



Composite NDI – Training

Challenges for Training of
Inspectors & Engineering

22.09.2016, CACRC, EASA, Cologne, Germany



- △ About Testia
- △ Inspection Methods for CFRP
- △ NDT Training Standards
- △ NDT Training Concepts
- △ NDT Training for Composite Inspection
- △ Training needs for NDT on Composites for In-Service



About Testia

- △ The Testia Group has 8 subsidiaries worldwide
 - About 200 Employees
 - Testia Group HQ located in Toulouse
- △ Testia Germany was founded on the 2nd October 2013
 - 45 employees (as of 01.09.2016)
 - △ 17 Engineers
 - △ 21 Inspectors
 - △ 2 Equipment & Tools Specialists
 - △ 3 Admin
 - △ 2 Student
 - > 70 employees in 3 years
 - Testia GmbH Headquarter in Bremen

Testia was founded as a small, very reactive company within Airbus Group to provide all kinds of services in regard to **non-destructive and destructive** testing.

TESTIA in the Airbus Group

AIRBUS
GROUP

CTO

 **AIRBUS**

 **AIRBUS**
HELICOPTERS

 **AIRBUS**
DEFENCE & SPACE



TESTIA Holding

SMW
Solutions

TESTIA
France

ENSIA
Spain

TESTIA
Germany

TESTIA
UK

TESTIA
Russia

TESTIA
Asia-Pac.

Subsidiaries in
South Africa
and Mexico

Testia is a full Service Provider



Level 1, 2, 3 and limited level 1 training for all NDT methods

- Ultrasonic Inspection(UT)
- Eddy Current (ET)
- X-Ray (RT) – Film & Non-Film
- Magnetic Particle (MT)
- Penetrant Testing (PT)
- Thermography (IRT)



Training available at:

- Testia GmbH Bremen
- Customer premises



All trainings according to EN4179/NAS410

Testia & Airbus are approved by the German National Aerospace NDT Board (NANDTB)

Bundesverband der Deutschen
Luft- und Raumfahrtindustrie e.V.
German Aerospace Industries Association



National Aerospace NDT Board NANDTB-GERMANY

Herewith the NANDTB-Germany confirms that the NDT Training provider

AIRBUS Operations GmbH

in cooperation with

Testia GmbH

NDT Training Center Bremen

is approved by the NANDTB-Germany.

The NDT Training Provider has been audited on

March 27th 2009 and January 19th 2011

in accordance with:

NANDTB-G, K02, 4 "Approval of NDT Training Provider"

NANDTB-G, N01, 3 "Minimum Requirements for NDT Training Provider"

This approval is applicable for following training modules according EN4179:

Method	Approved Levels	This approval is valid till
Penetrant Testing	PT Level 1, 2 and 3	March 27 th 2014
Ultrasonic Testing	UT Level 1, 2 and 3	March 27 th 2014
Edy Ray Testing	ET Level 1, 2 and 3	March 27 th 2014
Magnetic Particle Testing	MT Level 1, 2 and 3	March 27 th 2014
Thermographic Testing	IRT Level 1, 2 and 3	January 19 th 2016

For NDT training and examinations performed by the above-named NDT training provider the requirements of EASA AMC145.A.30 (14) have been fulfilled.

Certificate number: NANDTB-G A10007

Ref: March 27th 2013


Hans-Joachim Beyer
NANDTB-Germany (President)


Hans-Joachim Beyer
NANDTB-Germany (Vize President)

NANDTB-Germany
Approval of NDT Training Provider: AIRBUS
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24th March 2015 Issue 7
NANDTB-G_A1002

- △ NDT Special Equipment Trainings
- △ NDT Application Trainings (e.g. for NTM)
- △ NDT Training for CFRP structures
 - NDT for monolithic and sandwich CFRP structures
 - Dedicated Training provided in Frankfurt



- △ eLearning
 - Remote Training
 - Reduction of Classroom Trainings
 - Reduction of costs





