

Overview of NSRP Project: Design for Producibility for Mid-Tiered Shipyards

Product Design and Materials Technology Panel Meeting June 5, 2007



Technology Investment Agreement (TIA) 2007-380:

Category B Data – Government Purpose Rights

Distribution authorized to project participants and NSRP ASE Program representatives. Further distribution is prohibited.



Significance of the Project

- **State of the Industry**

- US Shipbuilding industry continues to face the challenges of building ships with limited design information and long design and construction lead times.
- Increased vessel complexity, options, variations are contributing factors to **cost escalation**.

- **Why this project?**

- Design-for-production methodologies have proven to be an effective tool to reduce excess design complexity in other industries, and were identified by NSRP (RA 06-01) as a research area of special interest.

Category B Data – Government Purpose Rights



FMI Benchmark on DFP

- “...there is a low appreciation of the importance of capturing production knowledge and defining facility constraints and attributes in order to define design parameters that result in optimum production performance...”
- “...high turnover of staff in many of U.S. yards means there is often a loss of DFP knowledge during gaps in design activity...”
- “...DFP applications in foreign shipyards include emphasis on design optimization to minimize material and work content, standardization and reduction of part count, design for self-alignment, and the application of group technology...”

(NSRP, “A National Consensus Investment Strategy to Address the findings of the 2004 Global Shipbuilding Industry Base Benchmarking Study”, 2005)

Category B Data – Government Purpose Rights



FMI Benchmark on DFP for Mid-Tiered Shipyard

Rank	Mid-tier (Part 2)	First-tier (Part 1)
1	Production engineering	Ship design and design for production
2	Design for production	Production engineering
3	Master planning, steel and outfit scheduling and production control	Master planning and steel and outfit scheduling
4	Manpower and organization of work	Outfit module building, pre-erection outfitting and onboard outfitting
5	Outfit installation and onboard services	Dimensional accuracy and QC
6	Outfit module building, pre-erection outfitting	Outfit parts marshalling and general storage and warehousing
7	Dimensional accuracy and QC	Pipe shop and other outfit manufacturing activities
8	Outfit parts marshalling	Manpower and organization of work
9	Steelwork and outfit coding system	Steelwork and outfit production information
10	Block assembly	Steelwork and outfit coding system

Table 0.2 – Top ten industry-wide action areas

Category B Data – Government Purpose Rights



DFP Team Members

- **Bollinger Shipyards - Lockport, LLC (Prime)**
 - Dennis Fanguy (Project Manager)
- **Todd Pacific Shipyards**
 - Bob Gilbert
- **Atlantic Marine – Jacksonville, LLC**
 - Chuck Nugent
- **Atlantic Marine – Mobile, LLC**
 - Tom Williams
- **Victoria Dlugokecki, P.E.**
- **Hepinstall Consulting Group, Inc.**
 - Lisa Hepinstall

