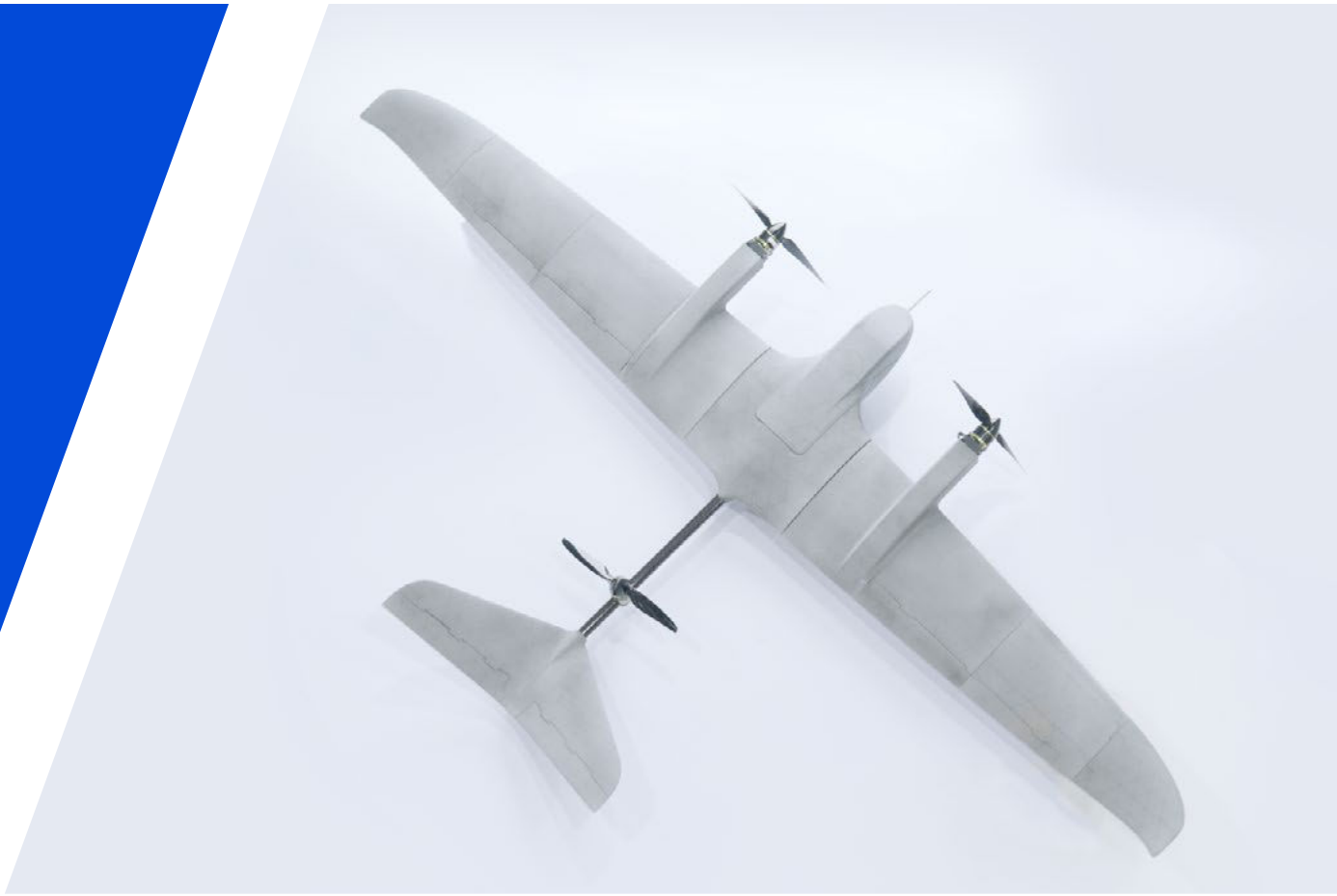
HP MJF Outperforms Conventional Approaches for Making Category I Fixed-Wing Drones



Category I fixed-wing unmanned aerial vehicles (UAVs) have a wingspan of less than 2 meters and a maximum take off weight (MTOW) of less than 9 kilograms.

The wings and fuselages of these drones are often manufactured with injected expanded polypropylene (EPP) or machined foam, which are known for low-cost and suitability with high-volume production. Higher end, performance-oriented UAVs, frequently utilize carbon fiber technologies that deliver superior strength and durability. While foam is generally chosen for its perceived affordability, carbon fiber introduces significant expenses, particularly in labor and tooling, which quickly escalates supply chain cost. Both approaches also require labor-intensive assembly. In contrast, HP Multi Jet Fusion (MJF) reshapes this landscape, offering dramatic improvements in cost per part, scalability, quality, and lightweight performance.

