TALON (Tactical Aerial Logistic-based Ornithological Navigator): Development of a Novel Biomimetic Ornithological Bot (BOB) Aerial System With Advanced Wing Morphing and Sensory Tech for Tactical Logistics in Disaster Relief and Military Operations

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Ornithopters have never fully replicated the efficiency of birds, which rely on complex kinematics that integrate thrust, lift, drag, and weight to optimize flight efficiency (Landell-Mills, 2024). Here I describe the construction of a low-cost biomimetic robot with multi-axial movement using a Capstan-Drive-operated mechanism for full figure-8 actuation of adaptable wings. Making use of advances in understanding of bird physiology, this Tactical Aerial Logistic-based Ornithological Navigator (TALON) mimics key features of bird morphology that define efficient flight (pneumatized structures, secondary/primary feathers, and morphing airfoils), while introducing complex training algorithms and positional sensing gyroscope/accelerometer data, parallel to birds in complex environments. TALON employs algorithms for object detection in crash prevention, an efficient wind-sensing system for energy conservation, autonomous navigation, and high-torque motor operations, making it biomechanically advanced alongside implementing intelligent systems. TALON mimics bird joint movements through multi-axis actuation, which allows for asymmetric flying patterns typical in birds. This, along with high degrees of freedom links, radio-controlled parts, and complex electronics, provides an efficient reproduction of bird flight in robotics, which has been proven to fare better in high winds and for disaster relief with novel morphologically accurate flight and under-radar stealth applications. TALON has exceeded goals for functionality, adaptability, and true bird aerodynamics and represents a major step toward advanced biomimetic aerial robotics with expanded capabilities, such as enhanced flight in disaster relief applications with higher cost efficiency compared to current market options.

Awards Won: