  IN.
YMRP  0.0000  IN.
ZMRP  0.0000  IN.
SCALE  0.0034

REFERENCE FILE
MSFC TWT 521  BOOSTER  NIB1  (A55003)  27 JAN 72  PAGE 41
NIB1-EFFECT OF MACH NO. ON LATERAL-DIRECTIONAL CHARACTERISTICS. ALPHA=51 DEGREES

YAWING MOMENT COEFFICIENT, CY (BODY AXIS)

LATERAL FORCE COEFFICIENT, CY

SYMBOL MACH ALPHA PARAMETRIC VALUES

d □ 2.740 5.400 81,000
□ 5.400
□ 4.859

REFERENCE INFORMATION
SREF 0.9350 39 IN
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CREF 7.2250 IN
XREF 4.6250 IN
YRHF 0.0000 IN
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SCALE 0.0054

REFERENCE FILE
MSFC TWT 521 BOOSTER NIB1 (A55003) 27 JAN 72 PAGE 42
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

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- LREF 7.2230
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- YMRP 0.0000
- ZMRP 0.0000
- SCALE 0.0034

MACH 1.96
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | ALPHA | DIMORL | REFERENCE INFORMATION
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(F3500Z) | MSFC TWT 521 BOOSTER N181 | 30.000 |  | SREF 0.0330 IN.
(A35005) | MSFC TWT 521 BOOSTER N181B | 30.000 |  | LREF 7.2250 IN.
(A35010) | MSFC TWT 521 BOOSTER N181F6 | 30.000 |  | BREF 7.2250 IN.

MACH 2.74

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHORL  REFERENCE INFORMATION
(F35002)  MSFC TWT 521 BOOSTER  N181  30.000  SREF  0.9330  sq. in
(A35003)  MSFC TWT 521 BOOSTER  N181F2  30.000  LREF  7.2230  in.
(A35010)  MSFC TWT 521 BOOSTER  N181F6  30.000  BREF  7.2230  in.

MACH  3.48  PAGE  45
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(F5002) ○ MSFC TWT 521 BOOSTER N1B1
(A5005) ● MSFC TWT 521 BOOSTER N1B1F2
(A5010) ● MSFC TWT 521 BOOSTER N1B1F6

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XMRP 4.6220 IN.
YMRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

MACH 1.96

PAGE 47
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA D Harry
(FSS002) MSFC TWT 521 BOOSTER NIBI 30.000 30.000
(A58005) MSFC TWT 521 BOOSTER NIBIF2 30.000 30.000
(A58010) MSFC TWT 521 BOOSTER NIBIF3 30.000 30.000

REFERENCE INFORMATION
SREF 0.0330 SQ. IN
LREF 7.2230 IN.
ZMB 4.6230  IN.
YMB 0.0000  IN.
SCALE 0.0034

MACH 2.74

PAGE 48
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

SIDE SLIP ANGLE, BETAS, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DINDLR REFERENCE INFORMATION
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(#35003) NSFC TWT 521 BOOSTER N1B1F2 30.000 30.000 LREF 7.2230 IN.
(#35010) NSFC TWT 521 BOOSTER N1B1F6 30.000 30.000 BREF 7.2230 IN.

XMRP 4.9230 IN.
YNRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH 3.48
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

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

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

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | \( \alpha \) | \( \delta_{\text{IN}} \) | REFERENCE INFORMATION
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(A35003) | MSFC TWT 521 BOOSTER N181F2 | 30.000 | 30.000 | LREF 7.2230 IN.
(A35010) | MSFC TWT 521 BOOSTER N181F6 | 30.000 | 30.000 | BREF 7.2230 IN.

MACH 4.96

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS. ALPHA = 30 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DINDRL  REFERENCE INFORMATION
(P9002)  MSFC TWT 521 BOOSTER  MIB1  30.000  REF  0.9330 SQ. IN
(A95005)  MSFC TWT 521 BOOSTER  MIB1F2  30.000  T.2230 IN.
(A95010)  MSFC TWT 521 BOOSTER  MIB1F6  30.000  BREF  7.2230 IN.

MACH  1.96  PAGE  51
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, \( \alpha = 30 \) DEGREES

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| YMNP  | 0.0000 | IN    |
| ZMNP  | 0.0000 | IN    |
| SCALE | 0.0034 |

MACH 3.48

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | N181 | N181F2 | N181F6 | ALPHA | DIMDRL |
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(P35003) | HSFC TWT 521 BOOSTER | 30,000 | 30,000 | 30,000 |
(P35010) | HSFC TWT 521 BOOSTER | 30,000 | 30,000 | 30,000 |

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN.
MREF 4.8230 IN.
ZMREF 0.0000 IN.
SCALE 0.0034

MACH 4.36

PAGE 54
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIMRL  REFERENCE INFORMATION
(F59002)  MSFC TWT 521 BOOSTER  MIB1  30.000  36.000  SREF  0.0330  sq. in.
(A89003)  MSFC TWT 521 BOOSTER  MIBIF2  30.000  30.000  LREF  7.2230  in.
(A93010)  MSFC TWT 521 BOOSTER  MIBIF6  30.000  30.000  BREF  4.9230  IN.

MACH  2.74  PAGE  56
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | ALPHA | DHDRDL
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(FOSSOR) | MSFC TWT 521 BOOSTER N1B1F6 | 30.000 | 30.000

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LREF: 7.2230 IN.
XREF: 4.6230 IN.
YREF: 0.0000 IN.
ZREF: 0.0000 IN.
SCALE: 0.0034

MACH 3.48

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA D/HOL
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(A59010) MSFC TWT 921 BOOSTER N181F6 30.000 30.000

REFERENCE INFORMATION
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LREF 7.2230 IN.
BREF 7.2230 IN.
XNRP 4.6230 IN.
YNRP 0.0000 IN.
ZMRF 0.0000 IN.
SCALE 0.0034

MACH 4.96

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL CONFIGURATION DESCRIPTION
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YHNP 0.0000 IN.
ZHRP 0.0000 IN.
SCALE 0.0034

MACH 1.94

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHORL
(F55003)  MSFC TWT 521 BOOSTER  N18F1  51.000  30.000
(A55089)  MSFC TWT 521 BOOSTER  N18F1E  51.000  30.000
(A55011)  MSFC TWT 521 BOOSTER  N18F6  51.000  30.000

REFERENCE INFORMATION
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LREF  7.2030  in.
DREF  7.0230  in.
XMRF  4.6230  in.
YMRF  0.0000  in.
ZMRF  0.0000  in.
SCALE  0.0034

MACH  2.74

PAGE  60
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

MACH 3.48
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DIHDL REFERENCE INFORMATION
(F59003) Q MSFC TWT 521 BOOSTER M181 51.000 SREF 0.9330 SQ. IN
(F59004) Q MSFC TWT 521 BOOSTER M181FE 51.000 30.000 LREF 7.2230 IN.
(FA9011) Q MSFC TWT 521 BOOSTER M181FB 51.000 30.000 BLREF 7.2230 IN.

