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SMART MATERIAL MECHANISMS FOR MORPHING AIRCRAFT

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ABSTRACT

Modern day aircraft have been confined to narrow flight regimes since the decision to use rigid wings over a century ago. Morphing aircraft – those capable of macro-scale shape change – have the ability to expand a particular craft's flight envelope to enable multiple missions, such as permitting both long loiter and fast dash capabilities. Using modern lightweight materials such as composite skins, shape memory alloy, and shape memory polymers, wing shape change concepts become more feasible. One such shape change mechanism has been deployed on NASA Langley's testbed wing shape, the hyper-elliptical cambered span (HECS) wing. This mechanism uses SMA wire to decrease wingspan while maintaining lift, with the potential for tailless flight. Similar mechanisms are being developed for use in a bat-like aircraft capable of effecting camber and span changes based on desired flight characteristics. Through the use of these novel materials, an actively rigid skin surface could be developed to prevent flutter without expending energy in maintaining rigidity within the membrane.

Keywords: Morphing, HECS, smart materials, SMA