SAND2014-15883R

Experimental Datasets for Release to The Technology Cooperation Program CP 5-2-2012 from Sandia National Laboratories.

I. Overview

The datasets being released consist of cavity configurations for which measurements were made in the Sandia Trisonic Wind Tunnel (TWT) facility. The cavities were mounted on the walls (ceiling/floor) of the wind tunnel, with the approach flow boundary layer thickness dictated by the run-length from the settling chamber of the tunnel. No measurements of the boundary layer for the different cases were made explicitly. However, prior measurements of the boundary layer have been made and simulations of the tunnel from the settling chamber on have shown that this method yields the correct boundary layer thickness at the leading edge of the cavity. The measurements focused on the cavity flow field itself and the cavity wall pressures. For each of the cases, the stagnation conditions are prescribed in order to obtain the correct inflow conditions upstream of the cavity. The wind tunnel contours have been approved for public release and will be made available also.

Two sets of cavity data are planned for release, a Simple rectangular cavity case and a Complex cavity case. In the case of the simple rectangular cavity, measurements are available with and with out a model store in the cavity. No pressure measurements are available on the store itself, only on the cavity walls (fore and aft).

II. Simple Rectangular Cavity Cases

The following cases are basic rectangular cavity cases with wall pressure data on the aft and front cavity walls. PIV data is not available for these cases.

	Transonic 5x5x1.5 Cavity		
Sensor	**x/L**	**y/D**	**z/W**
1	1.00	-0.42	-0.40
2	1.00	-0.42	-0.20
3	1.00	-0.42	-0.08
4	1.00	-0.42	0.00

	Supersonic 5x5x1.5 Cavity		
Sensor	**x/L**	**y/D**	**z/W**

1	0.00	-0.42	0.40
2	0.00	-0.42	0.20
3	0.00	-0.42	0.08
4	0.00	-0.42	0.00
5*	LDV	LDV	LDV
6	1.00	-0.33	0.00
7	1.00	-0.33	0.08
8	1.00	-0.33	0.20
9	1.00	-0.33	0.40

Wall pressure measurements are available at the locations given below. The coordinate system is such that x is along the flow, z is the spanwise direction and y is the vertical direction in and out of the cavity.

Sensor	x/L	y/D	z/W
1	0.00	−0.42	0.40
2	0.00	−0.42	0.20
3	0.00	−0.42	0.08
4	0.00	−0.42	0.00
6	1.00	−0.33	0.00
7	1.00	−0.33	0.08
8	1.00	−0.33	0.20
9	1.00	−0.33	0.40

III. Complex Cavity Cases

The following cases are referred to as the "Complex Cavity" cases and build up the complexity by incrementally adding features to a rectangular cavity. In these cases, wall pressure data is available at several locations on the floor and aft wall of the cavity. The letters in parenthesis refer to the figure below. Note that due to blockage concerns,

#	Configuration (LxWxD) (inches)	With/Without Store	Mach Number
A	Rectangular Baseline 8" x 4" x 1.15"(a)	w/o	1.5/0.8
B	+ Inlet Ramp (b)	w/o	1.5/0.8
C	+Inlet Scoop + tooth (c)	w/o	1.5/0.8
D	+ Internal Block (d)	w/o	1.5/0.8

