Modeling and Simulation

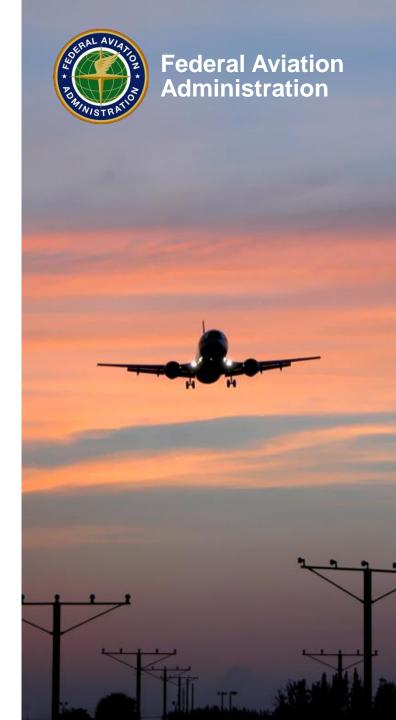
ACO Viewpoint:

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

Presented to: CBA Workshop

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§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:
 - Items of Mass Retained
 - Maintenance of Acceptable Accelerations & Loads Experienced by Occupants
 - 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
 - Test Component Level Full Drop to Validate Model at Agreed to Test Parameters
 - 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