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NDT on composite materials

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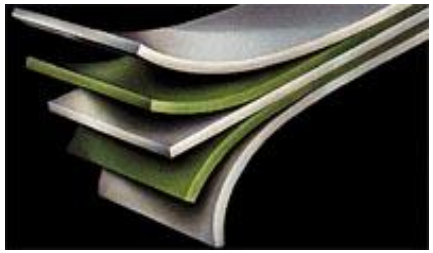
Introduction

- New materials
- New airplanes
- New methods
- Old methods new applications
- New problems
- Impact on training
- Impact on qualification and certification programs
- Responsibilities: Responsible LIII versus NANDTB
- Conclusions

New materials

- Fiber Metal Laminates (Glare)
- Developed by Technical University Delft (late 70's)
- Main goals
  - Strong and light material
  - Combines aluminum and fiber reinforced composite
  - Philosophy for the development of a no-repair aircraft structure
    - Impact resistance
    - Corrosion resistance
    - Fatigue resistance



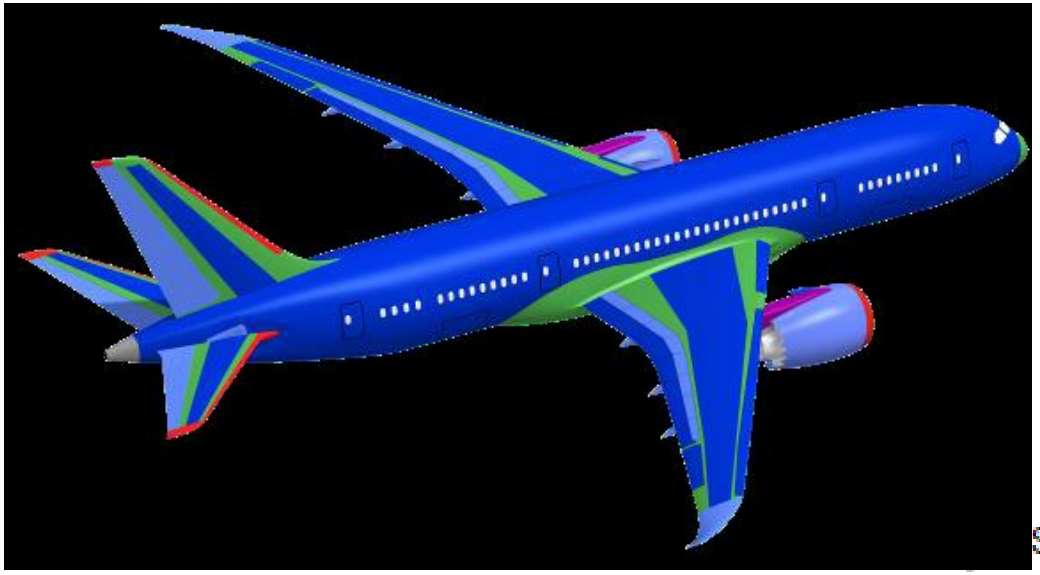
New materials (2)

- Composites
  - FRP (Fiber Reinforced Plastics)
  - CFRP (Carbon Fiber Reinforced Plastics)
  - GRP (Glass Fiber Reinforced Plastics)
  - Thermoplastics (CFRTP; Continuous Fiber Reinforced Thermoplastics)
  - Thermoset

