

Breakout Session:
*Damage Tolerance and Repair
Substantiation*

LEF Discussion

- Since LEF is dependent on material system and on the fatigue detail in question, the LEF given during the workshop presentations cannot be used for repair
- Recommend expanding database to address
 1. Bolted joints
 2. Adhesive/bonded joints

Substantiation of substitute repair materials

- Colin pointed out that they work on components with procedures in place for substantiating use of substitute repair materials (two products)
 - Test Requirements for Case 1
 - SET OF LAMINA TESTS (TENSION, COMPRESSION, INPLANE SHEAR, INTERLAMINAR shear) for range of temps under consideration, (all specimens conditioned to equilibrium). (Six specimens per temp per property)
 - INTERFACE CAPABILITY (WITH ADHESIVE) 6 specimens for each temp (all conditioned to equilibrium. FED TO STRESS AND ANALYZED AROUND 4 TEMPS 40 SPEC'S PER STRENGTH)

Substantiation of substitute repair materials

– Test Requirements for Case 2

- LAMINA TESTS FOR START FOR EACH TEMP THEN LAMINATE tests STATIC tension and compression (RTD & ETW) AND FATIGUE (RTD) TENSION & COMPRESSION. Laminates include damage (manufacturing, impact and holes)
- The second is much more extensive than the first. Not clear why. Need standard approach.

Substantiation of substitute materials using “repair class approach”

- Pointed out that Borgman was not clear on intent during presentation that touched on repair class substantiation approach
- Was not clear he was not talking in generalities aimed as PSE's

Breakout session discussed *SSE* with *Class 1 damage* (ult capable ^w/damage)

- General concurrence that it may be legitimate to have a repair scenario substantiated by a reduced volume of data (relative to new aircraft design)
- Need test evidence that with the repair intact we have ultimate capability and that...
- In event “significant” damage has occurred to the repair two things are true:
 1. The structure is still capable of ultimate load
 2. The damage state is readily inspect-able so repair can be reworked

Breakout session discussed SSE with class 1 damage (ult capable w/damage)

- Approach won't work unless "ADL" and "RDL" have standard meaning
- To test for substitute material equivalency, may be able to define a set of tests to run on the SRM designated material and use results as "performance target" for substitute material

Breakout session discussed SSE with class 1 damage (ult capable w/damage)

- Understanding of environmental requirements is a stumbling point
- Need to know what substitution is worth to the repair entity
- WE didn't identify all of them but feel that there are too many questions to allow each repair entity to choose their own "preferred material"
- Should converge on a single material across everyone (like CACRC target)

Breakout session discussed SSE with class 1 damage (ult capable w/damage)

- When demonstrating equivalency: Two issues exist for consideration 1) Compatibility and 2) structural substantiation
- What is worst environment
- Is strength vs. environment trend equivalent. Probably need to test a bunch of different environments
- Surface restoration capability
- Stiffness compatibility
- Scatter (batch to batch variability and process yield variability)

Breakout session discussed SSE with class 1 damage (ult capable w/damage)

- Step 1: Visit with OEM's with all relevant disciplines represented and characterize all drivers that lead to definition of ADL and RDL
- Define substantiation strategy to address the concerns