Paper ID: 14338
oral
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SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic and Combined Cycle Propulsion (5)

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SUPERSONIC COMBUSTION OF EMERGING FUELS

Abstract

The current cost of lifting one pound of payload out of the atmosphere is approximately $10,000. It is possible to significantly reduce this through utilization of air breathing rocketry, which eliminates the weight of the oxidizer from the configuration allowing more payload per weight of fuel. While air breathing propulsion systems are proven as a means to leave the atmosphere, new materials and findings have made it safer and more efficient. To set this research apart, the focus is on the utilization of emerging fuels as the propellant. Using a scram jet with optimized geometry, thus maximizing the thrust to drag, mounted in a supersonic wind tunnel set to Mach 4.5, it is possible to obtain the fuels thrust profiles in these conditions. This is the basis for the comparison. A Schlieren imaging system allows the observation of the oblique shock waves off the leading edge of the engine and those reflected into the intake where shock cancelation geometry is used. The Schlieren system also shows the shock diamonds in the exhaust. A test configuration with Pyrex sides enables the viewing of the fuel injection and any undue shock waves in the flow. The combustion is maintained by four Tesla Coils attached to spark emitters set in pairs and placed across from each other to create the constant ignition arcs. A transducer attached to the test vehicle enables the measurement of the thrust, drag, and lift. In addition, a gas analyzer determines the byproducts produced by the combustion. Testing newly synthesized fuels, biofuels, and flammable gases, in comparison to fuels that have been successfully used, gives a base line and a means of comparison. The goal is to find new viable fuels for supersonic flight; especially, those that leave a smaller carbon foot print and whose source is readily available.