

Introduction To Restructuring Mid-Tier Shipyard By Developing Rough Layout Concept

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- ▶ Introduction
- ▶ Objectives
- ▶ Approach
- ▶ Theoretical Foundation
 - Ship Production Processes
 - Simulation in Shipbuilding Industry
 - Description of Mid-tier shipyard
- ▶ Data Collection
- ▶ Experimental Procedure
- ▶ Conclusions

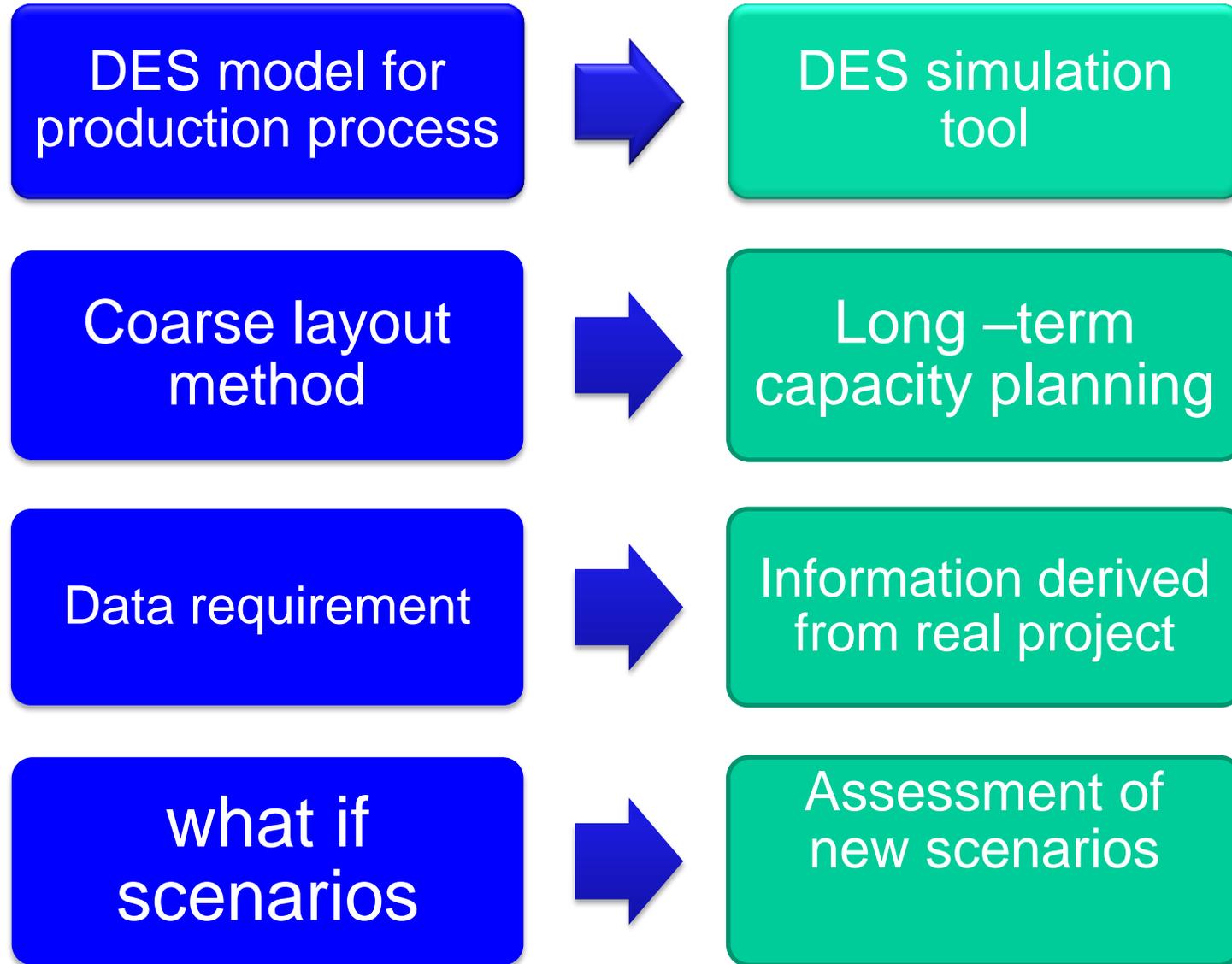
- ▶ Shipyards facing the crisis
 - Change in their strategies
- ▶ Optimization of shipbuilding processes
 - Reducing delivery time/cost
- ▶ Simulation as tool for shipbuilding industry
 - Simulation of very complex systems

