MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations (IP)

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STRUCTURAL ANALYSIS OF A CRITICAL DEVIATION OBSERVED AT AN INTERFACE IN A SOLID ROCKET BOOSTER MOTOR USING STRAIN BASED ACCEPTANCE CRITERIA

Abstract

The following observations were reported between the butting faces of the flanges by the integration team during the inspection after the assembly of Motor Nozzle End Segment (NES) to Nozzle convergent assembly of a 2.8m dia. Solid Rocket booster. 0.05mm thickness feeler gauge is entering up to a depth of 20mm (max) and 3mm (min) all around; 0.1mm feeler gauge is entering up to a depth of 10 mm (max) in a one pitch circumferential length. It is observed that the NES hardware, and the Nozzle convergent hardware, was Proof Pressure Tested (PPT) together earlier. The torque applied on M27 screws in PPT assembly was 120kg-m against 80kg-m in previous flight assemblies. The increased level of preload was implemented based on the recommendations of the designer and after getting the approval of the competent review team. As per the feeler gauge inspection after hardware assembly before PPT, even 0.05mm gap did not exist at the above interface. Root cause for the present deviation was not understood as perpendicularity measurements on the butting faces of flanges subsequent to their processing were not available. In order to understand the impact of this deviation, 3-D structural analyses simulating the critical deviation observed between the flanges was carried out simulating the preload corresponding to 120 kg-m and 80 kg-m for flight condition and PPT condition respectively considering the measured friction factor using strain gauged bolt in the actual assembly. This paper outlines the details of the finite element analyses carried out considering the critical deviation and the salient aspects of the results based on which this deviation was cleared for the flight.