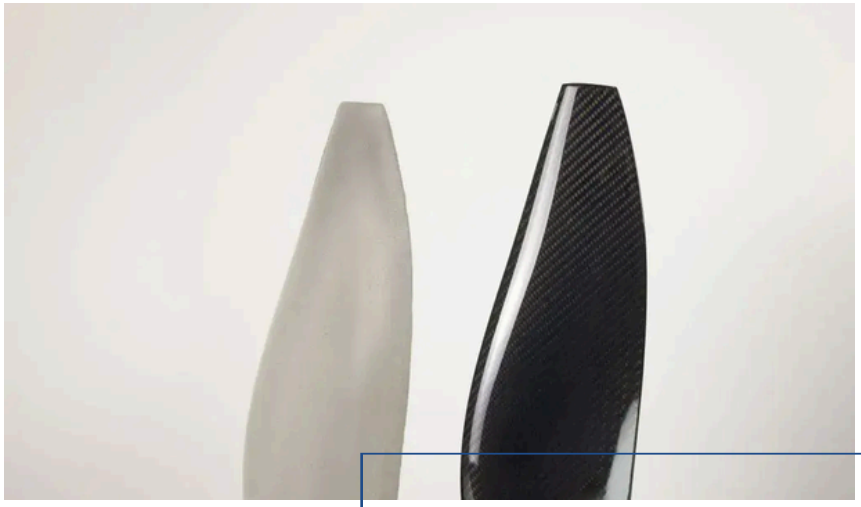
AEROSPACE MANUFACTURING

WHY BUY TO FLY MATTERS.

By Aurélien Goudier, R&D engineer, L&L Products

L&L Products®



L&L PRODUCTS RECKONS NEAR NET-SHAPE COMPOSITES ARE TRANSFORMING AEROSPACE MANUFACTURING

Rethinking buy-to-fly. Aurélien Goudier - L&L Products' R&D engineer and hands on composite applications - looks at how near net-shape composites are transforming aerospace manufacturing.

Across the aerospace industry, production systems are being stretched by a convergence of pressures: sustained demand growth, material shortages, labour constraints, and ongoing geopolitical instability.

According to PwC, commercial aerospace alone is working through a backlog that extends more than a decade, and multiple long-term forecasts point to more than 43,000 new aircraft required over the next 20 years.

The challenge is no longer simply building advanced aircraft. It is building them efficiently, repeatedly, and at scale. To do that, manufacturers must address one of the most persistent inefficiencies in aerospace production: the buy-to-fly (BTF) ratio.

The BTF ratio is often treated as a technical metric, but it is better understood as a window into manufacturing efficiency as it measures how much material is purchased versus how much actually makes it into a finished component. In traditional aerospace manufacturing, particularly with machined components, the gap can be significant.

When large volumes of material are removed to achieve the final geometry, the result is wasted raw material and extended machining times. These results have long been accepted as the cost of precision, but it's increasingly difficult to justify considering the cost and timing pressures of today's economic environment. With machined components, every unit of excess material represents not just waste, but lost capacity – capacity that manufacturers and suppliers can no longer afford to give up.

A strategic shift

Improving BTF ratios requires more than incremental process improvements. It requires a shift in manufacturing philosophy and a focus on efficiency at the materials level.

Advanced composite materials such as L&L Products' InsituCore® offer a clear path to an improved BTF ratio because they enable near net-shape composite parts and components.

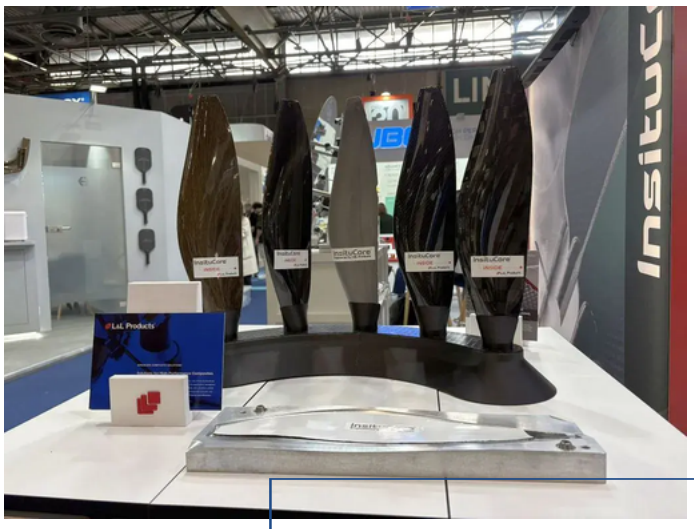
Near net-shape production flips the traditional model. Instead of machining parts down from oversized stock, components are moulded as close as possible to their final geometry from the outset. The result is a dramatic reduction in material removal, along with the time and energy associated with it.

This approach also opens the door to better design efficiency. Components that once required multiple parts and assemblies or complex, multi-step processes can be consolidated into single, optimised structures. Fewer parts mean simplified assembly and more predictable production outcomes. In an environment defined by throughput constraints, these advantages compound quickly.

Efficiency gains across the board

The impact of improved BTF ratios extends across the entire manufacturing system.

Reducing material input lowers direct material costs and decreases dependency on strained supply chains. Shorter machining cycles free up critical equipment and reduce bottlenecks. Tooling requirements are simplified, and maintenance demands are reduced.



L&L'S INSITUCORE® IS DESIGNED TO CREATE STRUCTURAL COMPOSITE CORES DIRECTLY WITHIN A MOULD

Operationally, one of the most important gains comes from cycle time. Processes that minimise idle mould time can significantly increase throughput without requiring additional capital investment.

Realising these benefits depends on materials and processes that can reliably produce complex geometries with minimal post-processing.

Advanced foaming core technologies are emerging as a key enabler. Materials such as InsituCore® are designed to create structural composite cores directly within a mould, eliminating many of the inefficiencies associated with traditional fabrication methods.

The process is both controlled and efficient:

- Material is placed into a heated mould alongside reinforcement layers such as prepreg or aluminium facings.
- As heat is applied, the material expands—up to 1,500% in volume—generating internal pressures of 3 to 15 bar.
- This expansion fills the mould cavity completely while consolidating the surrounding layers.
- The result is a fully formed, near net-shape 3D structural component, ready for minimal finishing.

Because material is added only where needed, waste is inherently minimised. Unlike subtractive machining methods, there is no excess to remove.

The impact on buy-to-fly ratios is significant. With InsituCore® in tacky sheet format, BTF ratios can reach approximately 0.81. In pelletised form, where placement can be even more targeted, ratios can approach 0.99.

Just as importantly, these improvements are achieved without introducing unnecessary process complexity or requiring large-scale capital investment. The footprint remains small, and the process is adaptable across a range of applications.

Designing for the future

The aerospace industry has always been defined by precision engineering. Increasingly, it will also be defined by precision manufacturing processes that use exactly the amount of material required.

As production demands continue to rise, manufacturers that succeed will be those that treat efficiency as a design principle, not a downstream optimisation. Buy-to-fly ratios will play a central role in that shift, serving as both a benchmark and a driver of innovation.

Near net-shape technologies - and the advanced materials that enable them - offer a clear path forward. By reducing waste, decreasing cycle times, and improving buy-to-fly ratios, they allow manufacturers to scale production more efficiently without compromising performance or sustainability.

In a market where capacity is constrained and expectations are rising, the ability to do more with less is no longer an advantage. It is a requirement.

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ABOUT THE AUTHOR

Aurélien Goudier is an R&D Engineer at L&L Products in France, focused on composite materials and processing methods. His work centers on InsituCore®, L&L's foaming core technology.

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