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Interaction of a Fin Trailing Vortex with a Downstream Control Surface STEVEN BERESH, JUSTIN SMITH, JOHN HENFLING, TOM GRASSER, RUSTY SPILLERS, Sandia National Laboratories — A sub-scale experiment has been constructed using fins mounted on one wall of a transonic wind tunnel to investigate the influence of fin trailing vortices upon downstream control surfaces. Data were collected using a force balance mounted on the downstream fin to measure the aerodynamic forces of the interaction, combined with stereoscopic Particle Image Velocimetry to measure vortex properties. The fin balance data show that the response of the downstream fin essentially is shifted from the baseline single-fin data dependent upon the angle of attack of the upstream fin. Freestream Mach number and the spacing between fins have secondary effects. The velocimetry shows that the vortex strength increases markedly with upstream fin angle of attack, though even an uncanted fin generates a noticeable wake. No Mach number effect can be discerned in the normalized data, but measurements taken progressively further from the fin trailing edge show the decay in vortex strength with downstream distance. Correlations between the force data and the velocimetry suggest that the interaction is fundamentally a result of an angle of attack induced upon the downstream fin by the vortex shed from the upstream fin tip.

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