

An Overview of Activities in High SuperSonic Tunnel (HSST) in Aero-Physics Laboratory

Erinc Erdem

erinc.erdem@postgrad.manchester.ac.uk

Key words: Hypersonic Wind Tunnels, Ground Testing, Experimental Methods

1 INTRODUCTION

Hypersonic flight within the atmosphere is of current interest, both military and civilian. Even though it has been become more reachable with the advent of new technologies and progress in propulsion systems, the difficulties regarding the control of high velocity flying vehicles are still prevailing. High SuperSonic Tunnel (HSST) of the Aero Physics Laboratory in the University of Manchester is a unique ground testing facility within the UK that allows. The tunnel is of the intermediate blowdown (pressure-vacuum) type which uses dry air as working fluid and is shown schematically in Fig. 1. The stagnation pressure can be ranged from 5 to 8 bar and thereby unit Reynolds numbers, Re/m , of between $4.0 - 16.0 \cdot 10^6 1/m$ can be achieved with Mach 5 nozzle. In total a set of three 150mm exit diameter open-jet nozzles with nominal Mach numbers of 4, 5 and 6, and a pair of 170mm exit diameter annular-jet Mach 5 nozzles containing 51mm and 30mm diameter centre-bodies are available. The tunnel working section is an enclosed free-jet design. The calibration of the facility was carried out by the authors; the variations in Mach number and unit Reynolds number were found to be $\pm 0.4\%$ and $\pm 3.7\%$ respectively. Maximum useful flow duration is around 7.5 seconds.

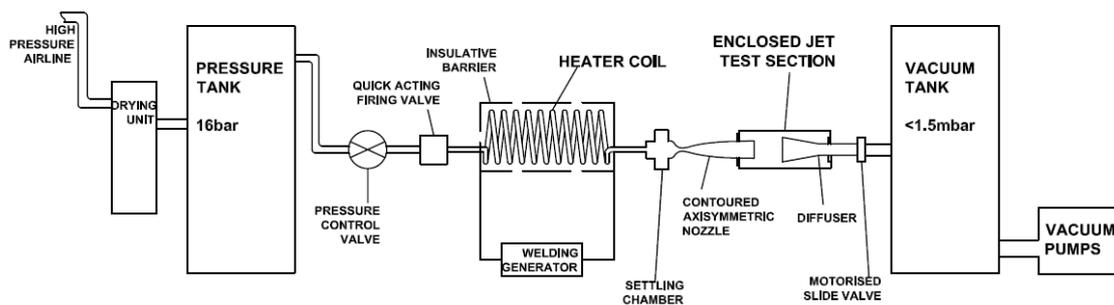


Figure 1: University of Manchester HSST schematic layout

Following flow diagnostics are available in this facility;

- Stagnation pressure and temperature along with pitot and wall pressure measurements
- Conventional and high speed Schlieren/Shadowgraph photography
- Oil film/dot visualisation
- Infrared thermography
- Pressure Sensitive Paints (PSP)
- 2 component Particle Image Velocimetry (PIV)
- 3 component force balance

The presentation is going to summarise the activities in HSST.