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Bio-Inspired Pressure Sensitive Foam Arrays for use in Hydrodynamic Sensing Applications JEFF DUSEK, MICHAEL TRIANTAFYLLOU, JEFFREY LANG, Massachusetts Institute of Technology — Shallow, turbid, and highly dynamic coastal waters provide a challenging environment for safe and reliable operation of marine vehicles faced with a distinct environmentally driven perceptual deficit. In nature, fish have solved this perplexing sensory problem and exhibit an intimate knowledge of the near-body flow field. This enhanced perception is mediated by the ability to discern and interpret hydrodynamic flow structures through the velocity and pressure sensing capabilities of the fish's lateral line. Taking cues from biological sensory principles, highly conformal pressure sensor arrays have been developed utilizing a novel piezoresistive carbon black-PDMS foam active material. By leveraging the low Young's modulus and watertight structure of closed-cell PDMS (silicone) foam, the sensor arrays are well suited for hydrodynamic sensing applications and prolonged exposure to fluid environments. Prototype arrays were characterized experimentally using hydrodynamic stimuli inspired by biological flows, and were found to exhibit a high degree of sensitivity while improving on the flexibility, robustness, and cost of existing pressure sensors.

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