

FAA Composite Safety

Presented to: AMTAS

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Federal Aviation
Administration



Agenda

- **Summary of FAA's AVS Composite Plan**
 - Showing how AMTAS research supports AVS Plan deliverables
- **Status of FAA Education Initiatives**



AVS Strategic Composite Plan

- **The FAA’s mission is to “provide the safest, most efficient aerospace system in the world.”**
 - Safety is always our first priority
- **Aircraft certification, manufacturing and operational oversight is performed by the Aviation Safety Office (AVS) of the FAA**
 - AVS is comprised of 7 offices, including Aircraft Certification (AIR) and Flight Standards (AFS)



AVS Composite Plan

- **The FAA has created an AVS Composite Plan to retain leadership of international safety and certification initiatives for composite airplane structures**
 - Seven-year plan updated annually
 - Depends on industry deliverables (e.g., CMH-17 and SAE)
 - Includes FAA research
- **Three focus areas**
 - Continued Operational Safety (COS)
 - Certification Efficiency (CE)
 - Workforce Education (WE)
- **Priority is assigned to tasks based on issues that pose the greatest safety threats**



Composite Plan Initiatives (FY15)

Continuous Operational Safety (COS)	Certification Efficiency (CE)	Workforce Education (WE)
<i>COS A: Bonding</i>	<i>CE A: Hybrid F&DT Substantiation</i>	<i>WE A: Composite Manufacturing Technology</i>
Bonded Repair	<i>CE B: Advanced Composite Maintenance</i>	<i>WE B: Composite Structures Technology</i>
Metal Bond Quality Control	<i>CE C: Bolted Repair</i>	<i>WE C: Composite Maintenance Technology</i>
Sandwich Disbond Growth	<i>CE D: Quality Assurance Guidance</i>	Composite Basics
<i>COS B: HEWABI (High-Energy, Wide- Area Blunt Impact)</i>	<i>CE E: Bonded Structure Guidance</i>	Composite DER
<i>COS C: Failure Analysis of Composites Subjected to Fire</i>	<i>CE F: General Composite Structure Guidance</i>	
	Transport Crashworthiness	
<i>Support to future COS Initiatives</i> <i>Aging Composite Aircraft Teardown</i>	Lightning Protection	
	CMH-17 Revision H	

COS Initiatives

- **Three COS items identified as posing the greatest safety risk**
 - A. Bonding
 - Bonded Repairs
 - Metal Bond Quality Control
 - Sandwich Disbond Growth
 - B. HEWABI (high-energy, wide-area, blunt impacts)
 - C. Failure analysis of composites subject to fire

COS A, Bonding

- **FAA Deliverables**

- Policy to limit repair size and document requirements to substantiate repairs for U.S. Title 14 Code of Federal Regulations (14 CFR) parts 23, 25, 27, and 29 products FY2015
- Chapter in Order 8900.1 “Flight Standards Information Management System” outlining Bonded Repair Size Limits FY2016
- Advisory Circular (AC) 65-33, “Development of Training/Qualification Programs for Composite Maintenance Technicians” FY2017
- **Part 21 AC for Bonded Structure that includes Bonded Repair Best Practices FY2020**



COS A, Bonding

- **Prerequisite Industry Deliverables and Research**
 - Publication of the AC is dependent on successful completion of the following documents by industry groups: Best Practices in Bonded Repair (SAE), CMH-17 Repair Substantiation (CMH-17 Rev H), Standards for Metal Bond Process QC (ASTM D3762), Test Standards for Disbond Growth (ASTM) and CMH-17 Risk Mitigation Guidelines (CMH-17 Rev H)

AMTAS Research Supporting FAA COS A, Bonding

- **Improving Adhesive Bonding of Composites through Surface Characterization**
- **Test Method Development for Environmental Durability of Composite Bonded Joints**
- **Effect of Surface Contamination on Composite Bond Integrity and Durability**
- **Delamination/Disbond Arrest Features in Aircraft Composite Structures**
- **Durability of Bonded Aerospace Structures**



COS Initiatives

- Additionally, the FAA is involved in **research initiatives** (e.g., aging aircraft teardown) **to identify, understand, and mitigate future COS issues**
 - Supported by AMTAS research in Composite Thermal Damage Measurement with Handheld FT-IR

Certification Efficiency Initiatives

- **Certification Efficiency (CE) initiatives capture best industry practices via regulatory guidance and industry standards documents.**
- **Goal is to standardize methods to certify composite structures and repairs which will address the current industry practice of using proprietary databases and advanced procedures.**



Certification Efficiency Initiatives

- **Six CE initiatives**
 - A. Hybrid Metallic/Composite Structure Fatigue and Damage Tolerance Substantiation
 - B. Advanced Composite Maintenance
 - C. Bolted Repair
 - D. Composite Quality Control
 - E. Bonded Structure Guidance
 - F. General Composite Structures Guidance
- **Additional standardization activities in the area of transport crashworthiness, fuel tank lightning protection, and composite flammability**
 - These FAA initiatives have some components specific to composites

CE A, Hybrid Structure

- **Deliverables**

- Policy on Hybrid Structure Testing FY2016
- A new rule defining fatigue and damage tolerance requirements for the certification of composite transport aircraft FY2020
- **Associated guidance for new part 25 rule FY2020**

- **Prerequisite Industry Deliverables and Research**

- Publication of the new rule and guidance is dependent on CMH-17 Rev H F&DT updates and ASTM test standards for laminate damage propagation

AMTAS Research Supporting FAA CE A, Hybrid Structure

- **Failure of Notched Laminates under Out-of-Plane Bending**
- **Notch Sensitivity of Composite Sandwich Structures**



CE E, Bonded Structure Guidance

- **Background**

- There is an existing part 23 policy memo covering bonded structure material and process, control, design, analysis, testing, manufacturing, and repair techniques. The policy will be expanded into a part 21 AC for all product types and will include sandwich construction guidance.

