New Challenges for Airlines/MRO dealing with New generation of Composite Aircrafts

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C. BOSQ, Head of structure training – Training Services
P. LAPLACE, Structure Program manager – Training Services
1. Context of the new challenges
2. Impacted domains
3. Manufacturer’s experiences
4. How Structure training can support these Challenges
5. Q&A
1. Context

New generation of A/C structure:
- Composites,
- Non removable and primary pressurized parts,
- New technologies for inspection

-> New skills needed for damage assessment, inspection procedures and repair activities
Advanced composites
—
Improve fuel efficiency
By achieving weight saving
While optimizing design & manufacturing constraints

1. Context: Structural Composites in Airbus Aircraft Family

Advanced composites
—
Improve fuel efficiency
By achieving weight saving
While optimizing design & manufacturing constraints

CFRP and Titanium Structural Weight

A310-300
Fin, Rudder, Elevators

A320
+ HTP, Flaps, Spoilers, Ailerons
ATR72 Outer wing

A330/340
+ HTP as fuel tank

A340-600
+ Rear pressure bulkhead, Keel beam

A380
+ Rear fuselage, Center wing box, Wing ribs

A400M
+ Cargo door

A350
+ Outer wing, Fuselage
1. Context: Structural Composites in A350 Aircraft

A350-900 Material Breakdown (%)
Including Landing Gear

Titanium
- High load frames
- Door surroundings
- Landing gear
- Pylons
- No corrosion tasks

Composite
- 53%

Al/Al-Li
- 19%

Steel
- 6%

Titanium
- 14%

Misc.
- 8%

CFRP
- Wings
- Centre wing box and keel beam
- Empennage & Tail cone
- Fuselage Skin panels
- Frames, stringers and doublers
- Doors (Passenger & Cargo)
- No corrosion & fatigue tasks
2. Impacted domains

- Structure maintenance and repair activities/
- Authorities regulation
- Facilities/new tools/equipment/shops
- Health, Safety, Quality
- Competence management and Training
2. New tools/equipment/materials

- Optical micrometre
- Line sizing tool
NDT inspection by non-specialist

**LineTOOL:** go/no go composite delamination assessment tool
- Prevent flight delay and cancellation due to lack of Non-Destructive Testing expert personnel availability
- Provide quick and reliable statement
- Already available and used by several Operators

**LineMAP:** Damage Localisation
- Accurate location of damage on A/C fuselage, automatic integration in A/C DMU (Digital Mock-Up)
- Damage location tracking and report generation
- Already available and used by several operators

**LineSIZING:** Damage sizing and reporting
- Easy to use device, enable B1 or equivalent mechanics to perform damage sizing on A350 monolithic CFRP.
- Ultrasonic C-scan, automatic damage size measurement.
- Enhanced damage tracking and automatic report creation.
3.3 **Training for composite technicians.**

The maintenance organisation is required by 145.A.30.(e) to “establish and control the competence of personnel involved in any maintenance...in accordance with a procedure and to a standard agreed by the competent authority”.

A training program should be therefore developed for qualification of composite technicians. The SAE AIR 5719 and FAA AC 65-33 documents (refer to chapter 7) provide detailed guidelines and a sample course syllabus, which can be used in order to develop training/qualification programs for composite maintenance technicians.

In addition to that, it is recommended that the technicians training would include an aircraft type training module (limited to the Structure ATA chapters) at least for those structural repair technicians which are authorised for aircraft on-board repairs (e.g., requiring interpretation of the SRM to define corrective actions). Such structural repair technicians should be authorised on the specific aircraft type.
2. Health & Safety, Environment

According to H&S & Environment requirements

- …

**Safety precautions.**

- Aircraft maintenance chemicals (e.g., abrasives, cleaners, corrosion preventatives, paint stripes, surface treatments, sealants, paints, solvents, etc.) may be hazardous. The maintenance organisation is responsible for the evaluation of the hazards in the workplace, awareness of personnel and to address safety precautions. The following elements should be taken into account:
  - Understand the warnings for using specific chemicals as published by the chemical manufacturer. Refer to the Material Safety Data Sheet which accompany the material. This is the primary source of information when determining the risk associated with any substance used in the workplace;
  - Observe the aircraft/component manufacturer’s warning and cautions in the applicable maintenance data;
  - Use personal protective equipment (e.g., gloves, respirators, glasses, boots, etc.) to prevent skin, eyes, respiratory and digestive tracts from being exposed to chemicals;
  - Make sure that sufficient ventilation exist;
  - Many combination of chemicals are incompatible and may produce toxic fumes and violent reactions. Extreme caution is required to ensure that maintenance chemicals are only mixed in accordance with the specific mixing procedure;
  - Set up first-aid measures in the workplace (e.g., eye washers, etc.).

**European Aviation Safety Agency User Guide** Foreign Part-145 approvals Composite repair workshop Doc # UG.CAO.00135-003 Approval Date 22/10/2015

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2. Competence management and training

- Specific and new skills needed on composite structure for damage assessment, for inspection, for repairs

- All structure staff concerned (engineer, line mechanic, shop technician)

- Composite shop specific requirements and dedicated controlled zone with associated management
3. Manufacturer’s experiences

- Internal learning path already set up and used for our own staff (Manufacturing & Maintenance)

- Existing Services to assess and advise on repair composite shop

- Lessons learnt on site from our customers repair activities has contributed to:
  * deploy internal learning paths per Job and per level fitting with this new context and requirements
  * optimize tooling/equipment/material/facilities
3. Examples of structure training:

**Quick Cosmetic Repair**

- Reduced curing cycle time
- ECF restoration

**Structural Bolted Repairs**

- Structural repair are bolted doublers

- Critical step is composite drilling → dedicated equipment required

- Pre-cured standard Repair parts defined to avoid on-demand manufacturing (on lead time)
4. How Structure training can support these Challenges

• Airlines have to be aware of these changes and constraints
• Be able to do Competence assessment: Diagnosis /metallic or first composite generation

• No certifying training requested yet by Authorities, but guidelines and recommendation for ensuring safety, environmental impacts (eg. FAA, EASA guidelines for part 145 )

• “Structure trainings” must address all these knowledges & competences to the different job categories
• With training modules including competence assessment at the end of the training (theoretical & practical)

• Training providers (e.g. Airbus, …) can support their customers with a modular approach and learning paths /job/role, and with more global service packages to support their customers

• => Ensure & Optimise competence gap closing and training efficiency