Composite Repair Roadmap Outline 2019

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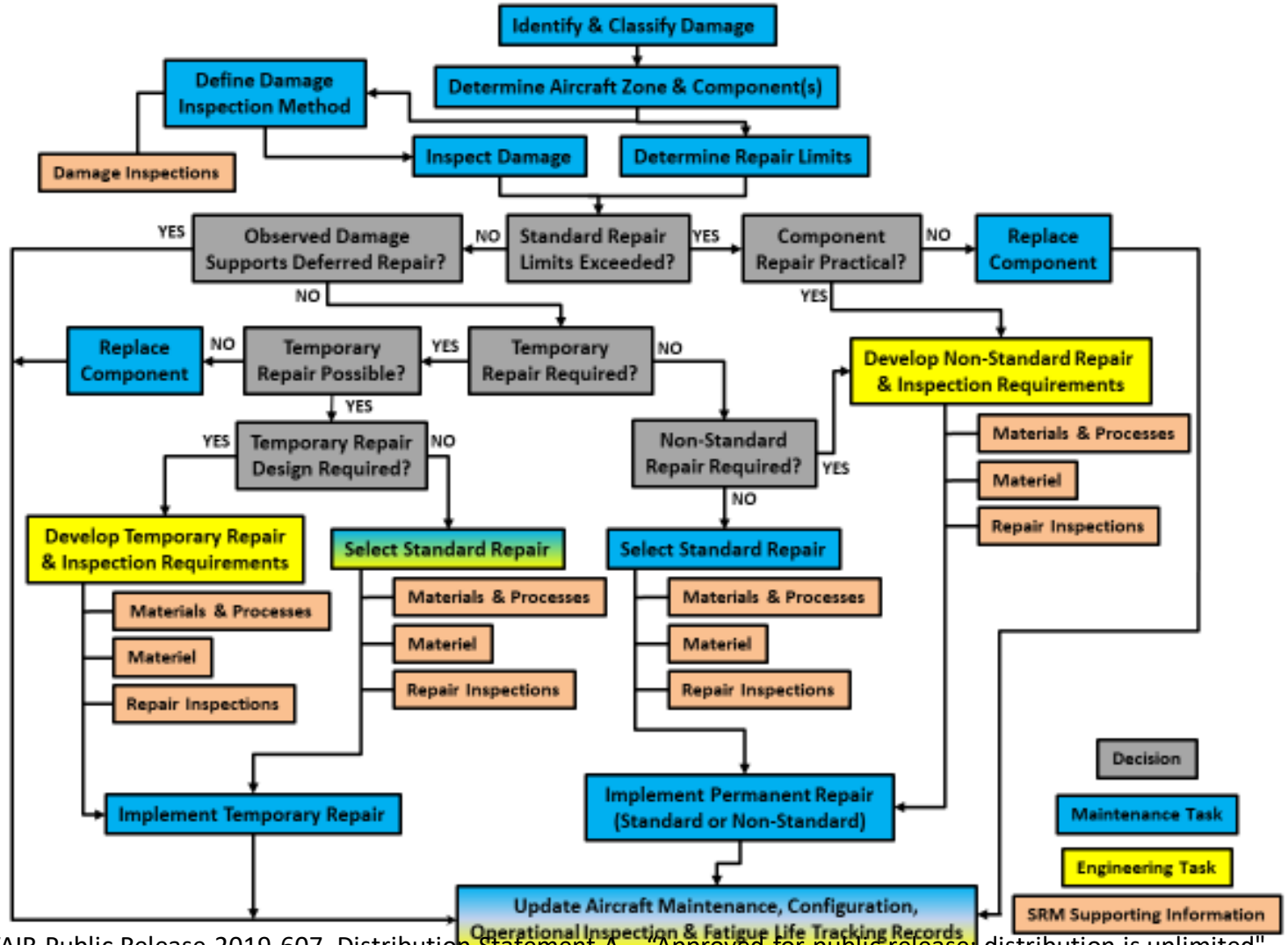
Repair Decision Tree & Classification



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 reparable 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.