Airbus A380

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Design Scope

In June 1994, Airbus began to discuss the design concept of a large single deck transport airliner, A3XX.

The design soon went to a double deck transport airliner.

Airbus recognized the increasing demand on air travel.

The mission of the A380 was to transport a large number of people is a safe and efficient way.

The A380 is a long range, high capacity, subsonic/transonic civil transport aircraft.

It is the largest airliner ever built consisting of a twin deck and four aisles, capable of carrying 555 passengers.

Specifications

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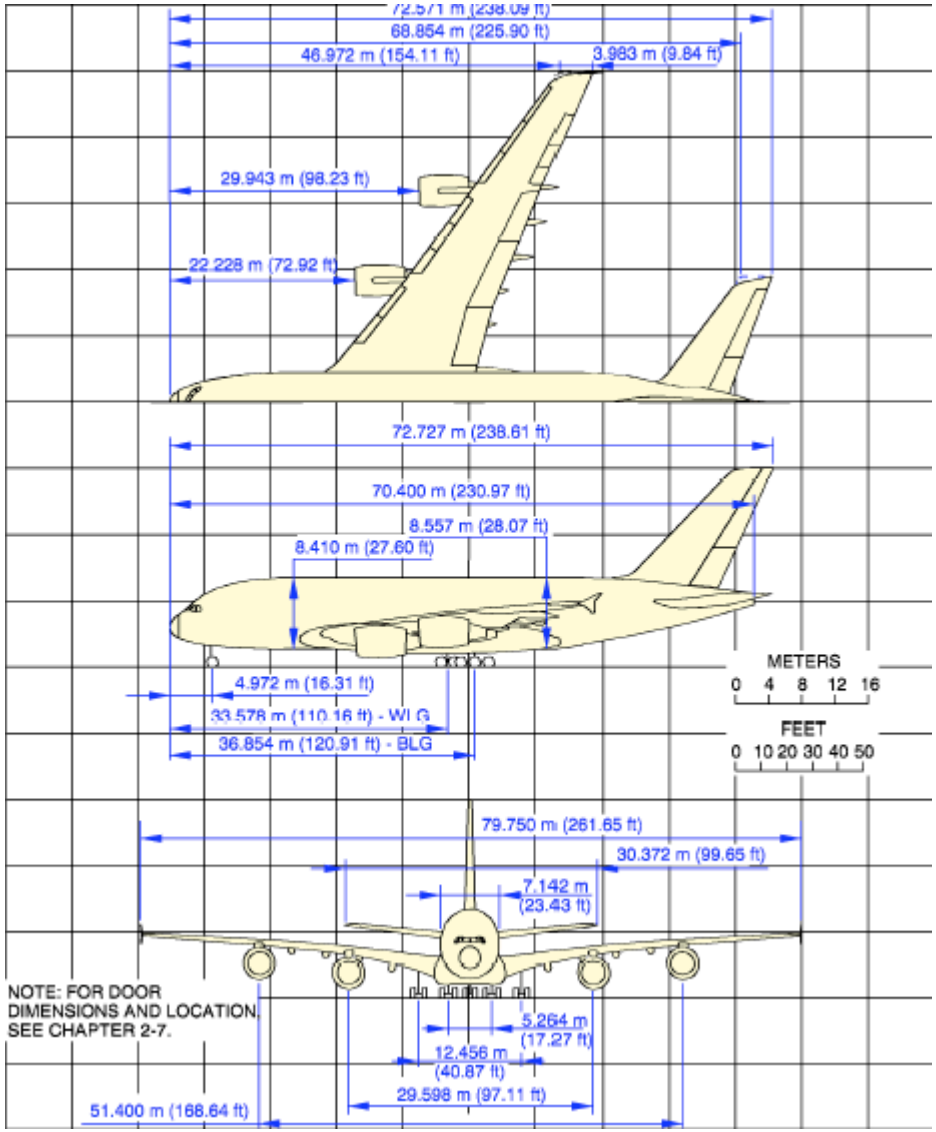
General Dimensions:

- Span = 261.65 ft
- Chord = 34.83 ft
- AR = 7.43
- $Sweep_{1/4chord}$ = 33.5°
- Taper = 0.17

The A340 has a span around 60 meters and the A380 is very close to the 80 meter limit at 79.8 meters. The A380 may suffer some penalty being so close to the 80 meter gate box limit.



