

# **NSRP International Shipyard Visits Post Report**

All Panel Meeting  
October 5, 2011



## Topics to be covered:

- Background
- Scope of the visits including main focus areas
- Shipyards visited and why
- ECB shipyard and Navy participants
- General observations
- Key observations
- Proposed actions/recommendations



# Background

- Instead of doing another benchmarking of US yards, the NSRP ECB thought it would be better for a team from the US to visit foreign yards to identify processes and practices that would foster Naval shipbuilding efficiencies in the US
- To facilitate access to the foreign yards only shipyards with ties to NSRP member shipyards were selected to visit.
- To focus the visits, the top ten areas recommended for improvement in the last US benchmarking effort (2005) along with input from the NSRP ECB members were merged into 4 major focus areas.



# Background (Cont'd)

- The 4 major focus areas along with questions in each area were sent to the selected yards prior to the visits
- To maximize the benefit of the visits teams comprised of members from US shipyards (first and second tier) and from the Navy were established. Team members were assigned to specific focus areas
- The visits focused on shipyards building military ships, and where possible, shipyards that represent U.S. shipyard output.



# Scope of the visits

- The team members were tasked to observe and document the key processes, practices and technologies employed by the foreign yards in their assigned focus areas.
- The plan for each visit was to receive an overview presentation and a yard tour for the whole team. This would be followed with individual breakout sessions for each of the four focus areas to obtain more detailed information from the yards.
- The objectives were to identify:
  - Opportunities for near term application in US yards
  - NSRP investment opportunities
  - Areas worthy of further investigation.



# Focus Areas



# Four Focus Areas

- Ship Design and Design for Production
- Production Engineering and Planning
- Purchasing and Material Management
- Organization and Structure

*The four focus areas along with questions in each area were provided to each shipyard visited in advance of the visit.*



# Ship Design and Design for Production

- Steelwork and outfit coding systems
- Tools used and integration of CAD, CAM, ERP, MRP, etc.
- Standards used ( rules, re-usable design modules, components, arrangement plans, steel outfit, etc.)
- Design time line (durations) – Contract design to functional design to production design
- Phasing of design and when production work starts
- % pre-engineering done prior to contract signing
- At what phase are necessary foundations identified
- At what stage are steel outfit items identified



# Production Engineering/Planning

- Steelwork and outfit production information
- Dimensional and accuracy control – what is measured, frequency of measurements, tolerance levels, feedback loops, how is data used/analyzed?
- Outfit module building, pre-erection outfitting and onboard outfitting- how planned
- Pipe shop and other outfit manufacturing activities
- Test and Trials – how planned and coordinated
- Distortion Control- who controls weld sequences, weld shrinkage allowances, etc. level of detail provided to shop
- Work sequence optimization, including outfitting – where and when developed
- Work packages – size, level of detail, where developed, visualization tools , links to design



# Organization and Structure

- Manpower and organization of work
- Master planning and steel and outfit scheduling
- Level of scheduling detail – comparison of detailed scheduling or more shop controlled scheduling
- Outsourcing/subcontracting – how much work is outsourced/ subcontracted, decision process
- QA/QC- how organized
- Comparison of Engineering Orgs
- Organization of Engineering, Production Engineering, Planning and their level of influence on design
- Information flow between Engineering, Production Planning, and Production including feedback loops



# Purchasing and Material Management

- VFI requirements – who identifies, who schedules, how scheduled?
- Material ordering schedule to support outfit schedule – who is responsible
- Timeline for scheduling procurement of long lead items and bulk material
- Control of material costs
- Make/Buy decision process
- Supplier relations- pre-approved vendors, standard items, who does QA checks
- Supplier performance measures
- General storage and warehousing practices
- Outfit parts marshaling
- Material control and tracking systems.



# Shipyards Visited

- Asia (Week of April 18th)
  - Singapore – Tuesday/Wednesday April 19, 20
    - Jurong & ST Marine (Tuas and Benoi shipyards)
  - Korea – Friday April 22
    - DSME
- Europe (Week of May 9th)
  - Italy – Tuesday/Wednesday May 10 & 11
    - Fincantieri (Muggiano & Riva Trigoso shipyards)
  - Spain - Friday May 13
    - Navantia Fenne – Ferrol Shipyard



# U.S. Visit Team – Asian Shipyards

## Production Engineering/Planning

John Sedor  
Carl Perry

Director of Planning  
Director, Adm, Labor  
Resources and Planning

General Dynamics Electric Boat  
Ingalls Shipbuilding

## Ship Design/Design for Production

Chris Waaler  
Lee Duneclift

Director of Engineering  
Manager, Production  
Engineering  
New Construction Ship Manager

