TECHNOLOGY IN SHIPBUILDING

... how to make it work

Akshay Jain
Naval Architect & CEO
Vedam Design & Technical Consultancy Pvt Ltd.
Acknowledgement

- Learned from working experience from Various shipyards.
  - Hyundai Heavy Industry
  - Hyundai Mipo Dockyard
  - DSME
  - Drydocks World Dubai
  - Brodosplit, Croatia
  - Volharding, Netherlands
  - Nantong Cosco, China
  - Shoft Shipyard
  - Nanjing Star Shipyard
  - Yulian Shipyard
  - IHC, Netherlands
  - Bharati Shipyard
  - Pipavav Shipyard
  - Chowgule Shipyard
  - Ananda Shipyard, Dhaka
The Facts presented are not from any particular shipyard specifically

The ‘problems’ presented are fictitious, resemblance is purely coincidental
Indian Shipbuilding Industry –

- **Present Status –**
  - Order Book of shipyards is good, all Shipyards are busy in executing the projects in Hand
  - Some delays in some projects
  - No spare capacity available for immediate delivery of vessels

- **The India Growth Story shall create demand for new ships in future, specifically –**
  - Navy – High budget for new vessels
  - High budget of major shipping players for new vessel acquisition
  - Domestic Trade increase – Coastal & Inland vessel requirements
  - Offshore activities increase – Offshore & workboats Requirements

- **Result –**
  - Back Log for Defense Vessels
  - Ship owners ordering to China, Korea and other countries
  - Opportunity for New Players to enter Shipbuilding
Introduction to Mr. PAGO

- An Indian Business Man with resources (Money!!) & Capabilities

- Realises the requirement of shipbuilding in India

- Studies Shipbuilding

- Plans to set up Shipyard with modern infrastructure & latest TECHNOLOGY
Ship Building Industry – Process

CONCEPT → BASIC DESIGN → Class Approvals → PROD. DESIGN

<table>
<thead>
<tr>
<th>EQUIPMENTS</th>
<th>PIPING Installation</th>
<th>HULL Fabrication</th>
<th>PROCUREMENT</th>
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<td>Test &amp; Trials</td>
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What is Technology?

- **Definition in Wikipedia** –

**TECHNOLOGY** is the making, usage, and knowledge of tools, machines, techniques, systems or methods of organization in order to solve a problem or perform a specific function.
Technology in ShipBuilding

- Design Technology
- Building Technology
- Processes
- Analytics

Mr. PAGO
Technology in ShipBuilding

- DESIGN TECHNOLOGY
  - Building Technology
  - Process
  - Analytics
Composite 3D Modeling (Eg: FORAN)

- Composite 3D modeling
  - Structure, Piping, Machinery, Outfitting, Electrical, HVAC, Accent fixture
- Interactive environment
  - Clash detection
  - Operational aspect (maintenance area)
  - Penetrations
  - Auto Pipe routing
- Data extraction & Calculation
  - Connection to ERP
  - Weight & COG
  - Paint area
  - Pressure drop calculation
  - Air flow calculation
  - Voltage drop and cable sizing
Design Optimisation

- **CAE Tools**
  - Structural FEM Analysis
  - CFD flow analysis
  - Mooring & riser analysis
  - Probabilistic Dam. Stability

- **Adv. Of CAE Tools**
  - Simulation of problem
  - Quick Iteration !!
  - Design optimisation wrt (weight, shape, strength)
Interim Product

- Assembly Line Fabrication
- Modular design
- Pre–outfitted Blocks
- Part Segregation
  - Parent unit wise
  - Workshop wise
  - Grade & quality wise
  - Stage of installation
Document Management....

- Drawing Tracking System
  - Design–Procurement–Production–QC
- Integration of Data in one platform
  - Yard, Design, Vendor, Sub-contractor
  - Access Control (Important!)
  - Integration of 2D drawings & 3D Database
- Use of Cloud Computing
  - Integrate all department
  - Integrate all communication device
  - Large Storage space
Technology in ShipBuilding

- Design Technology
- BUILDING TECHNOLOGY
- Process
- Analytics

Mr. PAGO
Technology in ShipBuilding

- **Cutting** by CNC machines -
  - Accuracy of Parts
  - Reduced Heat input, less deformation
  - Optimisation
  - Possibility of Bevel at cutting stage
  - Faster cutting
  - Better Edge preparation

