

# The RNLI's Experiences and Current Application of Marine Composites NDT

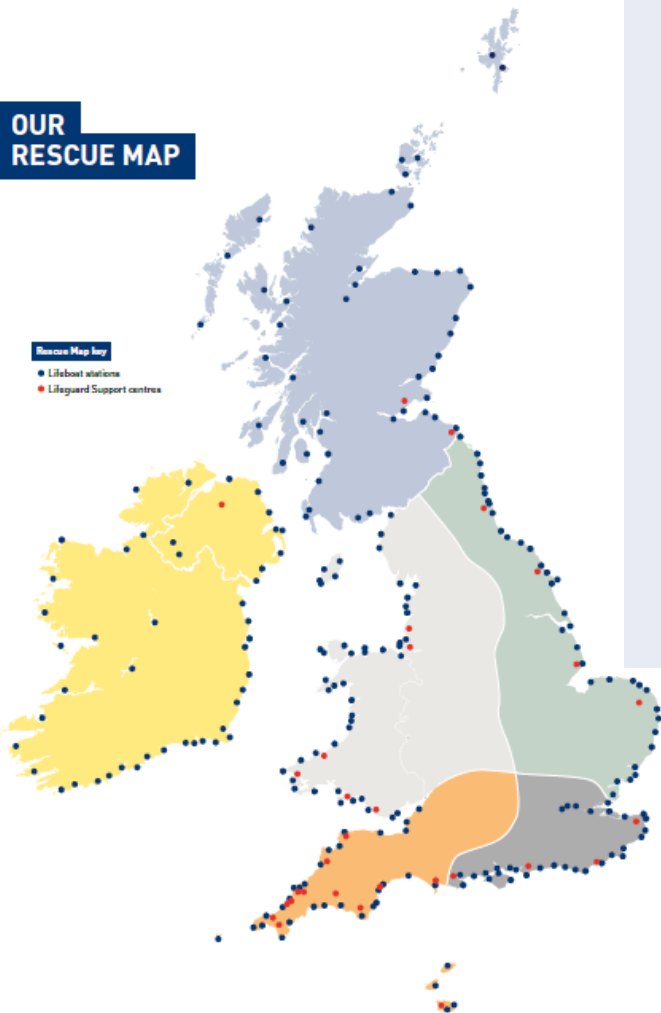
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## OUR RESCUE MAP



## LIFEBOATS

The RNLI provides a 24-hour search and rescue service around the UK and Ireland up to 100 nautical miles offshore.

238 operational lifeboat stations  
458 lifeboats (including relief fleet)  
163 all-weather lifeboats  
288 inshore lifeboats  
7 hovercraft

### 2020 statistics

8,239 launches from lifeboat stations  
in the UK and Ireland  
8,374 people aided  
239 lives saved  
23 people aided each day, on average

- Floating assets:
  - All weather Lifeboats
  - Inshore Lifeboats
  - Hovercraft
  - Lifeguard Equipment



# WE ARE THE RNLI

THE CHARITY THAT SAVES LIVES AT SEA

As featuring on BBC 2's  
"Saving Lives at Sea"!  
(Tuesdays at 20:00)



# RNLI Aims of Composites NDT

- Verification of new build processes
- Detect interlaminar shear in monolithic skins
- Through thickness testing of thick cored panels – skin to core and core to core disbonds
- Detect failure of secondary bonding of internal stiffening from outside hull
- Voids in glued joints
- Determine extent of damage
- Verification of repairs
- Structural evaluation for life extension programs
- Design authority assurance



Lifeboats



# Practical Considerations

- Working boatyards environmental aspects
- Yard health and safety policies
- Limited access / confined spaces
- Portability of equipment
- Manual handling, working at heights
- Impact on other maintenance activities on the vessel
- Post test processing & interpretation including operator skill & experience
- Type of structure and defect of interest
- Duration of inspection
- Cost of inspection





# Methods Considered

- Tap Testing
- Microwave
- Mechanical Impedance Analysis
- Radiography
- Laser Shearography
- Thermography
- Ultrasound

