

Ares I-X Ascent Base Environments

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ABSTRACT

Plume induced base heating environments were measured during the flight of the NASA Constellation Ares I-X developmental launch vehicle, successfully flown on October 28, 2009. The Ares I-X first stage is a four segment Space Shuttle derived booster with base consisting of a flared aft skirt, deceleration and tumble motors, and a thermal curtain surrounding the first stage 7.2 area ratio nozzle. Developmental Flight Instrumentation (DFI) consisted of radiometers, calorimeters, pressure transducers and gas temperature probes installed on the aft skirt and nozzle to measure the base environments. In addition, thermocouples were also installed between the layers of the flexible thermal curtain to provide insight into the curtain response to the base environments and to assist in understanding curtain failure during reentry. Plume radiation environment predictions were generated by the Reverse Monte Carlo (RMC) code and the convective base heating predictions utilized heritage MSFC empirical methods. These predictions were compared to the DFI data and results from the flight videography. Radiation predictions agreed with the flight measured data early in flight but gauge failures prevented high altitude comparisons. The convective environment comparisons demonstrated the need to improve the prediction methodology; particularly for low altitude, local plume recirculation. The convective comparisons showed relatively good agreement at altitudes greater than 50,000 feet.