Multi-Vehicle Aerial Platform (MVAP)
Flying-Wing UAV Carrier

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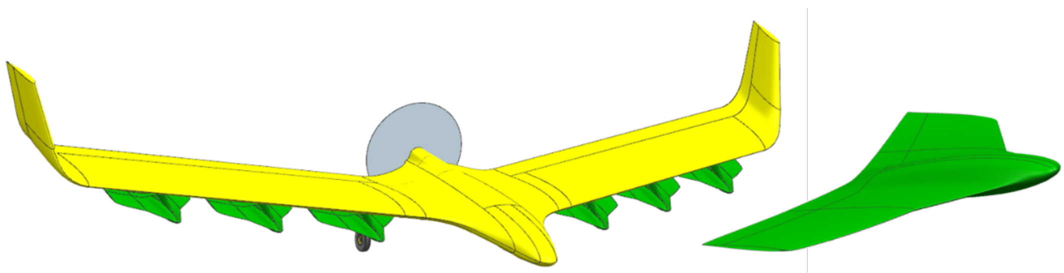
Abstract

This paper investigates the feasibility of a hierarchical unmanned aerial system composed of a flying-wing mothership UAV and six child micro delta wing UAVs attached to individual under-wing pylon stations. Potential civil applications of the system include environmental monitoring, infrastructure inspection, disaster response, precision agriculture, and temporary communications relay, whereas defence-related applications include distributed intelligence, surveillance and reconnaissance, electronic sensing, and cooperative multi-vehicle operations including long range kinetic effectors.

The mothership is a 50 kg-class tailless aircraft with a 5 m wingspan, originally designed, built, and flight tested as a highly stable observation and surveillance platform. Its baseline configuration has demonstrated solid stability, controllability, and low pilot/autopilot workload, making it a suitable candidate for expansion into a multi-vehicle aerial carrier role. The proposed concept requires structural reinforcement of the main landing gear, wing structure and attachment regions to accommodate increased external mass, altered load paths, and higher bending and torsional loads associated with carrying multiple child vehicles.



Each micro-UAV has a wingspan of approximately 0.5 m and an individual mass between 0.5 kg and 1.5 kg. These vehicles have been independently designed and flight tested for operation in difficult weather conditions, including elevated wind and turbulence, prioritizing robustness and mission reliability over recovery or reuse. Within the proposed system architecture, the small UAVs are treated as low-cost, rather disposable assets intended for short-range sensing, localized inspection, or risk-tolerant missions, while the mothership provides endurance, navigation, and communications support.

The study focuses on first-order feasibility rather than detailed optimization, with emphasis on configuration-dependent aerodynamics, local airflow interference between the micro-UAVs and the main wing, stability and control of a flying-wing configuration under symmetric and asymmetric loading, and the structural implications of increased internal and external mass. A feasibility approach is used to define acceptable operating envelopes as a function of child UAV mass and attachment configuration. The results indicate that the carrier concept is feasible within clearly defined structural, aerodynamic, and control-authority limits, and that reinforcement of the existing mothership airframe is a key enabling step. The work provides practical guidance for adapting an existing, proven UAV platform into a multi-UAV carrier system and establishes a foundation for future high-fidelity analysis and experimental validation.