# Case study

## RNLI composite hull frame analysis

### THE CHALLENGE

The lifeboat transverse frame detail is a top hat arrangement with a pre-fabricated foam core, over laminated with carbon reinforcement material. The manufacturing process for installing the transverse frames is as follows:

- CNC machine low density core, sandwiched by 10mm of high density core
- Bond transverse frame core to hull inner skin
- Apply wet laminated carbon biaxial over laminate and carbon unidirectional capping strips

To ease the manufacturing process, Frazer-Nash undertook a comprehensive analysis to find ways of optimising the transverse frame arrangement of the high speed craft.

### OUR SOLUTION

We began by examining what influence the bond between the core and the hull inner skin had on the performance of the transverse frame - focussing particularly on the shear webs' ability to withstand web skin buckling or wrinkling.

By constructing a Finite Element Analysis model of the transverse frame scantling arrangement, we were able to conduct a structural static and buckling analysis (*see below*). This enabled us to analyse the output stresses and buckling load factors for a range of scenarios, comparing them to assess their strength.

We were then able to make recommendations to improve the manufacturing process, which facilitated a reduced risk of core bond delamination, and an increased ability of the shear web to resist skin wrinkling or buckling in the transverse frame.

These recommendations optimised the transverse frame foam geometry and bonding method, to increase the consistency and overall load capacity of the frame, thereby reducing the risk of premature in service deterioration.

Client

Royal National Lifeboat Institution (RNLI)

Business need

Finite element analysis of hull frame to improve manufacturing process

Why Frazer-Nash?

Frazer-Nash has considerable expertise in structural analysis and Marine Technologies

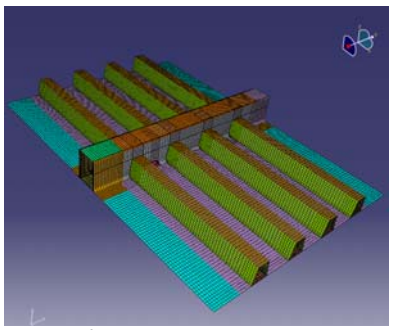

Figure 1: Transverse Frame Structural Model

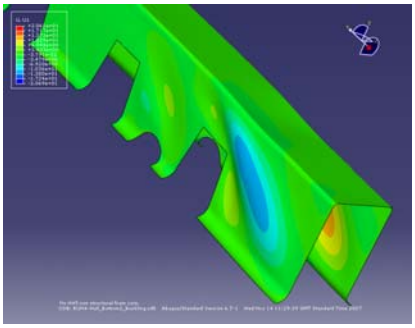

Figure 2: Transverse Frame Shear Web Skin Wrinkling

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