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Solid and Hybrid Propulsion (1) (3)

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IMPACT ASSESSMENT OF LONG TERM VERTICAL STORAGE 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 (S139) having five segments, 2.8m diameter loaded with 139 tons of HTPB based propellant with fixed convergent divergent nozzle of area ratio 9.1. 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 57 PSLV and 14 GSLV flights till date delivering consistent performance.

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

There was an inadvertent delay for the GSLV-F10 mission due to pandemic situation which had resulted in the vertical storage of S139 motor beyond 308 days [the previous maximum period for which a S139 flight motor was stored in vertically stacked condition and successfully flown in flight]. Even though there was no concern regarding the health of flight motor based on detailed structural and ballistic assessment, the motor was withdrawn from flight as an abundant precaution, as it exceeded the precedence for longer vertical storage. The motor was preserved in vertical condition for 2 years. Towards gaining confidence and to assess the effect of long term vertical storage on ballistic performance a hot test of the motor was proposed.

Accordingly a static test was conducted successfully and it was established that the long term vertical storage does not have any impact on the motor ballistics. Consequent to the static test, the segments were dismantled and a comprehensive post test assessment was carried out. This paper provides details on the impact assessment of long term vertical storage on the motor ballistics and its validation through static test firing of solid rocket booster.