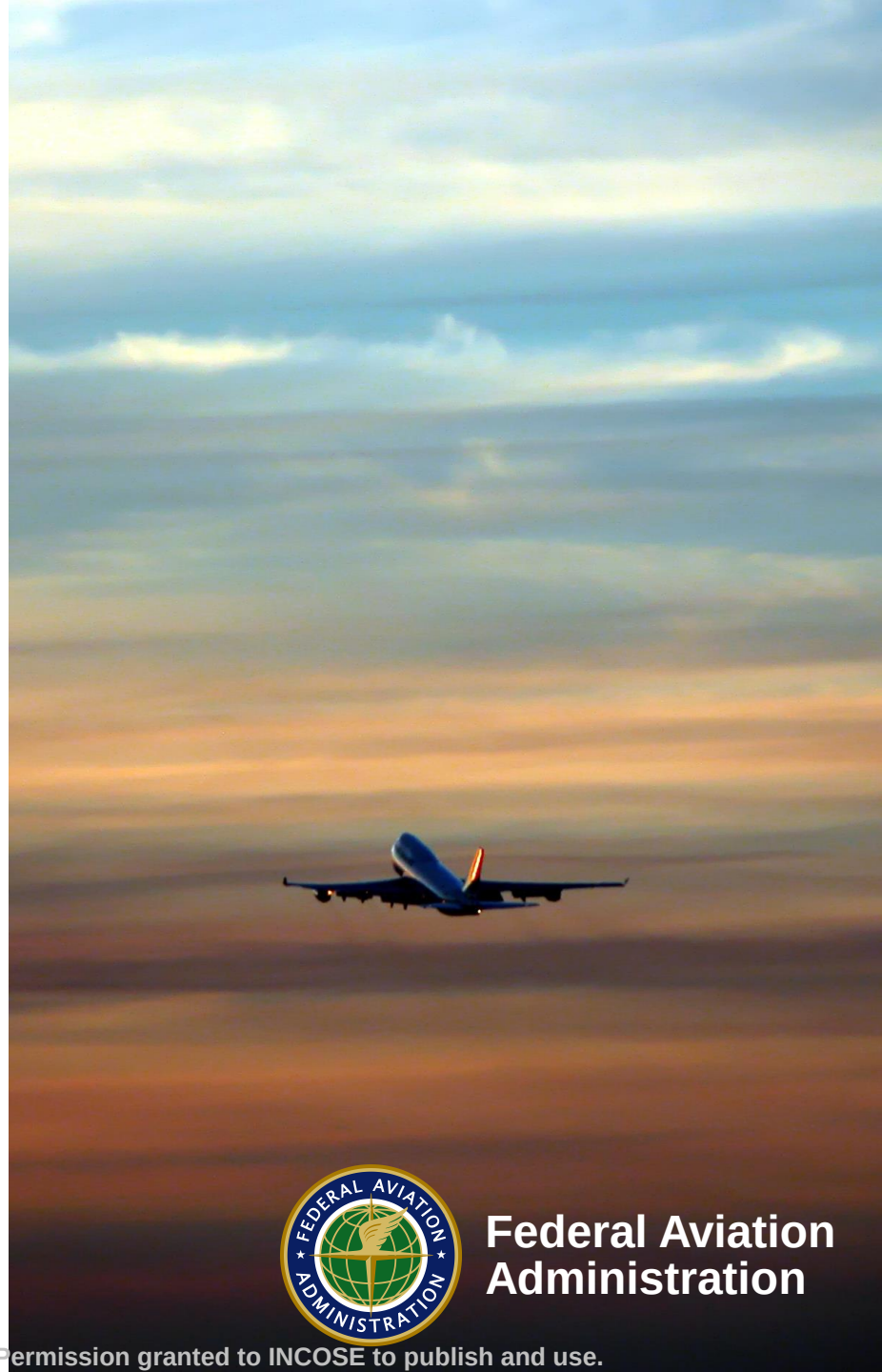
Accelerating Innovation Effectiveness: Model-Facilitated Collaboration by Regulators, Technical Societies, Customers, and Suppliers

Federal Aviation Administration



Presented to: INCOSE International Symposium

By: Joseph Pellettiere, Chief Scientific and Technical Advisor for Crash Dynamics, FAA

Date: July 2018

Disclaimer

- **Certification approvals are based on federal regulations, official FAA policy, and certification engineers – not research opinions**

Certification of Aircraft Articles

- **How do you certify an article?**
  - Demonstrate compliance with the applicable regulations
  - Sometimes in a single step and can be part of certification at aircraft level
  - Oftentimes, articles approved to an industry standard, then compliance to the applicable regulation is later demonstrated
    - Technical Standard Order (TSO)
  - Generally, compliance is through physical testing!