DES model for production process

Coarse layout method

Data requirement

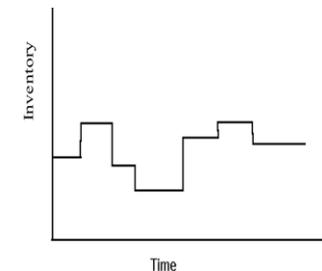
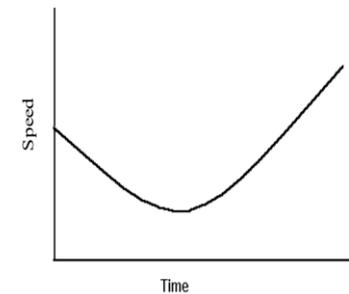
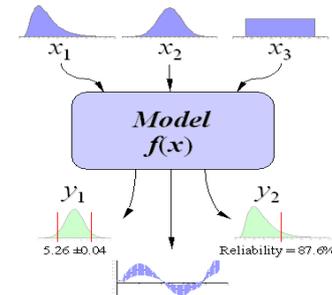
what if scenarios



- ▶ Ship Production Process
 - Product Work Breakdown Structure – PWBS
 - Hull Block Construction Method – HBCM
 - Zone Outfitting Method – ZO FM
 - Zone Painting Method – ZPTM
 - Pipe Piece Family Manufacturing (PPFM)

► Simulation in Shipbuilding

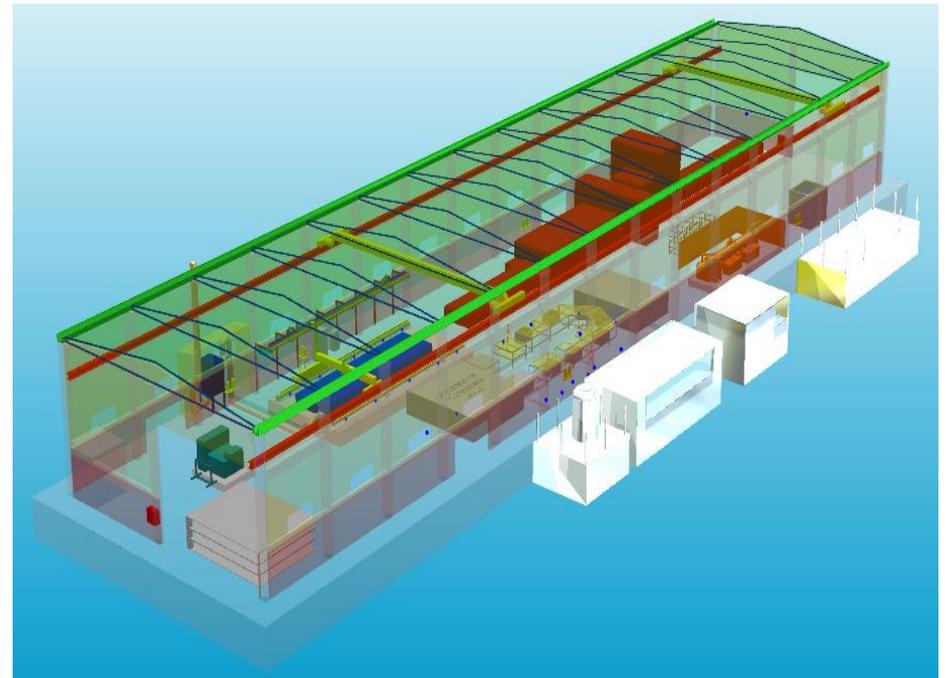
- Monte Carlo Simulation
 - Time unnecessary
- Continuous Simulation
 - Mathematical models
- Discrete Event Simulation
 - Event occur at an instant



