Development of novel composite sandwich structures with integrated shock absorbing functionality

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14/04/2015
Vision

Create energy absorbing sandwich panel composites, to be integrated into the boat structure, to protect crews from potentially dangerous whole body vibrations (WBV).

Design challenge illustration: Cromer D-class battling through the surf

Challenges:
- Boat trial data shows that wave impacts are highly non-linear
- Reduction in WBV will allow increased boat performance
- Restricted design space
- Solution to be integrated into composite deck
- “Soft” composite suspension required

Tools:
- 3D printing of shock absorbing cellular structures
- Sandwich panel integration and stiffness tailoring

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Cellular structure design and manufacture

Ultimaker 3D printer

Elastomeric test specimens
3D printed polyurethane properties

- Tensile stiffness and the UTS are highly influenced by print direction
- Significant strain rate dependence at high strains
- Results from testing have allowed the optimum print parameters to be defined

Stress-strain in tension, optimised variables, print direction 0° or 90° to the extension direction

Stress-strain for various strain rates, print direction 0° to the extension, optimised print parameters

Key variables:
- Material flow
- Layer height
- Print direction

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Ongoing work

Characterisation of the energy absorption potential of printed inserts

Increased pre-buckle leads to smoother transition

4 point bend force-displacement for sandwich panels with controlled skin buckling – finite element analysis

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I would like to acknowledge the EPSRC and also the RNLI for their continued support and sponsorship.

Please come and visit me at my poster where I would be pleased to discuss my work in more detail.