

Pultrusion-Based Fabrication of Revolutionary Phenolic Foam Replacement for Balsa in Navy Ship Structures

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Problem Statement

- Next generation Navy ships need composites in topside structures
 - Reduce weight and Radar Cross Section (RCS) signature
- Current composite structures
 - Expensive
 - Don't meet fire, smoke & toxicity (FST) requirements



Organizations With Problem

- U.S. Navy – NAVSEA / PEO Submarines / PMS435
- NGSS, Gulfport; NGNN; General Dynamics Electric Boat; NASSCUMM



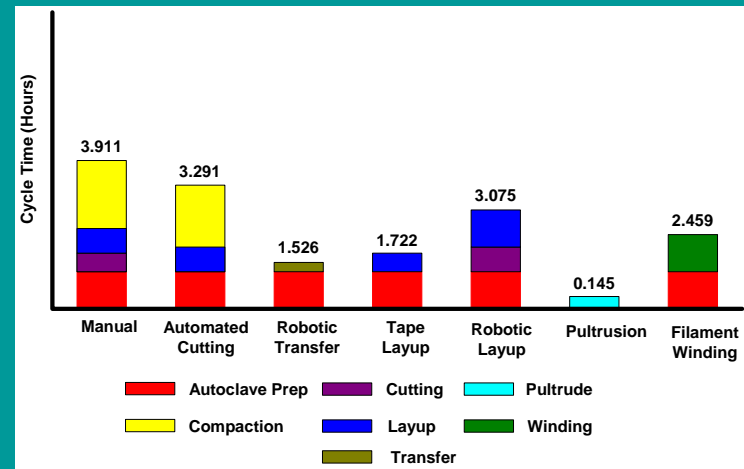
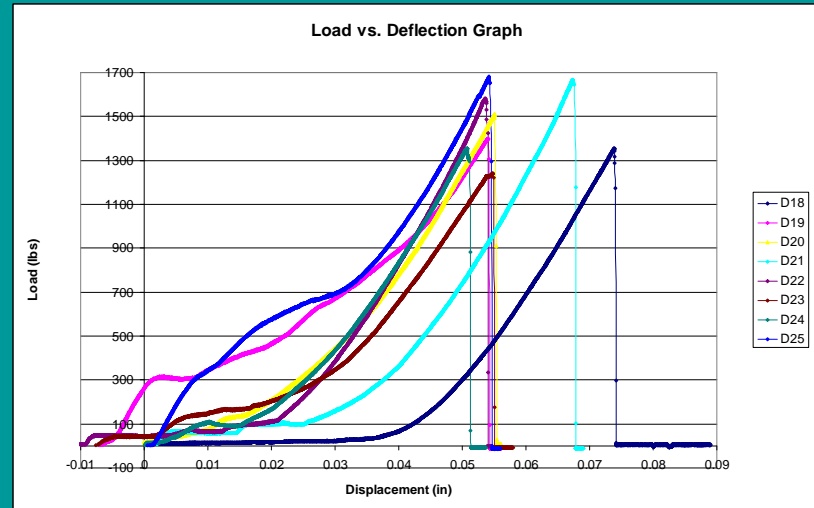
Baseline Technology - Balsa Core

- Current products - balsa for strength and light weight
- Fabrication is labor and time intensive
- Comparatively expensive material
- Does not meet Navy standards for FST
- Inconsistent in properties and often unavailable



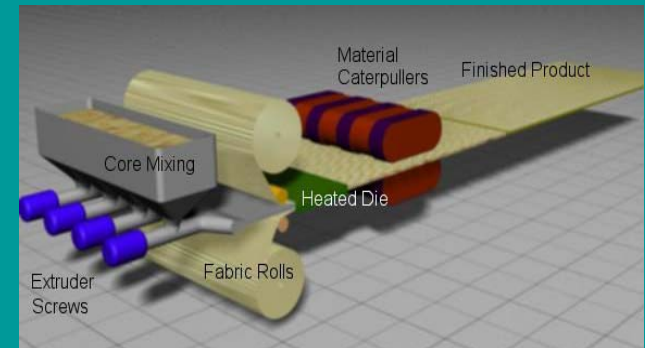
Customer Needs

- Reduced weight (approximate to balsa)
- FST requirements of Navy or better
- Structural properties meet building codes
- Lower cost than balsa
- Longer service life