MACH 1.94 PAGE 63
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DINDRL
(F5500S)  ○ MSFC TWT 521 BOOSTER N1B1 51.000 50.000
(A5508S)  △ MSFC TWT 521 BOOSTER N1B1F2 51.000 30.000
(A55011)  ○ MSFC TWT 521 BOOSTER N1B1F6 51.000 30.000

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN
BREF 7.2230 IN
XMRF 4.6230 IN
YMRF 0.0000 IN
ZNRF 0.0000 IN
SCALE 0.0034

MACH 3.48

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

YAWING MOMENT COEFFICIENT, CN (BODY AXIS)

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHADR
(F55G05)  MSFC TWT 521 BOOSTER M181  51.000  30.000
(A55G05)  MSFC TWT 521 BOOSTER M181F2  51.000  30.000
(A55G11)  MSFC TWT 521 BOOSTER M181F6  51.000  30.000

REFERENCE INFORMATION
SREF  0.9530 SQ. IN
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BREF  7.2230 IN.
XNF  4.6230 IN.
YNF  0.0003 IN.
ZNF  0.0000 IN.
SCALE  0.0034

MACH  4.96

PAGE  66
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPMA DIHAEL
(FS5003) MSFC TWT 521 BOOSTER NISBD 51.000 30.000
(A35006) MSFC TWT 521 BOOSTER NISBIF 51.000 30.000
(A38011) MSFC TWT 521 BOOSTER NISBIF 51.000 30.000

REFERENCE INFORMATION
SREF 0.9330 IN
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BREF 7.2230 IN
XHBP 4.6230 IN
YNBP 0.0000 IN
SCALE 0.0034

MACH 1.94

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

CONFIGURATION

MSFC TWT 521 E
MSFC TWT 521 I
MSFC TWT 521 I

DESCRIPTION

BOOSTER
BOOSTER
BOOSTER

SIDE SLIP ANGLE. BETA. DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DHDRL REFERENCE INFORMATION
(F55003) MSFC TWT 521 BOOSTER N181 51.000 SREF 0.8330 SQ. IN
(469006) MSFC TWT 521 BOOSTER N181F2 51.000 30.000 LREF 7.2230 IN.
(469011) MSFC TWT 521 BOOSTER N181F6 51.000 30.000 BREF 7.2230 IN.

MACH 3.48

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS. ALPHA=51 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHORL
(F9G03)  HSFC TWT S21 BOOSTER  HIB1  51.000  30.000
(AD506)  HSFC TWT S21 BOOSTER  HIB1F2  51.000  30.000
(AG501)  HSFC TWT S21 BOOSTER  HIB1F8  51.000  30.000

REFERENCE INFORMATION
SREF  0.9330  sq. in
LREF  7.2250  in
BREF  7.2250  in
XREF  4.6250  in
ZREF  0.0000  in
SCALE  0.0034

MACH  4.96

PAGE  70
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION
(FS5003) MSFC TWT 521 BOOSTER N181 SREF 0.3333 SQ. IN
(A55006) MSFC TWT 521 BOOSTER N181F2 LREF 7.2250 IN.
(A95011) MSFC TWT 521 BOOSTER N181F6 BREF 7.2250 IN.

ALPHA DIHDL
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LREF 7.2250 IN.
BREF 7.2250 IN.

XREF 4.8250 IN.
YREF 0.0000 IN.
ZREF 0.0000 IN.
SCALE 0.0034

MACH 1.94 PAGE 71
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHORL  REFERENCE INFORMATION
(F55003) Q  MSFC TWT 521 BOOSTER  N181  51.000  0.0330  SQ. IN
(A59006)  MSFC TWT 521 BOOSTER  N181F2  51.000  30.000  LREF  7.2230  IN.
(A59011)  MSFC TWT 521 BOOSTER  N181F6  51.000  30.000  BREF  7.2230  IN.

MACH 2.74

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EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

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(F59005) ○ MSFC TWT 521 BOOSTER NIB1 SREF 0.9330 SQ. IN
(A95006) ○ MSFC TWT 521 BOOSTER NIB1F2 1.0,000 30.000 IN
(A95011) ○ MSFC TWT 521 BOOSTER NIB1F6 0.9,000 30.000 IN

MACH   3.48
PAGE    73
EFFECT OF FIN SIZE ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=51 DEGREES

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | ALPHA | DINDRL |
--- | --- | --- | --- |
(P3903) | MSFC TWT 321 BOOSER N1B1 | 51.000 | |
(A52000) | MSFC TWT 321 BOOSER N1B1F2 | 51.000 | 30.000 |
(A52011) | MSFC TWT 321 BOOSER N1B1F6 | 51.000 | 30.000 |

REFERENCE INFORMATION
SREF 0.0330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XHPR 4.0000 IN.
YHPR 0.0000 IN.
ZHPR 0.0000 IN.
SCALE 0.0034

MACH 4.96

PAGE 74
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(AS500I)  MSFC TWT 521 BOOSTER NIBI  0.000 0.000 30.000
(AS5009)  MSFC TWT 521 BOOSTER NIBIF6  0.000 30.000

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
YMRF 4.4330 IN.
ZMRF 0.0000 IN.
SCALE 0.0034

MACH .90

PAGE 75
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(A5500) ○ MSFC TWT 521 BOOSTER N18I 0.000
(A5500) △ MSFC TWT 521 BOOSTER N18IF6 0.000

REFERENCE INFORMATION
BREF 0.5370 30. IN
LREF 7.2250 IN
BREF 7.2250 IN
YMBP 4.6250 IN
YMBP 0.0000 IN
ZMBP 0.0000 IN
SCALE 0.0034

MACH 1.20

PAGE 76
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

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- LREF: 7.2230 in.
- XHRR: 4.6230 in.
- ZHRR: 0.0000 in.
- SCALE: 0.0034 in.

MACH 1.46

PAGE 77
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(A55001) O HSFC TWT 521 BOOSTER HIB1
(A55009) O HSFC TWT 521 BOOSTER HIB1FG

ALPHA DIHORL
0.000 30.000

REFERENCE INFORMATION
SREF 0.9330 36. IN
LREF 7.2230 IN.
BREF 7.2230 IN.
XHFR 4.4230 IN.
YHFR 0.0000 IN.
ZHFR 0.0000 IN.
SCALE 0.0034

MACH .90

PAGE 78
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DIHORL
(A5S001) O MSFC TWI 521 BOOSTER NIB1 0.000 0.000
(A5S009) △ MSFC TWI 521 BOOSTER NIB1F6 0.000 30.000

REFERENCE INFORMATION
SREF 0.9350 SQ. IN.
LREF 7.2230 IN.
BREF 7.2230 IN.
XRHP 4.6250 IN.
YRHP 0.0000 IN.
ZRHP 0.0000 IN.
SCALE 0.0034

MACH 1.20

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EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS. ALPHA=0 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

DATA SET SYMBOL CONFIGURATION DESCRIPTION STATUS ALFA DIHDL
(A255001) O MSFC TWT 521 booster N181 0.000 30.000
(A255009) Q MSFC TWT 521 booster N181F6

REFERENCE INFORMATION
SREF 0.9330 sq. in.
LREF 7.2230 in.
XREF 4.6230 in.
YREF 0.0000 in.
ZREF 0.0000 in.
SCALE 0.0034

