Standard Aircraft Characteristics

F-89A
SCORPION
Northrop

TWO J53-A-21
ALLISON

BY AUTHORITY OF
COMMANDING GENERAL
AIR MATERIEL COMMAND
U.S. AIR FORCE

29 MAY 1950
CONFIDENTIAL
**POWER PLANT**

No. & Model ........ (2) J35-A-21
Mfr. ................. Allison
Engine Spec No. ........ 278
Type ................. Axial Flow
Length ................ 205" Diameter ................ 38"
Weight (dry) .......... 2635 lb Augmentation .......... Afterburning

**WEIGHTS**

Loading Lb L.F.
Empty ............ 23,645(E)
Basic ............ 24,912(E)
Design ........... 32,400 .......... 5.67
Combat ........... *31,680
Max T. O. .......... +42,026
Max Land .......... +42,026
(E) Estimated  
* For Basic Mission  
† Limited by space

**ENGINE RATINGS**

S. L. Static LB - RPM
Max: ............ *6800 - 7000
Mil: ............. 5200 - 7000
Nor: ............. 4480 - 7400

*With afterburning

**FUEL**

<table>
<thead>
<tr>
<th>Location</th>
<th>No. Tanks</th>
<th>Gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wgs</td>
<td>4</td>
<td>788</td>
</tr>
<tr>
<td>Fus*</td>
<td>2</td>
<td>212</td>
</tr>
<tr>
<td>Wgs, ext</td>
<td>2</td>
<td>616</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1616</td>
</tr>
</tbody>
</table>

Spec ............. MIL-F-5624  
Grade ............. JP-3

**OIL**

Cap. (gal.) .......... 12
Spec ............. AN-0-9  
Grade ............. 1010

**DIMENSIONS**

Wing
Span* ............ 56.2'
Incidence (root) 1.5°
(tip) ........... 1.5°
Dihedral .......... 1°
Sweepback (LE) ... 3°6'14"
Length ........... 53.4'
Height ........... 17.7'
Tread ........... 21.9'

*Includes non-jettisonable tip tanks

**MISSION AND DESCRIPTION**

The primary mission of the F-89A is the interception and destruction of enemy aircraft under night and inclement weather conditions.

This airplane carries a crew of two (pilot and radar operator) and is equipped with all-weather interception radar. It incorporates Instrument Landing System, Zero Reader, thermal anti-icing, cabin pressurization and refrigeration, ejection seats, anti-G suit provisions, F-5 auto pilot, split-aileron type dive brakes and full span landing flaps. Alternate armament, consisting of the Martin TO-8 turret and Hughes E-1 fire control system or an enclosed multiple-rocket launcher may be installed by replacing the nose section of the fuselage.

**Development**

Design initiated: ............ Sep 1946
First flight: .................. (XP-89) Aug 1948
First flight: .................. (F-89A) Jul 1950 (est)
First acceptance: .......... Jul 1950 (est)
First service use: .......... Oct 1950 (est)
In production

**ELECTRONICS**

Command ............. AN/ARC-3
Interphone .......... AN/AIC-29
Radio Compass ...... AN/ARN-6
Radar ................ AN/APG-33
Radar ................ AN/APX-6
Marker Beacon ...... AN/ARN-12

*Modified

**DIMENSIONS**

No. Size Type
2 .......... 1600 lb ........ A. P.
2 .......... 1000 lb ........ G. P.
2 .......... 500 lb ........ G. P.
2 .......... 250 lb ........ G. P.
2 .......... 100 lb ........ G. P.
Max Bomb Load: .......... 3200 lb

**ROCKETS**

No. Size Type Location
16 ....... 5" ....... HVAR .... Wings
### Loading and Performance - Typical Mission

