

# Airbus A380 Analysis



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# A380 Specifications

- Overall
  - Max TOGW = 1,235,000 lbs
  - Wingspan = 261.8 ft
  - Length = 239.5 ft
  - Height = 79.1 ft
- Planform
  - Wing Area = 9,100 ft<sup>2</sup>
  - AR = 7.53
  - Wing Sweep = 33.5°
  - Taper Ratio = 0.26
  - t/c = 0.08

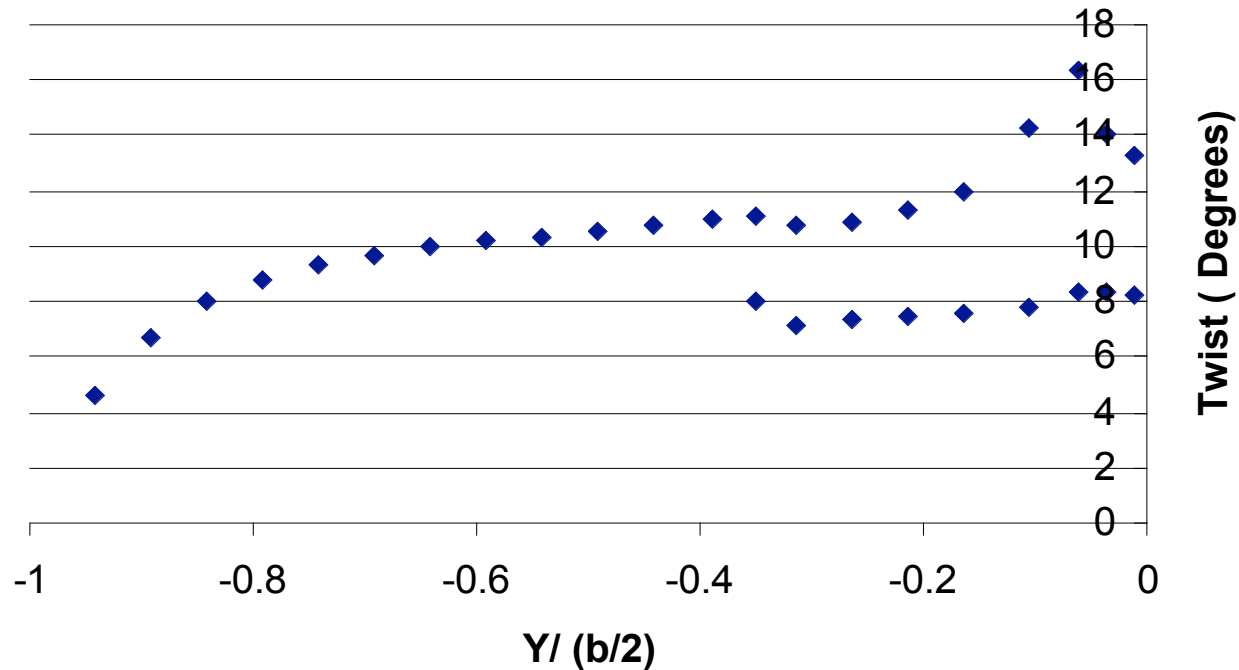
# Neutral Point

- Neutral Point: 121.4 ft from the nose
  - About 51% of the length of the fuselage
  - Found using VLMpc
- Could not find a given center of gravity location or a static margin for the A380
- Estimated center of gravity: 110-120 ft. from the nose