Certification of Aircraft Articles

- **If regulation/policy states testing *OR* analysis, applicant can use analytical modeling without a deviation**
- **Example: Advisory Circular 20-146 provides guidance for seats on:**
  - How to validate the computer model
  - Under what conditions the model may be used in support of original certification and design changes
  - If proposing to model vs. test, supply data proving model represents testing conditions/environment
- **FAA considering development of general M&S guidance**

Certification by Analysis

- **AC 20-146a**
  - Completed FAA comments
  - Completed Public comments – awaiting tech writer/legal review
- **New master AC**
  - Include AC 20-146a, but make generally applicable
- **ASME V&V 10**
  - Overarching validation document
- **SAE ARP 5765B**
  - Working on expanding
- **LSDYNA Aerospace Working Group**
  - Data sharing resolved, activities moving forward
- **Industry Processes**
  - Reviewing proposals and working to implement

FAA AC 20-146

- **Methodology for Dynamic Seat Certification by Analysis**
- **Provides high-level guidance on the validation of seat models**
- **Defines the conditions under which computer modeling can be used in support of certification**
- **Applicants using for case analysis**
- **AC 20-146a Revision**
  - Completed public comments
  - In Queue for tech writer and legal review before release

SAE ARP 5765

SAE International

Objectives

ARP5765: Analytical Methods for Aircraft Seat Design and Evaluation

The primary objectives are to provide

- Quantitative method to measure and evaluate the degree of correlation between a model and a physical test
- Best modeling practices to improve the accuracy and predictability of seat analyses

Participants

•Technical Specialist from

•Seat Suppliers
- Weber / Zodiac
- IPECO
- Recaro/Adient
- Sicma
- B/E Aerospace
- Contour

•A/C Manufacturers
- Airbus
- Cessna
- Embraer
- Boeing
- Gulfstream

•Software
- FTSS
- TASS
- ESI
- Altair

Regulatory
- FAA
- EASA

Academic
- NIAR
- VT

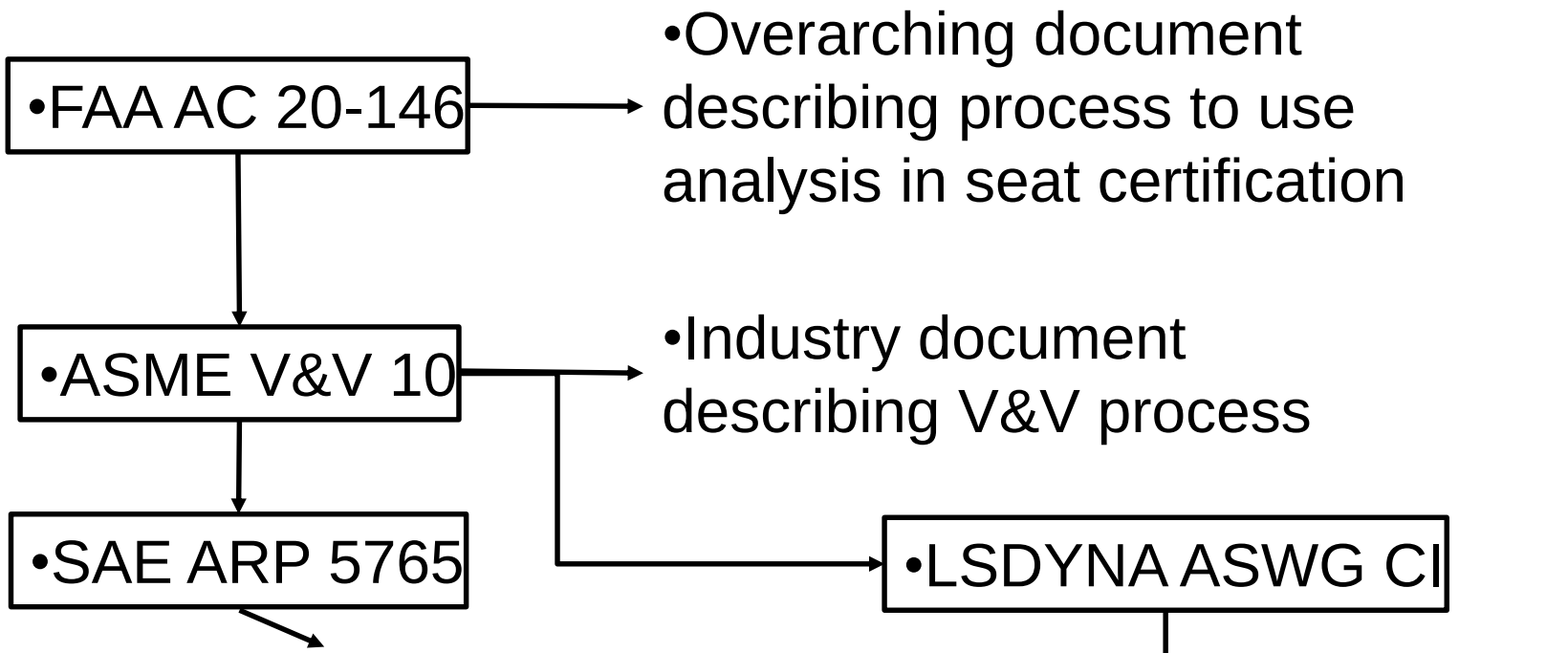
ASME V&V 10

- **ASME committee focused on writing consensus standards on verification and validation (ANSI approved)**
- **Membership includes multiple national laboratories (LLNL, LANL, SNL), DoD, FAA, GM, Boeing, non-profits (SWRI), universities, and consultants**
- **2 documents published, 2 under development**

