AEROTHERMAL DESIGN AND ASSESSMENT OF SCRAMJET ENGINE FLOW-DUCT AND COMPARISON WITH FLIGHT DATA

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Abstract

Aerothermal design has a crucial role to play in the design and development of air breathing scramjet engines. Hypersonic vehicles travelling in dense atmosphere experience severe aerodynamic heating levels at stagnation regions, leading edges and inlet compression ramps. Combustor ducts experience high heating levels owing to reflected shock systems and supersonic combustion. An accurate estimation of heating levels is imperative for thermal design to limit structure temperature within safe levels. This paper highlights the aerothermal design methodology adopted for estimation of heating levels in scramjet engine flow-duct. Details of vehicle trajectory and thermal instrumentation in flight hardware are provided. A heat sink based design approach is followed for finalizing material thickness levels of scramjet engines. Flight temperature measurements indicate temperature levels of engine structure are within design limits. Post flight assessment also proves the adequacy of aerothermal design methodology followed for scramjet engines.

Keywords: Scramjet, Combustion, Aero Thermal, Heat Flux, Temperature