MACH .90

PAGE 81
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHORL
(A99001)  Q  MSFC TWT 521 Booster M101  0.000  0.000
(A99002)  △  MSFC TWT 521 Booster M161F6  0.000  30.000

REFERENCE INFORMATION
SREF  0.9330  sq. in
LREF  7.2230  in.
BREF  7.2230  in.
XMRP  4.6230  in.
YMRP  0.0000  in.
ZMRP  0.0000  in.
SCALE  0.0034

MACH  1.20

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EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHDL
(A55001)  MSFC TWT 521 BOOSTER  N1B1  0.000  30.000
(A55009)  MSFC TWT 521 BOOSTER  N1B1F6  0.000  30.000

REFERENCE INFORMATION
SREF  0.0330  SQ. IN
LREF  7.2230  IN.
BREF  7.2230  IN.
XHMP  4.2230  IN.
YHMP  0.0000  IN.
ZMPR  0.0000  IN.
SCALE  0.0034

MACH  1.46

PAGE  83
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

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MACH 1.20

PAGE 85
EFFECT OF FIN F6 ON LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHRL  REFERENCE INFORMATION
(A89004)  M5FC TWT 321  BOOSTER  N181  0.000  0.000  MACH  1.46
(A89005)  M5FC TWT 321  BOOSTER  N181FC  0.000  30.000

SCALE  0.0034  IN.
XMRP  0.0000  IN.
ZMRP  0.0000  IN.
LREF  1.2235  IN.
XREF  1.2235  IN.

MACH  1.46  PAGE  86
N1B3-LONGITUDINAL CHARACTERISTICS, MACH NO.=4.96

SYMBOL  MACH  PARAMETRIC VALUES
O  4.999  BETA  0.000

REFERENCE INFORMATION
SREF  0.0000  SQ. IN
LREF  4.1720  IN.
BREF  4.1720  IN.
XNRP  0.2300  IN.
YNRP  0.0000  IN.
ZNRP  0.0000  IN.
SCALE  0.0034

DATA HIST. CODE  #E

MSFC TWT 521  BOOSTER  N1B3  (E55012)  02 FEB 72  PAGE  87
N1B3-LONGITUDINAL CHARACTERISTICS, MACH NO.=4.96

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES
• 4.959 BETA 0.000

REFERENCE INFORMATION
SREF 0.9330 66. IN
LREF 6.1720 IN.
BREF 6.1720 IN.
XMRP 5.2500 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B3
(E55012) 02 FEB 72 PAGE 89
N1B3-LONGITUDINAL CHARACTERISTICS, MACH NO.=4.96

SYMBOL: MACH 4.939 BETA 0.000
PARAMETRIC VALUES
REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 0.1720 IN.
BREF 0.1720 IN.
XHAP 5.2300 IN.
YNAP 0.0000 IN.
ZNAP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B3

(E55012) 02 FEB 72 PAGE 91
N1B3-LONGITUDINAL CHARACTERISTICS, MACH NO.=4.96

SYMBOL MACH PARAMETRIC VALUES
O 4.958 BETA 0.000

REFERENCE INFORMATION
SREF 0.9320 in.
LREF 0.1720 in.
XREF 5.2300 in.
YHASE 0.0000 in.
SCALE 0.0034

DATA NIST. CODE #E
MSFC TWI 521 BOOSTER N1B3 (E55012) 02 FEB 72 PAGE 92
N1B3-LONGITUDINAL CHARACTERISTICS, MACH NO. = 4.96

SYMBOL  MACH  PARAMETRIC VALUES
O  4.959  BETA  0.000

REFERENCE INFORMATION
SREF  0.9330  SO. IN
LREF  8.1720  IN.
BREF  8.1720  IN.
XMRP  5.2300  IN.
YMRP  0.0000  IN.
ZMRP  0.0000  IN.
SCALE  0.0034

DATA HIST. CODE  #E
MSFC TWT 521  BOOSTER  N1B3  (E55012)  02 FEB 72  PAGE 95
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

NORMAL FORCE COEFFICIENT, CN

REFERENCE INFORMATION

SYMBOL  MACH  PARAMETRIC VALUES

Diamond  0.899  BETA  0.000

Square  1.097

Circle  1.461

Diamond  1.964

DATA HIST. CODE  #C5E

MSFC TWT 521 BOOSTER N1B3 (ESS01S) 02 FEB 72 PAGE 97
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

NORMAL FORCE COEFFICIENT, CN

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOl MACH PARAMETRIC VALUES

2.740 BETA 0.000
3.480
4.259

REFERENCE INFORMATION
SREF 0.0330 SQ. IN
LREF 6.1720 IN.
BREF 6.1720 IN.
XHMR 5.2500 IN.
YHMR 0.0000 IN.
ZHMR 0.0000 IN.
SCALE 0.0034

DATA MIST. CODE MSFC
TWT 521 BOOSTER N1B3
(E5501S) 02 FEB 72 PAGE 98
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

PITCHING MOMENT COEFFICIENT, CL/M

SYMBOL MACH BETA PARAMETRIC VALUES
○ 0.699 BETA 0.000
▲ 1.197
▲ 1.461
▲ 1.966

REFERENCE INFORMATION
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BREF 8.1720 IN.
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YHREF 0.0000 IN.
ZHREF 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #64E
MSFC TWT 521 BOOSTER N1B3 (E5501S) 02 FEB 72 PAGE 99
N183-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

AXIAL FORCE COEFFICIENT, CA

SYMBOL  MACH  PARAMETRIC VALUES
□  0.899  BETA  0.000
□  1.187
□  1.481
□  1.884

REFERENCE INFORMATION
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BREF  8.1720  IN.
XMRP  5.2300  IN.
YMRP  0.0000  IN.
ZMRP  0.0000  IN.
SCALE  0.0034

DATA HIST. CODE  #66E
MSFC TWT 521  BOOSTER  N183  (E5501S)  02 FEB 72  PAGE 101
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

NORMAL FORCE COEFFICIENT, CN

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION

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BREF 0.4720 in.
XMRP 5.2300 in.
YMRP 0.0000 in.
ZMRP 0.0000 in.
SCALE 0.0034

DATA HIST. CODE  #60E

MSFC TWT 521 BOOSTER N1B3 (E5501S) 02 FEB 72 PAGE 103
N183-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

NORMAL FORCE COEFFICIENT, CN

PITCHING MOMENT COEFFICIENT, CLM

SYMBOL MACH

\[ \Delta \]
2.740
3.400
4.859

REFERENCE INFORMATION

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DATA HIST. CODE #GWE

MSFC TWT 521 BOOSTER N183 (E5501S) 02 FEB 72 PAGE 104
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION

SREF 0.9330 50. IN
LREF 6.1720 IN.
XREF 5.2300 IN.
YMF 0.0000 IN.
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SCALE 0.0034

DATA HIST. CODE #GWE

MSFC TWT 521 BOOSTER N1B3 (E5S01S) 02 FEB 72 PAGE 105
N183-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL  MACH  BETA  PARAMETRIC VALUES
∞  2.740  0.000
∞  3.480
∞  4.939

