SOFTWARE

Composite Product Developments Aid Aerospace Manufacturing

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PASSWORD

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Manufacturing Engineering: How critical is software to designing and building today's composite aircraft structures?

Steve Peck: Software is an essential part of the overall aerostructures development process. It's so critical to the process that firms have dedicated departments responsible for the implementation of not only the tools within their engineering environments, but also the development of supporting processes. Aerostructures development presents significant challenges for a variety of reasons: First, there are huge volumes of data to manage, and that volume is growing with the increased role of composites. If aerospace companies didn't use specialized software in the design and manufacture of aircraft, managing the sheer volume of information would literally take forever. Additionally, there is the need to manage the constant and inevitable changes that occur during the course of an aircraft program. Further, since modern aircraft are being designed and manufactured by geographically diverse partners, it's critical to standardize tools and processes to avoid common and frequent communication problems. Finally, specialized software enables the manufacturer to design with consideration for downstream reuse of engineering data throughout the enterprise and supply chain. For all these reasons, software is indispensable to the designing and building of composite aircraft structures.

ME: What software does your company offer for improving aircraft design and manufacturing?

Peck: We offer Vistagy AeroSuite, which enables aircraft manufacturers to manage the evolving product development process and deliver optimized parts and assemblies. While the CAD and PLM systems are the primary components of the engineering IT environment, these systems lack the specialization required for effective and efficient aerostructures development. AeroSuite consists of FiberSIM composites engineering software, SyncroFIT for designing and manufacturing airframe assemblies, and the Quality Planning Environment (QPE) to streamline the first-article inspection process. The final piece of the AeroSuite is professional services. FiberSIM addresses the entire composites engineering process, from conception, laminate definition, and ply creation through simulation, performance optimization, flat pattern generation, documentation, and manufacturing. SyncroFIT is a group of software products for easily authoring and managing the assembly interfaces and the hundreds of thousands of fasteners that are used in an airframe. With the QPE, engineers are able to generate quality plans and inspection data based on design and manufactur-

ing characteristics created by FiberSIM and SyncroFIT and saved in the CAD system.

ME: What benefits are provided by today's airframe-development process software?

Peck: There are a number of benefits. First, it enables the engineer to understand the implications of making design changes and rapidly implementing them. Next, it allows the user to design for the manufacturing process. It enables producibility assessments to be accomplished during the design phase, allowing engineers to make better-informed decisions earlier in the process to avoid costly rework and engineering changes. Non-value-added tasks can be automated to allow more time for optimizing the design and implementing innovative new ideas. By performing more iterations, the user has a better chance to optimize the design. Finally, manufacturing equipment—such as ply nesting/cutting, laser projection systems, automated fiber-deposition machines, automated drilling and fastening systems, and NDI inspection equipment—can all be fed data automatically. Ultimately, what this means is delivery schedules, program goals, and product performance goals can be met.

ME: What are some of the technical difficulties airframe manufacturers encounter with composites?

Peck: Composites introduce a high level of uncertainty and variability compared to the well-understood structural and manufacturing behavior of other materials, such as aluminum. Composites design requires a balance between the geometric requirements, the material form, and the manufacturing process. For example, a monolithic skin panel, a t-shaped stringer, and a sandwich panel fairing must be treated differently. Likewise, different materials, such as woven, unidirectional, and NCF [non-crimp fabric], present design and manufacturing implications of their own. Finally, manufacturing processes, such as hand layup, automated tape laying, automated fiber placement, and forming, need to be taken into consideration. The specific combination of these variables influences the design approach and, ultimately, the cost and quality of the finished product. Obviously, balancing all of these elements is a significant technical challenge.

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ME: What's the current outlook for composite aircraft/airframe manufacturing?

Peck: All new aircraft programs, such as the Boeing 787, Airbus A-350, Bombardier CSeries, LearJet 85 business jet, the MS-21, and Comac 919, to name just a few, incorporate a significant level of composites. In many cases, composites amount to more than 50% of the structure by weight. Right now, the wings and empennage are typically made entirely out of composites. In other cases, composites are used to manufacture complete fuselage skins and substructure. Composites will only become more prominent going forward.

ME: What other industries are making use of composites in a big way?

Peck: There are a number of industries that have really embraced composites, including wind energy, jet engines, and marine. The goal of delivering low-cost wind energy challenges engineers to develop larger and lighter composite wind-turbine blades. But these blade designs are becoming increasingly more sophisticated, complicated, and costly to manufacture at high volume using traditional techniques. To meet this challenge, engineers are developing designs that increasingly use automated manufacturing processes to reduce labor and manufacturing costs, and are looking for new composite blade-development processes. Composites are becoming the materials of choice for aircraft engine components as well. Using composites in aircraft engines enables manufacturers to reduce weight, improve performance and, in the case of ceramic matrix composites [which are typically used in the hot turbine section of the engine, for parts such as guiding vanes, turbine blades and shrouds], increase in-service temperatures and reduce cooling requirements. New technologies, manufacturing processes, and materials are paving the way for innovative new designs in the marine industry. Marine manufacturers are striving to take advantage of the weight savings offered by composites, while achieving part consolidation and less complex assemblies.■