# Minimum Drag due to Lift

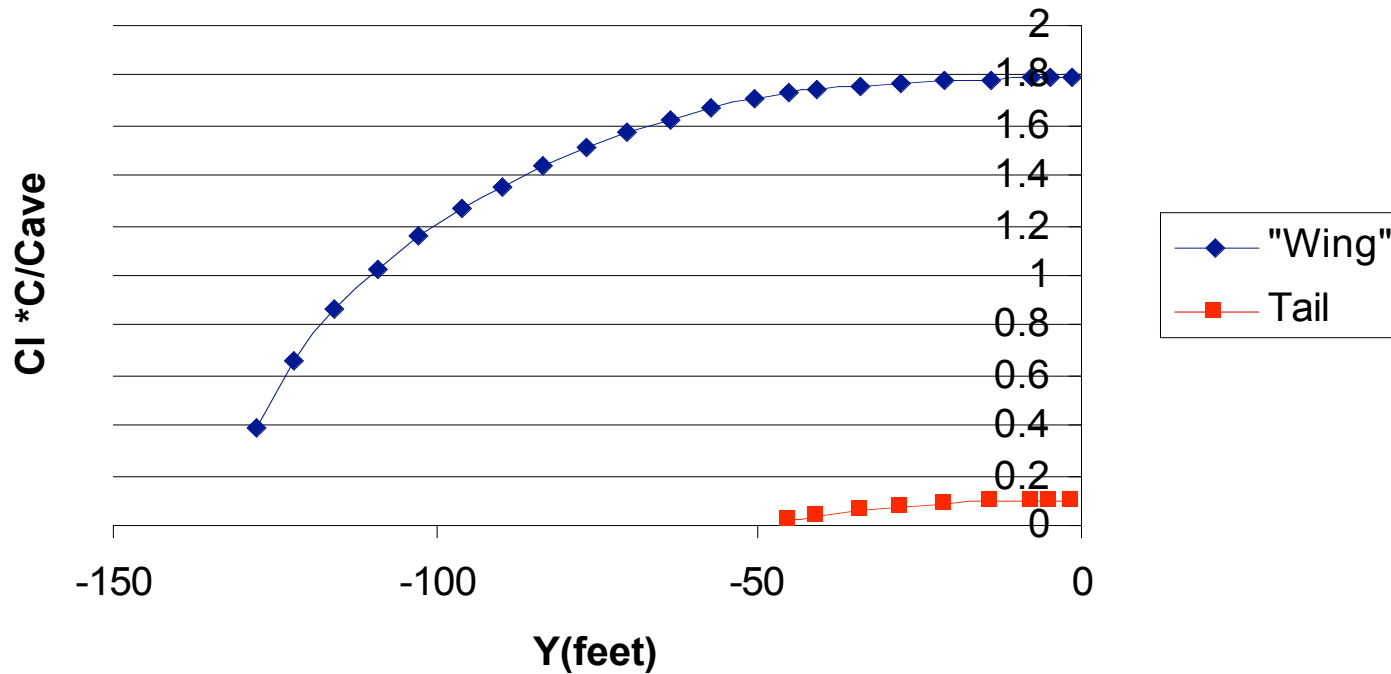
- The value for the minimum  $C_{Di}$  from LAMDES was given as 0.09564
- The value did not change as the cg location was varied
  - For every aft shift in cg, the values that LAMDES gave were the same
- Minimum  $C_{Di}$  for A380 = 0.09564
- Total minimum  $C_D = 0.14269$

## Linear Theory Twist Distribution



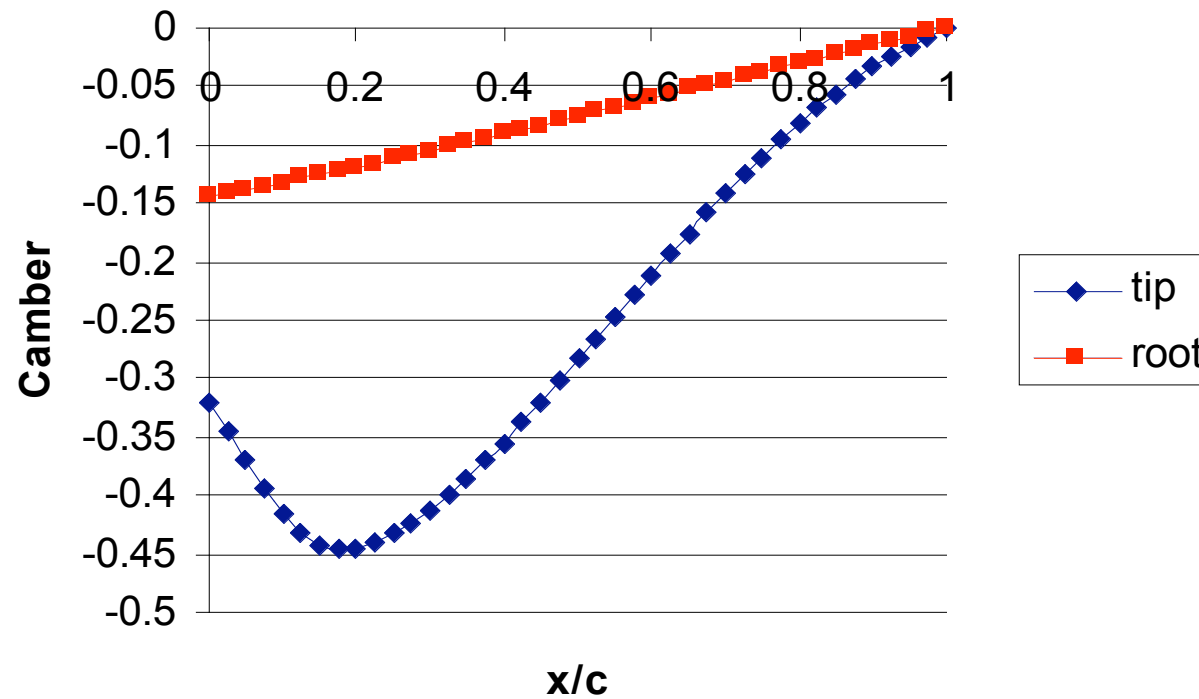
The Linear Theory Twist Distribution showed that the twist at the root was greatest near the root and decreasing out to the tip. The tail did not show much variation in the twist distribution.