REFERENCE INFORMATION
SREF  0.9330  sq. in
LREF  6.1720  in.
BREF  6.1720  in.
XREP  3.2300  in.
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ZREP  0.0000  in.
SCALE  0.0034

DATA HIST. CODE  #GGE
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### N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

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- XNRP: 5.2500 in.
- YNRP: 0.0000 in.
- ZNRP: 0.0000 in.
- SCALE: 0.0034

**DATA HIST. CODE**

- MSFC TWT 521
- BOOSTER
- N1B3

**PAGE**

- (E5501S) 02 FEB 72
- PAGE 111
NIB3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

LIFT COEFFICIENT, CL

DRAG COEFFICIENT, CD

SYMBOL MACH PARAMETRIC VALUES

\[ \begin{array} { c c c } 
\diamond & 2.740 & \beta = 0.000 \\
\circ & 3.440 & \\
\square & 4.950 & 
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MSFC TWT 521 BOOSTER NIB3 (E5501S) 02 FEB 72 PAGE 112
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL MACH  BETA  PARAMETRIC VALUES
  □  0.909  BETA  0.000
  □  1.197
  □  1.481
  □  1.964

REFERENCE INFORMATION
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  LREF  6.1720  IN.
  BREF  6.1720  IN.
  XMRP  5.2300  IN.
  YMRP  0.0000  IN.
  ZMRP  0.0000  IN.
  SCALE  0.0034

DATA MIST. CODE  69E

MSFC TWT 521  BOOSTER  N1B3  (E5501S)  02 FEB 72  PAGE 113
N1B3-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

LIFT COEFFICIENT, CL

PITCHING MOMENT COEFFICIENT, CLM

SYMBOL

2.740 BETA 0.000
3.460
4.096

REFERENCE INFORMATION
SREF 0.0030 IN.
LREF 6.1720 IN.
BREF 8.1720 IN.
XHNP 3.2300 IN.
YHNP 0.0000 IN.
ZHNP 0.0000 IN.
SCALE 0.0054 IN.

DATA HIST. CODE #G6E
MSFC TWT 521 BOOSTER N1B3 (E5501S) 02 FEB 72 PAGE 114
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

NORMAL FORCE COEFFICIENT, CN

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL | MACH | PARAMETRIC VALUES | REFERENCE INFORMATION
--- | --- | --- | ---
○ | 0.890 | BETA 0.000 DIMHDL 30.000 SREF 0.0350 SQ. IN
△△△ | 1.198 | LREF 8.1720 IN.
○ | 1.460 | BREF 0.1720 IN.
○ | 1.997 | XMRP 5.2300 IN.
△△△ | 2.500 | YMRP 0.0000 IN.
○ | 0.0000 | ZMRP 0.0000 IN.
△△△ | 0.0034 | SCALE

DATA HIST. CODE 669E

MSFC TWT 521 BOOSTER N1B3F12 (E5502S) 02 FEB 72 PAGE 115
N183F12—EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL  MACH  PARAMETRIC VALUES  REFERENCE INFORMATION

2.740  BETA  0.000  DIMDRL  30,000

SREF  0.9330  SQ. IN
LREF  6.1720  IN.
BREF  6.1720  IN.
XREF  5.2300  IN.
YREF  0.0000  IN.
ZREF  0.0000  IN.
SCALE  0.0034

DATA HIST. CODE #46E

MSFC TWT 521  BOOSTER  N183F12  (E5502S)  02 FEB 72  PAGE 116
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION
SREF 0.0350 30 IN.
LREF 6.1720 IN.
BREF 6.1720 IN.
XMRP 5.2300 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE 66E

MSFC TWT 521 BOOSTER N1B3F12 (E5502S) 02 FEB 72 PAGE 119
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

SYMBOL  MACH   PARAMETRIC VALUES
     □  0.898   BETA  0.000  DIHORL 30.000
     △  1.196
     ▲  1.460
     ▼  1.937

REFERENCE INFORMATION
SREF  0.9330  SQ. IN
LREF  8.1720  IN.
BREF  6.1720  IN.
XMPR  5.2500  IN.
ZMPR  0.0000  IN.
SCALE 0.0034  IN.

DATA MSTR. CODE #64E
MSFC TWT 521  BOOSTER  N1B3F12 (E5502S) 02 FEB 72  PAGE 121
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

SYMBOL MACH PARAMETRIC VALUES
O 2.740 BETA 0.000 DIMORL 30.000
O 3.480
O 4.959

REFERENCE INFORMATION
SREF 0.2330 SQ. IN.
LREF 6.1700 IN.
XREF 5.2300 IN.
YREF 0.0000 IN.
ZREF 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #G0E
MSFC TWT 521 BOOSTER N1B3F12 (E5502S) 02 FEB 72 PAGE 122
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

SYMBOL | MACH | BETA | DIHDR | REFERENCE INFORMATION
--- | --- | --- | --- | ---
O | 0.098 | 0.000 | 0.000 | SREF 0.9330
| 1.198 | | | LREF 6.1720
| 1.460 | | | BREF 6.1720
| 1.897 | | | XMRP 5.2300
| | | | IMRP 0.0000
| | | | SCALE 0.0034

DATA HIST. CODE: 998
MSFC TWT S21 BOOSTER N1B3F12 (E5502S) 02 FEB 72 PAGE 123
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

LIFT COEFFICIENT, CL

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAEMETRIC VALUES
⊙ 2.740 Beta 0.000 Dihedr 30.000
⊗ 3.460
⊗ 4.059

REFERENCE INFORMATION
SREF 0.9330 50. IN
LREF 8.1780 IN
XREF 5.2300 IN
YREF 0.0000 IN
ZREF 0.0000 IN
SCALE 0.0034

DATA MSTR. CODE #61E
MSFC TWT 521 Booster N1B3F12 (E5502S) 02 FEB 72 PAGE 124
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT-DRAUGHT RATIO, L/D

SYMBOL | MACH | PARAMETRIC VALUES
-------|------|-------------------
  0.898 |      |                   |
  1.198 |      |                   |
  1.460 |      |                   |
  1.957 |      |                   |

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 8.1720 IN.
XREF 5.2300 IN.
YREF 0.0000 IN.
ZREF 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #00E
MSFC TWT 521 BOOSTER N1B3F12 (F5502S) 02 FEB 72 PAGE 127
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

LIFT-DRAG RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES
O 2.740 BETA 0.000 DIMRL 30.000
A 3.480
D 4.999

REFERENCE INFORMATION
SREF 0.9330 SN. IN
LREF 0.1720 IN.
MREF 0.1720 IN.
XNRP 0.2300 IN.
YNRP 0.0000 IN.
SCALE 0.0034

DATA MIST. CODE #G#E
MSFC TWT 521 BOOSTER N1B3F12 (E5502S) 02 FEB 72 PAGE 128
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOl MACH PARAMETRIC VALUES

BETA 0.000  DlMOL 30.000

REFERENCE INFORMATION
SREF 0.9330  SQ. IN.
LREF 8.1720  IN.
BREF 8.1720  IN.
XNRP 5.2300  IN.
YNRP 0.0000  IN.
ZNRP 0.0000  IN.
SCALE 0.0034

