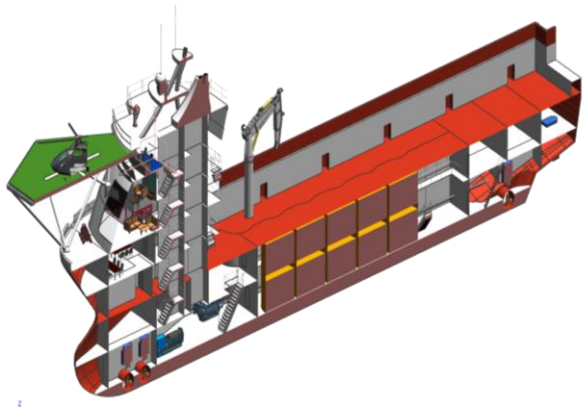

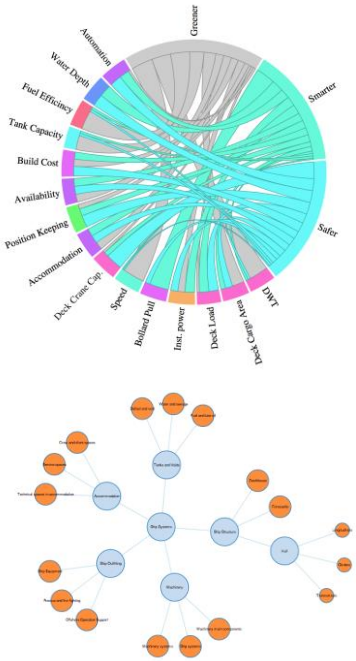

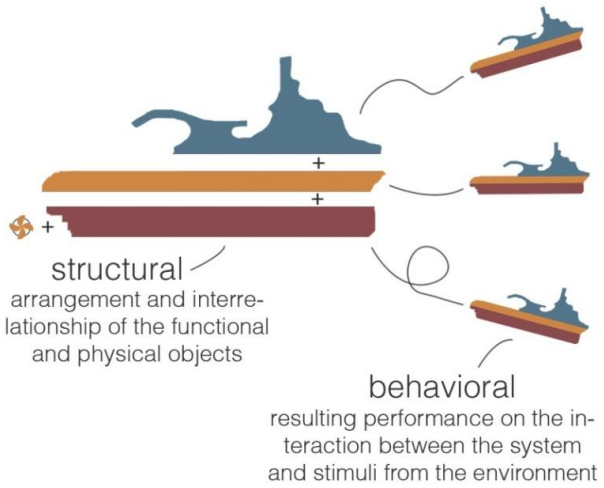

CSF INTERNSHIP: PROJECTS AND EXPECTATIONS

Henrique M. Gaspar

Aug. 2014

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Aalesund University College

THREE FUNDAMENTAL BRANCHES

HØGSKOLEN I ÅLESUND

Teaching

classes, MSc supervision, international students, extra-curricular activities

NTNU Norwegian University of Science and Technology

Massachusetts Institute of Technology

maritime knowledge hub

Research

cooperation within HIALS, maritime knowledge hub and international institutions

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Industry

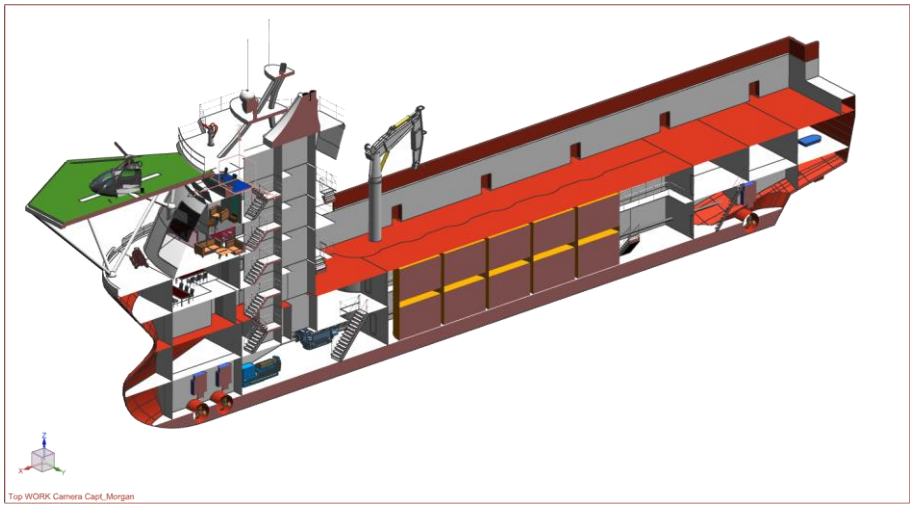
strong cooperation with Ulstein group and related companies in the region