- **Deliverables**

- Part 21 AC for Bonded Structure that includes Bonded Repair Best Practices FY2020 (Note this is the same deliverable as COS Initiative A for Bonded Repair)

CE F, General Composite Structure Guidance

- **Background**

- With the evolving/advancing composite technology and expanding composite applications, AC 20-107 “Composite Aircraft Structure” will require revision

- **Deliverables**

- Revision to AC 20-107, “Composite Aircraft Structure,” to incorporate advanced composite technologies and lessons learned FY2020

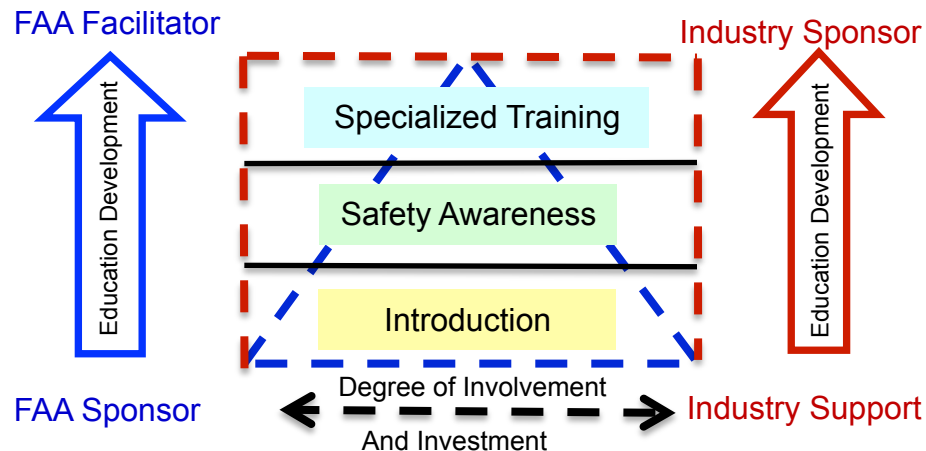
- **AMTAS Supporting Research**

- Certification of Discontinuous Composite Material Forms for Aircraft Structure

Workforce Education Initiatives

- **An essential component for COS and CE is a comprehensive educational development program**
- **Successful composite safety and certification oversight is dependent upon our workforce being knowledgeable of composite technologies**
- **Three initiatives – developed by the FAA but available to industry as well**
 - A. Composite Manufacturing Technology
 - B. Composite Structures Technology
 - C. Composite Maintenance Technology
- **Additional activities supporting “Composites 101” training and Composite DER designations**

Workforce Education Initiatives



Three levels of competency:

- **Introduction “Composites 101”**
- **Safety Awareness (courses for each functional discipline)**
 - Skills needed for FAA workforce supporting composite applications
- **Specific Skills Building (typically developed by industry)**
 - Specialized skills needed in the industry and some FAA experts

CMfgT Class

- **Composite Manufacturing Course for MIDO inspectors and designees**
- **Developed 2012-2014**
- **Offered through Wichita State University Continuing Education Department**
- **Approximately 40 hours online study over 8 weeks**
 - WSU Blackboard learning system
 - ~750 slides
 - Interactive discussion threads
 - Exams
- **Two-day Lab**
 - In person at National Center for Aviation Technology (Wichita)



Composite Structural Engineering Technology (CSET)

- Offered through Wichita State University Continuing Education Department
- **14 week course**
 - 1 week prerequisite study
 - 5 weeks online study
 - 1 week for laboratory offering (2-day lab common with CMfgT course)
 - 1 week midterm break
 - 6 weeks online study
- **Next Major CSET Update is planned for 2016**



FAA's Composite Structural Engineering Technology (CSET) Course

- **Top-level Course Objectives**
 - Students will describe essential safety awareness issues associated with composite structural engineering important to safe composite aircraft product applications
 - Students will describe engineering principles of composite airframe substantiation during all stages of aircraft product certification
- **Course Outline**
 - 1.0 Introduction
 - 2.0 Challenges of Composite Applications
 - 3.0 Design, Material and Fabrication Development
 - 4.0 Proof of Structure
 - 5.0 Quality Control of Composite Manufacturing Process
 - 6.0 Maintenance Interface Issues
 - 7.0 Additional Considerations
 - 7.1 Flutter
 - 7.2 Crashworthiness
 - 7.3 Fire safety and fuel tank issues
 - 7.4 Lightning protection

} 70% of course

Other Workforce Education (WE) Initiatives

- **Composite Maintenance Technology, CMT**
(for engineers/technicians/inspectors thru WSU)
 - Last taught in 2011
 - Updates pending development in 2016 or later (currently does not have priority)
- **Support to Level I course updates, such as CMH-17 Certification Tutorial**
- **Several specialized Level III courses planned for future**

Summary

- **The work you do supports the FAA's AVS Composite Plan**
- **FAA has developed courses which are available to the industry**

