Composite Repair Roadmap
Outline 2019

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Voice of the Customer – Repair Requirements

• Repair criteria compiled
  • OEM Design & Engineering Input
  • Service Logistics Requirements
  • DoD JSSG and M&P Specs

• Permanent repair except for BDR

• Restore Structural Integrity
  • Strength, durability and reliability

• Allowables derived from realistic materials and processes for design

• Most efficient maintenance time, consumables & facilities to minimize readiness impact

• O level preferred by logistics
  • Austere shipboard environment
  • Ambient storage and installation
  • Minimize demand on logistics thru common materials & processes

• Repair method qualified & scalable
Approach to Meet Engineering & Logistical Requirements

• Structural repairs – permanent & reliable
  • Repair engineering starts with damage assessment and characterization via NDI
  • Pre-engineered common repairs documented in an SRM & provisioned onsite
  • Engineering repair of major damage via digital thread to OEM and/or depot

• Logistics drives O-level suitability & maintenance readiness

• OEM, DoD engineering & logistics coordinate to minimize maintenance time & maximize readiness
Repair Concept Breadth, Versatility & Scalability

• Time, skill & cost constraints (business case) drive repair methods and location
• Seek maximum versatility of repair concepts, materials & methods
• Scalability of repair concepts would minimize inservice engineering & logistical problems
• Document designs and procedures in SRM and -21 type manuals for training and provisioning
Construct Update & Maintain Repair Technology Roadmaps

• Roadmaps used for joint planning and tracking of progress

• Monitor tech readiness levels for repairs under development & qualification

• Leverage generic technology applicable to repairs maturing in other programs like TRUST, nutplate bonding & fastener cleaning

• Track repair methods via construction type and maturity for implementation

• Maintain a lessons learned database for joint distribution
Expanding or Shifting the Paradigm Via Emerging Technology

• More conformable and reliable repair methods for emerging complex contoured structure
• Flush or near flush repair methods to satisfy laminar flow and other emerging vehicle requirements
• Minimum weight repairs for weight and balance critical structures
• Improving the reliability of bonded repairs and better control of repair processes
• Simplify repair and consumable material storage, environmental and health impact and logistics
Lessons Learned Database & Handout

**Design for Supportability Compiled Lessons Learned**

- Laminate design should be impact resistant and damage tolerant where minimum gage is at least 0.030 inch thick for 6 foot lbs impact strength.
- A more realistic criteria for sandwich facesheets is to minimize the potential for post impact moisture entry into the core. Frequently cores wick water or corrode like Nomex and aluminum respectively.
- Ensure that core to facesheet adhesive bonds have good filleting over the cell walls to minimize tendency to debond on impact.
- In general solid laminate structural concepts are more damage tolerant and repairable than sandwich construction.
- Laminar flow and supercritical aero wing concepts require repair flatness leading to flush repairs or highly tapered external repair concepts.
- Internal repair concepts with only outside access is far more difficult and time consuming than external repairs. Also internal repairs are subject to interference from substructure stiffeners and frames.