### LIMITATION CHANGES

#### TO:
Approved for public release; distribution is unlimited.

#### FROM:
Distribution authorized to U.S. Gov't. agencies only; Test and Evaluation; AUG 1972. Other requests shall be referred to Air Force Flight Test Center, Edwards AFB, CA.

### AUTHORITY
AFFTC ltr 28 Mar 1978
THIS REPORT HAS BEEN DELIMITED AND CLEARED FOR PUBLIC RELEASE UNDER DOD DIRECTIVE 5200.20 AND NO RESTRICTIONS ARE IMPOSED UPON ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.
LIMITED PERFORMANCE AND FLYING QUALITIES EVALUATION OF THE F-4E WITH THE RETROFIT TWO-POSITION MANEUVERING SLAT KIT

BILLY R. BOXWELL
Project Engineer

CECIL W. POWELL
Major, USAF
Project Pilot/Officer

RUSSELL C. HUBENET
Senior, USAF
Flying Qualities Engineer

TECHNICAL REPORT NO. 72-35
AUGUST 1972

Distribution limited to 'U.S. Government agencies only
(Test and Evaluation), August 1972. Other requests
for this document must be referred to ASD/SD4T, Wright-
Patterson AFB, Ohio 45433.

AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
Qualified requesters may obtain copies of this report from the Defense Documentation Center, Cameron Station, Alexandria, Va. Department of Defense contractors must be established for DDC services, or have "need to know" certified by cognizant military agency of their project or contract.

DDC release to OTS is not authorized.

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related government procurement operation, the government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Do not return this copy. Retain or destroy.
LIMITED PERFORMANCE AND FLYING QUALITIES EVALUATION OF THE F-4E WITH THE RETROFIT TWO-POSITION MANEUVERING SLAT KIT

BILLY R. BOXWELL
Project Engineer

CECIL W. POWELL
Major, USAF
Project Pilot/Officer

RUSSELL C. HUBENET
Sergeant, USAF
Flying Qualities Engineer

PROJECT AGILE EAGLE

Distribution limited to U.S. Government agencies only (Test and Evaluation), August 1972. Other requests for this document must referred to ASD/SD4T, Wright-Patterson AFB, Ohio 45433.
FOREWORD

This report presents the results of the Air Force/McDonnell Douglas performance and flying qualities evaluation of the F-4E with the production retrofit two-position maneuvering slat kit. These tests were conducted at the McDonnell Douglas flight test facility, St. Louis, Missouri, between 30 March and 25 May 1972, and at the Air Force Flight Test Center, Edwards AFB, California, between 31 May and 22 June 1972. Testing was conducted under the authority of Headquarters Air Force Systems Command as directed by APFTC Project Directive 72-27 and ASD message R 081410Z March 1972.

This report contains the test techniques, major results, conclusions and recommendations, substantiating data, and data reduction and analysis methods. Findings of the TAC evaluation will be published by TAC under separate cover.

Pilots who participated in the test program were Major Cecil W. Powell, Lieutenant Colonel Richard E. Lawyer, and several pilots from McDonnell Douglas flight test. The two TAC flights were flown by Major M.B. Johnson (Hq TAC) and Major H.W. Dibble (Hq USAFTAWC).

Foreign announcement and dissemination by the Defense Documentation Center are not authorized because of technology restrictions of the U.S. Export Control Acts as implemented by AFR 400-10.

Prepared by:

Billy L. Boxwell
BILLY L. BOXWELL
Project Engineer

Reviewed and approved by:

James W. Wood
JAMES W. WOOD
Colonel, USAF
Commander, 6510th Test Wing

Russell C. Hubenet
RUSSELL C. HUBENET
Sergeant, USAF
Flying Qualities Engineer

Robert M. White
ROBERT M. WHITE
Brigadier General, USAF
Commander

Cecil W. Powell
CECIL W. POWELL
Major, USAF
Project Pilot/Officer
ABSTRACT

This report presents the results of the limited performance and flying qualities evaluation of the F-4E with the production retrofit two-position maneuvering slat kit. The objective of the testing was to evaluate the performance and flying qualities of the F-4E aircraft equipped with the two-position leading edge slat and to obtain data necessary to update the F-4 Flight Manual. The two-position slat test results show an increase in turning capability in most of the flight envelope compared with that of the basic F-4E, and were comparable to those obtained with the previous fixed slat configuration, Agile Eagle IV. The normal takeoff rotation technique described in the Flight Manual was considered unsatisfactory for slat-equipped aircraft. The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the F-4 aircraft slightly. Cruise data obtained during the tests show a degradation in cruise performance of approximately four percent for the retracted slat configuration and seven percent for the extended slat. Decreased static stability made precise control of angle of attack (AOA) moderately difficult during landing approaches at 19 units AOA. Rudder rolls performed at high AOA showed improved performance. Lateral-directional flying qualities in the power approach configuration were generally not as good as with the unslatted F-4E, but were satisfactory. Tests performed to evaluate the flying qualities with simulated failures in one or more slat actuators revealed minor, acceptable degradations from the flying qualities observed with the symmetric slat condition.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS AND SYMBOLS</td>
<td>vii</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>DESCRIPTION OF THE TWO-POSITION SLAT INSTALLATION</td>
<td>9</td>
</tr>
<tr>
<td>TEST AND EVALUATION</td>
<td>12</td>
</tr>
<tr>
<td>Performance Tests</td>
<td>12</td>
</tr>
<tr>
<td>Takeoff</td>
<td>12</td>
</tr>
<tr>
<td>Level Flight Accelerations</td>
<td>13</td>
</tr>
<tr>
<td>Turning Performance</td>
<td>14</td>
</tr>
<tr>
<td>Cruise Performance</td>
<td>15</td>
</tr>
<tr>
<td>Static Thrust Calibration</td>
<td>15</td>
</tr>
<tr>
<td>Flying Qualities Tests</td>
<td>15</td>
</tr>
<tr>
<td>Takeoff</td>
<td>15</td>
</tr>
<tr>
<td>Trim Changes</td>
<td>16</td>
</tr>
<tr>
<td>Maneuvering Stability</td>
<td>16</td>
</tr>
<tr>
<td>Static and Dynamic Longitudinal Stability</td>
<td>17</td>
</tr>
<tr>
<td>Transonic Speed Stability</td>
<td>18</td>
</tr>
<tr>
<td>Roll Performance</td>
<td>18</td>
</tr>
<tr>
<td>Static Directional Stability</td>
<td>19</td>
</tr>
<tr>
<td>Power Approach Configuration Evaluation</td>
<td>19</td>
</tr>
</tbody>
</table>
## Stall Approach Characteristics and Aural Tone

- Stall Warning System .................................................. 20
- Asymmetric Stall Conditions ............................................ 20
  - General ........................................................................... 20
  - Trim Changes ............................................................... 21
  - High AOA Characteristics .............................................. 21
  - Power Approach Configuration ....................................... 21

## Angle of Attack Indications .............................................. 22

## CONCLUSIONS AND RECOMMENDATIONS .............................. 23

## APPENDIX I - DATA ANALYSIS METHODS AND TEST DATA ....... 26

- Climb Potential Determination ........................................ 26
- Drag Determination ....................................................... 28
- Dynamic Longitudinal Stability Determination ..................... 31
- Maneuvering Stability Determination ................................. 31
- Roll Capability Determination ......................................... 31
- Test Data ...................................................................... 31

## APPENDIX II - TEST INSTRUMENTATION AND FLIGHT LOG .... 278

- Test Instrumentation ..................................................... 278
- Flight Log .................................................................. 280

## REFERENCES ................................................................ 284
# list of illustrations

<table>
<thead>
<tr>
<th>Figure</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>Slat Configuration</td>
<td>2-4</td>
</tr>
<tr>
<td>6</td>
<td>Inboard and Outer Wing Slat Mechanism Schematic</td>
<td>5</td>
</tr>
<tr>
<td>7-9</td>
<td>Test Airplane Loadings</td>
<td>6-7</td>
</tr>
<tr>
<td>10</td>
<td>Test Airplane Instrumentation Package</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>Test Noseboom</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>Leading Edge Slat Control Switches</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>Leading Edge Slat and Flap/Slat Switches</td>
<td>11</td>
</tr>
<tr>
<td>14</td>
<td>Drag Coefficient Correction for cg Shift</td>
<td>30</td>
</tr>
<tr>
<td>15</td>
<td>Takeoff Performance</td>
<td>32</td>
</tr>
<tr>
<td>16-34</td>
<td>Level Flight Accelerations</td>
<td>33-51</td>
</tr>
<tr>
<td>35</td>
<td>Level Flight Envelope</td>
<td>52</td>
</tr>
<tr>
<td>36-50</td>
<td>Turning Performance</td>
<td>53-68</td>
</tr>
<tr>
<td>51-54</td>
<td>Drag Polars</td>
<td>69-72</td>
</tr>
<tr>
<td>55-59</td>
<td>Cruise Performance</td>
<td>74-79</td>
</tr>
<tr>
<td>60-61</td>
<td>Static Thrust Calibration</td>
<td>80-83</td>
</tr>
<tr>
<td>62-65</td>
<td>Engine Trim Schedules</td>
<td>84-87</td>
</tr>
<tr>
<td>66-75</td>
<td>Maneuver Points</td>
<td>88-97</td>
</tr>
<tr>
<td>76-85</td>
<td>Maneuver Point Determination</td>
<td>98-107</td>
</tr>
<tr>
<td>86-99</td>
<td>Longitudinal Maneuvering Stability</td>
<td>108-121</td>
</tr>
<tr>
<td>100-111</td>
<td>Windup Turn Time History</td>
<td>122-160</td>
</tr>
<tr>
<td>112-113</td>
<td>Static Longitudinal Stability Summary</td>
<td>170-171</td>
</tr>
<tr>
<td>114-128</td>
<td>Static Longitudinal Stability</td>
<td>172-186</td>
</tr>
<tr>
<td>129-130</td>
<td>Power Approach Static Longitudinal Stability</td>
<td>187-188</td>
</tr>
<tr>
<td>131-132</td>
<td>Longitudinal Short Period Damping</td>
<td>189-190</td>
</tr>
<tr>
<td>133-141</td>
<td>Dynamic Longitudinal Stability</td>
<td>191-199</td>
</tr>
<tr>
<td>142</td>
<td>Transonic Speed Stability</td>
<td>200</td>
</tr>
<tr>
<td>143</td>
<td>Transonic Decelerating Turn</td>
<td>201</td>
</tr>
<tr>
<td>144</td>
<td>Max A/B Thrust Acceleration Time History</td>
<td>202-203</td>
</tr>
<tr>
<td>145</td>
<td>Idle Thrust Deceleration Time History</td>
<td>204-205</td>
</tr>
<tr>
<td>146</td>
<td>Roll Capability - 10,000 Feet Altitude</td>
<td>206-207</td>
</tr>
<tr>
<td>147</td>
<td>Roll Capability - 35,000 Feet Altitude</td>
<td>208-209</td>
</tr>
<tr>
<td>148</td>
<td>Low Speed Roll Capability</td>
<td>210</td>
</tr>
</tbody>
</table>
list of abbreviations and symbols

<table>
<thead>
<tr>
<th>Item</th>
<th>Definition</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/B</td>
<td>afterburning</td>
<td>- - -</td>
</tr>
<tr>
<td>AND</td>
<td>aircraft nose down</td>
<td>- - -</td>
</tr>
<tr>
<td>ANL</td>
<td>aircraft nose left</td>
<td>- - -</td>
</tr>
<tr>
<td>ANR</td>
<td>aircraft nose right</td>
<td>- - -</td>
</tr>
<tr>
<td>AOA</td>
<td>angle of attack</td>
<td>deg or units</td>
</tr>
<tr>
<td>CD</td>
<td>drag coefficient</td>
<td>dimensionless</td>
</tr>
<tr>
<td>cg</td>
<td>center of gravity</td>
<td>percent mean aerodynamic chord</td>
</tr>
<tr>
<td>CL</td>
<td>lift coefficient</td>
<td>dimensionless</td>
</tr>
<tr>
<td>CN</td>
<td>normal force coefficient</td>
<td>dimensionless</td>
</tr>
<tr>
<td>CO</td>
<td>combat configuration</td>
<td>- - -</td>
</tr>
<tr>
<td>CR</td>
<td>cruise configuration</td>
<td>- - -</td>
</tr>
<tr>
<td>D</td>
<td>drag</td>
<td>lb</td>
</tr>
<tr>
<td>EROS</td>
<td>Eliminate Range Zero System</td>
<td>- - -</td>
</tr>
<tr>
<td>EXT</td>
<td>extended</td>
<td>- - -</td>
</tr>
<tr>
<td>Fn</td>
<td>engine net thrust</td>
<td>lb</td>
</tr>
<tr>
<td>FPA</td>
<td>flightpath acceleration</td>
<td>g</td>
</tr>
<tr>
<td>g</td>
<td>acceleration of gravity</td>
<td>32.17405 ft per sec²</td>
</tr>
<tr>
<td>Item</td>
<td>Definition</td>
<td>Units</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>KIAS</td>
<td>knots indicated airspeed</td>
<td>kt</td>
</tr>
<tr>
<td>L</td>
<td>landing configuration</td>
<td>-</td>
</tr>
<tr>
<td>LWD</td>
<td>left wing down</td>
<td>-</td>
</tr>
<tr>
<td>M</td>
<td>Mach number</td>
<td>-</td>
</tr>
<tr>
<td>MAC</td>
<td>mean aerodynamic chord</td>
<td>-</td>
</tr>
<tr>
<td>MDC</td>
<td>McDonnell Douglas Corporation</td>
<td>-</td>
</tr>
<tr>
<td>MLG</td>
<td>main landing gear</td>
<td>-</td>
</tr>
<tr>
<td>n,nz</td>
<td>normal load factor</td>
<td>g</td>
</tr>
<tr>
<td>PA</td>
<td>power approach configuration</td>
<td>-</td>
</tr>
<tr>
<td>PIO</td>
<td>pilot-induced oscillation</td>
<td>-</td>
</tr>
<tr>
<td>pps</td>
<td>pulses per second (frequency)</td>
<td>-</td>
</tr>
<tr>
<td>q</td>
<td>dynamic pressure</td>
<td>1b per ft²</td>
</tr>
<tr>
<td>R/C</td>
<td>rate of climb</td>
<td>ft per min</td>
</tr>
<tr>
<td>RET</td>
<td>retracted</td>
<td>-</td>
</tr>
<tr>
<td>RWD</td>
<td>right wing down</td>
<td>-</td>
</tr>
<tr>
<td>S</td>
<td>aircraft wing area</td>
<td>530 ft²</td>
</tr>
<tr>
<td>SAS</td>
<td>stability augmentation system</td>
<td>-</td>
</tr>
<tr>
<td>T</td>
<td>absolute temperature</td>
<td>deg K</td>
</tr>
<tr>
<td>TAC</td>
<td>Tactical Air Command</td>
<td>-</td>
</tr>
<tr>
<td>TAWC</td>
<td>Tactical Air Warfare Center</td>
<td>-</td>
</tr>
<tr>
<td>TED</td>
<td>trailing edge down</td>
<td>-</td>
</tr>
<tr>
<td>TEL</td>
<td>trailing edge left</td>
<td>-</td>
</tr>
<tr>
<td>TER</td>
<td>trailing edge right</td>
<td>-</td>
</tr>
<tr>
<td>TEU</td>
<td>trailing edge up</td>
<td>-</td>
</tr>
<tr>
<td>TLF</td>
<td>thrust for level flight</td>
<td>-</td>
</tr>
<tr>
<td>TO</td>
<td>takeoff configuration</td>
<td>-</td>
</tr>
<tr>
<td>V</td>
<td>airspeed</td>
<td>kt</td>
</tr>
<tr>
<td>W</td>
<td>aircraft gross weight</td>
<td>lb</td>
</tr>
<tr>
<td>δs</td>
<td>stabilator deflection</td>
<td>deg</td>
</tr>
</tbody>
</table>
INTRODUCTION

The objective of the testing was to evaluate the performance and flying qualities of the F-4E aircraft equipped with the two-position leading edge slat and to obtain data necessary to update the F-4 Flight Manual (reference 1). Fifty-eight flights were flown accumulating 59.7 flight hours, including two qualitative flights by TAC pilots.

In 1969, in an effort to improve the air combat maneuvering capabilities of the F-4 aircraft, the McDonnell Douglas Corporation (MDC) conducted a design and flight test program to investigate increased lift potential using wing leading edge slats. A USAF/USN/USMC flight evaluation was conducted in August 1969 on a YRF-4C equipped with fixed leading edge slats (reference 2). As a result of the improved maneuvering capability, a movable slat system was proposed for production F-4E aircraft which would consist of a hydraulically-actuated, two-position mechanism designed to extend the slats when the angle of attack (AOA) reached some predetermined value.

MDC continued development, corrected the deficiencies noted in reference 2, and installed the refined slats on a production F-4E. In April 1971, October 1971, and again in December 1971, further improved versions of the fixed slat were evaluated by the USAF (references 3, 4, and 5). The optimum fixed slat design, which resulted from the above tests, was mechanized for the two-position configuration and installed on F-4E USAF S/N 66-287A (figures 1 through 6), and an evaluation was conducted by MDC and the USAF. This report presents the results of those tests.

Table I is a summary of the basic configurations flown during the test program and referred to in the text. Table II and figures 7, 8, and 9 present the test loadings that were flown.

The test airplane was a production F-4E instrumented for performance and flying qualities testing. The configuration of the airplane had not been altered except for the removal of production equipment not required in the flight test program and installation of test instrumentation equipment in its place. The radar was replaced by an instrumentation package designed and installed by MDC which contained a magnetic tape airborne data recording system and other major components. The instrumentation package can be seen in figure 10.

A test noseboom was also installed with a pitot-static head for the measurement of airspeed and altitude, and vanes to facilitate the measurement of angle of attack, angle of sideslip, and flightpath acceleration. The noseboom can be seen in figure 11.

The test aircraft required no flight restrictions other than normal Flight Manual limits, with the exception of AOA and normal acceleration which were 32 units and 80 percent of Flight Manual limits, respectively. The normal acceleration limit of 80 percent will be observed on all two-position slat equipped F-4 aircraft until the flight loads testing is completed by MDC. Normal two-position slat operation limits are described in Table I.

Figure 1  Slat Configuration (Slats Retracted)

Figure 2  Slat Configuration (Slats Extended)
Figure 3  Slat Configuration (Slats Retracted)

Figure 4  Slat Configuration (Slats Extended)
Table I

AIRCRAFT CONFIGURATIONS

<table>
<thead>
<tr>
<th>Configuration (abbreviation)</th>
<th>Thrust</th>
<th>Gear</th>
<th>Flaps&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Slat Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takeoff (TO)</td>
<td>MIL or MAX</td>
<td>DOWN</td>
<td>DOWN (30°)</td>
<td>Extended</td>
</tr>
<tr>
<td>Cruise (CR)</td>
<td>TLF</td>
<td>UP</td>
<td>UP</td>
<td>Extended or Retracted&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Combat (CO)</td>
<td>Augmented</td>
<td>UP</td>
<td>UP</td>
<td>Extended or Retracted</td>
</tr>
<tr>
<td>Power Approach (PA)</td>
<td>TLF</td>
<td>DOWN</td>
<td>DOWN (30°)</td>
<td>Extended</td>
</tr>
<tr>
<td>Landing (L)</td>
<td>IDLE</td>
<td>DOWN</td>
<td>DOWN (30°)</td>
<td>Extended</td>
</tr>
</tbody>
</table>

Notes:

1. Trailing edge flaps on two-position slat-equipped aircraft are 30 degrees TED when in the DOWN position. No intermediate position is available.

2. In the cruise and combat configurations the slats may be extended or retracted depending upon the AOA of the aircraft. The slats automatically extend when the AOA reaches 10 units and retract at 8 units. For a complete description of slat/flap control see the Description of the Two-Position Slat Installation section.

3. Speed brakes are retracted unless specifically noted otherwise.
F-4E USAF S/N 66-2879
TWO POSITION WING LEADING EDGE SLAT SCHEMATIC

Figure 6  Inboard and Outer Wing Slat Mechanism Schematic
### Table II
**LOADING SUMMARY**
**F-4E USAF S/N 66-287A**
**J79-GE-17 ENGINES**

<table>
<thead>
<tr>
<th>Loading No.</th>
<th>Engine Start Gross Weight (lbs)</th>
<th>Drag Index No.</th>
<th>Stability Index No.</th>
<th>Fuselage Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>45,276</td>
<td>3.2</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>50,702</td>
<td>36.0</td>
<td>40.0</td>
<td>EROS Pod</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>52,333</td>
<td>41.6</td>
<td>129.0</td>
<td>EROS Pod</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>

**Notes:**
1. Prefix "A" denotes asymmetric fuel load in the 370-gallon external tanks (right tank half full, left tank empty).
2. Suffix "a" denotes AIM-7 missile mounted at station 6.
   Suffix "b" denotes AIM-7 missiles mounted at stations 3 and 7.
3. These drag index numbers are valid with the leading edge slat in the retracted position. The drag index for the F-4E with the slat retracted is 3.2; this information was not available for the extended slat configuration at the time of the preparation of this report.
4. The EROS Pod on station 4 is an AIM-7 shaped container housing an airborne anti-collision system.

Figure 7 Test Airplane Loadings (Loading 1: No External Stores)
Figure 8  Test Airplane Loadings (Loading 2: 2 370-Gallon External Tanks)

Figure 9  Test Airplane Loadings (Loading 3: 2 370-Gallon External Tanks, 2 MER's, 4 Empty LAU-10's)
Figure 10  Test Airplane Instrumentation Package

Figure 11  Test Noseboom
DESCRIPTION OF THE TWO-POSITION SLAT INSTALLATION

Flight testing of the F-4 fixed leading edge slat has shown a significant improvement in aircraft maneuvering capability and handling characteristics at high angles of attack. The fixed leading edge slat was mechanized through the utility hydraulic system to be either fully extended or retracted. Production F-4 wing moldlines were altered to contain the inboard slat actuator linkage and structure necessary for slat actuation under high loads. (While the aircraft is maneuvering at high normal load factors and transonic speeds, the slats and associated linkage will be subject to high loads when in operation.) The slat actuator linkage housing and relative slat positions on the inboard and outer wing can be seen in figures 4, 5, and 6.

Rapid slat actuation is required to coordinate the slat extension and retraction with high aircraft pitch rates. Through sizing of hydraulic lines and restrictors, the slat actuation time is controlled to 0.5 seconds and 1.0 seconds extension for the outer wing and inboard wing, respectively, and 0.9 seconds retraction for both. These times are unaffected by wing loads. When not in the extended position, the inboard slat section is completely retractable. The outer wing slat section when retracted rotates slightly aft and down to a low drag position.

The two-position wing leading edge slats are positioned automatically through several slat actuation and control parameters, or they can be controlled manually. A slat position indicator is located on the lower left front panel in the cockpit. Slat and flap control switches are shown in figures 12 and 13 along with a resume of slat actuation and control.
Control Parameters
- Angle of attack
- Cockpit slat override switch
- Cockpit flap/slat switch
- Airspeed switch
- Ground safety switches

Angle of Attack Control – Slot Switch in NORM, Weight off MLG
- Slats extended at 10 units AOA
- Slats retracted at 8 units AOA
- Slats extend when flap/slat switch is positioned to OUT or OUT & DOWN
- Slats retract above 600 KCAS

Manual Control – Slot Switch in SLATS OVERRIDE
- Slats remain retracted at any AOA or any flap selection

Slat Control with Flap/Slat W/switch in OUT or OUT & DOWN
- Slats extended unless landing gear pin/flag installed, or 600 KIAS is excee-ded, or slat override is selected

Slat Control on Ground
- Power removed from flaps and slats when landing gear pin/flag installed in nosewheel well. AOA signal deacti-vated with weight on wheels.

Figure 12 Loading Edge Slat Control Switches
Figure 13  Leading Edge Slat and Flap/Slat Switches
TEST AND EVALUATION

PERFORMANCE TESTS

TAKEOFF

Tests were conducted to determine the takeoff characteristics and performance of the F-4E with the two-position slat kit installed. All performance takeoffs were recorded by Askania phototheodolite cameras from brake release through a height of approximately 200 feet. Ambient temperature, pressure, and wind speed and direction were simultaneously recorded for later data analysis.

Performance takeoffs were performed in the takeoff configuration (TO) described in table I, with maximum afterburning thrust and loading 1 (no external stores). Loading 1, which has an Eliminate Range Zero System (EROS) pod on station 4, is referred to in the text as no external stores. The pod is an AIM-7 shape weighing approximately 200 pounds and has a drag index of 1.4, both of which have negligible effect on the aircraft. With both engines operating at approximately 80 percent, brakes held, and nose gear steering engaged to insure nose gear alignment, the brakes were released and both throttles advanced to full military thrust. At this point engine speed (rpm), exhaust gas temperature, and nozzle position were checked and the throttles advanced full forward to maximum afterburning thrust. During the takeoff roll, directional control was maintained with nosewheel steering until the rudder became effective at approximately 70 KIAS.

The normal takeoff procedure outlined in the F-4E Flight Manual indicates that sufficient aft stick should be applied prior to nosewheel liftoff speed to attain the desired pitch attitude. As the nose rises, pitch attitude must be controlled to maintain 10 to 12 degrees nose up for takeoff. This technique was considered unsatisfactory for the slat-equipped F-4E: early and/or rapid aft stick movement may result in over-rotation and the stabilator contacting the runway; also, slow and/or delayed aft stick movement will result in increased takeoff ground roll. The technique determined most satisfactory for slat-equipped F-4E aircraft was as follows: at approximately 80 KIAS, aft stick was smoothly applied to attain the desired 10 to 12 degrees pitch attitude just prior to liftoff. Normal takeoff procedures for slat-equipped F-4E aircraft should be changed to reflect the results of these tests. The Normal Takeoff section of the Flight Manual pertaining to rotation technique should be revised to read as follows: (R1)²

"Aft stick should be smoothly applied at approximately 80 KIAS to attain 10 to 12 degrees pitch attitude just prior to aircraft fly-off."

The results of the takeoff tests are presented in table III and figure 15. These data were not corrected for nonstandard ambient conditions and the comparisons made with the Flight Manual were for the test day conditions.

²Boldface numerals preceded by an R correspond to the recommendation numbers tabulated in the Conclusions and Recommendations section of this report.
Table III
TAKEOFF DISTANCE COMPARISON
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Takeoff Configuration
Dry Concrete Runway
Loading 1: No External Stores
Takeoff Gross Weight: 45,000 lb

<table>
<thead>
<tr>
<th>Flight No.</th>
<th>Ambient Temperature (deg C)</th>
<th>Headwind Component (kt)</th>
<th>Distance to Liftoff (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two-Position Slat Test Aircraft</td>
</tr>
<tr>
<td>279</td>
<td>21</td>
<td>5</td>
<td>2,580</td>
</tr>
<tr>
<td>280</td>
<td>31</td>
<td>1</td>
<td>2,850</td>
</tr>
<tr>
<td>281</td>
<td>35</td>
<td>5</td>
<td>2,500</td>
</tr>
<tr>
<td>282</td>
<td>26</td>
<td>12</td>
<td>2,575</td>
</tr>
<tr>
<td>283</td>
<td>34</td>
<td>5</td>
<td>2,675</td>
</tr>
</tbody>
</table>

LEVEL FLIGHT ACCELERATIONS

Level flight accelerations were performed to determine the speed schedules that would result in the maximum rate of climb and to check the Flight Manual schedules and level acceleration data. Data were obtained at various altitudes in both maximum afterburning and military thrust.

