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Aerodynamic Impact of an Aft-Facing Slat-Step on High Re Airfoils GEOFFREY KIBBLE, CHRIS PETRIN, JAMEY JACOB, BRIAN ELBING, Oklahoma State University, PETER IRELAND, BUDDY BLACK, Edge Aerodynamix — Typically, the initial aerodynamic design and subsequent testing and simulation of an aircraft wing assumes an ideal wing surface without imperfections. In reality, however the surface of an in-service aircraft wing rarely matches the surface characteristics of the test wings used during the conceptual design phase and certification process. This disconnect is usually deemed negligible or overlooked entirely. Specifically, many aircraft incorporate a leading edge slat; however, the mating between the slat and the top surface of the wing is not perfectly flush and creates a small aft-facing step behind the slat. In some cases, the slat can create a step as large as one millimeter tall, which is entirely submerged within the boundary layer. This abrupt change in geometry creates a span-wise vortex behind the step and in transonic flow causes a shock to form near the leading edge. This study investigates both experimentally and computationally the implications of an aft-facing slat-step on an aircraft wing and is compared to the ideal wing surface for subsonic and transonic flow conditions. The results of this study are useful for design of flow control modifications for aircraft currently in service and important for improving the next generation of aircraft wings.

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