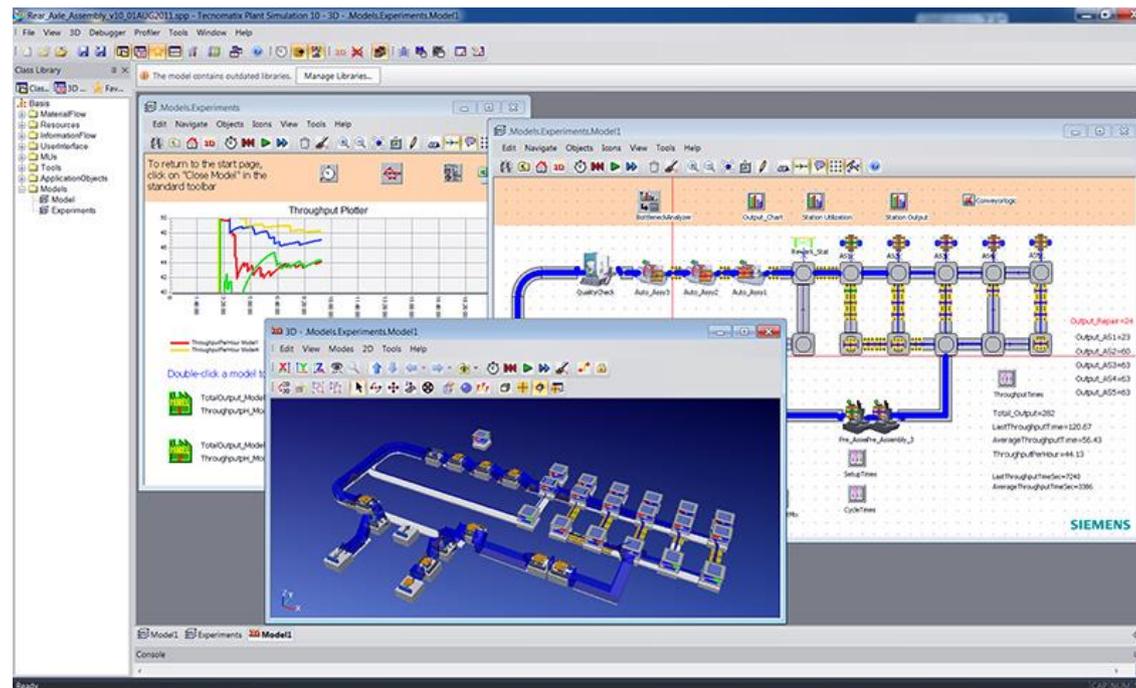
- ▶ Description of Mid-tier Shipyard
 - Capacities
 - Classification as mid-tier shipyard



<http://desarrolloydefensa.blogspot.de/2008/08/cotecmar-excelencia-en-astilleros.html>