Inspection Methods for CFRP

Examples

Tap Test



Manualer Tap Test
Easy to use
Cheap
Available everywhere



Mitsui Woodpecker
Easy system, as well
Traffic Light System, cheap, easy
to use



Thermography – Accidental Damage

High-lift flap
Cutout 2

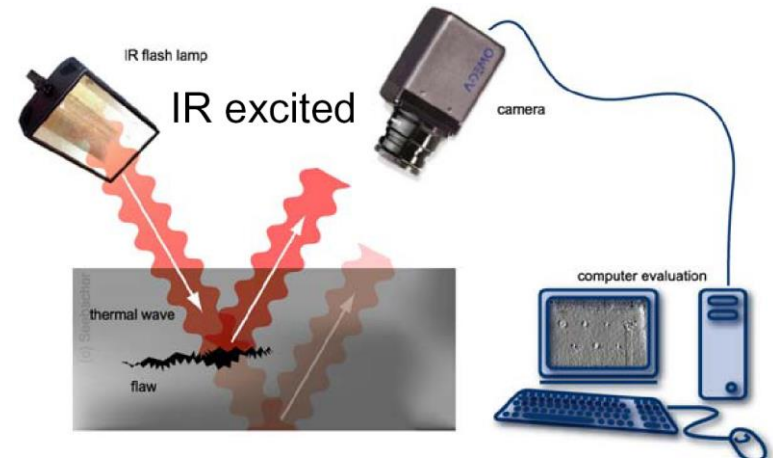
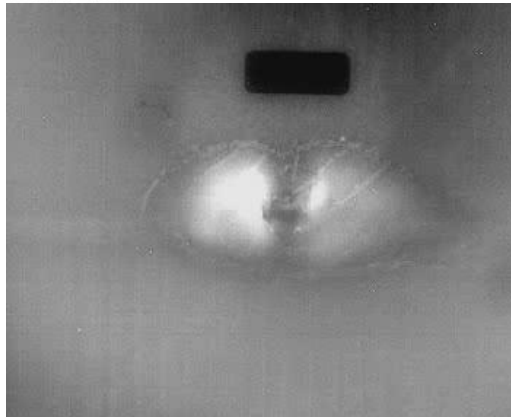


Exterior view

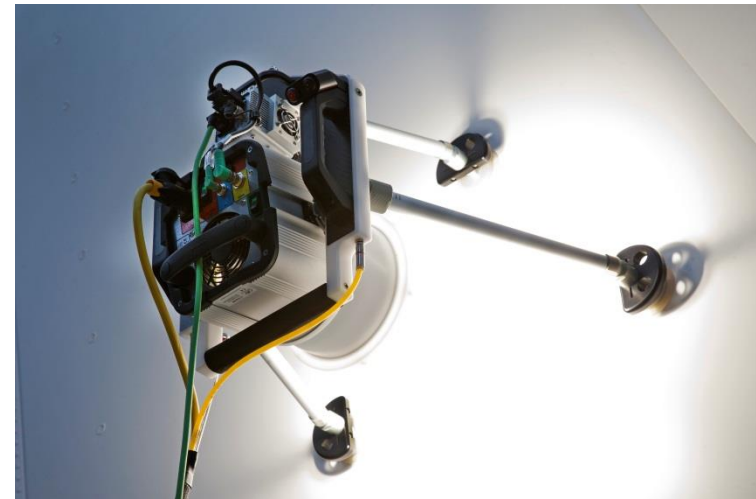
Layer
thickness
2,2 mm
2,0 mm



Interior view



GECKO
Low Budget IRT
System



FTIR Exoscan

System:

Infrared Spectrometer

- Portable (approx. 3 kg and approx. 17*12*22 cm³)
- Local measurement (IR Point: 1,5 mm²)
- Measurement depth up to 500 µm



***FTIR Exoscan with
Docking Station***

For the measurement:

- Contact with part necessary
- 30 sec per measurement
- Results on PC or tablet



Quelle: Agilent



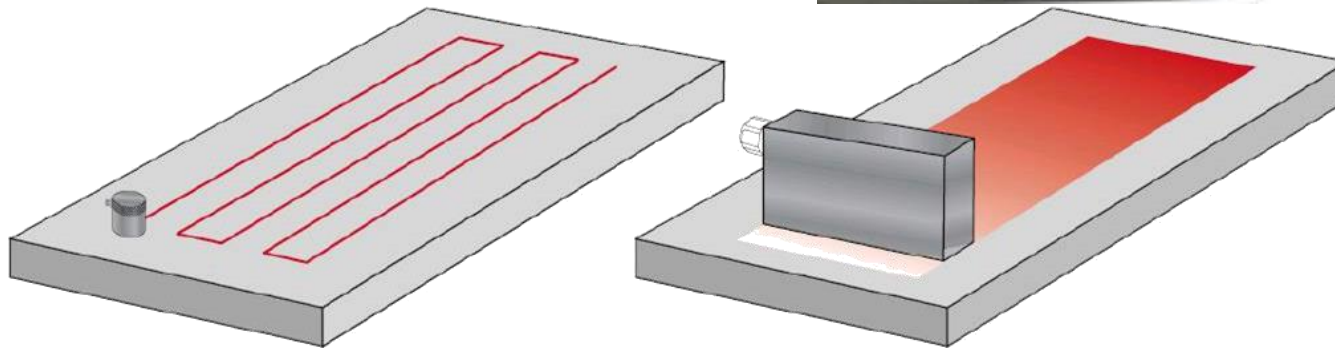
***FTIR Exoscan with mobile
PDA connection***

