29/2/8337 Noise sources in an airflow. Prichard, B.L.

A basic design and experimental study has been conducted to investigate noise source behaviour in the airflow of a closed section, closed return, low speed acoustic wind tunnel.

The work has been based on an acoustic conversion of the 2 x 1.5 m^2 aerodynamic wind tunnel at Southampton University, incorporating a porous wall test section and splitter silencing. The optimisation of silencing has been restricted by the inherent constraints of the wind tunnel structure. Modifications to the circuit must be considered if the wind tunnel is to be used as a major test facility.

The acoustic properties of the test section are determined by the nature of the test source. For real sources it is possible to obtain accurate noise data within the section. The predicted and measured flight effects on an acoustic calibrator suggested that there was no change in the test section properties up to the maximum tunnel speed of 30 m.p.s.

Accurate measurements of both static and in-flight jet noise can be obtained with microphones immersed in the tunnel flow. A two microphone method for measurements of jet noise has been developed to improve the wind tunnel signal/noise ratio.

Changes of flight effect due to variations of jet and external mean flows have been studied. Cold jet model tests at zero incidence have shown that close to the jet exit, the relative velocity effect is determined by the mean flow of the inner region of the external model boundary layer. Mean flow acoustic interaction in this region can alter the forward arc noise. If the jet source is set at incidence, additional sources of noise are generated. Attempts to correlate model data at incidence with aircraft noise have been restricted due to limited tunnel speed and inadequate simulation of aeroacoustic interactions associated with real, hot jet installations.