<table>
<thead>
<tr>
<th>CONDITIONS</th>
<th>BASIC MISSION</th>
<th>INTERCEPTOR MISSION</th>
<th>INTERCEPTOR MISSION</th>
<th>ATTACK MISSION</th>
<th>STRAFING MISSION</th>
<th>FERRY MISSION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WEIGHT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take-off weight (lb)</td>
<td>36,400</td>
<td>34,222</td>
<td>36,400</td>
<td>42,026</td>
<td>36,400</td>
<td>35,650</td>
</tr>
<tr>
<td>Fuel at 6.5 lb/gal (lb)</td>
<td>10,510</td>
<td>8322</td>
<td>10,510</td>
<td>10,510</td>
<td>10,510</td>
<td>10,510</td>
</tr>
<tr>
<td>Military load (as noted) (lb)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>5400</td>
<td>None</td>
</tr>
<tr>
<td>Wing loading (lb/sq ft)</td>
<td>60.1</td>
<td>56.5</td>
<td>60.1</td>
<td>69.4</td>
<td>60.1</td>
<td>58.8</td>
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<tr>
<td>Stall speed (power off) (kn)</td>
<td>98</td>
<td>95</td>
<td>98</td>
<td>105</td>
<td>98</td>
<td>97</td>
</tr>
<tr>
<td>Take-off ground run at SL (ft)</td>
<td>1960</td>
<td>1720</td>
<td>1960</td>
<td>2690</td>
<td>1960</td>
<td>1870</td>
</tr>
<tr>
<td>Take-off to clear 50 ft (ft)</td>
<td>2990</td>
<td>2625</td>
<td>2990</td>
<td>4000</td>
<td>2990</td>
<td>2860</td>
</tr>
<tr>
<td>Rate-of-climb at SL (fpm)</td>
<td>4900</td>
<td>9650</td>
<td>9400</td>
<td>3120</td>
<td>4900</td>
<td>5020</td>
</tr>
<tr>
<td>Time: SL to 20,000 ft (min)</td>
<td>5.5</td>
<td>3.0</td>
<td>2.5</td>
<td>10.0</td>
<td>5.5</td>
<td>5.2</td>
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<tr>
<td>Time: SL to 30,000 ft (min)</td>
<td>11.0</td>
<td>6.5</td>
<td>3.7</td>
<td>22.5</td>
<td>11.0</td>
<td>10.5</td>
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<tr>
<td>Service ceiling (100 fpm) (ft)</td>
<td>39,500</td>
<td>50,400</td>
<td>49,200</td>
<td>30,500</td>
<td>39,500</td>
<td>40,000</td>
</tr>
<tr>
<td>COMBAT RANGE</td>
<td>(n, mi)</td>
<td>1130</td>
<td>692</td>
<td>1000</td>
<td>620</td>
<td>1010</td>
</tr>
<tr>
<td>Avg cruising speed (kn)</td>
<td>434</td>
<td>437</td>
<td>439</td>
<td>365</td>
<td>425</td>
<td>434</td>
</tr>
<tr>
<td>Cruising altitude (ft)</td>
<td>37,900</td>
<td>40,000</td>
<td>38,100</td>
<td>25,000</td>
<td>30,000</td>
<td>38,400</td>
</tr>
<tr>
<td>Total Mission time (hr)</td>
<td>2.7</td>
<td>1.68</td>
<td>2.36</td>
<td>1.78</td>
<td>2.47</td>
<td>2.76</td>
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<tr>
<td>COMBAT RADIUS</td>
<td>(n, mi)</td>
<td>370</td>
<td>15</td>
<td>300</td>
<td>165</td>
<td>225</td>
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<tr>
<td>Avg cruising speed (kn)</td>
<td>432</td>
<td>442</td>
<td>439</td>
<td>375</td>
<td>414</td>
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<tr>
<td>Cruising altitude (ft)</td>
<td>37,900</td>
<td>40,000</td>
<td>38,100</td>
<td>25,000</td>
<td>30,000</td>
<td></td>
</tr>
<tr>
<td>Total mission time (hr)</td>
<td>2.13</td>
<td>1.06</td>
<td>1.37</td>
<td>1.05</td>
<td>1.25</td>
<td></td>
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<table>
<thead>
<tr>
<th>WEIGHT</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>COMBAT</td>
<td>(lb)</td>
<td>31,680</td>
<td>29,650</td>
<td>31,230</td>
<td>32,480</td>
<td>32,750</td>
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<tr>
<td>altitude (ft)</td>
<td>35,000</td>
<td>40,000</td>
<td>39,300</td>
<td>S. L.</td>
<td>S. L.</td>
<td>42,900</td>
</tr>
<tr>
<td>Combat speed (kn)</td>
<td>496</td>
<td>492</td>
<td>492</td>
<td>558</td>
<td>558</td>
<td>492</td>
</tr>
<tr>
<td>Combat climb (fpm)</td>
<td>4500</td>
<td>3430</td>
<td>3330</td>
<td>10,500</td>
<td>10,400</td>
<td>5330</td>
</tr>
<tr>
<td>Combat ceiling (500 fpm) (fpm)</td>
<td>50,200</td>
<td>51,700</td>
<td>50,600</td>
<td>49,700</td>
<td>49,500</td>
<td>54,100</td>
</tr>
<tr>
<td>Service ceiling (100 fpm) (fpm)</td>
<td>51,400</td>
<td>53,500</td>
<td>51,700</td>
<td>51,000</td>
<td>50,900</td>
<td>55,600</td>
</tr>
<tr>
<td>Max rate-of-climb at SL (fpm)</td>
<td>10,800</td>
<td>11,550</td>
<td>11,000</td>
<td>10,500</td>
<td>10,400</td>
<td>13,300</td>
</tr>
<tr>
<td>Max speed at Zero ft (kn)</td>
<td>558</td>
<td>558</td>
<td>558</td>
<td>558</td>
<td>559</td>
<td></td>
</tr>
<tr>
<td>LANDING WEIGHT</td>
<td>(lb)</td>
<td>26,512</td>
<td>26,732</td>
<td>26,512</td>
<td>26,950</td>
<td>26,512</td>
</tr>
<tr>
<td>Ground roll at SL (ft)</td>
<td>1770</td>
<td>1790</td>
<td>1770</td>
<td>1810</td>
<td>1770</td>
<td>1750</td>
</tr>
<tr>
<td>Total from 50 ft (ft)</td>
<td>3130</td>
<td>3150</td>
<td>3130</td>
<td>3170</td>
<td>3130</td>
<td>3100</td>
</tr>
</tbody>
</table>