Challenges with injection and machined foam airframes

Foam airframes strike a practical balance between lightweight construction and low material cost, making them a common choice in UAV systems worldwide. Aesthetically, they often lack the premium finish expected in higher-end platforms and present other notable drawbacks, including poor durability under UV exposure, restricted design flexibility, and assembly processes that require labor-intensive gluing and wiring integration. Moreover, once wingspans extend beyond 40 centimeters, reinforcement rods typically become necessary to preserve structural rigidity.

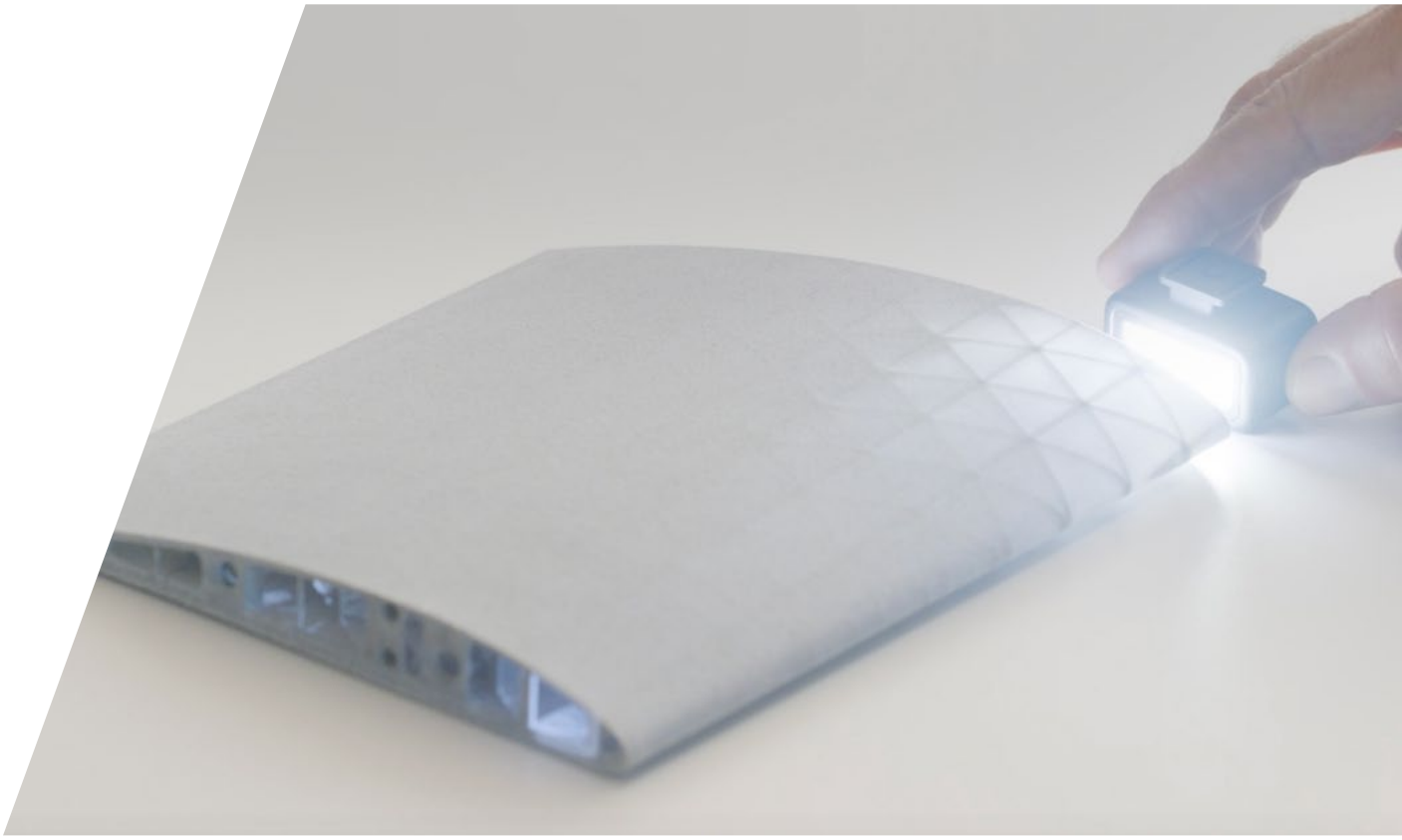
Drawbacks of carbon fiber or composite airframes

Carbon fiber manufacturing leverages aerospace-grade materials that deliver exceptional strength and endurance. Yet this performance comes with constrained scalability and significant cost, unless companies commit to substantial capital investments in equipment and manufacturing infrastructure.

