Airline Perspectives on the Constraints of Bonded Repair Size Limits

May 17th, 2011

Presented by:
Todd M. Herrington
Principal Engineer
Composite / Bonded Repair
Airline Perspectives on the Constraints of Bonded Repair Size Limits

May 17th, 2011

Part 1 – Examples of OEM authorized repairs by part type

Part 2 – Examples of damages not supported by OEM repairs

Part 3 – Available resources at Airline / MRO organizations
Part 1:
Examples of OEM Authorized Permanent Repairs by Part Type

• PSE / FCS Structure
• Non-FCS Flight Control Structure
• Secondary Structure
PSE / FCS: Flight Control Assemblies

**MD88 Rudder** - OEM authorized splice of rear spar (right) and significant trailing edge skin replacement. Techniques consist of pre-cured autoclave patches cured at 350 degrees F (using original materials) and secondarily bonded to part using 250 degree F vacuum pressure.
767 Rudder – In non-critical areas, OEM SRM authorizes unlimited size repair of rear spar and skins. Techniques consist of vacuum bag cured repairs cured at 350 degrees F (using original materials). Critical areas are usually supported on a case by case basis.
767 Aileron - OEM SRM authorizes replacement of skins and core with use of 250 degree F prepreg repair processes in non-critical areas. This repair example extends into critical areas and was approved by the OEM.
**PSE / FCS: Flight Control Assemblies**

**767 Aileron** - OEM SRM authorizes replacement of skins and core with use of 250 degree F prepreg repair processes in non-critical areas. This repair example extends into critical areas and was approved by the OEM.
Airline Perspectives on the Constraints of Bonded Repair Size Limits

MD88 Elevator - OEM SRM authorizes some repairs of limited size, however, on case by case basis, repairs are authorized for significant sizes using 350 degree F prepreg using same materials as the original structure. Example shown used pre-cured patches secondarily bonded to original structure using 250 degree F film adhesive.
Non-FCS Flight Control Structure

757 Aileron - OEM SRM authorizes replacement of skins and core with use of 350 degree F prepreg repair processes using original materials in non-critical areas. This repair example extends into critical areas, including the spar and was approved by the OEM.
Non-FCS Flight Control Structure

757 Aileron - OEM SRM authorizes replacement of skins and core with use of 350 degree F prepreg repair processes using original materials in non-critical areas and spar and...
757 Aft Flap - OEM SRM authorizes replacement of skins and core with use of 350 degree F prepreg repair processes using original material. There are no size, proximity or any other restrictions. There are no critical areas.
Non-FCS Flight Control Structure

MD90 Spoiler - OEM SRM authorizes some repairs of limited size, however, on case by case basis, repairs are authorized for significant sizes using 350 degree F prepreg using similar materials to the original structure.
Non-FCS Flight Control Structure

767 Aft Flap - OEM SRM authorizes virtually unlimited size repairs using original materials and processes common to the original structure. All metal bond repairs, regardless of location or structural classification, have the same reparability for this aircraft type.
Non-FCS Flight Control Structure

MD90 Spoiler - OEM SRM authorizes some repairs of limited size, however, on case by case basis, repairs are authorized for significant sizes using 350 degree F prepreg using similar materials to the original structure.
Secondary Structure

757 Fan Cowl (PW 2000) - OEM SRM authorizes unlimited size repairs in non-critical areas using 350 degree F prepreg repair processes using same materials as original structure. This example shows an OEM approved repair in a critical area near a latch.
Secondary Structure

757 Fan Cowl (PW 2000) - OEM SRM authorizes unlimited size repairs in non-critical areas using 350 degree F prepreg repair processes using same materials as original structure. This example shows an OEM approved repair in a critical area.
Part 2:
Examples of damages not supported by OEM repairs

• PSE / FCS Structure
• Non-FCS Flight Control Structure
• Secondary Structure
Secondary Structure

767 Fan Cowl (CF6-80C2) - OEM SRM authorizes very small damage sizes using wet lay-up repairs. There are no 350 degree F repair options. This example shows a damage that the OEM considered beyond repair.

DAMAGE AREA IN RED BOX
(26” x 8”)

Airline Perspectives on the Constraints of Bonded Repair Size Limits
Secondary Structure

767 Fan Cowl (CF6-80C2) - OEM SRM authorizes very small damage sizes using wet lay-up repairs. There are no 350 degree F repair options. This example shows a damage that the OEM considered beyond repair.

Airline Perspectives on the Constraints of Bonded Repair Size Limits
Airline Perspectives on the Constraints of Bonded Repair Size Limits

**Secondary Structure**

**MD90 Fan Cowl (V2500-D5)** - OEM SRM authorizes very small damage sizes using wet lay-up repairs. There are no 350 degree F repair options. This example shows a small corner damage that the OEM considered...
Secondary Structure

MD90 Nose Cowl (V2500-D5) - OEM SRM authorizes very small damage sizes using wet lay-up repairs. There are no 350 degree F repair options. This example shows a small corner damage that the OEM considered beyond repair.
Secondary Structure

767 Fan Cowl (CF6-80C2) - OEM SRM authorizes very small damage sizes using wet lay-up repairs. There are no 350 degree F repair options. This example shows a damage that the OEM considered beyond repair, however, it was later learned that the OEM authorized its own repair station to repair the damage.
Part 3:
Available resources at Airline / MRO organizations

- Technology Snap Shot
- Maintaining Critical Dimensions
- Maintaining Critical Processes and Cleanliness
Complying with OEM Restorative Repair Procedures

Manufacture data, technology for design and fabrication of proper tools, automation and equipment are widely available today in the repair station industry.
Complying with OEM Restorative Repair Procedures

Reverse Engineering tools, loft data transfers from OEMs and bondline control tests are becoming more widely used by airlines and top tier repair stations.
Quality assurance tools such as various self generating surface check reports, NDI advances and First Article / Qualification plans help catch problems in the repair design before flight.
Advances in CAD desktop systems has increased the speed and comfort level for mechanics, engineers and inspectors during accomplishment of QA oversight procedures.

On the floor, design can be overlaid digitally on the repair parts and tools so that a manufacturer’s level of control can be maintained in a repair environment.
Many repair stations have pursued manufacture certifications for bonding, implementing Controlled Contamination controls, time and temperature sensitive QA environments and adherence to OEM specs and standards for bonding.
Questions?
Thank You