Level flight accelerations were performed with loading 1, from near the minimum flying speed to the limit speed for the test data. The technique used was to stabilize the airplane near the minimum flying speed. The thrust setting was advanced to military thrust or maximum afterburning as desired, and the aircraft was allowed to accelerate at a constant altitude to the maximum speed at that altitude and thrust setting. The results of the level acceleration tests are presented in figures 16 through 34. A comparison of the Flight Manual level flight envelope, the flight envelope established during F-4E Category II testing (reference 6), and the flight envelope resulting from the installation of the two-position wing leading edge slat is presented in figure 35. The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the aircraft slightly. The Flight Manual should be revised to reflect the changes in the level flight envelope for F-4E aircraft equipped with the two-position slat. (R2)

The Flight Manual climb speed schedules for maximum and military thrust are in good agreement with the maximum rate of climb potential data presented in figures 20 and 22. It was interesting to note that when the aircraft was in a climb near its combat ceiling, the slats automatically extended when the AOA reached 10 units and the rate of climb increased rapidly by an additional 1,000 feet per minute.
Test day and standard day excess thrust and rate of climb potential were determined as outlined in the Climb Potential Determination section, appendix I, and in reference 7. Inflight thrust was obtained by use of a MDC computer program using established J79-GE-17 engine performance data. Test day thrust was determined by entering power lever position (military and maximum thrust only), altitude, Mach number, and free air temperature for the test condition into the program. Standardized thrust was obtained in the same manner except that standard altitude and free air temperature were used. Fuel flow data resulting from the level flight accelerations were not corrected for nonstandard test conditions.

**TURNING PERFORMANCE**

To evaluate the maneuvering capability of the test airplane, accelerating, decelerating, and thrust-limited turns were performed throughout the flight envelope of the aircraft in maximum afterburning thrust with loading 1 (no external stores). Accelerating turns were performed by banking the airplane into a turn at a constant normal load factor, at a speed where the excess thrust was positive and increasing, and allowing the airplane to accelerate to the thrust limit while holding as constant an altitude as possible. Decelerating turns were performed by banking the airplane into a turn at the completion of a level acceleration. The airplane was then turned at a constant normal load factor and altitude, and allowed to decelerate to initial stall buffet. Results of the accelerating and decelerating turns are presented in figures 36 through 49.

Maximum afterburning thrust-limited turning performance tests were conducted at 10,000, 20,000 and 35,000 feet pressure altitude with loading 1. At the test altitude an acceleration was performed to a selected Mach number. The airplane was then banked into a turn at a constant altitude while sufficient normal load factor was attained to stabilize airspeed. Approximately 360 degrees of turn were recorded during each stabilized turn. Thrust-limited turning performance data were also obtained from accelerating turns by allowing the airplane to accelerate at the test condition to near the thrust limit. These data were obtained at various cg positions from approximately 25 to 32 percent mean aerodynamic chord (MAC) and were corrected to 32.9 percent as outlined in appendix I. Thrust-limited turning performance data are presented in figure 50.

The thrust-limited turning capability presented in the F-4E Flight Manual indicates a sustained load factor higher than was demonstrated during Category II testing. These data were generated from thrust available and the airplane drag polars. Thrust-limited turning performance data obtained during the test program indicate a significant increase above the performance demonstrated during F-4E Category II testing (reference 6). The F-4E Flight Manual for slat-equipped aircraft should be revised to indicate the sustained load factor capabilities demonstrated during this test program. (R 3)

Turning performance maneuvers were also used to obtain drag data by the technique outlined above. While the aircraft decelerated or accelerated in the turn at a constant normal load factor, altitude, and thrust setting a range of lift and drag coefficients were obtained. These parameters were calculated as outlined in the drag determination section of appendix I. Drag data are presented in figures 51 through
54, appendix I. These data were also corrected to a cg of 32.9 percent MAC. Performance data to be obtained from these drag polars should be corrected to a more forward cg. The cg should be approximately 28.5 percent MAC, which would be representative of the clean airplane at combat weight (41,185 pounds). (R 4)

**CRUISE PERFORMANCE**

Level flight tests were conducted to obtain the change in cruise performance resulting from the two-position slat installation in both the retracted and extended positions. Data were obtained at various altitudes in loading 1.

Cruise performance data were obtained from stabilized conditions of airspeed and fuel flow at a constant weight-pressure ratio (airplane gross weight divided by the ratio of test atmospheric pressure to sea level standard day atmospheric pressure). A constant weight-pressure ratio \( W/\bar{a} \) was maintained by flying at successively higher altitudes to compensate for the decreasing gross weight due to fuel consumption. All data were obtained in the cruise (CR) configuration.

The results of the level flight tests are presented in figures 55 through 59. Comparisons of the test aircraft and corresponding data derived from F-4E Category II tests (reference 6) and the Flight Manual are presented in figure 55. These data show a degradation in cruise performance of up to four percent for the retracted slat and seven percent for the extended slat. The cruise performance section of the F-4 Flight Manual should be revised to reflect the cruise performance obtained during this test. (R 5)

**STATIC THRUST CALIBRATION**

A static thrust calibration was performed on 20 June 1972 at the AFFTC static thrust facility to check the installed static thrust of the J79-GE-17 engines in the test aircraft.

The gas generator data presented in figures 60 and 61 summarize the results of the static thrust calibration. With both engines operating, and with all systems on that are normally operating at takeoff, the thrust in maximum afterburning and military settings was 15,250 and 9,200 pounds per engine, respectively.

Engine speed and exhaust gas temperature operating schedules are presented in figures 62 through 65.

**FLYING QUALITIES TESTS**

**TAKEOFF**

Takeoffs were performed with several combinations of external stores, gross weight, cg position, and military or maximum afterburning thrust. The normal takeoff configuration with slats extended and flaps down 30 degrees was used for all takeoffs unless noted otherwise.

Applying full aft stick deflection prior to reaching 80 KIAS resulted in nosewheel liftoff at speeds significantly lower than obtained with the basic F-4E. The initial rotation rate was also increased.
Takeoff attitude could be attained at airspeeds that would allow liftoff at speeds too low for adequate lateral stability. Several uncommanded wing drops, similar to those reported in reference 4, occurred during the test program and were attributed to the low liftoff speeds and resulting inadequate lateral stability.

The modified takeoff technique described in the Takeoff Performance section of this report eliminated the early liftoff problem. Liftoff then occurred at a speed where lateral stability and controllability were adequate. A slight, unobjectionable forward stick deflection was needed just after liftoff to arrest rotation rate. Control forces with 3 units aircraft nose down (AND) trim were high, but not excessive during the ground run, and lightened at liftoff. Trim changes resulting from retraction of the landing gear and flaps were minor.

The external store loadings tested provided slower initial pitch rates during rotation. One takeoff performed with store loading A2 (right 370-gallon tank half full, left 370-gallon tank empty), required approximately one-half to two-thirds lateral stick deflection after liftoff to hold up the right wing.

One takeoff was made with the slats initially retracted, then allowed to extend just after liftoff. The resulting transients and trim changes were barely noticeable.

TRIM CHANGES

Trim changes resulting from actuation of the landing gear, speed brakes, flaps, and leading edge slats were evaluated. In the normal gear-down speed range, extension and retraction of the landing gear produced a negligible pitch trim change. Flap extension caused a definite, easily controlled, nose down trim change comparable to that of the basic F-4E. Speed brake actuation caused a moderate, easily controlled, nose up trim change (opposite in direction from that of the basic F-4E).

Trim changes occurring with normal slat extension and retraction were insignificant. The aircraft response to slat extension at 10 units A0A was a very slight nose down trim change. Using manual slat control to extend the slats at A0A's other than the normal operating point did not produce any unsatisfactory characteristics. Trim changes due to asymmetric slat extension are discussed in the Asymmetric Slat Conditions section of this report.

MANEUVERING STABILITY

Maneuvering stability was evaluated by performing constant Mach number windup turns over a wide range of trim Mach numbers at two altitudes. All the data presented are for the aircraft with AIM-7 stores only (loadings la and lb). The windup turns were performed by trimming the aircraft for level flight at the chosen altitude and Mach number then banking into a turn while increasing load factor. Altitude was sacrificed to maintain constant Mach number. The throttles and longitudinal trim were not moved during the maneuvers. Figures 66 through 75 show the maneuver points determined from figures 76 through 85. Figures 86 through 99 show the stick force and stabilator position data obtained during the maneuvers. The method used to determine the maneuver
For subsonic speeds at 37,000 feet altitude, windup turns performed with an aft cg position showed low or negative stability for most of the range of normal force coefficient ($C_N$) below 0.9. The effect was most noticeable in the 13 to 16 degree noseboom angle of attack range (17 to 20 units production indicator AOA). At $C_N$'s above approximately 0.9, a rapid increase in stick force per g and stabilator position per $C_N$ gradients was noted. This gradient increase was similar in nature to that reported in references 4 and 5, but reduced in effect. The aircraft's pitch response and pitch rate capability at high $C_N$'s were satisfactory, and the increased stick force and deflection needed to attain $C_N$'s greater than 0.9 provided additional security against inadvertently exceeding safe AOA limits.

The test aircraft was not fitted with a gunsight, but simulated air-to-ground and air-to-air tracking (with an unslatted F-4 target) showed that terminal tracking could be effectively accomplished up to 30 units AOA without excessive pilot workload.

STATIC AND DYNAMIC LONGITUDINAL STABILITY

Static longitudinal stability tests were performed at 10,000 and 35,000 feet altitudes with basic store loadings 1 and 3. The aircraft was trimmed for one-g level flight at a specified airspeed and altitude, then the airspeed was varied above and below the trim airspeed by performing a slow "push-pull" longitudinal control input. Throttle position and longitudinal trim position were not disturbed from their trim settings. Figures 112 and 113 show a summary of the data shown in figures 114 through 128 for the cruise and combat configurations. Power approach configuration data are shown in figures 129 and 130.

The effects of cg position and external store loadings on the static stability of the aircraft were comparable in nature to those experienced with the basic F-4E. Apparent and real static stability in the CR and combat (CO) configurations were determined by taking the slopes of the stick force and stabilator position versus $C_N$ data at the trim $C_N$ values. Store loading 1 (stability index number = 0) exhibited adequate stability, but the stability was significantly reduced by the effects of store loading 3 (stability index number = 129). Power approach configuration data for store loading 1 and a mid cg position indicate reduced stability in the 17 to 21 unit AOA range. This low static margin was noticed as difficulty in holding 19 units AOA precisely during landing approaches.

Dynamic longitudinal stability was evaluated by exciting the short-period oscillatory motion of the aircraft with a quick longitudinal control doublet or impulse input. After completing the control input, the pilot attempted to hold the stick steady in the neutral position. The aircraft's oscillatory response was computer analyzed to provide the damping ratio and damped period data shown in figures 131 and 132. Figures 133 through 141 show time histories of several of the tests.

As expected, stability augmentation system (SAS)-off oscillations had less damping than the SAS-on oscillations, and rearward cg movement reduced damping also. The period of the oscillation increased with altitude and rearward cg movement. Pilot-induced oscillations (PIO's) are
a potential problem at high speeds and low altitudes due to the low SAS-off damping, particularly with aft cg locations. No Flight Manual change is required for the slat-equipped aircraft, since there already is a NOTE describing PIO susceptibility in the Operating Limitations section of the current Flight Manual.

**TRANSONIC SPEED STABILITY**

Transonic speed stability was evaluated by trimming for level flight at approximately 0.85 Mach, then increasing the thrust to maximum afterburner and accelerating to approximately 1.2 Mach. After terminating the acceleration run, the aircraft was retrimmed for level flight, and the throttles were retarded to IDLE. During both the accelerating and decelerating runs, the pilot attempted to hold altitude constant by longitudinal control inputs. Figure 142 shows the data obtained during the level acceleration and deceleration. Figure 143 shows the transonic characteristics during high-g decelerating turns with maximum afterburning thrust. Figures 144 and 145 show time histories of the level transonic acceleration and deceleration.

Stabilator and stick force variations with Mach number were similar to those of the basic F-4E during the one-g acceleration/deceleration maneuvers. During the high-g decelerating turns, it was noted that the transonic "dig-in" characteristics of the test aircraft were much less severe than the basic F-4E's.

**ROLL PERFORMANCE**

Aileron and rudder rolls were performed at 10,000 and 35,000 feet altitude over a wide range of speeds. The maneuvers were initiated with abrupt aileron or rudder inputs from a level flight attitude or a stabilized high-g turn. The SAS was on for all tests.

Figure 146 shows roll data for the CR and CO configurations at 10,000 feet altitude. Comparable data for the basic F-4E were not available, but comments from both contractor and USAF pilots indicated that the high-AOA aileron rolling capability was slightly improved over that of the basic F-4E, while low AOA aileron roll performance was unchanged. Figures 149 and 150 show time histories of typical rolls performed at this altitude.

Roll capability at 35,000 feet is shown in figure 147 for the CR and CO configurations. Aileron roll performance at high AOA's was slightly improved, while at low and mid AOA's (below 20 units) aileron roll performance was approximately the same as that of the unslatted F-4E. Rudder rolls performed at high AOA's showed improved performance, but it was noted that rudder rolling performance decreased rapidly at lower AOA's. The variation of rudder rolling performance with angle of attack was much more noticeable than with the unslatted F-4E. Figures 151 through 153 show typical roll time histories at this altitude.

Low speed roll capability in the power approach configuration is shown in figure 148. The roll helix angle was determined by the method described in appendix I. As was noted with the CR and CO configuration roll tests, low AOA aileron roll performance was approximately the same as the unslatted aircraft's, while at higher AOA's the aileron roll performance was slightly improved. The improvement over the basic F-4E of
aileron roll performance was more noticeable in the CR and CO configuration tests than in the power approach (PA) configuration rolls. Rudder roll performance depended strongly on AOA: rolls at high AOA showed slightly increased performance; while rolls at lower AOA's did not show any increase in performance. Coordinated use of both aileron and rudder inputs gave the most favorable roll response at high AOA's. Figures 154 through 156 show typical PA configuration roll time histories.

STATIC DIRECTIONAL STABILITY

Static directional stability was evaluated by performing sideslips in the PA and CR configurations at several trim speeds at 10,000 feet altitude. The maneuvers were performed by slowly applying rudder pedal force while using lateral stick inputs to maintain a constant heading. Figures 157 through 162 show the control and attitude parameters of the aircraft plotted against sideslip angle. Static directional stability was satisfactory throughout the envelope tested, but the increased dihedral effect of the test aircraft was noticeable. Sideslips in the PA configuration caused increased difficulty in controlling AOA. A sideslip attempted while trimmed at 24 units AOA (production indicator) could not be stabilized in bank angle or AOA at sideslip angles greater than approximately +2 degrees.

POWER APPROACH CONFIGURATION EVALUATION

Power approach flying qualities were evaluated with landing gear and flaps down and slats extended. In addition, landing approaches were flown with several combinations of simulated slat and flap malfunctions. These approaches are discussed in the Asymmetric Slat Conditions section of this report.

Longitudinal flying qualities were satisfactory but were adversely affected by low static stability in the 17 to 20 units AOA range. This region of reduced stability made precise control of AOA moderately difficult during landing approaches at 19 units AOA. This difficulty would have been greater without the 16-pound longitudinal control feel system overbalance modification which had been installed in the test aircraft before the testing began. Terminating the approach with a flare to 20 to 21 units AOA was easily accomplished and resulted in reduced sink rates at touchdown.

Lateral-directional flying qualities in the PA configuration were generally not as good as those experienced with unslatted F-4E's, but were still termed satisfactory. Lateral control was adequate at 19 units AOA with either aileron or rudder inputs. Due to the increased dihedral effect of the slat-extended configuration, the test aircraft was more susceptible to roll disturbances caused by gusty crosswinds. This susceptibility to gust upsets was especially noticed just before touchdown where lateral control effectiveness was reduced by ground effect.

Figure 163 shows the approach speed data gathered during the tests. Approach speed with slats and flaps extended was approximately 7 knots higher than experienced with the unslatted aircraft. Although no landing data are included in this report, the following observations were made for the slat-equipped F-4E:

1. The aircraft had increased residual thrust during landing roll due to the lack of a BLC installation.
2. Approach speeds were higher and drag was reduced due to the lower maximum flap deflection.

These changes all tended to increase the stopping distance during landings. Landing performance tests should be conducted to insure that accurate data are presented in the Flight Manual for the slat-equipped F-4E aircraft. (R6)

STALL APPROACH CHARACTERISTICS AND AURAL TONE STALL WARNING SYSTEM

Stall approach characteristics were evaluated with several combinations of aircraft configuration, external stores, load factors, and slat conditions. Figure 164 shows a summary of the results, and figures 165 through 169 show time histories of several of the tests. The buffet onset data shown in figure 164 are incomplete because pilot comments noting buffet were not available for all the stall approaches flown. The wing rock onset data shown were obtained from the time histories of the maneuvers.

The aerodynamic stall warning characteristics of the test aircraft were generally better than those of the previously-evaluated slat configurations (references 2, 3, 4, and 5). Stall warning from wing rock or yaw oscillations, which occurred at 25 to 27 units AOA usually, was considered unreliable due to the non-repeatability of the characteristics. If the 24- to 27-unit AOA range was traversed at a moderately high pitch rate, it was possible to increase AOA to 32 units without any wing rock or directional instability. Buffet was of limited usefulness as a stall warning because of the large range between buffet onset AOA's and actual stall/loss of control AOA. The buffet levels were of lower intensity at all AOA's than those of the basic F-4E, and were mild enough not to mask the other aerodynamic stall warnings. The increase in stick force and position gradients at high Cn's, as discussed in the Maneuvering Stability section of this report, acted as an effective deterrent to exceeding safe AOA limits.

The aural tone stall warning system was scheduled by angle of attack as shown in figure 170. Because of the increased angle of attack capability of the slat-equipped aircraft, and the slightly improved aerodynamic stall warning, artificial stall warning was less critical than in the basic F-4E. The aural tone high schedule (figure 170) was defined from pilot comments obtained from previous slat tests. When considering the most favorable qualitative combination of turning performance and high angle of attack flying qualities, the 23- to 25-unit AOA range was considered the maximum maneuvering angle of attack. However, it should be noted that load factor limits of the aircraft can be attained at decreased AOA's in the low altitude regions of the flight envelope. In addition, thrust-limited turning capabilities of the aircraft were not considered in determining this maximum maneuvering AOA. The aural tone system, as presently scheduled, is effective as both a stall warning device and a maneuvering capability indicator.

ASYMMETRIC SLAT CONDITIONS

General

Several test flights were utilized to fully evaluate flying qualities with simulated failures in one or more slat actuators. All the flights

20
were flown with no external stores except the EROS pod (loading 1). The slat asymmetry referred to in the following sections is defined as both slats on one wing retracted and both slats on the opposite wing extended.

**Trim Changes**

Longitudinal trim changes accompanying asymmetric slat actuation were similar to those noted for normal symmetric slat extension. The trim change was barely perceptible both at one g and at elevated load factors. The asymmetric actuation was noted mainly as a tendency to roll into the wing with retracted slats. Little yaw resulted from asymmetric actuation at 10 units AOA.

**High AOA Characteristics**

The rolling tendency of the asymmetric slat configuration increased with angle of attack. Lateral control requirements as a function of angle of attack are shown in figure 171. At approximately 19 units AOA (production indicator), full lateral stick deflection toward the wing with extended slats was required to control bank angle. Above 19 to 20 units AOA, rudder inputs were helpful in controlling the increasing rolling tendency.

Light buffet onset was noted at the slat extension AOA during asymmetric actuation at one g. Moderate buffet was noted at 18 to 19 units AOA during one-g stall approaches. Wing rock and yaw oscillations did not occur consistently, but did sometimes begin in the AOA range of 23 to 26 units.

Windup turns were performed at 35,000 feet with the asymmetric slat extension. The general characteristics and lateral control requirements were similar to the one-g characteristics, except for the roll-off starting at 20 to 21 units AOA being more abrupt and not controllable with rudder inputs. The maneuvers were terminated when the roll-off started. Moderate buffet onset was at 16 to 17 units AOA. Dig-in characteristics during high-g transonic decelerations were less severe than those experienced with the basic F-4E and comparable to the symmetric slat condition characteristics.

**Power Approach Configuration**

A 19-unit AOA approach was flown with the asymmetric slat condition and gear and flaps down. Longitudinal controllability was similar to that noted during normal symmetric slat approaches in that holding 19 units AOA precisely was moderately difficult. Lateral-directional controllability was sufficient at 19 units AOA. Approach speed with the asymmetric slats was 4 to 5 knots higher than the normal symmetric slat approach speed.

One 19-unit approach was flown with gear and flaps down and all slats retracted. Buffet intensity was noticeably higher, but angle of attack control was easier than with the slats extended. Lateral and longitudinal controllability was sufficient throughout the approach. Approach speed at 19 units AOA was approximately the same as with extended slats.

Two approaches were flown with normal slat extension and retracted flaps. Pilot comments indicate increased workload and difficulty in controlling sink rate. Approach speed was increased by 15 to 20 knots.
One approach at 19 units AOA was flown with both slats and flaps retracted. Lateral controllability was poor; the ailerons were not effective, and rudder inputs were necessary for adequate roll response. Approach speed was approximately 20 knots above the normal slats out, flaps down speed.

Table IV summarizes the results of the different slat/flap combinations tested. This information should be included in the Flight Manual for slat-equipped aircraft. (R7)

ANGLE OF ATTACK INDICATIONS

An inflight, out-of-ground-effect calibration of the production angle of attack indicator versus noseboom angle of attack is shown in figure 172. The shift in calibration between the PA and CR configurations is similar to that of the basic F-4E, and is attributed to the airflow disturbance caused by the nose landing gear door when the gear is extended. Slat position appeared to have no effect on the calibration.

<table>
<thead>
<tr>
<th>Slat Position</th>
<th>Flap Position</th>
<th>Approximate Change in Approach Speed</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right - retracted</td>
<td>30° down</td>
<td>+4 to 5 kt</td>
<td>Lateral control adequate.</td>
</tr>
<tr>
<td>Left - extended</td>
<td>30° down</td>
<td>None</td>
<td>Buffet intensity higher,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AOA control easier.</td>
</tr>
<tr>
<td>Retracted</td>
<td>30° down</td>
<td>None</td>
<td>Sink rate hard to control.</td>
</tr>
<tr>
<td>Extended</td>
<td>Retracted</td>
<td>+15 to 20 kt</td>
<td>Poor lateral controllability.</td>
</tr>
<tr>
<td>Retracted</td>
<td>Retracted</td>
<td>+20 kt</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

1Increase in approach speed above a normal flaps down (30 degrees), slat extended approach at 19.2 units AOA.

2All approaches were flown at 19 units AOA.
CONCLUSIONS AND RECOMMENDATIONS

The two-position slat test results show an increase in turning capability in the subsonic portion of the flight envelope compared with that of the basic F-4E, and were comparable to those obtained with the previous fixed slat configuration, Agile Eagle IV. Flying qualities of the slatted F-4E were basically comparable to those of the unslatted aircraft. Most noticeable in the flying qualities area was the increased maneuvering capability at high angles of attack.

The takeoff rotation technique described in the Flight Manual was considered unsatisfactory for the slat-equipped F-4E: early and/or rapid aft stick movement may result in overrotation and the stabilator contacting the runway; slow and/or delayed aft stick movement will result in increased takeoff ground roll.

1. The Normal Takeoff section of the Flight Manual pertaining to rotation technique should be revised to read as follows (page 12):

   "Aft stick should be smoothly applied at approximately 80 KIAS to attain 10 to 12 degrees pitch attitude just prior to aircraft fly-off."

The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the aircraft slightly.

2. The Flight Manual should be revised to reflect the changes in the level flight envelope for F-4E aircraft equipped with the two-position slat (page 13).

   Thrust-limited turning performance obtained during this test program indicated a significant increase above that demonstrated during F-4E Category II testing (reference 6).

3. The F-4E Flight Manual for slat-equipped aircraft should be revised to indicate the sustained load factor capabilities demonstrated during this test program (page 14).

   The drag data presented were corrected to a cg position of 32.9 percent MAC.

4. Performance data to be obtained from these drag polars should be corrected to a more forward cg. This cg should be approximately 28.3 percent MAC, which would be representative of the clean airplane at combat weight (41,185 pounds) (page 15).

   The cruise data obtained during the tests show a degradation in cruise performance of approximately four percent for the retracted slat configuration and seven percent for the extended slat.

5. The cruise performance section of the F-4 Flight Manual should be revised to reflect the cruise performance obtained during this test program (page 15).
The aircraft pitch response and pitch rate capability at high $\theta_N$'s were satisfactory, and the increased stick force and deflection needed to attain $\theta_N$'s greater than 0.9 provided additional security against inadvertently exceeding safe AOA limits.

Simulated air-to-air tracking tests showed that terminal tracking could be effectively accomplished up to 30 units AOA without excessive pilot workload.

Static and dynamic longitudinal stability in the cruise and combat configurations was comparable to that of the unslatted F-4E. However, in the power approach configuration with no external stores and a mid cg position reduced static stability was noted in the 17 to 21 units AOA range. This region of reduced stability made precise control of AOA moderately difficult during landing approaches at 19 units AOA.

Transonic "dig-in" characteristics of the slat equipped test aircraft were much less severe than those of the basic F-4E.

The high-AOA aileron rolling capability was slightly improved over the basic F-4E, while low AOA aileron roll performance was unchanged. Rudder rolls performed at high AOA's showed improved performance, but reduced rapidly at lower AOA's. Coordinated use of both aileron and rudder inputs gave the most favorable roll response at high AOA.

Static directional stability was satisfactory throughout the flight envelope tested, but the increased dihedral effect of the test aircraft was noticeable.

Lateral-directional flying qualities in the power approach configuration were generally not as good as experienced with the unslatted F-4E, but were still termed satisfactory.

The F-4E aircraft equipped with the two-position leading edge slat had increased residual thrust during the landing roll due to the deleted BLC system. This, combined with the higher approach speeds and reduced drag caused by the lower maximum flap deflection, would tend to increase the stopping distance during landing.

6. Landing performance tests should be conducted to insure that accurate data are presented in the Flight Manual for the slat-equipped F-4E aircraft (page 20).

The aerodynamic stall warning characteristics of the test aircraft were generally better than those of the previously evaluated slat configurations, as well as those of the unslatted aircraft.

Tests performed to evaluate the F-4E flying qualities with simulated failures in one or more slat actuators revealed only minor, acceptable degradations from the symmetric slat condition characteristics. Trim changes with asymmetric slat actuation were barely perceptible. The asymmetric actuation was noted mainly as a tendency to roll into the wing with retracted slats. "Dig-in" characteristics during high-g transonic decelerations were less severe than experienced with the basic F-4E and comparable to the symmetric slat extension characteristics.
A 19-unit AOA approach was flown with the asymmetric slat condition and gear and flaps down. Longitudinal controllability was similar to that noted during normal symmetric slat approaches in that holding 19 units AOA precisely was moderately difficult. Lateral-directional controllability was sufficient at 19 units AOA. Approach speed with the asymmetric slats was 4 to 5 knots higher than the normal symmetric slat approach speed.

One 19-unit approach was flown with gear and flaps down and all slats retracted. Buffet intensity was noticeably higher, but angle of attack control was easier than with the slats extended. Lateral and longitudinal controllability was sufficient throughout the approach. Approach speed at 19 units AOA was approximately the same as with extended slats.