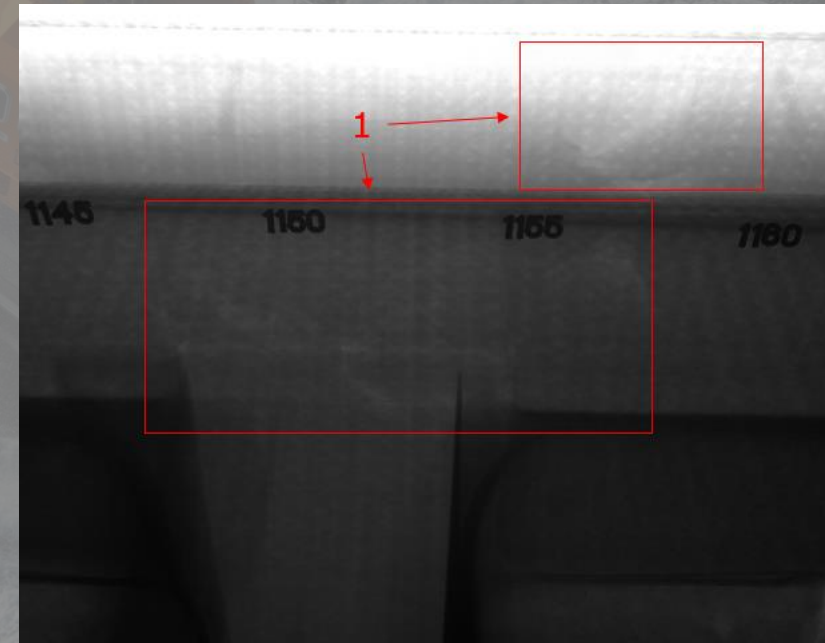
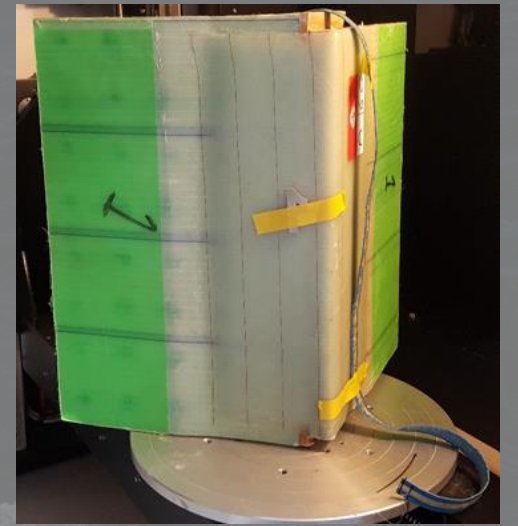




# Verification of New Build



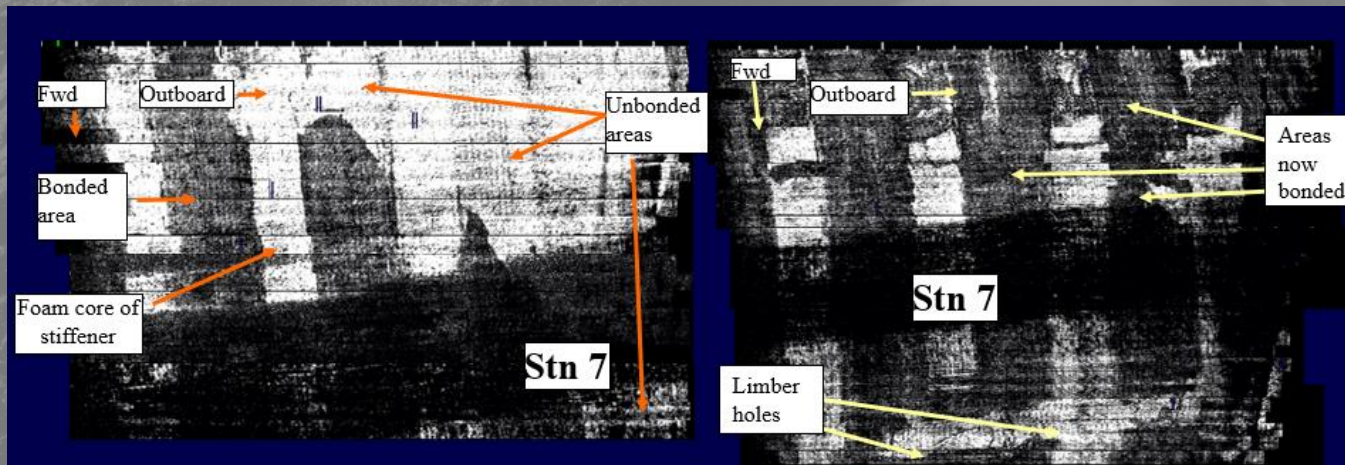
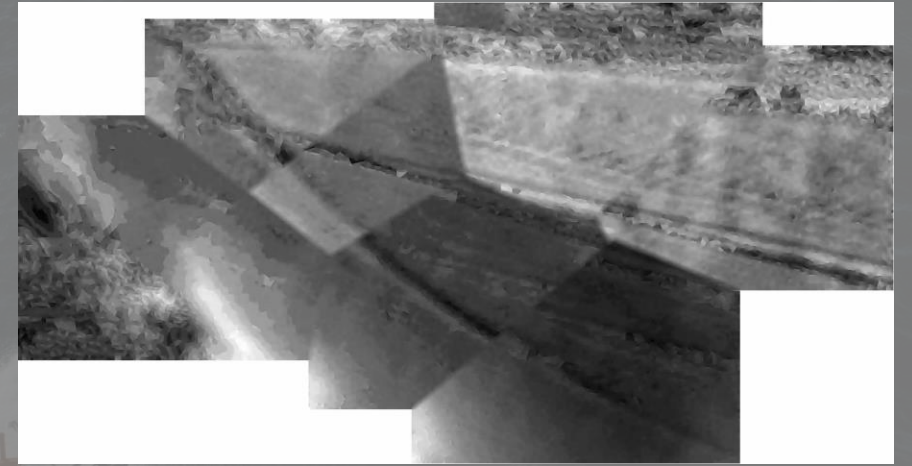
Shearography: Hull topsides – core to core disbond



