



Performance and Operability of a Dual Cavity Flame Holder in a Supersonic Combustor

BIBLIOSCHOLAR DISSERTATIONS

Air Force Institute of Technology (U.S.)
Graduate School of Engineering and
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MacKenzie J Collatz



The current generation of hydrocarbon fueled scramjet combustors typically requires a flame holding device to facilitate flame ignition and stable combustion. The amount of time available for fuel injection, fuel-air mixing, and combustion is very short, on the order of 1 millisecond. This short dwell time, along with the relatively long ignition delay times of hydrocarbon fuels, makes the flow path and flame holder design extremely important. This study investigates the performance and operability of using a symmetric dual cavity flame holder flow path to stabilize and enhance supersonic combustion. Testing of this flow path configuration, as well as a baseline single cavity flow path, was conducted in Research Cell 18 of the Propulsion Directorate at the Air Force Research Laboratory (AFRL/RZ). Performance and operability of the flow paths were determined through analysis of wall pressures, temperatures, pressure ratios, stream thrusts, combustion efficiencies, computational fluid dynamics, and visualization. The dual cavity flame holder showed a significant overall increase in performance through higher temperatures, pressure ratios, and stream thrusts. This research has proven the potential of a dual cavity flame holder to provide improved performance for a reliable scramjet engine.

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