Two approaches were flown with normal slat extension and retracted flaps. Pilot comments indicate increased workload and difficulty in controlling sink rate. Approach speed was increased by 15 to 20 knots.

One approach at 19 units AOA was flown with both slats and flaps retracted. Lateral controllability was poor; the ailerons were not effective, and rudder inputs were necessary for adequate roll response. Approach speed was approximately 20 knots above the normal slats out, flaps down speed.

7. The information contained in table IV of this report should be included in the Flight Manual for slat-equipped F-4E aircraft (page 22).
APPENDIX I
DATA ANALYSIS METHODS AND TEST DATA

CLIMB POTENTIAL DETERMINATION

Test day excess thrust was obtained during level accelerations and turning performance tests. It was then standardized and converted to rate of climb potential, or specific excess power, to enable the thrust-limited performance of the aircraft to be evaluated.

The method used to calculate rate of climb potential was based on the flightpath accelerometer (FPA) measurement. Data obtained from the FPA was very useful in yielding consistent results. To obtain climb potential the following equation was used:

\[ \frac{dH}{dt} + \frac{V}{g} \frac{dV}{dt} = \frac{V}{W} \left( \frac{F_n - D}{W} \right) \]

where

\[ \begin{align*}
R/C & = \text{test day rate of climb potential} \\
\frac{dH}{dt} & = \text{rate of change of altitude} \\
g & = \text{acceleration of gravity} \\
\frac{dV}{dt} & = \text{acceleration along the flightpath} \\
V & = \text{true airspeed} \\
W & = \text{airplane gross weight} \\
F_n & = \text{net thrust} \\
D & = \text{net drag} \\
\frac{F_n - D}{W} & = \text{specific excess thrust} = \text{FPA}
\end{align*} \]

using the FPA to obtain R/C results in the following

\[ \frac{R/C}{W} \]

where

\[ \begin{align*}
R/C & = \text{test day rate of climb potential in \text{ft/min}} \\
V & = \text{true airspeed in knots}
\end{align*} \]
Rate of climb potential calculated from test conditions was corrected for nonstandard temperature effects on velocity and thrust. The temperature effect on velocity correction to rate of climb potential was obtained from the following equation:

\[ V_s = V_t \sqrt{\frac{T_s}{T_t}} \]

where subscripts denote standard and test velocities and temperatures, respectively. The correction to rate of climb potential for nonstandard temperature effects on velocity is therefore

\[ \Delta R/C_{vel} = \left( \frac{T_s}{T_t} - 1 \right) V \times FPA \]

The thrust correction to rate of climb potential for nonstandard temperature is

\[ \Delta R/C_{thrust} = \frac{V_s}{W} (F_{n_s} - F_{n_t}) \]

where

- \( V_s \) = standard day true airspeed
- \( W \) = airplane gross weight
- \( F_{n_s} \) = standard day net thrust
- \( F_{n_t} \) = test day net thrust

Since aircraft drag for a given attitude and Mach number is a function of both normal acceleration and aircraft gross weight, a correction must be made to compensate for nonstandard weight and normal acceleration. Using the test day rate of climb potential equation and evaluating it for both the test day drag, \( D_t \), and the standard day drag, \( D_s \), yields the rate of climb potential correction for drag.

\[ R/C_{drag} = \frac{V_s}{W} (D_t - D_s) \]

where

\[ D = C_D (q) S \]
\[ C_D = f(C_N, M) \]
\[ C_N = \frac{N_z S}{q S} \]
\[ C_{N_t} = \frac{N_z W_t}{q S} \]
q = dynamic pressure
S = aircraft wing area
Nz = normal load factor
W = aircraft gross weight
Cd = drag coefficient
s = standard day
t = test day

These relationships can be determined from the aircraft drag polars which, for this evaluation, were obtained from wind tunnel measurements. It is acknowledged that the absolute magnitudes of these drag polars may not be exactly representative of the test aircraft; however, the accuracy of these corrections is enhanced by using only small incremental changes on the drag polar.

A momentum correction to rate of climb potential was obtained using the following equation:

\[ \Delta R/C_m = V_s \left( \frac{F_n - D_s}{W_s} \right) - V_s \left( \frac{F_n - D_s}{W_t} \right) \]

Finally, corrected rate of climb potential was obtained by combining the above corrections with test day climb potential.

\[ R/C_{corrected} = R/C + \Delta R/C_{vel} + \Delta R/C_{thrust} + \Delta R/C_{drag} + \Delta R/C_m \]

The complete derivation of the corrections used to obtain standard rate of climb potential can be found in reference 7.

**DRAG DETERMINATION**

Drag data for the test aircraft were obtained during turning performance maneuvers. Lift coefficient was calculated using the following equation.

\[ C_L = C_N / \cos \alpha \]

where

- \( C_L \) = lift coefficient
- \( \alpha \) = angle of attack
\[ C_N = \frac{(nW)}{(qS)} \]

\( n \) = normal load factor
\( W \) = aircraft gross weight
\( q \) = dynamic pressure
\( S \) = aircraft wing area

Drag for the test aircraft was calculated using the FPA and thrust available.

\[ D = F_n - FPA \cdot W \]

where

\( F_n \) = thrust available
\( FPA \) = flightpath acceleration
\( W \) = aircraft gross weight

and

\[ C_D = \frac{D}{qS} \]

The drag coefficient was then corrected to a reference cg location of 32.9 percent MAC. This correction was established using figure 14 and the following equation.

\[ C_{D_{\text{corrected}}} = C_D + \left( \frac{\Delta C_D}{\Delta cg} \right) \Delta cg \]

where

\( C_D \) = drag coefficient at test cg position
\( \Delta C_D/\Delta cg \) = obtained from figure 173 at the test CL
\( \Delta cg \) = cg_{\text{test}} - 32.9 percent
MODEL F-4E WITH WING, LEADING EDGE SLATS
INCREMENTAL DRAG COEFFICIENT PER PERCENT C.G. SHIFT
COMBAT CONFIGURATION

NOTE:
DATA OBTAINED FROM MC DONNELL DOUGLAS

Figure 14: Drag Correction for C.G. Shift
DYNAMIC LONGITUDINAL STABILITY DETERMINATION

The damping ratios and damped periods shown in the short period damping data were determined by a computer program that matched the aircraft response to an ideal second order oscillatory response. The damping ratio and damped period were extracted from the equation used to generate the matching second-order oscillation.

MANEUVERING STABILITY DETERMINATION

Maneuver points were determined from the windup turns performed by the following method:

1. Slopes of the longitudinal stick force ($F_s$) versus load factor ($g$) and stabilator position ($\delta_S$) versus normal force coefficient ($C_N$) were taken at several $C_N$ values. These slopes were taken from data at both forward and aft cg locations and approximately equal altitudes, Mach numbers, and gross weights.

2. The slopes were plotted versus cg location, and straight lines were faired through points of equal $C_N$ values. The intersection of the extrapolated straight lines and the slope = 0 line provided the cg location at which the slopes were reduced to zero. The cg position at which $dF_s/dg = 0$ was called the apparent maneuver point, and the cg position for $d\delta_S/dC_N = 0$ was the maneuver point.

3. The maneuver points were plotted versus $C_N$ for the several speeds and altitudes tested.

ROLL CAPABILITY DETERMINATION

Time-to-bank data were measured from the time point at which the initial control deflection occurred. Roll helix angle was calculated for the low speed roll data by the following formula:

$$\text{roll helix angle} = \frac{pb}{2V}$$

where

$\text{p} =$ average roll rate for the initial 30 degrees of bank, found by taking $30^\circ/(t_{30} \times 57.3)$ in radian/sec

$\text{b} =$ aircraft wing span in ft

$\text{V} =$ calibrated airspeed in ft/sec

TEST DATA
Figures 15 Through 172
### F-4E USAF S/N 66-287A

**Loadings:**
- 1a: FWD/AFT AIM-7's
- 1b: FWD/AFT AIM-7's

### Gross Weight (LB)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Gross Wt (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>44,700</td>
</tr>
<tr>
<td>□</td>
<td>44,200</td>
</tr>
<tr>
<td>△</td>
<td>44,000</td>
</tr>
<tr>
<td>△</td>
<td>43,900</td>
</tr>
<tr>
<td>△</td>
<td>43,700</td>
</tr>
<tr>
<td>△</td>
<td>43,600</td>
</tr>
<tr>
<td>△</td>
<td>43,500</td>
</tr>
<tr>
<td>△</td>
<td>43,700</td>
</tr>
<tr>
<td>□</td>
<td>43,400</td>
</tr>
<tr>
<td>□</td>
<td>43,300</td>
</tr>
<tr>
<td>□</td>
<td>43,500</td>
</tr>
<tr>
<td>□</td>
<td>43,600</td>
</tr>
<tr>
<td>□</td>
<td>43,700</td>
</tr>
<tr>
<td>□</td>
<td>43,500</td>
</tr>
<tr>
<td>□</td>
<td>43,100</td>
</tr>
</tbody>
</table>

### Max A/B Thrust

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Gross Wt (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>43,500</td>
</tr>
<tr>
<td>□</td>
<td>43,600</td>
</tr>
<tr>
<td>□</td>
<td>43,500</td>
</tr>
<tr>
<td>□</td>
<td>43,900</td>
</tr>
<tr>
<td>□</td>
<td>43,400</td>
</tr>
<tr>
<td>□</td>
<td>43,300</td>
</tr>
<tr>
<td>□</td>
<td>43,500</td>
</tr>
<tr>
<td>□</td>
<td>43,700</td>
</tr>
<tr>
<td>□</td>
<td>43,500</td>
</tr>
<tr>
<td>□</td>
<td>43,100</td>
</tr>
</tbody>
</table>

**Note:** Takeoff technique used: Full aft stick deflection prior to reaching 80 KIAS.

**Figure 15:** Nosewheel Lift-off Speed

- Basic F-4E at 44,000 LB Gross Weight (Reference 9)

- Aircraft CG Position (Pct MAC)
Figure 17: Fuel Flow
### MILITARY THRUST - CRUISE CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-BURN</th>
<th>ALTITUDE (FT)</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>241-9</td>
<td>10,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>256-4</td>
<td>10,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>233-11</td>
<td>20,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>233-9</td>
<td>20,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>253-3</td>
<td>25,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>252-15</td>
<td>35,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>252-11</td>
<td>35,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>247-4</td>
<td>36,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>236-7</td>
<td>40,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>236-6</td>
<td>40,000</td>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

**Note:** Data obtained from level accelerations.
### Table: Military Thrust-Cruise Configuration

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-Run</th>
<th>Altitude (FT)</th>
<th>Slats</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D )</td>
<td>241-9</td>
<td>10,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>( D )</td>
<td>256-4</td>
<td>10,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>( D )</td>
<td>233-11</td>
<td>20,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>( D )</td>
<td>233-9</td>
<td>20,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>( D )</td>
<td>233-3</td>
<td>25,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>( D )</td>
<td>232-15</td>
<td>35,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>( D )</td>
<td>232-11</td>
<td>35,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>( D )</td>
<td>247-4</td>
<td>35,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>( D )</td>
<td>236-7</td>
<td>40,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>( D )</td>
<td>236-6</td>
<td>40,000</td>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

**Note:** Data obtained from level accelerations.

---

**Figure G: Fuel Flow**

- **X-axis:** Mach Number
- **Y-axis:** Total Fuel Flow (lbs per hr)
- **Levels:**
  - 10,000 FT
  - 20,000 FT
  - 25,000 FT
  - 35,000 FT
  - 36,000 FT
  - 40,000 FT
F-4E USAF S/N 66-2874
J79-GE-17 ENGINES
MAXIMUM THRUST-COMBAT CONFIGURATION
GROSS WEIGHT 41,185 LB
LOADING: NO EXTERNAL STORES

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>ALTITUDE (FT)</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>279-3</td>
<td>5,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>□</td>
<td>282-3</td>
<td>10,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>□</td>
<td>285-3</td>
<td>20,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>▲</td>
<td>247-5</td>
<td>36,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>▲</td>
<td>254-5</td>
<td>36,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>▽</td>
<td>246-6</td>
<td>40,000</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

NOTE: DATA OBTAINED FROM LEVEL ACCELERATIONS.
F-4E USAF S/N 66-2879
F-4B USAF S/N 66-2879

J79-GE-17 ENGINES

MAXIMUM THRUST—COMBAT CONFIGURATION

GROSS WEIGHT 41,856 LB

LOADING II NO EXTERNAL STORES

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>ALTITUDE (FT)</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>279-3</td>
<td>10,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>O</td>
<td>282-3</td>
<td>10,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>O</td>
<td>283-3</td>
<td>20,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>A</td>
<td>247-5</td>
<td>30,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>O</td>
<td>254-5</td>
<td>36,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>O</td>
<td>246-6</td>
<td>40,000</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

NOTE: DATA OBTAINED FROM LEVEL ACCELERATIONS.
F-4E USAF S/N 66-287A
J79-GE-17 ENGINES
MILITARY THRUST - CRUISE CONFIGURATION
GROSS WEIGHT 41,655 LB
LOADING 1: NO EXTERNAL STORES

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>ALTITUDE (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>241-9</td>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td>233-11</td>
<td>20,000</td>
<td></td>
</tr>
<tr>
<td>253-3</td>
<td>25,000</td>
<td></td>
</tr>
<tr>
<td>232-15</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>247-4</td>
<td>35,000</td>
<td></td>
</tr>
<tr>
<td>236-7</td>
<td>40,000</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: DATA OBTAINED FROM LEVEL ACCELERATIONS.

SLATS RETRACTED

Figure 22: Climb Potential
F-4E USAF S/N 66-287A
J79-GE-11 Engines
Military Thrust-Cruise Configuration
Gross Weight 41,850 lb
Loading I: No External Stores

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>ALTITUDE(FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>241-9</td>
<td>10,000</td>
</tr>
<tr>
<td>O</td>
<td>233-11</td>
<td>20,000</td>
</tr>
<tr>
<td>O</td>
<td>253-3</td>
<td>25,000</td>
</tr>
<tr>
<td>V</td>
<td>232-18</td>
<td>35,000</td>
</tr>
<tr>
<td>D</td>
<td>247-4</td>
<td>36,000</td>
</tr>
<tr>
<td>O</td>
<td>236-7</td>
<td>40,000</td>
</tr>
</tbody>
</table>

Note: Data obtained from level accelerations.

Slats Retracted

Figure 23. Excess Thrust
E-4B USAF S/N 66-287A
J79-GE-17 ENGINES
MILITARY THRUST - CRUISE CONFIGURATION
GROSS WEIGHT 41,555 LB
LOADING 1: NO EXTERNAL STORES

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>EIGHT-BUN</th>
<th>ALTITUDE(FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>255-4</td>
<td>10,000</td>
</tr>
<tr>
<td>A</td>
<td>233-9</td>
<td>20,000</td>
</tr>
<tr>
<td>D</td>
<td>232-11</td>
<td>30,000</td>
</tr>
<tr>
<td>O</td>
<td>238-6</td>
<td>40,000</td>
</tr>
</tbody>
</table>

NOTE: DATA OBTAINED FROM LEVEL ACCELERATIONS

SLATS EXTENDED

Figure 24. Climb Potential
F-4E USAF S/N 66-2874
J79-GE-17 Engines
Military Thrust - Cruise Configuration
Gross Weight 41,850 lb.
Loading 1. No External Stores

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>ALTITUDE(FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>256-4</td>
<td>10,000</td>
</tr>
<tr>
<td>D</td>
<td>233-9</td>
<td>20,000</td>
</tr>
<tr>
<td>D</td>
<td>232-11</td>
<td>35,000</td>
</tr>
<tr>
<td>0</td>
<td>236-6</td>
<td>40,000</td>
</tr>
</tbody>
</table>

Note: Data obtained from level accelerations.

Figure 25. Excess Thrust
F-4E USAF S/N 66-2874
J79-GE-17 ENGINES
MAXIMUM THRUST - COMBAT CONFIGURATION
GROSS WEIGHT - 42,568 LB
LOADING: NO EXTERNAL STORES
ALTITUDE - 15,000 FT

SYMBOLO FLIGHT-RUN THRUST SLOTS
0 279-3 MAXIMUM RETRACTED

NOTE: DATA OBTAINED FROM LEVEL ACCELERATIONS.

THRUST AVAILABLE
THRUST REQUIRED

Figure 26: NET THRUST
**F-4B USN S/N 66-267A**

**J79-GE-17 Engines**

**Combat and Cruise Configuration:**
- Gross weight 4,650 lb
- Loading: 1
- No External Stores
- Altitude: 10,000 ft

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>THRUST</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>282-3</td>
<td>MAXIMUM</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>0</td>
<td>241-3</td>
<td>MILITARY</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>0</td>
<td>256-4</td>
<td>MILITARY</td>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

**Note:** Data obtained from level accelerations.

---

**Figure 27:**

**Thrust Available**
- MAX
- MIL

**Thrust Required**
- MAX
- MIL
F-4E USAF S/N 66-2878
770-GE-17 ENGINES

COMBAT AND CRUISE CONFIGURATION
GROSS WEIGHT 41,125 LB
LOADING I: NO EXTERNAL STORES
ALTITUDE 20,000 FT

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT - RUN</th>
<th>THRUST</th>
<th>SLOTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>◆</td>
<td>280-3</td>
<td>MAXIMUM</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>◆</td>
<td>233-11</td>
<td>MILITARY</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>△</td>
<td>233-9</td>
<td>MILITARY</td>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

Note: Data obtained from level accelerations.

![Graph of Thrust Available vs. Mach Number]

![Graph of Thrust Required vs. Mach Number]
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Military Thrust - Cruise Configuration
Gross Weight 41,855 lb
Loading I: No External Stores
Altitude 25,000 ft

Symbol | Flight Run | Slats
---|---|---
0 | 253 - 3 | Retracted

Note: Data obtained from level accelerations.

Figure 29: Net Thrust
F-4E USAF S/N 66-287A; J79-GE-17 Engines
Military Thrust - Cruise Configuration
Gross Weight 41,065 lb
Loading: No External Stores
Altitude: 35,000 ft

Symbol | Flight-RUN | Slats
--------|-------------|---------
D       | 232-11      | Extended
V       | 232-15      | Retracted

Note: Data obtained from level accelerations.

Figure 30: Net Thrust
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Maximum Thrust-Combat Configuration
Gross Weight 41,835 lb.
Loading 1: No External Stores
Altitude 36,000 ft

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>THRUST</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ</td>
<td>247-5</td>
<td>Maximum</td>
<td>Retracted</td>
</tr>
<tr>
<td>0</td>
<td>254-5</td>
<td>Maximum</td>
<td>Extended</td>
</tr>
</tbody>
</table>

Note: Data obtained from level accelerations.
F-4E USAF S/N 66-287A
J79-GE-17 Engines
MILITARY THRUST - CRUISE CONFIGURATION
GROSS WEIGHT 41,185 Lb.
LOADING 1: NO EXTERNAL STORES
ALTITUDE 36,000 FT.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>247-4</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

NOTE: DATA OBTAINED FROM LEVEL ACCELERATIONS.

**Figure 32: Net Thrust**

- THRUST AVAILABLE
- THRUST REQUIRED
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Maximum Thrust-Combat Configuration
Gross Weight: 41,000 lb
Loading: 11. No External Stores
Altitude: 40,000 ft

Symbol: 0
Flight Run: Z46-6
Slat: Retracted

Note: Data obtained from level accelerations.

Figure 53. Net Thrust


**F-4E USAF S/N 66-2874**

**J79-GE-17 ENGINES**

**MILITARY THRUST - CRUISE CONFIGURATION**

**GROSS WEIGHT** 41,185 LB

**LOADING** 11% EXTERNAL STORES

**ALTITUDE** 40,000 FT

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT-RUN</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>236-6</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>0</td>
<td>236-7</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

**NOTE:** DATA OBTAINED FROM LEVEL ACCELERATIONS

**Figure 34: Net Thrust**
F-4E USAF S/N 66-287A
J79-GE-17 ENGINES
COMBAT AND CRUISE CONFIGURATION

MILITARY THRUST

SYMBOL

SLATS

0 RETRACTED

0 EXTENDED

NOTE:
1. SYMBOLS DENOTE TEST DATA.
2. DASHED LINES DENOTE FLIGHT MANUAL DATA - WITHOUT SLATS.

MAXIMUM AFTERBURNING THRUST

LOADING (4) AIM-7E

LOADING 1

LOADING (4) AIM-7E

400 KIAS - AUTOMATIC SLAT RETRACTION

FLIGHT 35 - LEVEL FLIGHT ENVELOPE
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Maximum Thrust - Combat Configuration
Gross Weight 41,852 lb
Loading 1: No External Stores
Altitude 10,000 ft

Slats Extended

Note:
Fairings derived from Figure 43.

Figure 36 Climb Potential
F-4E USAF S/N 66-2879
J79-GE-17 ENGINES

MUM THRUST - COMBAT CONFIGURATION
LOADING: 1 NO EXTERNAL STORES
WEIGHT: 41,106 LB. ALTITUDE: 20,000 FT.

FIGURE 37: CLIMB POTENTIAL
F-4E USAF S/N 74-2874
U79-GE-17 ENGINES

M Thrust - Combat Configuration

Wing 1: No External Stores

GHT 41,185 lb
Altitude 20,000 ft
F-4E USAF S/N 66-2679
JT9D-GE-17 ENGINES
MAXIMUM THRUST - COMBAT CONFIGURATION
LOADING 1: NO EXTERNAL STORES
GROSS WEIGHT 41,185 LB  ALTITUDE 55,000 FT

SLATS RETRACTED

NOTE:
FAIRINGS DERIVED FROM FIGURE 47.

Figure 40: Supersonic Climb Potential
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Maximum Thrust - Combat Configuration
Loading 1: No External Stores
Gross Weight 41,185 lb
Altitude 35,000 ft

Slats Extended

Note:
Fairings derived from Figure 49.

Figure 42. Supersonic Climb Potential
F-4E USAF S/N 66-2879
J79-GE-17 ENGINES

Maximum Thrust - Combat Configuration
Loadings 1: No External Stores
Altitude 10,000 ft.

SLATS EXTENDED

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Mach No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>0.90</td>
</tr>
<tr>
<td></td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>0.70</td>
</tr>
</tbody>
</table>

Note:
Points crossplotted from fairings, Figure 36.

Figure 43: Generalized Thrust-Limited Performance
F-4E USAF S/N 66-2874
JT9-GE-17 ENGINES
MAXIMUM THRUST-COMBAT CONFIGURATION
LOADING I: NO EXTERNAL STORES
ALTITUDE 20,000 FT

SLATS RETRACTED

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>MACH NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>.70</td>
</tr>
<tr>
<td>□</td>
<td>.75</td>
</tr>
<tr>
<td>○</td>
<td>.80</td>
</tr>
<tr>
<td>△</td>
<td>.85</td>
</tr>
<tr>
<td>Δ</td>
<td>.90</td>
</tr>
<tr>
<td>⊖</td>
<td>.95</td>
</tr>
<tr>
<td>O</td>
<td>.98</td>
</tr>
<tr>
<td>○</td>
<td>1.00</td>
</tr>
</tbody>
</table>

NOTE:
POINTS CROSSPLOTTED FROM FAIRINGS, FIGURE 37.

DATA OBTAINED FROM LEVEL ACCELERATIONS
DATA OBTAINED FROM STABILIZED TURNS
DATA OBTAINED FROM DECELERATING TURNS

Fig. 44. GENERALIZED THRUST-LIMITED PERFORMANCE
F-4E USAF 5/N 66-287A
J79-GE-17 ENGINES

Maximum Thrust—Combat Configuration
Loading 1: No External Stores
Altitude 20,000 FT

SLATS EXTENDED

NOTE:
Points crossplotted from
fairings, Figure 38.

FIGURE 45: GENERALIZED THRUST—LIMITED PERFORMANCE
F-4E USAF S/N 66-287A
J79-GE-17 ENGINES
MAXIMUM THRUST-COMBAT CONFIGURATION
LOADING 1: NO EXTERNAL STORES
ALTITUDE 35,000 FT

SLATS RETRACTED

NOTE:
Points crossplotted from fairings; Figure 39.

DATA OBTAINED FROM LEVEL ACCELERATIONS
DATA OBTAINED FROM STABILIZED TURNS
DATA OBTAINED FROM DECELERATIVE TURNS

Symbol  Mach No.
   O    .70
   □   .75
   ◇   .80
   △   .85
   □   .90
   △   .95
   O    1.00
   O    1.05

Figure 46: Generalized Thrust-Limited Performance
F-4E USAF S/N 64-2674
J79-GE-17 ENGINES
MAXIMUM THRUST-COMBAT CONFIGURATION
LOADING: 1: NO EXTERNAL STORES
ALTITUDE 35,000 FT

SLATS RETRACTED

DATA OBTAINED FROM LEVEL ACCELERATION
DATA OBTAINED FROM STABILIZED TURN
DATA OBTAINED FROM DECELERATIVE TURN

CORRECTED EXCESS THRUST - $F_{ex}$ $\times 10^{-3}$ (LB)

SYMBOLS: MACH NO.

1.5
1.4
1.3
1.6
1.5
1.7
1.8
1.9
2.0
2.1

NOTE:
POINTS CROSSPLOTTED FROM FAIRINGS, FIGURE 40.

FIGURE 47: GENERALIZED THRUST-LIMITED PERFORMANCE
F-4E USAF S/N 64-2879
J79-GE-17 ENGINES
MAXIMUM THRUST-COMBAT CONFIGURATION
LOADING: NO EXTERNAL STORES
ALTITUDE 35,000 FT

SLATS EXTENDED

CORRECTED EXCESS THRUST - F Brick \( S_{th} \times 10^{-3} (lb) \)

MACH NO.

DATA OBTAINED FROM LEVEL ACCELERATIONS
DATA OBTAINED FROM SIMULATED TURNS
DATA OBTAINED FROM DECCELERATING TURNS

SYMBOL

Note:
Points crossplotted from fairings, Figure 41.

Figure 48: Generalized Thrust-Limited Performance
F-4E USAF S/N 66-287A
U79-GE-17 ENGINES
Maximum Thrust-Combat Configuration
Loading, 11 No. External Stores
Altitude 35,000 FT

Slats Extended

Note:
Points crossplotted from
fairings, Figure 42.

Data obtained from level acceleration.
Data obtained from stabilized turn.
Data obtained from decelerating turn.

Figure 49: Generalized Thrust-Limited Performance
F-4E USAF S/N 66-287A
J79-GE-17 Engines
Maximum Thrust-Combat Configuration
Loading II: No External Stores
Gross Weight 44,851 lb

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>Altitude(ft)</th>
<th>Slats</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>10,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>□</td>
<td>20,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>■</td>
<td>20,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>△</td>
<td>35,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>▲</td>
<td>35,000</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

Notes:
1. Dashed line denotes F-4E Category II test data.
2. Two-position slat data corrected to 32.9 % MAC.

