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Bioinspired Passive Flaps for Separation Control: Shark Scales v. Bird Feather.[1] SEAN DEVEY, CHRISTOPHER JARMON, PAUL HUBNER, AMY LANG, The University of Alabama — Water tunnel PIV studies have shown that the passively actuatable denticles of shortfin mako sharks are able to control flow separation. In a similar way, covert feathers on birds are able to passively actuate to delay flow separation. These two biological solutions to flow separation operate at different scales and in different fluids, and the relationship between them is not fully understood. Several iterations of a mechanical surface mimicking the geometry and kinematics of shortfin mako shark skin have been developed. In a low-speed wind tunnel, the performance of a NACA-0012 airfoil covered with over 6000 individually hinged microflaps has been characterized at a Reynolds number of 160000. At these conditions, the microflap array experiences similar dynamic pressures and Reynolds numbers to natural mako skin, but occupies an intermediate size between denticles and covert-feather flaps. Lift and drag measurements show that flaps of this size are ineffective for separation control, but the microflaps do exhibit passive actuation in response to flow separation. This provides insights into the relationship between denticles and covert feathers, suggesting that intermediately sized flaps may not be able to take advantage of either passive flow control mechanism.

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