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Learn How Greene Tweed is Using Discontinuous Thermoplastic Composites Technology to Reshape Aerospace Manufacturing

Aviation Week Network hosted a conversation with Travis Mease and Sébastien Kohler at Greene, Tweed and Co., the 160-year-old component manufacturer that provides trusted solutions for critical industry performance demands.

Q AW: What are the advantages of discontinuous long fiber (DLF) composites in aerospace manufacturing?

A TM: One key advantage of GT's Xycomp discontinuous long fiber (DLF) thermoplastic composite is its highly automated compression molding process, which supports both complex geometries and high-volume production for aerospace applications. We can repeatedly produce high-quality parts conforming to GD&T standards, often processing multiple components on the same pallet to increase throughput with minimal operator interaction. Greene Tweed has been introducing additional automation throughout this process, including material charge weighing, press and mold handling, and advanced capabilities like automatic fiber placement (AFP) reinforcement and cobot deburring. This reduces touch labor while increasing quality, throughput, and reliability. Compared to aluminum components, this process offers 30 to 50% weight savings depending on how optimized those aluminum components are, while remaining cost competitive with sophisticated, heavily machined parts.

A SK: DLF composites serve as an excellent middle ground between injection molding, which offers high shape complexity but low mechanical properties, and traditional continuous fiber composites, which provide great properties but limited draping capability around complex shapes. DLF typically achieves about 75% of the stiffness of a quasi-isotropic layup and half its strength. This makes it ideal for replacing complex-shaped metallic parts, particularly machined aluminum components. The advantages can be even more significant in certain applications due to the high susceptibility to heat of the microstructure in many typical aerospace-grade aluminum alloys. This leads to significant strength knockdown, whereas our DLF is more stable within its operating range, with an ability to sustain continuous high stresses up to at least 180°C. In some cases, we've even replaced titanium or steel components, resulting in even more substantial weight savings.

Q AW: Let's look at a specific use case. How does the weight and performance of a DLF stator vane with a metallic leading edge compare to an all-aluminum vane?

A SK: We identified business jet outer guide vanes — a complex-shaped part — as an excellent application for DLF. These parts are non-structural, fully floating, and we can mold them with the foot as a single, net-molded component. However, hail impact resistance presented a significant challenge. The high-velocity hail impact load case involves both a local crushing beneath the impact point and a three-point bending of the vane, making the airfoil profile thickness crucial. While increasing blade thickness could improve hail impact resistance, this wasn't feasible due to

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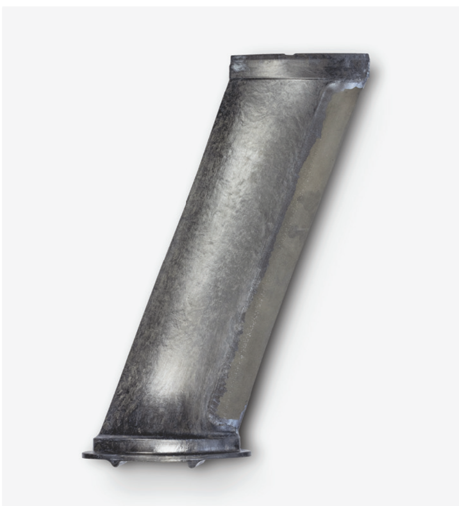
fixed geometry requirements. After exploring various hybridization approaches with both DLF and continuous fiber composite materials, we developed a metallic leading edge that provides excellent protection. We validated this through extensive testing with our own hail impact testing rig in Switzerland. The resulting co-molded design — combining a metallic leading edge with a net-molded guide vane — offers a cost-effective solution that provides significant weight savings: initially four to six pounds per engine, now up to eight to 10 pounds per engine in the newest version.

A **TM:** These performance requirements are particularly critical because each engine typically contains 55 to 60 vanes positioned directly behind the fan blades. This subjects them to substantial impact and durability demands. We recognize both the strengths and limitations of Xycomp DLF technology, which is why we're continuously innovating and working toward DLF 2.0, which will address some of these challenges.