Figure 50: Maximum A/B Thrust-Limited Turn Performance
E-4E USAF S/N 66-2878
J79-GE-17 ENGINES
Maximum Thrust - Combat Configuration
Loading 1 No External Stores

SYMBOL
- EXTENDED
□ RETRACTED

0.70 MACH NUMBER

LIFT COEFFICIENT (C_L)

0.4

0.6

0.8

1.0

0.2

0.4

0.6

0.8

1.0

DRAG COEFFICIENT (C_D)

0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16

EXTENDED

RETRACTED

Figure 5. Drag Polar
F-4E USAF S/N 66-2878
J79-GE-17 Engines
Maximum Thrust - Combat Configuration
Loading 1: No External Stores

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>○</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>□</td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

0.8 Mach Number

Figure 5.7 Drag Polar
F-4E USAF S/N 66-287A
J79-GE-17 ENGINES

Maximum Thrust - Combat Configuration
Loading 1: No External Stores

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>RETRACTED</td>
</tr>
</tbody>
</table>

0.95 Mach Number

Figure 54 Drag Polar
### F-4E USAF S/N 66-287A

#### J79-GE-17 Engines

**Cruise Configuration**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WEIGHT (LB)</th>
<th>W/G</th>
<th>LOADING</th>
<th>FLAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>◇</td>
<td>5,000</td>
<td>40,800</td>
<td>60,000</td>
<td>I</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>◈</td>
<td>21,000</td>
<td>37,300</td>
<td>85,000</td>
<td>I</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>◈</td>
<td>30,000</td>
<td>41,700</td>
<td>140,000</td>
<td>I</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>◈</td>
<td>37,600</td>
<td>39,300</td>
<td>190,000</td>
<td>I</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>◈</td>
<td>41,300</td>
<td>40,300</td>
<td>230,000</td>
<td>I</td>
<td>RETRACTED</td>
</tr>
<tr>
<td>◈</td>
<td>7,000</td>
<td>37,500</td>
<td>50,000</td>
<td>I</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>◈</td>
<td>22,000</td>
<td>36,700</td>
<td>85,000</td>
<td>I</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>◈</td>
<td>31,000</td>
<td>40,100</td>
<td>140,000</td>
<td>I</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>◈</td>
<td>38,000</td>
<td>37,600</td>
<td>190,000</td>
<td>I</td>
<td>EXTENDED</td>
</tr>
<tr>
<td>◈</td>
<td>42,000</td>
<td>38,400</td>
<td>230,000</td>
<td>I</td>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

**Note:**
1. Open symbols denote slats retracted.
2. Solid symbols denote slats extended.
3. Dashed line denotes results of F-4E CAT II test (reference 6.1).
4. <FLIGHT MANUAL DATA.

![Graph](image)
### Cruise Configuration

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WEIGHT (LB)</th>
<th>W/G LOAD</th>
<th>SLOTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5,000</td>
<td>40,000</td>
<td>50,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>21,000</td>
<td>37,000</td>
<td>85,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>30,000</td>
<td>41,700</td>
<td>140,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>37,600</td>
<td>39,300</td>
<td>190,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>41,300</td>
<td>40,300</td>
<td>230,000</td>
<td>RETRACTED</td>
</tr>
<tr>
<td></td>
<td>7,000</td>
<td>37,500</td>
<td>50,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>22,000</td>
<td>36,700</td>
<td>85,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>31,000</td>
<td>40,100</td>
<td>140,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>38,000</td>
<td>37,600</td>
<td>190,000</td>
<td>EXTENDED</td>
</tr>
<tr>
<td></td>
<td>42,000</td>
<td>36,400</td>
<td>250,000</td>
<td>EXTENDED</td>
</tr>
</tbody>
</table>

**NOTE:**
1. Open symbols denote slats retracted.
2. Solid symbols denote slats extended.
3. Dashed line denotes results of F-4E CAT II test (reference 6).
4. Actual flight manual data.

**Figure 8.5: Cruise Performance Summary (Concluded)**
F-4E USAF S/N 66-2879
TF-GE-17 ENGINES
LOADING I: NO EXTERNAL STORES
CRUISE CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT</th>
<th>ALTITUDE (FT)</th>
<th>WEIGHT (LB)</th>
<th>W/S (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q</td>
<td>28</td>
<td>5,000</td>
<td>40,800</td>
<td>50,000</td>
</tr>
<tr>
<td>O</td>
<td>43</td>
<td>21,000</td>
<td>37,300</td>
<td>85,000</td>
</tr>
<tr>
<td>O</td>
<td>43</td>
<td>30,000</td>
<td>41,700</td>
<td>140,000</td>
</tr>
<tr>
<td>O</td>
<td>11</td>
<td>37,600</td>
<td>39,100</td>
<td>150,000</td>
</tr>
<tr>
<td>O</td>
<td>46</td>
<td>41,300</td>
<td>40,300</td>
<td>230,000</td>
</tr>
</tbody>
</table>

[SLATS RETRACTED]

Figure 56: Specific Range
F-16 USAF S/N 60-2670
J79-GE-11 ENGINES
LOADING 1: NO EXTERNAL STORES
CRUISE CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT</th>
<th>ALTITUDE (FT)</th>
<th>WEIGHT (LBS)</th>
<th>W/L (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>26</td>
<td>5,000</td>
<td>46,300</td>
<td>50,000</td>
</tr>
<tr>
<td>4-3</td>
<td>21,000</td>
<td>37,300</td>
<td>65,000</td>
<td></td>
</tr>
<tr>
<td>4-3</td>
<td>30,500</td>
<td>41,700</td>
<td>140,000</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>37,600</td>
<td>39,100</td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>41,300</td>
<td>40,300</td>
<td>230,000</td>
<td></td>
</tr>
</tbody>
</table>

(SLATS RETRACTED)

Figure 57: Power Required
### F-4E USAF S/N 66-287A
**J79-GE-17 ENGINES**

**Loading I: No External Stores**

**Cruise Configuration**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT</th>
<th>ALTITUDE (FT)</th>
<th>WEIGHT (LB)</th>
<th>W/F (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>7,000</td>
<td>37,500</td>
<td>50,000</td>
</tr>
<tr>
<td>▲</td>
<td>4.3</td>
<td>22,000</td>
<td>36,700</td>
<td>85,000</td>
</tr>
<tr>
<td>▲</td>
<td>4.3</td>
<td>31,000</td>
<td>40,100</td>
<td>140,000</td>
</tr>
<tr>
<td>▲</td>
<td>4.2</td>
<td>38,000</td>
<td>37,600</td>
<td>180,000</td>
</tr>
<tr>
<td>▲</td>
<td>4.6</td>
<td>42,000</td>
<td>38,400</td>
<td>230,000</td>
</tr>
</tbody>
</table>

**Figure 58: Specific Range**

Legend:
- ▲: 7,000 FT
- ▼: 22,000 FT
- ◊: 31,000 FT
- O: 38,000 FT
- △: 41,000 FT
- ◇: 48,000 FT
### F-4E USAF S/N 66-2674
**J79-GE-17 Engines**
**Loading 1: No External Stores**
**Cruise Configuration**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT</th>
<th>ALTITUDE (FT)</th>
<th>WEIGHT (LB)</th>
<th>W/A (LB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>7,000</td>
<td>37,500</td>
<td>50,000</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>22,000</td>
<td>36,700</td>
<td>85,000</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>31,000</td>
<td>40,100</td>
<td>140,000</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>39,000</td>
<td>37,600</td>
<td>180,000</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>42,000</td>
<td>38,400</td>
<td>230,000</td>
<td></td>
</tr>
</tbody>
</table>

**Slats Extended**

**Figure 59: Power Required**
F-4E USAF S/N 66-287A
J79-GE-17 ENGINES
NONAFTERBURNING OPERATION
SEA LEVEL STANDARD DAY

MILITARY RATED THRUST SETTING

CORRECTED THRUST PER ENGINE
$F_g/S_x \times 10^{-3}$ (Lb)

CORRECTED RPM - $N/\sqrt{S_0}$

Figure 61: Installed Static Thrust
F-4E USAF SRN 11-2 DATA
770-08-17 ENGINES

MAXIMUM THRUST - COMBAT CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT NO.</th>
<th>ALTITUDE (FT)</th>
<th>ENGINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>282-3</td>
<td>10,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>3</td>
<td>282-3</td>
<td>10,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>9</td>
<td>247-5</td>
<td>35,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>0</td>
<td>247-5</td>
<td>35,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>0</td>
<td>249-5</td>
<td>40,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>5</td>
<td>249-5</td>
<td>40,000</td>
<td>RIGHT</td>
</tr>
</tbody>
</table>

Note 1: Data obtained from level accelerations.
Note 2: Schedule obtained from Reference 9.

Figure 62: Engine Speed Schedule
F-4B USAF A/N 65-2074
J79-26-17 ENGINES
MAXIMUM THRUST - COMBAT CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT RUN</th>
<th>ALTITUDE (FT)</th>
<th>ENGINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>263 - 3</td>
<td>10,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>0</td>
<td>262 - 3</td>
<td>10,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>0</td>
<td>247 - 5</td>
<td>30,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>0</td>
<td>247 - 5</td>
<td>30,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>0</td>
<td>246 - 6</td>
<td>40,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>0</td>
<td>246 - 6</td>
<td>50,000</td>
<td>RIGHT</td>
</tr>
</tbody>
</table>

Note: 1. Data obtained from level accelerations.
2. Schedule obtained from Reference 9.
### F-4E USAF S/N 66-287A
**JT9-GE-17 ENGINES**
**MILITARY THRUST - CRUISE CONFIGURATION**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FLIGHT RUN</th>
<th>ALTITUDE (FT)</th>
<th>ENGINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>◊</td>
<td>235 - 3</td>
<td>20,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>◢</td>
<td>235 - 3</td>
<td>20,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>◢</td>
<td>235 - 3</td>
<td>25,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>◢</td>
<td>235 - 3</td>
<td>25,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>◢</td>
<td>232 - 11</td>
<td>35,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>◢</td>
<td>232 - 11</td>
<td>35,000</td>
<td>RIGHT</td>
</tr>
</tbody>
</table>

**NOTE:**
1. Data obtained from level accelerations.
2. Schedule obtained from Reference 9.

---

**Figure 64: Engine Speed Schedule**

- **Minimum**
- **Design Trim Value**
- **Maximum**

**Compressor Inlet Temperature (°C):**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Speed (PCT RPM)</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
<td>110</td>
<td>120</td>
</tr>
</tbody>
</table>
### Military Thrust Cruise Configuration

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Flight Run</th>
<th>Altitude (ft)</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ω</td>
<td>241-9</td>
<td>0,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>Ω</td>
<td>241-9</td>
<td>0,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>Γ</td>
<td>233-9</td>
<td>20,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>Γ</td>
<td>233-9</td>
<td>20,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>Ω</td>
<td>253-3</td>
<td>25,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>Γ</td>
<td>253-3</td>
<td>25,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>Γ</td>
<td>232-11</td>
<td>35,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>Γ</td>
<td>232-11</td>
<td>35,000</td>
<td>RIGHT</td>
</tr>
<tr>
<td>Γ</td>
<td>238-6</td>
<td>40,000</td>
<td>LEFT</td>
</tr>
<tr>
<td>Γ</td>
<td>238-6</td>
<td>40,000</td>
<td>RIGHT</td>
</tr>
</tbody>
</table>

**Note:**

1. Data obtained from level accelerations.
2. Schedule obtained from Reference 3.
Figure 66
Maneuver Points

F-16 USAF S/N 66-287A

Loading: 1a and 1b
CR Configuration
Forward/Aftertrim = 7.5
Mach No.: 0.70
Altitude: 10,500 ft

Apparent Maneuver Point
\( \frac{d_d}{d_0} = 0 \) (FCT MAC)

Maneuver Point
\( \frac{d_5}{d_0} = 0 \) (FCT MAC)

Normal Force Coefficient - \( C_n \)

0 0.2 0.4 0.6 0.8 1.0 1.2
F-4E USAF S/N 66-287A
LOADING: 1a AND 1b
CR CONFIGURATION
FWD/AFT AIM-7E
MACH NO.: 0.72
ALTITUDE: 37,200 FT

**Figure 70** Maneuver Points
F-4E USAF S/N 66-287A

LOADING: 1a AND 1b FWD/AFT AIM-7B
0 CONFIGURATION
MACH NO.: 0.86
ALTITUDE: 36,300 FT

FIGURE 72 MANEUVER POINTS
F-4E USAF S/N GG-287A

LOADING: 12A AND 16 FOG/AFT AIM-7B
CONFIGURATION

MACH NO.: 1.05
ALITUDE: 37,000 FT

FIGURE 74 MANEUVER POINTS
F-4E USAF 6/N 66-287A

LOADING: 16.00 AND 16.0 FWD/AFT AIM-7'S
MACH NO. 1.121
CO CONFIGURATION
ALTITUDE: 37,100 FT

APPARENT MANEUVER POINTS ARE AFT OF THE 100-PCT MAC POINT.
F-4E USAF S/N 66-2974

LOADING: 14 AND 15 FWD/AFT AIM-7B
DATA TAKEN FROM FIGURES 66 AND 87
ALTITUDE: 10,500 FT

AR Configuration
0.70 Mach No.

Symbol
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

Figure 76 Maneuver Point Determination
LOADING: IA AND IB: FWD/AFT AIM-75.
DATA TAKEN FROM FIGURES 58 AND 59.
ALTITUDE: 10,200 FT

CR CONFIGURATION
0.83 MACH NO

SYMBOL CA
0 0.1
0 0.3
0 0.4

STICK FORCE PER G — 0.5, 1.5, 4.5, 14.5 (LBS)
STABILIZER DEVIATION PER NORMAL FORCE (DEG)

AIRCRAFT CG POSITION (PCT MAC)

FIGURE 77 MANEUVER POINT DETERMINATION
F-15 USAF 5/N 66-287A

LOADING: 16 AND 18 PUD/AFT AU-75
DATA TAKEN FROM FIGURE 33
ALTIMETER 10,000 FT

STICK FORCE PER G - 60/100G

STABILATOR POSITION - DEG/AU-75

AIRCRAFT CG POSITION (PER MAC)

FIGURE 70: MANEUVER POINT DETERMINATION
F-4C USAF S/N 69-087A

LOADING: 10 AND 15
FUJ/OAF AIM-7A
DATA TAKEN FROM FIGURE 92.
ALTITUDE: 37,000 FT

CR CONFIGURATION
0.72 EACH NO.

SYMBOL  Cn
O  0.6
O  0.7
O  0.8
O  1.0

FIGURE 50: MANEUVER POINT DETERMINATION
Figure 62: Progressive Point Determination
F-4E USAF S/N 66-287A

LOADING: 1a AND 1b FWD/AFT AIM-7's
DATA TAKEN FROM FIGURE 56.
ALTITUDE: 36,900 FT

CO. CONFIGURATION
0.86 MACH NO.

SYMBOL

CH

0 0.4

0 0.6

0 0.8

0 0.9

STICK FORCE PER g - 0.5/1G (Lb/G)

STABILATOR POSITION PER NORMAL FORCE COEFFICIENT - g/1Cn

AIRCRAFT CG POSITION (PCT MAC)

FIGURE 62. MANEUVER POINT DETERMINATION
F-102 USAF S/N 66-287A

LOADING I A AND III FLIGHT AFT ANV-75
DATA TAKEN FROM FIGURE 56.
ALTIMETER 37,400 FT

STABILIZER POSITION PER NORMAL FORCE
STICK FORCE PER G - 0.5/G

CO CONFIGURATION
0.9111 - MACH NO.
SYNCHRONY 0.6
0.3
0.5
0.7
0.8
0.9

FIGURE 63 MANEUVER POINT DETERMINATION
LOADING: 12 AND 16 FWD/AFT AIM-7'S
DATA TAKEN FROM FIGURE 96.
ALTITUDE: 37,000 FT

CO CONFIGURATION
1.0 B. MACH NO.

SYMBOL  CD
0  0.3
0  0.5
0  0.7
0  0.9

FIGURE 64  MANEUVER POINT DETERMINATION
F-4E USAF S/N 66-287A

LOADING FIGS. AND FIG. FWD/AFT AIM-7S
DATA TAKEN FROM FIGURE 97.
ALTITUDE: 37,100 FT

CO. CONFIGURATION
1.21 MACH NO.

SYMBOL  Cw

-  0.2

-  0.3

-  0.4

-  0.5

FIGURE 88 MANEUVER POINT DETERMINATION
Figure 86. Longitudinal Maneuvering Stability.
Figure 87. Longitudinal Maneuvering Stability
LOADINGS:
1a: FWD AIM-7
1b: AFT AIM-7's

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10,500</td>
<td>0.82</td>
<td>454</td>
<td>39,700</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>10,300</td>
<td>0.82</td>
<td>458</td>
<td>36,800</td>
<td>29.8</td>
</tr>
</tbody>
</table>

NORMAL ACCELERATION AT AIRCRAFT CG (G)

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 8B. LONGITUDINAL MANEUVERING STABILITY
Figure 05: Longitudinal Maneuvering Stability
### L-119  USAF S/N 66-287A

**CR Configuration**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (FCT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10,900</td>
<td>0.66</td>
<td>478</td>
<td>39,300</td>
<td>25.4</td>
</tr>
<tr>
<td>1</td>
<td>11,300</td>
<td>0.66</td>
<td>475</td>
<td>36,800</td>
<td>29.7</td>
</tr>
</tbody>
</table>

**Figure 90: Longitudinal Maneuvering Stability**

- **Longitudinal Stick Force (Lb) vs. Pull**
- **Normal Acceleration at Aircraft CG (g)**
- **Noseboom Angle of Attack (Deg)**
- **Stabilator Position (Deg) vs. TED**
- **Normal Force Coefficient - Cn**

**Note:** Solid symbols denote trim.
### CR Configuration

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (FT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10,400</td>
<td>0.32</td>
<td>516</td>
<td>39,000</td>
<td>24.8</td>
</tr>
<tr>
<td>0</td>
<td>10,800</td>
<td>0.31</td>
<td>505</td>
<td>37,000</td>
<td>30.1</td>
</tr>
</tbody>
</table>

### Figure 9.1: Longitudinal Maneuvering Stability

**Note:** Solid symbols denote trim.
### Loadings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Altitude (FT)</th>
<th>Mach No</th>
<th>KCAS (KIAS)</th>
<th>Gross WT (LB)</th>
<th>CG Position (FT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>37,000</td>
<td>0.71</td>
<td>224</td>
<td>37,000</td>
<td>24.7</td>
</tr>
<tr>
<td>-</td>
<td>35,700</td>
<td>0.74</td>
<td>244</td>
<td>42,200</td>
<td>34.2</td>
</tr>
</tbody>
</table>

#### Figure 52

**Longitudinal Maneuvering Stability**

- **Normal Acceleration at Aircraft CG (G)**
- **Normal Force Coefficient (Cn)**
- **Stabilator Position (Deg)**
- **Angle of Attack (Deg)**
- **Nose Down (Deg)**
- **Stick Force (Lb)**

**Note:** Solid symbols denote trim.
F-1E USAF S/N 66-387A

LOADINGS
16.  FWD AIM-7
16.  AFT AIM-7'S

CG CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PGT. MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>36,200</td>
<td>0.81</td>
<td>269</td>
<td>40,800</td>
<td>24.8</td>
</tr>
<tr>
<td>-</td>
<td>36,200</td>
<td>0.93</td>
<td>278</td>
<td>41,300</td>
<td>34.0</td>
</tr>
</tbody>
</table>

NORMAL ACCELERATION AT AIRCRAFT CG (G)

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 98  LONGITUDINAL MANEUVERING STABILITY
FIGURE 3.4  LONGITUDINAL MANEUERING STABILITY

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>WEIGHT (LB)</th>
<th>CG POSITION (FT)</th>
<th>CG POSITION (ALT. MAG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>34,000</td>
<td>0.65</td>
<td>294</td>
<td>38,900</td>
<td>24.1</td>
</tr>
<tr>
<td>-0</td>
<td>34,500</td>
<td>0.67</td>
<td>291</td>
<td>40,900</td>
<td>24.1</td>
</tr>
</tbody>
</table>

NORMAL ACCELERATION AT AIRCRAFT CG (G)

NOTE: SOLID SYMBOLS DENOTE TRIM.

LONGITUDINAL FORCE (LBS) VS. NORMAL FORCE COEFFICIENT (Cn)
F-4E USAF S/N 66-287A

LOADINGS: 1a: FWD AIM-7
1b: AFT AIM-7's

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>37,800</td>
<td>0.91</td>
<td>236</td>
<td>39,400</td>
<td>23.4</td>
</tr>
<tr>
<td>-1</td>
<td>37,100</td>
<td>0.92</td>
<td>301</td>
<td>40,000</td>
<td>33.7</td>
</tr>
</tbody>
</table>

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 85: LONGITUDINAL MANEUVERING STABILITY
LOADINGS
1. FWD AIM-7
2. AFT AIM-7's

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (RCT. MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>37,400</td>
<td>1.21</td>
<td>418</td>
<td>37,400</td>
<td>32.0</td>
</tr>
</tbody>
</table>

NORMAL ACCELERATION AT AIRCRAFT CG (G)

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 97: LONGITUDINAL MANEUERING STABILITY
F-4E USAF S/N 66-287A

LOADING AFT AM-73

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO.</th>
<th>KCAS (KIAS)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (RT MACH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>56,500</td>
<td>1.42</td>
<td>513</td>
<td>41,000</td>
<td>31.2</td>
</tr>
</tbody>
</table>

Figure 92: Longitudinal Maneuvering Stability

Normal acceleration at aircraft CG (G)

Note: Solid symbols denote trim.
Figure 9-3: Longitudinal Maneuvering Stability

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>MACH NO.</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (AC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25,600</td>
<td>1.65</td>
<td>596</td>
<td>33,800</td>
<td>50 A</td>
</tr>
</tbody>
</table>
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 267-261    RUN OB    DATE 12 MAY 1972
F-4E    MCAI NO. 2280    USAF 86-0287
WIND-UP-TURN

LONG STICK POSITION DEGREES
0 20 40 60 PUL

FMD
0 10 20 30 40 50 60 ANG.

TEU
0 10 20 30 40 50 PUS

STAR POSITION DEGREES
0 5 10 15 20 25 30 35 40 45 50 DEGREES

TED
0 10 20 30 40 50 ANG.

PITCH RATE DEG/SEC
0 20 40 60 ANG.

N/B ANGLE OF ATTACK DEGREES
0 20 40 60 ANG.

NORMAL ACCEL AT C.G. 0.5'
0 20 40 60 ANG.

RIGHT 2 EXT
L/R SLAT 1 POSITION
0 RET
L/EFT

0 10 20 30 40 50 60 70 ELAPSED TIME IN SECONDS

WIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-261  FLIGHT RUN 06  DATE 12 MAR 1972
F-4E USAF SER No. 2280  USAF #N 66-0287
WIND-UP TURN

Y - L/H SIDE  SQUARE - R/H SIDE

-30  -20  -10  0  10  20  30  40  50  60  70
ELAPSED TIME IN SECONDS

FIGURE 100 WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLOTS

FLT 287-261 RUN 06 DATE 12 MAY 1972
F-4E MCRN NO. 2280 USAF S/N 66-0287

HIND-UP-TURN

FIGURE 100 WINUP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 267-263  RUN 13  DATE 15 MAY 1972
F-4E  HCAIR NO. 2280  USAF S/N 68-0287

WIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION: BASIC MODEL F-4E WITH TWO POSITION HINGE LOADING
LEADING EDGE SLATS FOR 53 3000 16 LB
LONGITUDINAL CONTROL SYSTEM IMBALANCE
WEIGHT LONG FLIGHT TEST HUSEBOOM EMO
POD AT L/H FORWARD MISSILE WELL.
NO INITIATION

ENTRY CONDITIONS
1.30335  WEIGHT  37140  LBS
1.304  POSITION  300.4. TEST MAC

N/B ALTITUDE
HPC FT X 1000

N/B MACH NO H NO

L/M TOTAL TEMP DEG C

NOT AVAILABLE

FREE AIR TEMP 0 F.H.I. DEG C

22.10.27.439
ELAPSED TIME IN SECONDS

FIGURE 101 WINDUP TURN TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-263 RUN 13 DATE 15 MAY 1972
F-4E MCRN NO. 2280 USAF 3/N 66-0287

**WIND-UP-TURN**

<table>
<thead>
<tr>
<th>X - L/H SIDE</th>
<th>SQUARE - R/H SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFT</td>
<td>0</td>
</tr>
<tr>
<td>FWD</td>
<td>10</td>
</tr>
<tr>
<td>TEU</td>
<td>20</td>
</tr>
<tr>
<td>STAR Position</td>
<td>10</td>
</tr>
<tr>
<td>TEO</td>
<td>0</td>
</tr>
<tr>
<td>PITCH RATE</td>
<td>0</td>
</tr>
<tr>
<td>DEG/SEC</td>
<td>0</td>
</tr>
<tr>
<td>M/B Angle of}</td>
<td>0</td>
</tr>
<tr>
<td>Attack</td>
<td>0</td>
</tr>
<tr>
<td>Normal Accel</td>
<td>0</td>
</tr>
<tr>
<td>at C.G.</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**ELAPSED TIME IN SECONDS**

**FIGURE 101 WINDUP TURN TIME HISTORY (CONTINUED)**
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS
FLT 287-263  RUN 13  DATE  15 MAY 1972
F-4E  HCAIR NO. 2280  USAF 3/N 68-0287
MIXD-UP-TURN

- L/H SIDE  SQUARE - R/H SIDE

ROLL RATE
80 60 40 20 0 -20 -40 -60
DEG/SEC

TWAIN RATE
-30 -15 15 30
DEG/SEC

ROLL ANGLE
-15 0 15
DEGREES

N/B ANGLE OF
SIDE SLIP
5 10 15
DEGREES

LATERAL STICK
FORCE
5 10 15
POUNDS

LATERAL STICK
POSITION
0 5 10
DEGREES

RUDDER
POSITION
0 10 20
DEGREES

ROLL
10 20 30
DEGREES

L/DUB - L/H SIDE  SQUARE - R/H SIDE

WIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-283       RUN 13       DATE  15 MAY 1972
F-4E                MCAR No. 2280      USAF S/N 85-0287
WIND-UP TURN

X - L/H SIDE        SQUARE - R/H SIDE

FLIGHT PATH ACCEL 0°'S

0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6

LATERAL ACCEL AT C.G. 0°'S
0.4
0.2
0.0
-0.2
-0.4
-0.6

THROTTLE 0° POSITION DEGREES
20
40
60
10
30° RUQ
40° RUQ
20
40° RUQ

SPOILER 0° POSITION DEGREES
20
40° RUQ
60° RUQ

ROLLING ACCEL 0° RUQ/SEC2
2
4
6

ELAPSED TIME IN SECONDS

FIGURE 101. WINDUP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-281  RUN 08  DATE 12 MAY 1972
F-4E  NSN NO. 2280  USAF 5/N 68-0287
HIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION:  BASIC MODEL F-4E WITH TWO POSITION WING LOADING &
LEADING EDGE SLATS PER 23 38 809. 16 LB
LONGITUDINAL CONTROL SYSTEM IMBALANCE
WEIGHT & STR FLIGHT TEST NOSEBOMB END
POD AT L/H FORWARD MISSLE WELL.
SPANN IN R/H FORWARD MISSLE WELL

ENTRY CONDITIONS:
1. CROSS-HEADING 15070 LBS
2. C.G. - 2 POSITION 23.4

N/B ALTITUDE
FT  X 1000

N/B AIRSPEED
KTS

MACH
NO.
N=0

FREE AIR
TEMP.
OF A.T.
DEG.C

L/H TOTAL TEMP.
DEG. C

NOT AVAILABLE

19.13.30.621  ELAPSED TIME IN SECONDS

FIGURE 102:  HIND-UP TURN TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-261  RUN 08  DATE 12 MAY 1972
F-4E  MCRR No. 2280  USAF S/N 86-0287
WIND-UP TURN

WIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-261        RUN 08        DATE 12 MAY 1972
F-4E        HCAIR NO. 2280        USAF 9/66-0287
WIND-UP-TURN

WIND-UP TURN TIME HISTORY (CONCLUDED)

