



Bonded Structures Workshop

Repair Implementation-Summary

Design for Bonded Repairs

- Software to optimize repair layups
- Develop a fracture mechanics approach to analysis of bonded original structures and repairs
- A simple PC based analysis tool to design and substantiate repairs
- A4EI and BJAM type analyses-need to look at non-uniform shear stresses in bondlines
- Looking forward to CACRC operators' analysis tool and MIL HDBK-17 OEM analysis tool
- Shared OEM base and repair material databases would help airlines and MROs, but don't hold your breath
- Bondline strength and durability analyses are needed



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Repair Material and Process Control

- Standardized repair materials would alleviate the availability problem
- Material suppliers are not interested in furnishing small lots
 - Obtaining small lots from second tier suppliers can be problematic due to lack of warehouse/shipping controls
- Repair environment needs to be controlled
- Good surface preparation paramount
- Moisture elimination for thin face sheet sandwich, but for thick laminates not possible
- Companion coupons can be proof of cure, but do not guarantee bondline integrity
- Processes need to be robust and repeatable
 - Cure temperature ranges can be opened up, e.g. F18E/F
 - Cold spots within heat blankets



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Considerations for Research and Development for Bonded Structures

- Bondline strength and durability prediction capability needed
- Multi-tiered SRMs
 - Qualification for upper tiers
 - Operator experience, facilities and expertise

Certification and qualification of complete repair system

- Repair technicians, QA staff, engineering and regulators
- Repair materials
- Repair process
 - Environment
 - Surface preparation
 - In-process controls

Failsafe considerations for bonded primary structural repairs

- Fasteners in bondline not recommended
- Limit load requirement in the event the repair falls off-conservative, but less risk
 - US Navy-on carrier repairs
- Confidence from service experience will allow bonded repairs for damaged components with less than limit load strength
 - AOG repairs