Federal Aviation Administration

FAA Composite Safety & Certification Initiatives and Recent AC Development

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Federal Aviation Administration (FAA)

May 17, 2011
Composite Safety & Certification Initiatives (CS&CI) and Recent AC Development

- CS&CI Progress Update
- AC 20-107B Development
- AFS AC Development Efforts

[Presented by Mr. Rusty Jones]
Ongoing FAA Composite Safety & Certification Initiatives

- Actively working with industry since 1999

**Objectives**

1) Work with industry, other government agencies, and academia to ensure safe and efficient deployment of composite technologies used in existing and future aircraft

2) Update policies, advisory circulars, training, and detailed background used to support standardized composite practices

- Safety management approach used to interface with the industry
- Composite Team consists of 20+ FAA engineers & inspectors
Composite Technical Thrust Areas

Advancements depend on close integration between areas

Material Control, Standardization and Shared Databases

Progress to Date
- AC 20-107B (9/09)
- 2 other Advisory Circulars
- 6 Policy Memos
- 11 Workshops
- 3 Training Initiatives
- 2 Technical Documents
- CMH-17 Updates
- SAE CACRC Standard
- ~60 FAA R&D Reports

Structural Substantiation
- Advances in analysis & test building blocks
- Statistical significance
- Environmental effects
- Manufacturing integration

Damage Tolerance and Maintenance Practices
- Critical defects (impact & mfg.)
- Bonded structure & repair issues
- Fatigue & damage considerations
- Life assessment (tests & analyses)
- Accelerated testing
- Structural tear-down aging studies
- NDI damage metrics
- Equivalent levels of safety
- Training standards

Crashworthiness & Flammability
- Support to cabin safety research groups

Bonded Joint Processing Issues

Advanced Material Forms and Processes

Significant progress, which has relevance to all aircraft products, has been gained to date
FAA Approach to Composite Safety and Certification Initiatives

**Evolving**
- Certification and Service History
- New Technology Considerations
- Time
- Internal Policies
- Focused RE&D

**Mature**
- Rules & General Guidance
- FARs
- Advisory Circulars
- Policy Statements
- Training (Workshops, Courses, Videos)
- Detailed Background
  (various forms of technology transfer)
- Public Documents and Standards (e.g., CMH-17, SAE AMS, Contractor Reports)
- Industry Interface
- JAMS

Composite Safety & Certification Initiatives and Recent AC Developments
Important Teammates

- Partnerships with industry have been essential, including working groups & standards org. (e.g., CMH-17, SAE P-17, CACRC, ASTM, SAMPE, AGATE, SATS, RITA, SAS/IAB/AACE)

- EASA, TCCA and other foreign regulators
- NASA research and other support
  - Significant research support since 1970/1980s
  - AA587, A300-600 accident investigation
- DOD and DARPA research
  - NCAMP support to material standardization
FAA Joint Advanced Materials and Structures (JAMS) Centers of Excellence

FAA JAMS Centers of Excellence to provide research and training in support of expanding composite applications

Wichita State University
Northwestern University
Purdue University
Tuskegee University
University of California at Los Angeles
University of California at San Diego
University of Delaware

University of Washington
Edmonds Community College
Oregon State University
Washington State University
University of Utah
Florida International University
Progress in Composite Safety and Certification Initiatives

*Milestones achieved to date*

- FAA policy/training for base **material qualification & equivalency** testing for shared databases (update 2003)*
- Policy/training for **static strength** substantiation (2001)
- AC for **material procurement & process specs** (2003)*
- Policy on substantiation of **secondary structures** (2005)
- Policy for **bonded joints & structures** was released (2005)*
- Composite **maintenance & repair awareness training** (2008)*
- **AC 20-107B** (Composite Aircraft Structure) (2009)*
- National Center for Advanced Material Performance Policy (2010)
- **Revision G** to CMH-17 in work (2011)

* FAA Technical Center reports exist for detailed background on engineering practices
Recent/Future Milestones for Composite Safety & Certification Guidance & Training

Implement Composite Maintenance Awareness Course
High Energy Blunt Impact Awareness

Release CMH-17 Revision G
- Advances in statistics, test methods and data reduction protocol
- Major Volume 3 re-organization
- New Volume 6 (Sandwich)
- New certification & compliance chapter
- New crashworthiness chapter
- New safety management chapter
- Updates to damage tolerance & maintenance

Release AC 20-107B (Composite Aircraft Structure)
- NCAMP shared databases and specifications (CMH-17, SAE AMS)
  - Additional FAA/EASA/Airbus/Boeing WG initiatives
  - FAA/Industry composite education initiatives
  - Metal bond durability standards & guidance
  - Composite damage tolerance guidance
  - Crashworthiness guidance

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<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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Milestones for Composite Damage Tolerance and Maintenance Initiatives

- FAA/NRC Workshop (5/04) Composite Maintenance Overview
  - FAA Seattle Workshop (11/04) Initiate Composite Maintenance Training (CMT)
  - JAMS CMT Develop. (11/04-7/05) Draft Course Objectives/Modules
  - FAA/Industry CMT Workshop (9/05) Detailed CMT Review