General Dynamics Bath Iron Works  
General Dynamics NASSCO

Jeff O' Day

Todd Pacific Shipyards

## Organization & Structure

Bryan Ruiz  
Pat Burlison

New Construction Program  
Director of Operations

General Dynamics NASSCO  
Ingalls Shipbuilding

## Purchasing & Material Management

Eric Meulemans  
Alma Martinez Fallon  
Russell Clark

Director of Purchasing  
Dir. Supply Chain Procurement  
Logistics Manager

Marinette Marine Corporation  
Newport News Shipbuilding  
Austal USA

## Navy Team members

Gary Humes  
Philip Koenig

Director, Strategic Operations  
Director, Industrial and Economic  
Analysis Division

PEO Ships  
Naval Sea Systems Command

Timothy Roberts  
Nidak Sumrean

Principal APM T-AKE & T-AO(X)  
Dir. Cost Estimating & Industrial  
Analyses Division

PEO Ships  
Naval Sea Systems Command



# U.S. Visit Team – European Shipyards

## Production Engineering/Planning

Scott Theriot	Vice President/General Manager Lockport New Construction	Bollinger Shipyards
Mike Butler	Director, Navy Program Operations	Newport News Shipbuilding
John Sedor	Director of Planning	General Dynamics Electric Boat

## Ship Design/Design for Production

Wallace Goodloe	Director, Detail Design	Ingalls Shipbuilding
Josh Horst	Project Engineer	Todd Pacific Shipyards

## Organization & Structure

Bob Watkins	Engineering Hull Manager	Marinette Marine Corporation
Zach McWaters	Deputy Program Manager	General Dynamics NASSCO

## Purchasing & Material Management

Scott Mullen	Supervisor Procurement	General Dynamics Bath Iron Works
Lori Okrasinski	Purchasing Manager	Marinette Marine Corporation

## Navy Team members

Connie Bowling	Program Manager	NAVSEA NSRP Program Office
Art Divens	Executive Director	PEO Ships
Gary Humes	Director, Strategic Operations	PEO Ships



# Were we Successful?

- Partially:
  - With the exception of Navantia in Spain,
    - The visits were not as structured as we would have liked.
    - The questions sent were not answered
    - Plenary sessions were held with the entire team rather than breakout sessions for each focus area thus limiting the amount of information received.
  - On the positive side, we did observe practices, processes and technologies that could have application in the US and others that deserve further investigation.



# General Observations

- Many processes and practices observed were not that different from those used in U.S. shipyards demonstrating that US yards have made significant improvements since the 2005/2006 benchmarks.
- Safety is very strongly stressed in Asian shipyards, but not so much in European shipyards visited. As an example, ST Marine annual shipyard worker bonus is 25% safety related; however, having a major safety violation will cancel the whole bonus
- The depressed economy is having an impact on European shipyards visited. Fincantieri is considering reorganization and consolidation of its yards.
- All shipyards visited use a large amount of Subcontracted labor (up to 60-70% in some cases)
- Foreign military standards allowed using bulb flats on military ships
- The Spanish government owns Spanish shipyards ( Run like a GOCO, where gov't owns the land and buildings, but everything in the buildings is company owned)
- DSME employees start each day by stretching and cleaning the shipyard. (the cleanliness was obvious)



# General Observations (Cont' d)

- DSME shipyard is divided into three general areas each with its own shops and docks
  - Commercial (VLCC, Container, LNG & LPG)
  - Off shore (Jack Up Rigs, Semi-submersibles, FPSOs & Drill Ships)
  - Specialty ships (Navy – submarine and surface & Car Passenger Ferries)A single facility does the plate preparation and cutting for all three areas.
- DSME owns a facility in China that builds 2500T ring blocks for transport to Korea for erection. They also outsource pipe fabrication and assembly
- All steel in European shipyards was brought in blasted and primed. Typically 3-4 month's supply of steel which is based on the life of the primer.
- European labor unions are multi-trade political party based where Asia labor unions are trade based. This gives Europeans more flexibility for cross-crafting.
- The two Fincantieri shipyards use a team approach to build and launch Navy surface ships. Riga Trigoso builds the vessels and does all the pre-launch outfitting. The vessels are barged to Muggiano for launching and final outfit and tests. Muggiano also builds Mega Yachts, Submarines and other smaller/specialty vessels.



