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Experimental Analysis of Flow over a Highly Maneuverable Airframe JONATHAN SPIRNAK, MICHAEL BENSON, BRET VAN POPPEL, United States Military Academy Department of Mechanical Engineering, CHRISTOPHER ELKINS, Stanford University Department of Mechanical Engineering, JOHN EATON, Stanford Department of Mechanical Engineering, TEAM HMA TEAM[1] — One way to reduce the collateral damage in war is by increasing the accuracy of indirect fire weapons. The Army Research Laboratory is currently developing a Highly Maneuverable Airframe (HMA) consisting of four deflecting canards to provide in-flight maneuverability while fins maintain short duration aerodynamic stability. An experiment was conducted using Magnetic Resonance Velocimetry (MRV) techniques to gather three dimensional, three-component velocity data for fluid flow over a scaled down HMA model. Tests were performed at an angle of attack of 2.3° and canard deflection angles of 0° and 2°. The resulting data serve to both validate computational fluid dynamics (CFD) simulations and understand the flow over this complex geometry. Particular interest is given to the development of the tip and inboard vortices that originate at the canard/body junction and the canard tips to determine their effects on airframe stability. Results show the development of a strong tip vortex and four weaker inboard vortices off each canard. Although the weaker inboard vortices dissipate rapidly downstream of the canard trailing edges, the stronger tip vortices persist until reaching the fins approximately six chord lengths downstream of the canard trailing edges.

[1]Team HMA designed and built the water channel and airframe for this experiment.

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