

Strategic Distribution of Shipbuilding Construction

Data-Driven Decision Support for Navy's 50% Construction Mandate

Lead: HII – Ingalls

Partner: HII – Newport News Shipbuilding

Challenge and Solution

Navy Mandate: 50% of shipbuilding construction distributed across multiple suppliers

Current Gap:

No systematic framework to coordinate multi-supplier efforts

Manual planning takes weeks per distribution decision

Cannot optimize cost, capacity, schedule, and risk simultaneously

"What-if" scenarios require weeks to re-evaluate

Our Solution - Three-Model Optimization Framework:

Supplier Capability Model - Facility capacities, skills, constraints

Site Placement Optimization - Optimal work assignments

Network Flow Optimization - Transportation routes & timing

Builds on Previous Work

- NSRP Project 2005-341-054: *Supplier Technical Assessment Criteria*
  → Leveraging standardized scoring for capability modeling

Project Objectives and Methodology

Objectives

- Enable faster schedules through optimized work assignment
- Maximize capacity utilization across U.S. shipbuilding industrial base
- Provide clear roadmap to meet Navy's 50% requirement
- Transform distributed construction from compliance burden to capability

5-Phase Methodology (12 Months)

- **Months 1-2:** Problem Definition → SME collaboration, define decision variables
- **Months 3-4:** Synthetic Data Design → Realistic scenarios, validation
- **Months 5-7:** Model Development → MILP optimization + disruption scenarios
- **Months 8-10:** Experimentation → Test scenarios, measure improvements
- **Months 11-12:** PoC & Roadmap → Interactive interface, implementation plan

BEFORE vs. AFTER

Current Process: Weeks

- Manual facility assessments via phone/email
- Evaluate 3-4 scenarios max
- Gut-feel decision making
- 20-30% schedule buffers due to uncertainty
- "Workable" solution, not optimal

With Optimization Tool: 3 Days

- Automated supplier capability database
- Evaluate 10,000+ assignment combinations
- 10+ scenarios analyzed in real-time
- 10-15% data-driven buffers
- Mathematically optimal solution

KEY DELIVERABLES & TECHNOLOGY

Project Deliverables

- **Interactive Proof-of-Concept** with 'what-if' scenario capability
- **Model Documentation & User Guide**
- **Implementation Roadmap** (PoC → operational deployment)
- **Quarterly Reports & Panel Presentations**
- **Final Knowledge Transfer** to NSRP membership

Technology Innovation

Mixed-Integer Linear Programming (MILP)

- Evaluates thousands of assignment combinations simultaneously
- Optimizes across competing objectives (cost, schedule, capacity, risk)
- Integrates disruption scenarios (supplier failures, capacity overruns)

Built-In Risk Modeling:

- Monte Carlo simulations (1,000+ scenarios in minutes)
- Identifies bottlenecks before they impact schedules
- Pre-planned alternatives ready to execute

PROJECT BENEFITS

Primary: Prime Shipyards

- Replace manual planning with data-driven optimization
- Meet Navy requirements while maintaining competitiveness
- Standardized framework across multiple ship classes
- Real-time response to changes and disruptions

Secondary: Subcontractor Shipyards

- Work allocation based on unique strengths/capabilities
- Improved capacity utilization
- Foundation for competitive bidding marketplace

Navy/Industry Impact

- Strengthens U.S. shipbuilding industrial base
- Accelerates production schedules
- Reduces costs: transportation optimization, capacity utilization, fewer errors
- Creates common planning language across industry

Annual Savings Potential: $5-10M (for 2-3 ships/year)

IMPLEMENTATION PATHWAY

Year 1: This Project (TRL 1→5)

- **Q1-Q2:** Problem definition + synthetic data design
- **Q3:** Model development with disruption scenarios
- **Q4:** Experimentation + PoC interface + roadmap delivery

Deliverable: Proof-of-concept with synthetic data

Year 2+: Operational Deployment (TRL 5→9)

- **Phase 1:** Transition to real program data (selected ship class)
- **Phase 2:** IT system deployment + user training
- **Phase 3:** Pilot application with validation
- **Phase 4:** Multi-program integration

Benefitting Platforms: All U.S. Navy ship construction programs requiring distributed construction