DATA MIST. CODE  MSFC TWT 521  Booster  N1B3F12  (E5502S)  02 FEB 72  PAGE 129
PARAMETRIC VALUES

0.000 DIHORL
1.0
0.8
0.6
0.4
0.2
0.0

PITCHING MOMENT COEFFICIENT, CLM

REFERENCE INFORMATION

SREF 0.9330
LREF 0.1720
XREF 0.5300
YREF 0.0000
ZREF 0.0000
SCALE 0.0034

SYMBOL MACH BETA DIHORL

0.898 0.000 30.000
1.198
1.460
1.957

DATA HIST. CODE MSRC TWT 521 BOOSTER N1B3F12 (ES502S) 02 FEB 72 PAGE 131
N1B3F12-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PITCHING MOMENT COEFFICIENT, CLM

SYMBOL MACH  PARAMETRIC VALUES REFERENCE INFORMATION

△ 2.740  BETA  0.000  DIONR  30.000

SREF  0.0330  IN
LREF  4.1720  IN
XREF  5.2300  IN
YREF  0.0000  IN
ZREF  0.0000  IN
SCALE  0.0034  IN

DATA HIST. CODE  #60E

MSFC TWT 521  BOOSTER  N1B3F12  (E5502S)  02 FEB 72  PAGE 132
N1B3F12-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

NORMAL FORCE COEFFICIENT, CN

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL  MACH  PARAMETRIC VALUES
     D  0.897  BETA  0.000  DIMRDL  30.000
     O  1.199
     O  1.465

REFERENCE INFORMATION
SREF  0.9330  Sq. IN
LREF  8.1720  IN.
BREF  8.1720  IN.
XNRP  5.2300  IN.
YNRP  0.0000  IN.
ZMNP  0.0000  IN.
SCALE  0.0034

DATA HIST. CODE  #E
MSFC TWT  521  BOOSTER  N1B3F12  (E55019)  02 FEB 72  PAGE  133
N1B3F12-LONGITUDINAL CHARACTERISTICS AT TRANSonic MACH NUMBERS, LOW ALPHAS

ANGLE OF ATTACK, ALPHA, DEGREES

PITCHING MOMENT COEFFICIENT, CLM

SYMBOL MACH PARAMETRIC VALUES
X 0.897 BETA 0.000 D1NORL 30,000
△ 1.399
◇ 1.405

REFERENCE INFORMATION
SREF 0.9330 sq. in
LREF 8.1720 in
BREF 8.1720 in
XNRP 5.2300 in
YNRP 0.0000 in
ZNRP 0.0000 in
SCALE 0.0034

DATA MAST. Code 4E
MSFC TWT 521 Booster N1B3F12 (E55019) 02 FEB 72 PAGE 134
N1B3F12-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL  MACH  PARAMETRIC VALUES  REFERENCE INFORMATION
D  0.897  BETA  0.000  DIHORL  30.000
D  1.199
D  1.493

SREF  0.9330  SQ. IN
LREF  8.1720  IN
BREF  6.1720  IN
XREF  5.2300  IN
ZREF  0.0000  IN
SCALE  0.0034

DATA MIST. CODE  #E
MSFC TWT 521  BOOSTER  N1B3F12  (E55019)  02 FEB 72  PAGE 135
N1B3F12-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

SYMBOL MACH PARAMETRIC VALUES
    0.807 Beta 0.000 Dihorl 30.000
    1.199
    1.445

REFERENCE INFORMATION
SREF 0.9330 SQ. IN
LREF 6.1720 IN.
BREF 6.1720 IN.
XMRP 1.2500 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E
MSFC TWT 521 BOOSTER N1B3F12 (E55019) 02 FEB 72 PAGE 137
N1B3F12-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

LIFT-DRAG RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES
O 0.997 BETA 0.000 DINDRL 30.000
D 1.199
O 1.465

REFERENCE INFORMATION
SREF 0.6330 SQ. IN
LREF 8.1720 IN.
BREF 6.1720 IN.
XHSP 5.2300 IN.
YHSP 0.0000 IN.
ZHRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #E

MSFC TWT 521 BOOSTER N1B3F12 (E55019) 02 FEB 72 PAGE 139
N1B3F12-LONGITUDINAL CHARACTERISTICS AT TRANSONIC MACH NUMBERS, LOW ALPHAS

PITCHING MOMENT COEFFICIENT, CLM

LIFT COEFFICIENT, CL

SYMBOL | MACH | PARAMETRIC VALUES | REFERENCE INFORMATION
-------|------|-------------------|------------------------
O      | 0.897| BETA 0.000 DIHORL 30.000 | SREF 0.9330 SQ. IN
      | 1.198|                   | LREF 0.1720 IN.
      | 1.408|                   | BREF 0.1720 IN.
      |       |                   | XNRP 5.2300 IN.
      |       |                   | YNRP 0.0000 IN.
      |       |                   | ZNRP 0.0000 IN.
      |       |                   | SCALE 0.0034

DATA MAST. CODE 0E
MSFC TWT 521 BOOSTER N1B3F12 (E55019) 02 FEB 72 PAGE 141
N1B3-EFFECT OF MACH NUMBER ON BASE AXIAL FORCE

ANGLE OF ATTACK, ALPHA, DEGREES

BASE AXIAL FORCE COEFFICIENT, CAB

SYMBOL MACH PARAMETRIC VALUES
○ 0.899 BETA 0.000
△ 1.197
△ 1.451
△ 1.884

REFERENCE INFORMATION
SREF 0.9330 SQ. IN.
LREF 8.1720 IN.
BREF 8.1720 IN.
XMRP 5.2300 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE #6

MSFC TWT 521 BOOSTER N1B3 (A5503S) 02 FEB 72 PAGE 143
N1B3-EFFECT OF MACH NUMBER ON BASE AXIAL FORCE

ANGLE OF ATTACK, ALPHA, DEGREES

BASE AXIAL FORCE COEFFICIENT, C_AB

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION

DATA HIST. CODE 46

MSFC TWT 521 BOOSTER N1B3 (A5503S) 02 FEB 72 PAGE 144
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

MACH .90  PAGE 145
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET | SYMBOL | CONFIGURATION | DESCRIPTION | ALPHA | DIMORL |
---------|--------|---------------|------------|-------|--------|
(495018) | O      | MSFC TWT 921 | Booster    | 0.000 | 30.000 |
(495023) | O      | MSFC TWT 921 | Booster    | 0.000 | 30.000 |

REFERENCE INFORMATION
SREF 0.0330 50 IN.
LREF 6.1720 IN.
BREF 6.1720 IN.
XNRP 5.2300 IN.
YNRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

MACH 1.20
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIMORL
(A85016)  MSFC TWT 521 BOOSTER  N1B3  0.000  30.000
(A85023)  MSFC TWT 521 BOOSTER  N1B3F12  0.000  30.000

REFERENCE INFORMATION
LREF  6.1720  IN.
BREF  6.1720  IN.
XHRP  3.2500  IN.
YHRP  0.0000  IN.
ZHRP  0.0000  IN.
SCALE  0.0034