### Notes
1. Max power
2. Military power
3. For Radius Mission if Radius is shown
4. Take-off and landing distances are obtainable at sea level using normal technique. For airport planning, distances should be increased by appropriate factors to determine runway requirements.
5. Detailed descriptions of the RADIUS & RANGE missions are given on pages 6 & 7.
6. Includes 2x1600 lb bombs and 16x5' HVAR's.
7. Includes time from start of ground roll.

### Conditions
(a) Performance Basis: Estimated data based on flight tests of XF-89
(b) In computing Radius and Range, specific fuel consumptions have been increased 5% to allow for variations of fuel flow in service aircraft.
(c) Performance is based on powers shown on page 7.
NOTES

FORMULA: RADIUS MISSION I

Take-off at max power, climb on course to cruising ceiling at military power, cruise to objective at long range speeds at cruising ceiling, combat for 20 minutes, cruise back to base at long range speeds at cruising ceiling. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off, fuel for 20 minutes combat (consisting of 7.5 minutes at maximum power and 12.5 minutes at military power) plus 10% of initial fuel for reserve.

FORMULA: RANGE MISSION I

Take-off at max power, climb on course to cruising ceiling at military power, cruise at long range speeds at cruising ceiling until 90% of initial fuel is consumed. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off plus 10% of initial fuel for combat, evasive action and landing reserve.