- **MARKING**

- **Multi Torch Cutting** –
  - Flat Bar cutting
  - Strips cutting
Technology in ShipBuilding

- Low Cost Cutting Tools –
  - Automated gas cutting
  - Beveling Machines
  - widely used in Chinese shipyards
  - NOT expensive compared to the saving in time & reworks.
**Technology in ShipBuilding**

**CO2 Welding**
- Easier Welding (Straight line)
- Faster (Almost 3 Times)
- Controlled Leg length
- Better Quality
- Slag removal is easier
- Clean work area
- Easy automation is possible

Equipped with a suitable carrier, CO2 welding can be AUTOMATED for down hand, horizontal or vertical welding.
Accuracy Control Using 3–D Scanning

- Measuring exact curvature for Bent plates – difficult and time consuming
- 3–D scanning – compare fabricated curvature with design curvature
- Extensively in Chemical Industry
- Can be adapted easily to Ship building Industry
Technology in ShipBuilding

- Pipe Fabrication –
  - **Pipe Bending Machine**
  - Stub Penetration Cutting Machine
  - Pipe Welding Roller
  - Pipe Cutting Machine
  - Pipe beveling Machine
  - Polypropylene Coating
Technology in ShipBuilding

- Pipe Fabrication –
  - Pipe Bending Machine
  - **Stub Penetration Cutting Machine**
  - Pipe Welding Roller
  - Pipe Cutting Machine
  - Pipe beveling Machine
  - Polypropylene Coating
Technology in Shipbuilding

- Pipe Fabrication –
  - Pipe Bending Machine
  - Stub Penetration Cutting Machine
  - **Pipe Roller – Welding & Grinding**
  - Pipe Cutting Machine
  - Pipe beveling Machine
  - Polypropylene Coating
Technology in ShipBuilding

- Pipe Fabrication –
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  - Stub Penetration Cutting Machine
  - Pipe Welding Roller
  - **Pipe Cutting Machine**
  - Pipe beveling Machine
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Pipe Fabrication –

- Pipe Bending Machine
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Technology in ShipBuilding

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Technology in ShipBuilding

- Design Technology
- Building Technology
- PROCESS
- Analytics

Mr. PAGO
Technology in ShipBuilding

- Process
  - Building Strategy
  - Automatic Plate Cutting
  - Pipe Spool Fabrication
  - Block Building Methodology
Building Strategy

- Pre Build the ship using software (eg: FORAN)
- Includes Hierarchical trees with interim products
- Tree – Ship at the top, one plate part/bolt in bottom.
- IP can be – block, sub assembly, unit, etc
- IP – enables to calculate weight, CG.
- Allocate resource to IP
- Allocate workshop to IP
- Trace the movement of IP
Automatic Plate Cutting (Process Modernisation)
PIPE SPOOL MANUFACTURING
Technology in ShipBuilding

- Design Technology ✓
- Building Technology ✓
- Process ✓

ANALYTICS

Mr. PAGO
Technology in ShipBuilding

Analytics – 1. Throughput measurement

- **Ton based measurement** – Can be FLAWED
  - Heavy Scantling Vessels shall give higher Throughput
  - Same vessel – Different scantling in different locations – Varied throughput
  - Varied distortion with varied thickness
  - Doesn’t account for Structural Complexity
  - Misguided Weightages for different stages to calculate daily/monthly Tonnage
Analytics – Throughput measurement

- **Alternative – Weld length Method –**
  - Independent of thickness
  - Considers Structural Complexity (no. of parts)
  - Close to actual throughput
  - Very Easy to calculate

- **Similar Other Methods –**
  - Paint surface Area
  - Pipe fitting Length
  - Cable length
Technology in ShipBuilding

Analytics – 2. Time Study / Work Sampling

Actual Capacity of a Labour:
- Random samples among labors
  - Useful time, Necessary wasting time, Unnecessary wasting time,
  - Review of time data – exposes the problems on the shop floor
  - A root cause analysis & Preventive actions
## Analytics – Illustration