Radiography: Void in Hull to Deck Joint adhesive



# Repair Examples



C Scan Ultrasound

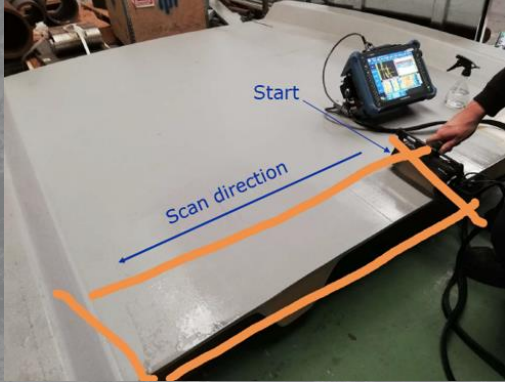


Shearography

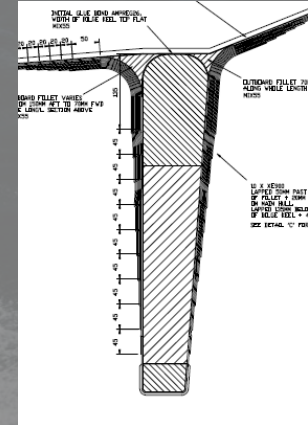
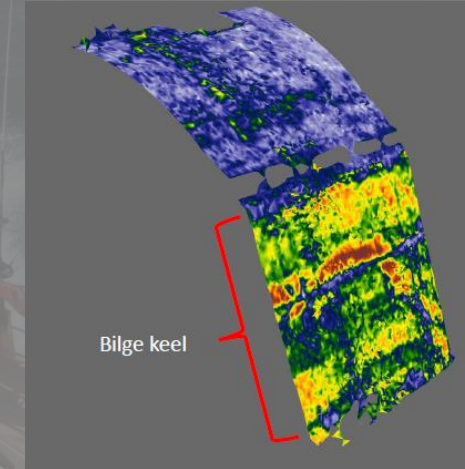
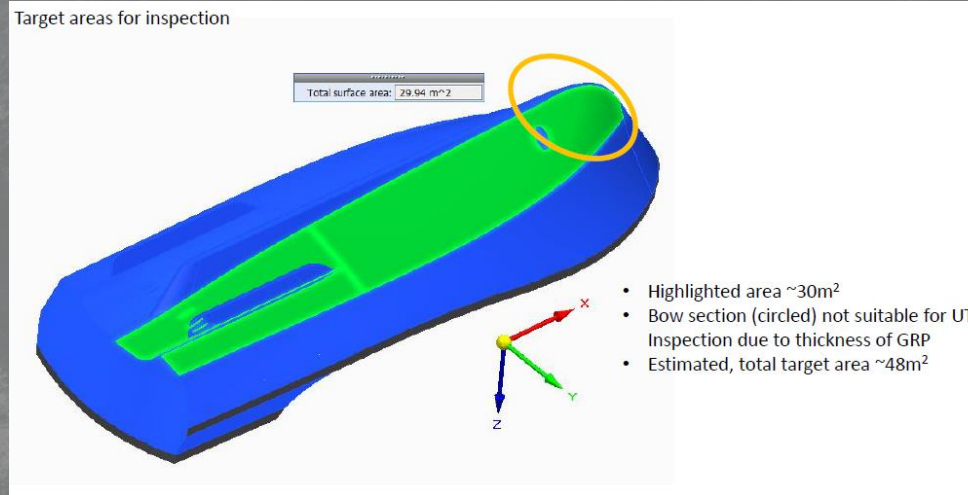