Airbus/Boeing FAA/EASA Composite Damage Tolerance and Maintenance WG
  - Toulouse (9/05) Seattle (3/06)
  - JAMS CMT Develop. (7/06-10/09)
  - SAE CACRC Course Standard

- FAA/EASA/Industry Damage Tolerance and Maintenance Workshops
  - Chicago (7/06)
  - Amsterdam (5/07)
  - Tokyo (6/09)
  - White Paper on High-Energy, Blunt Impact (9/08)
  - New content in AC 20-107B (9/09)

Ongoing CMH-17 Revision G Developments (2005-2009)
Past FAA Composite Damage Tolerance & Maintenance Workshops

**Chicago, IL, USA July 19-21, 2006**

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**Amsterdam, Netherlands May 9-11, 2007**

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**Tokyo, Japan June 4 & 5, 2009**

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Presentations, recaps and breakout session summaries at: [http://www.niar.wichita.edu/niarworkshops/](http://www.niar.wichita.edu/niarworkshops/)
Summary/Observation: Damage Tolerance WG & Workshops (Y05-11)

- **Knowledge Integration**
  - Global Community Effort
  - Best Engineering Practice
  - Level Playing Field

- **Shared Objectives**
  - Safety Enhancement
  - Cost Effectiveness
  - Certification Efficiency

- **Forward Looking (Y11 and On)**
  - Areas of Challenge
  - Work Force Training
AC 20-107B Development

- AC 20-107B Issued in Sep/2009
- Justification: Need for Update
- Development – Global Efforts (FAA/EASA/TCCA, Industry Interactions)
- Review Processes
  - Clearance Record Process
  - Public Commenting Process
- Final Issuance & Post AC Efforts
AC 20-107B Outline (released in 9/09)

1. Purpose
2. To Whom This AC Applies
3. Cancellation
4. Regulations Affected
5. General
6. Material and Fabrication Development
7. Proof of Structure – Static
8. Proof of Structure – Fatigue and Damage Tolerance
9. Proof of Structure – Flutter
10. Continued Airworthiness
11. Additional Considerations

Appendix 1
Applicable Regulations & Guidance

Appendix 2
Definitions

Appendix 3
Change of Material & Process

AC 20-107A 11 pages
AC 20-107B 37 pages
Harmonized AMC 20-29

8a Damage Tolerance Evaluation
1) Damage threat assessment
2) Structural tests for damage growth
3) Extent of initially detectable damage
4) Extent of damage/residual strength
5) Repeated load testing
6) Inspection program
7) Discrete source damage
8) Environmental effects

8b Fatigue Evaluation

8c Combined Damage Tolerance and Fatigue Evaluation
Need for AC 20-107A Updates

- AC 20-107A issued on 4/25/1984
- Inputs collected from certification projects (20+ years) (Noted by FAA Directorates)
- Continued evolvement of composite technology
- Gatwick Meeting (March 2003) - Understanding
- FAA Composite Safety & Certification Initiatives (CS&CI) developed more definitive guidance
Gatwick Meeting - Understanding CAA (Gatwick, UK) Meeting (March 20 & 21, 2003)

- All participants agreed on a need for revision
  - Harmonization (FAA/EASA)
  - Remove obsolete guidance
  - Key technical areas should include industry and regulatory composite experts
- To retain this AC as a “general composite guidance”
  - Other more definitive guidance is also needed as industry standards evolve

*Gatwick inputs were initial basis for FAA current plans*
AC 20-107B Development Biz Plan


- Key Milestones
  ^ FAA Internal Review – Fall 2008
  ^ Public Commenting – Spring 2009
  ^ Final Issuance – September 2009
AC 20-107B Development Effort

- A Joint Effort of Global Community
  - FAA Development Team Meeting (Seattle, Dec/07)
  - FAA/EASA/TCCA/LBA Meeting (Cologne, Apr/08)
  - FAA/EASA/TCCA/LBA Meeting (Seattle, Jun/08)
  - Interactions with Industry
    - CMH-17 Mtgs – Cocoa Beach, Ottawa & Salt Lake City
    - CACRC Meetings – Wichita, Athens & Minneapolis
    - EASA-Industry Meeting – Cologne
AC 20-107B Review Processes

- Clearance Record Process (CRP)
  - Initiated in Oct/2008
  - Comments Received from AFS & AIR (250+)
  - Additional (Informal) Comments
    ^ CACRC Meeting
    ^ CMH-17 Meeting
    ^ Europe Industry
  - Development Team Conducted Review/Disposition
  - AC Updated per Disposition in Apr/2009
AC 20-107B Review Processes

- Public Commenting Process (PCP)
  - Initiated in May/2009
  - Comments Received from Global Communities (165+)
  - Development Team Conducted Review/Disposition
  - AC Updated per Disposition in Aug/2009
AC 20-107B Final Issuance