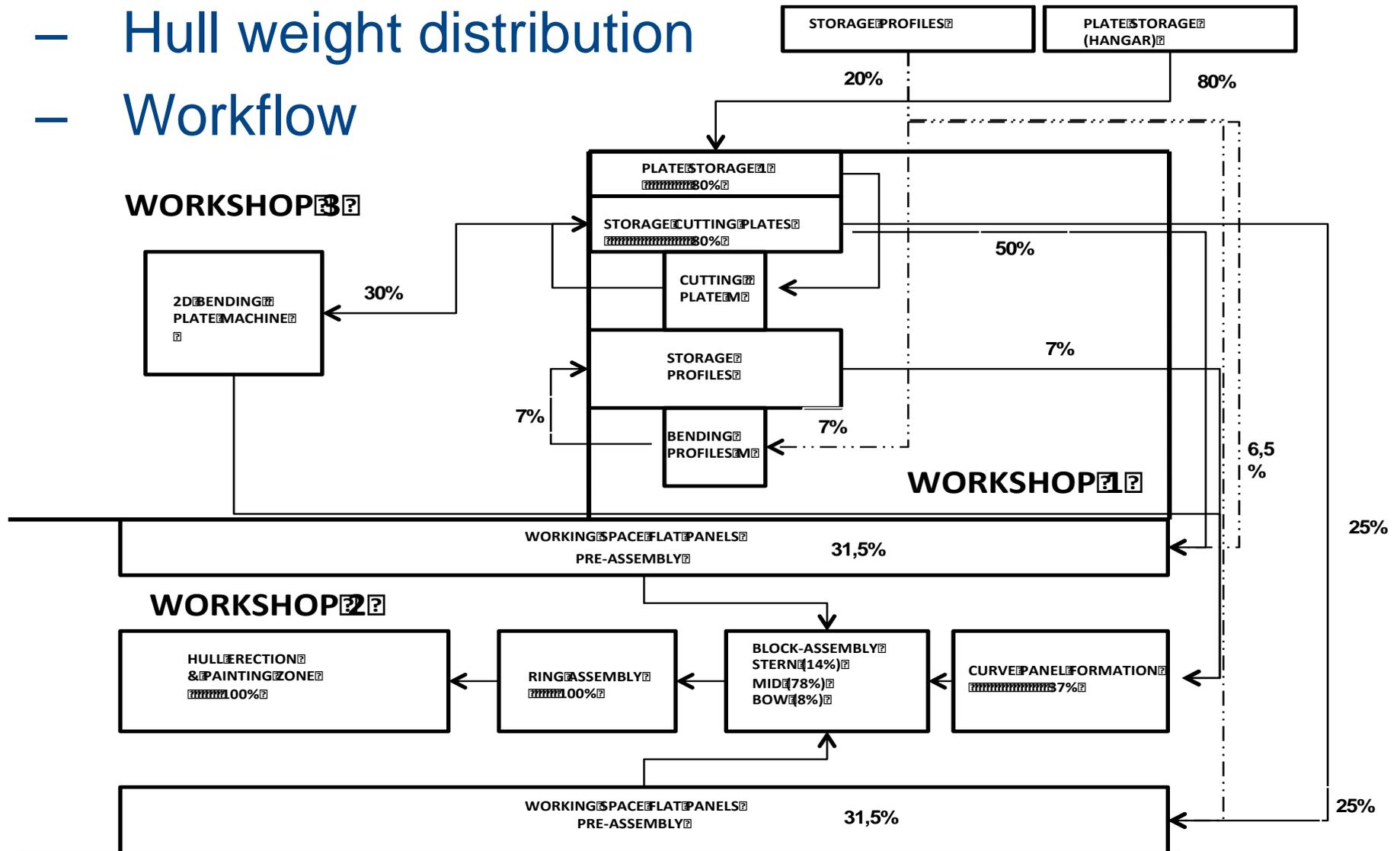
- ▶ Simulation Tool Description
 - Objects represented by icons
 - Hierarchically structured
 - Graphical representation



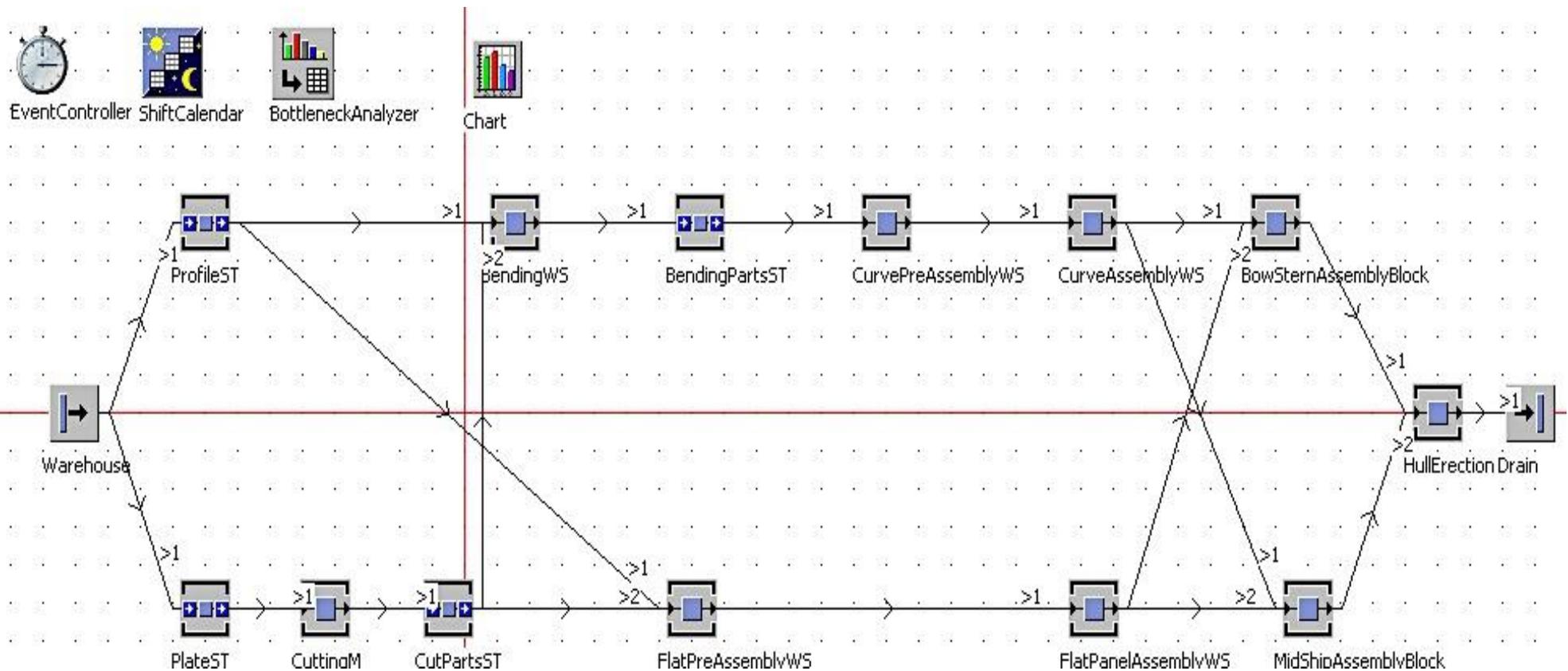
https://www.plm.automation.siemens.com/en_us/products/tecnomatix/plant_design/plant_simulation.shtml#lightview-close

