AE 1601 Wind Tunnel Activity

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## Nomenclature

b	span
c	chord
t/c	thickness to chord ratio
AR	aspect ratio
S	planform area
α or AOA	Angle of Attack
C_l	Lift Coefficient
C_{d_i}	Induced Drag Coefficient
a	lift curve slope of the (finite) wing
a_0	lift curve slope of the airfoil

Data Reduction

Results

v (m/s)	Re	α_0 (1/rad)
4	3.076957e+04	9.596064
8	6.153914e+04	5.413088
12	9.230871e+04	5.590212
16	1.230783e+05	5.762940

Plotting
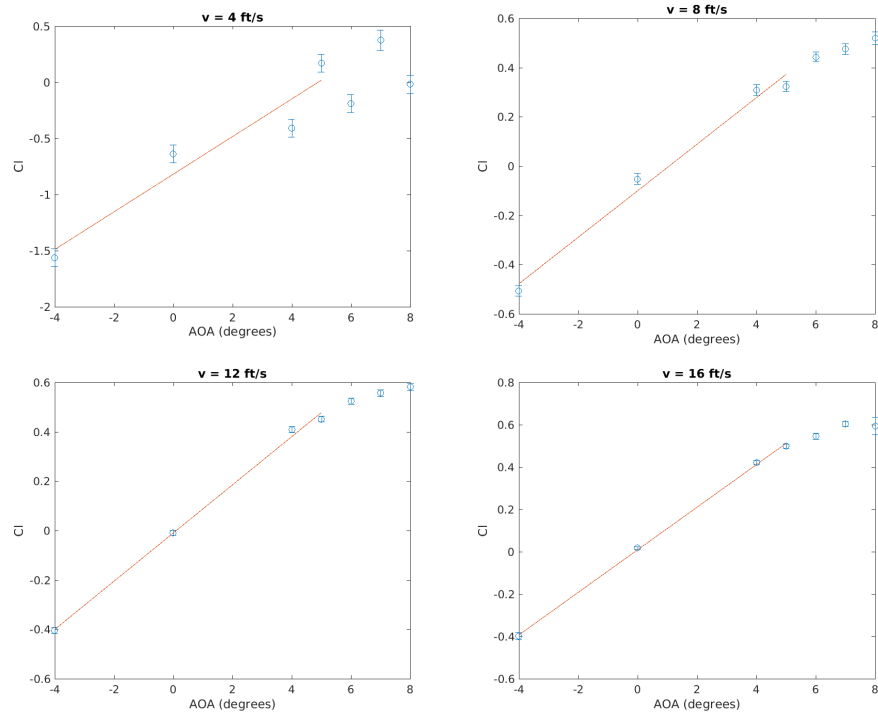
Answers to Problems

1. Other Group Members:

   - Austin Rose
   - Afiq Manap
   - Meric Taneri
   - Tyler Fuhrman
   - Yohannes Kasseya

2. Geometry:

b	0.47m
c	0.12m
t/c	0.42
AR	3.92
S	$0.06123m^2$

   N.B. $S \neq bc$ because the span and area are measurements estimates obtained by treating the blade as a rectangle. This inconsistency leads to some ambiguity as to the meaning of the geometric parameters (i.e. does

c refer to 0.12m, or S/b?). All following calculations were done using the listed value of each parameter, not any other values that could be obtained by interpolating between other parameters. Also, the value of AR was computed as b/c not b^2/S.

3. As I had an excused absence that day, I was unable to take a photograph.

4. Our data:

$\rho(slug/ft^3)$	Speed (ft/s)	α	Lift (lbf)
2.264353e-03	13.12	6°	0.048
2.264353e-03	26.24	6°	0.244
2.264353e-03	39.36	6°	0.644
2.264353e-03	52.49	6°	1.242

| $\rho(kg/m^3)$	Speed (m/s)	α	Lift (N)
1.167	4	6°	0.213
1.167	8	6°	1.087
1.167	12	6°	2.866
1.167	16	6°	5.525

5. It appears Professor Komerath expected each group to perform measurements at a range of α values. The activity was conducted such that each group took measurements at only one α value, at a range of velocities. Nevertheless, we have the degenerate table:

α	C_l
6°	0.330

6. The data, agregated over velocities, is tabulated below.

α	C_l
$-4°$	-0.718
0°	-0.171
4°	0.182
5°	0.360
6°	0.330
7°	0.502
8°	0.419

7. The aggregated data is plotted below:
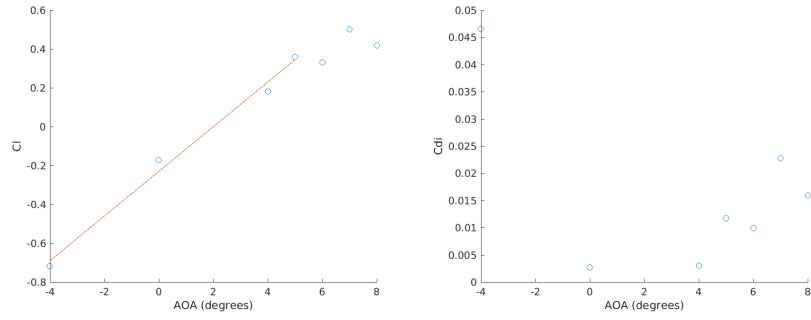
8. The slope of the linear fit was calculated using MATLAB's `polyfit` function. The value is 6.59/rad. Using the formula

$$a_0 = \frac{a}{1 - \frac{ae}{\pi AR}}$$

a_0 was calculated to be 6.65/rad.