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CONFIGURATION DESIGN ASPECTS OF ATMOSPHERIC CREW ESCAPE SYSTEM FOR MANNED FLIGHT

Abstract

This paper presents the criticalities and challenges of configuring an Atmospheric Crew Escape System (ACES) for manned flight. ACES ensure to take away the Crew Module (CM) to a safer distance from the parental Launch Vehicle (LV) in case of abort initiated during the atmospheric phase of flight.

Abort mission specifications are primarily driven by the LV configuration, launch site location, ascent mission profile and crew's physiological limits. Architecture of the ACES evolves subject to these specifications. Quick reaction, reliable and robust characteristics of the solid motor based ACES configuration along with robust health monitoring and intelligent abort logic does not demand a close-loop control for the ACES. Requirement of enabling the ACES to reorient to release CM for subsequent safe parachute deployment depends on the dynamics of the CM and the capabilities of deploying parachutes in those adverse abort conditions.

This paper presents ACES configuration for ISRO's Mission Gaganyaan and highlights the significance of (a) aerodynamic configuration, (b) Grid Fins (GFs), (c) time of GF deployment and its duration, (d) Firing sequence of escape motor and pitch motor, (d) aerodynamic moment characteristics of CM, for ACES configuration design. In addition to the above, requirement of Thermal Protection System (TPS), Acoustic Protection System (APS) and provision of Venting aspects of the ACES will be discussed.