BIP PROJECT

Innovation Project for the Industrial Sector between Ulstein and HIALS :

ÉMIS - Efficient Modular Integration of Systems for Ship Design: Speeding up Modules Customization and Detailing Engineering for Ulstein

- To develop and implement more efficient methods to integrate complex modules in the process performed at Ulstein
- Productivity constrained by the limited ways to create, combine, evaluate and document each of the modules
- Effective and robust modular framework, able to combine standard (traditional) with customized (emergent) solutions through the ship design process.
- Take into account as well the detailing engineering, specially regarding an effective documentation towards 3rd party partners.



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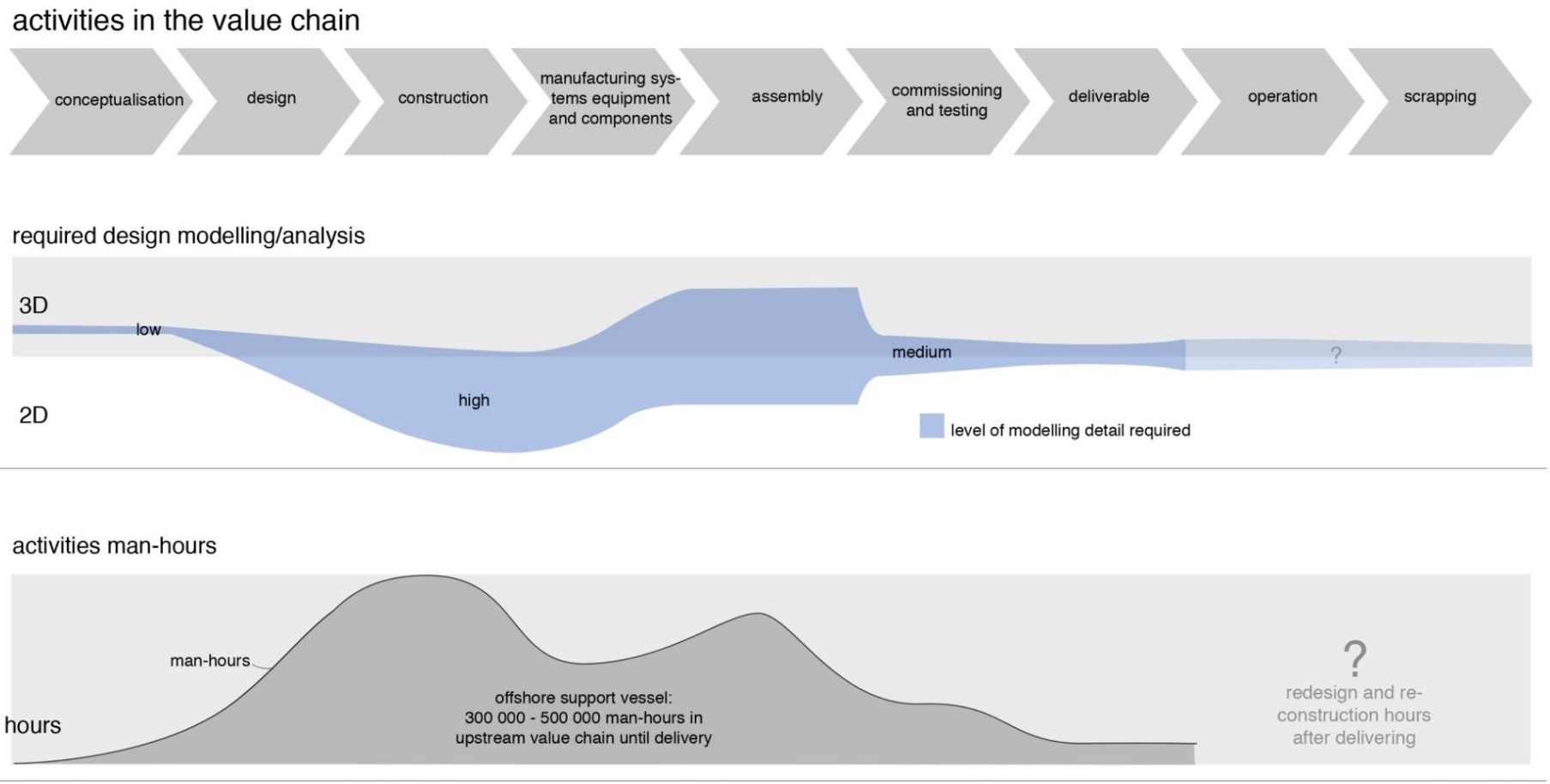
WHY INTEGRATE?



