# Lockheed Martin Demonstrates Resin Transfer Molding Technology In Advanced Fighter Vertical Tail Project

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Lockheed Martin Aeronautics Company successfully demonstrated use of an advanced resin transfer molding (RTM) process to fabricate a unitized component for an advanced fighter aircraft. The all-composite component selected resembles the vertical tail of the Lockheed Martin Joint Strike Fighter.

The RTM vertical tail project began in the fall of 1998 and was one of many structural projects conducted under Lockheed Martin Aeronautics' Advanced Affordability Initiative (AAI). AAI was initiated in 1997 to demonstrate advanced material, designs and manufacturing technologies that will significantly reduce cost of aircraft components for the next generation of combat aircraft.

Compared to traditional designs, the unitized tail structure was cured in a press as a single component. The RTM process reduced the part count from 13 to one and eliminated more than 1,000 fasteners. The corresponding manufacturing costs are reduced by more than 60 percent.

The project also demonstrated that modeling of the resin flow can accurately identify preferred injection sites and sequences to assure proper impregnation throughout the component. Using the optimum model prediction resulted in complete mold filling, i.e., no dry spots and significant benefits to quality and production cost.

The vertical tail is one of the largest and most complex composite components ever produced using the RTM process. The tail measures 12 feet along the leading edge and weighs almost 200 pounds. The skins are composed of more than 100 plies and vary in thickness by a factor of four from root to tip. Fourteen unique, complex mandrels having continuously variable cross sections were over-braided to create the internal structure.

"This RTM demonstration is a major step forward in advancing the producibility of complex, composite aircraft components," said Kenneth Taylor, director of the Advanced Affordability Initiative at Lockheed Martin Aeronautics. "We are beginning to capitalize on the performance advantages of composite materials at costs that rival traditional metallic designs. These advances in composites are providing us confidence in our ability to affordably produce the next generation of fighters."

The following team members made significant contributions to the project:

- -- Air Force Research Laboratory and University of Dayton Research Institute -- assisted in modeling to predict resin flow patterns in mold filling.
- -- Cytec Fiberite -- supplied the BMI resin and graphite fabric material.
- -- A&P Technology -- provided complex, computer-controlled custom braiding over machined mandrels.
- -- North Coast Tool and Mold -- provided the 10-ton steel and aluminum mold and the injection restraint fixture.
- -- Radius Engineering -- provided the computer-controlled resin injection system.

Lockheed Martin Aeronautics Company is a leader in the design, development, systems integration, production and support of advanced military aircraft and related technologies. Its customers include the military services of the United States and allied countries throughout the world. Products include the F-22, F-16, F-117, C-5, C-27J, C-130, P-3, U-2, X-33 and Joint Strike Fighter, among other renowned aircraft.

LM Aeronautics is a unit of Lockheed Martin Corp. , headquartered in Bethesda, Md. Lockheed Martin is a global enterprise principally engaged in the research, design, development, manufacture and integration of advanced-technology systems, products and services. The corporation's core businesses are systems integration, space, aeronautics and technology services.

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