



Blast and Impact Resistant Composite Structures for Navy Ships

P. Raju Mantena, Alexander H.D. Cheng, Ahmed Al-Ostaz, A.M. 'Raj' Rajendran
 Composite Structures and Nano-Engineering Research - The University of Mississippi



OBJECTIVE AND SCOPE OF RESEARCH

- Light weight, fast, stealthy ships are required for the US Navy littoral operations. The currently approved series of ships, the DD(X), has stringent requirements for reduced topside weight and fire/smoke toxicity.
- Need for reducing life cycle costs, and the ability to incorporate multi-functionality, including blast/shock/impact resistant features, lead towards the use of affordable composite materials and sandwich structures.

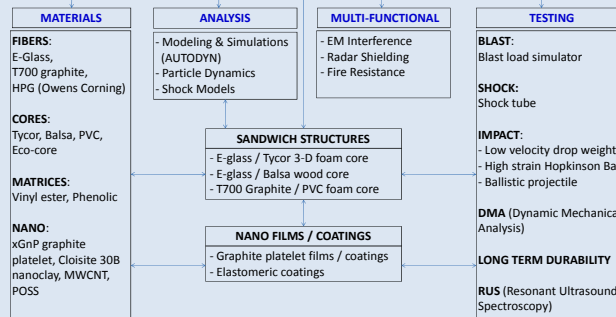
- Our research scope includes: **low-cost fire-resistant** exfoliated graphite nano platelet reinforced glass/carbon polymeric based composites with fly ash and 3-D fiber reinforced foams; investigating their response to low-velocity impact, ballistic, shock and blast loads; dynamic mechanical analysis for modulus, damping, creep and stress relaxation; developing constitutive models and high-performance scalable computing based modeling and simulations; accelerated testing for long-term durability; and the radar-absorbing and EM-shielding characteristics for improved stealth/safety.



RESEARCH PARTNERS

- The University of Mississippi (UM), Michigan State University (MSU), and University of New Orleans (UNO), supported by the US Army Corps Engineer Research and Development Center (ERDC) are utilizing their research strengths in modeling, analysis, fabrication and testing of affordable blast/shock/impact resistant nanoparticle reinforced composite structures for the new generation navy ships.
- University of Alabama-Birmingham (UAB) fabricated the VARTM sandwich composite panels and performed ballistic tests.
- North Carolina A&T State University (NC AT) provided their patented low-cost fire resistant fly ash based Eco-core foams.
- Northrop Grumman Ship Building (NGSB), Gulfport, MS advised and facilitated UM on these research efforts.
- Webcore Technologies, Miamisburg, OH provided their patented TYCOR® foam cores for fabricating the blast / shock / impact resistant sandwich panels.

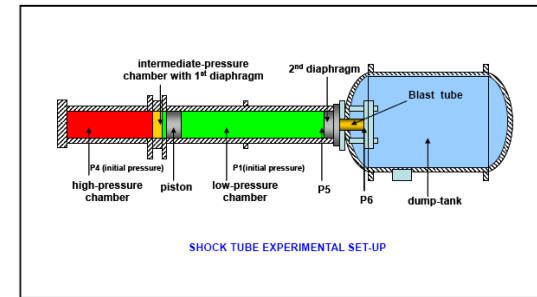
BLAST AND IMPACT RESISTANT COMPOSITE STRUCTURES FOR NAVY SHIPS



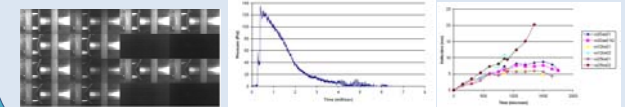
ACKNOWLEDGEMENT

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PROPOSED TEST FACILITIES (YEAR-II)



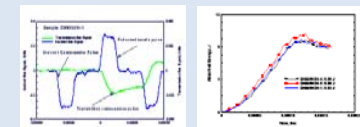
SHOCK TUBE EXPERIMENTAL SET-UP



Shock tube testing - Typical outputs



SPLIT HOPKINSON PRESSURE BAR APPARATUS
 (material evaluation at very high strain rates)



Hopkinson bar high strain rate testing - Typical outputs