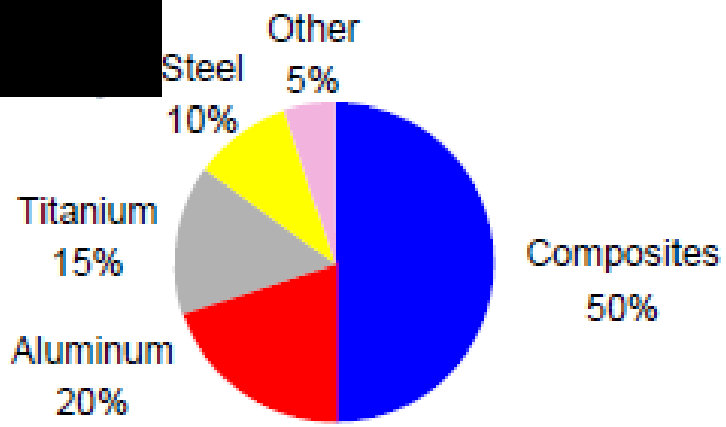
New airplanes

- Airbus A380
  - Glare (Fuselage)
  - Composites
- Airbus A350
  - Composites
- Boeing 787 Dreamliner
  - Composites
    - Fuselage
- NH90
  - Composites
- Cirrus SR22
  - Composites

Material build-up Boeing 787



- Carbon laminate
- Carbon sandwich
- Other composites
- Aluminum
- Titanium
- Titanium/steel/aluminum



New methods

- Thermography (IRT)
  - Use camera's to visualize heat distribution
- Shearography (ST)
  - -use of lasers to measure surface displacements
- Digital Radiography
- Ultrasonic Phased Array testing (PA)

New methods world

- Pulsed/Passive, Vibro, Flash, Lock-in Thermography
- Thermosonic/Vibro, LCD, Line scanning Thermography
- Thermal, Pressure, Acoustic, Vacuum Shearography
- Acoustocam
- Bondtracer
- Air coupled ultrasonics
- Laser ultrasonics
- Back scatter ultrasonics
- Ultrasonic spectroscopy
- Acousto ultrasonics
- Acoustography
- Penetrant enhanced X-ray
- X-ray back scattered tomography
- Acousto ultrasonics

Old methods new applications

- Ultrasonic (UT)
  - Puls-echo
  - Through transmission
  - Resonance (bondtesters)
- Radiography
  - Film
- Tap testing
  - Manual
  - Woodpecker

Eddy current Penetrant Magnetics

New problems

- **Unvisible damages**
- **Unreported incidents**

  - Debonding
  - Delaminations
  - Fiber break out
  - Matrix cracking

  - Traditional defects

    Fatigue cracks Overload Corrosion

Impact on performing inspections

- Lack of technically skilled personell
  - Is becomming a major issue
  - Techniques develop towards Monkey-see Monkey-do
  - Is this the way we want to go?
    - Every problem a different solution
    - Investment in equipment?

- Large areas need to be covered
  - Defect position unknown
  - Defect type unknown