Cont. Specifications

Performance:

- Max Speed = 0.89
- Max Cruise Speed = 0.85
- Service Ceiling = 43,000 ft
- Range = 7991 miles

Powerplant:

- 4 Rolls-Royce Trent 900
- Thrust = 267,960 lbs

Weights:

- Max TO Weight = 1,235,000 lbs
- Empty Weight = 608,400 lbs
- Max Payload = 200,587 lbs

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LAMDES Calculations

LAMDES was used to calculate the following information:

- Drag due to lift as a function cg location
- Section Cl distribution
- Twist distribution
- Camber distribution

Sample input file from LAMDES is located in Appendix A.

Drag due to lift vs. CG location

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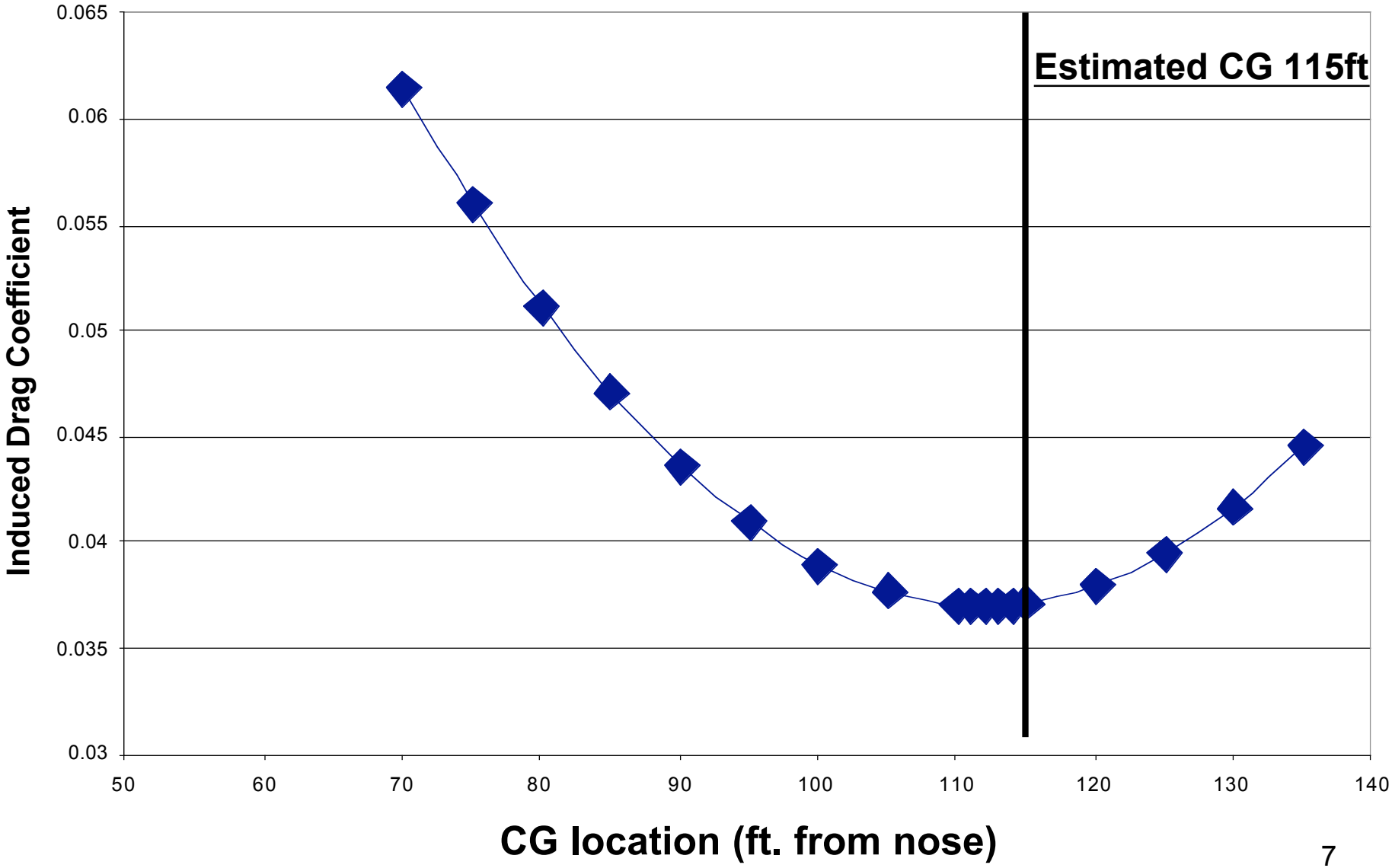

