Jet and Anechoic Facilities for Jet Noise Research at ARC

The jet and anechoic chamber facilities consist of a jet exhausting horizontally into a fully anechoic chamber (Figure 1). The chamber is constructed of sound-dampening walls and fiberglass wedges. The dimensions of the chamber are 6.20 wide by 5.59 m long and 3.36 m tall, with internal wedge-tip to wedge-tip dimensions of 5.14 m by 4.48 m and 2.53 m. The wedges have a base of 24 in by 24 in and tip length of 16 in, producing a cutoff frequency for the chamber of 160 Hz, which is well below the frequencies of interest for acoustic radiation from the jets studied herein. Compressed and dried air is supplied to the facility from cylindrical storage tanks with a capacity of 43 m³ and maximum pressure of 16 MPa, allowing the jet to run anywhere from low subsonic velocities up to Mach 2.5, with nozzle exit diameters of one to two inches for single jets, or 0.75 inches for a twin-jet configuration. An off-line electric heater upstream of the nozzle enables the jet to operate with a stagnation temperature up to 800 K. Opposite the nozzle, a collector collects the entrained air from the jet and exhausts to ambient. Removable wall segments on the north, south, and west walls allow access to the jet during tests to facilitate data acquisition based using optical diagnostics.

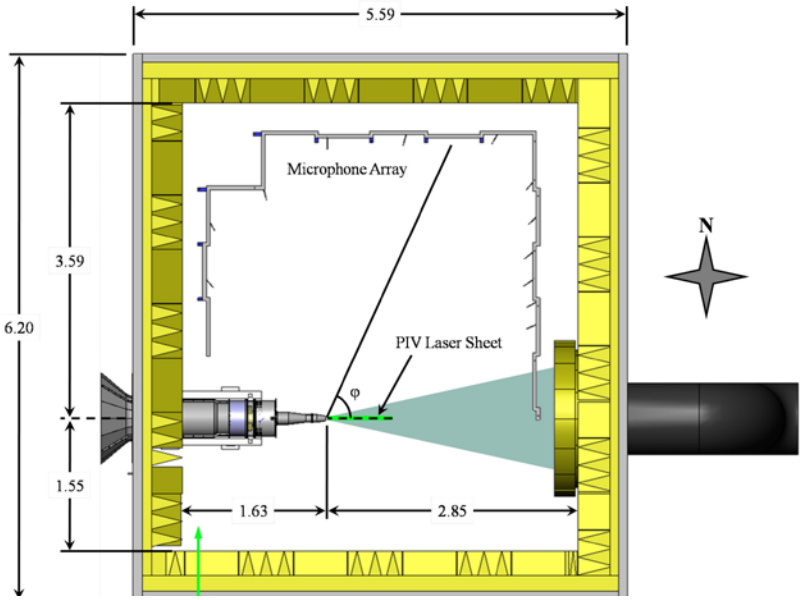

Figure 1: Plan view of jet and anechoic chamber (dimensions in m).

The GDTL jet and anechoic chamber facilities utilize a variety of data acquisition methods for studying the mixing characteristics and acoustic radiation from free jets. Two- or three-component velocity maps of the jet are acquired with the use of a stereoscopic PIV system. Seed particles introduced into the flow scatter light from a dual-head, 400 mJ Nd:YAG laser which is captured with CCD cameras. A Z-type Schlieren system producing an 8 in diameter collimated light beam is used for imaging the jet based on density variations. Sixteen microphones arranged in either an azimuthal or linear array can be configured for simultaneous acquisition of the pressure fluctuations in the near-field and hydrodynamic regions of the jet. Twelve microphones mounted along a rail and oriented normal to the jet exit make up the far-field acoustic array (Figure 1). The microphones are located at least 50 jet diameters from the nozzle exit and at polar angles spanning 30° to 135°.