Quelle: Agilent

Manual, One-Channel Equipment

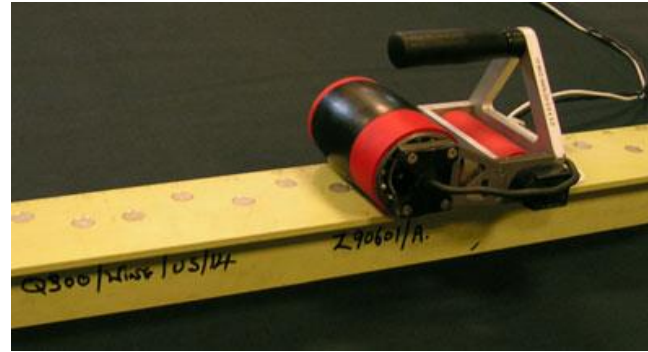
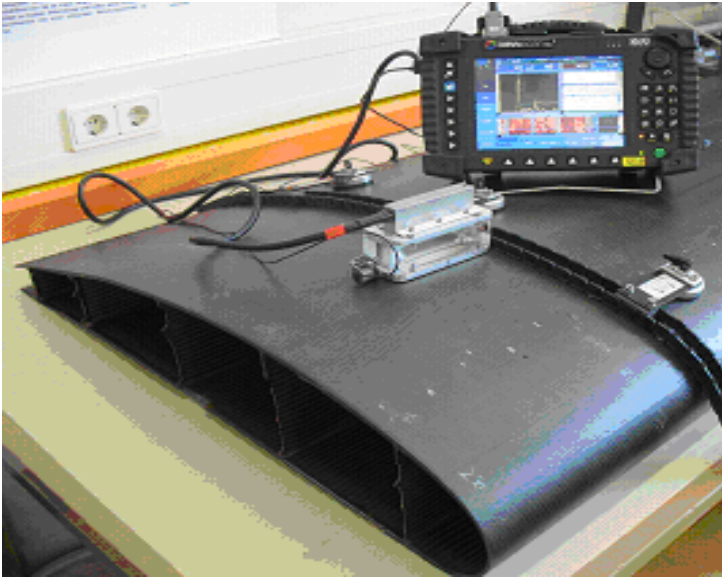


ArraySystems (PAUT)

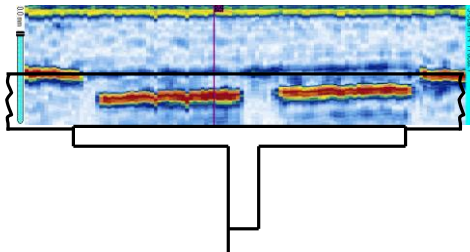
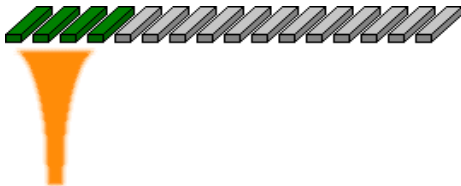
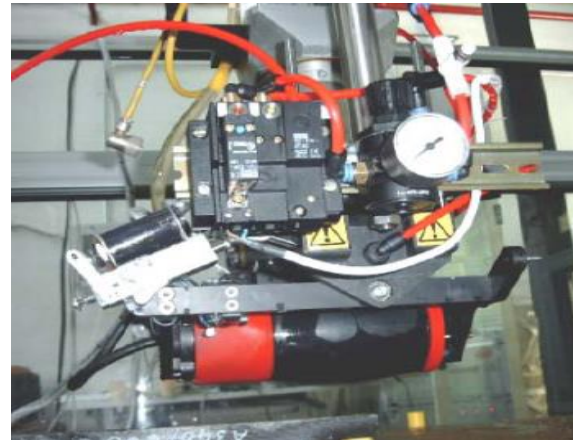


