

***NORTHROP GRUMMAN***

DEFINING THE FUTURE

# Evaluation of a Commercial Numerical Tool for Composite Structures

**NSRP SP14**

**Product Design & Manufacturing Technology Panel  
Biloxi, MS**

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# Evaluation of a Commercial Numerical Tool for Composite Structures

<b>PROGRAM INFORMATION</b>	<b>OBJECTIVE</b>
<p><b><u>Prime/Lead</u></b>: Northrop Grumman Newport News</p> <p><b><u>Team Member</u></b>: ESI North America</p> <p><b><u>Duration</u></b>: 9 months</p>	<p>This program is to investigate the use of SYSPLY® to design composite structures. This tool, a FEA design tool, will allow engineers to utilize the positive attributes of composite materials to create more efficient composite ship structures.</p>
<b>DELIVERABLES/BENEFITS/ROI</b>	<b>FINANCIAL</b>
<ul style="list-style-type: none"><li>• Composite marine material properties, of single &amp; multi-ply, will be developed. Industry sharing based on DoS &amp; DoD approval.</li><li>• Model &amp; analyses of test structures.</li><li>• Assessment of TRL of the software.</li><li>• With success, potential optimization of composite structures may result in design and fabrication cost reduction up to 30%.</li></ul>	<p><b>Program Funds:</b> \$99,500</p> <p><b>Cost Share:</b> \$0</p>

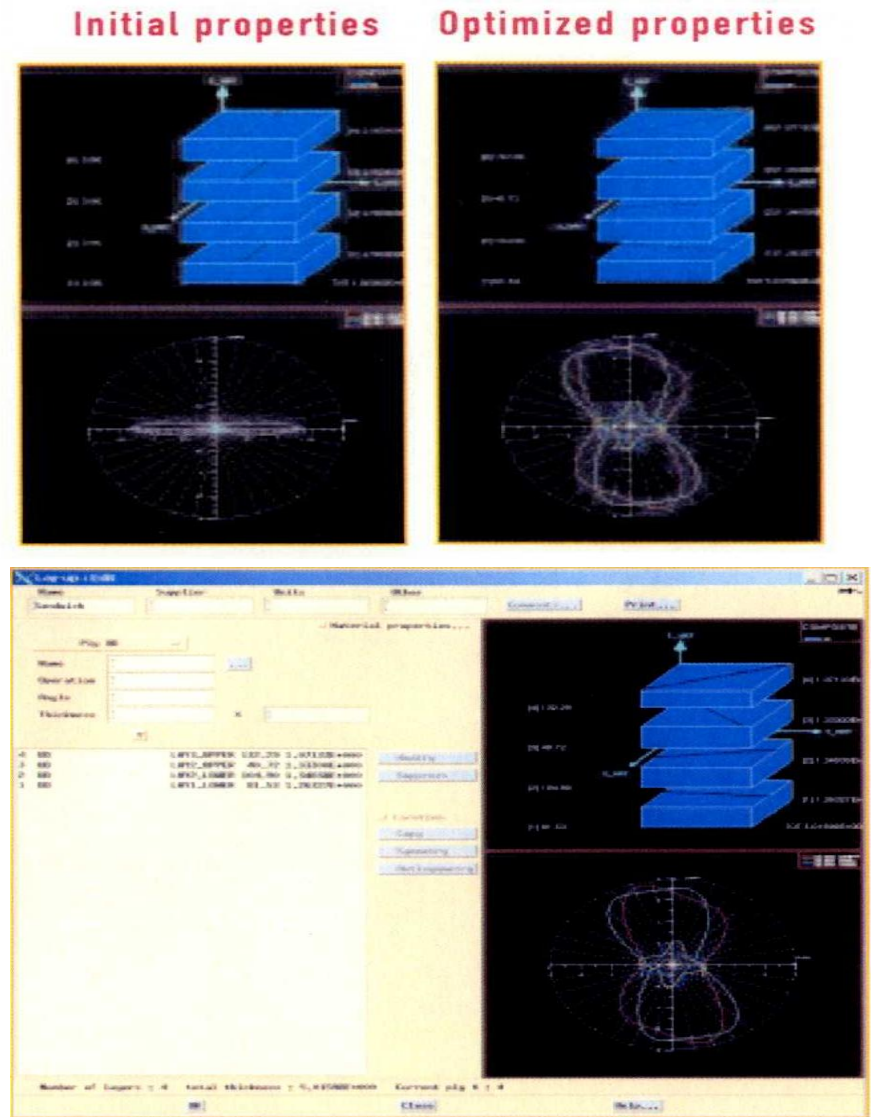
# Why?

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- Currently, there is not a 'tool' for composite structure designs being used by the shipbuilding industry.
- There are FEA tools available that assist the design engineer but these are not optimized for composites.
  - Used mainly to analyze a design once completed.
- New method is to use the tools to determine topologically the stress (shear) flow direction and magnitude.
- From the testing, a material library based on the ply and inter-ply strengths will have been started. A numerical 'lay-up', using this information, can then be attempted.
- Present designs are homogeneously derived designs that may be very heavy. E.g., Designed to resist loading in three directions when only one is needed! This is creates an over-designed structure which adds labor costs, material costs, and complexity.

# Evaluation of a Commercial Numerical Tool for Composite Structures – How does this work?

- These new tools calculate stress (shear) based on a per unit thickness basis (topologically). Within the programs, a material library using single ply and inter-ply reactions can be used to determine the 'thickness' and lay-up direction of the composite. This enables the design engineer to optimize the part for those determined load conditions.
- An interactive GUI will allow the engineer to lay the composite up to meet the direction and magnitude of the forces created by the boundary conditions.



# Benefits

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- This program, while not inclusive of all available software tools, starts the investigative process to determine the TRL of these products.
- If successful a potential new tool has been identified for use by the shipbuilding community that can optimize the design of composite structures.
- This lean method of design can lead to a savings in engineering time, as well as fabrication time and material costs. It also increases the confidence of a successful design and potentially reduces prototyping costs.

# Questions?

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