► Current scenario

- Hull weight distribution
- Workflow



- ▶ Current scenario
 - Unidirectional workflow
 - Stations



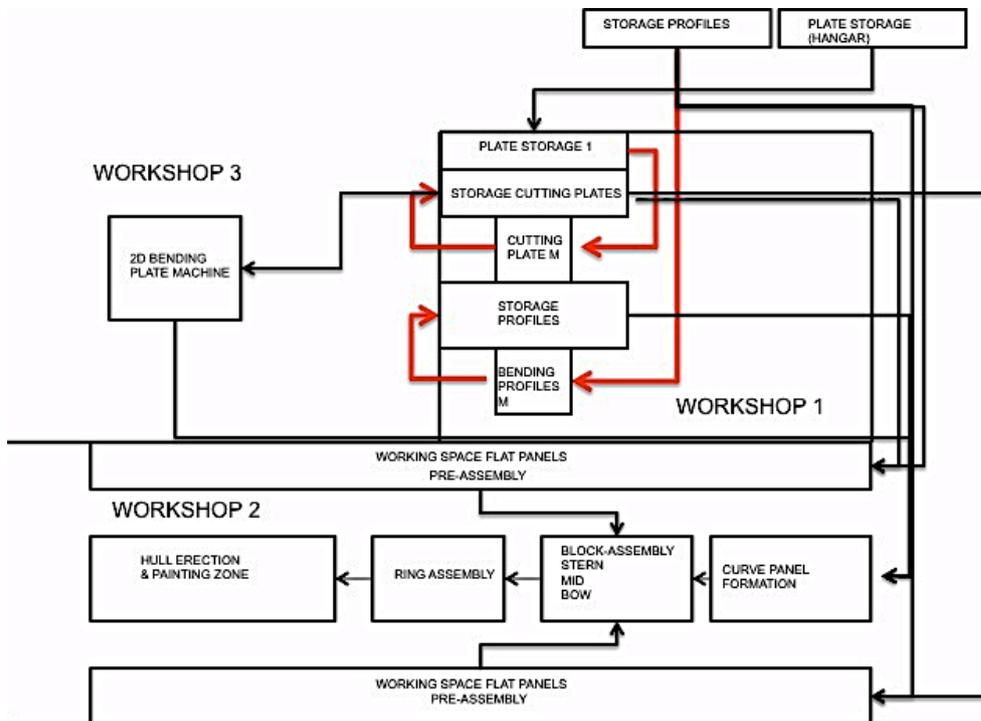
► Scenario 1. Welding Robot in the production line



