

Rapid Airframe Production Integration Demonstration

PROBLEM / OBJECTIVE

The aerospace industry is undergoing significant changes in the way DoD aircraft programs are awarded. The shift is moving away from the award of large, multi-year programs such as the F-35 to smaller incremental contracts that may involve the initial fabrication of only 1-5 vehicles. The DoD also requires that the programs be completed at a fraction of the cost and schedule of what is typical. To meet those challenges, the Northrop Grumman Team (supported by Spirit AeroSystems for detail part fabrication) is taking a completely fresh look at how composite aircraft are designed and built.

ACCOMPLISHMENTS / PAYOFF

Process Improvement:

The Northrop Grumman Aerospace Sector team is endeavoring to “Think Different” and feels there is better way of building future aircraft that will allow the design, fabrication, and assembly of the composite structures to be performed at a fraction of the cost and schedule of traditional manufacturing approaches.

Under the Rapid Airframe Production Integration Demonstration (RAPID) program, funded by OSD’s Defense Wide Manufacturing Science and Technology program and managed by AFRL’s Materials and Manufacturing Directorate, Northrop Grumman has just completed the assembly of a complex, bonded composite, center fuselage structure. The 18-month effort involved conceptual re-design, fabrication and assembly of a center fuselage section modeled after Northrop Grumman’s X47-B. The selected fuselage section is one of the most challenging areas of an aircraft for application of composite structures. The complexity of the bonded structure can be seen in the incorporation of an integrated composite duct and very highly loaded “cat” and “trap” and nose landing gear metallic bulkheads.



Implementation and Technology Transfer:

RAPID has demonstrated methods to fabricate and assemble airframes at lower cost. The team built extensively on the work performed under AFRL’s Composites Affordability Initiative (CAI). Application of out-of-autoclave cure composite materials, 3D woven preforms, and bonded joints as well as other individual technologies used throughout the industry have been combined with novel fabrication methods that are “faster, better, and cheaper”. The end result is a composite airframe that “snaps” together with very little fabrication or assembly tooling compared to conventional composite structures.

Expected Benefits and Warfighter Impact:

Preliminary estimates predict a reduction in nonrecurring tooling costs in excess of 50% and recurring assembly cost reductions in the neighborhood of 15%. This does not even take into account the performance benefits associated with the removal of thousands of airstream fasteners. The concept is also extremely “change friendly,” enabling modifications very late in the design cycle that are typically very expensive and extremely disruptive to programs. If successfully transitioned on future programs, costly assembly jigs, autoclaves, and most of the traditional composite cure tools may become a thing of the past.

POINT OF CONTACT

POC: Dr. John Russell

Email: John.Russell@wpafb.af.mil