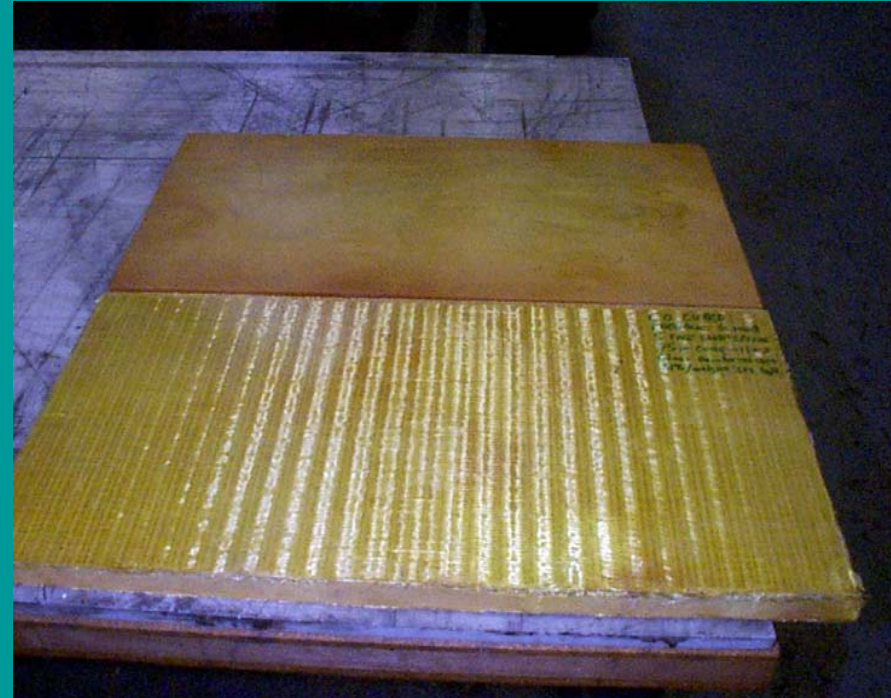
Solution

- Phenolic syntactic foam core
- Durable fiberglass laminate face sheets
- Pultrusion process - continuous and low-cost
- Tailored design to meet specific density and structure property needs



Performance Specs

- Can be tailored to density down to 9 lb/ft³
- Density / mechanical properties trade-offs predictable & tailored
- Impact, mechanical and FST properties equivalent to, or better than, balsa wood
- Available as core with thin scrim/face sheets or as finished sandwich panel
- Lower cost than balsa equivalents



Comparison to Balsa

- Meets Navy FS&T needs
- Lower cost materials and process method
- Widths up to 10 ft and any specified length
- Consistent physical properties
- Dependable sourcing of materials



Current State of Development

- Scale-up of process to production level capability underway
- Development of VE laminate/ Phenolic co-cured sandwich constructions ongoing
- Prototype of core feeder system undergoing final design optimization



Technology Development Milestones

SBIR	Milestone	TRL	Date
Phase 2-Yr 1	Develop Foam Composition	6	June 2007
Phase 2-Yr 1	Demonstrate FST and Mechanical Properties	5	July 2007
Phase 2-Yr 1	Foam Pultrusion Demonstration	4	August 2007
Phase 2-Yr 2	Demonstrate Large Panel Pultrusion Manufacturing	6	August 2008
Option	Shipyard Trials for Large Panels	7	TBD

Transition to Fleet

TRL	Required Tests, Demos	Target Date	Organizations to be involved
8	Demonstrate Product Consistency in Production-Like Scenario. Develop Property Database.	TBD	NSWC, NGSS, Others
8	Full-Scale Fire Testing	TBD	NSWC, NGSS, Others
8	Full-Scale Mechanical Testing (Bending, Shear, Compression)	TBD	NSWC, NGSS, Others
8	Full-Scale Impact Testing (MIL-STD-901D)	TBD	NSWC, NGSS, Others

Partners/Company Role

- KaZaK seeks partnerships with shipbuilding prime contractors
- Company will consider:
 - Direct production and sale of pultruded sandwich panels
 - Technology Licensing
 - Manufacturing equipment set up; engineering support
 - Production process training and support



About the Company



- High performance composite structures
- Large pultruded structures, panels and tubes
- Specializing in large and unusual pultrusions
- Established in 1992 – privately held
- Engineering – Woburn, MA
- Manufacturing – Hudson, NH

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