

Numerical Study of Flow Characteristics and Performance of 14-X B Inlet with Blunted Cowl-Lip

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Abstract : A numerical study has been carried out to investigate the flow characteristics and performance of the 14-X B inlet with blunted cowl-lip. The Brazilian aerospace hypersonic vehicle 14-X B is a technology demonstrator of a hypersonic air-breathing propulsion system, based on supersonic combustion ramjet (scramjet). It is designed for Earth's atmospheric flight at Mach number of 6 and an altitude of 30 km. Currently, it is under development in the aerothermodynamics and hypersonic Professor Henry T. Nagamatsu laboratory at Advanced Studies Institute (IEAv). Numerical simulations were conducted at nominal freestream Mach number and altitude for two cowl-lip blunting radius and several angles of attack close to horizontal flight. The results show that the shock interference behavior on the blunted cowl-lip change with the angle of attack and blunted radius. The type VI or V together with III shock interferences are more likely to occur simultaneously at small negative angles of attack. When the inlet operates in positive angles of attack higher to 1, no shock interference occurs, only the bow shock conditions. The results indicate a high air pressure at beginning of the combustor and higher pressure recovery with 2 mm radius and positives angles of attack.

Keywords : blunted cowl-lip, hypersonic inlet, inlet unstart, shock interference

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