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Impact of surface proximity on flow and acoustics of a rectangular supersonic jet. EPHRAIM GUTMARK, FLORIAN BAIER, PABLO MORA, University of Cincinnati, KAILAS KAILSANATH, KAMAL VISWANATH, RYAN JOHNSON, Naval Research Laboratory — Advances in jet technology have pushed towards faster aircraft, leading to more streamlined designs and configurations, pushing engines closer to the aircraft frame. This creates additional noise sources stemming from interactions between the jet flow and surfaces on the aircraft body, and interaction between the jet and the ground during takeoff and landing. The paper studies the impact of the presence of a flat plate on the flow structures and acoustics in an M=1.5 (NPR=3.67) supersonic jet exhausting from a rectangular C-D nozzle. Comparisons are drawn between baseline cases without a plate and varying nozzle-plate distance at NPRs from 2.5 to 4.5, and temperature ratios of up to 3.0. At the shielded side and sideline of the plate noise is mitigated only when the plate is at the nozzle lip (h=0). Low frequency mixing noise is increased in the downstream direction only for h=0. Screech tones that exist only for low NTR are fully suppressed by the plate at h=0. However, for h>0 the reflection enhances screech at both reflected side and sideline. Low frequency mixing noise is enhanced by the plate at the reflected side at all plate distances, while broad band shock associated noise is reduced only at the sideline for h=0. Increased temperature mitigates the screech tones across all test conditions. The results are compared to a circular nozzle of equivalent diameter with an adjacent plate.

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