AN OVERVIEW OF THE ONR SOLID MECHANICS PROGRAM

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The Solid Mechanics Program of the Office of Naval Research (ONR) provides the scientific basis for the effective design and utilization of affordable and reliable Naval structures operating in severe environments. These structures are designed to withstand complex multi-axial loading conditions, including highly transient loads. The analysis and effective design of these structures requires the incorporation of the effects of sea water and moisture, temperature extremes, hydrostatic pressure, time-dependent three-dimensional loading, and structure-fluid interactions. The current research focus is on mechanics of marine composite materials and composite sandwich structures.

The program supports research dealing with understanding of, and establishing physically based models for, the physical processes involved in the response of glass-fiber and carbon-fiber reinforced composite materials and composite sandwich structures, to static, cyclic, and dynamic, multi-axial loading conditions, in severe environments. The establishment of these models, with predictive capabilities, requires multi-scale, multi-physics analysis. Avenues for enhancing the performance of marine composite structures through the introduction of nanoparticles (and carbon nanotubes), and through the incorporation of novel design concepts, are also being explored. Research on multifunctional composites seeks to enhance performance through the incorporation of additional beneficial attributes, without compromising on the mechanical properties.

The presentation will include examples of recent/current research, and a discussion of future directions of ONR research in mechanics of marine composites and sandwich structures. A major focus is on the dynamic response and failure of composites and sandwich structures. Topics for discussion include: dynamic constitutive equations; strain rate effects; dynamic failure criteria; impact, shock, and blast; hull slamming; implosions; and mitigation concepts. This research will contribute to the design of affordable Naval structures with enhanced performance and reduced life-cycle costs.