E	+ Open Doors (e)	w/o	0.8

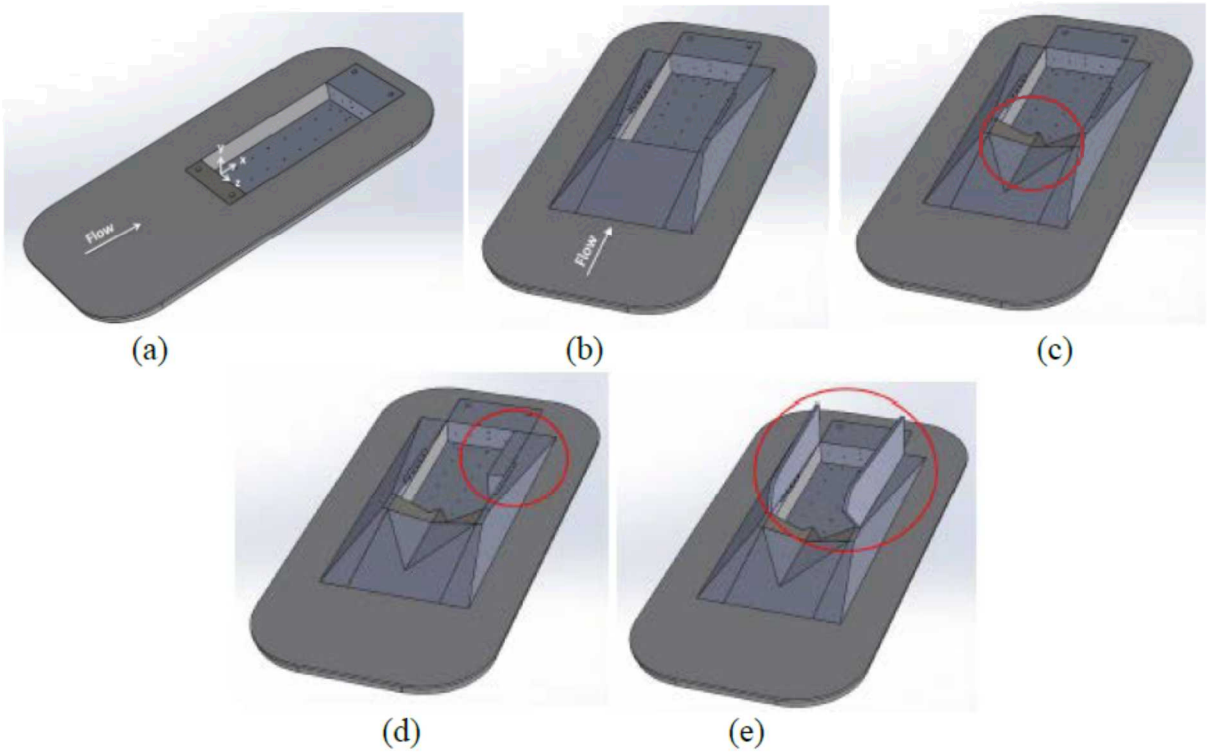

Figure 1. Complex Bay configurations. See table for descriptions.

The pressure measurements for these cases are complete and available at the locationshown in the figure below. Five sensors are located in the spanwise direction along the forward floor of the cavity (FFP1-FFP5, Figure 2). There is also a line of sensors down the center of the cavity (C2-C7). Two sensors are located on either side of sensor C4 in the spanwise direction and are designated L4 and R4. There is another spanwise line of sensors at the rear of the cavity (RFP1-5), as well as at the aft wall of the cavity (AWP1-AWP5, Fig. 6(b)). A final sensor AWP6 is located on the cavity centerline, on the aft wall above sensor AWP3. A schematic of these locations with respect to the cavity geometry is shown in Fig. 6(c). When the centered tooth is installed, the front floor sensors FFP1-5 are located beneath an overhang created by the tooth. Sensor C2 is just downstream of the tooth on the cavity floor. When the side insert is installed, sensor R4 is located in front of the insert, while sensors RFP5 and AFP5 are covered.

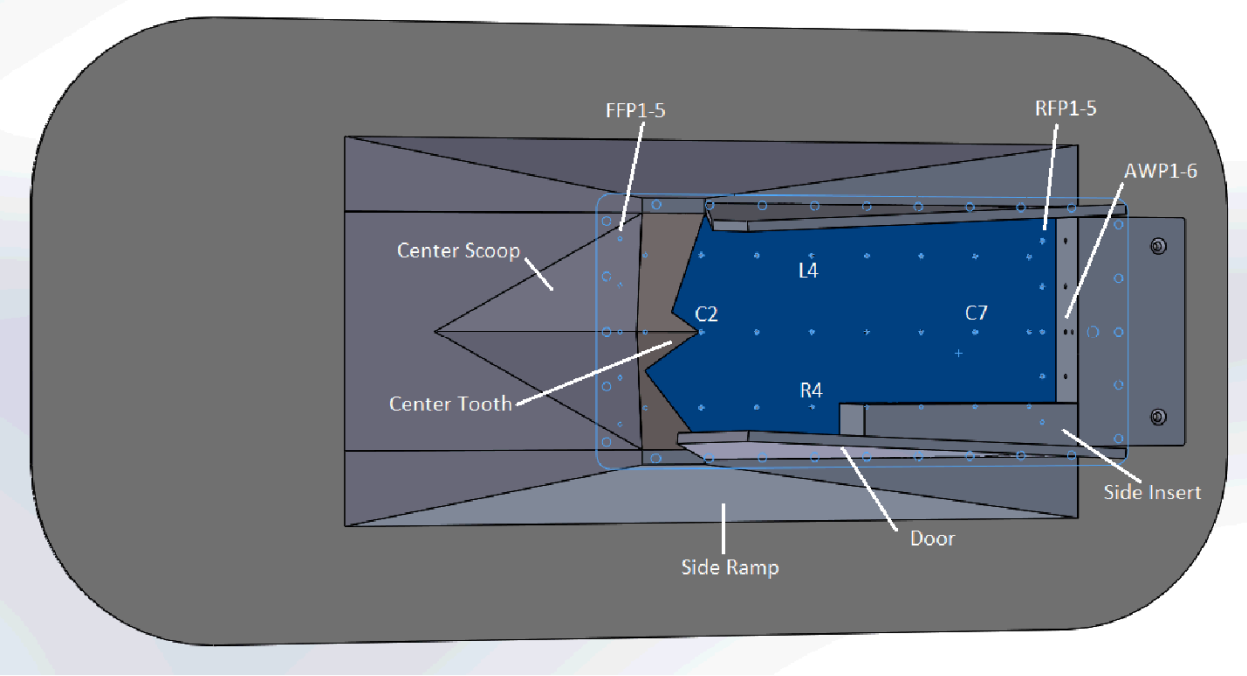

Figure 2. Wall pressure sensor locations for the Complex Cavity Cases. FFP: Front Floor Pressure Sensors, RFP : Rear Floor Pressure Sensors, AWP: Aft Wall Pressure Sensors, C2-7 : Centerline Pressure Sensors.

Position Name	x/L	y/D	z/W
FFP1	0.01	-1.00	-0.40
FFP2	0.01	-1.00	-0.20
FFP3	0.01	-1.00	0.00
FFP4	0.01	-1.00	0.20
FFP5	0.01	-1.00	0.40
C2	0.19	-1.00	0.00
C3	0.31	-1.00	0.00
C4	0.44	-1.00	0.00
C5	0.56	-1.00	0.00
C6	0.69	-1.00	0.00
C7	0.81	-1.00	0.00
L4	0.44	-1.00	-0.33
R4	0.44	-1.00	0.33
RFP1	0.97	-1.00	-0.40
RFP2	0.97	-1.00	-0.20
RFP3	0.97	-1.00	0.00
RFP4	0.97	-1.00	0.20
RFP5	0.97	-1.00	0.40
AWP1	1.00	-0.57	-0.40
AWP2	1.00	-0.57	-0.20
AWP3	1.00	-0.57	0.00
AWP4	1.00	-0.57	0.20

AWP5	1.00	-0.57	0.40
AWP6	1.00	-0.25	0.00

IV. Instrumentation

Kulite XCQ-062-30A (or similar) pressure transducers are used to measure the unsteady cavity pressure fluctuations. These sensors have a resonant frequency of 240–300 kHz. The repeatability is approximately 0.1% of the full scale. The Kulite signal output is passed through an Endevco Model 136 DC Amplifier. This provides a 10 V excitation and is also used to supply a gain of 50–100. A Krohn-Hite Model 3384 Tunable Active Filter is used to provide a 50 kHz anti-aliasing low-pass Bessel filter. This filter has eight poles and provides 48 dB attenuation per octave. The Kulite sampling frequency is typically 500 kHz. Data are acquired using a National Instruments PXI-1042 chassis with 14-bit PXI-6133 modules (10 MHz bandwidth).

V. PIV Measurements

PIV measurements are underway and will become available by Oct. 2014. These measurements will consist of mean velocities and turbulence intensities on the spanwise mid-plane of the cavity and will be made for all configurations except the ones with the doors due to limitations in the ability to image with door on. More details regarding these measurements will be made available once the data becomes available.