The SDSU Wind Tunnel Complex

The wind tunnel complex supports continuous undergraduate activities such as AE303 and AE403, numerous graduate projects, and some external projects as well.

The facility consists of:

1) Subsonic wind tunnel
2) Supersonic wind tunnel
3) Smoke tunnel
4) Machine shop

SAN DIEGO STATE UNIVERSITY'S LOW-SPEED WIND TUNNEL

The San Diego State University's Low-Speed Wind Tunnel is a single-return, closed jet, continuos-flow tunnel designed and built by the Kenny Engineering Corporation of Pasadena, California.

Airflow in the wind tunnel is generated by means of a 150 HP constant speed electric motor driving a variable-pitch, 4-bladed propeller. This system provides for a continuously variable speed range in the test section from 0 to 180 mph.

The test section is 45 inches wide, 32 inches high, and 67 inches long in the streamwise direction, with viewing windows on each side and on the top. This section is vented at the downstream end to maintain atmospheric pressure in the test rhombus.

Airflow calibration has yielded the following charcteristics:

1. The turbulence factor in the test section is 1.27.
2. The maximum deviation of dynamic pressure from the mean value does not exceed 1 % at each of three survey stations; with the central survey station being located at the mid-plane of the test rhombus in the streamwise direction; the other two stations located 14 inches upstream and 14 inches downstream, respectively, from the central station.
3. Flow angularity is less than ½ degree in two planes with respect to the axis of the test section within the middle half, exclusive of boundary layer.
4. The static pressure variation along the longitudinal axis of the test section is less than 1 % of mean dynamic pressure.

Force and moment data are obtained from a 6-component, load-cell, strain-gage type balance system. The load limits for this balance system are as follows:

Lift:	150	lb
Drag:	50	lb
Side Force:	100	lb
Pitch:	1000	lb-in.
Roll:	1000	lb-in.
Yaw:	1000	lb-in.

Extensive calibration of this balance system has demonstrated negligible interaction between the six components for single axis loadings up to the limit loads. Also, interaction is less than 1 % under any combination of loadings up to approximately 75 % of limit loads. These loadings are rarely exceeded in routine testing so that interaction corrections are seldom necessary.

INSTRUMENTATION

Six-component floor mounted balance (specification are listed above)
Six-component sting balance (specification ???)
6 single component load cells (+-100lb)
2 six-component load cells (one +-100lbs, other +- 40lbs)

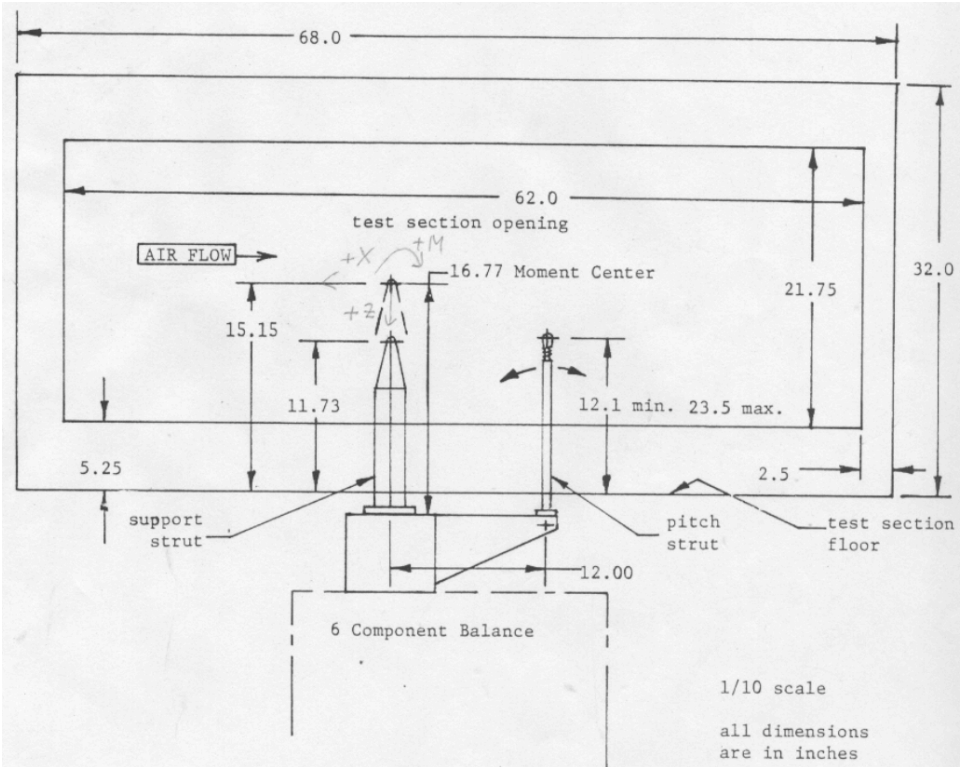
2 each: 10" Differential Micromanometer, water
1 each: 60" 50 tube Manometer bank, water
1 each: 15cm Alcohol Manometer, 0.800s.g.
1 each: 4 Channel Storage Oscilloscope
1 each: DC Power Supply, 0-5DCV 1.5A, 0 20DCV 0.5A
2 each: 60" Manometer, water
1 each: 48 port Scanivalve, ± 1.000 psi