ASME V&V 10-2006

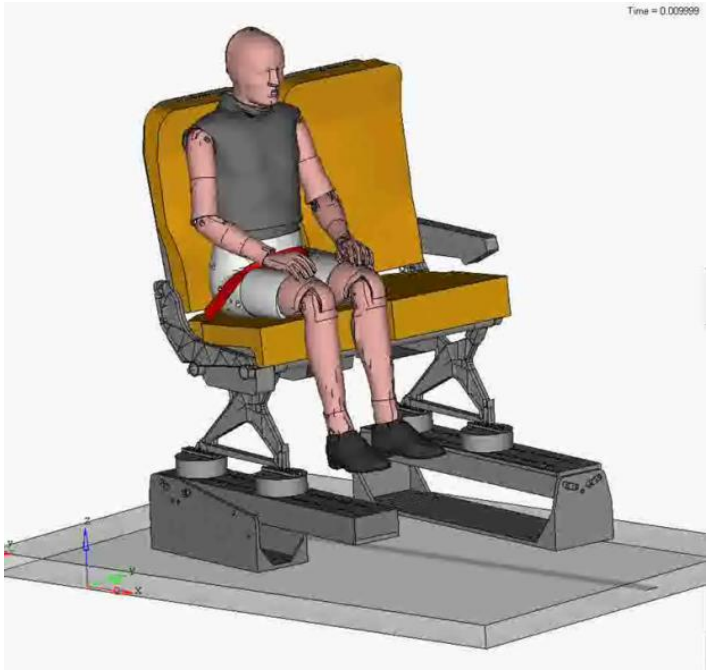
- Guide for Verification and Validation in Computational Solid Mechanics
- High level document that provides a framework for implementing verification and validation of computational models for complex systems in solid mechanics
- Provides a common language and process definition
- ASME V&V 10.1-2012: An Illustration of the Concepts of Verification and Validation in Computational Solid Mechanics

M&S Guidance - Process



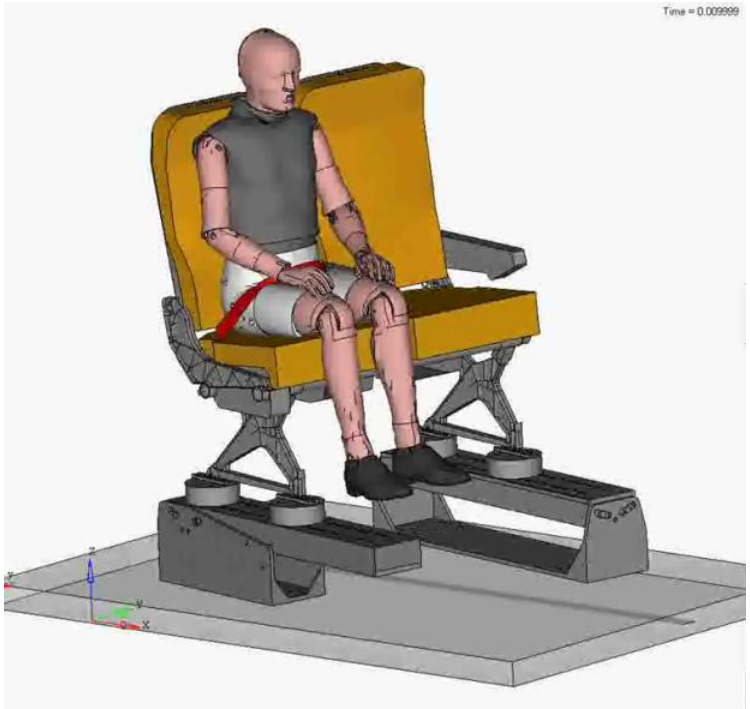
Outreach

- **Dynamic Impact Analytical Methods training course**
  - Training for AC 20-146 and SAE ARP 5765; Combined training with other disciplines
    - Birdstrike/Engine/Structures
    - Goal to work on master AC
- **FAA working with academia and NASA to expand publically available information**
  - Most industry work is proprietary



Outreach

- **Participation in Technical Societies**
  - ASME
  - SAE International
  - ASTM
- **Suppliers**
  - LSTC LS-Dyna Aerospace Working Group
  - Humanetics – v-ATD models
- **Industry Support**
  - Review of process proposals



Questions?