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Static Margin

- Static Margin = C_M*K_L
- From Estimated CG at 115 ft:

  SM = 0.112 or 11.2% MAC
- For Exact CG at 112ft:

  SM = 0.113 or 11.3% MAC
- The estimated CG gave a lower static margin than the exact CG, therefore the estimated value needs less trim than the exact value.

Cl Distribution

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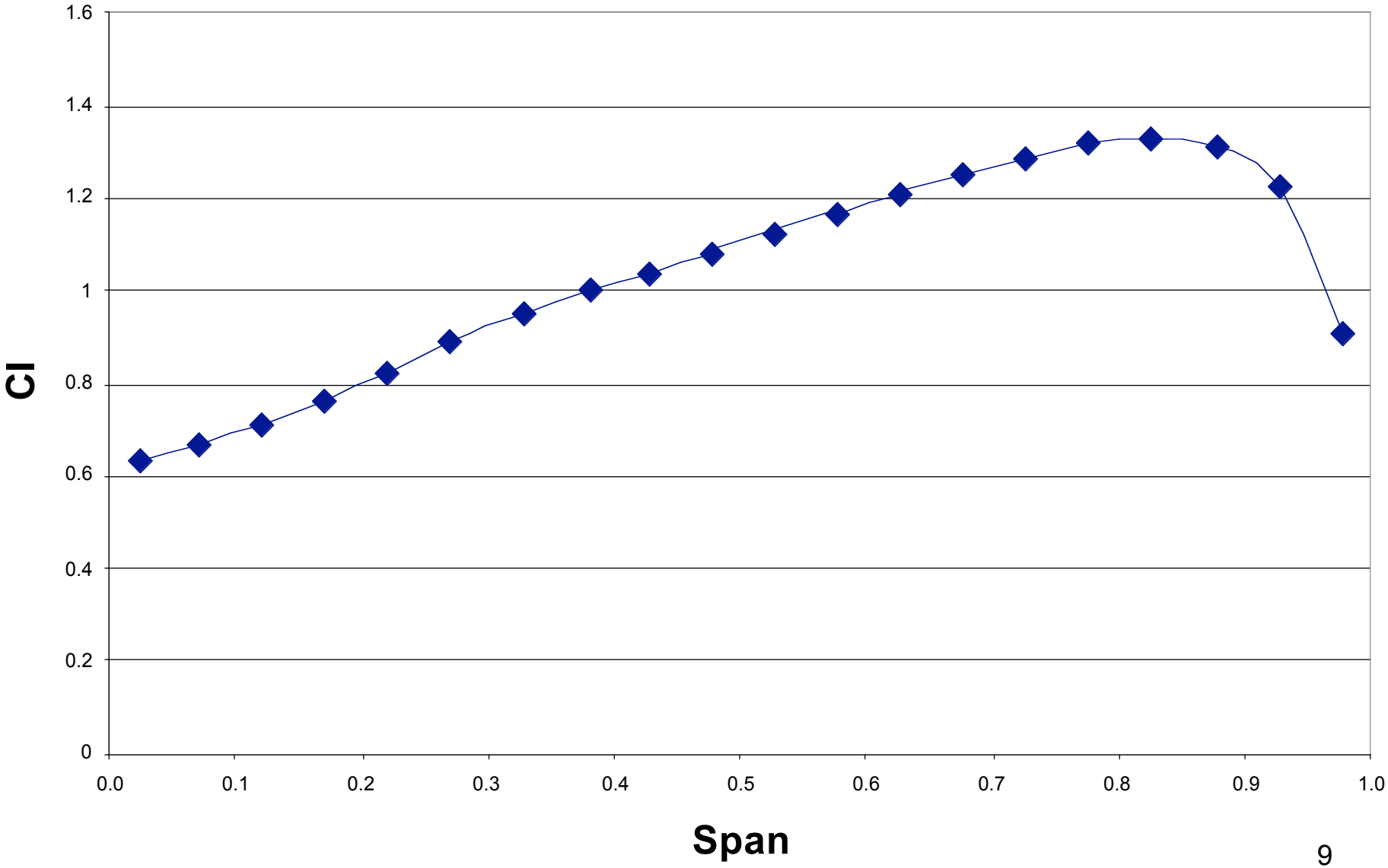