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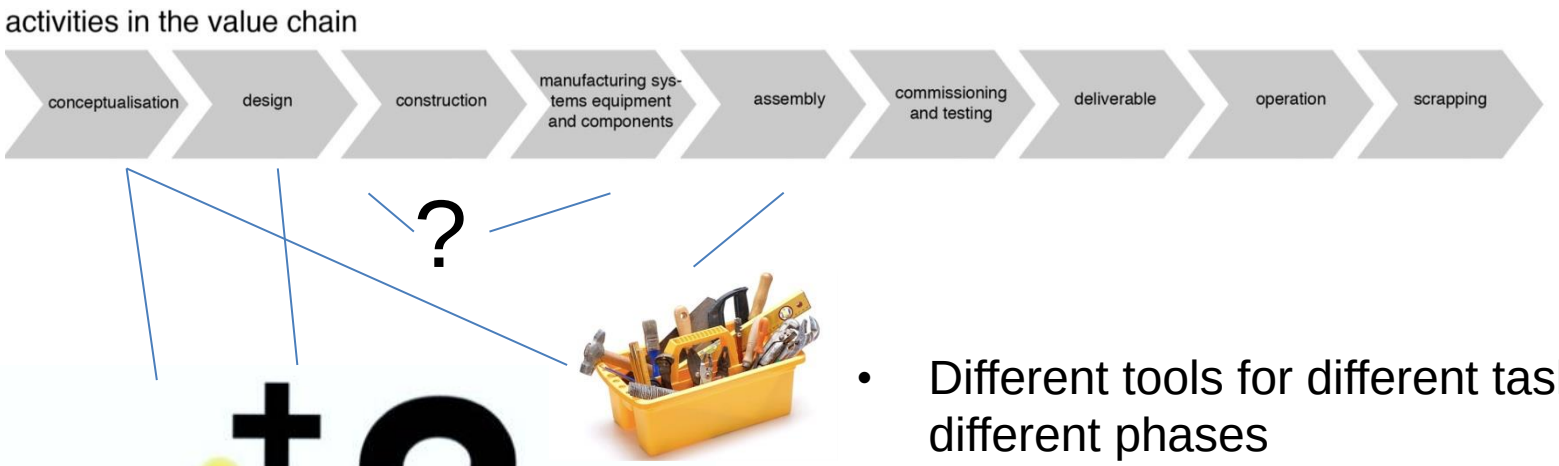
TOOLBOX ANALOGY