Category B Data – Government Purpose Rights



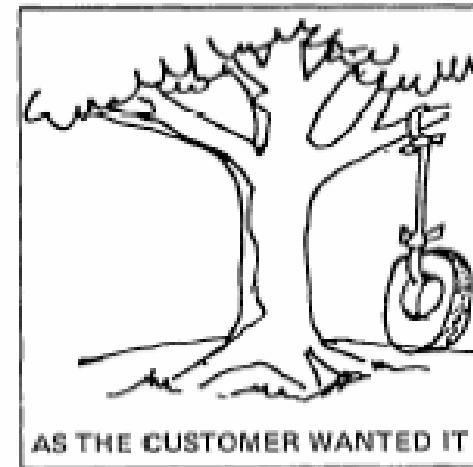
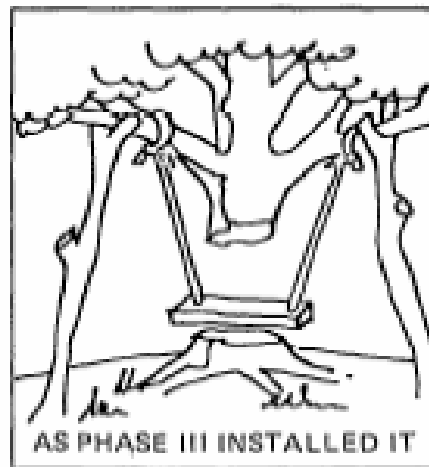
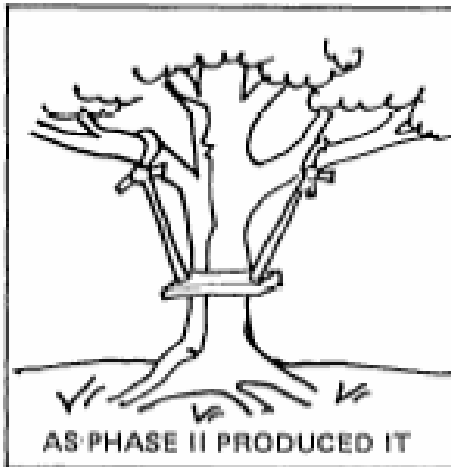
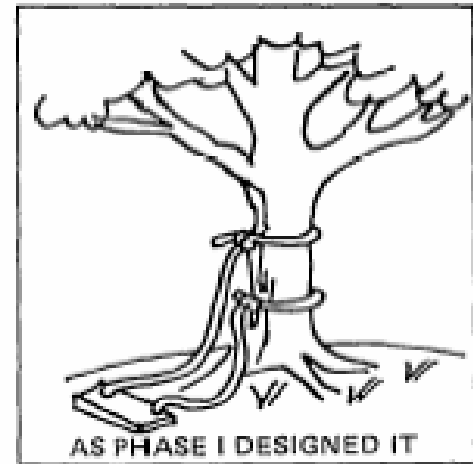
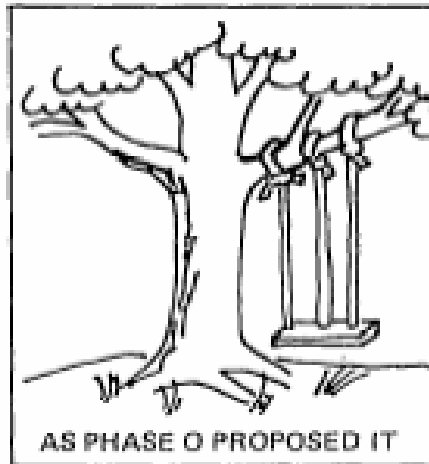
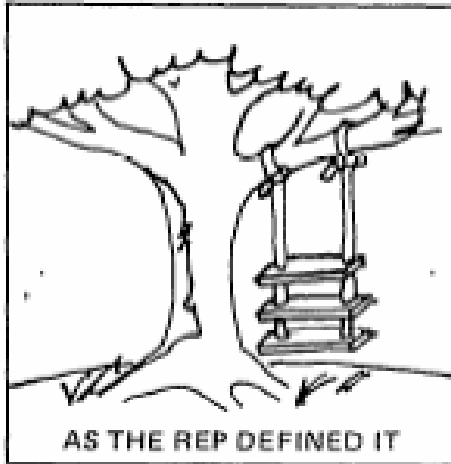
What is Design for Production?

- The deliberate act of designing a product to meet its specified technical and operational requirements and quality so that the **production costs will be minimal** through low work content and ease of fabrication.
- Today's ship designer has both the **opportunity and the obligation** to design ships so that the minimum total cost is achieved.
- However, this opportunity cannot be seized by the ship designer in isolation.
- It is only possible through an awareness of the facilities and production techniques & methods used in the shipyard that will build the design.

Category B Data – Government Purpose Rights



History of DFP...the Before Picture



Category B Data – Government Purpose Rights



Project Objectives

- To provide a reliable methodology to minimize excess design variation through the incorporation and delivery of a **comprehensive DFP guide** for vessel construction in U.S. mid-tiered shipyards.
- To demonstrate the business case forecasted for this project through the realization of reduced design lead times and **lower ship construction costs**.
- To advance the industry's awareness and utilization of Design-For-Production principles to **leverage cost reduction opportunities** in the vessel construction process.