Twist vs. Span

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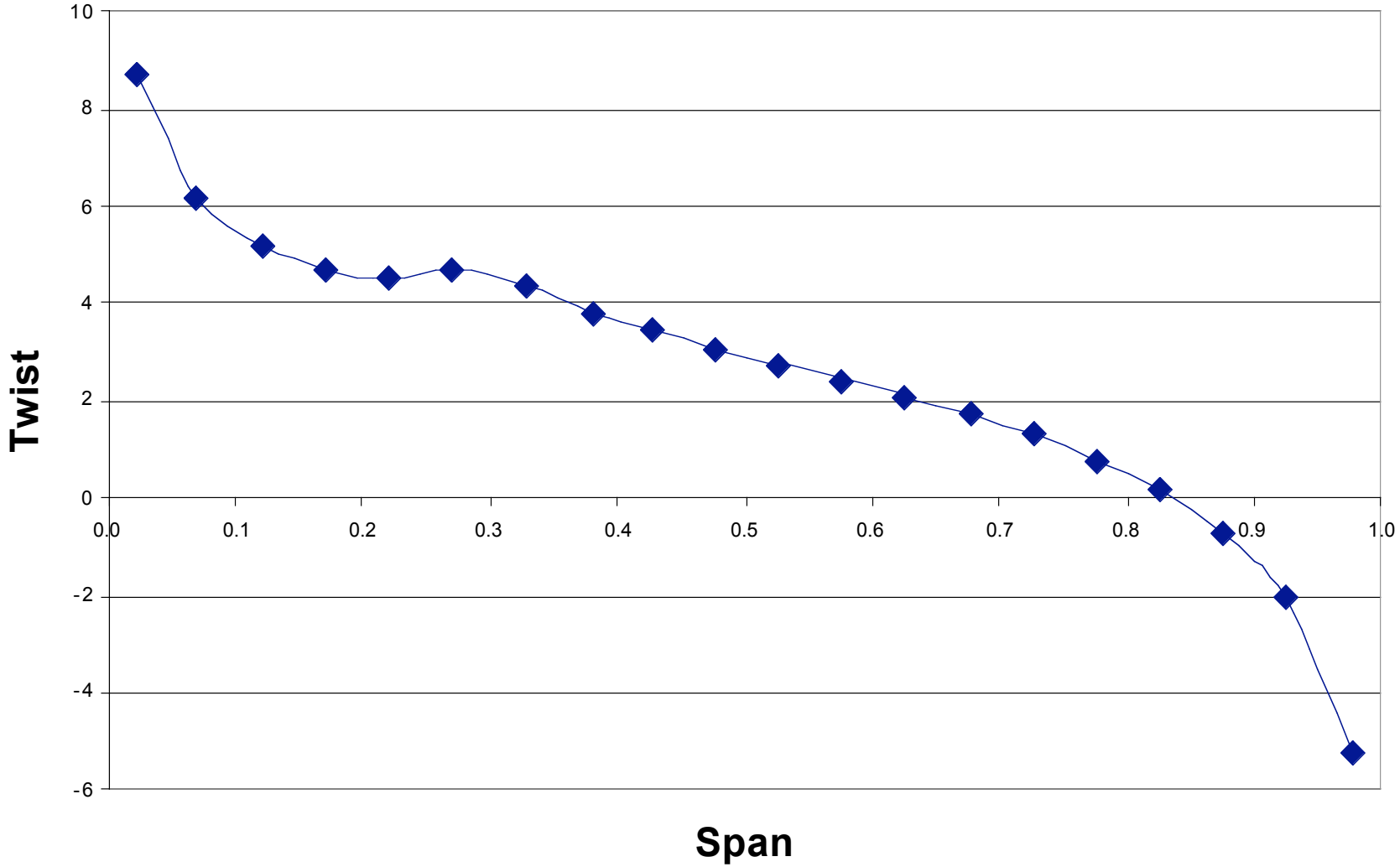

