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Standard Aircraft Characteristics

MODEL D181

DUCTED PROPELLER ASSAULT TRANSPORT AIRCRAFT

REPORT NO. D181-945-008. 56AA 46311

MAY 1956

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POWER PLANT

Number: MAIN
Six Turboprop Engines
AUXILIARY
(VTOL Pitch and Yaw Control)
One Turbojet Engine
Models: MAIN
Allison 550-B1
AUXILIARY
J85
Manufacturers:
MAIN
General Motors Corp.
AUXILIARY
General Electric Corp.

ENGINE RATINGS

Static Rating at Sea Level - Maximum
Main (Shaft HP - total) 31,008 HP
Jet Thrust 830 lb
Auxiliary (Jet Thrust) 2,450 lb
Vertical Thrust - VTOL Cond. (6000 ft - 95°F) with water injection 72,100 lb

DIMENSIONS

Length 81 ft 1 in.
Height 33 ft 11 in.
Span (over-all) 97 ft 6 in.
Wing Area (neglecting ducts) 1220 sq. ft.
Wing Aspect Ratio 5.8
Wing Section NACA 64A412
Wheel Tread (aft gear) 157 in.
Wheelbase 366 in.

Mission and Description

DESCRIPTION
The basic mission required a radius of 425 miles at 300 mph with an initial vertical take-off. An 8000 pound payload is carried out and 4000 pounds back. The general flight plan of all missions was quite similar to the basic mission:

1. Take-off at 6000 ft and 95°F - VTO or STO depending on initial loading.
   All landings and subsequent take-offs are vertical. Payload out is 8000 pounds or greater.
2. Climb to cruise altitude; fly 80% of radius.
3. Descend to sea level; fly remaining 20%.
4. Land vertically at 6000 ft and 95°F; remove payload; reload a 4000-pound payload. NO FUEL IS ADDED.
5. Take-off vertically at 6000 ft and 95°F and return.
6. Fly first 20% at sea level.
7. Climb to cruise altitude for remainder of distance.
8. Descend and land vertically at 6000 ft and 95°F holding a 10% fuel reserve.

MISSIONS WITH ALL VTO

BASIC MISSION
1. Minimum vertical take-off gross weight to accomplish this mission.
2. Minimum cruise altitude to accomplish this mission.
3. Highest allowable velocity at altitude and 300 mph at sea level to accomplish this mission.

BASIC MISSION VARIATIONS
4. High-speed mission: Cruise at 455 mph at altitude and sea level.
5. Maximum VTO Radius with take-off at sea level standard; cruise for maximum radius at 300 mph at sea level and altitude.

MISSION WITH INITIAL STO — all other landings and take-offs are vertical.
1. Maximum radius with 8000-pound payload out.
2. Maximum payload out for 425 miles radius.
3. 450 mph cruise; maximum radius with an 8000-pound payload out.

WEIGHTS

Max. Vertical Take-off @6000 ft and 95°F 70,000 lb
Max. Vertical Landing @ 6000 ft and 95°F 70,000 lb
Weight Empty 43,815 lb

FUEL

Internal
2308 gal. 6.5 lb/gal 15,000 lb

ELECTRONICS

AN/ARC-34 UHF Radio
AN/ARC-49 VHF Radio
AN/APN-22 Radar Altimeter
AN/ARN-31 Glide Path Rec.
AN/ARN-21 Nav. Radio
AN/APX-25 Transponder (IFF)
AN/ARN-32 Marker Beacon Rec.
618S-1 HF Radio (provision only)

CARGO CAPACITY

2500 cubic feet
8000 pounds basic
16,720 pounds maximum

MAY 1956
## Loading and Performance - Typical Mission

### TAKE-OFF WEIGHT: OUTBOUND
- **Payload**: lb 67,380
- **Fuel**: lb 13,290
- **Wing Loading**: psf 55.1
- **Take-Off Ground Run at 6000 ft & 95°F**: ft 0
- **Average Cruising Altitude**: ft 320
- **Maximum Ground roll at 6000 ft & 95°F**: lb 81,150
- **Take-Off & Landings Vertical**: lb 56,000
- **Stall Speed, Power Off**: mph 400

### TAKE-OFF WEIGHT: RETURN
- **Payload**: lb 4,000
- **Stall Speed, Power Off**: mph 131

### PERFORMANCE
- **High-Speed Cruise**: 450 mph
- **Radius with S.L. Std. Take-off**: lb 1,510
- **Radius Payload**: lb 65,790
- **Radius Cruiser**: lb 52,590

### NOTES
- *This is the average altitude which does not include the portion flown at sea level.
- **No fuel is added.
- † This velocity at 30,000 feet. Velocity at Sea Level = 300 mph
- ‡ Available with reserve of 10% initial fuel.
SUPPLEMENTAL

