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Investigation of Cooling Water Injection into Supersonic Rocket Engine Exhaust[1] HANSEN JONES, CHRISTOPHER JEANSONNE, SHYAM MENON, Louisiana State University — Water spray cooling of the exhaust plume from a rocket undergoing static testing is critical in preventing thermal wear of the test stand structure, and suppressing the acoustic noise signature. A scaled test facility has been developed that utilizes non-intrusive diagnostic techniques including Focusing Color Schlieren (FCS) and Phase Doppler Particle Anemometry (PDPA) to examine the interaction of a pressure-fed water jet with a supersonic flow of compressed air. FCS is used to visually assess the interaction of the water jet with the strong density gradients in the supersonic air flow. PDPA is used in conjunction to gain statistical information regarding water droplet size and velocity as the jet is broken up. Measurement results, along with numerical simulations and jet penetration models are used to explain the observed phenomena. Following the cold flow testing campaign a scaled hybrid rocket engine will be constructed to continue tests in a combusting flow environment similar to that generated by the rocket engines tested at NASA facilities.

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