## Cl Distribution



The  $Cl$  Distribution showed high lift on the main wing and low lift on the tail as to be expected as well as an elliptic distribution. The Span  $e$  was found to be 1.1011. This was expected as the A380 has a small dihedral to its wings, giving a Span  $e$  value greater than 1.

## Root and Tip Camber



The Camber of the root was shown to be almost linear, while the camber at the tip has area of large camber just aft of the leading edge and decreasing to the trailing edge.

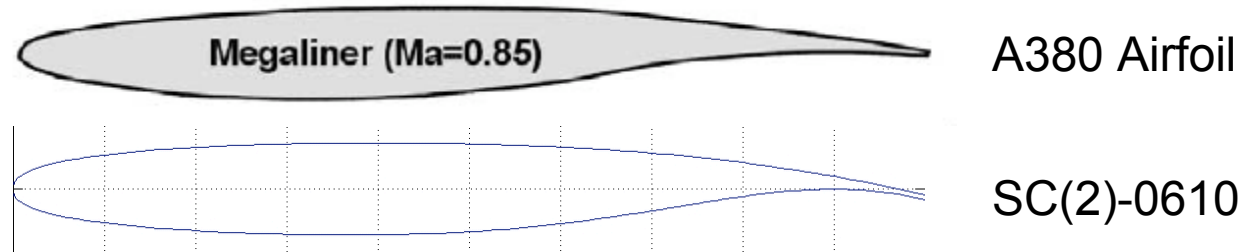
# Skin Friction Drag

- Inputted A380 geometry into FRICTION
  - At cruise (Mach 0.85 @ 35,000 ft)  $C_{DO}$  is 0.01523
  - 20 counts higher than 747
- $L/D_{MAX}$  is 19.36 with this  $C_{DO}$  value
  - About 10% less than other Airbus aircraft

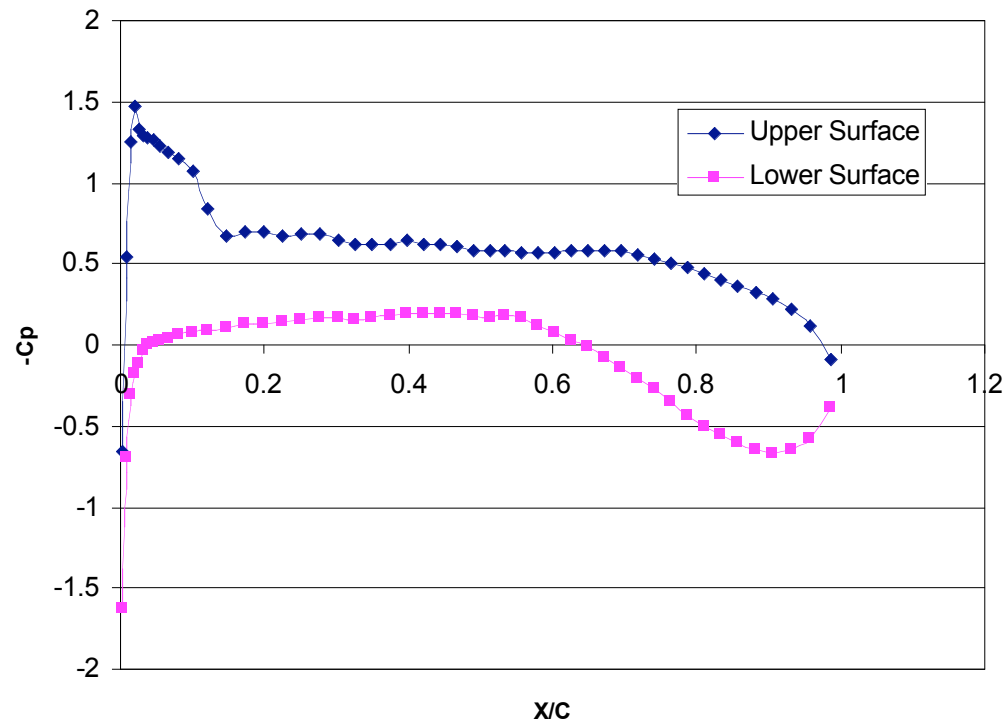


# Airfoil Analysis

- Approximated the root airfoil to be a NASA SC(2)-0610 and the tip airfoil to be a NASA SC(2)-0606.
  - Based on similar geometries and thicknesses.



- $C_{Lmax}$  determined from XFOIL to be approximately 1.48 at an angle of attack of  $18^\circ$ .
- Pressure Distribution from TSFOIL at cruise  $C_L$ :



- Quite difficult to design an airfoil factoring in transonic effects

# Box Effects

- Two major effects on the design of the A380 with the box effects.
  - Maximum TOGW
  - Span Loading
- A380 does not meet normal trends and was a major area of concentration during the design phase.

# References

- [www.airbus.com](http://www.airbus.com)
- Mason, W.H.,  
[http://www.aoe.vt.edu/~mason/Mason\\_f/MRsoft.html](http://www.aoe.vt.edu/~mason/Mason_f/MRsoft.html)