Wall Pressure Coefficient (Cp) Details
14x22 Test 653 - 8% Juncture Flow Model with Horn
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Datafiles contain:

- cp: fitted wall Cps with Junture Flow model installed and includes effect of the tunnel gradient; cp = cpdelta + cpgradient
- cpgradient: test section streamwise gradient from empty tunnel runs (due to test section walls and divergence)
- cpdelta: this is the wall Cp due to model only
- xtunnel (mm): tunnel station where all the fits were evaluated, these are not the actual orifice locations in the physical tunnel, units are millimeters
- ytunnelnominal (mm): nominal tunnel y for wall orifice rows, this value does not take into account the divergence of the tunnel side walls, units are millimeters
- ztunnelnominal (mm): nominal tunnel z for wall orifice rows, units are millimeters

Origin for xtunnel, ytunnel, and ztunnel is at start of the test section and at the centerline.

Use of data:

- If CFD simulation is done only with model in-tunnel, then "cp" is the appropriate variable.
- If CFD simulation is done with model in-tunnel and is tared to an empty tunnel simulation, then "cpdelta" is the appropriate variable.

Various details for Cp calculations:

14x22 wall static orifices are not pristine orifices and were always intended to be used with a tare process.

Empty tunnel data were used to tare each orifice. Empty tunnel data were also used to estimate the test section streamwise gradient. The empty tunnel data were from the following tests:

Test 635: runs 148, 149, 150, 151, 152, 153
Test 641: runs 5, 7, 8, 53, 54, 55, 59

Test 653 runs used for these results are from the alpha polars and include runs 202, 203, 205, 211, 213, and 214. (upright runs only)

Processing:

1) For each wall orifice, fit empty tunnel data versus q (from 10 psf to 140 psf)

2) For each point used from T653, used the fits from step 1 to get the empty tunnel Cp value at the q with the model installed; subtracted the empty tunnel Cp value from the model installed Cp value. This provides a delta Cp between model installed and empty tunnel for each point. But this delta Cp loses the effect of the test section gradient.

3) For a given alpha, and assuming symmetry in the test section, combined delta Cp data from rows 1 and 12; rows 2 and 11; rows 3 and 10; rows 4 and 9; rows 5 and 8; and rows 6 and 7. Used a smoothing spline to fit each combined row and evaluated the spline from x = 0 to 40 feet (0 to 12192 mm). This provides the "cpdelta" values.

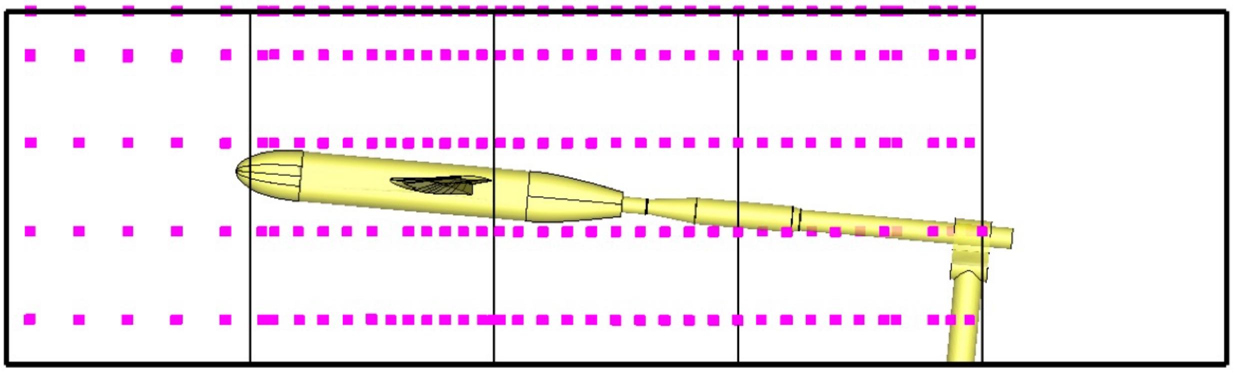
4) To take the tunnel gradient into account, used empty tunnel data and combined all 12 rows together for each point and did a first order polynomial fit (using data from x = 3 feet to 38.5 feet). Then combined all fit information together and did another fit versus q. Using the average q for the model-installed data points, then calculated the tunnel gradient information and evaluated from x = 0 to 40 feet. These are the "cpgradient" values.

5) Then calculated "cp" using: cp = cpdelta + cpgradient

Uncertainty:

The uncertainty with this method is still being evaluated, but based on the variation in wall pressures, I expect the wall Cp uncertainty (95% confidence level) will be on the order of ±0.010 to ± 0.015.

Side view of test section with model at 5 degrees.



Upstream view with model at 5 degrees and wall pressure row numbers.