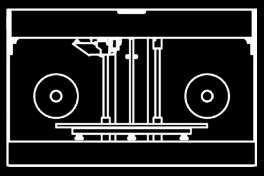
Tsalla Aerospace



Industry	Aerospace and Defense
Application	Tail Assembly Part for Wind Tunnel Testing
Technology	Mark Two
Materials	Onyx®

Markforged

The Challenge

A leading aerospace company has adopted additive manufacturing (AM) to provide fast, efficient and cost-effective ways to meet challenges it faced in developing prototype parts for wind-tunnel testing, a process demanding high levels of accuracy and surface smoothness in the parts to be tested.

Tsalla Aerospace Pvt. Ltd., an innovator in unmanned aerial systems and defense technology, is at the forefront of developing advanced vertical take-off and landing (VTOL) systems. The company combines cutting-edge design with state-of-the-art manufacturing techniques to build unmanned aerial vehicles (UAVs) capable of transforming defense and commercial applications. To accelerate development cycles and reduce costs, Tsalla Aerospace has invested in advanced manufacturing technologies that enable rapid prototyping and precise validation of complex systems.

During the development of their proprietary VTOL system, Tsalla Aerospace faced a critical challenge: designing and fabricating a tail assembly part for a wind tunnel testing model. This was essential to validate that analytical models would hold up to experimental testing. However, traditional manufacturing methods were slow, costly, and often compromised on precision due to the multiple joints and fasteners required in the production of intricately-shaped components.

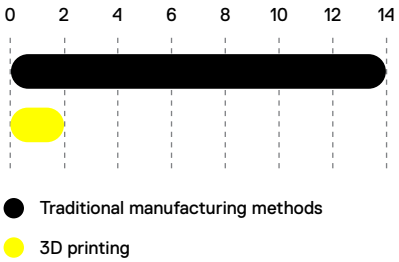
To achieve the required standards for accurate testing, Tsalla needed to be able to produce single, complex components, eliminating joints and surface disruptions, at the same time ensuring high dimensional precision for accurate airflow analysis. The company was also looking to substantially reduce the costs and lead times faced when using conventional methods of production.

Extensive research indicated the potential of AM to meet all Tsalla's criteria, so the company partnered with Markforged, a leader in 3D printing technology known for its industrial-grade printers and materials. The collaboration aimed to leverage Markforged's ability to deliver precision-engineered parts quickly and cost-effectively.

> "Markforged printers have revolutionized our wind tunnel test model development process. Their ability to go from computer design to physical part in a remarkably short timeframe is a game-changer."

— Vinayak
Founder and CEO, Tsalla Aerospace

Lead Time Improvement (Days)



Additional Key Benefits

Dimensional Precision
Meeting stringent tolerance requirements

Single-Part Design
Printed as a seamless component



Showcased here is the 3D Printed component of the aircraft.

The Solution

Using the Markforged Mark Two printer and Onyx material, Tsalla Aerospace printed the tail assembly components as connected parts, maximizing build volume while maintaining high strength and accuracy. The Onyx material, reinforced with continuous carbon fiber where needed, provided exceptional strength and stiffness, mimicking real-world conditions for the wind tunnel tests. The results have been so impressive in terms of strength and accuracy that the company is now using AM in a full production line for finished components.

Key benefits included:

- **Rapid Production:** Lead times were reduced from 2 weeks to just 2 days, allowing for faster iterations.
- **Cost Savings:** Prototyping costs were cut by 80%, freeing up resources for further innovation.
- **Dimensional Precision:** The printed parts met stringent tolerance requirements, ensuring accurate aerodynamic testing.
- **Single-Part Design:** The empennage was printed as a seamless component, eliminating the need for multiple joints and fasteners, which often affect aerodynamic performance.

> "The dimensional accuracy of the printed components is exceptional, ensuring precise wind tunnel testing results. The strength of the reinforced carbon fibre material, coupled with accuracy and short lead times, is so good that we have moved from experimental parts to production components on the same printer."

> "We are highly impressed with Markforged's technology and its positive impact on our workflow."
>
> — Vinayak
> Founder and CEO, Tsalla Aerospace

The integration of Markforged technology transformed Tsalla Aerospace's wind tunnel testing process, enabling the company to:

- **Validate Designs Efficiently:** The precise test models allowed Tsalla to compare analytical predictions with real-world data, optimizing their VTOL system.
- **Enhance Product Quality:** The strength and accuracy of the printed parts contributed to more reliable and robust UAV designs.
- **Accelerate Innovation:** Rapid prototyping meant faster design iterations and the ability to explore multiple configurations in a fraction of the time.
- **Fast, Economical Production:** The strength and accuracy of printed components has encouraged Tsalla to extend its use of AM from prototyping to full production.

Adopting Markforged's advanced 3D printing technology, Tsalla Aerospace first streamlined their prototyping process, then moved on to use AM for full production runs. The collaboration has allowed Tsalla to focus on refining their designs, push the boundaries of UAV performance, and create a fast, efficient production line. Markforged's solutions continue to play a vital role in enabling cost-effective, high-precision manufacturing that supports Tsalla Aerospace's mission to develop cutting-edge aerospace systems.

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