Category B Data – Government Purpose Rights



DFP for Mid-Tiered Shipyards Project Status

Task	Description	When	Participation
1	Hold Kick-off Meeting	Completed	Proj Team
2	Assess shipyard potential application of DFP and provide awareness training to stakeholders	Mar – May 07 Completed	Each Shpyd
3	Document ship construction constraints	June – Aug 07	Each Shpyd
4 5	Formalize structural steel preferences and associated design rules	Sept – Nov 07	Each Shpyd
6 7	Formalize outfit preferences and associated design rules	Dec 07 – June 08	Each Shpyd
8	Create DFP manuals	July 08	Tech Team
9	Evaluate impact of DFP application in shipyard environment	Mar – July 08	Each Shpyd
10	Finalize DFP manuals	Aug – Sept 08	Tech Team
11	Hold final workshop to disseminate project accomplishments to the industry	Sept 2008	Proj Team

Category B Data – Government Purpose Rights



Key Project Deliverable

- The design-for-production work will be formalized through DFP Manuals that provide designers, design agents, and customers with the design rules associated with the constraints and preferences of each shipyard.

- Steel
- Piping
- Machinery
- Electrical
- HVAC
- Joiner
- Paint
- Steel Outfit

Facility Capabilities
Design Rules
Material Schedules
Design Details

Category B Data – Government Purpose Rights



DFP During Concept / Preliminary Design

- **Basic Hull Arrangements**

- **Standardization** of Space Arrangements
 - Repeatable
 - Standard Lengths
 - Standard Widths
 - Mirror P/S
- Deckhouse 'tween deck heights limited to plate size constraints
- Appropriate design margins built into arrangements

Category B Data – Government Purpose Rights



DFP During Functional Design

- **Structural Considerations**

- Minimum scantling variations
- Minimum compound curvature
- Minimum structural discontinuities
- Self Supporting Blocks

- **Outfitting Considerations**

- Symmetrical Arrangements
- Equipment located near point of use
- Access routes – personnel
- Right-of-ways – piping, HVAC, electrical
- Stacked T&S modules in deckhouse
- Integral plenums, uptakes, intakes, outfitting trunks

Category B Data – Government Purpose Rights



DFP During Detailed Construction Design

- **Structural Considerations**

- Assemblies sized to meet facility constraints
- CNC information developed for facility specific equipment
- **Shrinkage, weld gap, and excess information incorporated**
- Standardized details for end-cuts, snipes, scallops, water/oil stops, etc.

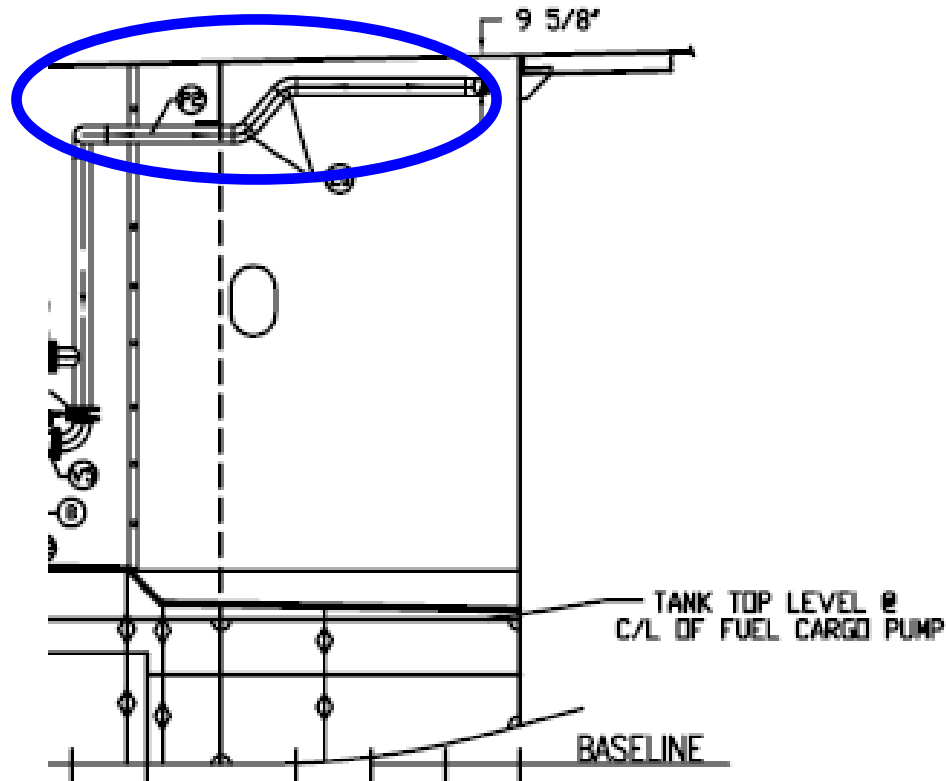
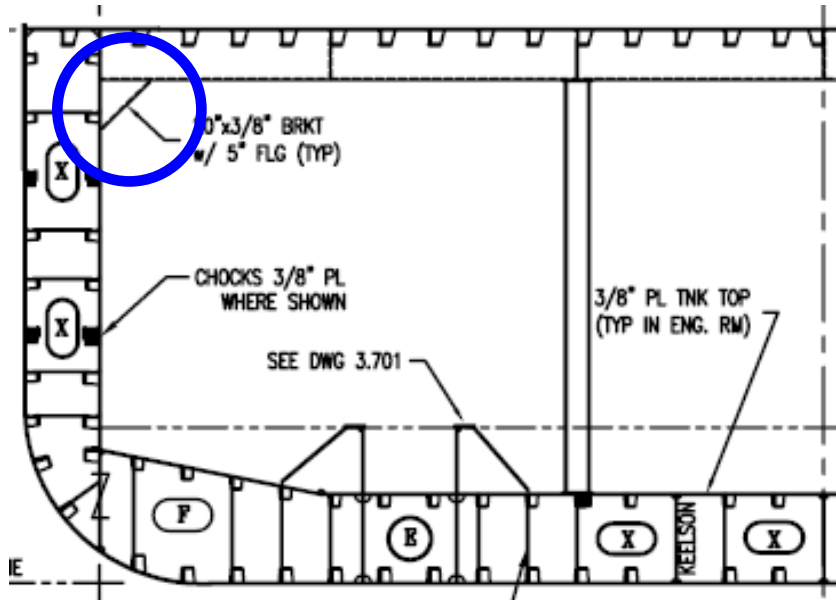
- **Outfit Considerations**