Training programs

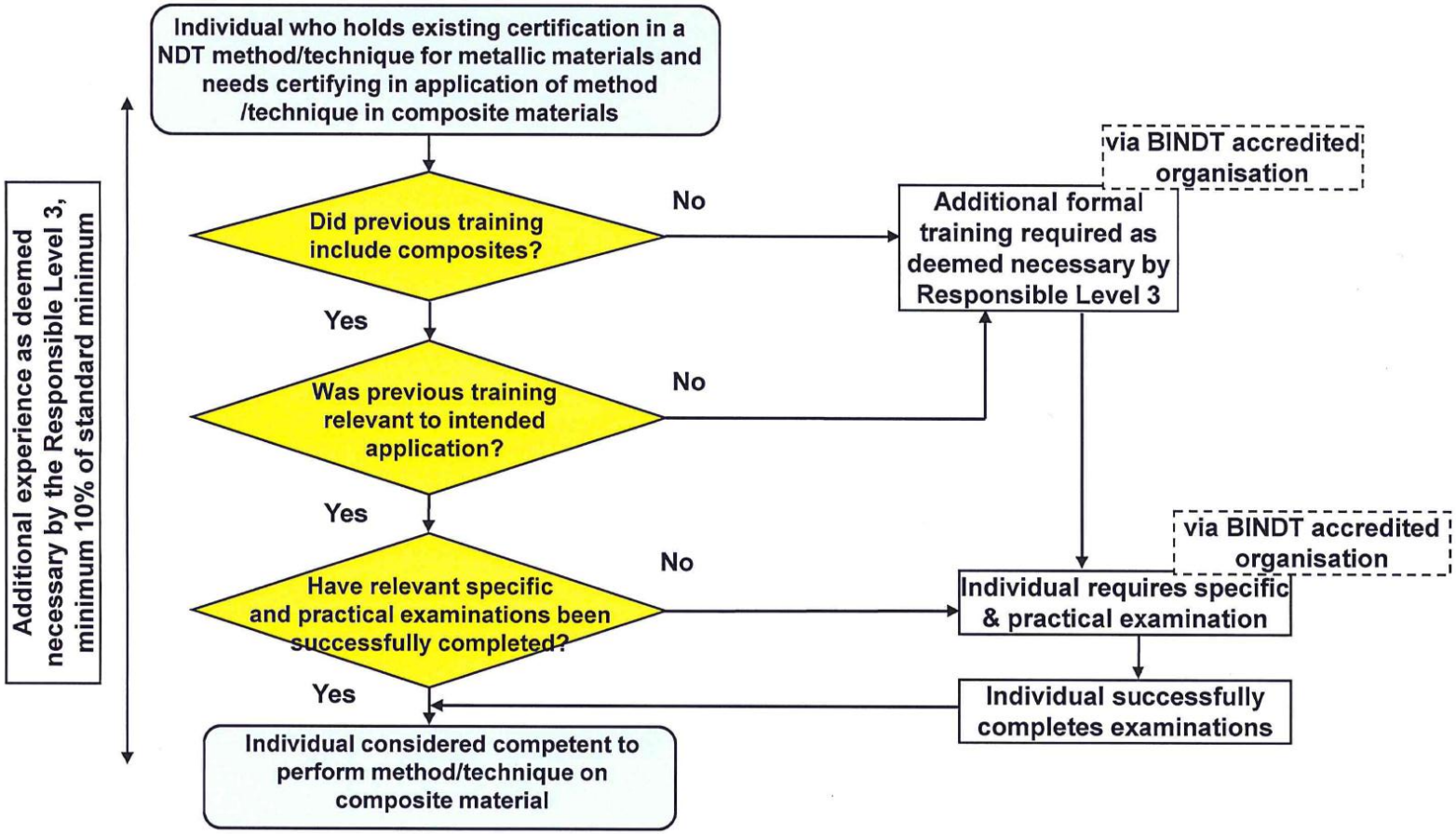
- Impact on training programs
  - Previous training
  - New applications
- In depth training versus equipment training
  - (learning the trick)
- How to qualify and certify (approve) staff for all these different applications
- Previous training programs have not always included new materials
- Advanced equipment may not always be available for NDT training centers
  - Price
  - Specialized
- Experience with special equipment may be limited
- Examination/training parts need to be available