- Different tools for different tasks for different phases
- Not necessarily they “work together”
- Each solution as a necessary tool for the ship design process
- It all converges on **how the relevant information is handled** (observed, generated, analysed, evaluated and presented)

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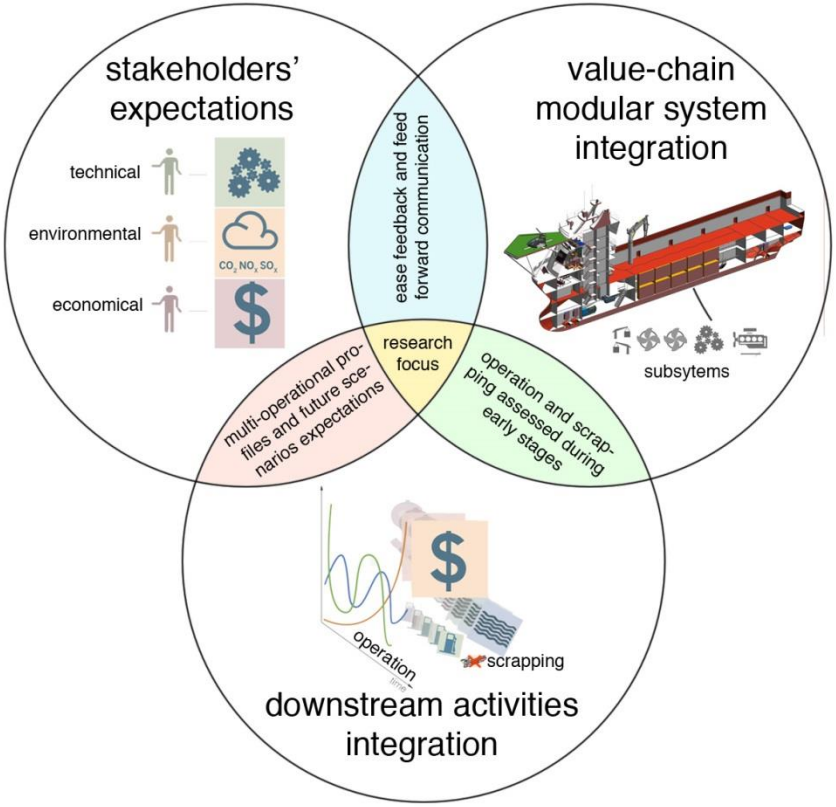
EMIS FOCUS AND CHALLENGES

3 Main Objectives:

1. Develop a cost-effective **framework for design and engineering of Offshore Vessels** based on a modularized and standardized approach, through the whole value-chain, from the conceptual design of the vessel until scrapping
2. Develop a system theory based prototype design tool able to concurrently **integrate the framework with the current module work** at the value-chain
3. **Test and implement** the framework within the value chain elements



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EMIS FOCUS AND CHALLENGES

2 research lines: Framework and 3D Modular System Integration

UDD FRAMEWORK TASKS JUNE 2ND	AUGUST 5TH UPDATE
Study on an multi-stakeholder/multi-platform framework needs and functionalities, which integrate the multi-levels of the ship design value chain (Ulstein Design Dashboard - UDD)	*UDD Presentation July 8th [1]* *Requirements to be sketched on August/September, based on Hydro tools and/or catalogue vessel.*
Sketch of a prototype version of the framework, integrating designers and clients approaching conjointly a conceptual design	*Functionalities presented in [1].* *Waiting feedback for requirements from Øyvind Kamsvåg, Per Ivar Roald and Stein Frode Haugen.* *Prototypes activities starting in August.*
Integrate basic parametric equations for a fast first approach design in the framework	*Meeting with Ali & Per Olaf during August.* *Implementation Framework starting from August.*
Study on the level of detail required to jump from fast to customized design in the framework	*Study requiring feedback from other tasks, probably starting around October/November*
Sketch methodology for integrating the framework with Ulstein tools from 2015	*Study requiring feedback from other tasks, probably starting around October/November*
Summary of the pros and cons of the approach	*Study requiring feedback from other tasks, probably starting around December*

