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Dimensional Management of Lay-up Mandrels for the World's Largest One-Piece All-Composite Aircraft Fuselage

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ABSTRACT

Dimensional Management of Lay-up Mandrels for the World's Largest One-Piece All-Composite Aircraft Fuselage

The 787 fuselage team is building a complete full size Test and Certification Barrel of the Boeing 787 Dream Liner fuselage. The all- composite fuselage is constructed as a "One Piece Barrel Section". This means that the entire circumference, including skins and structural stringers, are co-cured in a very large lay-up mandrel. This is the largest One Piece Composite airplane fuselage in aviation history. The barrel is laid up much like a carbon fiber fishing rod with the mandrels on the inside of the fuselage (on the IML). Our largest test lay-up tool is nineteen feet in diameter and thirty-three feet long. The tool is built in six sections which translate inboard for extracting the finished barrel.

Metrology application The metrology challenge is to inspect the surfaces of the mandrel segments and analyze the as-built condition of each section when the entire mandrel is assembled, so all six sections will be in the correct orientation, yielding the best product. A combination of laser radar scanner and laser trackers driven by scripted measurement plans will be used to accomplish this, collect data to assist in the final assembly of the mandrel, and measure the actual fuselage IML to determine spring-back factors and other characteristics of the finished barrel. This data will be used in the certification and validation of the manufacturing processes for the FAA. Previous test barrels on the program have suffered from delayed data analysis, so it is imperative that this project have fast feedback loops of the survey data. Using metrology applications will help to accomplish these

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