Ultrasound testing machines for CFRP components of the new Airbus A350XWB

Dr. Edgar Zaus, intelligeNDT Systems & Services GmbH
Paul-Gossen-Str. 100, 91052 Erlangen, edgar.zaus@intelligendt.de
Matthieu Libert, Dr. Oliver Bullinger, Axel Beck, Reinhard Spiegel, Airbus
Rainer Meier, Bernd Gohlke, intelligeNDT

DGZfP-Jahrestagung
Erfurt, 12.5.2010

An Airbus takes-off or lands every 2.5 Seconds ...

Airbus facts: (End March 2010)
9546 Orders
6120 Deliveries
3 428 a/c backlog
371 Customers
- 17,600 Flights per day

Passengers

Airbus A330 XWB 1000
Airbus A320
Airbus A330 200
Airbus A340 300
Airbus A340 600
An Intelligent Airframe by design

Examples for part spectrum (1)

- Center wing box part
- Keel beam
- T-stringer
- Lower wing cover
Examples for part spectrum (2)

- Barrel S19
- Fuselage Side Shell

In total more than 30 different parts with different stringers (T & Ω)

Boundary Conditions

Spectrum of components (selected properties)
- skin curvatures as low as 300 mm
- spherical shaped skins
- T- and Ω-stringer to be tested
- different CFRP materials
- skin thickness 2 - 50 mm
- part length up to 33 m
- ramps up to 1:10

Testing performance
- 6x6 mm defects
- porosity evaluation
- measuring of wall thickness

Productivity
- Operating and maintenance convenience

Costs

- ...
Harmonization & Standardization as a key mission from Airbus

- **A350XWB Programm Specific (1x)**
- **Generic Spec Software Spec AITM Standards**
- **Local Specs CAD-Models**

**Harmonization & Standardization**

**Standardization**
- Control system (PLC)
- Acquisition- & evaluation-SW

**Platforms**
- Mechanic concepts
- Probe systems
- UT-Device SAPHIRplus

**Customized**
- Part support systems
- Detailed machine layouts
- Combination of probe systems

---

Standardization of Manipulator

Reduction of the total manipulator types to a minimum of 3 based on the components and their inspection scope

- **Gantry**
- **2 Towers**
- **Tower + Jib**
Standardization of Probes: Skin

Line array probes
- 32 elements
- water delay line
- pre-wetting jets

Element pitch 1 mm
- special design for edge inspection

Element pitch 1 mm
- for strongly curved components

Element pitch 2 mm
- for slightly curved components

Standardization of Probes: T-Stringers

Stringer web

Line array probes
- 48 elements
- plastics delay line
- element pitch 2 mm
- shorter delay line for web of T-stringers up to height 96 mm up to thickness 18 mm

Phased array probes
- water delay line
- for foot of T-stringer of radius 5 mm

Stringer radii
- 56 elements
- longer delay line for web of T-stringers up to height 112 mm up to thickness 25 mm
Standardization of Probes: Ω-Stringers

Probes designed for a special geometry of Ω-stringers

Stringer top & sides

- Line array probes
  - plastics delay line
  - element pitch 2 mm
  - 19 elements
  - 27 elements

Stringer radii

- Phased array probes
  - water delay line

Summary

The relationships between Airbus and its partners for the A350XWB-project were a step for future projects... Harmonization & Standardization are keys on this way and means for Airbus:

- **Flexibility**
  - The relationships between Airbus and its partners for the A350XWB-project are setting a step for future projects.
  - Same parts can be inspected on different sites
  - Results of inspections are fully comparable

- **Logistic**
  - Most spare- and maintenance parts fits for all machines
  - Maintenance procedures follows standardization

- **Economy**
  - Cost cutting for new machines by harmonization
  - Developed tools & Software will be used for 9+ machines

- **Multi-Project-Management**
  - Standards for Critical Design Reviews, project-management, acceptance procedures etc.
  - supports multi-project-management for A350XWB
Commissioning experience

Status spring 2010
► First machines in service at customer
► Other machines in installation phase near completion

1st machine very complex (inspection of skin, stringer web & stringer radii)
► Kind of reference machine
► Mechanical fine-tuning of sensor system
► Interaction control – scanning technique
► Inspection software

Customer gets “series approved” inspection technology with so far surpassing inspection quality

From machine to machine further increase of commissioning efficiency by
► Mature technology
► Approved software
► Learning effect of commissioning personnel