MACH  1.46
PAGE  147
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL | CONFIGURATION DESCRIPTION | N1B3 | ALPHA | DIHDR | REFERENCE INFORMATION
---|---|---|---|---|---
(95016) | MSFC TWT 521 BOOSTER | N1B3 | 0.000 | 0.000 30.000 | REF 0.9330 S# IN
(95023) | MSFC TWT 521 BOOSTER | N1B3F12 | 0.000 30.000 | REF 0.1720 IN

MACH .90

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EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

SIDE SLIP ANGLE, BETA, DEGREES

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  
(A55016)  MSFC TWT 521  BOOSTER  N1B3  
(A55023)  MSFC TWT 521  BOOSTER  N1B3F12  

REFERENCE INFORMATION
SREF 0.9330  SW. IN.  
LREF 0.1720  IN.  
BREF 0.1720  IN.  
XMRP 5.2300  IN.  
YMRP 0.0000  IN.  
ZMRP 0.0000  IN.  
SCALE 0.0034

MACH 1.20

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EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DINDRL
(AS5018) MSFC TWT 521 BOOSTER N1B3 0.000 30.000
(AS5023) MSFC TWT 521 BOOSTER N1B3F12

REFERENCE INFORMATION
SREF 0.0330 SQ. IN
LREF 6.1720 IN.
BREF 6.1720 IN.
XHPR 5.2300 IN.
YHPR 0.0000 IN.
ZHPR 0.0000 IN.
SCALE 0.0034

MACH 1.46

PAGE 150
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(A55016) □ MSFC TWT 521 BOOSTER N1B3 0.000 0.000
(A55023) △ MSFC TWT 521 BOOSTER N1B3F12 0.000 30.000

REFERENCE INFORMATION
SREF 0.9330 SQ. IN.
LREF 6.1720 IN.
BREF 4.1720 IN.
XHNP 5.2300 IN.
YNRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

MACH .90

PAGE 151
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA D1MDRL REFERENCE INFORMATION
A (ASSO16) MSFC TWT 521 BOOSTER N1B3 0.000 BREF 0.9330 SQ. IN
A (ASSO23) MSFC TWT 521 BOOSTER N1B3F12 0.000 30.000 LREF 8.1720 IN.
XMPF 5.2300 IN.
YMMP 0.0000 IN.
ZMNFP 0.0000 IN.
SCALE 0.0034

MACH 1.20

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EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL   CONFIGURATION DESCRIPTION  ALPHA  DHIHRL
(A55016)  N5FC TWT 521  BOOSTER  N1B3  0.000  30.000
(A55023)  N5FC TWT 521  BOOSTER  N1B3F12  0.000  30.000

REFERENCE INFORMATION
SREF  0.9350 SQ. IN
LREF  6.1720 IN
BREF  6.1720 IN
XHPR  5.2300 IN
ZMRP  0.0000 IN
SCALE  0.0034

MACH  1.46

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EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHDL

M0FC TWT 321 BOOSTER N1B3  0.000  30.000

REFERENCE INFORMATION
SREF  0.9330  59 IN
LREF  6.1720  IN
BREF  6.1720  IN
XMPF  5.2350  IN
YMPF  0.0000  IN
ZMPF  0.0000  IN
SCALE  0.0034

MACH .90
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=0 DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHADMORL
(A59016) △ MSFC TWT 521 BOOSTER N183 0.000 30.000
(A59023) ○ MSFC TWT 521 BOOSTER N183F12 0.000

REFERENCE INFORMATION
SREF 0.8330 SQ. IN.
LREF 8.1720 IN.
BREF 8.1720 IN.
XMRP 5.2300 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH 1.20

PAGE 155
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

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<th>ALPHA DIHRDL</th>
<th>REFERENCE INFORMATION</th>
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<td>31.000 31.000</td>
<td>BREF 6.1720 IN.</td>
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<td>YHSP 0.0000 IN.</td>
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<td>SCALE 0.0034</td>
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</tbody>
</table>

MACH .90

PAGE 157
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS. ALPHA=30 AND 51 DEG.

SIDE SLIP ANGLE, BETA, DEGREES

LATERAL FORCE COEFFICIENT, CY

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHDL  REFERENCE INFORMATION
(AS8017)  MSFC TWT 521 BOOSTER N183  30.000  30.000  REF  0.8330  sq. in
(AS9024)  MSFC TWT 521 BOOSTER N183F12  30.000  30.000  LREF  6.1720  in.
(AS9018)  MSFC TWT 521 BOOSTER N183  51.000  30.000  BREF  6.1720  in.
(AS9025)  DATA NOT AVAILABLE FOR ALL CONDITIONS  51.000  30.000  IMNP  5.2300  in.
                158
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(A59017) MSFC TWT 521 BOOSTER N1B3 30.000
(A59024) MSFC TWT 521 BOOSTER N1B3F12 30.000 30.000
(A59018) MSFC TWT 521 BOOSTER N1B3 51.000
(A59028) MSFC TWT 521 BOOSTER N1B3F12 51.000 30.000

REFERENCE INFORMATION
SREF 0.0330 SQ. IN
LREF 0.1720 IN.
BREF 0.1720 IN.
XMRP 5.2300 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH 1.95

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EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA = 30 AND 51 DEG.

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DINDRL
(ASS017)  MSFC TWT 521 BOOSTER  M1B3  30.000  30.000
(ASS024)  MSFC TWT 521 BOOSTER  M1B3F12  30.000  30.000
(ASS018)  MSFC TWT 521 BOOSTER  M1B3  51.000  30.000
(ASS025)  MSFC TWT 521 BOOSTER  M1B3F12  51.000  30.000

REFERENCE INFORMATION
SREF  0.9330  34. IN.
LREF  8.1720  IN.
BREF  8.1720  IN.
XMRP  5.2300  IN.
YMRP  0.0000  IN.
ZMRP  0.0000  IN.
SCALE  0.0034

MACH  3.48  PAGE  161
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHATDINDR L
(AS0017) MSCR TWT 521 BOOSTER NIB3 30.000 30.000
(AS002) MSCR TWT 521 BOOSTER NIBS12 30.000 30.000
(AS0018) MSCR TWT 521 BOOSTER NIB3 31.000 30.000
(AS0023) DATA NOT AVAILABLE FOR ALL CONDITIONS 31.000 30.000

REFERENCE INFORMATION
SREF 0.9390 BA. IN
LREF 0.1720 IN.
BREF 0.1720 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH .90 PAGE 163
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

SIDE SLIP ANGLE, BETA, DEGREES

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHORL
(ASS017)  MSFC TWT 521 BOOSTER  N1B3  30.000  30.000
(ASS024)  MSFC TWT 521 BOOSTER  N1B3F12  31.000  30.000
(ASS018)  MSFC TWT 521 BOOSTER  N1B3F12  31.000  30.000

REFERENCE INFORMATION
SREF  0.9330  SQ. IN
LREF  0.1780  IN.
BREF  4.1780  IN.
XNRP  5.2300  IN.
YNRP  0.0000  IN.
ZNRP  0.0000  IN.
SCALE  0.0034

MACH  1.95

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EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

MACH 3.48

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EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

SIDE SLIP ANGLE, Beta, DEGREES

YAWING MOMENT COEFFICIENT, CYN (BODY AXIS)