FORMULA: RADIUS MISSION II

Take-off at max power, climb on course to 40,000 feet at max power, cruise at 40,000 feet at long range speeds, search 10 minutes at normal power, combat for 16.5 minutes. Cruise back to base at long range speeds at cruising ceiling, descend to 40,000 feet and loiter for 10 minutes at minimum power prior to landing. Range free allowances include 5 minutes at normal power and 1 minute at max power at sea level for starting engines and take-off, fuel for combat (consisting of 5 minutes at max power plus 11.5 minutes at military power); fuel for 10 minutes loiter at 40,000 feet at minimum power plus 10% of initial fuel for reserve.

NOTE: Insufficient fuel is available for the normal combat period of 5 minutes max plus 15 minutes military power for this mission.

FORMULA: RANGE MISSION II

Take-off at max power, climb on course to 40,000 feet at max power, cruise at long range speeds at cruising ceiling until 90% of initial fuel is consumed. Range free allowances include 5 minutes at normal power and 1 minute at max power at sea level for starting engines and take-off plus 10% of initial fuel for combat, evasive action and landing reserve.

FORMULA: RADIUS MISSION III

Take-off at max power, climb on course to cruising ceiling at max power, cruise to objective at long range speeds at cruising ceiling, combat for 20 minutes, cruise back at long range speeds at cruising ceiling. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off, fuel for combat (consisting of 7.5 minutes at max power and 12.5 minutes at military power), plus 10% of initial fuel for reserve.

FORMULA: RANGE MISSION III

Take-off at max power, climb on course to cruising ceiling at max power, cruise at cruising ceiling until 90% of initial fuel is consumed. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off, plus 10% of initial fuel for combat, evasive action and landing reserve.

FORMULA: RADIUS MISSION IV

Take-off at max power, climb on course to 25,000 feet at military power, cruise at 25,000 feet at long range speeds, descend to sea level (no distance credit) expend military load operating 5 minutes at max power, climb on course to 25,000 feet at military power, cruise back to base at 25,000 feet at long range speeds. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off, 5 minutes combat fuel at sea level at max power plus 10% of initial fuel for reserve.

FORMULA: RANGE MISSION IV

Same as outbound leg of Radius Mission IV continued at 25,000 feet until 90% of initial fuel has been consumed. Range free allowances include 5 minutes at normal power for starting engines and take-off plus 10% of initial fuel for combat, evasive action and landing reserve.

FORMULA: RADIUS MISSION V

Take-off at max power, climb on course to 30,000 feet at military power, cruise at 30,000 feet at long range speeds, descend to sea level (no distance credit) expend ammunition operating 5 minutes at max power, climb on course to 30,000 feet at military power, cruise back to base at 30,000 feet at long range speeds. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off, 5 minutes combat fuel at sea level at max power plus 10% of initial fuel for reserve.

FORMULA: RANGE MISSION V

Same as outbound leg of Radius Mission V continued at 30,000 feet (continued to page 7)
FORMULA: RANGE MISSION V (cont'd)

until 90% of initial fuel has been consumed. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off plus 10% of initial fuel for combat, evasive action and landing reserve.

FORMULA: FERRY MISSION VI

Take-off at max power, climb on course to cruising ceiling at military power, cruise at long range speeds at cruising ceiling until 90% of initial fuel has been consumed. Range free allowances include 5 minutes at normal power at sea level for starting engines and take-off plus 10% of initial fuel for landing reserve.

GENERAL DATA:

(a) Engine ratings shown on page 3 are engine manufacturer's guaranteed ratings. Power values used in performance calculations are as follows:

<table>
<thead>
<tr>
<th></th>
<th>J35-A-21</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. L. Static</td>
<td>LB</td>
</tr>
<tr>
<td>Max:</td>
<td>7070</td>
</tr>
<tr>
<td>Mil:</td>
<td>5410</td>
</tr>
<tr>
<td>Nor:</td>
<td>4660</td>
</tr>
</tbody>
</table>

Note: Satisfactory engine operation at 50,000 ft and above was assumed in determining rates of climb and ceilings shown on pages 4 and 5.

(b) Cruising ceiling as used herein is defined as that altitude at which a rate of climb of 300 feet per minute can be maintained at normal power and momentary weight.