PAUT Applications

Waterbox

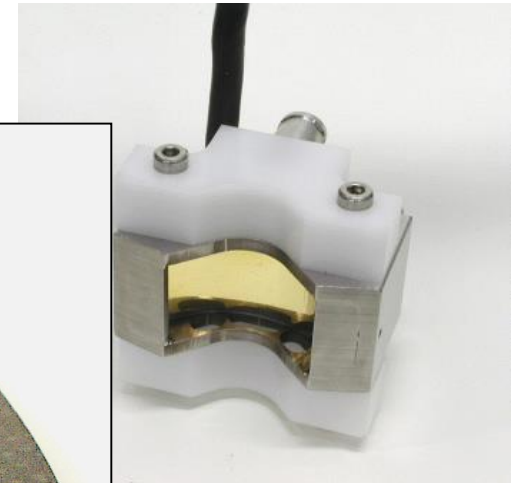
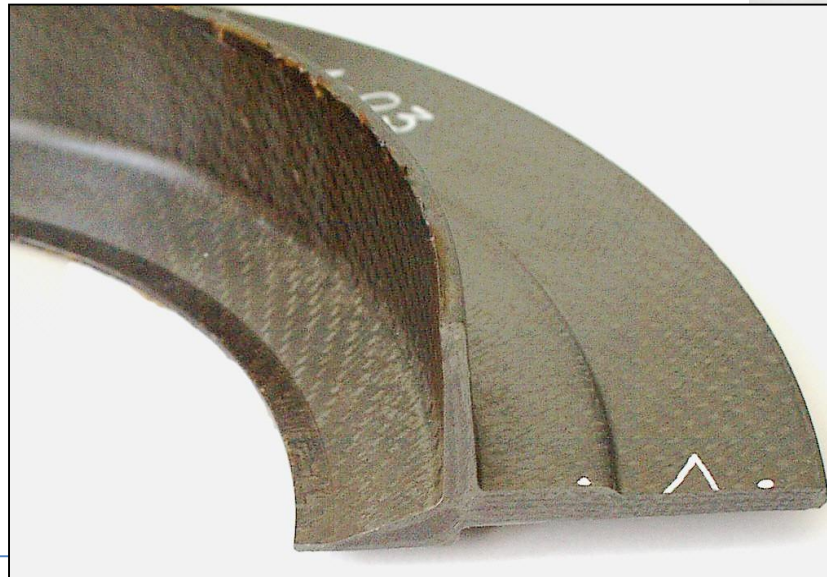
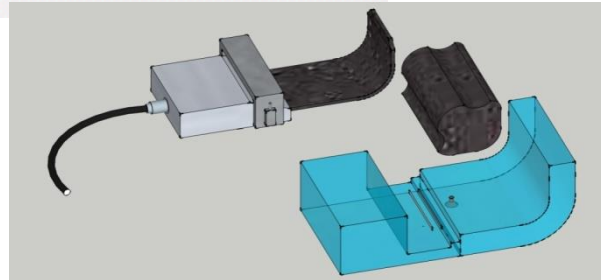
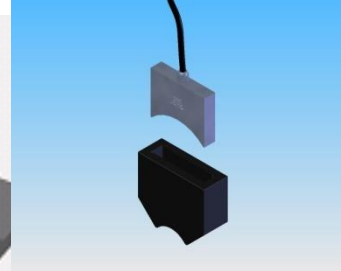
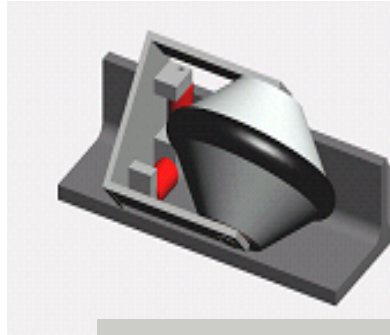
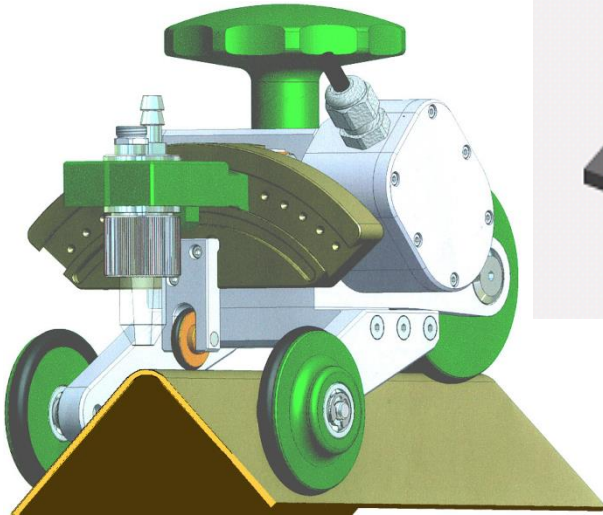


