

EXPERT-VEHICLE AEROTHERMODYNAMIC INVESTIGATION

Henny Bottini, Italy

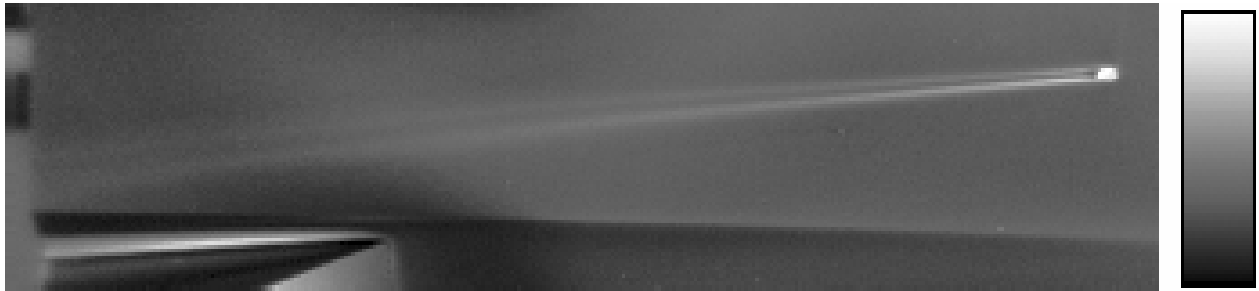
Supervisors: D. G. Fletcher & S. Paris

This Diploma Course Project deals with the numerical, theoretical and experimental analysis of the turbulence-inducer effects on the surface of a vehicle flying at hypersonic speeds. This work is in support of the ESA EXPERT Program, whose purpose is to obtain in-flight hypersonic data for the study of the critical aerothermodynamic phenomena of a vehicle reentering the earth atmosphere.

Estimation of the heat load on the inducer and on the vehicle structure in the inducer wake are presented, and commented. A preliminary design of the turbulence inducer is also provided.

Infrared visualizations of the hypersonic-flow effects on the EXPERT test article are presented and commented along with heat loads and temperature measurements derived from them. Specifically, the effects of the turbulence inducer located on the model hull and of a Pitot-probes rake located at the back of the model have been experimentally evaluated.

Among the most noticeable experimental results is the evidence that at angles of attack higher than 5° , the inducer wake is very likely to impinge on the flap located at the vehicle base.



*Figure 1: Infra-Red Image from the Longshot Test no.1493
(The Inducer Laminar Wake)*