The wing is twisted (washout) to reduce the chance that the wing tip will not stall first. Twist unloads the tip of the wing by changing the section lift distribution as seen on the plot of the Cl distribution.

Camber Distribution

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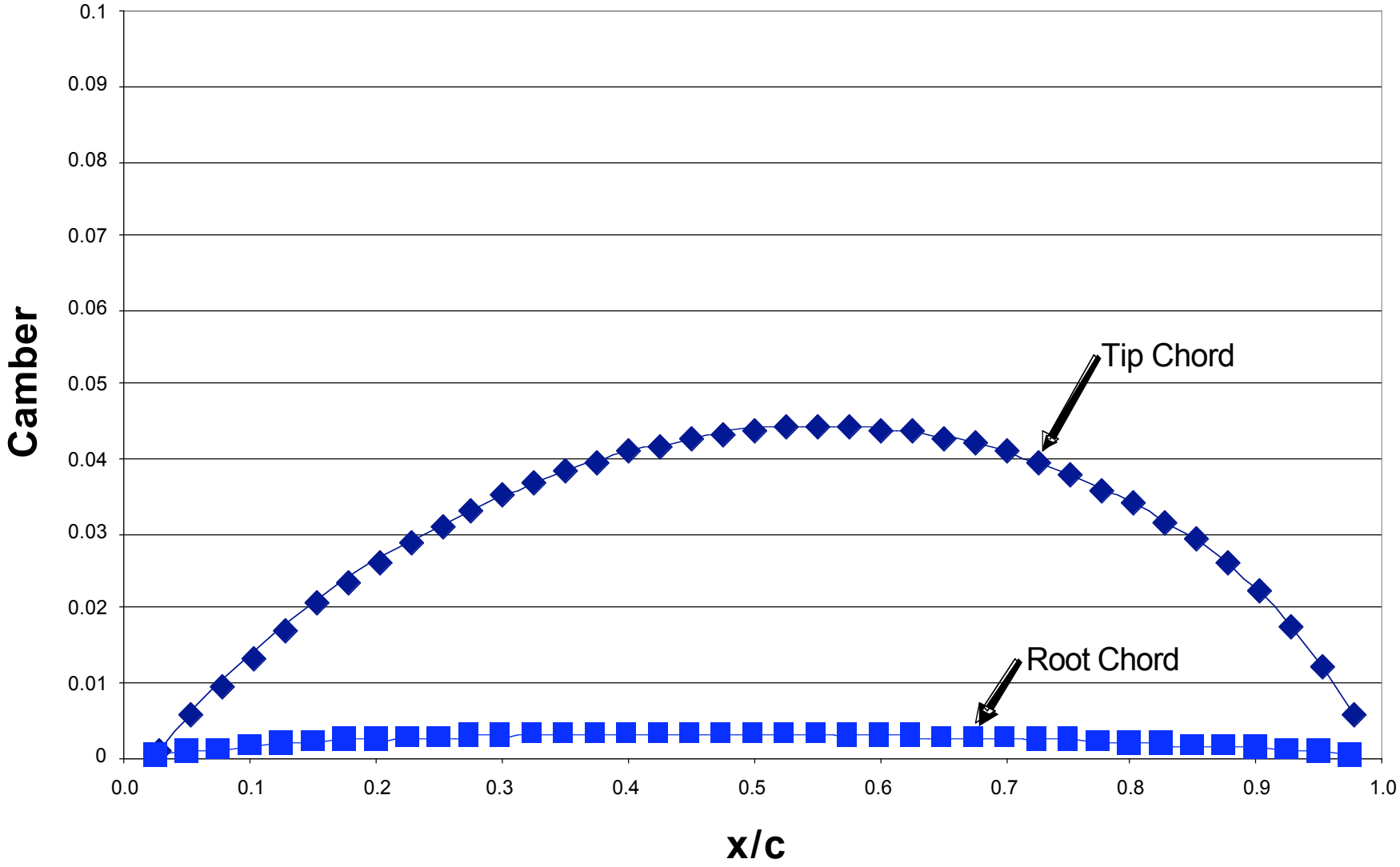
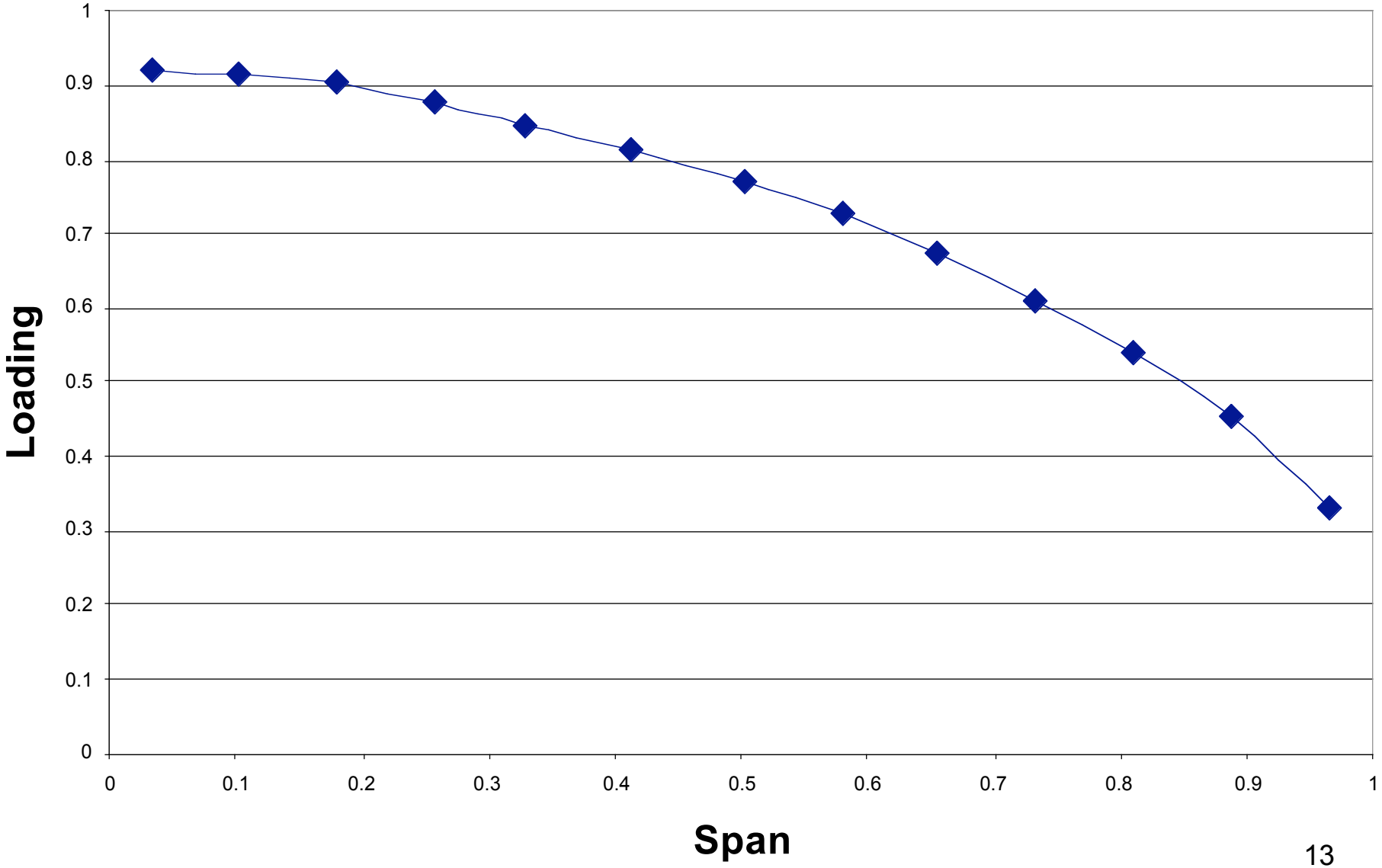