Phased Array
Roto Array

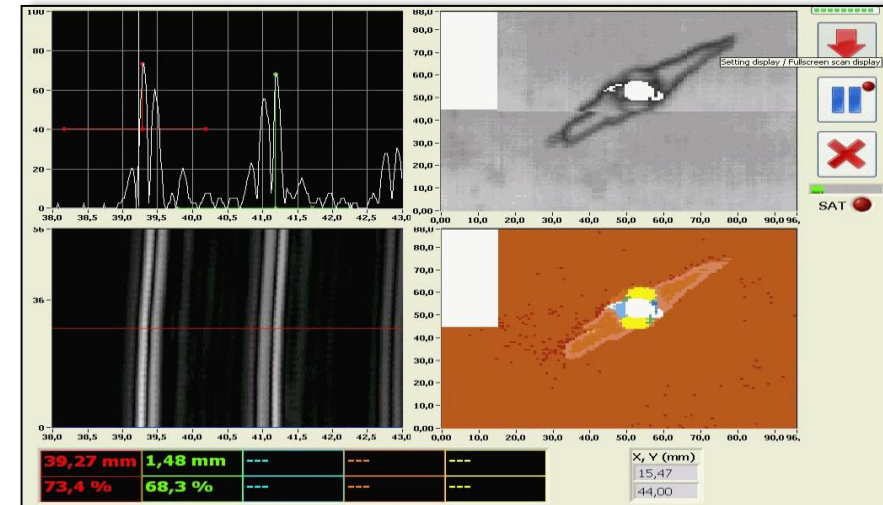


Ω-Stringer
Inspection

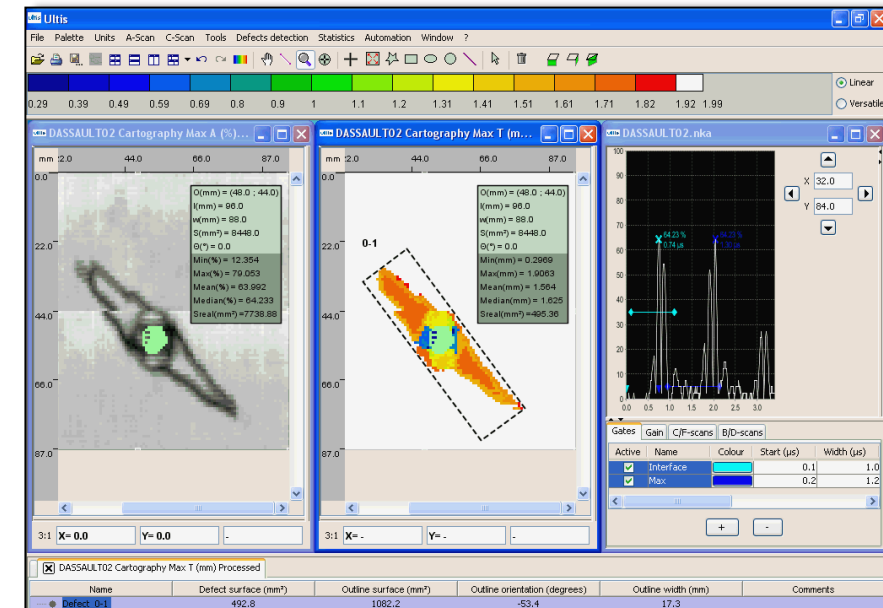
Inspection of Radii



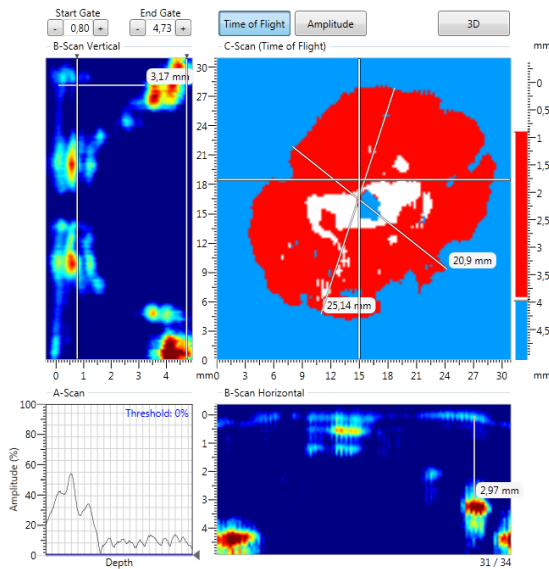
Roto-Array



**Fast solution to generate
C-Scans**

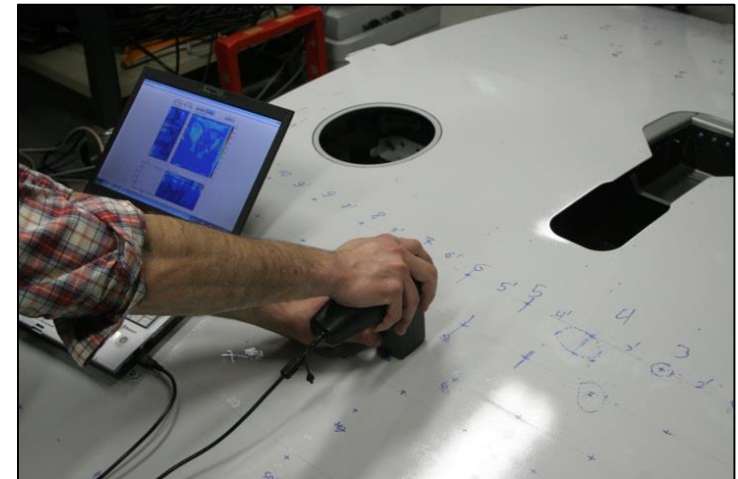
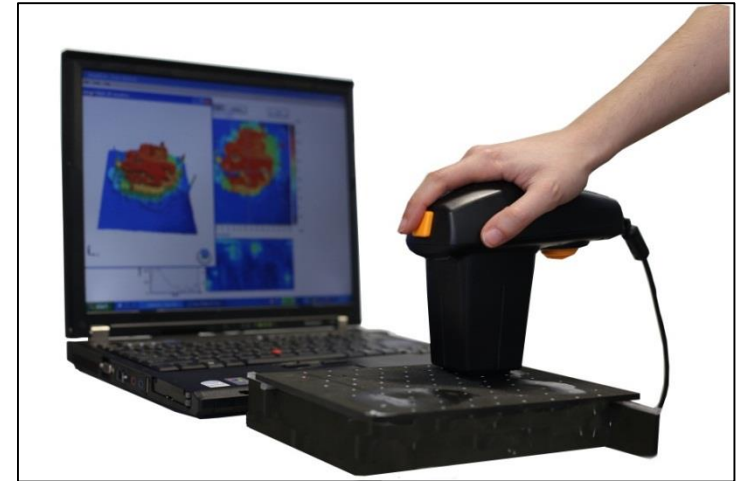
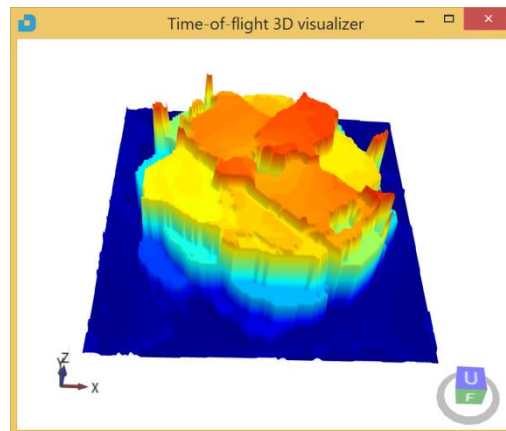