Review of time data

<table>
<thead>
<tr>
<th>Name of welder:</th>
<th>1. Ram (CO2)</th>
<th>2. Shyam (CO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>19-04-</td>
<td>Time: 8:00-03:15</td>
</tr>
<tr>
<td>The Observation has been done from 8:00 to 3:22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activities</th>
<th>8:00-10:30 Ram (CO2 Welder)</th>
<th>10:30-12:00 Ram (CO2 Welder)</th>
<th>1:00-3:15 Ram (CO2 Welder)</th>
<th>Total</th>
<th>8:00-10:31 Shyam (CO2 Welder)</th>
<th>10:30-12:01 Shyam (CO2 Welder)</th>
<th>1:00-3:16 Shyam (CO2 Welder)</th>
<th>Total</th>
<th>Total Time</th>
<th>Grand total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root keeping</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>18</td>
<td>40</td>
</tr>
<tr>
<td>Arranging cable</td>
<td>12</td>
<td>1</td>
<td>1</td>
<td>14</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>W/O Air</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>Chipping</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>7</td>
<td>14</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Changing Electrode</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>22</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>Shifting</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>16</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Wire stoped in tip</td>
<td>5</td>
<td>4</td>
<td>0</td>
<td>9</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
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<tr>
<td>Ceramic pasting</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Cleaning nozzle</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>9</td>
<td>18</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Adj current</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>14</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Heating the joint</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Cleaning job</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Grinding</td>
<td>0</td>
<td>6</td>
<td>10</td>
<td>16</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Arc</td>
<td>6</td>
<td>14</td>
<td>14</td>
<td>34</td>
<td>68</td>
<td>13</td>
<td>10</td>
<td>3</td>
<td>26</td>
<td>52</td>
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<td>Rest</td>
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<td>2</td>
<td>17</td>
<td>19</td>
<td>38</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Searching for job</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>22</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td>Not in site</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>11</td>
<td>22</td>
<td>6</td>
<td>9</td>
<td>11</td>
<td>26</td>
<td>52</td>
</tr>
<tr>
<td>Waiting for grinding</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Extra Break (Morning)</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Extra Break (Afternoon)</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Repairing shield</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**First arc:** 1:15  
**Neccessary wasting time:** 8:38  
**Unneccessary wasting time:** 10:49

Prepared By: Vedam Design & Technical Consultancy Pvt. Ltd.
Analytics – Illustration

Name of welder: Ram, Shyam

Date: 19-04-
Time: 08:00-15:15

The Observation has been done from 8:00 to 3:22

34% of Unnecessary Wasting Time !!!

Overall Time Distribution

- Unnecessary wasting time: 34%
- Necessary wasting time: 49%
- Arc: 17%

Review of time data

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<td>Lot of time of welder getting wasted in arranging cables and machines</td>
<td>Welding machine to be left at the worksite during breaks; Only coil to be removed for safety purposes</td>
</tr>
<tr>
<td>2</td>
<td>Worker wasting lot of time in shifting from one job location to another</td>
<td>For new blocks, all welding parts in sub assembly line to be placed together to ensure minimum movement of welder</td>
</tr>
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<td>3</td>
<td>Worker has to go to store to replace CO2 core and grinding wheel</td>
<td>Worker to carry an additional CO2 core/grinding wheel with him. All consumables to be replaced by the supervisor</td>
</tr>
<tr>
<td>4</td>
<td>Workers idling away when not supervised</td>
<td>Minimum 3 supervisors to be appointed for each production team. One supervisor to be present on the shop floor all the time.</td>
</tr>
<tr>
<td>5</td>
<td>Welder waiting for grinder to come and finish the grinding</td>
<td>One 4” grinder to be provided to every welder; All welders shall do the grinding themselves</td>
</tr>
<tr>
<td>6</td>
<td>Leg length of the welder is more than requirement leading to waste of welding core and time</td>
<td>A welding leg length measurement template to be provided to every welder to ensure minimum adherence to the quality</td>
</tr>
<tr>
<td>7</td>
<td>Moisture is trapped inside fit ups in the morning leading to welding defects</td>
<td>The stiffeners to be partially heated up in the morning to evaporate trapped moisture</td>
</tr>
<tr>
<td>8</td>
<td>Workes wasting lot of time in searching for tools or borrowing tools</td>
<td>Separate tool box with lock and key arrangement to be provided for every two welder</td>
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Root Cause Analysis

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Observation  Corrective Action Plan  

Worker has to go to store to replace CO2 core and grinding wheel  Worker to carry an additional CO2 core/grinding wheel with him. All consumables to be replaced by the supervisor

