

Breakout Session on Damage/Defect Types and Inspection Technology

The following charts document the results of a session conducted at the July 2006 FAA Composite Damage Tolerance & Maintenance Workshop.

The basic charts were prepared in advance of the session to facilitate brainstorming and discussion, and the text and/or slides highlighted in **red** represent comments and feedback provided by workshop participants during the session.

On chart number 5, the yellow-shaded cells are intended to improve visualization of “Good” techniques for participants. Likewise, the blue-shaded row label cells represent defects/conditions for which there are no “Fair” or “Good” NDI techniques identified.



Breakout Session on Damage/Defect Types and Inspection Technology

Primary objective: Address safety concerns & technical issues for damage/defect types and inspection technology.

Secondary objectives

1. Discuss damage & defect types and inspection technology used for manufacturing, field inspection and repair
2. Discuss elements of safety management
3. Identify needs for regulatory requirements & guidance
4. Identify training developments needs for inspection
5. Identify needs for standards (guidelines, inspection samples)
6. Provide directions for research



Damage/Defect Types & Inspection Technology

- Discussion of damage/defect types associated with each category, and inspection methods/strategies for each
 - Category 1: Allowable damage that may go undetected
 - Category 2: Damage detected by field inspection
 - Category 3: Obvious damage detected within a few flights
 - Category 4: Discrete source damage known to pilot
 - Category 5: Severe damage created by anomalous ground or flight events (not covered by design and maintenance experience)
- Safety concerns: if associated technical issues for detection, disposition and subsequent repair inspection for a given category of damage are not covered by current industry practices
- Other discussion points (as time allows)
 - Damage assessments
 - Structural design construction

Types of Defects/Damage

- Defects/Damage Types
 - NVID/BVID
 - Visible impact damage and penetrations
 - Scratches, gouges, surface and coating imperfections
 - Fluid and moisture intrusion (in sandwich structures)
 - Delaminations and disbonds
 - Chemical/corrosion damage
 - Thermal damage
 - Other



Inspection Technologies

- Visual inspection
- Tap testing
- Ultrasonic – various techniques
- Shearography
- Thermography
- Microwave (or Millimeter Wave)
- Radiography
- **Thermo Sonics**



Safety Concerns for Damage Detection, Disposition and Repair Inspection

- Ability to rapidly inspect large areas
- Safety impact of large damage to secondary structures
- Blunt impact damage detection and assessment
- Inspection of bonded repair integrity
- Damage selective method
 - Human factors associated with interpretation
 - Baseline information on the structure
- Access to the damage for visual inspection
- Environment, lighting and human factors (limitations) in inspection
- Engineering data to assess the extent of deterioration of a damaged part



Safety Concerns for Damage Detection, Disposition and Repair Inspection

- Economic pressures (safety management issue – lack of proper inspection detection, standards and training, water vs. debond)
- Qualification of inspectors and inspection technique (more for NDI world, not the airline community)
- Older aircraft documentation – obsolete documentation and lack of support
- Heat damage – validated NDI method
- Inspection for contamination (skydrol and water combination) What other combos of environments and materials were not evaluated in the initial qualification?
- Identify methodology for detection of contaminants and deteriorations.



Discussions of Inspection Technology Used for Different Damage/Defect Types

- Other safety concerns (not addressed in the discussion on previous chart for damage detection, disposition and repair)
 - None
- Present practices & associated challenges
 - Ability to relate allowable damage to the individual parts structural requirement.
 - Training issues
 - Ability to understand the damage and implications.
 - Transfer of experts in metal to composite structures
 - Training for ground operators and pilots
 - Ground operations (jacking, etc...)



Discussions of Inspection Technology Used for Different Damage/Defect Types

- Technical “Gaps”
 - Detection of minor impact (see slide 6 for details)
 - Detection of Kissing debonds, uneven bond and weak bond
 - Data on the original strength and degradation over time. How much is acceptable? Preventative action is preferred.
- Regulation needs (missing rules, guidance & training)
 - Training requirements for operators (ground handling personnel and pilots), engineers (DER and OEM), inspectors (DMIR, airlines, IA and A&P mechanics) and technicians
- Urgent issues for next workshop
 - Certification of new aircraft (SRM, allowable damage, inspection validation, etc...)
 - More time in breakout session (shift time away from presentations given the audience’s experience)