- Detection after „Impact“.
- Direct Damage Sizing



Color Palette

3-D



.....and much more

What does this mean

- △ CFRP requires lots of different NDT technologies and methods
- △ Complexity of inspection methods increased compared to metal
- △ Several new technologies appear which were less used for NDT InService in the past
- △ UT is the main technology used
- △ Thus, inspectors facing more and more challenges
- △which leads to higher training demands



NDT Training Standards

Certification & Qualification of Inspectors

- △ **ATA-105** - Airlines for America (A4A) Specification 105, Training and Qualifying Personnel in Nondestructive Testing Methods
- △ **NAS-410** - Aerospace Industries Association, National Aerospace Standard, NAS Certification & Qualification of Nondestructive Test Personnel.
- △ **EN 4179** - Aerospace Series, Qualification and Approval of Personnel for Non-destructive Testing
- △ **SNT-TC-1A** – ASNT Recommended Practice, Personnel Qualifications and Certification in Nondestructive Testing
- △ **FAA Order 8900.1 Volume 6**, Chapter 11, Section 27 – Surveillance of a Nondestructive Test Program/Facility (Flight Standards policy and guidance concerning aviation safety inspector job tasks)
- △ **MIL-STD-410E** - Military Standard Nondestructive Testing Personnel Qualification and Certification
- △ **CAN/CGSB 48.9712.2006** - Canadian General Standards Board (ISO 9712:2005), Non-destructive Testing—Qualification and Certification of Personnel.

- △ **Section 51**, Nondestructive Test Manuals
- △ **AC 25-29** – Development of a Nondestructive Inspection Program
- △ **AC-43-13-1B** - Acceptable Methods, Techniques, and Practices for Aircraft Inspection and Repair
- △ **AC 43-214** – Repairs and Alterations to Composite and Bonded Aircraft Structure
- △ **AC 65-31B** – Training, Qualification and Certification of Nondestructive Inspection Personnel
- △ **AC 65-33** – Development of Training/Qualification Programs for Composite Maintenance Technicians
- △ **AIR 4938** - Composite and Bonded Structure Technician/Specialist: Training Document
- △ **AE-27** - Design of Durable, Repairable, and Maintainable Aircraft Composites
- △ **DOT/FAA/AR-08/54** – Guidelines for the Development of a Critical Composite Maintenance and Repair Issues Awareness Course
- △ **Related industry classes**



NDT Training Concepts

- △ 3rd Party certification
- △ Mainly managed by the NANDTB
- △ European NDTB with low influence on NANDTB
- △ Very few employer train own staff or allowed to do it

- △ NANDTB define content of the training (Syllabus)
- △ NANDTB approve examination questions
- △ NANDTB audit and approve training schools
- △ Employer send inspectors to approved training schools

Other European Countries have similar principles

- △ No NANDTB
- △ Employer mainly train & certify NDT staff
- △ Very few 3rd party education/certification
- △ For service ATA-105 was established by A4A instead of using NAS410

Worldwide a mix of US and European training principles are used

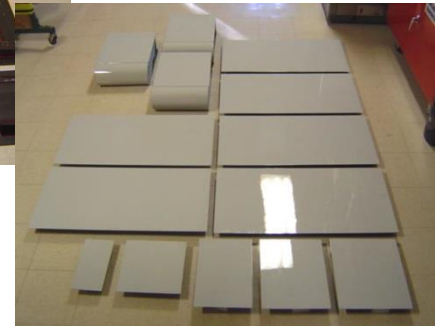


NDT Training for Composite Inspection CACRC Approach

- △ Complexity of CFRP inspection has increased the demand on training
- △ Worldwide studies (e.g. FAA/Sandia) have shown a lack of education
- △ Different training approaches in the world cause a different level of education
 - e.g. in Germany a 32 hours training + exam just for PAUT on composites, while the A4A members would like to have a 2 days training for Pulse Echo & PAUT

