Use of Dynamic Analysis Methods in Aircraft Certification

Federal Aviation Administration

Presented to: *Use of Dynamic Analysis Methods in Aircraft Certification Workshop*

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Welcome

- **Purpose**
- **Introductions**
  - Sign in sheet
- **Logistics**
- **Agenda**

Tour

- **Sled Facility**
- **Wed at end of meeting**

- **Drive separately, plenty of parking**
- **VCOM II Building, 2280 Kraft Drive**
- **Blacksburg, VA 24060**

Purpose

- **Review current state of use of dynamic analysis in aerospace applications**
  - Certification
  - Industry
  - Other agencies
- **Determine areas that are common**
  - Use for basis of future guidance development
  - Possibly 20 series AC
  - Can then be referenced by application specific guidance

Workshop Presentations

- **Review material**
- **Current guidance and application of guidance/policy, industry documents**
- **Works in progress**
- **Other agency applications**
- **Material from other organizations**
- **Ending with open discussion**

Activities

- **LS-Dyna Aerospace Working Group**
  - http://awg.lstc.com/
  - Engine Related Impact Failure
  - Cabin Interiors

  A partnership of federal agencies, corporations, and universities working together to develop and publish aerospace test cases and modeling guidelines for finite element analyses with LS-DYNA®. The actions of the AWG serve to support the use, development, and reliability of LS-DYNA® for aerospace numerical analyses

Activities

- **LS-Dyna Aerospace Working Group**
  - Yearly face to face meeting
  - Several telecons in between
  - Working to develop Modeling Guidelines and test cases
  - Will help support code and calculation verification and configuration control

Activities

- **FAA AC 20-146A, Methodology for Dynamic Seat Certification by Analysis for Use in Parts 23, 25, 27, and 29 Airplanes and Rotorcraft**
- **http://www.faa.gov/aircraft/draft_docs/ac/**
  - Comments due 1 Sept 2016
- **Was a mild update, but contains key concepts that will form basis for future efforts**
  - Additional details to be discussed later

Questions to consider

Questions that came up during the meeting and discussion points during the open session

- **What is the appropriate margin of safety for Analysis?**
- **When are quasi-static properties applicable?**
- **What is the statistical basis to recommend for material properties?**
- **Is it appropriate to model test fixtures?**
- **How should simulation data be treated?**
- **Composite modeling?**

Questions cont'd

- **Analyst DER or other qualifications?**
  - Qualifications on who does the analysis and how to determine adequate experience and education?
- **Do we need to require a mesh convergence?**
  - Discretization error was noted as a primary source of error.
  - Require sensitivity studies?
  - Including all of these raises the cost of the M&S

Questions cont'd

- **Is a failed test bad or can it be usable?**
  - A cert test passes, so it does not predict failure, how then can you validate a model to predict failure?
    - If model fails pretest, then test is not run
    - If model passes pretests and test fails, then model is wrong
- **Statistical basis for material properties?**
  - Allow typical for validation
  - Require A/B basis for validation

Questions cont'd

- **NASA Std 7009**
  - Has a nice checklist and might be helpful if something similar could be developed
  - Maybe even application specific

Summary

- **Was short of time**
  - Maybe longer would be better?
  - Or cut out some of the technical review?
- **Feedback**
- **Continue discussions and development**
  - Goal to be more inclusive
  - Continue path of commonality, or just focus on individual disciplines?
- **Recommendations for future meetings**
  - One thought, have the meeting be topical, e.g. material characterization