

NPS Acquisition Research Program: Creating Synergy for Informed Change

Reinvigorating the Ship Design and Shipbuilding Process

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AGENDA

- **International Naval Technology Transfer: Lessons Learned from the Spanish and Chilean Shipbuilding Experience**, Larrie Ferreiro, Defense Acquisition University
- **Total Ship Design Process Modeling**, David Helgerson, CSC Advanced Marine Center, Gilbert Goddin, Naval Surface Warfare Center, Dahlgren and Sean Gallagher, Naval Surface Warfare Center, Carderock
- **Revitalization of Naval Surface Warfare Center Excellence in Early Stage Combat System Engineering**, Terence Sheehan, Mark Williams, Ashby Hall, Naval Surface Warfare Center, Dahlgren

Bottom Line Up Front (BLUF)

- 1. Less Dense, Complex Design**
- 2. Integrated Physics-Based Design Tools**
- 3. Design-Build Collaboration**

Density as a Cost-driver in Naval Submarine Design and Procurement*

“A strategic contradiction occurs when ship and submarine designs are built smaller as a means to lower costs, while installed capability is maximized for the same reason. The smaller space requires increased innovation to incorporate the same capabilities. If increased capability per hull is desired, a larger—not smaller—design must be incorporated to avoid the penalties associated with unnecessarily complex and congested designs.”

*Benjamin P. Grant, LT, USN, NPS, June 2008 (underline added)

Toward Robust Design: CREATE-SHIPS Project, DoD High Performance Computing Program

- **Computational Research & Engineering for Acquisition Tools & Environments (CREATE)-SHIPS:**
 - **Build on NAVSEA's LEAPS (Leading Edge Architecture for Prototyping Systems) and ASSET (Advanced Surface & Submarine Evaluation Tool)**
 - **Replace empirical design with validated physics-based computational design**
 - **Detect and fix design flaws early in design process**
 - **Develop optimized designs for new concepts**
 - **Begin system integration earlier in acquisition process**
 - **Increase acquisition program flexibility and agility to respond to rapidly changing requirements**

CREATE-SHIPS: Leading The Way Toward “Elegant” Design

- **Concept Design High Quality, Physics-Based Software**
 - **Intelligent Ship Arrangements (ISA):** a new surface ship architectural optimization system
 - **Weapons Effects (Shock) & Seaway Loads Predictions**
 - **Integrated Hydrodynamic Design Environment (IHDE):** hull form design and evaluation
 - **Integrated Structural Design Environment (ISDE):** incorporate reliability-based structural design
 - **Rapid Ship Design Environment (RSDE):** higher fidelity design definition, physics-based analyses, rapid exploration of design space

A HPCMPO – NAVSEA – ONR Collaboration



The Way Ahead: To Efficiently Produce And Own A Warship

- Less Dense Design
 - Develop minimal cost design, not minimal size
 - Arrange ship to reduce costs due to increased volumetric density and complex architectures
- Integrated Physics-Based Design Tools
 - Analyze hundreds of ship concepts using physics- based analysis tools, captured in design space
 - Use high performance computing to reduce time to solution, within decision cycle of concept design
- Design-Build Collaboration between Navy & Shipbuilder(s)

Invest Early in More Robust Ship Design