An example

| 5     | Welder waiting for grinder to come and finish the grinding                  | One 4” grinder to be provided to every welder; All welders shall do the       |
|       |                                                                            | grinding themselves                                                            |
| 6     | Leg length of the welder is more than requirement leading to waste of      | A welding leg length measurement template to be provided to every welder to   |
|       | welding core and time                                                       | ensure minimum adherence to the quality                                         |
| 7     | Moisture is trapped inside fit ups in the morning leading to welding       | The stiffeners to be partially heated up in the morning to evaporate trapped  |
|       | defects                                                                     | moisture                                                                       |
| 8     | Workes wasting lot of time in searching for tools or borrowing tools       | Separate tool box with lock and key arrangement to be provided for every      |
|       |                                                                            | two welder                                                                     |

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Technology in ShipBuilding

- Design Technology
- Building Technology
- Process
- Analytics

- Other Important Technology applications –
  - Safety
  - Training
  - Material handling & Movement
  - Procurement
  - Equipment Installations
  - Test & Trials
  - Many more…

Mr. PAGO
Mr. Pago Very Happy with all technology investments
Post Technology Investment

- For next few months
- Mr. Pago gets continuous reports on throughput showing various figures.
Post Technology Investment

Few months later,

Mr. Pago is worried as the delivery date is approaching and he doesn’t see the vessel in ready condition.
Post Technology Investment

Delivery date slipped, team reports delivery to be delayed by 2 Months.

Mr. Pago depressed. Wonders what is going wrong.

Goes back to study.
What is Technology?

Bill Gates, Founder of Microsoft Co.,

The first rule of any technology used in a business is that technology applied to an efficient operation will magnify the efficiency. The second is that technology applied to an inefficient operation will magnify the inefficiency.
What is Technology?

Revisits –
Definition in Wikipedia –

Technology is the making, usage, and knowledge of tools, machines, techniques, systems or methods of organization in order to solve a specific problem or perform a specific function.
What is Technology?

Revisits –

Definition in Wikipedia –

Technology is the making, usage, and knowledge of tools, machines, techniques, systems or methods of organization in order to solve **A SPECIFIC PROBLEM** or perform **A SPECIFIC FUNCTION**.

Mr. PAGO
### Typical Problem

**Multiple Parties**

- Designer
- Engineer
- Procurement
- Hull Construction
- Piping
- Electrical
- Commissioning

**Varied Interests**

- Performance
- Weights, Dimensions
- Delivery, Prices, Spares
- Foundation
- Connections (FO, FW, etc)
- Power Connections
- Commission – availability

*(EG - Main Engine)*

**Multiple Parties** under various interests can lead to varied interests among different parties involved in the project.
Common Problems

- Designs never get finished
- Material is never on time
- Material doesn’t match the design => Redesign
- Due to Bulk order for price advantage – Over Inventory & Material damage during storage (Pitting, thefts), Unavailable when required
- Trained Manpower is either idle (available but no work) OR short (too much workflow).
- Tools & Consumables not available as required
- Piping never finishes
- Inability on part of management to fix the delivery date
- Customer who is always sitting on head
Ship Building Industry – Process

CONCEPT → BASIC DESIGN → Class Approvals → PROD. DESIGN

PROD. DESIGN → PROCUREMENT

EQUIPMENTS → PIPING Installation → HULL Fabrication

HULL Fabrication → ELECTRICAL & HVAC

ELECTRICAL & HVAC → Test & Trials

Test & Trials → Mr. PAGO
Ship Building Industry – Process

- Concept
- Basic Design
- Class Approvals
- Production Design
- Procurement
- Hull Fabrication
- Piping Installation
- Electrical & HVAC
- Equipment
- Test & Trials

Mr. PAGO
Real Problem –

Inefficient Collaborative Working

- Various Departments
- Especially ... Shipyard – Vendor relationship
Evolution of Dutch Ship Building Industry –

* Taken from a public presentation by IHC
Evolution of Dutch Ship Building Industry –

Changing role for the yard!

Dominator-role; based on ‘purchase power’

Integrator-role; captain and coach: on basis of common interest, ‘complete overview’ and build facility

* Taken from a public presentation by IHC
Evolution of Dutch Ship Building Industry –

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Creating a Team; based on respect and being conscious of each others strengths (synergy)

* Taken from a public presentation by IHC
Evolution of Dutch Ship Building Industry –

Strong Need to move to this Level

Mr. PAGO

Changing role for the yard!