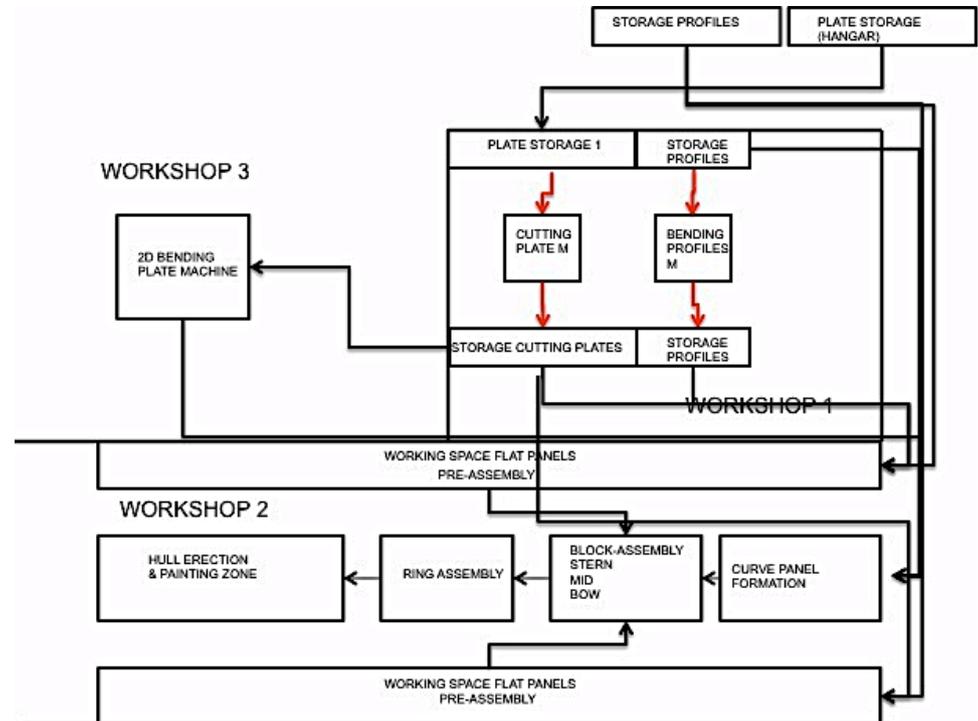
<http://cfnewsads.thomasnet.com/images/large/515/515802.jpg>