DATA SET SYMBOL, CONFIGURATION DESCRIPTION
(A55017) MSFC TVT 521 BOOSTER N183
(A55024) MSFC TVT 521 BOOSTER N183F12
(A55018) MSFC TVT 521 BOOSTER N183
(A55025) MSFC TVT 521 BOOSTER N183F12

ALPHA, Dinda
30.000
30.000
51.000
51.000
30.000
30.000

REFERENCE INFORMATION
3REF 0.9330 SQ. IN
LREF 4.1720 IN.
DREF 4.1720 IN.
XMP 5.2300 IN.
ZMP 0.9900 IN.
SCALE 0.0034

MACH 4.96

PAGE 168
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

MACH .90
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

SIDE SLIP ANGLE, BETA, DEGREES

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DINDRL
(A59017)  MSFC TWT 521 BOOSTER  N1B3  30.000  30.000
(A59024)  MSFC TWT 521 BOOSTER  N1B3F12  30.000  30.000
(A59018)  MSFC TWT 521 BOOSTER  N1B3  51.000  30.000
(A59025)  DATA NOT AVAILABLE FOR ALL CONDITIONS

REFERENCE INFORMATION
BREF 1.0330  SQ. IN.
LREF 4.1720  IN.
XREF 4.1720  IN.
XMRP 5.2500  IN.
YMRP 1.0000  IN.
ZMRP 1.0000  IN.
SCALE 0.0034

MACH 1.20

PAGE 170
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

SIDE SLIP ANGLE, BETA, DEGREES

ROLLING MOMENT COEFFICIENT, CBL (BODY AXIS)

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DIHORL REFERENCE INFORMATION
(A56017) MSFC TWT 521 BOOSTER N183 30.000 30.000 SNEF 0.9530 SQ. IN
(A56024) MSFC TWT 521 BOOSTER N183F12 30.000 30.000 LREF 6.1720 IN.
(A56019) MSFC TWT 521 BOOSTER N183 51.000 30.000 BREF 6.1720 IN.
(A56023) MSFC TWT 521 BOOSTER N183F12 51.000 30.000 XNRP 5.2300 IN.

MACH 2.74

PAGE 172
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIHDRL  REFERENCE INFORMATION
(A59017)  MSFC TWT 521 BOOSTER  N1B3  30.000  30.000  SREF  0.9330  56. IN
(A59024)  MSFC TWT 521 BOOSTER  N1B3F12  30.000  30.000  LREF  8.1720  IN.
(A59018)  MSFC TWT 521 BOOSTER  N1B3  51.000  30.000  BREF  8.1720  IN.
(A59029)  MSFC TWT 521 BOOSTER  N1B3F12  51.000  30.000  XHNP  5.2500  IN.

MACH  3.48  PAGE  173
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS. ALPHA=30 AND 51 DEG.

MACH 4.96
EFFECT OF F12 ON N183 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL CONFIGURATION DESCRIPTION
(A55017) MSFC TWT 321 BOOSTER N183
(A55024) MSFC TWT 321 BOOSTER N183F12
(A55018) MSFC TWT 321 BOOSTER N183
(A55025) DATA NOT AVAILABLE FOR ALL CONDITIONS

REFERENCE INFORMATION
SREF 0.9330 58. IN
LREF 8.1720 IN.
BREF 8.1720 IN.
XMRP 5.2300 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0034

MACH .90

PAGE 175
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION
(A55017) MSFC TWT 521 BOOSTER N1B3 SREF 0.9330 SQ. IN
(A55024) MSFC TWT 521 BOOSTER N1B3F12 LREF 8.1720 IN.
(A55018) MSFC TWT 521 BOOSTER N1B3 YHPR 0.0000 IN.
(A55025) MSFC TWT 521 BOOSTER N1B3F12 ZHPR 0.0000 IN.

SCALE 0.0034

MACH 1.95

PAGE 177
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHA DINDRL
(A59017) MSFC TWT 521 BOOSTER N1B3 30.000 30.000
(A59024) MSFC TWT 521 BOOSTER N1B3F12 30.000 30.000
(A59018) MSFC TWT 521 BOOSTER N1B3 51.000 30.000
(A59025) MSFC TWT 521 BOOSTER N1B3F12 51.000 30.000

REFERENCE INFORMATION
SEF 0.9330 sq. in.
LREF 8.1720 in.
BREF 8.1720 in.
XNBP 5.2500 in.
YNBP 0.0300 in.
SCALE 0.0004

MACH 2.74

PAGE 178
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL CONFIGURATION DESCRIPTION ALPHAD1NHD1L REFERENCE INFORMATION
(A55017) MSFC TWT 521 BOOSTER N1B3 30.000 30.000 SREF 0.9330 50. IN
(A55024) MSFC TWT 521 BOOSTER N1B3F12 30.000 30.000 LREF 0.1720 IN.
(A55028) MSFC TWT 521 BOOSTER N1B3 51.000 51.000 XREF 5.2300 IN.
(A55025) MSFC TWT 521 BOOSTER N1B3F12 51.000 51.000 YH REF 0.0000 IN.
SCALE 0.0034

MACH 3.48

PAGE 179
EFFECT OF F12 ON N1B3 LATERAL-DIRECTIONAL CHARACTERISTICS, ALPHA=30 AND 51 DEG.

DATA SET SYMBOL  CONFIGURATION DESCRIPTION  ALPHA  DIMLRL
(A95017)  MSFCTW521BOOSTER  N1B3  30.000  30.000
(A95018)  MSFCTW521BOOSTER  N1B3F12  31.000  30.000
(A95025)  MSFCTW521BOOSTER  N1B3F12  31.000  30.000

REFERENCE INFORMATION
SREF  0.9330  39. IN
LREF  8.1720  IN
BREF  8.1720  IN
EXRP  5.2300  IN
ZMXP  0.0000  IN
SCALE  0.0054

MACH  4.96  PAGE  180
N2B2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES
△ 1.861 BETA 0.000
□ 2.740
○ 3.480
□ 4.950

REFERENCE INFORMATION
SREF 2.1590 SQ. IN.
LREF 5.8590 IN.
BREF 3.5150 IN.
YMRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE 88E
MSFC TWT 521 BOOSTER N2B2 (E55026) 02 FEB 72 PAGE 183
WB2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

LIFT COEFFICIENT, CL

PARAMETRIC VALUES

MACH  BETA  0.000
1.161  2.740  3.480  4.899

REFERENCE INFORMATION
SREF  2.1590  in.
LREF  5.8590  in.
BREF  5.8590  in.
XMRP  3.3150  in.
YMRP  0.0000  in.
ZMRP  0.0000  in.
SCALE  0.0034  in.

DATA HIST. CODE  BnE
MSFC TWT 521  BOOSTER  N2B2  (E55026)  02 FEB 72  PAGE 185
N2B2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

DRAG COEFFICIENT, CD

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION

SREF 2.1590 SQ. IN
LREF 3.6290 IN.
BREF 3.8590 IN.
XHNP 3.5150 IN.
YHNP 0.0000 IN.
ZHNP 0.0000 IN.
SCALE 0.0024

DATA HIST. CODE 50E

MSFC TWT 521 BOOSTER N2B2 (E55026) 02 FEB 72 PAGE 186
N2B2-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL MACH | PARAMETRIC VALUES
---- | ---- | ----
| 1.961 | BETA | 0.000

REFERENCE INFORMATION
SREF 2.1590 IN.
LREF 5.8590 IN.
BREF 5.8590 IN.
XMRP 3.5150 IN.
ZMRP 0.0000 IN.
SCALE 0.0034 IN.