- AIR-100 Fine-Tuned AC Format
- AIR-100 Manager Approved AC
- FAA Issued AC 20-107B (9/8/09)
- “Change 1” (minor items) (Aug/10)
  ^ wordings
  ^ format
  ^ page-number
Post AC 20-107B Activities

● Harmonization Efforts

- AC 20-107B & AMC 20-29
  ^ FAA/EASA Meeting (Cologne, Dec/09)
  ^ FAA Participation on EASA CRD
  ^ EASA Issued AMC 20-29 (7/26/10)

- AC 20-107B & TCCA Guidance
  ^ FAA/TCCA Meeting (Ottawa, Aug/10)
Post AC 20-107B Activities

- AC Seminars & Industry Meetings
  - ^ Atlanta ACO Seminar (Nov/09)
  - ^ Rotorcraft Directorate Seminar (Mar/10)
  - ^ EU Industry Meeting (Hamburg, Apr/10)
  - ^ Los Angeles ACO Seminar (Jul/10)
  - ^ LA Area Industry Meeting (Jul/10)
  - ^ Denver ACO Seminar (Aug/10)
  - ^ Canada Industry Meeting (Montreal, Nov/10)
  - ^ SmAD (incl. ICT ACO) Seminar (Mar/11)
  - ^ DT Workshop Industry Meeting (Atlanta, May/11)

(-- Seminars/Meetings for FY 11-12 --) [TBD]
AFS AC Development Efforts

- **Draft Advisory Circular 65-CT**
  - Development of Training/Qaulification Programs for Composite Maintenance Technicians

- **Advisory Circular 145-6**
  - Repair Stations for Composite and Bonded Aircraft Structure
PURPOSE

• Guideline for organizations to develop a formal training program for qualification of composite technicians.

• Recommendations for the experience, training, qualification, and examination of persons performing maintenance and repair of aircraft composite structures.

• Organizations may use the information contained in this AC to develop a written practice.

• Not regulatory!!
Composite Maintenance and Repair:

• The maintenance and repair of composites is complex and requires knowledge and skills to assure the continued airworthiness of these products.

• Experience, classroom training, hands-on, on-the-job training (OJT), and assessments all work together to ensure that the necessary skills
Composite Maintenance Training

- Course training curriculum (sample in Appendix 1), should be tailored to individual operator needs.
- Classroom/written tests,
- Demonstrations, and
- Hands-on-training/practical tests.
PERSONNEL QUALIFICATIONS

• Control and Administration Program (Certificate holder);
• Training Instructors;
• Formal Training;
• Qualification (based on demonstration of satisfactory performance)
ASSESSMENTS:

- **General Knowledge Assessment** (may be an open book test consisting of questions that cover the basic knowledge of composite repair methods, materials, and procedures)
- **Practical Assessment** (Documentation is required)
- **Recognition of Prior Experience**
- **Continued Competence**
- **All components must be documented!!**
Status Update:

- Internal comment disposition complete.
- Posted for “public comment” for thirty days.
- Public comments received and dispositioned.
- Final version reviewed and signed by Manager AFS-320 (May 4, 2011)
- Final management signatures and publication expected by the end of May.
Advisory Circular 145-6

• Repair Stations for Composite and Bonded Aircraft Structure
• Will be superseded by:
  – 43-XX as the AC is not germane to repair stations but rather to all aspects of composite repair.
  – Repairs and Alterations to Composite and Bonded Aircraft Structure
• Originally published 11/96
Team concept

- AFS-320, FY 2011 Business Plan Item
- 1 member Flight Standards
- 2 members Aircraft Certification
- 1 member Aircraft Evaluation group
- AFS-320 lead
- Input solicited from other FAA personnel overseeing composite maintenance and repair.
PURPOSE.

This advisory circular (AC) provides information and guidance concerning an acceptable means, but not the only means, of demonstrating compliance with the requirements of Title 14 of the Code of Federal Regulations (14 CFR) parts 21, 43, 121, 125, 127, 135, and 145 regarding procedures and facilities for repairs and alterations of structure.
• Provides general guidance for an operator to manage a composite repair facility.
• Not intended to define all aspects of composite repair facilities.
• Will be revised as more composite aircraft enter into service utilizing lessons learned and input from organizations such as CACRC.
Expanded areas

Data Requirements and Compliance.
  – SFAR 36 authorization (no longer applicable)

• Data Types
• Material Specifications
  – Purchaser Quality Control.
  – Storage Conditions
• Material Handling and Storage Procedures
• Qualified personnel (reference AC 65-CT)
Areas simplified

• NDI
  – Awareness that NDI is an integral part of repair process both pre and post repair.
  – Methodologies constantly changing
  – No need to describe all the individual methods and techniques
Conclusion

- Draft completed February 2011
- Internal comments have been dispositioned
- Sent to the contractor 4/12
- Will be posted for public comment, expected early summer
- We recognize all the input CACRC and others had in developing the original AC and welcome your inputs in the revision.