

## Case Studies: Submarine Mast Raising Equipment

Frewer Engineering designed composite telescopic submarine mast assembly components using state-of-the-art materials and manufacturing techniques.



### Novel Composites Design

To radically advance existing mast designs, the customer required the integration of novel materials such as GFRP and CFRP prepreg composites to achieve their demanding requirements. We provided our knowledge implementing modern composites in compact and highly intricate structures from a design, analysis and manufacturing feasibility standpoint.

### Optimising Stiffness, Strength & Mass

The customer required the assembly to meet exacting global stiffness and optimised strength; driven by the demanding operational loading conditions and challenging environmental conditions in which it would operate. We optimised laminate stacks in GFRP & CFRP prepreg to meet the challenging load-deflection specifications; concurrently iterating dynamic non-linear finite element analyses of the design to ensure the weight budget was met with requisite stiffness and strength.



### Practical & Efficient Manufacture

We worked closely with the manufacturer to review the various concept options as the design progressed, ensuring that especially in more complex regions of the mast assembly, manufacture remained practical without compromising structural integrity, de-risking the manufacturing programme. With a fixed budget, it was imperative we innovated, whilst remaining cost-competitive to manufacture; our agile team delivered on-time & in-budget.