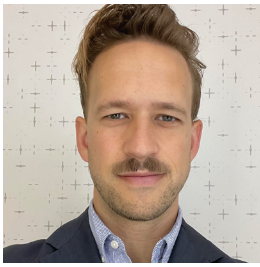
Q **AW: What are some of the regulatory and certification challenges associated with new thermoplastic composite materials and processes in aerospace?**

A **TM:** Certification can be a significant barrier to entry when introducing new materials in aerospace. The materials must be fully characterized, which is why we work with thoroughly tested and validated materials rather than experimenting with new ones. This is essential in sectors like Advanced Air Mobility (AAM), where companies, due to investor commitments and tight timelines, need completely validated material solutions. One of Greene Tweed's key advantages is that we offer a comprehensive package that includes not only material characterization but also predictive design analysis capabilities — and we have a proven performance history. This reduces risk, shortens timelines, and cuts costs for our customers, as we can accurately predict how these materials will perform in testing scenarios.

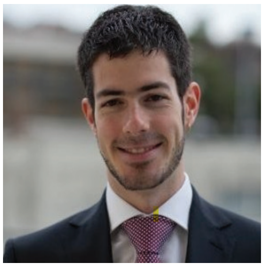
A **SK:** The certification process involves an extensive body of testing work across multiple parameters. We conduct comprehensive testing on coupons under various environmental and loading conditions, using different material batches and part configurations. Due to the capability offered by DLF to vary part thickness and incorporate complex rib reinforcement, we've also characterized performance across different material thicknesses. This results in an extensive testing matrix — approximately 200 panels with five to seven samples each, including fatigue characterization, which involves lengthy trials. This extensive database of material properties and performance data is invaluable to our customers because they can use our allowables data for their own certification processes, eliminating the need to duplicate this testing themselves.

Q **AW: Based on Greene Tweed's experience, what are the recyclability considerations for thermoplastic composites?**

A **TM:** We're currently conducting preliminary work with AAM companies and larger aerospace OEMs to explore recyclability options. We're testing small quantities of recycled materials — from scrap, waste, or, potentially, decommissioned aircraft — to evaluate their compatibility with our molding processes and develop appropriate recipes and procedures.



Travis Mease
Product Manager at
Greene Tweed



Sébastien Kohler
Scientist at Greene Tweed

Interestingly, some AAM companies are beginning to see value in the environmental aspects of recycled materials beyond pure cost considerations, instead viewing it as a marketable feature for their platforms. While still in early stages, this suggests a growing recognition of the broader value proposition of recyclable materials in aerospace applications.

A SK: While thermoplastic composites are theoretically recyclable through remelting, the practical implementation in aerospace faces several challenges — particularly with high-value, high-temperature polymers like PEEK and PEKK. The business case for recycling these materials isn't yet fully defined, largely because it's difficult to justify the premium pricing for recycled versions of these already expensive materials. Recycled materials introduce new certification challenges, especially for structural aircraft parts. This often leads to downgrading recycled materials for non-structural interior components or even non-aerospace applications like sporting equipment. We are already supporting such activities in industrial and medical applications, where we recycle our own waste material. Looking forward, we expect government regulations and incentives to drive the development of circular supply chains, forcing manufacturers to qualify recycled materials and define internal recycling streams. Our technical capabilities are well-suited to help the industry develop these thermoplastic composite recycling solutions.

Meet the Experts

Travis Mease is Greene Tweed's Thermoplastics Product Manager for Structural Composites, specializing in chopped fiber applications. He leads product strategy development and technology roadmap execution, driving the expansion of thermoplastic composites into emerging markets.

Sébastien Kohler is a Scientist at Greene Tweed, working on Structural and Engineered Composite materials. He is part of a cross functional team developing new composite materials, novel processes, and new part development, with a special focus on the aerospace industry.