CAD/CAE SOFTWARE TASKS	AUGUST 5TH UPDATE
Study on using NX as tool for rapid ship design prototype: first phase - conceptual design	*Short example during April's workshop [3] and another case during Allan's internship [4].* *A more robust case connecting MaxSurf and/or Napa should be done during September/October*
Tutorial on how to draw a simple hull in Siemens NX (conceptual design)	*Sketch from Allan's internship [4]* *A more robust case using MaxSurf and/or Napa should be done during September/October*
Tutorial on how to parameterize a simple hull in Siemens NX	*Sketch from Allan's internship [4]* *A more robust case using MaxSurf and/or Napa should be done during September/October*
Study on which calculations are provided "out of the box" for Stability and Structural analysis	*Requiring NX server implementation, probably starting around October/November*
Study on the level of detail required to jump from conceptual to basic design in Ulstein case	*Requiring NX server implementation and Ulstein design team feedback from the prototype, probably starting around October/November*
Proposal for methodology to merge CAD/CAE with the UDD framework from 2015	*Study requiring feedback from other tasks, probably starting around November/December*
Summary of the pros and cons of the approach (bottlenecks)	*Study requiring feedback from other tasks, probably starting around December*

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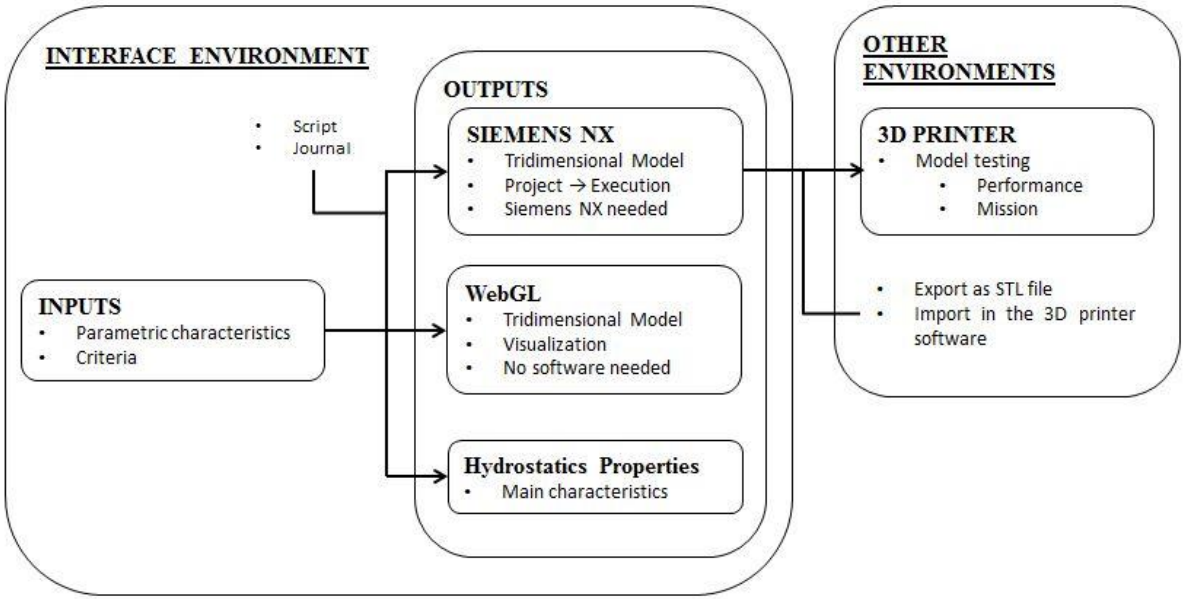
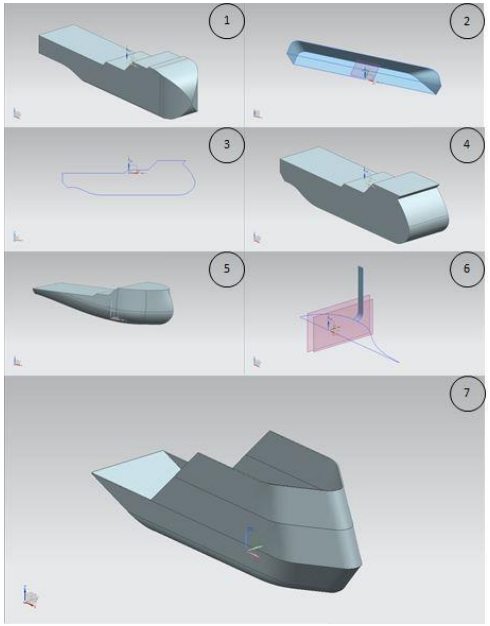
EMIS FOCUS AND CHALLENGES