Harness the benefits of HP MJF technology

When fuselage or wing components are optimized for Multi Jet Fusion, it's possible to achieve structures as lightweight as foam while dramatically enhancing mechanical strength and durability, along with a host of additional advantages. From prototype through full-scale production, it simplifies the assembly of parts, shortens lead times, and yields drastic cost savings. HP MJF also facilitates rapid design iterations, helping teams respond quickly to evolving market needs and drive innovation.

When combined, optimized process parameters and the HP Jet Fusion 5600 3D Printing Solution can allow drone manufacturers to achieve rigid yet lightweight structures that match or even exceed the lightweight characteristics of foam, while offering superior mechanical properties. Applying Design for Additive Manufacturing (DfAM) principles and adhering to printing guidelines enables consistent production of intricate features down to 0.5 millimeters.



HP Concept S Drone soars to new heights

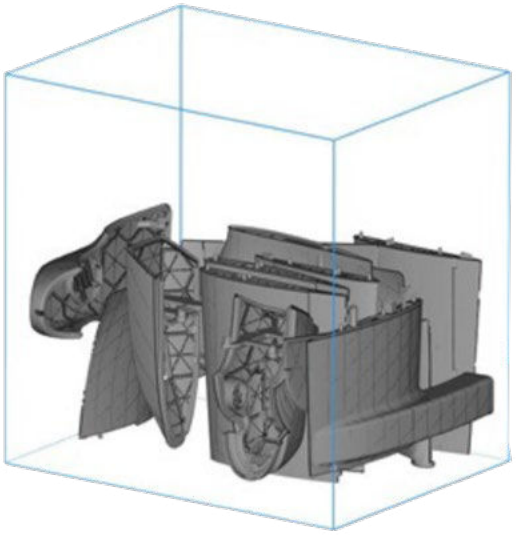
The HP fixed-wing drone demonstrator provides a compelling summary of the possibilities:

- A vertical take off and landing (VTOL) drone with a 2.5 kilogram MTOW and a wingspan of 1.5 meters.
- Features an optimized structure, which combines standard carbon fiber profiles and MJF 3D printed components that support all safety factors and loads.
- The full drone is printed in one half of a build area, enabling over 1,200 printed units per year on a HP Jet Fusion 5600 system.
- Mechanical assembly takes less than 30 minutes, thanks to innovative clipping systems that minimize use of screws.
- The electrical wiring is easily integrated using a sacrificial printed feature.
- Three different iterations were developed and tested within a three month period, validating that HP MJF significantly shortens product development cycles and accelerates time-to-market.
- The drone's airframe was engineered with a total weight under 500 grams, with less than 180 grams allocated to the wings (1.5m total wingspan and wing chord of 140mm) and the remainder to the fuselage and tail.

The airframe has been developed with design features that enhance functionality, simplify assembly, lower labor costs, and elevate aesthetics. With extensive training in HP's design programs, certified partners are uniquely equipped to provide consultancy and engineering services that enable customers to fully leverage HP Multi Jet Fusion technology to develop innovative UAV airframes.

This document is intended to inspire drone manufacturers by showcasing the production potential of MJF. Additionally, HP strongly advises readers to implement comprehensive aerospace engineering and design processes, ensuring UAV systems are developed with full consideration of materials, production methods, design for manufacturing principles, and specialized production expertise.

Initially, it may be more efficient to engage HP Professional Services to leverage the team's expertise. As an engineering and design team with deep knowledge of process-specific requirements and the distinct capabilities of HP Multi Jet Fusion, they can simulate wing deflection for each drone, factoring in mission profile, weight, and environmental conditions. Beyond crafting tailored redesigns that are optimized for HP MJF technology, they can also deliver training programs that provide a deeper understanding of manufacturing costs and the unique advantages of MJF, equipping in-house teams to develop their own designs. Ultimately, their mission is to fast-track customer adoption and empower engineers to confidently design and scale next-generation MJF UAV platforms on their own.



Accelerate drone innovation now with MJF

Leading UAV manufacturers are already harnessing HP Multi Jet Fusion to boost performance, cut costs, and expand production. Already building drone components? Contact an expert from the HP Drone Team to optimize your parts or learn where to print them.

Additional resources:

Paper A: Achieve New Heights with HP Multi Jet Fusion (MJF) Technology

Paper B: UAV components in mass production: From compact quadcopters to core components in large drones, HP MJF delivers performance and cost advantages

For more information, please visit the HP Drones website: www.hp.com/drones
or contact us: drones@hp.com

4AA8-5265ENW, February 2026