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Integrator-role; captain and coach: on basis of common interest, ‘complete overview’ and build facility

Creating a Team; based on respect and being conscious of each others strengths (synergy)

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Need of the hour –

Enhancing Collaborative Efficiency

Accountability

Vendor Development / Outsourcing
OUTSOURCING – Causes for Resistance

- Quality
- Delays
- Defaulting
- Loss of Control

How to Ensure these Inhouse – ACCOUNTABILITY

Why Pay for Margins !!
Need of the hour –

Enhancing Collaborative Efficiency

ACCOUNTABILITY

OR

OUTSOURCING
Solutions from Effective Collaboration

Problem

- Designs never get finished

Solution

- Shipyard needs to work together with Basic Designer + Class + production designer and allows smooth communication
Solutions from Effective Collaboration

Problem

- Material is never on time

Solution

- Material Department needs to be involved in Building process (not isolated), should be informed about the affects of delay in Material.
Solutions from Effective Collaboration

**Problem**

- Material doesn’t match the design ⇒ Redesign

**Solution**

- Ensure the basic design is done as per the material available... Supplier should understand building process and the affects of supplying varied product.
- Equipment supplier to be able to provide data in time for production engineering.
Solutions from Effective Collaboration

**Problem**

- Due to Bulk order for price advantage – Over Inventory & Material damage during storage (Pitting, thefts), Unavailable when required

**Solution**

- Ensure project head is accountable for the material requisition & consumption. Accountability shall prevent wastage and motivates for optimisation, hence reducing project costs.
  
  OR

- Outsource turnkey to specialists –
  - Cut parts to specialist shops including maerial supply, Priming, cutting, segregation
  - LumSum order will ensure optimisation
Solutions from Effective Collaboration

**Problem**
- Trained Manpower is either idle (available but no work) OR short (too much workflow).

**Solution**
- Accountability to project heads to ensure no blockage of idle manpower.
- Advance understanding of the continuous requirement, Outsourced work force for peak periods.
Solutions from Effective Collaboration

Problem

- Tools & Consumables not available as required

Solution

- Accountability to project head, the affect of unavailability of tools should be known.
Solutions from Effective Collaboration

- Problem
  - Piping never finishes

- Solution
  - Define Accountability – for cost & time overruns.
  - Define Accountability for Reworks, to ensure efforts for ‘Do it right the first time’.
  - Accountability shall ensure proper capturing of as Built data for Sister ships.
    OR
  - Outsourcing –
    - Lumpsum contract for Pipe Spools to specialist shops including material, fittings, spool fabrication, segregation
    - Reworks means loss of money – minimised, delay means loss of money in salary – minimised.
Solutions from Effective Collaboration

Problem

- Inability on part of management to fix the delivery date

Solution

- Develop system to enable Monitoring on a Daily basis.
- Define Accountability for the late escalations of problems & bottle necks.
Technological tool
...for Effective Colaborative working

PLANNING !!

Monitoring progress as per the deviation from the schedule instead from throughput