1 each 48 port mechanical Scanivalve (+-1.00 psi)
1 each 48 port mechanical Scanivalve (+-15.00 psi)
1 LaVision 3 dimensional particle image system

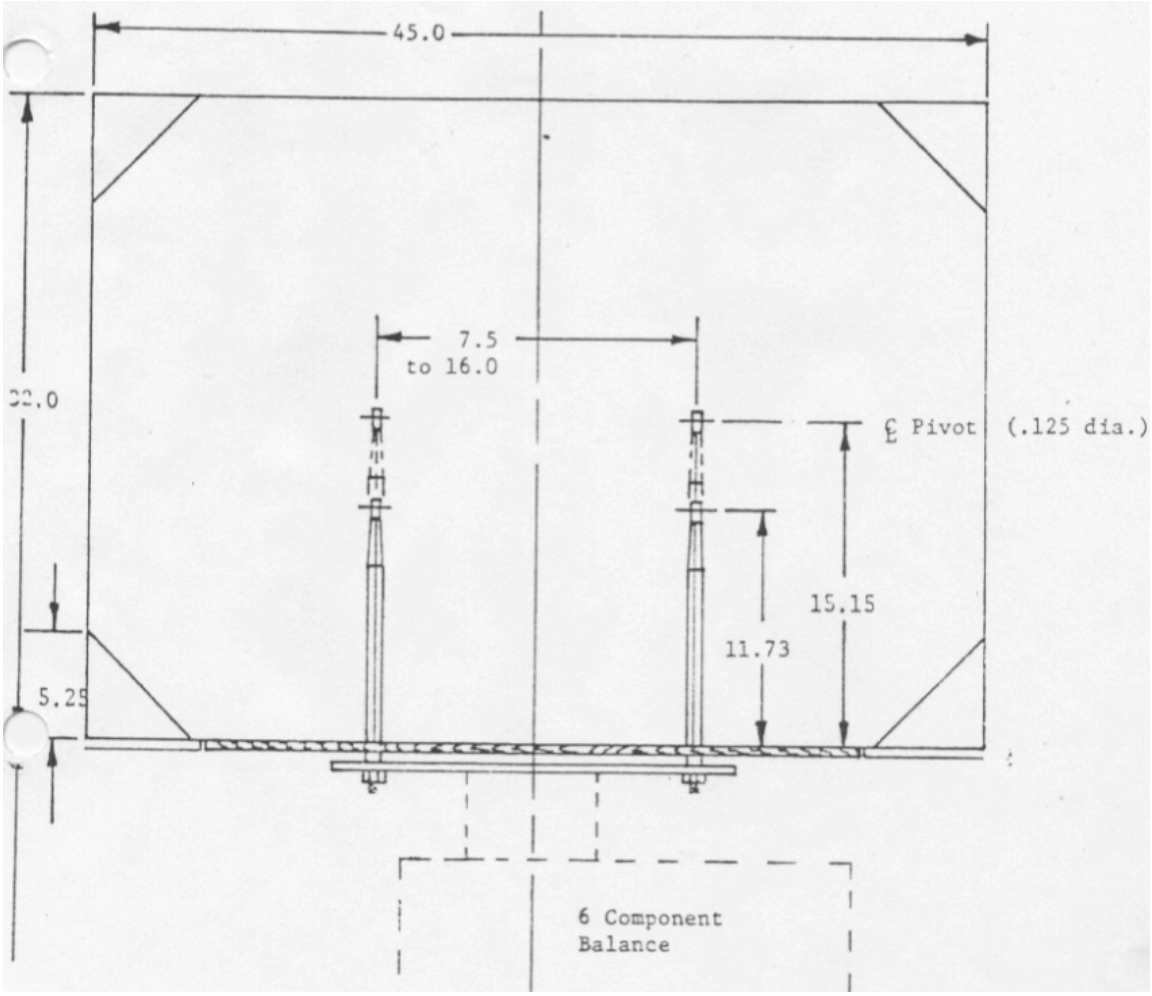
All these instrument can be connected to a central computer via a LabView system.

Wind Tunnel Dimensions

Side view



Front View



SAN DIEGO STATE UNIVERSITY
6” x 6” SUPERSONIC WIND TUNNEL

The San Diego State University wind tunnel was designed and constructed by Kenney Engineering Corporation and put into operation in 1963. During recent years, several modifications were introduced into the air pumping, tunnel control, and instrumentation equipment to keep up with current technology.

The air pumping system consists of a LeRoi/Dresser Model 256S2C 2-stage air compressor driven by a 125 hp motor. The compressor can pump the storage system up to 250 psig. A drying and filtering system is provided which includes both drying by cooling and drying by absorption. Air storage system consists of a single 5,000 gall tank. Tunnel control system includes a Toshiba EC321 Process Loop Controller and a quick opening, pneumatically actuated butterfly valve.

