COMPOSITES AFFORDABILITY INITIATIVE VACUUM ASSISTED RESIN TRANSFER MOLDING (VARTM)

PROBLEM / OBJECTIVE

Autoclave curing of high performance composite materials has been the standard practice in the aerospace industry for over 30 years. Autoclaves require a significant capital investment, consume significant energy, and are recurring cost intensive. As a result, the supplier base for high performance composites has been limited to large companies with high overhead. The objectives of this project were to realize significant cost reductions for composite aircraft components by demonstrating the scale-up of the Vacuum Assisted Resin Transfer Molding (VARTM) process and by expanding the supplier base.

APPROACH / BUSINESS STRATEGY

Although VARTM processes have been used in the boating industry for many years, there has been little data generated on typical aerospace materials, material forms, and structural shapes via the VARTM process. The use of VARTM, in place of autoclave curing, reduces costs and expands the number of low cost suppliers that can produce high performance composite parts. The VARTM process uses vacuum pressure to compact the composite structure and, therefore, does not require the precision or the strength of matched metal tools required for competing processes. VARTM tooling is not only lower in cost but also is easier to modify when incorporating engineering changes.

ACCOMPLISHMENTS / PAYOFF

This effort validated the VARTM process using aerospace grade materials, demonstrated repeatability and reliability, and demonstrated the scale-up of the process to parts over eight feet in length with integral stiffeners. Transition of this technology to a sub-tier vendor enabled lower cost fabrication through competition. The VARTM process generally enables significant cost reductions. It obviates the need for expensive autoclave operations. It eliminates the need for expensive match metal tooling. It permits the fabrication of large, highly integrated aerospace structures, thereby reducing costs associated with mechanically fastened multi-part construction. Integration also reduces weight by significantly reducing fastener count, edge distance requirements, and faying surfaces. This has been done while obtaining properties equivalent to those of autoclaved cured composites. The JSF Alternate Cockpit Tub (JACT) demonstrated a cost savings of 38% with no weight growth compared to the metallic baseline. The fastener-free, one-piece composite JACT replaced a nine-piece aluminum assembly while eliminating approximately 400 fasteners.

Implementation

UCAV Forward Fuselage Lower Skin

TIMELINE/MILESTONES

Start Date: June 1998
End Date: October 2001

FUNDING

Air Force Navy-Jointly Funded Project
Total Government Cost: $2M
Industry Cost Share: $2M

PARTICIPANTS

The Boeing Company
Lockheed Martin
Northrop Grumman
Navy ManTech Program Office
Joint Strike Fighter Program Office
Naval Air Systems Command (Materials and Structures)
US Air Force Research Laboratory's Materials and Manufacturing Directorate
US Air Force Air Vehicles Directorate

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Generic - Fighter Aircraft

Performing Activity
Boeing St. Louis