Qualification and approval

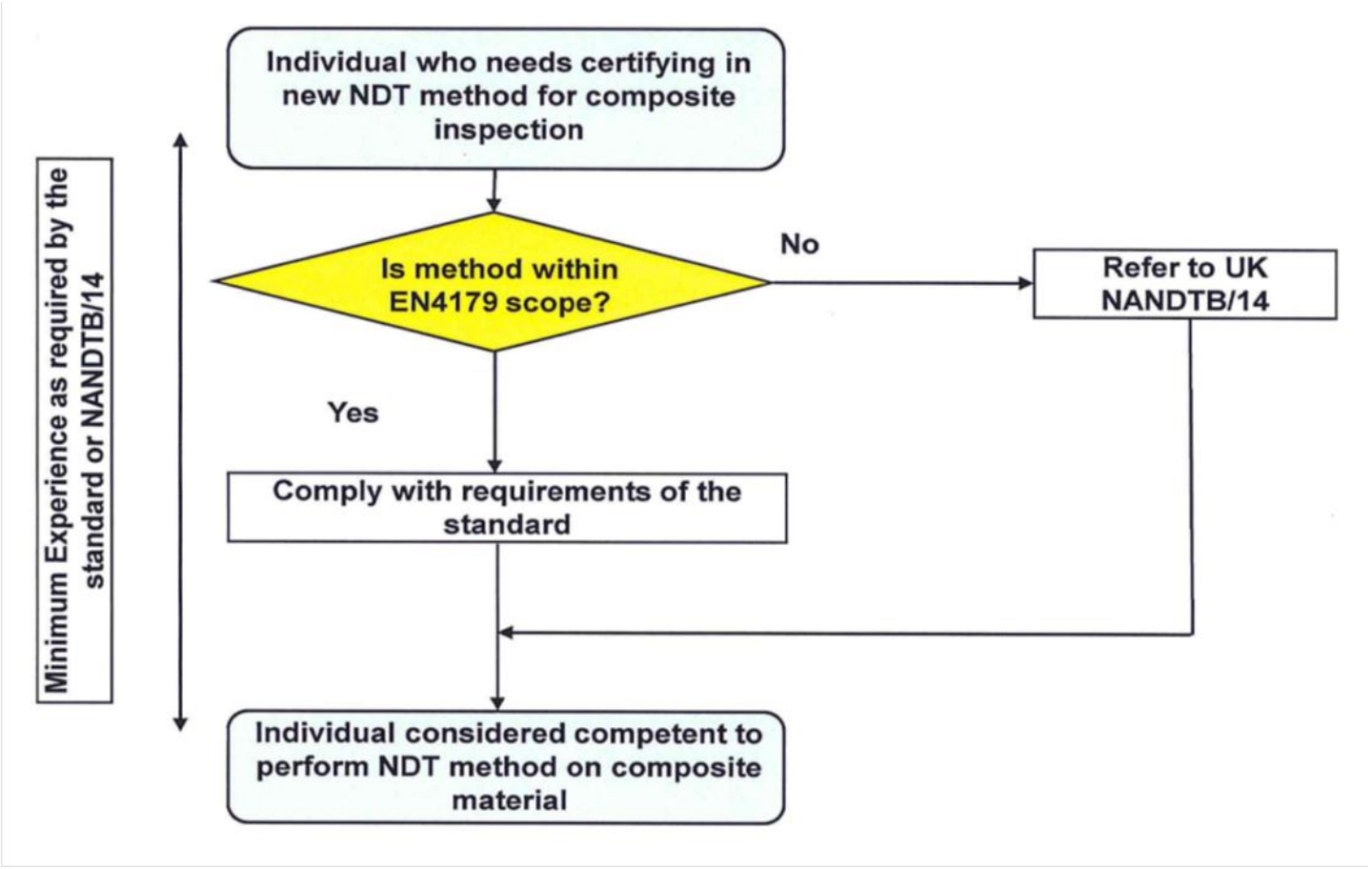
for composite inspections

- EN4179 does not clearly define that training should be related to materials inspected
- Responsible Level 3 is responsible to determine if extra training is required
- Responsible Level 3 does not necessarily have the management authority within the company
- The British NDT board has issued some documents to assist the responsible level 3 and guidelines to handle this subject
- Define 3 scenarios
  - 1 NDT inspector metallic materials needs application in composites
  - 2 New method for inspection of composites only
  - 3 New method for both metallic and composites