The settling chamber contains several damping screens, and probes measuring stagnation pressure and temperature. The nozzle chamber is designed with interchangeable, two-dimensional contoured nozzle blocks made of cast aluminum. The tunnel is equipped with four complete nozzle block sets for the Mach numbers 1.0, 2.0, 3.0, and 4.5. Recently we've developed a perforated wall test section for transonic flow measurements.

The test section of the tunnel, which measures 6" x 6" x 10", is equipped with a remotely controlled model support for controlling the angle of attack. The model holder moves in a pure translation in the vertical direction as the control strut is moved up and down. The maximum angle of attack is about +/- 25 degrees. After passing through a diffuser, the air flow is discharged into the atmosphere trough a muffler and then exhausted to the outside of the building.

Test run times depend, of course, on Mach number and the stagnation pressure. Approximate times are shown in the able below:

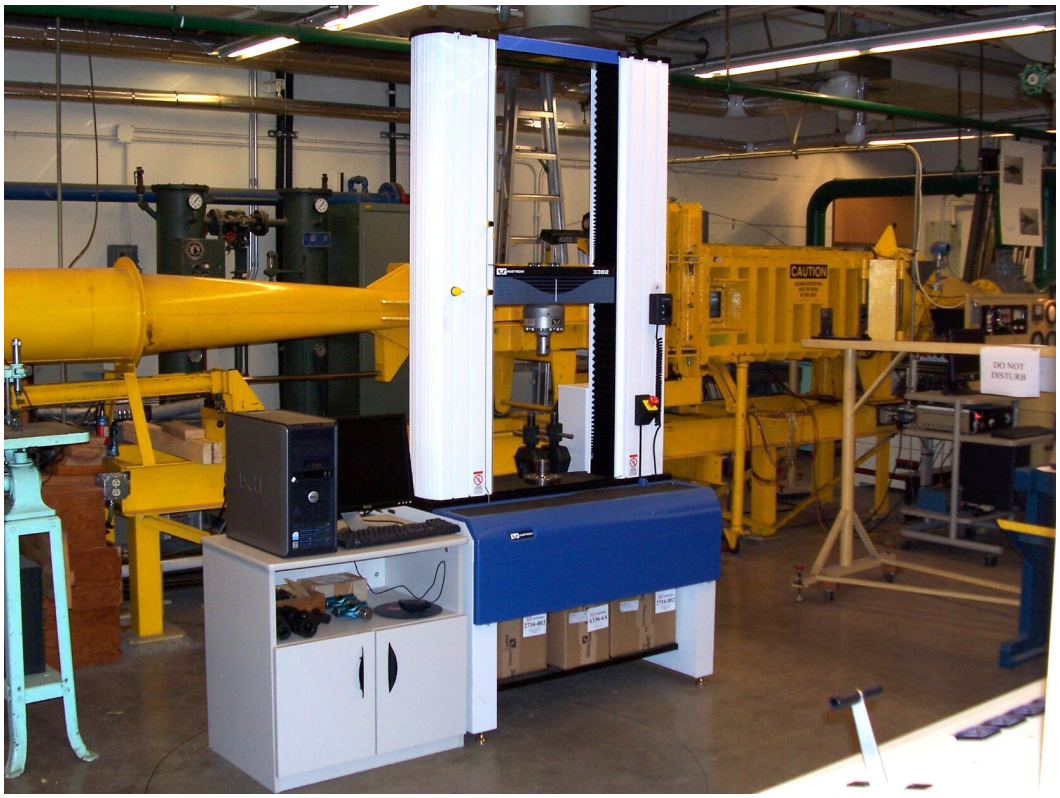
Mach Number	Stagnation Pressure, psi	Run Time, Seconds
1.0	30	30
2.0	30	30
3.0	70	20
4.5	180	10

Instrumentation

A 20 cm Schlieren system comprising two optical benches is used to visualize shock waves in the test section.

A data acquisition system comprising LabView software and a 32-channel Scanivalve ZOC system utilizing 15 psi transducers is used for pressure measurements.

General view of the Supersonic tunnel



Machine Shop and Project support

3 Lathes
2 Milling machines
1 Quick prototype (printer)
Woodshop and composite preparation facility (+ oven)

Costs and Services

Current
$400/hour for Wind tunnel
occupancy $220/hour for model set up

The machine shop is available for model mounting and setup fabrication

These fees include:

1) Use of the Wind Tunnel
2) Use of support equipment
3) Use of Wind Tunnel operator
4) Maintenance of the tunnel
5) Access to tools and hardware as available

These fees do not include:

1) Any special mounting to adapt the model to the tunnel
2) Test engineers or mechanics needed to work on the model and conduct the testing.
3) Data reduction
4) Any services other than those listed without specific consent of the Wind Tunnel operator.