DATA HIST. CODE SKE
MSFC TWT 521 BOOSTER N2B2 (E55026) 02 FEB 72 PAGE 187
N2B2F7-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

Symbol  Mach  Parametric Values

-  1.975  Beta  0.000  Dihedral  30.000
-  2.740
-  3.480
-  4.959

REFERENCE INFORMATION

- BREF  2.1590  Sq. In.
- LREF  5.6590  In.
- HREF  3.5150  In.
- YMRP  0.0000  In.
- SCALE  0.0034

DATA MIST. CODE  SEE

MSFC TWT 521  BOOSTER  N2B2F7  (E55027)  02 FEB 72  PAGE 191
N2B2F7-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

MACH 1.975  BETA 2.740
MACH 3.480  BETA 4.959

PARAMETRIC VALUES
0.000  OIHDRL
DATA MSET S*E
MSFC TWT 521 BOOSTER
N2B2F7

REFERENCE INFORMATION
SREF 2.1590  56. IN
LREF 5.8590  IN.
BREF 5.8590  IN.
XMRP 3.1150  IN.
YMRP 0.0000  IN.
ZMRP 0.0000  IN.
SCALE 0.0034

DATA MIST. CODE S#E
N2B2F7 (E55027) 02 FEB 72
PAGE 193
N2B2F7-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL MACH  PARAMETRIC VALUES
\( \bigcirc \) 1.975  BETA 0.000  DIMORL 30.000
\( \triangle \) 2.740
\( \Diamond \) 3.480
\( \square \) 4.959

REFERENCE INFORMATION
SREF 2.1590 SQ. IN
LREF 5.8990 IN.
BREF 5.8590 IN.
XNRP 3.5150 IN.
YNRP 0.0000 IN.
ZNRP 0.0000 IN.
SCALE 0.0034

DATA HIST. CODE  S#E
MSFC TWT 521  BOOSTER  N2B2F7  (E55027)  02 FEB 72  PAGE 197
N2B4-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

ANGLE OF ATTACK, ALPHA, DEGREES

NORMAL FORCE COEFFICIENT, CN

SYMBOL MACH PARAMETRIC VALUES
1.955 BETA 0.000
2.740
3.480
4.950

REFERENCE INFORMATION
SREF 2.1590 SQ. IN
LREF 7.6590 IN.
BREF 7.6590 IN.
XHBP 4.5950 IN.
YHBP 0.0000 IN.
ZHBP 0.0000 IN.
SCALE 0.0042

DATA NIST. CODE 5G4E
MSFC TWT 521 BOOSTER N2B4
(E5504S) 02 FEB 72 PAGE 199
N2B4-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

SYMBOL MACH PARAEMETRIC VALUES
\( \circ \) 1.955 BETA 0.000
\( \Delta \) 2.740
\( \square \) 3.450
\( \triangle \) 4.959

REFERENCE INFORMATION
SREF 2.1590 SQ. IN
LREF 7.6590 IN.
BREF 7.6590 IN.
ZXP 4.5950 IN.
YYP 0.0000 IN.
ZYP 0.0000 IN.
SCALE 0.0042

DATA HIST. CODE 5504E
MSFC TWT 521 BOOSTER N2B4 (ES504S) 02 FEB 72 PAGE 200
N2B4-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH BETA PARAMETRIC VALUES

REFERENCE INFORMATION

DATA MIST. CODE  S**G**E

MSFC TWT 521 BOOSTER N2B4 (E5504S) 02 FEB 72 PAGE 201
N2B4-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

LIFT COEFFICIENT, CL

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL | MACH | PARAMETRIC VALUES
-------+------|---------------------
      | 1.0  | BETA 0.000
      | 2.3  |                   
      | 3.4  |                   
      | 4.0  |                   

REFERENCE INFORMATION
SREF 2.1590 SQ. IN
LREF 7.6590 IN.
BREF 7.6590 IN.
XMRP 4.8350 IN.
YMRP 0.0000 IN.
ZMRP 0.0000 IN.
SCALE 0.0042

DATA HIST. CODE: S*G*E
MSFC TWT 521  BOOSTER  N2B4  (E5504S)  02 FEB 72  PAGE 203
N2B4-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

LIFT-DRAg RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH BETA PARAMETRIC VALUES

REFERENCE INFORMATION

SREF 2.1590 SQ. IN
LREF 7.6590 IN.
XREF 7.6590 IN.
YREF 4.9550 IN.
ZREF 0.0000 IN.
SCALE 0.0042

DATA MESS. CODE. SNGE

MSFC TWT 521 BOOSTER N2B4 (ES504S) 02 FEB 72 PAGE 205
N2B4-EFFECT OF MACH NO. ON LONGITUDINAL CHARACTERISTICS

PARAMETRIC VALUES

DATA MIST. CODE S*G*E

REFERENCE INFORMATION

PITCHING MOMENT COEFFICIENT, CLM

LIFT COEFFICIENT, CL

SYMBOL MACH BETA PARAMETRIC VALUES

REFERENCE INFORMATION

SREF 2.1590 SQ. IN
LREF 7.8590 IN.
BREF 7.8590 IN.
XREF 4.5950 IN.
YREF 0.0000 IN.
ZREF 0.0000 IN.
SCALE 0.0042

DATA HIST. CODE S*G*E

MSFC TWT 521 BOOSTER N2B4 (E5504S) 02 FEB 72 PAGE 207
N2B5-Longitudinal Characteristics

Pitching Moment Coefficient, CLM

Angle of Attack, Alpha, Degrees

Symbol MACH Parametric Values
Ω 3.480 Beta 0.000
Δ 4.959

Reference Information
SREF 2.1500 sq. in
LREF 7.6590 in.
BREF 7.6590 in.
XHREF 4.5950 in.
YNREF 0.0000 in.
ZHREF 0.0000 in.
SCALE 0.0042

Data Hist. Code S&G#E
MSFC TWT 521 Booster N2B5 (E55055) 02 Feb 72 Page 209
N285 - LONGITUDINAL CHARACTERISTICS

AXIAL FORCE COEFFICIENT, CA

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL | MACH | PARAMETRIC VALUES
--- | --- | ---
O | 3.480 | BETA 0.000
△ | 4.959 |

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DATA HIST. CODE: SGE
MSFC TWT 521  BOOSTER  N285  (E55055)  02 FEB 72  PAGE 210
N2B5-LONGITUDINAL CHARACTERISTICS

LIFT-DRAG RATIO, L/D

ANGLE OF ATTACK, ALPHA, DEGREES

SYMBOL MACH PARAMETRIC VALUES

REFERENCE INFORMATION

DATA HIST. CODE  SN#E

MSFC TWT 521 BOOSTER N2B5 (E55055)  02 FEB 72  PAGE 214