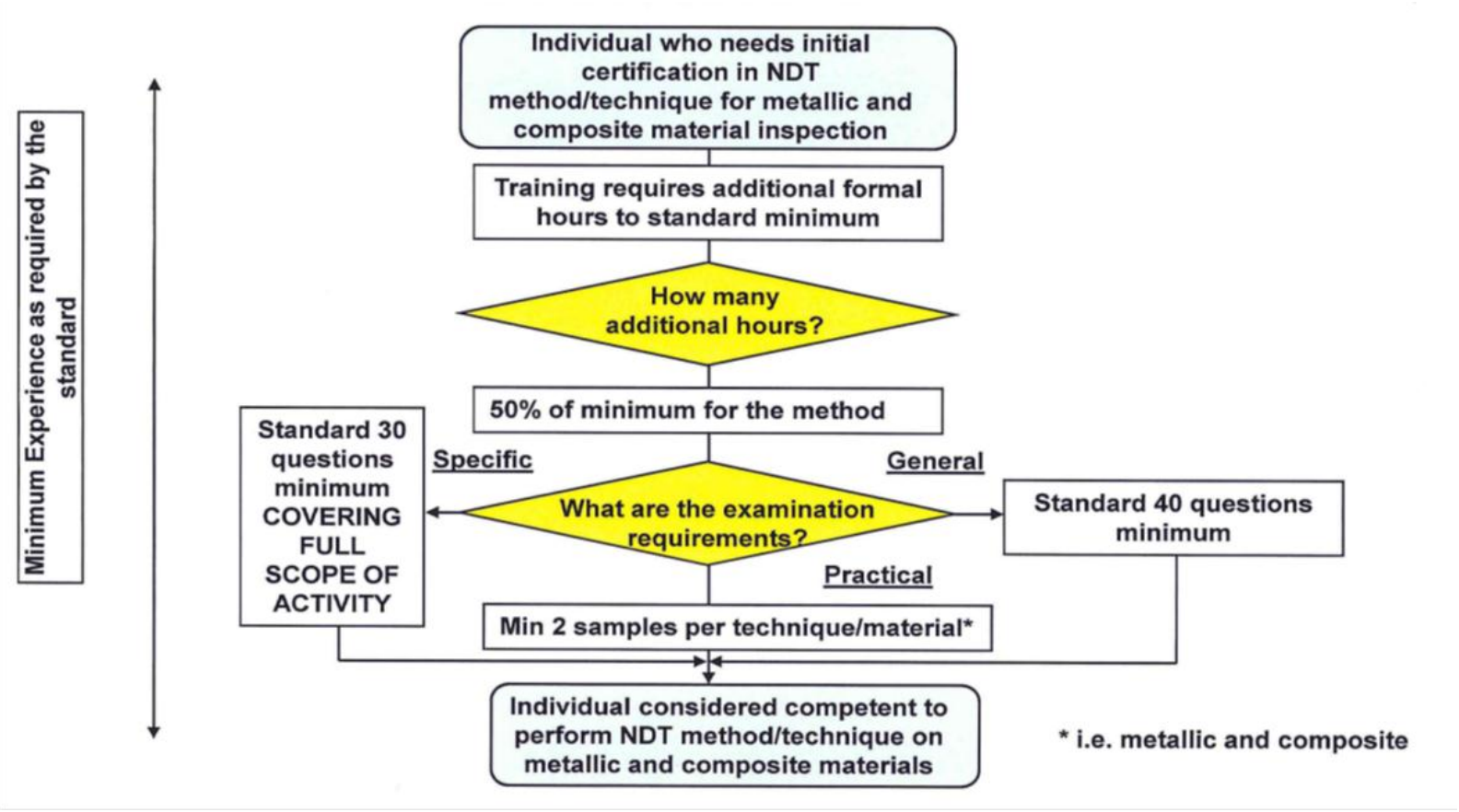
Scenario 1 (UK NDT Board)



Scenario 2 (UK NDT Board)



Scenario 3 (UK NDT Board)



Conclusions

- The world of NDT is changing rapidly at the moment
  - Introduction of new materials
  - Advanced techniques that solve specific inspection issues
- Training requirements need to looked at
  - Role of the responsible Level 3
  - Role of the NDT Board
- Two new methods will be added to the approval scheme shortly
  - Thermography
  - Shearography
  - (Visual ???)
- Special methods/techniques need to be handled case by case

Thank you for your attention