VERTICAL TAKE-OFF FLIGHT PATH
T.O.G.W. = 70,000 LB, T/W = 1.03

VERTICAL RISE
V = 5 FT/SEC
50 FT

500 FT
1740 FT

VERTICAL LANDING FLIGHT PATH
G.W. = 50,000 LB

NORMAL GLIDE
ROTATE DUCTS
IDLE POWER

LEVEL DECELERATION
CONSTANT ANGLE OF ATTACK, C_L = 0,
INCREASING POWER

V=0

1290 FT

2420 FT

50 FT

BELL D181
CONFIDENTIAL
MAY 1956
GENERAL NOTES

1. It was not necessary to comply with Specification MIL-C-5011A by verbal agreement with ONR. For presentation purposes the general format of the specification was used and the intent was followed with the following deviations:
   
   a. The actual fuel used to take-off and accelerate to climb speed, as determined by a numerical integration was used.
   
   b. The reserve used was 10% of the total fuel on board at take-off. No fuel was added during the mission.

2. Alterations in the prescribed format were made to present more satisfactorily the VTOL features of this aircraft.

3. The technical summary report presents complete performance information on this airplane. But due to the nature of the contract, does not contain details of method and sample calculations.
**Characteristics Summary Basic Mission**

**Cruise Altitude**
- 29,000 feet
- 24,800 feet

Vertical take-off:
- 425 miles
- 300 mph

**Performance**

<table>
<thead>
<tr>
<th>Combat Radius</th>
<th>Ferry Range</th>
<th>Maximum Speed</th>
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<tbody>
<tr>
<td>425 miles at 300 mph; 20% at sea level</td>
<td>1120 miles at 320 mph Cruise at 30,000 ft.</td>
<td>520 mph at 35,000 ft.</td>
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</tbody>
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**Climb**
- 9440 ft per min at sea level, take-off weight, and military power
- 11,710 ft per min at sea level, radius point take-off weight, and military power

**Ceiling**
- 49,900 ft at 100 ft per min, take-off weight, and military power
- 52,000 ft at 100 ft per min, radius point take-off weight, and military power

**Hovering Endurance**
- Maximum — 70 min
- Minimum — 6.24 min

**Stalling Speed**
- 143 mph at take-off weight
- 131 mph at radius point take-off weight

**Load**

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<thead>
<tr>
<th>Crew (3)</th>
<th>Oil</th>
<th>Fuel</th>
<th>Payload</th>
</tr>
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<tbody>
<tr>
<td>645 lb</td>
<td>328 lb</td>
<td>13,290 lb</td>
<td>8,000 lb</td>
</tr>
</tbody>
</table>

**Weights**

<table>
<thead>
<tr>
<th>Initial take-off</th>
<th>Radius point take-off</th>
<th>Maximum VTO at 6000 ft and 95°F with 3% thrust margin</th>
</tr>
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<tr>
<td>67,380 lb</td>
<td>56,000 lb</td>
<td>70,000 lb</td>
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**Time to Climb**
- To 20,000 ft at T.O.G.W. 2.51 min
- To 30,000 ft at T.O.G.W. 4.30 min
- To 20,000 ft at radius point G.W. 2.02 min
- To 30,000 ft at radius point G.W. 3.35 min

**Notes**
1. Performance Basis: ISA standard atmosphere no wind except for take-offs and landings, which were at 6000 ft and 95°F. Fuel consumption corrected for installation and increased 5% per MIL-C-5011A.
2. Missions: Vertical take-off and landing at all points.
   II Minimum cruise altitude for basic mission, 11,300 ft.
   III High-speed cruise at altitude and 300 mph at sea level for basic mission, 420 mph at 30,000 ft.
   IV High-speed cruise of 455 mph at sea level and 30,000 ft radius = 302 miles.
   V Max. VTO Radius with sea level standard take-off and cruise at 300 mph: R = 705 miles.
3. Missions with initial STO; all later take-offs and landings vertical.
   A. Max. Radius. Initial Ground Run = 770 ft, Rad = 987 mi.
   B. Max. payload with 425-mile radius. Initial ground run = 300 ft, payload = 16,720 lb.
   C. High-speed radius at 450 mph. Rad = 607 mi., initial ground run = 660 ft.
Characteristics Summary

MODEL D181 Ducted Propeller Assault Transport Aircraft

AVAILABILITY

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<th>ACTIVE</th>
<th>RESERVE</th>
<th>TOTAL</th>
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PROCUREMENT

STATUS

FEATURES

1. Vertical take off and landing in horizontal attitude.
2. Can make overload short take off for increased radius, range, and payload.
3. High speed in excess of 500 mph. and hovering capability of 70 minutes.
4. Superior stability during hovering and transition due to ducted propellers.
5. Good handling and maintenance characteristics.
6. Proven reaction control during vertical take off and landing.
7. Manual pilot control without automatic stabilization or control during vertical take off and landing.

CARGO

1. Max load (16,720 pounds)
2. Clear space.
   35' x 10' 8'' x 8'

MAY 1956

BELL D181