

Modeling and Simulation

ACO Viewpoint :

Example Working Crashworthiness Requirements via Modeling and Simulation for a Composite Fuselage to be No Worse than Current Metallic Designs

Presented to: CBA Workshop

By: William Griffith

Date: 7 August 2012



Federal Aviation
Administration



§25.307 states “structural analysis may be used only if the structure conforms to that which experience has shown this method to be reliable.”

- Current Issue for Composite Aircraft – Very Little Experience to Show Analytical Methods Reliable with Composite Material Behavior.**
- For FAA Buy-In : Applicants Should State What is Being Modeled and How That Model is Being Validated.**
- Provide Specifics and Details of the Modeling/Validation Process.**
- Ensure Enough Information is Provided to Bridge ALL Assumptions Which Are Key to Validating the Model.**
- Within Steps to Validate Model, Ensure Adequate Pass/Fail Criteria is Provided to Show Success.**

CRASHWORTHINESS EXAMPLE

(Outlined in AC 20-107B)

- **Basic Requirement is to Satisfy Descent Velocities from 0 to 30 Feet per Second Showing the Following Compared to Metallic Aircraft of Similar Size:**
 1. Items of Mass Retained
 2. Maintenance of Acceptable Accelerations & Loads Experienced by Occupants
 3. Survivable Volume Maintained
 4. Emergency Egress Paths Maintained
- **Select Metallic Aircraft Similar to Composite Aircraft (Weight/Size/Performance)**
- **Define Composite and Metallic Model – Establish and Agree on a Pass/Fail Criteria (<10% Provides Similarity to Metallic) and Agree to Model Increments (5 Feet per Second) and Checks to Stipulated Criteria (Items 1 thru 4 Above)**

CRASHWORTHINESS EXAMPLE

(Continued)

- **Use Established Material Properties/Failure Modes for Metallic Material Properties (Get ACO Acceptance) and Model Aircraft to Show Comparable Metallic Aircraft Survivable Performance**
- **Use Composite Building Block and Gated Process to Validate Failure Modes and Further Calibrate Composite Model**
 1. Test Coupons/Elements to Establish Composite Material Properties for Lower Level Model Validation and Large Model Calibration
 2. Gate Check – Technical Coordination (Between Applicant and ACO)
 3. Test Actual Details/Sub Components to Calibrate Model Further
 4. Gate Check
 5. Test Component Level – Full Drop to Validate Model at Agreed to Test Parameters
 6. Final Gate – Technical Coordination (Pass/Fail Criteria Met to Finalize Analytical Tool and Utilize Over Entire Requirement Range)



SEEK EXPERT ADVISE

- **Applicant Should Have (or Hire) the Experts**
- **Coordination with FAA via Issue Paper Process**
- **Seek Assistance from ACO and Chief Scientific Technical Advisor (CSTA)**
- **Important to Coordinate with ACO via a Gated Process Rather Than Data Dump at End of Certification Program in Order to Avoid Last Minute Surprises**

