EXPERIMENTAL STUDIES OF HYPERSONIC HEATING RATES TO FACETED SHAPES

Short Research Visit by Thomas Rees (Imperial College) to Thomas Fisher and Mark Quinn (University of Manchester)

This SRV took place over two sessions: a preliminary visit from 28/1/19 to 1/2/19, followed by a second visit from 13/5/19-24/5/19. The goal of this SRV was to use the University of Manchester's High Super Sonic Tunnel (HSST) to obtain measurements of the flow around various faceted shapes in a Mach 5 hypersonic flow. Namely, Infrared Thermography (IRT) was used in order to calculate the heat flux to the models, while optical and Background-Oriented Schlieren (BOS) were used to visualise the flow-field around the cube.

During the preliminary session, BOS measurements were taken around both cuboidal and cylindrical shapes. Preliminary IRT data were also collected and used to develop the postprocessing procedure for converting the temperature data to heat flux data.

During the second session, IRT measurements were taken on cuboidal at hemispherical models over significant range of total temperatures and pressures (Figure 2). From these results, the Stanton number over the entire surface of the model was calculated and compared with CFD. Figure 3 shows the experimental Stanton number along the centreline of the cube, compared to a 2D CFD simulation. 3D heat fluxes are generally higher than 2D, and the results show good agreement.

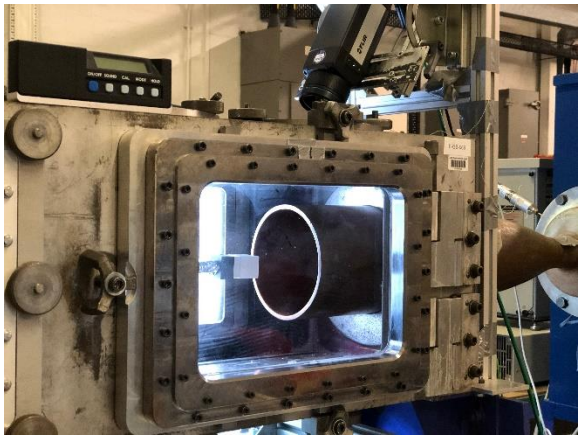

Figure 1: Cube in the HSST, with IR camera

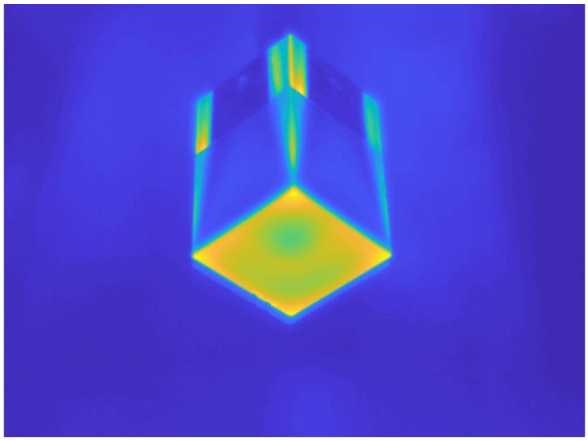

Figure 2: Raw IR frame

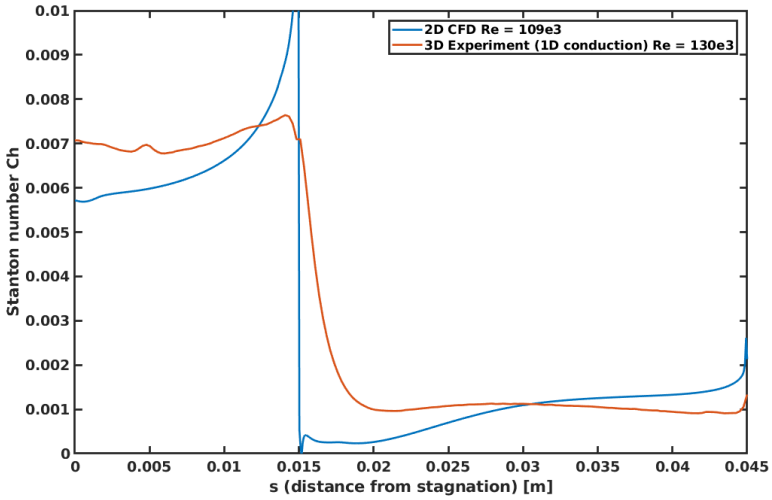

Figure 3: Comparison of Stanton number between IRT measurements and 2D CFD