Substantiation of Bonded Repairs

Boeing Commercial Airplane
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FAA/Bombardier/TCCA/EASA/Industry
Composite Transport Damage Tolerance and Maintenance Workshop
Substantiation of Bonded Repair

Structural Substantiation of Bonded Repairs

Full-scale tests

Component tests

Sub-component tests

Structural elements tests

Allowable development

Material specification development

Material screening and selection

Analysis verification

Design-value development

Material property evaluation


Structural Substantiation of Bonded Repairs

- **Material Screening**
  - Only done if evaluating new or improved repair materials

- **Material Specification Development**
  - Process development/improvement testing to account for the “repair environment” (e.g. vacuum pressure, less controlled humidity, etc.).

- **Allowables Development**
  - To the extent necessary to develop repair process induced corrections to baseline allowables. Repair specific materials require full allowables development.

- **Sub-Component/Structural Element**
  - Bulk of substantiation and methods validation testing is done at this level, verifying structural properties at a larger scale as well as failure modes and locations.

- **Component Test(s)**
  - Planned and unplanned repairs were fabricated. Substantiation and analysis validation of repair performance on complicated scale and loading.

- **Full Scale Test(s)**
  - Rarely done as part of repair substantiation although any unplanned repairs are monitored
Issues and Concerns from an OEM’s perspective w/substantiation of beyond SRM limit for bonded repairs:

1. Difficult to impossible to replicate OEM configured panel testing, fabrication of test panels requires qualification to production process specification(s), testing requires knowledge of boundary conditions, loading conditions, environments, etc. from original OEM substantiation testing.

2. Requires prior knowledge of the critical failure mode(s) and margins are not available outside of the OEM.

3. Unconfigured panel testing (or smaller element/coupon testing) yields results not representative of the structural requirements of the configured structure (combined loads interactions, stability modes, etc.).

4. Coupon/small element data cannot be analytically “bridged” to configured panel performance without item 2 knowledge (and is very difficult/impossible) even with that knowledge.