- Pipe / HVAC arrangements / spools developed to minimize complexity
- **Route pipes / HVAC / electrical with consideration for access for welding, maintenance, etc.**
- Simplified penetration details

Category B Data – Government Purpose Rights



DFP During Detailed Construction Design



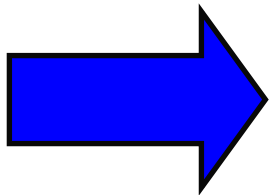
Category B Data – Government Purpose Rights



DFP Manuals – Steel

- **Facility Workflow**

- Documentation of workstations, workstation flow
- Includes receipt of raw materials to post-launch



**Useful to designers in
development of detailed
construction drawings**

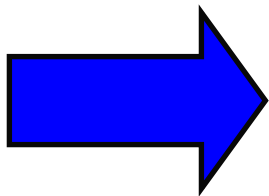
Category B Data – Government Purpose Rights



DFP Manuals – Steel

- **Facility Capabilities**

- Size and Weight limitations / capabilities at the various workstations
- Includes maximum plate length, width, and thickness for cutting for different cutting machinery
- Includes any height / weight restrictions for various workstations
- Steel Shrinkage and Adjustment “Schedule”



**Needed by designers / build
strategy developers**

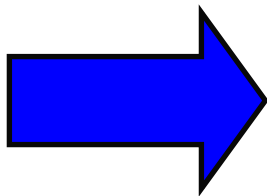
Category B Data – Government Purpose Rights



DFP Manuals – Pipe

- **Facility Workflow**

- Documentation of workstations, workstation flow
- Includes receipt of raw materials to post-launch



**Useful to designers in
development of detailed
construction drawings**

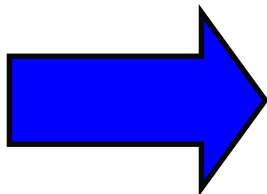
Category B Data – Government Purpose Rights



DFP Manuals – Pipe

- **Facility Capabilities**

- Size and Weight limitations / capabilities at the various workstations
- Includes maximum pipe lengths, diameters for cutting and bending for different machinery
- Includes any height / weight restrictions for various workstations



**Needed by designers / build
strategy developers**

Category B Data – Government Purpose Rights



Questions?
Feedback?

Category B Data – Government Purpose Rights