Aviation Safety Initiative: Bonded Structures

Substantiation of Bonded Repair – Task Group (SoBR-TG)

Bonded Repair Prerequisites

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NEW CMH-17 V3 Ch14 §14.6.2 “Prerequisites” Sections

• Prologue
  – “Prerequisites” content still work in progress
  – DRAFT excerpts shown herein
  – This presentation not intended to present what the content will be, but rather to discuss what it should contain
  – Objectives of this presentation
    • Clarify “Prerequisites” concept/intent
    • Introduce topics SoBR-TG currently writing content to address
    • Solicit discussion on whether the topics accomplish the intent or if expansion is required
• Status of “Prerequisite” sections development
  – Content still evolving
  – Reference SAE/CACRC documents for content when available

• Silly example of “Prerequisite” concept:
  – Say I give you $5 to cook me an egg.
  – Some prerequisites I assume you have in control are: You know what an egg is. You have one or can get one. You know what kind to get. It will be fresh. You have a kitchen. You have a stove. The temperature of the stove can be accurately controlled. You have a pan to cook the egg in. You have a cook. The cook can operate the stove. The cook has a spatula. Your kitchen, stove, pan and spatula are clean and to code. The cook’s hands are clean. The cook knows how to cook my egg as ordered. Etc....

• Objective of §14.6.2 “Prerequisites” sections to establish credential expectations on repair entity to assert itself competent and equipped for composites repair
  – What are the “key” facility, infrastructure, people and governance prerequisites?
  – Can §14.6.2 “Prerequisites” sections be used to complement AIR6292?
14.6.2 Prerequisites for repair of composite and metalbond structure

14.6.2.1 Approved data
14.6.2.2 Material and process specifications
14.6.2.3 Purchase control
14.6.2.4 Raw material storage and handling
14.6.2.5 Qualified materials
14.6.2.6 Facilities and work space control
14.6.2.7 Contact and non-contact materials
14.6.2.8 Equipment calibrations
14.6.2.9 Technician/inspector/engineer qualifications and training
14.6.2.10 Tooling and repair-work-station challenges to ensure proper form and fit
14.6.2.11 Quality Control
14.6.2.1 Approved data
- In FAA system,
  - Repair data classified “approved” or “acceptable” by Administrator
    - Depends on whether repair major or minor respectively
    - Major repairs require approved data
    - Minor repairs can be accomplished using data acceptable to Administrator
  - Approved data is approved by FAA or FAA delegate such as DER, ODA or DOA in EASA system
  - Sources of approved data include:
    - Direct application to FAA for approval
    - SRM data for Transport Category aircraft
    - DER/ODA/DOAH with special delegations to approve major repairs
  - Sources of acceptable data include:
    - Structural Repair Manual (SRM)
    - Aircraft Maintenance manual (AMM)
    - Component Maintenance Manual (CMM)
    - Service documents
    - Other National Aviation Agency approvals
- Current advisory material should be consulted for additional detail and current interpretation.
14.6.2.2 Material and process specifications

- FAA Advisory Circular AC 43-214.2016 “Repairs and Alterations to Composite and Bonded Aircraft Structure” (reference 14.6.2.2 (a)) summarizes for composite and metal bonded repairs the relevance of these specifications and their minimum content.
14.6.2.3 Purchase control

- Complexity of material supply and distribution illustrated in FAA AC 43-214
  - Offers differing approaches to quality control testing and receiving inspection depending on if material purchased from approved vendor, and on the quality procedures among manufacturer, vendor and purchaser
- V3 Ch6 §6.2.2 and §6.2.3 explain the rationale of material control at the supplier level and at the purchaser level, respectively
- Typical acceptance tests at supplier and purchaser are presented in V3 Ch6 Table 6.2.2.3 and in AC 43-214.2016
- Further information available in:
  - SAE AIR6291 “Guidelines for Repair Process Evaluation of Aluminum Bonded Structure”
14.6.2.4 Raw material storage and handling

- References for necessary precautions to be considered
  - SAE AIR6291 “Guidelines for Repair Process Evaluation of Aluminum Bonded Structure”
NEW CMH-17 V3 Ch14 §14.6.2 “Prerequisites” Sections

• 14.6.2.5 Qualified materials
  – Content still too incomplete to show

• 14.6.2.6 Facilities and work space control
  – Content still too incomplete to show

• 14.6.2.8 Equipment calibrations
  – Content still too incomplete to show

• 14.6.2.7 Contact and non-contact materials
  – Content still too incomplete to show
14.6.2.9 Tech/inspector/engineer qualifications & training

- FAA Advisory Circular 65-33 “Development of Training/Qualification and Certification Programs for Composite Maintenance Technicians” issued as aid in developing an effective qualification program

- All players should be familiar with
  - Relevant SRM and repair requirements
  - All phases of a repair and criticality of each step

- The Commercial Aircraft Composite Repair Committee (CACRC) has developed multiple documents through the “Training Task Group” outlining curriculums from basic safety awareness to apprentice level qualification:
  - AIR4938A: Composite and Bonded Structure Technician/Specialist Training Document
  - AIR5278: Composite and Bonded Structure Engineers: Training Document
  - AIR5279: Composite and Bonded Structure Inspector: Training Document
  - AIR5719: Teaching Points for an Awareness Class on "Critical Issues in Composite Maintenance and Repair"
  - ARP6262: Basic Composite Repair Technician Certification Standard
14.6.2.10 Tooling and challenges to ensure proper form and fit

- Repairs may require tooling to ensure geometric integrity
- Critical loft or aero-smoothness areas can drive precision cure tools
- Support cradles, jigs, and cure tools must be developed prior to repair
- Layup cure tools must be thermally mapped
  - Ensure uniformity and control during cure
  - Thermal mass, insulation, and support structure should be considered
- Pre-load in final assembly must be minimized
  - May require alignment jigs or drill fixtures
- Special attention in accurately recreating original interface geometry(s) helps mitigate risk of misalignment at assembly
14.6.2.11 Quality Control

- Repairs should be governed by approved work instructions
  - With inspection requirements at completion of significant process steps
- Quality control of bonded repairs begins with incoming material
  - Check for certificate of conformity, correct part numbers, condition, expiration dates and time/temperature during freezer-to-freezer transport
- Quality dependent on training and qualification of all members of repair team (engineers, inspectors, repair technicians)
  - All steps in process should include signature block for accomplishment
  - For critical structure, two individuals may be required to sign
END

Thank you.