NDT Requirements for Marine Composites
Defence Sector Requirements
Richard Hammond
Current use of composites

- Mine Counter Measure Vessels (Hunt Class)
  - 1978 to 1988

- Mine Hunters (Sandown Class)
  - 1988 to 2001

- Monolithic glass fibre and polyester resin construction

- Hand lay-up / resin infusion
Current NDT process

• Paint and compartment linings are stripped

• Defects identified by
  • Visual inspection
  • Coin tapping
  • Ultrasound

• Defects are repaired

• Paint and compartment linings are reinstated
Typical defects

- Delamination from impact damage
  - Dropped tool
  - Impact with quayside
- Deterioration of secondary bonding
  - Whitening at stiffener roots
  - Degradation of resin properties
    - Age
    - Chemical exposure
- Pitting of the surface from the paint removal
Future composite structures

- Sandwich panel construction
  - Glass fibre
  - Balsa core

- Flat panels
  - Ease of manufacture
  - Low radar cross section

- Mast or superstructure

![Image of a composite structure with a table showing stiffness, flexural strength, and weight comparisons. The table has columns for Solid Material, Core Thickness 1t, and Core Thickness 3t. The values are as follows:
- Stiffness: 1.0, 7.0, 37.0
- Flexural Strength: 1.0, 3.5, 9.2
- Weight: 1.0, 1.03, 1.06]
Composite to steel joints

- Bonded (or bolted)
- Embedded steel plate
- Adhesively bonded in a steel channel
Other challenges

- Armour
- Electromagnetic screen
- Fire insulation
- Radar absorbent material
Start of life

- Verify structure is built as intended
- Stresses due to curing
- Stresses due to welding
- Baseline condition
Through-life

- Degradation of structural performance from baseline
  - Natural aging of materials
  - Environmental loadings

- Changes in stiffness

- Prediction of remaining structural life
NDT wish list

- Affordable

- Appropriate
  - Identify defects that matter
  - Suitable for use in a shipyard environment
  - Not impact other maintenance period activities

- Relatively easy to use

- Not require removal of paint!
Thank you
Any questions?

Restrictions on use:
Permission to reproduce any part of this document should be sought from BAE Systems. Permission will usually be given providing the source is Acknowledged and the copyright notice and this notice are reproduced.