Enhancing Flight Efficiency: Redesigning the Sukhoi-Su 30MKI Airfoil Geometry for Improved Speed and Maneuverability in Sustained Flight

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My project focused on refining the Sukhoi-Su 30MKI fighter jet's airfoil geometry to enhance its efficiency and maneuverability and over 25 iterations of airfoil designs, putting each through computational fluid dynamics and structural analysis tests. Initial successes led to notable improvements, with a maximum lift:drag ratio reaching 2.49, a significant leap from the original 1.38 recorded by the original plane (published by the Indian Air Force, IAF). However, structural analysis revealed permanent deformation and displacement exceeding 68ft, attributed primarily to its 0.9% thickness. This restrained the aircraft from sustaining constant flight (sustainable flight requirements: cruising speed of 600MPH, 90,217.82 N of force, and cruising alt. of 36,000ft). After refining the design, I focused on balancing dynamic and static pressure with structural integrity. I achieved a new, more efficient, sustaining flight with a maximum lift:drag ratio of 3.49 through adjustments and optimizations while experiencing only 1.51ft of displacement. Furthermore, during sustained flight, the airfoil maintained Bernoulli's constant at 223,015.78Pa; alongside this, the single wing maintained an estimated Thrust-to-Weight ratio of 0.981 for the single airfoil, meaning that the aircraft would hold approximately a 1.962 ratio when doubled for both airfoils. I created a more efficient airfoil for the Sukhoi-Su 30MKI, increasing the max lift:drag ratio by 2.57. My computational test verified my work, proving structural integrity and greater flight efficiency in potential speed and maneuverability. If made into a wing, my geometry for this new airfoil would sustain improved and more efficient flight (at MACH 0.8) for the Sukhoi-Su 30MKI.

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