Re–planning as per new status on a daily basis

Water spider (Kaizen)
### Project Planner Tool

**Task Table**

<table>
<thead>
<tr>
<th>ID</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Predecessors</th>
<th>Resource Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil Tanker Project</td>
<td>775.75 days</td>
<td>Sun 5/21/11</td>
<td>Mon 7/13/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Oil Tanker Project</td>
<td>0 days</td>
<td>Thu 3/17/11</td>
<td>Thu 3/17/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oil Tanker Project</td>
<td>0 days</td>
<td>Mon 3/17/11</td>
<td>Mon 3/17/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Production Drawing</td>
<td>63.5 days</td>
<td>Wed 3/23/11</td>
<td>Tue 3/22/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Block drawing</td>
<td>63.5 days</td>
<td>Wed 3/23/11</td>
<td>Tue 3/22/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>CARGO HOLD</td>
<td>63.5 days</td>
<td>Wed 3/23/11</td>
<td>Tue 3/22/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CH 25210</td>
<td>4 days</td>
<td>Mon 3/21/11</td>
<td>Fri 3/18/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>CH 25210/1/1</td>
<td>4 days</td>
<td>Wed 3/23/11</td>
<td>Sun 3/27/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>CH 25210/1/2</td>
<td>4 days</td>
<td>Wed 3/23/11</td>
<td>Sun 3/27/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ENGINE ROOM</td>
<td>0.25 days</td>
<td>Thu 3/24/11</td>
<td>Wed 3/30/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>FORECAST STRUCTURE</td>
<td>57.75 days</td>
<td>Mon 4/11/11</td>
<td>Tue 5/24/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>POPO DECK STRUCTURE</td>
<td>19.63 days</td>
<td>Mon 4/11/11</td>
<td>Sat 4/17/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>SUPER STRUCTURE</td>
<td>37.75 days</td>
<td>Mon 4/11/11</td>
<td>Tue 5/24/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Block Fabrication</td>
<td>106.36 days</td>
<td>Sun 3/21/11</td>
<td>Wed 3/23/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Plate cutting</td>
<td>70.05 days</td>
<td>Sun 3/21/11</td>
<td>Wed 3/23/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>CARGO HOLD</td>
<td>70.05 days</td>
<td>Sun 3/21/11</td>
<td>Wed 3/23/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>CH 25210</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>18</td>
<td>CH 25210/1/1</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>19</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>20</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>21</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>22</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>23</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>24</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>25</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
<tr>
<td>26</td>
<td>CH 25210/1/2</td>
<td>1 day</td>
<td>Thu 3/17/11</td>
<td>Wed 4/11/11</td>
<td>7F+3 days</td>
<td>CNC Machine</td>
</tr>
</tbody>
</table>

**Gantt Chart**

The Gantt chart provides a visual representation of the project timeline, with tasks represented as bars, and their start and end dates indicated. The chart aids in tracking progress and managing resources efficiently. It is a crucial tool for project managers to ensure all tasks are completed on schedule.
Project Planner tool...

- Planning as per Consent of ALL departments
  - (with various assumptions)
- Assumptions are refined enroute

- Major Milestones are set .. Promulgated!

- Daily & Weekly tasks & Targets set for each department.

- Monitoring – **DAILY** (for variation against daily target)
### Daily Monitoring

#### REPORT DETAIL
- **Date:** 24/11/10
- **Prepared by:** Anup Jadhav

#### Cumulative Status
<table>
<thead>
<tr>
<th>Item</th>
<th>Total</th>
<th>Completed</th>
<th>In Progress</th>
<th>Yet to start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawings</td>
<td>80</td>
<td>84</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Cutting</td>
<td>50</td>
<td>30</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Fabrication</td>
<td>80</td>
<td>52</td>
<td>4</td>
<td>27</td>
</tr>
</tbody>
</table>

#### Target Monitoring, Status & Effect

**Item** | **Block No.** | **Target** | **Status** | **Reason** | **Effect** | **Remarks** |
---|---|---|---|---|---|---|
**Drawing**
PS02 | PS02 | PS04 | Failed | Effect of turning of turning lathe machinery unsuitability from 15th. This delay is affecting on upcoming blocks. |
PS02 | PS02 | PS02 | Failed | This delay is affecting the erection schedule. |
FB01 | FB01 | FB01 | Failed | The basic drawing not approved for superstructure. |
FB03 | FB03 | FB03 | Failed | |
**Cutting**
FG01 | FG01 | FG01 | Failed | CNC platform arrangement is being done for new machines. The output is slow. Cutting will get delayed. |
FG02 | FG02 | FG02 | Failed | 50% cutting manpower staff is not available (on leave). |
**Block Fabrication**
BG02 | BG02 | BG02 | Failed | | |
BG01 | BG01 | BG01 | Failed | | |
BG00 | BG00 | BG00 | Failed | | |
**Extrusion**
EA02 | EA02 | EA02 | Failed | | |

#### General Remarks & Status
- Two new CNC cutting machines are coming. The requirements are being started at the installation site. The approval of drawings should come by 8th for the opening in tank top. Not yet received. Need to get approval as soon as possible.
- Superstructure drawing's approval from 8th not yet come.

#### Concern Points (Need attention)
- Need to start.
# Daily Monitoring

## Target Monitoring, Status & Effect

<table>
<thead>
<tr>
<th>Item</th>
<th>Block No.</th>
<th>Target</th>
<th>Status</th>
<th>Reason</th>
<th>Effect</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Concern Points (Need attention)

**CNC3 and CNC1 need maintenance.** These two machines are under repair. After repair, it will improve productivity up to 25%.

**Blasting process is very slow**, our blasting machine is having heavy maintenance. Productivity cannot improve with this situation. Also we cannot achieve the target for block cutting. This will effect on whole process.
### Target Monitoring, Status & Effect

<table>
<thead>
<tr>
<th>Item</th>
<th>Block No.</th>
<th>Target</th>
<th>Status</th>
<th>Reason</th>
<th>Effect</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD02</td>
<td></td>
<td></td>
<td></td>
<td><strong>Effected because of</strong></td>
<td><strong>This delay is effecting on</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting</td>
<td>EG12</td>
<td>Cutting Finish.</td>
<td>Failed</td>
<td>Blasted plates are not available for cutting.</td>
<td>Stations are empty. Also two block’s drawing is released for cutting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EG13</td>
<td>Cutting Finish.</td>
<td>Failed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block Fabrication and Assembly</td>
<td>HS02</td>
<td>Final QC To be finished.</td>
<td>Failed</td>
<td>Torch not available for block’s inside inspection.</td>
<td>13 blocks are ready for QC and inspection. Erection process will get delayed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Other</td>
<td>As per individual</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Daily Monitoring

Target Monitoring, Status & Effect

<table>
<thead>
<tr>
<th>Item</th>
<th>Block No.</th>
<th>Target</th>
<th>Status</th>
<th>Reason</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>HB02</td>
<td>Release corrected cutting and assembly drawing to production.</td>
<td>Failed</td>
<td>Printer pages are not available.</td>
<td>Cutting Got Delayed. CNC &amp; Manpower idle. Shall affect the erection and potential to affect Vessel Delivery.</td>
</tr>
<tr>
<td></td>
<td>HB07</td>
<td></td>
<td>Failed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HB08</td>
<td></td>
<td>Achieved</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>HB09</td>
<td></td>
<td>Achieved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Accountability !!

Mr. PAGO
## Daily Monitoring

### REPORT DETAIL
- **Date:** 2011/05/21
- **Prepared by:** Anup Jadhav

### CUMMULATIVE STATUS

<table>
<thead>
<tr>
<th>Item</th>
<th>TOTAL</th>
<th>COMPLETED</th>
<th>IN PROGRESS</th>
<th>Yet To start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawings</td>
<td>81</td>
<td>56</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Cutting</td>
<td>81</td>
<td>47</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>Fabrication</td>
<td>81</td>
<td>0</td>
<td>47</td>
<td>34</td>
</tr>
</tbody>
</table>

### Target Monitoring, Status & Effect

<table>
<thead>
<tr>
<th>Item</th>
<th>Block No.</th>
<th>Target</th>
<th>Status</th>
<th>Reason</th>
<th>Effect</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawing</td>
<td>PD02, PD03, PD04</td>
<td>Assembly and cutting drawing release for checking.</td>
<td>Failed</td>
<td>Effected because of tribon error on 25th &amp; 26th April.</td>
<td>This delay will effect on upcoming blocks.</td>
<td>Tribon has stoped working again.</td>
</tr>
<tr>
<td></td>
<td>PD11, PD12, PD13</td>
<td></td>
<td>Achieved</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Cutting</td>
<td>EG02</td>
<td>Cutting Finish.</td>
<td>Failed</td>
<td>Not mentioned.</td>
<td>Cutting will get delayed.</td>
<td>HT02,HT05 &amp; HT03, are waiting for cutting.</td>
</tr>
<tr>
<td></td>
<td>PD01</td>
<td>Cutting 70% Finish.</td>
<td>Achieved</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block</td>
<td>All Other Blocks</td>
<td>As per individual Stage. Block final inspection to be done.</td>
<td>Achieved</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Fabrication</td>
<td></td>
<td></td>
<td>Failed</td>
<td>Effected because of storm.</td>
<td>Rework is being done.</td>
<td>Removed the collapsed crane.</td>
</tr>
<tr>
<td>Erection</td>
<td></td>
<td>Work not started.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### General Remarks & Status
- Profile estimation for the project was not correct. Need to prepare new profile estimation list. Yard design team has requested to CS Marine for new profile estimation list. After receiving the list the profiles can be ordered.