The tip of the wing is cambered more than the root of the wing. The tip of the wing produces more lift which is also seen in the Cl distribution.

Spanload

- The program VLMpc was used to produce the spanload of the wing.
- The input file used to run VLMpc is located in Appendix B.

Span Loading



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Maximum Lift to Drag Ratio

- L/D_{MAX} was produced by the use of the FRICTION program.
- The purposed L/D_{MAX} = 13.79.
- Using FRICTION at the cruising speed of 0.85 Mach and a service ceiling of 43,000 ft, therefore the calculated C_{Do} = 0.01537.
- The estimated L/D_{MAX} = 17.43, about 4 values higher than the purposed.
- The input into FRICTION is roughly calculated and wasn't exact value which could have given the error on L/D_{MAX}..
- The input file used to calculate the C_{Do} is located in Appendix C.

References

- http://www.airbus.com/product/a380_backgrounder.asp
- http://www.airliners.net/info/stats.main?id=29
- http://www.aerospaceweb.org/aircraft/jetliner/a380/index.shtml
- A380 Airplane Characteristics For Airport Planning AC, AIRBUS
- http://www.aoe.vt.edu/~mason/Mason_f/ConfigAero.html

APPENDIX A

INPUT - LAMDES

```
A380 Project - Planform for LAMDES
 2.000   -112.00   34.83     9100.     1.0       0.0       0.0
 4.000   0.0       0.0       -14.4     0.0       0.0
-52.5    0.0
-154.11   -125.     0.0       1.0
-163.95   -125.     0.0       1.0
-123.853  -36.697   0.0       1.0
-116.25   0.0
 3.000   0.0       0.0       -25.8     0.0       0.0
-180.4    0.0
-225.90   -44.725   0.0       1.0
-238.09   -44.725   0.0       1.0
-213.303  0.0
1.0  10.0 20.0 0.85 0.9  40.0 0.0005
1.0       1.0       0.0       -0.10     0.0
0.03      1.0       0.0       0.0       0.0       0.0
```

APPENDIX B

INPUT - VLMpc

```
A380 Project - Planform for V LMpc
2.000     1.0       34.83     9100.     -112.0
4.000     0.0       0.0       0.0
 -52.5    0.0       0.0       1.0
-154.11   -125.     0.0       1.0
-163.95   -125.     0.0       1.0
-123.853  -36.697   0.0       1.0
-116.25   0.0
  3.000   0.0       0.0       0.0
-180.4    0.0       0.0       1.0
-225.90   -44.725   0.0       1.0
-238.09   -44.725   0.0       1.0
-213.303  0.0
380. 10.0 20.0 0.85 0.9  0.0  0.0  1.0  0.0       1.0  0.0       0.0
```

APPENDIX C

INPUT - FRICTION

```
A380 - FRICTION
9100.       1.        5.        0.0
FUSELAGE          17800.    230.97    .10144    1.0       0.0
ENGINES           3700.0    28.0      .37931    1.0       0.0
VERT TAIL         3000.0    28.0      .19521    0.0       0.0
WING              21400.    25.0      .20000    0.0       0.0
HORIZ TAIL        4300.0    22.0      .19241    0.0       0.0
    0.850    43.000
    0.880    43.000
```