FIGURE 102
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-263  RUN 15  DATE  15 MAY 1972
F-4E  MCAIR NO. 2280  USAF 3/N 68-0287

WIND-UP TURN

ENTRY CONDITIONS

N/B AIRSPEED

HIND-UP TURN TIME HISTORY

 Figure 103
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-283 RUN 15 DATE 15 MAY 1972
F-4E NCRAF NO. 2280 USAF 3/6-0267

WIND-UP TURN HISTORY (CONTINUED)

Figure 103 Windup Turn Time History (Continued)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 207-261  RUN 15  DATE 15 MAR 1972
F-4E  MCAF NO. 2280  USAF 3/N 60-0289
WIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

ROLL ANGLE 0 DEGREES
ROLL RATE DEG/SEC
YAW RATE DEG/SEC

LATERAL STICK 0 FORCES POUNDS
LATERAL STICK POSITION DEGREES
RUDER POSITION DEGREES
ROLL ANGLE 0 DEGREES
SQUARE - R/H SIDE

WIND-UP TURN TIME HISTORY (CONTINUED)
**FLIGHT TEST EVALUATION OF THE MODEL F-4E**

**WITH TWO POSITION MANEUVERING SLATS**

**FLT 287-262**  
**RNL 19**  
**DATE 12 MAY 1972**  
**F-4E**  
**MCNMA NO. 2280**  
**USAF 5/6-0257**

**WIND-UP TURN**

<table>
<thead>
<tr>
<th>ENTRY CONDITIONS</th>
<th>WEIGHT</th>
<th>33800 LBS</th>
</tr>
</thead>
</table>

**DIAGRAM**

- **N/B ALTITUDE**
- **MACH NO**
- **L/H TOTAL TEMP DEG. C**

**FREE A.I.R. TEMP**  
**60 F.A.T. DEG C**

**ELAPSED TIME IN SECONDS**

**FIGURE 104** **WINDUP TURN TIME HISTORY**

- **0 - 20**
- **20 - 40**
- **40 - 60**
- **60 - 80**
- **80 - 100**
- **100 - 120**
- **120 - 140**
- **140 - 160**
- **160 - 180**
- **180 - 200**
- **200 - 220**
- **220 - 240**
- **240 - 260**
- **260 - 280**
- **280 - 300**

**NOT AVAILABLE**

**0.2**  
**0.4**  
**0.6**  
**0.8**  
**1.0**  
**1.2**  
**1.4**  
**1.6**  
**1.8**  
**2.0**  
**2.2**  
**2.4**  
**2.6**  
**2.8**  
**3.0**  
**3.2**  
**3.4**  
**3.6**  
**3.8**  
**4.0**  
**4.2**  
**4.4**  
**4.6**  
**4.8**  
**5.0**  
**5.2**  
**5.4**  
**5.6**  
**5.8**  
**6.0**  
**6.2**  
**6.4**  
**6.6**  
**6.8**  
**7.0**  
**7.2**  
**7.4**  
**7.6**  
**7.8**  
**8.0**  

**0.0**  
**0.1**  
**0.2**  
**0.3**  
**0.4**  
**0.5**  
**0.6**  
**0.7**  
**0.8**  
**0.9**  
**1.0**  
**1.1**  
**1.2**  
**1.3**  
**1.4**  
**1.5**  
**1.6**  
**1.7**  
**1.8**  
**1.9**  
**2.0**  
**2.1**  
**2.2**  
**2.3**  
**2.4**  
**2.5**  
**2.6**  
**2.7**  
**2.8**  
**2.9**  
**3.0**  
**3.1**  
**3.2**  
**3.3**  
**3.4**  
**3.5**  
**3.6**  
**3.7**  
**3.8**  
**3.9**  
**4.0**  

**0 - 40**  
**40 - 80**  
**80 - 120**  
**120 - 160**  
**160 - 200**  
**200 - 240**  
**240 - 280**  
**280 - 320**  

---

**CONCLUSION**

- **LEADING EDGE SLATS PER 35 75 509. 15 LBS**
- **LONGITUDINAL CONTROL SYSTEM SHEAR RACE**
- **HEIGHT, LONG FLIGHT TEST 103833.49, ORE**
- **FGO AT L/H FORWARD MISSILE WELL**
- **SPRMON AT R/H FORWARD MISSILE WELL**

---

**NOTES**

- **LTITJIOE**
- **MPC**
- **FT**
- **N**
- **0**
- **L/M**
- **TOTT**
- **DEO. C**
- **RCON**
- **15U**
- **•TIIOH**
- **•**
- **Bfl3**
- **LER**
- **:c MO**
- **MMG**
- **SEL. F**
- **JDÖE**
- **!UrtT3**
- **tTH**
- **TJO**
- **PobtTio**
- **PBIT**
- **•SS| 303.**
- **1**
- **10 L**
- **LO »I.KG**

- **N**
- **LON**
- **mi**
- **itTUO**
- **mi**
- **itMU**
- **ONG**
- **miOHTfl**
- **LIGH**
- **3L   ST**
- **TES**
- **ITEM**
- **r 403**
- **TUBflL^riCE**
- **1**

- **POD**
- **3Pfl**
- **Bf.-.U**
- **•H  FO**
- **n/**
- **f'ÖR**
- **MISS**
- **ILS  W**
- **1I33I**
- **•LL.**
- **•L**
- **•L**
- **.E   1^**
- **1**
- **1**
- **1**

- **283**
- **1**
- **3**
- **I-  ;;**
- **INTRT**
- **CONO**
- **TION**
- **LIGHT**
- **7040**
- **LBS**

---

**DATA**

- **IBSPEED**
- **300 VC**
- **KTS**

---

**FIGURE 104** **WINDUP TURN TIME HISTORY**

---

**100, 17, 31, 875**

---

**PAGE 01**
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUERING SLATS
FLT 287-262       RUN 13       DATE 12 MAY 1972
F-4E         MCRN No. 2280       USAF 56-0287
MIND-UP-TURN

LONG STICK
POSITION
DEGREES

FNO

TEU

STAB
POSITION
DEGREES

T skins

PITCH
RATE
DEG/SEC

W/B
ANGLE OF
ATTACK
DEGREES

NORMAL
ACCEL. AT
C.G.'S

X - L/M SIDE
SQUARE - R/H SIDE

50 PUL
40
30
20 LONG
STICK
FORCE
POUNDS
10
0
20 PUS
60 ANU
40
20
PITCH
ANGLE
DEGREES
20
40
60 ANU
0
30
40
0
20 ANG.
0
20 ANG.
0
20 ANG.
0
0

ELAPSED TIME IN SECONDS

FIGURE 104  MIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 207-262 RUN 13 DATE 12 MAY 1972
F-4E NMA No. 2280 USAF 5/N 56-0287

MIND-UP-TURN

X - L/H SIDE SQUARE - R/H SIDE

ROLL RATE DEG/SEC

YAW RATE DEG/SEC

ROLL ANGLE DEGREES

LATERAL STICK FORCE POUNDS

N/B ANGLE OF SIDESLIP DEGREES

N/B NO. 2200 USF 83/N 68-0287

MIND-UP-TURN

ELAPSED TIME IN SECONDS

FIGURE 104 WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 297-262  RUN 13  DATE 12 MAY 1972
F-4E  MCRIM NO. 2280  USAF S/N 55-0287

WIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

FLIGHT PATH ACCEL 0°/S

0.8
0.4
0.2
0.0
-0.2
-0.4
-0.6

LATERAL ACCEL AT 0.0 0.5 1.0

0.0
0.2
0.4

ROLLING ACCEL RAD/SEC²

6
4
2
0

SPOILER 0° POSITION DEGREES

40° RWU
30° RWU
20° RWU
10° RWU
0° RWU

ROLLING ACCEL 0° POSITION DEGREES

6
4
2
0

ELAPSED TIME IN SECONDS

FIGURE 104 WINDUP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-263  RUN 05  DATE  15 MAY 19/2
F-4E  HCRAA NO. 2790  USNASA 3/N 65-0267

WIND-UP TURN

<table>
<thead>
<tr>
<th>X - L/M SIDE</th>
<th>SQUARE - R/H SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFT</td>
<td>30</td>
</tr>
<tr>
<td>LONG STICK POSITION DEGREES</td>
<td></td>
</tr>
<tr>
<td>FWD</td>
<td>10</td>
</tr>
<tr>
<td>TEU</td>
<td>20</td>
</tr>
<tr>
<td>STAR POSITION DEGREES</td>
<td></td>
</tr>
<tr>
<td>TED</td>
<td>10</td>
</tr>
<tr>
<td>PITCH RATE</td>
<td>0</td>
</tr>
<tr>
<td>DEG/SEC</td>
<td>-20</td>
</tr>
<tr>
<td>N/B ANGLE OF ATTACK DEGREES</td>
<td></td>
</tr>
<tr>
<td>NORMAL ACCEL AT C.G. O'S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

WIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-263    RUN 05    DATE 15 MAY 1972
F-4E    MCAEA NO. 2260    USAF 56-0297
WIND-UP-TURN

X - L/H SIDE    SQUARE - R/H SIDE

LATERAL STICK POSITION DEGREES
LATERAL STICK FORCE POUNDS
ROLL ANGLE DEGREES
ROLL RATE DEG/SEC
YAW RATE DEG/SEC
ELAPSED TIME IN SECONDS

FIGURE 105  WIND-UP TURN TIME HISTORY (CONTINUED)
FIGURE 105 WINDUP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4C WITH TWO POSITION MANEUVERING SLATS

F-4F
FLT 287-259

DATE: 12 MAY 1972

CONFIGURATION: BASIC MODEL F-4E WITH NO POSITION MANEUVERING SLATS

ENVIRO. TEMP. 60 °F SCALE: 100°F.

FREE HI-WIND: 300 KTS.
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-262  RUN 08  DATE 12 MAY 1972
F-4E  MCAIR NO. 2280  USAF S/N 66-0287
WIND-UP TURN

X - L/H SIDE  SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>LONG STICK POSITION DEGREES</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>FWD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAR POSITION DEGREES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PITCH RATE DEG/SEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/B ANGLE OF ATTACK DEGREES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NORMAL ACCEL AT C.G. G'S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIGHT</td>
<td>2 EXT</td>
<td>I/B SLAT</td>
<td>1 POSITION</td>
<td>0 RET</td>
<td>LEFT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ELAPSED TIME IN SECONDS

FIGURE 106 WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-262 RUN 08 DATE 12 MAY 1972
F-4E MCAIN NO. 2200 USAF 5/N 68-0287

HIND-UP-TURN

WIND-UP-TURN HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-262 RUN 08 DATE 12 MAY 1972
F-4E MCAIR NO. 2280 USAF 3/N 66-0287
WIND-UP-TURN

Figure 106 Windup Turn Time History (Concluded)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 267-263  RUN 07  DATE  15 MAY 1972
F-4E  NCTR M000 NO. 2280  USAF 5/6-0287
WIND-UP-TURN

<table>
<thead>
<tr>
<th>MACH NO</th>
<th>ALTITUDE</th>
<th>L/H TOTAL TEMP DEG. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>3200</td>
<td>-90</td>
</tr>
<tr>
<td>0.6</td>
<td>3200</td>
<td>-90</td>
</tr>
<tr>
<td>0.8</td>
<td>3200</td>
<td>-90</td>
</tr>
<tr>
<td>1.0</td>
<td>3200</td>
<td>-90</td>
</tr>
</tbody>
</table>

**NOT AVAILABLE**

22.13:16:755 ELAPSED TIME IN SEC/DEG

FIGURE 107 WIND UP TURN TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-283         RUN 07         DATE 15 MAY 1972
F-4E          MCRIM NO. 2280         USAF 3/N 66-0287

WIND-UP TURN

WIND-UP TURN TIMING HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-263  RUN 07  DATE  15 WMY 1972
F-4E   MCAIN NO. 2200   USAF 5/N 65-0287
MIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

ROLL RATE
DEG/SEC

TANK RATE
DEG/SEC

ROLL ANGLE
DEGREES

SIDE SLIP ANGLE
DEGREES

STICK FORCE
POUNDS

LATERAL STICK
POSITION DEGREES

Rudder Position
DEGREES

Nose Wheel
ANGLE

ELAPSED TIME IN SECONDS

FIGURE 107  WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-263  RUN 07  DATE 15 MAY 1972
F-4E  MCAIN NO. 2280  USAF 3/N 56-0287
WIND-UP-TURN

Figure 107  Windup Turn Time History (Concluded)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-262  RUN 09  DATE 12 MAY 1972
F-4E  MCAIR NO. 2280  USAF 5/N 68-0287

WIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION - BASIC MODEL F-4E WITH TWO POSITION WING LEADING EDGES
LEADING EDGE SLATS PER 64 509. 15 LB
LONGITUDINAL CONTROL SYSTEM IMBALANCE
WEIGHT - LONG FLIGHT TEST NOSEDOWN, EMB
POD AT L/H FORWARD MIDDLE WELL
SPRING AT R/H FORWARD MIDDLE WELL

ENTRY CONDITIONS
CROSS WIND 30 MPH 1359 DEGREES

FREE AIR TEMP 80 F.R.T. DEG. C
N/B AIRSPEED 900 KTS

N/B ALTITUDE 9500 FT
MACH NO 1.0
N-O

L/H TOTAL TEMP DEG. C
NOT AVAILABLE

20.13.35.395
ELAPSED TIME IN SECONDS

FIGURE 108  WIND-UP TURN TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 267-262 RUN 09 DATE 12 MAY 1972
F-4E MCRM NO. 2280 USAF 5/N 86-0287

WIND-UP TURN

![Graph showing wind-up turn data](image-url)

**Figure 108: Wind-up turn time history (continued)**
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 207-262 RUN 09 DATE 12 MAY 1972
F-4E MCAIR NO. 2280 USAF S/N 58-0287
WIND-UP-TURN

**Figure 108** WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-262  RUN 09  DATE 12 MAY 1972
F-4E  HCAIRN NO. 2280  USAF 5/6-0287
WIND-UP TURN

FIGURE 108 WINDUP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-263  RUN 08  DATE  15 MAY 1972
F-4E  MCAIR NO. 2286  USAF S/N 88-0287

MIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

- CONFIGURATION - BASIC MODEL F-4E WITH TWO POSITION WING LEADING EDGES SLATS FOR 53 35 80G. 16 LB
- CONDITIONAL CONTROL SYSTEM IMBALANCE WEIGHT L/N FLIGHT TEST NOTEBOOK ERRORS
- POD AT L/H FORWARD MIDDLE WELL.
- TWO FLAP SPANS

ENTRY CONDITIONS
1 CROSS HEIGHT 40070  33
30-DEG. POSITION 83.5  KNOTS

N/B ALTITUDE
NFC FT X 1000

N/B AIRSPEED
300 KTs

MACH NO.
N-O

FREE AIA
TEMP
60 F.P.R.T.
DEG. C

L/H TOTAL TEMP.
DEG. C

NOT AVAILABLE


FIGURE 109  MIND-UP TURN TIME HISTORY
FIGURE 109  WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLOTS
FLT 287-283 RUN DB DATE 15 MAY 1972
F-4E MCAID NO. 2280 USARF 3/N 65-0207
WIND-UP TURN

X - L/H SIDE SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>Roll Rate (deg/sec)</th>
<th>Twist Rate (deg/sec)</th>
<th>Rudder Position (deg)</th>
<th>Stick 0 Force (lbs)</th>
<th>Lateral Stick Position (deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 109: WIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 267-283  RUN 08  DATE 15 MAY 1972
F-4E  MACAI NO. 2280  USAF 3/N 66-0287
WIND-UP TURN

X - L/H SIDE  SQUARE - R/H SIDE

FLIGHT PATH ACCEL G/16

LATERNAL ACCEL AT G/15

RIGHT 30 RAD

SILENCE 0 POSITION DEGREES

30 RAD

RIGHT 40 RAD

SILENS 0 POSITION DEGREES

20

40 RAD

LEFT 6

ROLLING ACCEL RAD/SEC2

ELAPSED TIME IN SECONDS

FIGURE 109 WINDUP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-262       RUN 11       DATE 12 MAY 1972
F-4E       MCRIA NO. 2280       USAF S/N 66-0287
MIND-UP-TURN

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION - BASIC MODEL F-4E WITH TWO POSITION SLATS, LOADING 1A
1. LEADING EDGE SLATS PER 13 S8 300, 16 LB
2. LONGITUDINAL CONTROL SYSTEM IMBALANCE
3. HEIGHT, LONG FLIGHT TEST NOSEBOOM, EMBR
4. ADD PT L/H FORWARD MISSLE WELL
5. SPARRING AT R/H FORWARD MISSLE WELL

ENTRY CONDITIONS
1. CROSS HEIGHT 33700 LBS
2. EMBR. MCRIA NO. 2280

0/N  ALTITUDE MILES
FT X 1000

0.8  1.0  1.2  1.4  1.6  1.8  2.0  2.2
0.4  0.6
0
-0.2 -0.4 -0.6
0
100 150 200 250 300 350 400
FREE AIR TEMP
60 F.A.T.
C
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500
520
540
560
580
600
620
640
660
680
700
720
740
760
780
800
820
0/N  AIRSPEED KC HS

20 40 60

0/N  TOTAL TEMP DEG. C
NOT AVAILABLE

20, 15, 20, 518
ELAPSED TIME IN SECONDS

FIGURE 110  MIND-UP TURN TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-262  RUN II  DATE 12 MAY 1972
F-4E  MCRIM No. 2280  USAF 3/N 66-0287
WIND-UP TURN

X - L/H SIDE  SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>TIME (SEC)</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL ACCEL AT C.G. G's</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-0.5</td>
</tr>
<tr>
<td>W/B ANGLE OF ATTACK DEGREES</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
</tr>
<tr>
<td>PITCH RATE DEG/SEC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TEU DEGREES</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>STAR POSITION DEGREES</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FWD</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>L/R SIDES</td>
<td>LEFT</td>
<td>LEFT</td>
<td>LEFT</td>
<td>LEFT</td>
<td>LEFT</td>
<td>LEFT</td>
<td>LEFT</td>
<td>LEFT</td>
</tr>
<tr>
<td>NORMAL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>STICK FORCE POUNDS</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

FIGURE 110 WIND-UP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS
FLT 287-267  RUN 11  DATE 12 MAY 1972
F-4E  HCAH NO. 2280  USAF S/N 66-0287
WIND-UP TURN

X - L/H SIDE  SQUARE - R/H SIDE

RWD 15
20
25
30
35
40
LATERAL STICK POSITION DEGREES

LATERAL STICK FORCE LBS

LATERAL STICK POSITION DEGREES

N/D

Rudder Position DEGREES

ROLL RATE DEG/SEC

TAN RATE DEG/SEC

ELAPSED TIME IN SECONDS

FIGURE 110 WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-262 RUN 11 DATE 12 MAY 1972
F-4E MCRRA NO. 2260 USAF 5/4 58-0087
WIND-UP TURN

X - L/H SIDE SQUARE - R/H SIDE

FLIGHT PATH ACCEL G**2

0.8
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8

LATERAL ACCEL AT 0.0 G, 0.5 G, 1.0 G

-0.8
-0.4
0.0
0.4
0.8

RIGHT 30 RAO
20
10
0
-10
-20
-30 RAO

SPOILER 0 POSITION DEGREES

20
10
0
-10
-20
-30
-40
-50
-60
-70

NO RAO

ROLLING ACCEL RAD/SEC**2

0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30

ELAPSED TIME IN SECONDS

FIGURE 110 WIND-UP TURN TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-263
RUN 10
DATE 15 MAY 1972
F-4E
MCAIM NO. 2260
USAF S/N 66-0287

WIND-UP TURN

K - L/H SIDE
SQUARE - R/H SIDE

CONFIGURATION: BASIC MODEL F-4E WITH TWO POSITION WIND LOADING
LEADING EDGE SLATS PER 53 58 929, 16 LB
LONGITUDINAL CONTROL SYSTEM BALANCE
WEIGHT, LONG FLIGHT TEST HOSEBOARD END
PROD AT L/H FORWARD MIDDEL MESS.
TWO ART SPARRS

ENTRY CONDITIONS

1._grass

2.15.160.175

2.90.20.215

N/B

ALTITUDE

HPC

FT

X 1000

MACH NO.

N-D

L/H TOTAL

TEMP.

DEG. C

NOT AVAILABLE

FREE AIR

TEMP.

60 F.A.T.

DEG C

N/B AIRSPEED

200 KS

N/B

80 F.T.

200

40

100

0

N/B

500

0

100

300

400

500

600

700

800

22.15.32.930

ELAPSED TIME IN SECONDS

FIGURE III WINDUP TURN TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 267-263     RUN 10     DATE  15 MAY 1972
F-4E     NCAIA NO. 2280     USAF 3/N 56-0287
WIND-UP-TURN

**X - L/H SIDE**

- **AWD**
- **LATERAL STICK POSITION DEGREES**
- **RUDDER POSITION DEGREES**
- **ROLL RATE DEG/SEC**
- **THW RATE DEG/SEC**

**SQUARE - R/H SIDE**

- **LATERAL STICK FORCE POUNDS**
- **N/B ROLL ANGLE OF 0 SIDESLIP DEGREES**
- **AWL**
- **AWH**

**ELAPSED TIME IN SECONDS**

**FIGURE III**  WINDUP TURN TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-289  RUN 10  DATE 15 MAY 1972
F-4E  MCAIR NO. 2280  USAF S/N 66-0287
WIND-UP-TURN

**Figure III**  WINDUP TURN TIME HISTORY (CONCLUDED)
FIGURE 112: STATIC LONGITUDINAL STABILITY SUMMARY

F-4E USAF S/N 66-287A

LOADINGS 10 AND 16: FWD/AFT AIM-7’S

CR CONFIGURATION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT MAC)</th>
<th>KCAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>10,300</td>
<td>36,900</td>
<td>24.4</td>
<td>398</td>
</tr>
<tr>
<td>●</td>
<td>10,100</td>
<td>42,700</td>
<td>31.8</td>
<td>406</td>
</tr>
<tr>
<td>□</td>
<td>10,500</td>
<td>36,700</td>
<td>24.3</td>
<td>451</td>
</tr>
<tr>
<td>■</td>
<td>10,500</td>
<td>43,000</td>
<td>32.0</td>
<td>440</td>
</tr>
<tr>
<td>◇</td>
<td>10,700</td>
<td>35,700</td>
<td>23.8</td>
<td>475</td>
</tr>
<tr>
<td>▼</td>
<td>10,800</td>
<td>36,300</td>
<td>23.9</td>
<td>511</td>
</tr>
</tbody>
</table>
Figure 113: Static Longitudinal Stability Summary

**LOADINGS: 1a AND 1b: FWD/AFT AIM-7s**

**3,370-gal Tanks and Lau-10’s**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PER MAC)</th>
<th>KCAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35,500</td>
<td>41,600</td>
<td>25.8</td>
<td>224</td>
</tr>
<tr>
<td>0</td>
<td>35,200</td>
<td>41,200</td>
<td>33.6</td>
<td>239</td>
</tr>
<tr>
<td>0</td>
<td>35,500</td>
<td>40,900</td>
<td>25.0</td>
<td>266</td>
</tr>
<tr>
<td>0</td>
<td>35,400</td>
<td>39,800</td>
<td>27.2</td>
<td>272</td>
</tr>
<tr>
<td>0</td>
<td>35,400</td>
<td>40,500</td>
<td>24.1</td>
<td>287</td>
</tr>
<tr>
<td>0</td>
<td>35,800</td>
<td>39,400</td>
<td>24.3</td>
<td>276</td>
</tr>
<tr>
<td>0</td>
<td>35,600</td>
<td>37,300</td>
<td>23.4</td>
<td>314</td>
</tr>
<tr>
<td>0</td>
<td>35,900</td>
<td>35,900</td>
<td>31.1</td>
<td>309</td>
</tr>
<tr>
<td>0</td>
<td>35,300</td>
<td>39,100</td>
<td>24.2</td>
<td>373</td>
</tr>
<tr>
<td>0</td>
<td>35,100</td>
<td>36,500</td>
<td>29.7</td>
<td>379</td>
</tr>
<tr>
<td>△</td>
<td>35,100</td>
<td>37,700</td>
<td>25.1</td>
<td>427</td>
</tr>
<tr>
<td>△</td>
<td>35,400</td>
<td>35,400</td>
<td>27.7</td>
<td>439</td>
</tr>
<tr>
<td>△</td>
<td>35,000</td>
<td>43,200</td>
<td>32.2</td>
<td>229</td>
</tr>
<tr>
<td>△</td>
<td>35,400</td>
<td>47,100</td>
<td>32.3</td>
<td>259</td>
</tr>
<tr>
<td>△</td>
<td>35,400</td>
<td>45,700</td>
<td>31.5</td>
<td>271</td>
</tr>
<tr>
<td>△</td>
<td>35,000</td>
<td>41,900</td>
<td>31.9</td>
<td>285△</td>
</tr>
<tr>
<td>△</td>
<td>35,800</td>
<td>44,400</td>
<td>30.3</td>
<td>307△</td>
</tr>
</tbody>
</table>

**NOTE:** Flags denote loading 3. All other points are loadings 1a and 1b.
F-RE USAF S/N 06-287A

LOADING: 1A AND 1B: FWD/AFT AIM-7'S
CR CONFIGURATION

CROSS-SECTION

GROSS WT (LB) (FST MN)

<table>
<thead>
<tr>
<th>SYM (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>WT (LB)</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10,300</td>
<td>0.72</td>
<td>598</td>
<td>56,900</td>
</tr>
<tr>
<td>-</td>
<td>10,100</td>
<td>0.73</td>
<td>406</td>
<td>42,700</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM

FIGURE 114  STATIC LONGITUDINAL STABILITY
F-4E USAF S/N 66-257A

LOADING: 1A AND 1B: FWD/AFT AIM-7'S.
CR CONFIGURATION

ALTITUDE (FT) MACH KIAS WT (LB) PSTMAC

<table>
<thead>
<tr>
<th>SYM</th>
<th>10,500</th>
<th>0.81</th>
<th>451</th>
<th>36,700</th>
<th>24.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10,500</td>
<td>0.79</td>
<td>440</td>
<td>43,000</td>
<td>32.0</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 11.5 STATIC LONGITUDINAL STABILITY
F-4E USAF S/N 66-287A

LOADING: 1a: FWD AIM-7
CR CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG (PER MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10,700</td>
<td>0.86</td>
<td>475</td>
<td>35,700</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 116: STATIC LATERAL STABILITY
F-1E USAF S/N 66-287A

LOADING: 1a. FWD AIM-7
CR CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE</th>
<th>GROSS</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYM (FT)</td>
<td>MACH</td>
<td>KCAS</td>
</tr>
<tr>
<td>-0</td>
<td>10,800</td>
<td>0.92</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH - PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 117: STATIC LONGITUDINAL STABILITY
F-4E LEAP S/N 00-207A

LOADING 1 4 AND 15: FWD/AFT AIM-7B
CR CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>WT (LB) (INTKG)</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.65</td>
<td>224</td>
<td>41,600</td>
<td>25.0</td>
</tr>
<tr>
<td>0</td>
<td>0.71</td>
<td>229</td>
<td>41,200</td>
<td>33.6</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 118  STATIC LONGITUDINAL STABILITY
F-1E USAF S/N GG-287A

LOADING: 1a AND 1b: FWD/AFT AIM-7'S
CR CONFIGURATION

<table>
<thead>
<tr>
<th>SYM</th>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>GROSS WT (LB)</th>
<th>CG (PCT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35,500</td>
<td>0.79</td>
<td>266</td>
<td>40,900</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>35,400</td>
<td>0.81</td>
<td>272</td>
<td>38,800</td>
<td>32.7</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST PUSH - PULL

NOTE: SOLID SYMBOLS DENOTE TRIM

FIGURE 119 STATIC LONGITUDINAL STABILITY
F-4E USAF S/N 66-287A

LOADING: 1a AND 1b: FWD/AFT AIM-7'S CR CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>WT (LB)</th>
<th>CG (PCT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35,400</td>
<td>0.85</td>
<td>287</td>
<td>40,500</td>
<td>24.1</td>
</tr>
<tr>
<td>35,800</td>
<td>0.82</td>
<td>276</td>
<td>38,400</td>
<td>32.3</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST PULL/PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 120  STATIC LONGITUDINAL STABILITY
F-4E USAF S/N 66-287A

LOADING: 1a. AND 1b. FWD/AFT AIM-7'S
CR CONFIGURATION

ALTIMETRY
<table>
<thead>
<tr>
<th>SYM</th>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>WT (LB)</th>
<th>CG (PC% MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>35,000</td>
<td>0.92</td>
<td>311</td>
<td>33,000</td>
<td>23.4</td>
</tr>
<tr>
<td>1b</td>
<td>35,900</td>
<td>0.91</td>
<td>309</td>
<td>35,900</td>
<td>31.1</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 121: STATIC LONGITUDINAL STABILITY
F-1E USAF S/N 66-287A

LOADING IA AND IE: FWD/AFT AIM-7 B
CO CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>WT (LB)</th>
<th>GROSS CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>35,000</td>
<td>1.06</td>
<td>373</td>
<td>39,100</td>
<td>24.2</td>
</tr>
<tr>
<td>35,100</td>
<td>1.07</td>
<td>379</td>
<td>36,500</td>
<td>29.7</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM

FIGURE 122. STATIC LONGITUDINAL STABILITY
Figure 123  STATIC LONGITUDINAL STABILITY
LOADING: 3,370-GAL TANKS AND LAU-10'S

CR CONFIGURATION

<table>
<thead>
<tr>
<th>SYM</th>
<th>ALTITUDE (FT)</th>
<th>MACH</th>
<th>KCAS</th>
<th>WT (LB)</th>
<th>(PCT MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36,000</td>
<td>0.68</td>
<td>229</td>
<td>43,200</td>
<td>32.2</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.
FLAGS DENOTE INCREASING $C_n$
Figure 125: Static Longitudinal Stability
Loading: 370-gal tanks and LAU-10s

Configuration:

<table>
<thead>
<tr>
<th>Sym (ft)</th>
<th>Mach</th>
<th>KCAS</th>
<th>Gross (lb)</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.80</td>
<td>271</td>
<td>45,700</td>
<td>31.5</td>
</tr>
</tbody>
</table>

Test method: Constant thrust
Push-pull

Note: Solid symbols denote trim.