► Scenario 2. Restructuration of the Current Layout

Current Layout



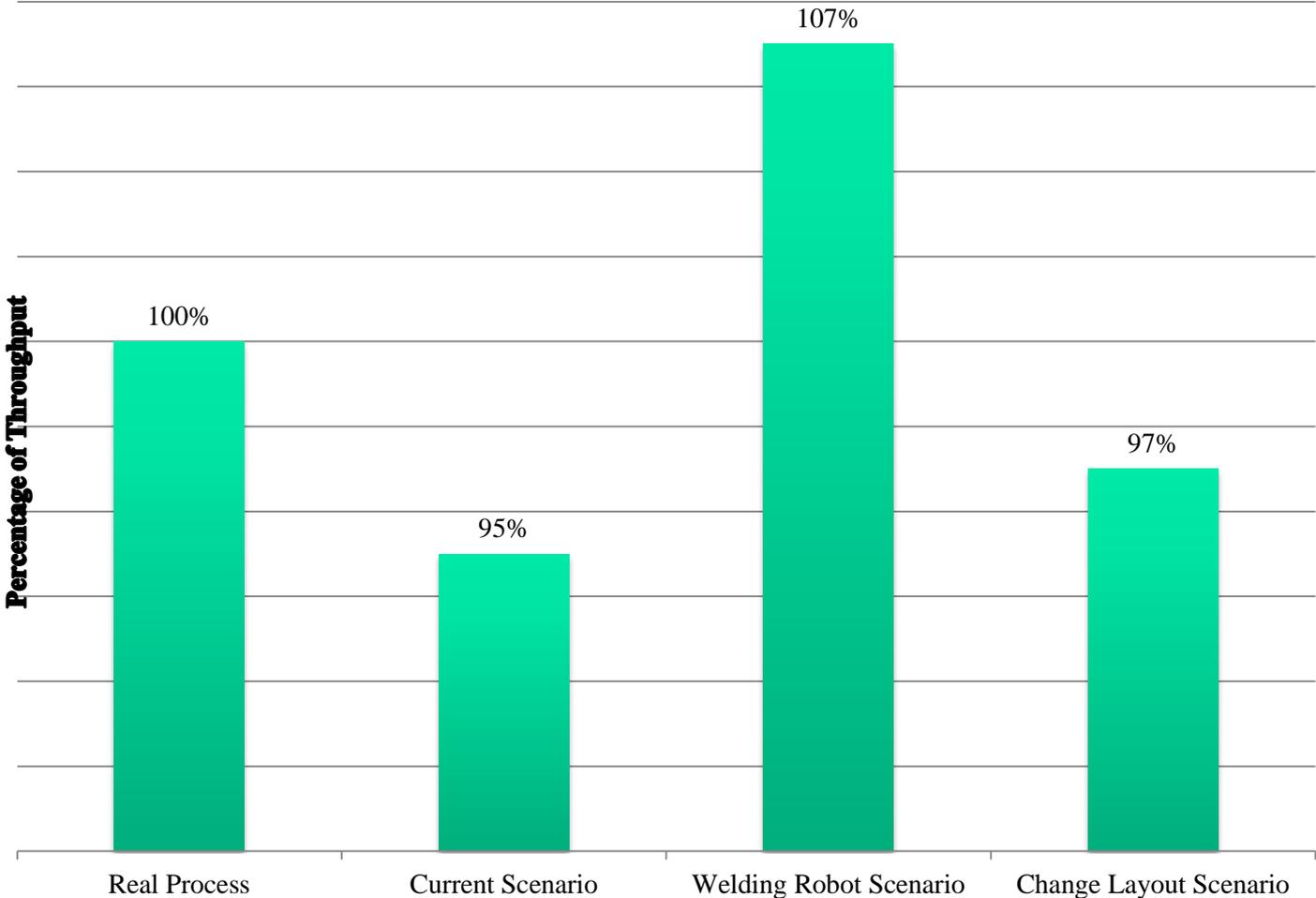
Restructured Layout



EXPERIMENTAL PROCEDURE

STATION	CURRENT SCENARIO		Welding Robot Scenario		Restructuration of the current layout	
	Processing Time	Set-up Time	Processing Time	Set-up Time	Processing Time	Set-up Time
Warehouse		2h:30m		2h:30m		2h:30m
Plate Storage	1h:00m	---	1h:00m	---	1h:00m	---
Profile Storage	1h:00m	---	1h:00m	---	1h:00m	---
Cutting Machine	1h30m	00h:45m	1h30m	00h:45m	1h30m	00h:30m
Bending Workshop	7h:00m	2h:00m	7h:00m	2h:00m	7h:00m	00h:45m
Flat pre-assembly workshop	3h:30m	1h:30m	1h:30m	1h:30m	3h:30m	00h:45m
Flat assembly workshop	3h:30m	2h:00m	3h:30m	2h:00m	3h:30m	3h:30m
Curve pre-assembly workshop	6h:00m	2h:00m	6h:00m	2h:00m	6h:00m	6h:00m
Curve assembly workshop	6h:00m	2h:00m	6h:00m	2h:00m	6h:00m	6h:00m
Aft-bow assembly blocks ws	4h:00m	1h:30m	4h:00m	1h:30m	4h:00m	4h:00m
mid-ship assembly blocks ws	3h:00m	1h:30m	3h:00m	1h:30m	3h:00m	3h:00m

EXPERIMENTAL RESULTS



EXPERIMENTAL RESULTS

STATION	CURRENT SCENARIO		Welding Robot Scenario		Restructuration of the current layout	
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Warehouse	---	2h:30m		2h:30m	---	2h:30m
Plate Storage	1h:00m	---	1h:00m	---	1h:00m	---
Profile Storage	1h:00m	---	1h:00m	---	1h:00m	---
Cutting Machine	1h30m	00h:45m	1h30m	00h:45m	1h30m	00h:30m
Bending Workshop	7h:00m	2h:00m	7h:00m	2h:00m	7h:00m	00h:45m
Flat pre-assembly workshop	3h:30m	1h:30m	1h:30m	1h:30m	3h:30m	00h:45m
Flat assembly workshop	3h:30m	2h:00m	3h:30m	2h:00m	3h:30m	2h:00m
Curve pre-assembly workshop	6h:00m	2h:00m	6h:00m	2h:00m	6h:00m	2h:00m
Curve assembly workshop	6h:00m	2h:00m	6h:00m	2h:00m	6h:00m	2h:00m
Aft-bow assembly blocks ws	4h:00m	1h:30m	4h:00m	1h:30m	4h:00m	1h:30m
mid-ship assembly blocks ws	3h:00m	1h:30m	3h:00m	1h:30m	3h:00m	1h:30m
THROUGHPUT	474 tons		532 tons		483 tons	

- ▶ Develop very fine simulation model
- ▶ Evaluate impact of new machinery before investment
- ▶ Include all the processes related with shipbuilding