# Severn Class Life Extension programme

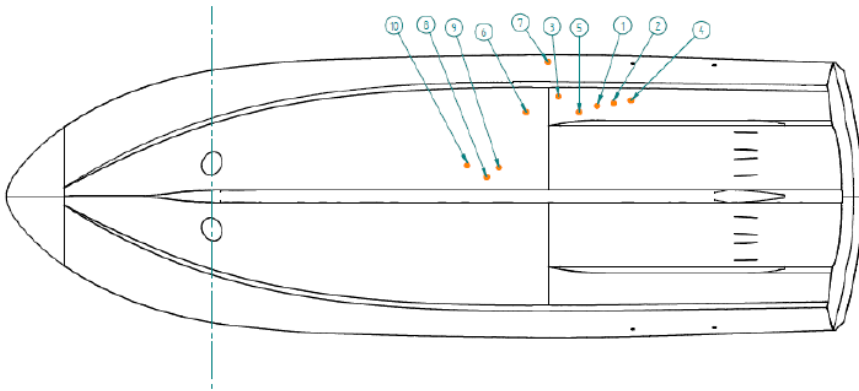
## Ultrasound



C Scan Ultrasound:  
Sample Test Scan

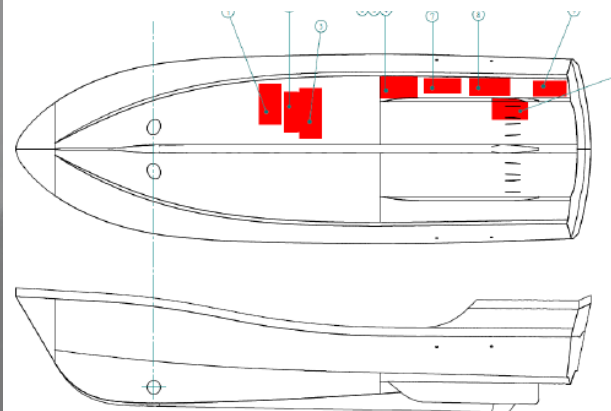


Locations of thickness measurements /  
Single Element Probe tests

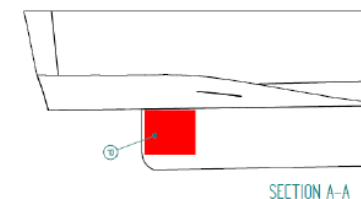
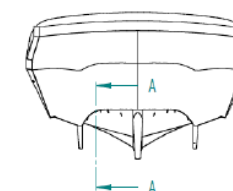


Areas covered by PAUT inspection

### PAUT – Phased Array Ultrasound Technique



- Each area covered 3-4 times
- Estimated total area covered  $\sim 15\text{m}^2$

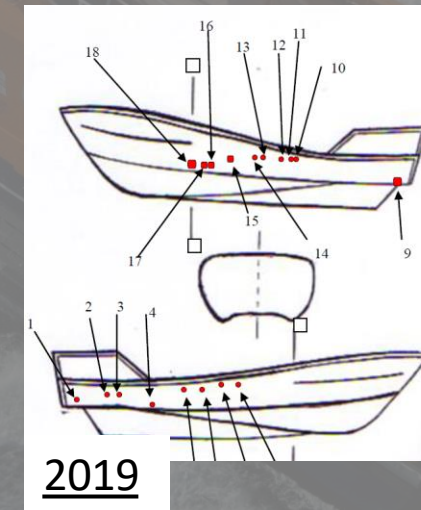
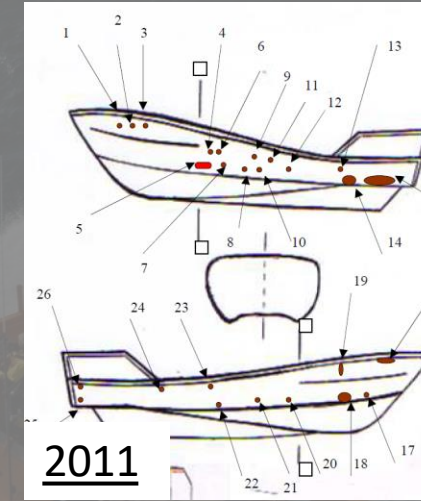




# Severn Class Life Extension programme

## Shearography

- Vacuum stressing laser Shearography was carried out on all accessible areas of cored structure
- Stripped out condition gives unique opportunity for detailed inspection
- The following areas were assessed:
  - Topsides
  - Decks
  - Wheelhouse & Superstructure
  - Internal soles
  - Bulkheads
- A total area of 225m<sup>2</sup> was inspected compared to standard Severn Refit inspection area of 65m<sup>2</sup>
- Findings
  - Internal defects were minimal
  - Majority were found externally on deck areas
  - Top side defects





# Conclusions

- No single solution for all structures / flaws
- Methods must offer rapid area coverage, required sensitivity and the ability to operate in a boatyard environment. Skill required to interpret results.
- Laser Shearography found to be effective and efficient on cored panels
- Ultrasonic Testing area scanning can be used successfully on the outer surface to detect delamination of stiffeners from the hull. Current limitations in terms of speed and interpretation of results
- Radiography has been found to be effective at finding voids in glued joints but does present logistical challenges within the facility in terms of access and HSE licence required but these are becoming easier
- Use of NDT provides assurance to the RNLI Design Authority