Figure 126: Static longitudinal stability
Figure 127: Static Longitudinal Stability

F-115 USAF S/N 68-257A

Loading: 3: 370-Gal Tanks and LAU-103
CR Configuration

Altitude (ft) Mach KCAS Int (lb) Lift (max)
0 35,000 0.63 2815 41,900 31.9

Test Method: Constant Thrust Push-Pull

Note: Solid symbol denotes trim.
F-4E USAF S/N GG-287A

## Loading:
3: 370-gal tanks and LAU-10’s

### Configuration

<table>
<thead>
<tr>
<th>Sym</th>
<th>Altitude (ft)</th>
<th>Mach</th>
<th>KCAS</th>
<th>Gross Wt (lb)</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>35,000</td>
<td>0.90</td>
<td>307</td>
<td>44,400</td>
<td>30.3</td>
</tr>
</tbody>
</table>

### Test Method:
Constant thrust

Push - Pull

### Note:
Solid symbols denote trim.
Flags denote C_n increasing.

### Figures
- **Figure 128:** Static Longitudinal Stability
F-4E USAF S/N 66-267A

LOADING: NO EXTERNAL STORES
PA CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE</th>
<th>PROD. AOA</th>
<th>GROSS</th>
<th>CG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9,900</td>
<td>146</td>
<td>19.4</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM,
FLAGS DENOTE \( C_n \) INCREASING.

**FIGURE 129** POWER APPROACH STATIC LONGITUDINAL STABILITY
F-16 USAF S/N 66-287A

LOADING: 1: NO EXTERNAL STORES
PA CONFIGURATION

<table>
<thead>
<tr>
<th>SYM</th>
<th>KCAS (LBS)</th>
<th>WT (B)</th>
<th>CG</th>
<th>(FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0</td>
<td>10 100</td>
<td>171</td>
<td>13.1</td>
<td>35,700</td>
</tr>
</tbody>
</table>

TEST METHOD: CONSTANT THRUST
PUSH-PULL

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 130  POWER APPROACH STATIC LONUDITUDINAL STABILITY
Figure 131: Longitudinal Short Period Damping
LOADING 1. NO EXTERNAL STORES
3. 570-GAL TANKS AND LAU-10'S

CR-CO CONFIGURATIONS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT. MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35,100</td>
<td>41,200</td>
<td>33.6</td>
</tr>
<tr>
<td>0</td>
<td>35,900</td>
<td>38,600</td>
<td>32.6</td>
</tr>
<tr>
<td>0</td>
<td>35,400</td>
<td>37,700</td>
<td>31.5</td>
</tr>
<tr>
<td>0</td>
<td>36,600</td>
<td>37,200</td>
<td>30.9</td>
</tr>
<tr>
<td>0</td>
<td>35,400</td>
<td>38,300</td>
<td>29.9</td>
</tr>
<tr>
<td>0</td>
<td>36,300</td>
<td>36,200</td>
<td>27.0</td>
</tr>
<tr>
<td>0</td>
<td>35,000</td>
<td>40,900</td>
<td>24.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT. MAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35,800</td>
<td>40,100</td>
</tr>
<tr>
<td>0</td>
<td>35,800</td>
<td>38,700</td>
</tr>
<tr>
<td>0</td>
<td>35,700</td>
<td>36,000</td>
</tr>
<tr>
<td>0</td>
<td>35,400</td>
<td>37,400</td>
</tr>
<tr>
<td>0</td>
<td>35,700</td>
<td>38,700</td>
</tr>
<tr>
<td>0</td>
<td>35,700</td>
<td>37,200</td>
</tr>
<tr>
<td>0</td>
<td>35,700</td>
<td>36,100</td>
</tr>
<tr>
<td>0</td>
<td>35,900</td>
<td>38,600</td>
</tr>
<tr>
<td>0</td>
<td>34,800</td>
<td>38,700</td>
</tr>
<tr>
<td>0</td>
<td>35,100</td>
<td>37,500</td>
</tr>
</tbody>
</table>

NOTES: 1. PLAIN SYMBOLS DENOTE SAS OFF AND LOADING 1.
SOLID SYMBOLS DENOTE SAS ON; FLAGS DENOTE LOADING 3.
2. STICK NOT RESTRAINED AFTER DOUBLET INPUT.

FIGURE 132  LONGITUDINAL SHORT PERIOD DAMPING
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-256  RUN 13  DATE 10 MAY 1972
F-4E  MCRP NO. 281  USAF S/N 55-0287

DYNAMIC LONGITUDINAL STABILITY (SAS ON)

CONFIGURATION: BASIC MODEL F-4E WITH TWO POSITION WING LEADING EDGE SLATS
LEADING EDGE SLATS PER 53 DEG 80 HP, 19 LP
LONGITUDINAL CONTROL SYSTEM IMBALANCE
WEIGHT, LONG FLIGHT TEST HOPPER, ENSO.
POD AT L/H FORWARD MISSILE WELL.

INITIAL CONDITIONS

1. GROSS WEIGHT
2. L/D PITCHING MOMENT
3. G/D ALTITUDE
4. L/D GND ATTITUDE
5. THRU-THRU ALTITUDE
6. WEIGHT
7. NO. OF OILS
8. PITTS PITCHING MOMENT
9. DEGREES
10. PITCH RATE DEGREES/SEC
11. PROD ANGLE OF ATTACK DEGREES

NORMAL ACCEL. AT C.G. 0.9"S

PITCH ANGLE DEGREES

ELAPSED TIME IN SECONDS

22, 13, 55, 391

FIG. 133 DYNAMIC LONGITUDINAL STABILITY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 237-258  RUN 14  DATE 10 MAY 1972
F-4E  MCRIA NO. 2280  USAF 9/N 88-0287

DYNAMIC LONGITUDINAL STABILITY (SR3 OFF)

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION - BASIC MODEL F-4E WITH TWO POSITION WING LANDING
LEADING EDGE SLATS PER 93 59 009. 16 LB
LONGITUDINAL CONTROL SYSTEM IMBALANCE
HEIGHT, LONG FLIGHT TEST NACELLE, EAMS
POD AT L/H FORWARD MIDDLE WELL.

ENTRY CONDITIONS
1.ross WEIGHT  35320  LBS
2. W/CATITUDE HCG  22.5  FT
3. W/B 40000  LBS
4. MACH NO  0.757  N-D

NORMAL MODEL AT C.G. 0.9

PITCH ANGLE
DEGREES

ANGLE OF ATTACK
DEGREES

N/B NO. 20 ATTACK UNITS

ELAPSED TIME IN SECONDS
22.14 16.7 17

FIGURE 154  DYNAMIC LONGITUDINAL STABILITY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 207-255  RUN 23  DATE 10 MAY 1972
F-4E  MCAIR NO. 2200  USAF S/N 66-0287
DYNAMIC LONGITUDINAL STABILITY (SAS ON)

X - L/H SIDE  SQUARE - R/H SIDE

**CONFIGURATION**
- BASIC MODEL F-4E WITH TWO POSITION WING LEADING EDGES
- SLATS PER 33 39 009. LBS
- LONGITUDINAL CONTROL SYSTEM IMBALANCE
- WEIGHT LONG FLIGHT TEST NOTEBOOK END
- POD AT L/H FORWARD HELSE WEL.

**ENTRY CONDITIONS**

<table>
<thead>
<tr>
<th>Entry</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gross Weight</td>
<td>37,160 LBS</td>
</tr>
<tr>
<td>2</td>
<td>C.G. Position</td>
<td>80.4 FT</td>
</tr>
<tr>
<td>3</td>
<td>N/V Position</td>
<td>30,470 FT</td>
</tr>
<tr>
<td>4</td>
<td>N/V Elevator</td>
<td>0.4</td>
</tr>
<tr>
<td>5</td>
<td>R/GC Thrust</td>
<td>1,455 N-U</td>
</tr>
</tbody>
</table>

**CHART**

- Normal Acceleration at C.G. 315
- Star Position Degrees
- Pitch Angle Degrees
- R/GC Angle of Attack Degrees

**Figure 135** DYNAMIC LONGITUDINAL STABILITY
FLIGHT TEST EVALUATION OF THE MODEL F-14E
WITH TWO POSITION MANEUVERING SLATS

F-14E MCAIR NO. 2280

DYNAMIC LONGITUDINAL STABILITY (SAS OFF)

Figure 136 DYNAMIC LONGITUDINAL STABILITY
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS
/LT 297-258  RUN 26  DATE 11 MAY 1972
F-4E  MCAIR NO. 2260  USAF 5/11 56-0287
DYNAMIC LONGITUDINAL STABILITY (SAS OFF)

X - L/H SIDE  SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>CONFIGURATION</th>
<th>BASIC MODEL F-4E WITH TWO POSITION NING LOADING</th>
<th>L/H SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEADING EDGE SLATS PER 33 38 009 16 LB</td>
<td>LONGITUDINAL CONTROL SYSTEM INHABITANCE</td>
<td></td>
</tr>
<tr>
<td>WEIGHT LONG FLIGHT TEST NO FLOORS END</td>
<td>POD AT L/H FORWARD MISSILE WELL</td>
<td></td>
</tr>
<tr>
<td>SPAN ON AT R/H FORWARD MISSILE WELL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ENTRY CONDITIONS

<table>
<thead>
<tr>
<th>ENTRY</th>
<th>CROSS WEIGHT</th>
<th>0.000</th>
<th>1.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CROSS WEIGHT</td>
<td>0.700</td>
<td>0.700</td>
</tr>
<tr>
<td>2</td>
<td>AIR ABNORMAL</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>AIR ABNORMAL</td>
<td>0.950</td>
<td>0.950</td>
</tr>
<tr>
<td>4</td>
<td>AIR ABNORMAL</td>
<td>1.200</td>
<td>1.200</td>
</tr>
</tbody>
</table>

NORMAL ACCEL AT C.G. DEG/SEC

PITCH ANGLE DEGREES

ROLL ANGLE DEGREES

N/B ANGLE OF ATTACK DEGREES

17,21,25,000  ELAPSED TIME IN SECONDS

FIGURE 138 DYNAMIC LONGITUDINAL STABILITY
**FLIGHT TEST EVALUATION OF THE MODEL F-4E**

**WITH TWO POSITION MANEUVERING SLATS**

FLT 287-254  RUN 17  DATE 9 MAY 1972

**F-4E**  **MCR 2280**  **USAF S/N 66-0287**

**DYNAMIC LONGITUDINAL STABILITY (SAS ON)**

### Configuration
- Basic model F-4E with two position wing loading
- Leading edge slats per D3 36 903, 14 lb
- Longitudinal control system imbalance
- Weight, long flight test handbook, EAGS
- Pod at L/H forward missile well

### Entry Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross weight (lb)</td>
<td>25,330</td>
</tr>
<tr>
<td>Mach number</td>
<td>0.800</td>
</tr>
<tr>
<td>Altitude (ft)</td>
<td>5000</td>
</tr>
</tbody>
</table>

### Graphs

- Normal acceleration at E.G.
- Angle of attack
- Pitch angle degrees
- Roll angle

### Data

- **20, 20, 57.476**  **ELAPSED TIME IN SECONDS**

**Figure 139**  **DYNAMIC LONGITUDINAL STABILITY**
## FLIGHT TEST EVALUATION OF THE MODEL F-4E

**With Two Position Maneuvering Slats**

**Flight Test No.:** 287-252  
**Run:** 35  
**Date:** 2 May 1972  
**Model:** F-4E  
**MCR No.:** 2280  
**USAF S/N:** 66-0287  

### Configuration: Basic Model F-4E With Two Position Maneuvering Slats

<table>
<thead>
<tr>
<th>Entry Condition</th>
<th>Normal Acceleration at C.G. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Configuration Notes:**
- Leading Edge Slats Per Sec 33 839.15 LB
- Longitudinal Control System Imbalance
- Height Long Flight Test Notebook Ends
- POD At L/H Forward Missile Well

**Figure 141: Dynamic Longitudinal Stability**

**Legend:**
- L/H Side
- R/H Side
- Square - R/H Side
- Cross - L/H Side
TRANSONIC SPEED STABILITY

F-4E USAF S/N G-287A

LOADING & NO STORES

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT MAC)</th>
<th>THRUST</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>38,400</td>
<td>37,400</td>
<td>29.2</td>
<td>MAX A/B</td>
</tr>
<tr>
<td>- - 0</td>
<td>39,600</td>
<td>36,100</td>
<td>28.3</td>
<td>IDLE</td>
</tr>
</tbody>
</table>

NOTE: SOLID SYMBOLS DENOTE TAUM.
F-4F USAF S/N 66-2876

LOADING I: NO STORES

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (IN Xt PLANE)</th>
<th>THrust</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>0</td>
<td>58,600</td>
<td>29.120</td>
<td>29.6</td>
</tr>
<tr>
<td>o</td>
<td>0</td>
<td>58,700</td>
<td>29.700</td>
<td>29.5</td>
</tr>
</tbody>
</table>

MAX A/B

NOTE: SOLID SYMBOLS DENOTE TRIM; FLAGS DENOTE RETRACTED SLATS.

Figure 13b: Transonic Decelerating Turn
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-273  RUN 19  DATE 24 MAY 1972
F-4E  MAP No. 2280  USAF 3/N 66-0267
A/B POWER ACCELERATION

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Basic Model F-4E with Two Position Maneuvering Slats</th>
<th>Leading Edge Slats Per 35 50 80% 16 Lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>X - L/H Side</td>
<td>Square - R/H Side</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N/B</th>
<th>ALTITUDE</th>
<th>MACH NO</th>
<th>CONS總</th>
<th>L/H TOTAL</th>
<th>NOT AVAILABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FT</td>
<td></td>
<td></td>
<td>DEG. C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CARTOGRAPHER</th>
<th>BASIC MODEL F-4E WITH TWO POSITION MANEUVERING SLATS</th>
<th>LEADING EDGE SLATS PER 35 50 80% 16 Lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>X - L/H SIDE</td>
<td>Square - R/H Side</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 144** MAX A/B THRUST ACCELERATION TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 207-275
RUN 10
DATE 24 MAY 1972

F-4E MCRAE NO. 2280
USAF 54-65-0267

A/B POWER ACCELERATION

FIGURE 144 MAX A/B THRUST ACCELERATION TIME HISTORY (CONCLUDED)
F-1E USAF S/N 68-287A

FLT 267-273    RUN 21    DATE 24 MAY 1972

X-L/H SIDE

CONFIGURATION
LOADING 1 EAG PAD ON FUSELAGE STATION 1
EXTERNAL STORES: NONE

ENTRY CONDITIONS
1. GRAVITY
2. C.G. POSITION
3. 24400 LBS'AEROACO

SQUARES-R/H SIDE

N/B
ALTITUDE
HFT
X 1000

MACH
NO.
N-D

L/H
TOTAL
TEMP
DEG. C

NOT AVAILABLE

0 20 40 60 80 100 120 140
ELAPSED TIME IN SECONDS

FIGURE 145 IDLE THRUST DECELERATION TIME HISTORY
Figure 145  Idle Thrust Deceleration Time History (Concluded)
### Table: Loadings for NO External Stores

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Altitude (FT)</th>
<th>Gross WT (LB)</th>
<th>CG Position (PT MAC)</th>
<th>Production AOA (UNITS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10,000</td>
<td>33,300</td>
<td>26.9</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>10,500</td>
<td>35,100</td>
<td>26.6</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>10,200</td>
<td>36,000</td>
<td>29.9</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>10,400</td>
<td>35,400</td>
<td>26.2</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>10,700</td>
<td>36,100</td>
<td>27.7</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>10,300</td>
<td>35,600</td>
<td>26.0</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>10,400</td>
<td>34,700</td>
<td>26.0</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>11,500</td>
<td>36,300</td>
<td>28.4</td>
<td>12</td>
</tr>
<tr>
<td>E</td>
<td>11,900</td>
<td>37,700</td>
<td>25.3</td>
<td>12</td>
</tr>
<tr>
<td>F</td>
<td>10,700</td>
<td>37,300</td>
<td>24.0</td>
<td>10</td>
</tr>
<tr>
<td>G</td>
<td>10,000</td>
<td>37,100</td>
<td>24.3</td>
<td>10</td>
</tr>
<tr>
<td>H</td>
<td>11,500</td>
<td>35,500</td>
<td>24.0</td>
<td>10</td>
</tr>
<tr>
<td>I</td>
<td>10,100</td>
<td>35,900</td>
<td>27.8</td>
<td>10</td>
</tr>
<tr>
<td>J</td>
<td>9,900</td>
<td>35,600</td>
<td>28.0</td>
<td>21</td>
</tr>
<tr>
<td>K</td>
<td>10,400</td>
<td>35,100</td>
<td>28.4</td>
<td>10</td>
</tr>
<tr>
<td>L</td>
<td>12,400</td>
<td>35,400</td>
<td>24.1</td>
<td>10</td>
</tr>
<tr>
<td>M</td>
<td>9,900</td>
<td>35,500</td>
<td>29.1</td>
<td>9</td>
</tr>
</tbody>
</table>

### Diagram: Roll Capability

- **Max Roll Aileron Deflection (DEG):**
  - 30°
- **Time to Bank 100 Degrees (SEC):**
  - 70°
- **Bank angle after 1 second (DEG):**
  - 10°

**Note:** Plain symbols denote left rolls, flags denote right rolls.

**Figure 146:** Roll capability - 10,000 feet altitude
### Loadings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Altitude (FT)</th>
<th>Gross WT (LB)</th>
<th>CG Position (Pct MAC)</th>
<th>Production AOA (Units)</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10,400</td>
<td>36,900</td>
<td>26.4</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Q</td>
<td>10,400</td>
<td>39,800</td>
<td>26.7</td>
<td>10</td>
<td>A2</td>
</tr>
<tr>
<td>P</td>
<td>10,300</td>
<td>39,600</td>
<td>26.5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>10,900</td>
<td>38,900</td>
<td>27.7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>9,800</td>
<td>45,500</td>
<td>29.2</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

### Notes
1. Plain symbols denote left roll, flags denote right roll.
2. External fuel tanks empty.
3. Asymmetric fuel load as follows: right 370-gal tank half full; left 370-gal tank empty.

---

**Figure 146:** Roll Capability: 10,000 Feet Altitude (Concluded)
### Table: Loadings and CG Configuration

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (FT MAC)</th>
<th>PRODUCTION ADA (UNITS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>39,700</td>
<td>36,600</td>
<td>28.4</td>
<td>8</td>
</tr>
<tr>
<td>□</td>
<td>35,700</td>
<td>36,000</td>
<td>28.8</td>
<td>6</td>
</tr>
<tr>
<td>△</td>
<td>35,000</td>
<td>36,800</td>
<td>28.7</td>
<td>16</td>
</tr>
<tr>
<td>□</td>
<td>35,200</td>
<td>36,400</td>
<td>28.2</td>
<td>5</td>
</tr>
<tr>
<td>△</td>
<td>35,600</td>
<td>41,600</td>
<td>27.8</td>
<td>15</td>
</tr>
<tr>
<td>□</td>
<td>36,800</td>
<td>40,600</td>
<td>27.1</td>
<td>18</td>
</tr>
<tr>
<td>△</td>
<td>34,300</td>
<td>39,700</td>
<td>26.5</td>
<td>25</td>
</tr>
<tr>
<td>□</td>
<td>35,800</td>
<td>38,200</td>
<td>25.6</td>
<td>28</td>
</tr>
<tr>
<td>△</td>
<td>35,300</td>
<td>37,100</td>
<td>24.3</td>
<td>11</td>
</tr>
<tr>
<td>□</td>
<td>34,300</td>
<td>36,600</td>
<td>24.3</td>
<td>20</td>
</tr>
<tr>
<td>△</td>
<td>34,400</td>
<td>36,300</td>
<td>24.0</td>
<td>11</td>
</tr>
<tr>
<td>□</td>
<td>35,500</td>
<td>35,000</td>
<td>28.6</td>
<td>11</td>
</tr>
<tr>
<td>△</td>
<td>35,400</td>
<td>34,800</td>
<td>28.5</td>
<td>12</td>
</tr>
<tr>
<td>□</td>
<td>35,500</td>
<td>34,700</td>
<td>27.7</td>
<td>12</td>
</tr>
</tbody>
</table>

**Notes:** Plain symbols denote left aileron rolls, flags denote right rolls, solid symbols denote rudder rolls.

---

**Figure 147:** Roll capability - 35,000 feet altitude.
### Loadings:
2: 370-Gal Tanks, 3: Tanks and Lau-10's

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Altitude (FT)</th>
<th>Gross WT (Lb)</th>
<th>CG Position (PCT MAC)</th>
<th>Production AOA (Units)</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>34,900</td>
<td>42,600</td>
<td>27.7</td>
<td>13-17</td>
<td>3 SEE NOTE 2</td>
</tr>
<tr>
<td></td>
<td>35,100</td>
<td>42,100</td>
<td>27.0</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>34,600</td>
<td>42,000</td>
<td>27.7</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>△</td>
<td>35,100</td>
<td>40,500</td>
<td>26.8</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>△</td>
<td>35,300</td>
<td>40,200</td>
<td>26.7</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>△</td>
<td>34,700</td>
<td>40,000</td>
<td>26.6</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>△</td>
<td>35,200</td>
<td>41,000</td>
<td>29.4</td>
<td>12</td>
<td>A2 SEE NOTE 3</td>
</tr>
<tr>
<td>△</td>
<td>35,200</td>
<td>40,500</td>
<td>29.3</td>
<td>10</td>
<td>A2</td>
</tr>
<tr>
<td>△</td>
<td>35,900</td>
<td>40,100</td>
<td>29.0</td>
<td>8</td>
<td>A2</td>
</tr>
<tr>
<td>■</td>
<td>35,200</td>
<td>39,000</td>
<td>27.2</td>
<td>26</td>
<td>3 SEE NOTE 4</td>
</tr>
<tr>
<td>■</td>
<td>32,400</td>
<td>38,800</td>
<td>27.0</td>
<td>29</td>
<td>3</td>
</tr>
</tbody>
</table>

**Notes:**
1. Plain symbols denote left aileron rolls. Flags denote right rolls. Solid symbols denote rudder rolls.
2. External fuel tanks full. 3. Asymmetric fuel load as follows: Right, 370-gal tank half full, left 370-gal tank empty. 4. External fuel tanks empty.

**Figure 147:** Roll capability - 35,000 feet altitude (concluded)
### F-4E USAF S/N 66-287A

**SAS ON**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG (PER MAC)</th>
<th>AOA (UNITS)</th>
<th>LOADING</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6,500</td>
<td>36,000</td>
<td>26.3</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>□</td>
<td>10,000</td>
<td>35,000</td>
<td>25.6</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>α</td>
<td>9,100</td>
<td>37,700</td>
<td>26.8</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>О</td>
<td>10,100</td>
<td>38,200</td>
<td>27.1</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>V</td>
<td>10,000</td>
<td>35,700</td>
<td>26.1</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Δ</td>
<td>9,900</td>
<td>37,500</td>
<td>29.3</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Ч</td>
<td>10,100</td>
<td>37,200</td>
<td>29.0</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>А</td>
<td>10,000</td>
<td>36,700</td>
<td>28.4</td>
<td>15</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE 1:** PLAIN SYMBOLS DENOTEAILERON ROLLS ANDAILERON POSITION; SOLID SYMBOLS DENOTE RUDDER ROLLS AND RUDDER POSITION.

