JOUKOWSKY FOIL LAB

PURPOSE: The main purpose of this lab is to measure the pressures on a Joukowsky foil and to use these pressures to compute the lift and drag on the foil.

PROCEDURE: Fix the flow speed S and vary the angle of attack θ of the foil. For each θ, measure the pressures on the foil. Use the pressures to calculate the lift on the foil per unit span. The lift is:

$$\Sigma\ P\Delta c\ \mathrm{Sin}(\boldsymbol{\theta}-\theta)$$

Plot the lift versus the angle of attack. The drag is:

$$\Sigma\ P\Delta c\ \mathrm{Cos}(\boldsymbol{\theta}-\theta)$$

Plot the drag versus the angle of attack.

The theoretical lift per unit span is $\rho\Gamma S$ where Γ is the foil circulation and ρ is the air density. The circulation can be calculated using:

$$\Gamma = 4\pi\ S\ R\ \mathrm{Sin}(\theta+\varepsilon) \qquad \varepsilon = \tan^{-1}[m/(n+a)])$$

For the lab foil, the circle radius R is 55mm, the vertical offset m is 10mm and the horizontal offset n is 5mm. The theoretical drag is zero. Compare the theoretical lift with the calculated lift.

FOIL DATA SHEET

	θ	θ	θ	θ		**θ**
2T						314.7
4T						292.7
6T						283.1
8T						276.1
10T						269.9
12T						264.6
14T						259.7
16T						255.6
18T						252.4
20T						248.4
2B						74.0
4B						98.6
6B						100.5
8B						99.4
10B						97.2
12B						94.2
14B						90.5
16B						86.2
18B						81.4
20B						79.6


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