Woven composites take flight

Area-I performs accurate, efficient analysis of complex woven composites with Autodesk Simulation Composite Analysis

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— Nicholas Alley
Chief Executive Officer Area-I

Project summary
Area-I, an aircraft research and fabrication company, recently completed development and flight testing for its Prototype Technology Evaluation Research Aircraft (PTERA). The PTERA is an unmanned aerial vehicle (UAV) that serves as a low-risk, low-cost platform for flight testing high-risk technologies such as advanced aerodynamic treatments.

To perform a detailed analysis of the innovative wing design for the PTERA UAV, Area-I engineers relied on the woven composite analysis capabilities in Autodesk® Simulation Composite Analysis software.

The challenge
The PTERA UAV’s wing structure needed a design that would provide high lift and low drag with minimal bending. The high stiffness-to-weight ratio of carbon-based composites and the manufacturing versatility of woven fabrics made a plain-weave carbon epoxy composite the clear choice for meeting design objectives. However, since the PTERA UAV’s wing structure is comprised of more than 50 individual woven components, employing traditional analysis techniques to optimize each part would be cumbersome. The results also would be based on methodologies not designed for woven materials.

The solution
By using Autodesk Simulation Composite Analysis software on the PTERA UAV project, Area-I engineers were able to design a layup that met all weight, strength, and deflection goals. Wing bending was minimized to ensure leading- and trailing-edge jet slots remained open during all phases of flight. In addition, the final layup schedules satisfied requirements that the wing would be failure free under severe 6-g loading.

The result
The constituent level stress and failure indices obtained by Autodesk Simulation Composite Analysis helped to greatly simplify analysis for Area-I’s engineering team.

“With Autodesk Simulation Composite Analysis software, [we were able to] rapidly and accurately predict the structural performance of our complex composite airframe—manufactured from both unidirectional and woven composites—while identifying several inconspicuous structural problem spots,” says Nicholas Alley, chief executive officer of Area-I. “The superior analysis allowed us to integrate solutions quickly into our design process, which literally saved hundreds of design hours by giving us the confidence to utilize a less complex and lighter design.”

Learn more
Learn more about Autodesk Simulation Composite Analysis software at www.autodesk.com/products/autodesk-simulation-family/overview.