**NOTE 2:** ASYMMETRIC FUEL LOAD AS FOLLOWS: RIGHT 370-GAL TANK HALF FULL, LEFT 370-GAL TANK EMPTY.

**Figure 148** LOW SPEED ROLL CAPABILITY

---

**AVERAGE HELIX ANGLE FOR INITIAL 30 DEG OF BANK - PB/2Y (RADIANS)**

**MAXIMUM CONTROL SURFACE DEFLECTION (DEGREES)**

**R.Y.D. TELEMETRY**

**CALIBRATED AIRSPEED (KT)**
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS

FLT 287-260    RUN 22    DATE 11 MAY 1972
F-4E    NCAIN NO. 2280    USAF S/N 66-0287
ROLLING PERFORMANCE

<table>
<thead>
<tr>
<th>ENTRY CONDITIONS</th>
<th>X - L/H SIDE</th>
<th>SQUARE - R/H SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEADING EDGE SLATS PER 33.3% 80% 15 LB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LONGITUDINAL CONTROL SYSTEM PERFORMANCE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HEIGHTS, LONG FLIGHT TEST RUNBOOK, ETC.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>POO AT LH FORWARD MIDDLE WELL.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SPINNOR AT R/H FORWARD MIDDLE WELL.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENTRY CONDITIONS</th>
<th>WEIGHT</th>
<th>L.M.B. POSITION</th>
<th>95239</th>
<th>83</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>M/B ALTITUDE MPC FT</th>
<th>1200</th>
</tr>
</thead>
<tbody>
<tr>
<td>W/B MACH NO M-0</td>
<td>0.6</td>
</tr>
<tr>
<td>FREE M/C TEMP</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L/M TOTAL - TEMP DEG. C</th>
<th>NOT AVAILABLE</th>
</tr>
</thead>
</table>

PAGE 01

FIGURE 149  MILLISECOND TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-260  RUN 22  DATE 11 MAY 1972
F-4E  MACRA NO. 2280  USAF 5/N 59-0387
ROLLING PERFORMANCE

X - L/H SIDE  SQUARE - R/H SIDE

LONG STICK POSITION DEGREES
FHD 10 0 10
TEU 20 0 20

PITCH RATE
DEG/SEC
0 20 40 60 ANU
-20 -40 -60 ANU

N/B ANGLE OF ATTACK DEGREES
10 -10 0 10 20

NORMAL ACCEL AT C/D.
0

2 RIGHT
1 2 EXT
0/8 SLAT
1 POSITION
0 MET
LEFT

ELAPSED TIME IN SECONDS

FIGURE 149 AILUREN ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS

FLT 287-260     RUN 22     DATE 11 MAY 1972
F-4E     MCAIM NO. 2280     USAF 3/N 68-0287
ROLLING PERFORMANCE

ROLLING PERFORMANCE

ROLL RATE
DEG/SEC
0 100 200
-100 -200 -300
0 1.0 2.0 3.0 4.0 5.0 6.0 7.0
ELAPSED TIME IN SECONDS

FIGURE 149 AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS

FLT 287-260 RUN 22 DATE 11 MAY 1972
F-4E MCAIR No. 2280 USAF S/N 6A-0287
ROLLING PERFORMANCE

X - L/H SIDE SQUARE - R/H SIDE

FLIGHT PATH ACCEL 0.0

0.6
0.2
0.0
-0.2
-0.4
-0.6

0.4
0.2
0.0
-0.2
-0.4
-0.6

0.0
0.2
0.4
0.6

LAT'L
0.0
0.2
0.4
0.6

ROLLING ACCEL
0
2
4
6

ROLLING
0
2
4
6

4.0
5.0
6.0
7.0

ELAPSED TIME IN SECONDS

FIGURE 149 \( \text{ROLLING MANEUVER HISTORY (CONCLUDED)} \)
### Flight Test Evaluation of the Model F-4E

**With Two Position Maneuvering Slats**

**Flight Test Configuration:** Basic Model F-4E with two position wing loading.

- Leading edge slats per Ref. 33. 88. 80. 18 lbs.
- Longitudinal control system imbalance
- Height: Long flight test nose-down, end.
- Mod at L/H forward missile well.

#### Entry Conditions:

- Gross Weight
- Height
- 324.47 ft
- 55.1 ft
- 18.27
- 0.0 NAC

---

**Chart Details:**

- **X - L/H Side**
- **Square - R/H Side**
- **Elapsed Time in Seconds:** 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0
- **Free Air Temp:** 70.0 deg C
- **Mach No.**
- **NAC No.**
- **Altitude (FT) X 1000**
- **Altitude (MPC)**
- **Total Temp (DEG. C)**
- **Not Available**

---

**Figure 150: Allison Roll Time History**
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-269  RUN 27  DATE 22 MAY 1972
F-4E  MCAIR NO. 2200  USAF S/N 65-0287
ROLLING PERFORMANCE

X - L/H SIDE  SQUARE - R/H SIDE

- Long Stick Position Degrees
- Fwd
- Tilt
- Stab Position Degrees
- Ted
- Pitch Rate Deg/Sec
- N/S Angle of Attack Degrees
- Normal Accel at C.O. G's

ELAPSED TIME IN SECONDS

Figure 150 Aileron Roll Time History (Continued)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-289        RUN 27        DATE 22 MAY 1972
F-4E                  NCARP NO. 2280       USAF 5/N 66-0287
ROLLING PERFORMANCE

ROLLING PERFORMANCE

X - L/H SIDE
SQUARE - R/H SIDE

LATERAL STICK
POSITION DEGREES

LATERAL FORCE
POUNDS

ROLL RATE
DEG/SEC

ROLL ANGLE
DEGREES

TAN RATE
DEG/SEC

ELAPSED TIME IN SECONDS

FIGURE 150 AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-269  RUN 27  DATE  22 MAY 1972
F-4E  MCR 20  USAF 375-06-0267
ROLLING PERFORMANCE

X - L/H SIDE

0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6

SQUARE - R/H SIDE

0.4
0.2
0.0
-0.2
-0.4
-0.6

0.0 2.0 4.0 6.0 8.0 10.0

ELAPSED TIME IN SECONDS

FIGURE 150  AILERON ROLL TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-260  RUN 09  DATE 11 MAY 1972
F-4E  MCRP NO. 2280  USAF 3/4 68-0287

ROLLING PERFORMANCE

<table>
<thead>
<tr>
<th>ENTRY CONDITIONS</th>
<th>N/B</th>
<th>WEIGHT</th>
<th>L/H</th>
<th>R/H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14950</td>
<td>2630</td>
<td>21.6</td>
<td>27.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONFIGURATION- BASIC MODEL F-4E WITH TWO POSITION HINGED LEADING EDGE SLATS PER 33 55 659, 18 LB</th>
</tr>
</thead>
<tbody>
<tr>
<td>LONGITUDINAL CONTROL SYSTEM IMBALANCE</td>
</tr>
<tr>
<td>N/D 1076  FORWARD MIDDLE ELL</td>
</tr>
<tr>
<td>N/D 2318  FORWARD MIDDLE ELL</td>
</tr>
<tr>
<td>N/D 3046  FORWARD MIDDLE ELL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>X - L/H SIDE</th>
<th>SQUARE - R/H SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME</td>
<td>ROLLING PERFORMANCE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELAPSED TIME IN SECONDS</th>
<th>10</th>
<th>12</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREE AIR TEMP DEG C</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>N/B R.A.SPEED KTS</td>
<td>300</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>N/B ALTITUDE MSL FT X 1000</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>MACH NO M N-D</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>L/H TOTAL TEMP DEG C</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

| NOT AVAILABLE |

FIGURE 151 ALLIDON ROLL TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-260 RUN 08 DATE 11 MAY 1972
F-4E MCRIA NO. 2260 USAF 5/N 88-0287
ROLLING PERFORMANCE

ELAPSED TIME IN SECONDS

FIGURE 151 VERTICAL ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-260  RUN 09  DATE 11 MAY 1972
F-4E  NCAIR NO. 2280  USAF S/N 66-0287
ROLLING PERFORMANCE

ROLLING PERFORMANCE
X - L/H SIDE  SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>Angle</th>
<th>Roll Rate (Deg/Sec)</th>
<th>Roll Angle (Deg)</th>
<th>Roll Stick Position (Deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 151  AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS
FLT 287-260  RUN 09  DATE 11 MAY 1972
F-4E  NORAM NO. 2280  USAF S/N 88-0287
ROLLING PERFORMANCE

X - L/H SIDE  SQUARE - R/H SIDE

FLIGHT PATH ACCEL 0'S

0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6

LATERAL ACCEL AT 0'S  0.5
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5

ROLLING ACCEL 0 R/A SEC2
20
10
0
-10
-20
-30
-40

SPOILER 0 POSITION DEGREES
20
10
0
-10
-20

FUSELAGE 0 POSITION DEGREES
20
10
0
-10
-20
-30

ELAPSED TIME IN SECONDS
0  2  4  6  8  10  12  14

FIGURE 151 ALLIUM ROLL TIME HISTORY (CONCLUDED)
FIGURE 152 AILERON ROLL TIME HISTORY
FIGURE 152 AILERON ROLL TIME HISTORY (CONTINUED)
<table>
<thead>
<tr>
<th>Time (sec)</th>
<th>Aileron Roll Rate (deg/sec)</th>
<th>Rudder Position (deg)</th>
<th>Lateral Stick Position (deg)</th>
<th>Roll Rate (deg/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>20</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>30</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>40</td>
<td>25</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>50</td>
<td>30</td>
<td>50</td>
</tr>
</tbody>
</table>

Figure 152: Aileron Roll Time History (Continued)
Flight Path Acceleration G's

X-L/H Side

Squares-R/H Side

Elapsed Time in Seconds

Figure 152: Aileron Roll Time History (Concluded)
FIGURE 153  AILERON ROLL TIME HISTORY
Figure 153  Aileron Roll Time History (continued)
FIGURE 153  AILERON ROLL TIME HISTORY (CONTINUED)
FIGURE 153 AILERON ROLL TIME HISTORY (CONCLUDED)
**FLIGHT TEST EVALUATION OF THE MODEL F-4E**

**WITH TWO POSITION MANEUVERING SLATS**

**FLT 207-272**  **MAY 18**  **DATE**  **23 MAY 1972**

**F-4E**  **ADHOC NO. 2280**  **USAF S/N 66-0287**

**ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)**

<table>
<thead>
<tr>
<th>X - L/H SIDE</th>
<th>SQUARE - R/H SIDE</th>
</tr>
</thead>
</table>

**NOTES:**

- BASIC MODEL F-4E WITH TWO POSITION WING LEADING EDGE SLATS PER 335000 LB
- LEADING EDGE SLATS PER 335000 LB
- LONGITUDINAL CONTROL SYSTEM BALANCE WEIGHT. LONG FLIGHT TEST NOSE DOWN, Его
- NOG AT L/H FORWARD MISSILE ROLL.

**ENTRANCE CONDITIONS**

<table>
<thead>
<tr>
<th>GROSS WT.</th>
<th>37520</th>
<th>L/H SIDES</th>
<th>R/H SIDES</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 L/H</td>
<td>38.4</td>
<td>1.65</td>
<td></td>
</tr>
<tr>
<td>1 R/H</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONFIGURATION:**

- AILNERON ROLL TIME HISTORY

**FIGURE 154** AILNERON ROLL TIME HISTORY

**ELAPSED TIME IN SECONDS**

- 0
- 2
- 4
- 6
- 8
- 10
- 12
- 14

**NOTES:**

- 5.11.30.565
- ELAPSED TIME IN SECONDS
- NOT AVAILABLE
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-272 RUN 16 DATE 23 MAY 1972
F-4E MCAIR NO. 2280 USAF 5/N 66-0287
ROLLING PERFORMANCE (GROSS, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE SQUARE - R/H SIDE

MACH NO. N-D
ALTITUDE HPC FT X 1000

N/B AIRSPEED KTS

FREE AIR TEMP 0 F.R.T. DEG C

TOTAL TEMP DEG. C

NOT AVAILABLE

ELAPSED TIME IN SECONDS

FIGURE 154 AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-272 RUN 16 DATE 23 MAY 1972
F-4E MCA 2280 USAF S/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)
FIT 287-272 RUN 16 DATE 23 MAY 1972
F-4E MCA 2280 USAF S/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

FIGURE 154 AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-WE
WITH TWO POSITION MANEUVERING SLATS

FLT 207-272       RUN 16       DATE 23 MAY 1972
F-WE       MCARR NO. 2280       USAF 5/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG I.E. FLAPS)

FIGURE 154  AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 267-272 RUN 16 DATE 29 MAY 1972
F-4E MAIN NO. 2200 USAF 3/N 66-0267
ROLLING PERFORMANCE (GEAR, SLATS, 10 DEG T.E. FLAPS)
X - L/H SIDE
- SQUARE - R/H SIDE

FIGURE 154 AILEN ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLY 207-272    RUN 16    DATE  23 MAY 1972
F-4E   NCAI NO. 2280    USAF S/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

ROLLING ACCEL 0-9 RAD/SEC^2
SPOILER 0 POSITION DEGREES
AILERON 0 POSITION DEGREES
LATERAL ACCEL AT C.G. 0-9 G'S
FLIGHT PATH ACCEL 0-9 G'S

X - L/H SIDE
SQUARE - A/H SIDE

ELAPSED TIME IN SECONDS

FIGURE 154AILERON ROLL TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-16 WITH TWO POSITION MANEUVERING SLATS

FLT 287-272 RUN 16 DATE 23 MAY 1972
F-16 MCR No. 2267 USAF S/N 66-037
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

FIGURE 154 AILERON ROLL TIME HISTORY (CONCLUDED)
FIGURE 155  Rudder Roll Time History
FIGURE 155 Rudder Roll Time History (Continued)
FLIGHT PATH ACCEL G'S

LATERAL ACCEL AT 0.0 C.G. 0.5

RUDDER ROLL TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 207-272  RUN 17  DATE  23 MAY 1972
F-4E  MACRAE NO. 2290  USAF S/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION: BASIC MODEL F-4E WITH TWO POSITION WING LOADING 1
LEADING EDGE SLATS PER 33 30 009, 18 LB
LONGITUDINAL CONTROL SYSTEM IMBALANCE
WEIGHT, GUN FLIGHT TEST HOODS, ENP
POD AT L/H FORWARD MISSILE WELL.

ENTRY CONDITIONS
1/3 CRSS  W. B.  WEIGHT  POSITION  32430  LBS  MAC

N/B ALTITUDE 100 METER 1600 FT
N/B RASPEED 300 VC KTS

MACH NO. M 0.4
FREE AIR TEMP 0 DEG C

L/H TOTAL TEMP DEG C 50 NOT AVAILABLE

0 10 20 30 40 50 60 70 ELAPSED TIME IN SECONDS

FIGURE 156 Rudder Roll Time History
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-272 RUN 17 DATE 23 MAY 1972
F-4E MCAR No. 2280 USAF S/N 66-0287
ROLLING PERFORMANCE (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

FLIGHT PATH
ACCEL AT 0.5
0.0 C.G., 0.5
0.2
0.4
0.6

LATERAL
0 POSITION
DEGREES
10
20
30 RAND
40 RAND

ROLLING
ACCEL
0 RAND/SEC^2
0
2
4
6
8

ELAPSED TIME IN SECONDS

FIGURE 156 RUDDER ROLL TIME HISTORY (CONTINUOUS)
### Loading: 1, No Stores

#### Configuration

<table>
<thead>
<tr>
<th>Altitude (FT)</th>
<th>Gross WT (LB)</th>
<th>CG Position (PCT MAC)</th>
<th>Mach No</th>
<th>Production</th>
<th>Ada (Units)</th>
<th>Slats</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,200</td>
<td>37,900</td>
<td>29.8</td>
<td>0.37</td>
<td>14</td>
<td>EXT</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Solid symbols denote trim.

**Figure 15.7:** Static Directional Stability
F-4E USAF S/N 66-287A

LOADING: NO STORES

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT MAC)</th>
<th>MACH NO.</th>
<th>PRODUCTION AOA (UNITS)</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>35,800</td>
<td>27.8</td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SOLID SYMBOLS DENOTE TRIM.
LOADING: 1: NO STORES

CR CONFIGURATION

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (FT MAC)</th>
<th>PRODUCTION</th>
<th>Mach No.</th>
<th>AOA (UNITS)</th>
<th>SLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,300</td>
<td>35,400</td>
<td>27.5</td>
<td></td>
<td>0.71</td>
<td>5</td>
<td>RET</td>
</tr>
</tbody>
</table>

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 159  STATIC DIRECTIONAL STABILITY
<table>
<thead>
<tr>
<th>STABILATOR POSITION</th>
<th>BANK ANGLE</th>
<th>LAT. STICK POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TED (DEG)</td>
<td>TEU (DEG)</td>
<td>LWD (DEG)</td>
</tr>
<tr>
<td>9 0 9</td>
<td>8 6 0</td>
<td>9 8 6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LONG. STICK FORCE</th>
<th>RUDDER POSITION</th>
<th>LAT. STICK FORCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUSH (LB)</td>
<td>PULL (LB)</td>
<td>TEL (DEG)</td>
</tr>
<tr>
<td>0 0 0</td>
<td>0 0 0</td>
<td>0 0 0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALTIMETER (FT)</td>
</tr>
<tr>
<td>10,700</td>
</tr>
<tr>
<td>ALTITUDE (FT)</td>
</tr>
<tr>
<td>34,800</td>
</tr>
<tr>
<td>GROSS WT.</td>
</tr>
<tr>
<td>2037</td>
</tr>
<tr>
<td>CG POSITION</td>
</tr>
<tr>
<td>0.0</td>
</tr>
<tr>
<td>MACH NO.</td>
</tr>
<tr>
<td>0.92</td>
</tr>
<tr>
<td>PRODUCTION</td>
</tr>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THEORETICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOAD NO. STORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATIC DIR. STABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIRECTIONAL STABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AIRSPEED (MP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SKY CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOAD NO. STORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STATIC DIR. STABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIRECTIONAL STABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.92</td>
</tr>
</tbody>
</table>
F-4E USAF S/N 66-287A

LOADING: 1 NO STORES

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>CG POSITION (PCT MAC)</th>
<th>KEA'S</th>
<th>AOA (UNITS)</th>
<th>FLATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,100</td>
<td>36,000</td>
<td>27.7</td>
<td>158</td>
<td>17</td>
<td>EXT</td>
</tr>
</tbody>
</table>

NOTE: SOLID SYMBOLS DENOTE TRIM.
F-4E USAF S/N 66-287A

LOADING: 1: NO STORES

<table>
<thead>
<tr>
<th>ALTITUDE (FT)</th>
<th>GROSS WT (LB)</th>
<th>GG POSITION (PCT MAC)</th>
<th>KCNS</th>
<th>AP (UNITS)</th>
<th>SLEAT</th>
<th>EXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,600</td>
<td>35,500</td>
<td>26.0</td>
<td>199</td>
<td>10</td>
<td>EXT</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: SOLID SYMBOLS DENOTE TRIM.

FIGURE 162: STATIC DIRECTIONAL STABILITY
F-4E USAF S/N GG-287A

Loading: 1. No Stores
2. PA Configuration

Symbol CG Location
- O Approximately 25 Pct MAC
- □ Approximately 27 Pct MAC

Notes: 1. "On-Speed" Approach Airspeeds are for a 19.2 Unit AoA approach.
2. Fairing is from contractor model studies and previous fixed-slat configuration tests.

Figure 153: Landing Approach Airspeed
<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>GROSS WT (LB)</th>
<th>AIM LOAD FRACTION</th>
<th>STORE LOADING</th>
<th>SLATS LEFT</th>
<th>SLATS RIGHT</th>
<th>CONFIG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>41,000</td>
<td>2</td>
<td>1</td>
<td>A2</td>
<td></td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td>38,900</td>
<td>2</td>
<td>1</td>
<td>A2</td>
<td></td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td>37,100</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42,600</td>
<td>2.8</td>
<td></td>
<td>A2</td>
<td></td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td>41,700</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42,000</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td>35,800</td>
<td>3</td>
<td></td>
<td>A3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36,800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35,900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>41,700</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35,800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36,800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>37,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>41,600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36,100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35,800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>35,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Buffet onset data is incomplete.
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-254  RUN 10  DATE 18 MAY 1972
F-4E  MCAIR NO. 2280  USAF S/N 66-0287

APPROACH TO STALL

X - L/H SIDE  SQUARE - R/H SIDE

CONFIGURATION: BASIC MODEL F-4E WITH TWO POSITION WING ELEVONS
LEADING EDGE SLATS PER S3 SB BOD. 18 LB
LONGITUDINAL CONTROL SYSTEM FAULTY
HEIGHT. LONG FLIGHT TEST NOSEBOOM FRAUD
POD AT L/H FORWARD MUSCLE WELL.

ENTRY CONDITIONS:
N/B  DASS  HEIGHT  POSITION  3010  0.3  R. MCA

N/B ALTITUDE

MPC

FT x 1000

N/B AIRSPEED

300 KTS

FREE AIR TEMP

40 F.A.T.

DEG C

L/H TOTAL TEMP

DEG C

NOT AVAILABLE

23.25.05.207  ELAPSED TIME IN SECONDS

FIGURE 165  STALL APPROACH TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-294  RUN 10  DATE  16 MAY 1972
F-4E  MCAS No. 2250  USAF S/N 66-0287
APPROACH TO STALL

FIGURE 165  STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-264                  RUN 10                  DATE 18 MAY 1972
F-4E                      MCRAF NO. 2280                  USAF 5/N 66-0287
APPROACH TO STALL

FIGURE 165 STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS
FLT 287-264    RUN 10    DATE 18 MAY 1972
F-4E    RCNIP NO. 2280    USAF 3/N 68-3287
APPROACH TO STALL

X - L/H SIDE    SQUARE - R/H SIDE

FLIGHT PATH ACCEL G/"?

0.8
0.4
0.2
-0.2
-0.4
-0.6

LATERNAL ACCEL AT
0.0 0.5 1.0 G/"?

0.4
0.2
-0.2
-0.4
-0.6

ROLLING ACCEL G/"?

0.1
0.2
0.3
0.4

ELAPSED TIME IN SECONDS

0 10 20 30 40 50 60 70

FIGURE 17-5    STALL APPROACH TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-243  RUN 06  DATE 25 APRIL 1972
F-4E  USAF S/N 65-0287

APPROACH TO STALL

<table>
<thead>
<tr>
<th>CONFIGURATION</th>
<th>LEADING EDGE SLATS FOR 30° 30°  89.1 LB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LONGITUDINAL CONTROL SYSTEM BALANCE</td>
</tr>
<tr>
<td></td>
<td>WEIGHT - LONG FLIGHT TEST NOSE BOOM, CAGE</td>
</tr>
<tr>
<td></td>
<td>NO AT L/H FORWARD MIDDLE WELL.</td>
</tr>
</tbody>
</table>

ENTRY CONDITIONS

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Weight</td>
<td>41,890</td>
<td>L/B</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>L.G. Position</td>
<td>31.1</td>
<td>M/C</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Entry Condition</td>
<td>33</td>
<td>Sqr</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

FREE AIR TEMP.
60 F.A.T.
DEG C

FREE AIR SPEED
300 KTS

ELAPSED TIME IN SECONDS

FIGURE 166 STALL APPROACH TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS
FLT 287-243   RUN 08   DATE 25 APRIL 1972
F-4E   MCRAE NO. 2280    USAF S/N 66-0287
APPROACH TO STALL

FIGURE 166  STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLATS

FLT 287-243  RUN 05  DATE 25 APRIL 1972
F-4E  MCAIN NO. 2280  USAF 5/N 86-0207

APPROACH TO STALL

FIGURE 166  STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-243       RUN 06       DATE 25 APRIL 1972
F-4E              HCAIR NO. 22260
                  USAF 3/N 66-0287
APPROACH TO STALL

[Graph showing flight test data with various axes labeled:
- Flight path angle
- Lateral acceleration
- Additional data points labeled]

ELAPSED TIME IN SECONDS

FIGURE 100 STALL APPROACH TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-XE
WITH TWO POSITION MANEUVERING SLATS
FLT 297-299 RUN 13 DATE 11 MAY 1972
F-XE MCAIR NO. 2280 USAF S/N 66-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE SQUARE - R/H SIDE

1. CONFIGURATION: BASIC MODEL F-XE WITH TWO POSITION NING IDLING 1b
   LEADING EDGE SLATS PER 53 39 009. 16 LB
   LONGITUDINAL CONTROL SYSTEM IMBALANCE
   HEIGHT: LONG FLIGHT TEST NOSEBOOM, ERR03
   POO AT L/H FORWARD MISSIE NELL.
   SPARON 37 R/H FORWARD MISSILE WELL.

ENTRY CONDITIONS
   L/D (K) WEIGHT 3140.0 LBS
   L.O. POSITI0N 25.0 L/D MAC

N/B
   ALTITUDE
   ENC
   FT
   X 1000

MACH
   N/D
   N-D

C/11
   TOTAL
   DEG. C
   NOT AVAILABLE

FREE AIR
   TEMP
   0 F.P.R.
   DEG C

ELAPSED TIME IN SECONDS

FIGURE 167 STALL APPROACH TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-259  RUN 13  DATE 11 MAY 1972
F-4E  MCAIN NO. 2280  USAF 5/N 66-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

ELAPSED TIME IN SECONDS

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS) (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-259  RUN 13  DATE 11 MAY 1972
F-4E  MCRIN NO. 2290  USAF S/N 68-0287
APPROACH TO STALL (GARR. SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

LATERAL

STICK

POSITION

DEGREES

ROLL

RATE

DEG/SEC

TAN

RATE

DEG/SEC

ROLL ANGLE
0 DEG-15

SIDE-SLIP
0 DEG-30

N/B

RNDLE OF

SIDESLIP

0 DEG-30

ROLL ANGLE
0 DEG-15

ELAPSED TIME IN SECONDS

FIGURE 167 BSTALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 297-259    RUN 13    DATE 11 MAY 1972
F-4E    MCR-11 NO. 2200    USAF 3/N 66-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE    SQUARE - R/H SIDE

ELAPSED TIME IN SECONDS

FIGURE 167 STALL APPROACH time HISTORY (concluded)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 287-259 RUN 15 DATE 11 MAY 1972
F-4E MCRIN NO. 2290 USAF 7/A 66-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

CONTRIBUTION: BASIC MODEL F-4E WITH TWO POSITION MACH NO.
LEADING EDGE SLATS PER 53 36 389, 16 LB
LONGITUDINAL CONTROL STICK EMBALANCE
HEIGHT. LONG FLIGHT TEST 1972-1973, END
NOTE AT L/H FORWARD MIDDLE NPS,
SPAN AT R/H FORWARD WING NPS

ENTRY CONDITIONS
122000 FT HEIGHT
25,000 FT POSITION
55000 LBS

N/B ALTITUDE
MPC FT X 1000

MACH NO.
R N-D

L/H TOTAL TEMP
DEG. C

NOT AVAILABLE

18.22.01.438 ELAPSED TIME IN SECONDS

FIGURE 168 STALL APPROACH TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-259 RUN 15 DATE 11 MAY 1972
F-4E MCRR NO. 2280 UAF 3/11 6-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE SQUARE - R/H SIDE

ELAPSED TIME IN SECONDS

FIGURE 168 STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH THE POSITION MANEUVERING SLATS
FLT 287-259  RUN 15  DATE 11 MAY 1972
F-4E  NCAIA NO. 2280  USAF 3/N 66-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.I.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

LATERAL STICK POSITION DEGREES

ROLL ROLL RATE DEG/SEC

ROLL ANGLE DEGREES

THRU RATE DEG/SEC

LATERAL STICK FORCES POUNDS

N/B ANGLE OF SIDESL DEGREES

ANL

EWAPED TIME IN SECONDS

FIGURE 168  STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-14E
WITH TWO POSITION MANEUVERING SLOTS

FLT 287-259  RUN 15  DATE 11 MAY 1972
F-14E  MCRAE NO. 2290  USAF S/N 66-0287

APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

ELAPSED TIME IN SECONDS

FIGURE 168  STALL APPROACH TIME HISTORY (CONCLUDED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E WITH TWO POSITION MANEUVERING SLOTS

APPROACH TO STALL (GEAR, SLOTS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>ENTRY CONDITIONS</th>
<th>X - L/H SIDE</th>
<th>SQUARE - R/H SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROG. X - L/H SIDE</td>
<td>WEIGHT POSITION</td>
<td>38090</td>
</tr>
</tbody>
</table>

| CONFIGURATION - BASIC MODEL F-4E WITH TWO POSITION MANEUVERING SLOTS |
|------------------|--------------|-------------------|
| LEADING EDGE SLOTS PER 23 30 009. 15 LB |
| LONGITUDINAL CONTROL SYSTEM BALANCE |
| WEIGHT, LONG FLIGHT TEST NOSESEAT, EMS |
| POOL AT L/H FORWARD MIDDLE WELL |