△ Prepare a set of specimen with

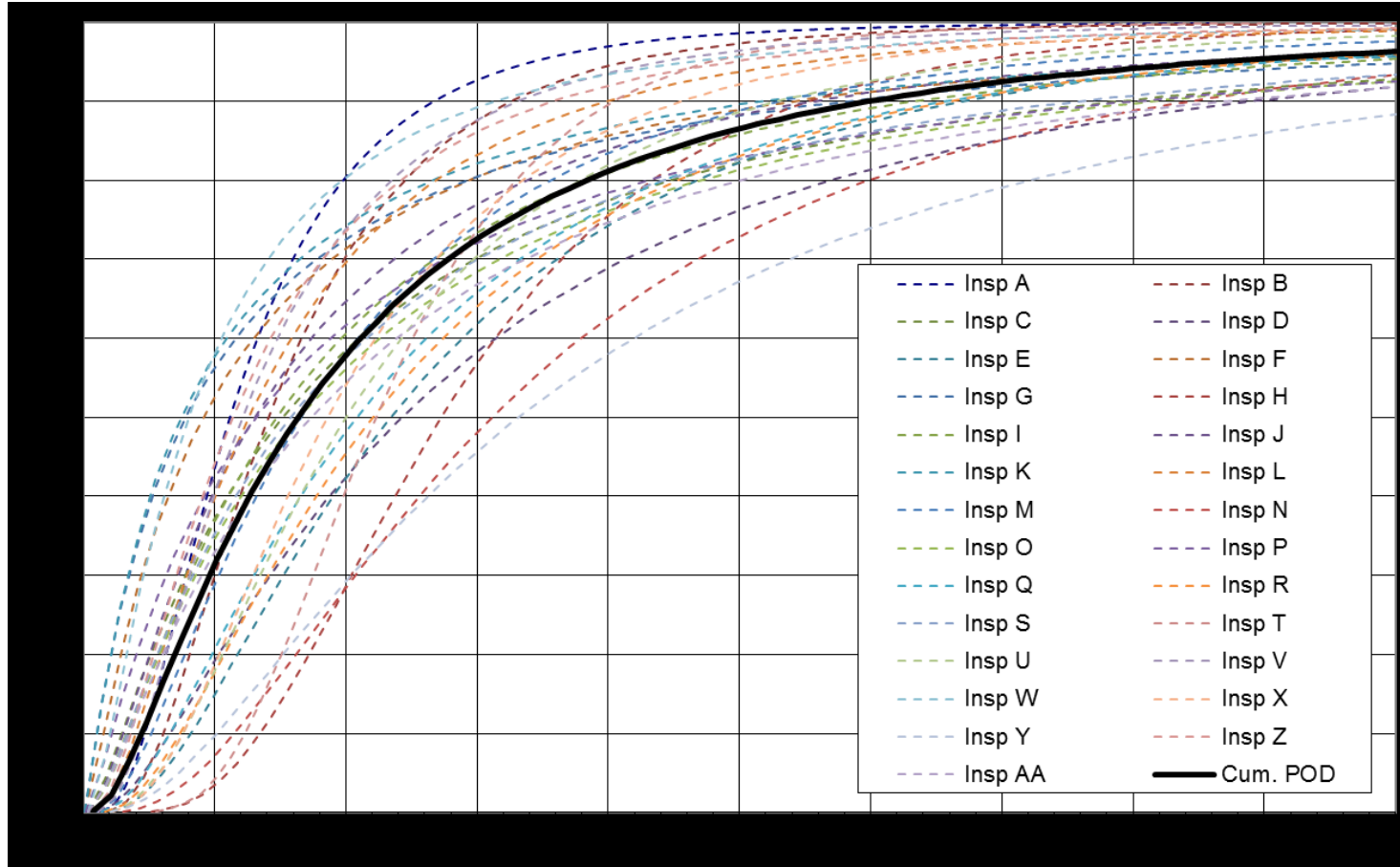
- Simple tapers
- Complex tapers
- Curved surfaces
- Array of flaw types



△ Let lots of inspectors perform inspections on these samples



△ Assess the POD of inspectors from all over the world



Large variance of results!

- △ Increased exposure to representative composite inspections – common industry NDI Feedback Specimens
- △ Increased, focused composite NDI **training**
- △ Use of NDI and composite shop apprenticeships (OJT, awareness **training**, formal/uniform use of this tool)
- △ Enhanced NDI procedures – deployment, signal interpretation, clearer schematics showing structural configuration
- △ Use of inspection coverage aids should be required
- △ Divide large area inspections into a number of smaller regions
- △ Add audible alarms & detection lights to probe in “Go”/”No-Go” devices
- △ Prepare additional industry guidance to address **training**, use of NDI Reference and Proficiency specimens, procedures, composite construction awareness – produced by joint effort of OEMs, Airlines, FAA & industry groups

**Major outcome of the study:
TRAINING is needed**

Source: Sandia/FAA



Composite NDT Training in Airbus (commercial)

- △ Foundation of Testia to harmonize NDT training in Airbus and Airbus Group wide
 - Currently restrictions due to different rules defined by the NANDTB

- △ All trainings according to EN4179/NAS410

- △ Trainings performed for Airbus, suppliers to Airbus and customers in the same way
 - Benefit: All inspectors have roughly the same basic education

