C-17 Globemaster III

Image from www.fas.org

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C-17 Mission

- Strategic airlift for U.S. Air Force
- Deployment of troops or cargo to operating bases or forward deployment areas
- Capable of performing theater airlift missions

Image from www.fas.org
Basic Geometry

- Length: 173.92 ft
- Diameter: 33.67 ft
- Wingspan: 170.75 ft
- Wing Area: 3800 ft²
- Wing Sweep: 25°
- Wing Anhedral: 3°
- H.T. span: 65 ft
- H.T. Area: 845 ft²
- H.T. Sweep: 27°
- H.T. Anhedral: 3°
- V.T. Area: 685 ft²
- V.T. Sweep: 41°
Winglet Geometry

- Height: 8.92 ft
- Sweep: 30° (aft)
- Vertical Angle: 15°

Image from www.fas.org
Cruise Conditions

- **Weight**: 585,000 lb (max peace-time)
- **Mach Number**: 0.76 (450 kts at 29,000 ft)
- **Range**: 4,741 nm (without mid-air refueling)
- **$C_L$**: 0.578
  - $C_{La}$: 0.11458 /°
  - $\alpha$: 5.0446°
- Neutral point located 73.0 ft from nose (65% of m.a.c.)
- 10% static longitudinal stability
Induced Drag at Cruise

- Cruise $C_L$: 0.578
- $C_{Di}$: 0.0111
- Aspect Ratio: 7.673
- $e$: 1.01
- Winglets give Oswald efficiency factor greater than 1.0
Drag at Cruise

For cruise condition:

- **Friction Drag:**
  \[ C_{Df} = 0.00510 \]

- **Form Drag:**
  \[ C_{Dform} = 0.00109 \]

- **Wave Drag:**
  \[ C_{Dwave} = 0.00169 \]
Wave Drag at Cruise

- “Best Guess” airfoil given limited data
  - NASA Supercritical SC(2)-0412
    - Design $C_l = 0.4$
    - 12% thick

TSFOIL Results:
2D $C_l = 0.872$
$C_p = -0.841$

Image from NASA Technical Paper 2969
Pressure Coefficient Distribution for C-17 Airfoil during Cruise

Cₚ,upper
Cₚ,lower
Drag Polars

C-17 Cruise Drag Polar

CD

C
Takeoff/Landing

Note: Lift coefficients determined from gross maximum takeoff weight.

- Takeoff (at sea level)
  - Mach Number: 0.18
  - $C_L$: 3.156

- Landing (at sea level)
  - Mach Number: 0.13
  - $C_L$: 5.014

- The C-17 was designed for STOL capabilities and can takeoff and land in distances as short as 3,500 ft.

- A sophisticated high-lift system is needed for both takeoff and landing.

Image from www.fas.org
High-lift System

- Externally-blown flaps for superior STOL performance
- $C_{L_{\text{max}}} \approx 7.2$
- T-tail configuration used to avoid large downwash from high-lift system
- Vertical tail and rudder sized for engine out conditions

Image from www.fas.org
F117-PW-100 Turbofan Engine

- Manufactured by Pratt & Whitney
- Military variant of PW2000 used on Boeing 757
- C-17 uses 4 of these engines certified at 40,400 lb of thrust apiece
- Capable of thrust reversal

Image from www.pw.utc.com
References

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