# Ship Design and Design for Production

## Asian Yards

- Extensive use of standards (components and interim products) across platforms at DSME
- DSME uses a 16-number steel and outfit coding system that reflects a standard build strategy
- Tribon used by DSME and ST Marine
- All Technical Requirements locked in prior to start of fabrication
- ST Marine buys foreign Navy designs and has first of a class built in the foreign yard
- DSME identifies all steel foundations 4 mo prior to SOF and steel outfit items 1 mo prior to SOF. KL - 5 mo after SOF
- ST Marine –completes arrangements and identifies all equipment, steel outfit and cableways prior to SOF

## European Yards

- Use of standards across platforms, (not to the extent of Daewoo)
- Both Fincantieri and Navantia have a standard , unique coding system that provides a lot of intelligence about the part ( not as detailed as DSME)
- Navantia develops build strategies prior to design.
- Fincantieri uses Tribon for CAD and Tecnomatics for build strategy and resource planning
- Navantia is using Foran v70 linked to Windchill PLM system
- Fincantieri uses SAP as their ERP system, Navantia uses an in-house developed system (NECORA)
- At Navantia, Functional Design starts at CA and takes 12 mo. Prod. Design starts at 10 mo after CA and takes 18-24 mo.
- Fincantieri uses their best people for functional design phase and completes this phase prior to start of production design. Functional design takes between 6-8 months.



# Engineering and Planning

## Asian Yards

- DSME strives to reduce WP size by reducing time vs. man-hours
- DSME strives to continuously improve their designs and processes to minimize distortion
- DSME uses multi-disciplinary teams to develop detailed assembly, outfitting and erection procedures
- Daewoo has developed an in-house Integrated Production Mgmt. System (IPMS) and Integrated Planning System (DIPS) that is linked to their CAD system

## European Yards

- Yards have recommended procedures for reducing distortion
- Yards have company standards for acceptable tolerance levels for all typical steel fabrications and assemblies
- Production engineering and planning plays a strong role in defining engineering requirements
- Navantia has a robust block centric planning process.



# Organization and Structure

## Asian Yards

- ST Marine promotes yard-wide commitment to quality resulting in a much smaller QA department.
- There are clear trade demarcations with little cross crafting
- DSME's planning and scheduling processes are robust and detailed. Would take time to really understand their system

## European Yards

- Navantia subcontracts their engineering by design zone – e.g. engine room, bow, stern, superstructure, etc.
- There is a very close working relationship between production engineering, planning and engineering dept.
- Unions are multi-trade and politically based. Provides yard with more flexible trade utilization



# Purchasing and Material Management

## Asian Yards

- St Marine created a separate division for planning, procuring and managing all major equipment to better support production
- DSME Operations and Procurement team are not under Shipyard General Manager.
- DSME and ST Marine both use pre-approved vendors
- Key focus of DSME's procurement is delivery schedule and quality

## European Yards

- Fincantieri has a central procurement division responsible for ordering common material and equipment for all their yards.
- Fincantieri uses a company wide vendor evaluation procedure
- Navantia schedules VFI to support different stages, e.g., foundations, electrical info., automation and control info., factory acceptance testing, etc.
- Navantia's initial procurements are based on estimates developed during the functional design phase. Amounts and schedules are refined as design progresses.



# Potential Near Term Opportunities

- Non-Painted cables on Navy Ships (Navantia)
- Shrink wrapped protection of SS Pipe (Navantia)
- Numbered and color coded wireways (Navantia)
- Peel off paint protection (Muggiano)
- Well organized and very visible 5S shadow boards (Navantia)
- Use of shipside material and personnel elevators (DSME)
- Do not complete system arrangement plans prior to commencement of work. Complete arrangement plans block by block to support block erection sequence. (Navantia)
- Develop build strategy prior to design so build strategy drives design. (all yards)
- Minimize use of scaffolding to improve safety. (DSME)
- Better coordination and integration of production engineering and planning with engineering department.



# Near Term NSRP Investment Opportunities

- Investigate use of camera recognition robotic welders for sub-assemblies (used by both Fincantieri and Navantia)
- Investigate DSME practice of sizing work packages by time to complete vs. number of man-hours.
- Compare US Mil Standards (ABS Navy Vessel Rules) to foreign Mil Standards (Lloyds, RINA, DNV, ROK) to identify opportunities for use of more commercial like standards used by foreign Navies including;
  - Bulb flats, corrugated bulkheads, Van Stone (slip) flanges, tank coating systems, etc.



# Areas for Further NSRP Investigation

- Modular Weapons systems being considered by Fincantieri and Navantia
- Fincantieri's standardized weld procedures and sequences for all typical structural assemblies to reduce weld distortion
- Navantia's company dimensional tolerance standards.
- Vendor rating system used by Fincantieri.
- Portable robotic welders for unit assembly (being investigated by Fincantieri)
- Navantia's BOSE Noise Suppression system in pipe shop
- DSME's Production Management Information System (PMIS)
- DSME's Detailed Assembly Procedures (DAP), Detailed Outfitting Procedures (DOP) and Detailed Erection Procedures (DEP).

