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Drag Measurements over Embedded Cavities Modeled after Butterfly Scales in Low Reynolds Number Couette Flow[1] ROBERT JONES, AMY LANG, University of Alabama — Recent research has shown that symmetric, embedded square cavities can reduce the net drag acting on a surface through the formation of embedded vortices. It is hypothesized that the scales on butterfly wings (approximately 100 microns in length), though asymmetric, may act in a similar way resulting in greater flying efficiency. In this experimental study, cavities were modeled based on the geometry observed for bristled butterfly scales. Plates were designed to have parallelogram-shaped embedded cavities with an approximate 2:1 length to depth aspect ratio. The plates were suspended in high viscosity mineral oil above a rotating belt to generate a Couette flow condition such that the cavity Re was maintained in a similar regime as that occurring for the flow over butterfly scales. The net drag forces were measured with a force gauge and compared to flat plate measurements in the same facility. The variation in drag over a range of Reynolds numbers was analyzed.

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