- Tribon is not working from last 5 days. Need to get the help to start tribon as soon as possible.

### Concern Points (Need attention)
- CNC3 and CNC1 need maintenance. These two machines are under repair. After repair, it will improve productivity up to 25%.
Project Planner tool...

- Daily target Failure affect – analysed Daily!
- ReScheduling – if required.
- New Schedule & Targets Promultaged.
- Critical Action Points – Compiled & Monitored Daily
# Critical Action Points

## Project Raised Issue’s Status report.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Issue date</th>
<th>Issue description</th>
<th>Date of Action</th>
<th>Type of Action</th>
<th>Status Open/Closed</th>
<th>Closed date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3-Apr-11</td>
<td>Block-wise plate segregation is not being done after blasting. It will reduce plate handling time/man hours.</td>
<td>7-Apr-11</td>
<td>Informed to Blasting to do this.</td>
<td>OPEN</td>
<td></td>
<td>No sufficient space available for storage of plates.</td>
</tr>
<tr>
<td>2</td>
<td>5-Apr-11</td>
<td>CNCs and CNC1 need maintenance. These two machines are under repair. After repair, it will improve productivity up to 25%.</td>
<td>5-Apr-11</td>
<td>Informed to top management to look at this issue.</td>
<td>CLOSED</td>
<td></td>
<td>Two new CNC machine has come, installation is going on. The issue will be solved.</td>
</tr>
<tr>
<td>3</td>
<td>5-Apr-11</td>
<td>The checking of production drawing is to be done at the same time from design department and production department. This will reduce the time for checking and correction.</td>
<td>10-Apr-11</td>
<td>Informed to Design to do so as soon as possible.</td>
<td>CLOSED</td>
<td>6-May-11</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>7-Apr-11</td>
<td>After blasting process QC has to check the pitted plates, then it can send to cutting or next process.</td>
<td>10-Apr-11</td>
<td>Informed to follow the system.</td>
<td>CLOSED</td>
<td>16-May-11</td>
<td>QC has started checking at blasting plant.</td>
</tr>
<tr>
<td>5</td>
<td>10-Apr-11</td>
<td>The software for the design (tribon) is stopped working. This may effect on upcoming block's production drawing delivery.</td>
<td>12-Apr-11</td>
<td>Informed to contractors, not to take any plate or profile without consulting to Material Controller.</td>
<td>CLOSED</td>
<td>23-Apr-11</td>
<td>Now proper track is being taken for profile allotment for contractor.</td>
</tr>
<tr>
<td>6</td>
<td>17-Apr-11</td>
<td>The software for the design (tribon) is stopped working. This may effect on upcoming block's production drawing delivery.</td>
<td>18-Apr-11</td>
<td>Sent the request to CS Marine to look at the error in tribon.</td>
<td>CLOSED</td>
<td>22/04/2011</td>
<td>Design has shifted the dates for the delivery of the production drawings;</td>
</tr>
<tr>
<td>7</td>
<td>18-Apr-11</td>
<td>The tools are not available at the QC department; this has become a bottleneck for the erection and inspection process. This will create the big problem in next days to achieve target.</td>
<td>19-Apr-11</td>
<td>Informed to QC DGM to provide the tools as soon as possible.</td>
<td>CLOSED</td>
<td>25/04/2011</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>22-Apr-11</td>
<td>The superstructure drawings are not approved from the BV. Need to approve the drawings.</td>
<td>24-Apr-11</td>
<td>Drawings are not yet received from BV to CS marine.</td>
<td>CLOSED</td>
<td>26/07/2011</td>
<td>Approved drawings will be received on 11th July 2011.</td>
</tr>
</tbody>
</table>
Strict implementation of planning & monitoring

the simple bottlenecks badly affecting production projected in the daily reports were removed immediately

Mr. Pago sees immediate results!!
Stage level Technologies Invested –

- Design
- Building
- Process
- Analytics
- Misc

GOOD & USEFUL

Enhancing Collaborative Efficiency using Planning – MOST IMPORTANT

Mr. Pago has real data and complete control on the production.

Lives Happily Ever after !!
Planning is enabler of Digital Era, its a process that creates order out of chaos & renders TECHNOLOGY usable to business.
THANK YOU!