

IAF SPACE PROPULSION SYMPOSIUM (C4)  
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IMPACT ASSESSMENT OF PROPELLANT ENTRAPMENT IN LOOSE FLAP CAVITY ON  
BALLISTIC PERFORMANCE AND VALIDATION THROUGH HOT TEST OF SOLID ROCKET  
BOOSTER**Abstract**

First stage of Polar Satellite Launch Vehicle (PSLV) Geosynchronous Satellite Launch Vehicle (GSLV) employs a Solid rocket motor having five segments, 2.8m diameter loaded with 139 tons of HTPB based propellant. Based on the confidence gained through a single static test in 1997, the work horse motor had been qualified for flight and successfully flown in 44 PSLV and 12 GSLV flights till date delivering consistent performance.

The flight motor is cleared for assembly operations based on the acceptance of each motor subsystem. Acceptance criteria for the Propellant system are based on ballistic, mechanical and interface properties meeting the specifications. In addition the soundness of interfaces and integrity of the grain is also confirmed by suitable NDT techniques.

Recently six S139 middle segments processed were withdrawn from flight due to propellant entrapment in the insulation loose flap cavity, observed during radiography of the segments, as the effect of this deviation on motor ballistics had to be studied. Even though the ballistic as well as structural analysis indicated there is no functional impact, towards gaining confidence and to assess the effect of deviation on performance a hot test was conducted with three middle segments having entrapped propellant with varying mass from 120g to 740g.

Accordingly a static test was conducted successfully and it was established that the entrapped propellant in the loose flap cavity does not have any impact on motor ballistics and no pressure rise was observed on the P-t trace of the motor. Subsequent to the static test, the segments were dismantled and a comprehensive post test assessment was carried out. No evidence of burn through/traces of impact due to the observed deviation on the performance of insulation and interfaces were noticed. This paper provides details on the impact assessment of the observed NDT defect on the motor ballistics and its validation through static test firing of solid rocket booster.