- △ Harmonized training for all NDT methods applied on composite parts and structures
 - UT, IRT, RT,

- △ Technical Qualification (TQ) cause additional practice to Airbus materials and parts
 - TQ is a concept where NDT shops of Airbus OEM and suppliers show, by practical performance of inspection procedures, their capability to perform these inspection procedure on a specific material/structure (incl. POD)

- △ Training on the job for all inspection task by experienced level 2 inspectors

- △ NADCAP/NUCAP as surveillance tool

- △ In Europe only trainings performed in training schools approved by the NANDTB, are accepted by the authorities (EASA)
- △ Low influence on basic training (EN4179/NAS410) for NDT on composites as customers would not accept requirements on trainings coming from the OEM
- △ Nevertheless more and more request from Airlines/MRO for on the on-the-job, equipment and other special trainings

Training for special Equipment

- ⚠ Trainings on applications of specific equipment in cooperation with equipment manufacturer and aircraft OEM
- ⚠ Trainings can be done In-Situ or by eLearning

Gecko (Thermography)



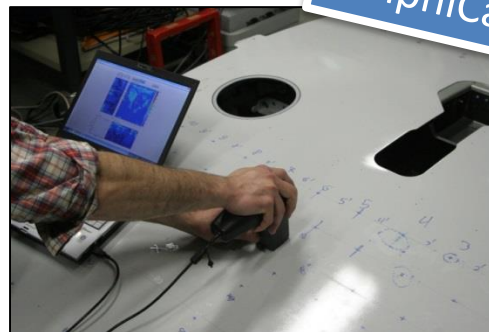
Elasticity Laminate Checker (ELCH)



ExoScan



DolphiCam



FSC1/2

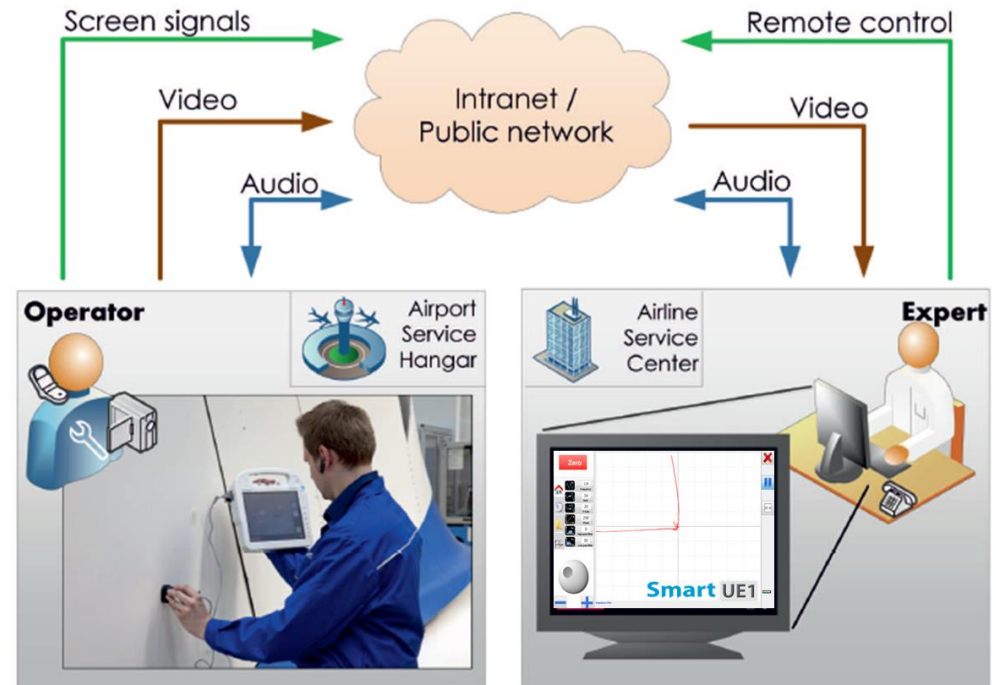


- △ Thermography inspection (NTM) to detect repairs on rudders and elevators
- △ Awareness Trainings for inspectors of Airlines/MRO to give an overview on possible NDT methods and applications



Online Maintenance Assistance (OMA) Tool

- Remote service
- Remote training
- Remote trouble shooting



eLearning

- Equipment Trainings
- Training on the job
- Preplace step by step classroom trainings related to EN4179/NAS410



Training Needs for NDT on Composite for Service

What is needed (training related)

- △ **Special Composite Trainings** for NDT on Composite under In-Service conditions
- △ Increase use of **eLearning** approaches to get know-how easy into all parts of the world
- △ **Harmonized Training Approach** – Today too much Specs
- △ **Trainings** of how to perform NDT inspections **before and after repairs**
- △ Availability of tools to **support/train inspectors in situ** in case of problems
(Remote NDT – Online Maintenance assistance OMA)
- △ Similar **surveillance concept** for In-Service as for manufacturing (NADCAP)

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