

Fluids Lab 1 (SPL1) – Assignment

Wind Tunnel Pitot Measurements

Learning Objectives

- Practice using pitot probe relations (Bernoulli, etc)
- Familiarization with tunnel test procedures
- Practice nondimensionalization of data

Experimental Rig

Test Article: 47:1 Boeing Blended Wing Body (BWB) in Wright Brothers Wind Tunnel
Instrumentation:

- Tunnel’s pitot-static probe. Reports $p_{o_\infty} - p_\infty$ in Torr (mm Hg).
- Hand-held pitot-static probe. Reports $p - p_\infty$ in Torr.

Test Conditions

Nominal tunnel speed: 40 mph
Angles of attack $\alpha = -7^\circ, 7^\circ$

Raw Data Acquired

For each angle of attack $\alpha \dots$

- 0) $p_{o_\infty} - p_\infty \equiv q_\infty$ (from tunnel’s pitot-static probe)
- 1) $p(x) - p_\infty \equiv \Delta p(x)$, top and bottom centerline, (from hand-held pitot-static probe)
- 2) $p(x) - p_\infty \equiv \Delta p(x)$, top and bottom off-centerline, (from hand-held pitot-static probe)

Normalized Data Presentation and Analysis

- 1) Plot centerline C_p vs x/c_0 , for $\alpha = -7^\circ$ and 7° , for top and bottom. Put the four curves on one plot, label clearly. Centerline chord is $c_0 = 37.7$ in.
- 2) Plot off-center C_p vs x/c_{10} , for $\alpha = -7^\circ$ and 7° , for top and bottom. Put the four curves on one plot, label clearly. Off-center chord is $c_{10} = 20.5$ in.
- 3) The best possible place to locate a static pressure sensor is that where C_p changes are the smallest as the angle of attack varies. In other words, where $|dC_p/d\alpha|$ is minimum. From your data, estimate the value of $|dC_p/d\alpha|$ and plot it versus x/c , for both the centerline and off-centerline.

Submit the 2-sided turn-in sheet provided for parts 1) and 2). If the plots are clearly incorrect, partial credit can be given only if you show your work (equations used, sample calculations, etc). Attach a separate sheet for part 3) and any additional work. Feel free to use any graphic software to create the plot in part 3), i.e., Excel.

Centerline and off-centerline pressure measurement locations:

