CALIFORNIA POLYTECHNIC STATE UNIVERSITY

Aerospace Engineering Department

Supersonic Wind Tunnel (SSWT) Activity Procedure

Please review the Facility Safety Overview (FSO) before operating the wind tunnel or any instruments in the lab.

Procedure Details:

This procedure is formatted as a checklist; please print out a hardcopy and use it as such. During the lab activity, please make a hand-written note for all deviations from the nominal procedure on that hardcopy.

Procedure Conventions:

Buttons, switches, and other controls manipulated by an operator are called out with bold italicized font, e.g. ***Manual Valve*** switch.

Readouts or other information displays are called out with italicized font, e.g. *Elapsed Run Time* value.

A. SSWT PREPARATION

	A.1. Fully open the exhaust-side test cell "roll-up" door (the door on the same side of the building as the door to the control room) and lock in place with chain.
	A.2. Clear test cell area of any loose objects (anything that may be kicked up by the SSWT).
	A.3. Check compressor area for any oil or fuel spills or leaks; clean up any spills or leaks.
	A.4. Confirm that ***Manual Valve*** is closed and locked in place and that, assuming the lock is removed; the valve handle should have a clear travel path.
	A.5. Check the compressed air tank for pressure via gauge on side of tank; operate the compressor to fill the compressed air tank as needed.
	A.6. Ensure that the C/D nozzle bolts are tight and the test section is locked into place. Contact the lab tech if you are unsure of either.
	A.7. Place warning sign at top of steps coming from the hangar.

B. PERSONNEL PREPARATION

Please note that the SSWT is extremely loud; per safety regulations, ear protection is required in the control room and around the SSWT facility while the tunnel is operating. Note also that while it is possible to hear people yelling while the SSWT is operating, you will likely only know that you are being yelled at if you happen to be looking at the person who is yelling. As such, please coordinate with your test team how you plan to communicate while the SSWT is running; use of pre-defined hand signals is suggested.

	B.1. Familiarize all personnel with features of the SSWT apparatus, including ***Manual Valve***, ***Electro-Pneumatic Valve***, pressure regulator, C/D nozzle, and pressure transducers.
	B.2. Review all safety information for the facility and lab.
	B.3. Familiarize all personnel with the lab procedure and control room set up.
	B.4. Clearly determine which personnel will execute which parts of the lab activity.
	B.5. Determine run time(s) and run pressure(s) for the activity.
	B.6. Run Section C, and dry-run Sections D through E of this procedure with the personnel who will execute those activities prior to running the procedure “for real”.

C. SSWT PREPARATION

	C.1. All personnel in test area acquire ear protection.
	C.2. Power on the SSWT lab DAQ computer (dark grey Dell) and log on (Username:FLIGHTSIM2\user; Password: <Enter>; Yes, the password is blank) a. Start LabVIEW b. OpenLabVIEW VI "C:\Users\user\Documents\SSWT\401 and 402 SSWT 2018.vi”
	C.3. Turn on the DAQ power supply and set to 10 Volts. Note: the pressure gauges **on the VI should read ‘zero’ or fluctuate around ‘zero’.**
	C.4. Test operation of the VI: a. Click the Run button (white arrow) at top of VI window b. Enter a test data file name in the prompt c. Verify that the VI is operating (pressure gauges should start updating) d. Click the Record button on the front panel of the VI (button should switch to a

	brighter green color) e. Verify that the Elapsed Run Time value increments f. Click the Record button a second time (to stop the recording) g. Click the Stop button (red stop sign) at the top of the VI window h. Open the test data file and see that all data values have been written to it.
	C.5. Confirm ***Manual Valve*** is closed.
	WARNING: The Electro-Pneumatic Valve requires both power and pressurized air to operate; removal of either will allow the *Electro-Pneumatic Valve* to change state without being commanded to do so (by the switch in the control room). Ensure that the Manual Valve is closed and locked before changing configuration of power or pressurized air for the *Electro-Pneumatic Valve*. C.6. Configure ***Electro-Pneumatic Valve*** a. Open facility air valve in control room (orange valve below window to test cell); should hear a "whoosh" b. Find the ***Electro-Pneumatic Valve*** control switch and plug; plug in the plug.
	C.7. With at least one person in control room and one nearby ***Electro-Pneumatic Valve***, test ***Electro-Pneumatic Valve*** through one close and opening cycle. a. Operate switch to "open" b. Confirm valve movement c. Return switch to "close" d. Confirm valve movement. **Note that when "closed," the metal vane at the top of the electro-pneumatic valve is 90 degrees from in-line with the flow.** **Note also there is a slight delay in the operation; it takes ~ 1 second for the Electro-Pneumatic Valve to open or close.**
	C.8. As needed, configure pressure regulator. a. Remove bottom cap from regulator adjustment. b. Move adjustment bolt to desired position. c. Replace bottom cap.
	C.9. **Clear all personnel from the SSWT test cell. Person running test (instructor, teaching assistant, or like) to verify before proceeding.**

	C.10. Test valves a. Review hand signals for manual valve (arms extended together horizontally, hands touching for "close", arms spread to aprox. 45 to 90 degree angle for "open) Station one person at the manual valve, one person in the control room to operate the ***Electro-Pneumatic Valve*** switch, and one "relay" person at the corner of the SSWT facility with a view of the manual valve operator and the electro-pneumatic valve operator (through the window). b. When the valve operators are ready, the relay person checks to see that nobody is approaching the SSWT facility. c. If someone is approaching, the relay person waits. d. When there is nobody approaching, the relay person signals the manual valve operator to open the manual valve. e. If the tunnel starts to operate, the manual valve operator closes the ***Manual Valve***. Check the ***Electro-Pneumatic Valve*** configuration. f. Assuming the tunnel did not start to operate, manual valve operator moves to relay position, and relay person moves into control room.

(need how/when to open the manual valve)

D. SSWT OPERATION

	D.1. Close the control room door a. Send instructor to empty water from bottom of air tank (Makes a really loud NOISE)
	D.2. When all personnel are ready to start the test, start operation of the VI: a. Click the Run button (white arrow) at top of VI window b. Enter a test data file name in the prompt c. See that the VI is operating (pressure gauges should start updating)
	D.3. As the first step of starting the test run: a. Click the Record button on the front panel of the VI (button should switch to a brighter green color) b. See that the Elapsed Run Time value increments
	D.4. Relay person checks visually with manual valve operator that there are no people approaching.
	D.5. Run the tunnel a. Relay person indicates start of run to manual valve operator b. Electro-pneumatic valve operator opens the ***Electro-Pneumatic Valve*** via

	the switch in the control room c. Timer counts down the desired run time d. Electro-pneumatic valve operator closes the ***Electro-Pneumatic Valve*** via the switch in the control room
	D.6. Stop LabVIEW by pressing the Record button on the front panel of the VI (button should return to a grey-green color). Pressing the record button only stops recording but does not close the file. Click the Stop button to close the file.
	D.7. Manual valve operator moves back to ***Manual Valve*** and closes valve

E. SSWT INTERIM OPERATIONS

	E.1. Ensure that the ***Manual Valve*** is closed.
	E.2. Check the compressed air tank for pressure; operate the compressor to fill the compressed air tank as needed.
	E.3. As needed, configure pressure regulator. a. Remove bottom cap from regulator adjustment b. Move adjustment bolt to desired position c. Replace bottom cap Repeat sections D and E as needed.

F. LAB CLOSE-OUT

	F.1. Replace ear protection in the cabinet.
	F.2. Ensure ***Manual Valve*** is closed and locked.
	F.3. Unplug the ***Electro-Pneumatic Valve*** switch.
	F.4. Close the valve for facility air (orange valve left of observation window) for the ***Electro-Pneumatic Valve***.
	F.5. Close and lock the roll-up door to the test cell.
	F.6. Power off both the DAQ power supply and the Dell.

Additional Info:

Regulator Bolt Displacement	**Steady-State Plenum Pressure**

2.2 mm	**23 psig**
2.0 mm	**38 psig**
1.8 mm	**N/A**
1.6 mm	**N/A**
1.4 mm	**N/A**