<table>
<thead>
<tr>
<th>N/B ALTITUDE</th>
<th>AIRSPEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/B ALTITUDE</td>
<td>AIRSPEED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAC</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>-0.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L/H TOTAL TEMP</th>
<th>DEG. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-50</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>500</td>
<td>600</td>
<td></td>
</tr>
</tbody>
</table>

10, 20, 29, 397 ELAPSED TIME IN SECONDS

FIGURE 169 - STALL APPROACH TIME HISTORY
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLOTS

FLT 267-240  RUN 19  DATE 24 APRIL 1972
F-4E  MCRAE NO. 22620  USAF S/N 68-0287

APPROACH TO STALL (GEAR, SLOTS, 30 DEG T.E. FLAPS)

X - L/H SIDE  SQUARE - R/H SIDE

- L/H SIDE  SQUARE - R/H SIDE

ELAPSED TIME IN SECONDS

FIGURE 169  STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS

FLT 297-240 RUN 19 DATE 24 APRIL 1972
F-4E NCRN No. 2280 USAF 5/N 56-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE SQUARE - R/H SIDE

<table>
<thead>
<tr>
<th>ELAPSED TIME IN SECONDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

| ROLL RATE DEG/SEC |
| 0 | 10 | 20 | 30 | 40 | 50 | 60 |

| ROLL ANGLE DEGREES |
| 0 | 10 | 20 | 30 | 40 | 50 |

| YAW RATE DEG/SEC |
| 0 | 10 | 20 | 30 | 40 | 50 |

| LATERAL STICK POSITION DEGREES |
| 0 | 5 | 10 | 15 |

| LATERAL FORCE POUNDS |
| 0 | 10 | 20 | 30 | 40 |

| RUDER POSITION DEGREES |
| 0 | 5 | 10 | 15 |

| TAIL |
| 0 | 5 | 10 | 15 |

| L/H SIDE |
| 0 | 10 | 20 | 30 |

| SQUARE |
| 0 | 10 | 20 | 30 |

FIGURE 169 STALL APPROACH TIME HISTORY (CONTINUED)
FLIGHT TEST EVALUATION OF THE MODEL F-4E
WITH TWO POSITION MANEUVERING SLATS
FLT 287-240 RUN 19 DATE 24 APRIL 1972
F-4E MCRD NO. 2280 USAF 5/N 65-0287
APPROACH TO STALL (GEAR, SLATS, 30 DEG T.E. FLAPS)

X - L/H SIDE

SQUARE - R/H SIDE

ELAPSED TIME IN SECONDS

FIGURE 169 STALL APPROACH TIME HISTORY (CONCLUDED)
F-4E USAF S/N 66-287A

- STEADY TONE
- INTERRUPTED TONE

LOW SCHEDULE — SLATS IN/OUT AND GEAR DOWN

- PULSE RATE 1.5 PPS INCREASING TO 6.2 PPS
- CONSTANT 20 PPS
- VOLUME INCREASE

HIGH SCHEDULE — SLATS OUT AND GEAR UP

- PULSE RATE 1.5 PPS INCREASING TO 6.0 PPS
- CONSTANT 20 PPS
- VOLUME INCREASE

FIGURE 170 ANGLE OF ATTACK AURAL TONE INDICATIONS
<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>LOADING</th>
<th>LANDING GEAR</th>
<th>FLAP POSITION</th>
<th>SLAT POSITION</th>
<th>AIM LOAD FACTOR (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>A2</td>
<td>UP</td>
<td>UP</td>
<td>RET</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>UP</td>
<td>UP</td>
<td>EXT</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>UP</td>
<td>UP</td>
<td>EXT</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>UP</td>
<td>UP</td>
<td>EXT</td>
<td>2</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>UP</td>
<td>UP</td>
<td>EXT</td>
<td>3.5</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>DOWN</td>
<td>DOWN</td>
<td>EXT</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>DOWN</td>
<td>DOWN</td>
<td>EXT</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>A2</td>
<td>DOWN</td>
<td>DOWN</td>
<td>EXT</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE:** DASHED FAIRINGS ARE FOR BASIC F-4E. (REFERENCE 8)

**Figure 172** PRODUCTION AOA VERSUS NOSEBOOM AOA

**Notes:**
1. ALL DATA ARE FOR MACH NUMBERS BELOW 0.75.
2. DATA ARE NOT CORRECTED FOR UPWASH.
3. NOSEBOOM AOA IS MEASURED FROM AIRCRAFT WATERLINE. WING INCIDENCE ANGLE IS +1°.
APPENDIX II
TEST INSTRUMENTATION AND FLIGHT LOG

TEST INSTRUMENTATION

Test instrumentation used on F-4E, USAF S/N 66-287A, was designed, installed and maintained by MDC. Special instrumentation included a test noseboom, a 14-track magnetic tape airborne data recording system, and a UHF telemetry system.

The test noseboom system was installed on the radome (figure 11). This included a Rosemount noncompensated pitot-static probe, angle of attack and angle of sideslip vanes, and a vane for the Donner dual-axis flightpath accelerometer.

An Ampex magnetic tape recording system was installed in the radome in place of the production radar package. Data was recorded on a 14-track magnetic tape recorder utilizing a pulse duration modulation (PDM) system which incorporates two multicoxers and a proportional multiplex (FM-FM) system. Operation speeds for the Ampex tape system could vary from 60 inches per second to 1.875 inches per second. During this test program only 15 inches per second was used. The data recording system was operated from either the front or the aft cockpit.

The test aircraft was also equipped with a UHF telemetry system for real time monitoring of critical parameters and inflight data edition.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (noseboom)</td>
<td>-1K to 60K</td>
<td>feet</td>
</tr>
<tr>
<td>Airspeed (noseboom)</td>
<td>80 to 800</td>
<td>knots</td>
</tr>
<tr>
<td>Angle of attack (production)</td>
<td>+5 to +35</td>
<td>units</td>
</tr>
<tr>
<td>Angle of attack (noseboom)</td>
<td>-10 to +40</td>
<td>degrees</td>
</tr>
<tr>
<td>Pitch angle</td>
<td>-40 to +40</td>
<td>degrees</td>
</tr>
<tr>
<td>Roll angle</td>
<td>-185 to +185</td>
<td>degrees</td>
</tr>
<tr>
<td>Pitch rate</td>
<td>-40 to +40</td>
<td>degrees/sec</td>
</tr>
<tr>
<td>Roll rate</td>
<td>-300 to +300</td>
<td>degrees/sec</td>
</tr>
<tr>
<td>Total air temperature (noseboom)</td>
<td>-50 to +200</td>
<td>degrees C</td>
</tr>
<tr>
<td>Total air temperature (fuselage installation)</td>
<td>-50 to +200</td>
<td>degrees C</td>
</tr>
<tr>
<td>Yaw angle</td>
<td>-15 to 15</td>
<td>degrees</td>
</tr>
<tr>
<td>Yaw rate</td>
<td>-60 to +60</td>
<td>degrees/sec</td>
</tr>
<tr>
<td>Normal acceleration at cg</td>
<td>-3.5 to +10</td>
<td>g</td>
</tr>
<tr>
<td>Longitudinal acceleration at cg</td>
<td>-1.0 to +1.0</td>
<td>g</td>
</tr>
<tr>
<td>Lateral acceleration at cg</td>
<td>-0.5 to +0.5</td>
<td>g</td>
</tr>
<tr>
<td>Parameter</td>
<td>Range</td>
<td>Units</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Flightpath acceleration</td>
<td>-0.6 to +0.6</td>
<td>g</td>
</tr>
<tr>
<td>Pitch acceleration</td>
<td>-1.0 to +1.0</td>
<td>radian/sec²</td>
</tr>
<tr>
<td>Roll acceleration</td>
<td>-6.0 to +6.0</td>
<td>radian/sec²</td>
</tr>
<tr>
<td>Yaw acceleration</td>
<td>-1.0 to +1.0</td>
<td>radian/sec²</td>
</tr>
<tr>
<td>Nosegear liftoff accelerometer</td>
<td>Uncalibrated</td>
<td>- - -</td>
</tr>
<tr>
<td>Stabilator position</td>
<td>10 LEU to 22 LED</td>
<td>degrees</td>
</tr>
<tr>
<td>Rudder position</td>
<td>-30 to +30</td>
<td>degrees</td>
</tr>
<tr>
<td>Aileron position (left and right)</td>
<td>-30 to +1</td>
<td>degrees</td>
</tr>
<tr>
<td>Spoiler position (left and right inboard)</td>
<td>0 to +45</td>
<td>degrees</td>
</tr>
<tr>
<td>Inboard slat position (left and right)</td>
<td>retracted -</td>
<td>- - -</td>
</tr>
<tr>
<td></td>
<td>extended</td>
<td></td>
</tr>
<tr>
<td>Outboard slat position (left and right)</td>
<td>retracted -</td>
<td>- - -</td>
</tr>
<tr>
<td></td>
<td>extended</td>
<td></td>
</tr>
<tr>
<td>Longitudinal stick force</td>
<td>-25 to +75</td>
<td>pounds</td>
</tr>
<tr>
<td>Slat/flap control switch position</td>
<td>norm-extend-retract</td>
<td>- - -</td>
</tr>
<tr>
<td>Longitudinal stick force</td>
<td>-25 to +75</td>
<td>pounds</td>
</tr>
<tr>
<td>Lateral stick position</td>
<td>-12 to +12</td>
<td>degrees</td>
</tr>
<tr>
<td>rpm (left and right)</td>
<td>65 to 110</td>
<td>percent</td>
</tr>
<tr>
<td>Exhaust gas temperature</td>
<td>0 to 1,200</td>
<td>degrees C</td>
</tr>
<tr>
<td>Main engine fuel flow (left and right)</td>
<td>720 to 15,000</td>
<td>pounds/hour</td>
</tr>
<tr>
<td>Main engine fuel flow temperature (left and right)</td>
<td>-50 to +150</td>
<td>degrees C</td>
</tr>
<tr>
<td>A/B core fuel flow (left and right)</td>
<td>2K to 16.9K</td>
<td>pounds/hour</td>
</tr>
<tr>
<td>A/B annulus fuel flow (left and right)</td>
<td>2K to 25.0K</td>
<td>pounds/hour</td>
</tr>
<tr>
<td>Total fuel quantity (production)</td>
<td>0 to 100</td>
<td>percent</td>
</tr>
<tr>
<td>Individual tank fuel quantities, tanks 1 to 7</td>
<td>0 to 100</td>
<td>percent</td>
</tr>
<tr>
<td>Record number</td>
<td>- - -</td>
<td>units, tens</td>
</tr>
<tr>
<td>Pilot's voice (T/M only)</td>
<td>- - -</td>
<td></td>
</tr>
</tbody>
</table>


FLIGHT LOG
F-4E USAF S/N 66-287A

<table>
<thead>
<tr>
<th>Flight Number</th>
<th>Date (1972)</th>
<th>Takeoff (hr)</th>
<th>Duration (hr+min)</th>
<th>Tests Accomplished</th>
</tr>
</thead>
<tbody>
<tr>
<td>228</td>
<td>30 Mar</td>
<td>0940</td>
<td>1+35</td>
<td>Manual and auto slat cycles were performed. Wind-up turns (WUT's) at 0.9 Mach and 35,000 ft, thrust-limited MIL power turns at 20,000 ft, stall approaches to 30 units AOA at 35,000 ft and 30,000 ft were conducted. No external stores.</td>
</tr>
<tr>
<td>229</td>
<td>4 Apr</td>
<td>1000</td>
<td>1+05</td>
<td>Max A/B turning performance tests were conducted at 35,000 ft at 1.5, 2.5, and 3.0 q's. Stabilized turns were also performed at 20,000 ft and 2.0 q's. No external stores.</td>
</tr>
<tr>
<td>230</td>
<td>4 Apr</td>
<td>1610</td>
<td>0+40</td>
<td>Max A/B turning performance tests were conducted at 20,000 ft with the slats extended and retracted. No external stores.</td>
</tr>
<tr>
<td>231</td>
<td>5 Apr</td>
<td>0915</td>
<td>0+35</td>
<td>Mil and max A/B turning performance tests were conducted at 10,000 ft with the slats extended and retracted. Stall approach was conducted at 18,000 ft. No external stores.</td>
</tr>
<tr>
<td>232</td>
<td>5 Apr</td>
<td>1230</td>
<td>1+05</td>
<td>Mil and max A/B turning performance tests were conducted at 35,000 ft with the slats extended and retracted. Stall approach was conducted at 18,000 ft. No external stores.</td>
</tr>
<tr>
<td>233</td>
<td>5 Apr</td>
<td>1530</td>
<td>0+50</td>
<td>Mil and max A/B turning performance tests were conducted with slats in and out at 20,000 ft, followed by left and right rolls in PA and cruise at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>234</td>
<td>6 Apr</td>
<td>1140</td>
<td>1+25</td>
<td>Static and dynamic longitudinal stability tests were conducted at 10,000 and 35,000 ft, SAS on and SAS off, followed by aileron and rudder rolls at 10,000 and 35,000 ft. External loading: two 370-gallon wing tanks, two MAU-12 pylons, one TER on each pylon, and four LAU-10 rocket pods without end cones on the TER shoulder stations.</td>
</tr>
<tr>
<td>235</td>
<td>6 Apr</td>
<td>1600</td>
<td>1+20</td>
<td>WUT's, stalls, and roll performance tests at 35,000 ft. Rolls in cruise and PA, and PA stalls at 10,000 ft. External loading: two 370-gallon external wing tanks, right tank half full and left tank empty. Stability index number = 59.6.</td>
</tr>
<tr>
<td>236</td>
<td>17 Apr</td>
<td>1440</td>
<td>0+50</td>
<td>Military thrust accelerations at 40,000 ft, slats in and out. Max A/B acceleration at 40,000 ft to 2.1 Mach. No external stores.</td>
</tr>
<tr>
<td>237</td>
<td>18 Apr</td>
<td>0720</td>
<td>1+24</td>
<td>Tower fly-bys in PA configuration. No external stores.</td>
</tr>
<tr>
<td>238</td>
<td>18 Apr</td>
<td>1320</td>
<td>1+50</td>
<td>Cruise performance tests at 190,000 W/4 and approximately 35,000 ft with no external stores. PA trim was flown at 10,000 ft.</td>
</tr>
<tr>
<td>239</td>
<td>21 Apr</td>
<td>1200</td>
<td>1+15</td>
<td>Qualitative flying qualities with asymmetric slat conditions. No external stores.</td>
</tr>
<tr>
<td>240</td>
<td>24 Apr</td>
<td>1000</td>
<td>1+15</td>
<td>Mil and max A/B accelerations, WUT's, roll performance tests and stall approaches in PA configuration at 35,000, 20,000, and 10,000 ft, with asymmetric slat conditions. No external stores.</td>
</tr>
<tr>
<td>241</td>
<td>24 Apr</td>
<td>1400</td>
<td>1+20</td>
<td>Static longitudinal stability and slat transient check at 10,000 ft. Turning performance test at 35,000 ft. Stall approaches at 35,000, 20,000 and 10,000 ft. No external stores. First APFFC participation flight.</td>
</tr>
<tr>
<td>Flight Number</td>
<td>Date</td>
<td>Takeoff (hr)</td>
<td>Duration (hr+min)</td>
<td>Tests Accomplished</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>--------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>242</td>
<td>25 Apr</td>
<td>1200</td>
<td>1+20</td>
<td>Static and dynamic longitudinal stability evaluated at 10,000 and 35,000 ft. Lateral control effectiveness was evaluated and WUT's were conducted at 35,000 ft. Stall approaches were performed clean and in PA configuration at 35,000 and 10,000 ft, respectively. External loading: two 370-gallon wing tanks, two MAU-12 pylons, one TER on each pylon, and four LAU-10 rocket pods without end cones on the TER shoulder stations.</td>
</tr>
<tr>
<td>243</td>
<td>25 Apr</td>
<td>1600</td>
<td>1+30</td>
<td>Asymmetric slat handling qualities evaluated at 35,000 ft. WUT's were performed at 35,000 ft with the asymmetric slat condition. The PA trim curve was recorded with slats retracted, gear and flaps down. Touch-and-go landings were performed at Scott AFB in various combinations of slat/flap failure conditions. No external stores.</td>
</tr>
<tr>
<td>244</td>
<td>26 Apr</td>
<td>0900</td>
<td>1+20</td>
<td>TAC two-position slat evaluation flight. No external stores.</td>
</tr>
<tr>
<td>245</td>
<td>26 Apr</td>
<td>1300</td>
<td>1+05</td>
<td>TAC two-position slat evaluation flight. No external stores.</td>
</tr>
<tr>
<td>246</td>
<td>26 Apr</td>
<td>1630</td>
<td>0+45</td>
<td>Mil and max A/B accelerations at 40,000 ft were conducted with a decelerating turn. Stall approach at 35,000 ft to 30 units AOA. Air-to-air tracking was evaluated during descent from 35,000 ft. No external stores.</td>
</tr>
<tr>
<td>247</td>
<td>27 Apr</td>
<td>0930</td>
<td>1+00</td>
<td>Mil and max A/B accelerations 36,000 ft were conducted with a decelerating turn. Slats out PA trim curve was established at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>248</td>
<td>1 May</td>
<td>0900</td>
<td>0+55</td>
<td>Max A/B turning performance test was conducted at 20,000 ft. Asymmetric slat stall approach at 20,000 ft. No external stores.</td>
</tr>
<tr>
<td>249</td>
<td>1 May</td>
<td>1300</td>
<td>0+50</td>
<td>Max A/B acceleration and max A/B turning performance test conducted at 35,000 ft. No external stores.</td>
</tr>
<tr>
<td>250</td>
<td>1 May</td>
<td>1630</td>
<td>0+50</td>
<td>Max A/B acceleration and max A/B turning performance test conducted at 35,000 ft. No external stores.</td>
</tr>
<tr>
<td>251</td>
<td>2 May</td>
<td>0950</td>
<td>0+55</td>
<td>Max A/B accelerations and max A/B subsonic turning performance tests conducted at 20,000 ft. Roll performance test was also conducted in PA configuration at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>252</td>
<td>2 May</td>
<td>1330</td>
<td>0+55</td>
<td>Max A/B accelerations and turning performance tests were conducted at 35,000 ft. A WUT was performed at 18,000 ft. PA sideslip data, SAS on and off were obtained at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>253</td>
<td>2 May</td>
<td>1630</td>
<td>1+20</td>
<td>Military thrust accelerations and turning performance test were conducted at 20,000 ft. Pitch doublets were performed in PA configuration with SAS off at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>254</td>
<td>9 May</td>
<td>0940</td>
<td>0+55</td>
<td>Military thrust and max A/B accelerations were performed at 36,000 ft with a decelerating turn starting at Mach 2.1. Cruise trim curve was established at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>255</td>
<td>9 May</td>
<td>1400</td>
<td>0+50</td>
<td>Accelerations were performed with military thrust at 25,000 ft and max A/B at 36,000 ft. Static and dynamic longitudinal stability tests, SAS on and off, were conducted at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>256</td>
<td>10 May</td>
<td>0740</td>
<td>1+20</td>
<td>Cruise performance was conducted at 50,000 ft, with slat switch in NORM. Sideslips were also performed in PA at 8,000 ft, with SAS on and off. No external stores.</td>
</tr>
</tbody>
</table>
Flight Number | Date     | Takeoff | Duration  | Tests Accomplished                                                                 |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>257</td>
<td>10 May</td>
<td>1230</td>
<td>1+10</td>
<td>Military thrust acceleration was performed at 10,000 ft. Static and dynamic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>longitudinal stability tests were conducted at 35,000 ft, SAS on and off. WUT's</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>were also performed at 35,000 ft. No external stores.</td>
</tr>
<tr>
<td>258</td>
<td>10 May</td>
<td>1530</td>
<td>0+45</td>
<td>Max A/B supersonic turning performance tests conducted at 35,000 ft. PA trim curve</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>was also established at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>259</td>
<td>11 May</td>
<td>0900</td>
<td>1+05</td>
<td>Military thrust climb to 35,000 ft, with static and dynamic longitudinal stability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>tests conducted at 35,000 ft, SAS on and off. Static and dynamic longitudinal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>stability tests also conducted at 10,000 ft. No external stores.</td>
</tr>
<tr>
<td>260</td>
<td>11 May</td>
<td>1230</td>
<td>0+50</td>
<td>Military thrust climb to 36,000 ft followed by a max A/B acceleration and a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>supersonic climb to 50,000 ft. A max A/B subsonic climb from 36,000 ft to 50,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ft was also performed. Stall approaches in PA were performed at 10,000 ft. No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>external stores.</td>
</tr>
<tr>
<td>261</td>
<td>11 May</td>
<td>1530</td>
<td>0+55</td>
<td>Military thrust climb to 36,000 ft. Rudder rolls and aileron rolls were performed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>at 35,000 ft. AIM-7 missiles in forward stations and gun bay ballast. (Loading la)</td>
</tr>
<tr>
<td>262</td>
<td>12 May</td>
<td>1000</td>
<td>1+05</td>
<td>Military thrust climb to 36,500 feet was performed. WUT's and roll performance tests</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>were also conducted at 10,000 ft. AIM-7 missiles in forward station and gun bay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ballast. (Loading la)</td>
</tr>
<tr>
<td>263</td>
<td>12 May</td>
<td>1340</td>
<td>0+55</td>
<td>Military thrust climb to 36,000 ft with WUT's, subsonic and supersonic, at 36,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ft. Roll performance tests and stall approaches were performed at 35,000 ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Air-to-ground tracking during descent. No external stores.</td>
</tr>
<tr>
<td>264</td>
<td>15 May</td>
<td>1520</td>
<td>0+55</td>
<td>Maximum A/B takeoff was performed followed by a military thrust climb to 36,000 ft.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WUT's, roll performance tests and stall approaches were conducted between 36,000 and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32,000 ft. Air-to-ground tracking was also accomplished prior to landing. No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>external stores.</td>
</tr>
<tr>
<td>265</td>
<td>16 May</td>
<td>0935</td>
<td>1+00</td>
<td>Maximum A/B takeoff followed by a military thrust climb to 35,000 ft performed. WUT'</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>s at 35,000 and 12,000 ft were also conducted. No external stores.</td>
</tr>
<tr>
<td>266</td>
<td>16 May</td>
<td>1420</td>
<td>0+35</td>
<td>Military thrust takeoff was performed followed by a military thrust climb to 36,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ft. Supersonic maximum A/B thrust turning performance test was performed at 36,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ft. Cruise and power approach stall approaches were accomplished. No external</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>stores. (Flow divider removed and right wing slat restrictor installed to force slats</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>to extend and retract at different rates.)</td>
</tr>
<tr>
<td>267</td>
<td>17 May</td>
<td>0900</td>
<td>0+45</td>
<td>A maximum A/B thrust takeoff was performed followed by a military thrust climb to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>35,000 ft. Supersonic and subsonic turn performance tests were conducted at 35,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and 20,000 ft, respectively. No external stores.</td>
</tr>
<tr>
<td>268</td>
<td>17 May</td>
<td>1200</td>
<td>0+40</td>
<td>A maximum A/B thrust takeoff was performed followed by subsonic maximum A/B turn</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>performance tests at 20,000 ft with slats both extended and retracted. No external</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>stores.</td>
</tr>
<tr>
<td>269</td>
<td>18 May</td>
<td>0900</td>
<td>1+05</td>
<td>This flight was flown with misrigged right outer wing slats to qualitatively</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>determine the flying qualities resulting from production quality control problems.</td>
</tr>
<tr>
<td>270</td>
<td>22 May</td>
<td>0930</td>
<td>1+30</td>
<td>Cruise performance was conducted at 200,000 and 180,000 W/6 with no external</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>stores. Roll performance tests and sideslips were performed at 35,000 and 10,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>feet, respectively.</td>
</tr>
</tbody>
</table>
Cruise performance tests were conducted at 140,000 and 85,000 W/S with no external stores. Roll performance tests and sideslips were also performed at 10,000 ft.

Max A/B thrust takeoff was performed followed by maximum A/B thrust turning performance test at 10,000 ft. No external stores.

Max A/B thrust turning performance was conducted at 20,000 ft. Cruise and PA aileron rolls, sideslips, and PA rudder rolls were performed at 10,000 ft. No external stores.

A maximum A/B takeoff was performed followed by cruise performance test at 220,000 W/S with no external stores. Aileron rolls and rudder doublets were also performed at 38,000 ft.

Supersonic thrust-limited turn performance data obtained at 35,000 ft followed by roll performance test at 10,000 ft. No external stores.

Ferry flight from St. Louis, Mo. (enroute stop at Cannon AFB, New Mexico). Cruise performance at 180,000 W/S was obtained. Three external tanks.

Continuation of ferry flight from Cannon AFB to Edwards AFB. No data obtained.

Pilot canopy was lost shortly after takeoff. Flight was terminated without obtaining test data. No external stores.

Supersonic thrust-limited turn performance data were obtained. Takeoff and landing data were recorded. No external stores.

A maximum A/B acceleration to 700 KIAS was performed, followed by a WUT to 5 g's. Supersonic thrust-limited turn performance data were obtained at 20,000 ft altitude and 1.4, 1.2, and 1.1 Mach number. Roll performance data at 35,000 ft and supersonic were also obtained. Takeoff and landing data were recorded. No external stores.

A maximum A/B climb to 50,000 ft was performed followed by supersonic turn performance test at 20,000 ft. Takeoff and landing data were obtained. No external stores.

A maximum A/B acceleration to 710 KIAS at 10,000 ft was performed followed by supersonic turn performance test at 20,000 ft. Takeoff and landing data were obtained. No external stores.

A military thrust climb was performed to 40,000 ft altitude followed by supersonic WUT's at 35,000 and 25,000 ft. Takeoff and landing data were obtained. No inert AIM-7 missiles aft (on stations 3 and 7).

Static thrust engine calibration. Data were obtained from idle to maximum afterburning thrust in 5 percent rpm increments for each engine and with both engines operating.

Ferry flight from Edwards AFB to St. Louis, Mo. (enroute stop at Buckley NAS, Colorado). No data obtained.

Continuation of ferry flight to St. Louis, Mo. No data obtained.
REFERENCES


The test objective was to evaluate the performance and flying qualities of the F-4E aircraft equipped with the two-position leading edge slat and to obtain data necessary to update the F-4 Flight Manual. The two-position slat test results show an increase in turning capability in most of the flight envelope compared with that of the basic F-4E, and were comparable to those obtained with the previous fixed slat configuration, Agile Eagle IV. The normal takeoff rotation technique described in the Flight Manual was considered unsatisfactory for slat-equipped aircraft. The installation of the two-position wing leading edge slat has degraded the maximum speed capability of the F-4 aircraft slightly. Cruise data obtained during the tests show a degradation in cruise performance of approximately four percent for the retracted slat configuration and seven percent for the extended slat. Decreased static stability made precise control of angle of attack (AOA) moderately difficult during landing approaches at 19 units AOA. Rudder rolls performed at high AOA showed improved performance. Lateral-directional flying qualities in the power approach configuration were generally not as good as with the unslatted F-4E, but were satisfactory. Tests performed to evaluate the flying qualities with simulated failures in one or more slat actuators revealed minor, acceptable degradations from the flying qualities observed with the symmetric slat condition.
<table>
<thead>
<tr>
<th>KEY WORDS</th>
<th>LINK A</th>
<th>LINK B</th>
<th>LINK C</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-4E aircraft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>performance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flying qualities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>slats</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>takeoff</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>static stability</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>