3D Modular System Integration (2 master students)





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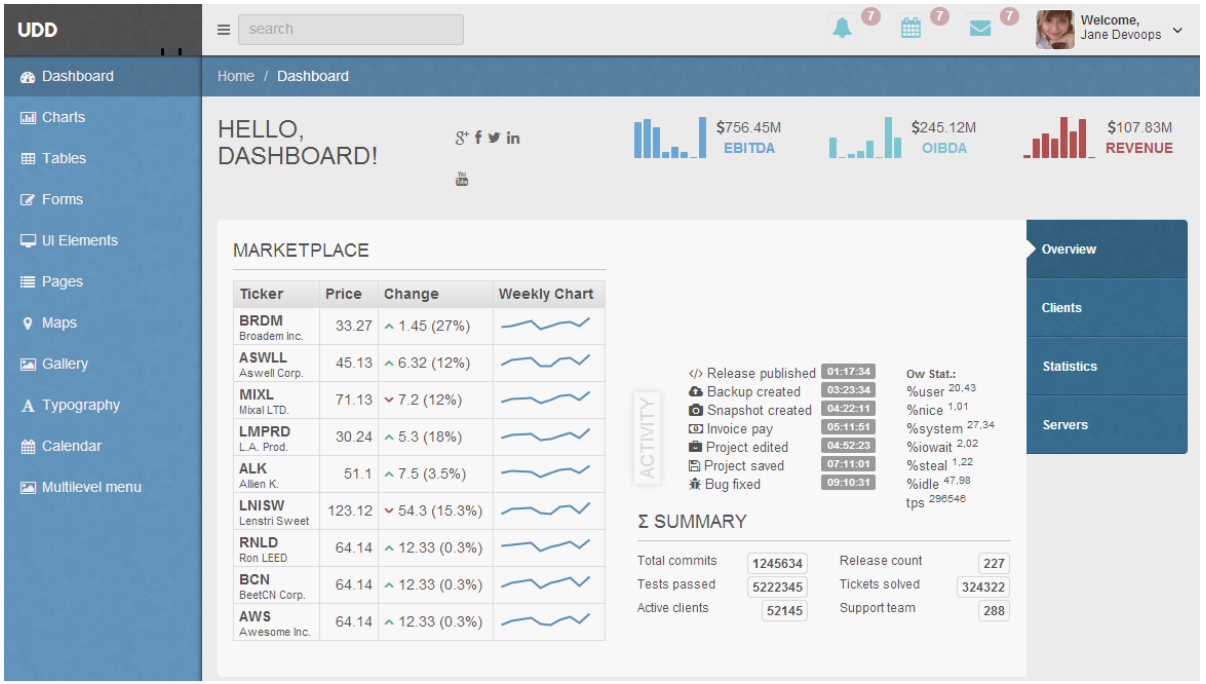
DESIGN DASHBOARD (UDD)

Dashboard:

a visual display of the relevant information needed to achieve one or more objectives, consolidated on a single platform, so the information can be reached at a glance



(based on Few, 2006)

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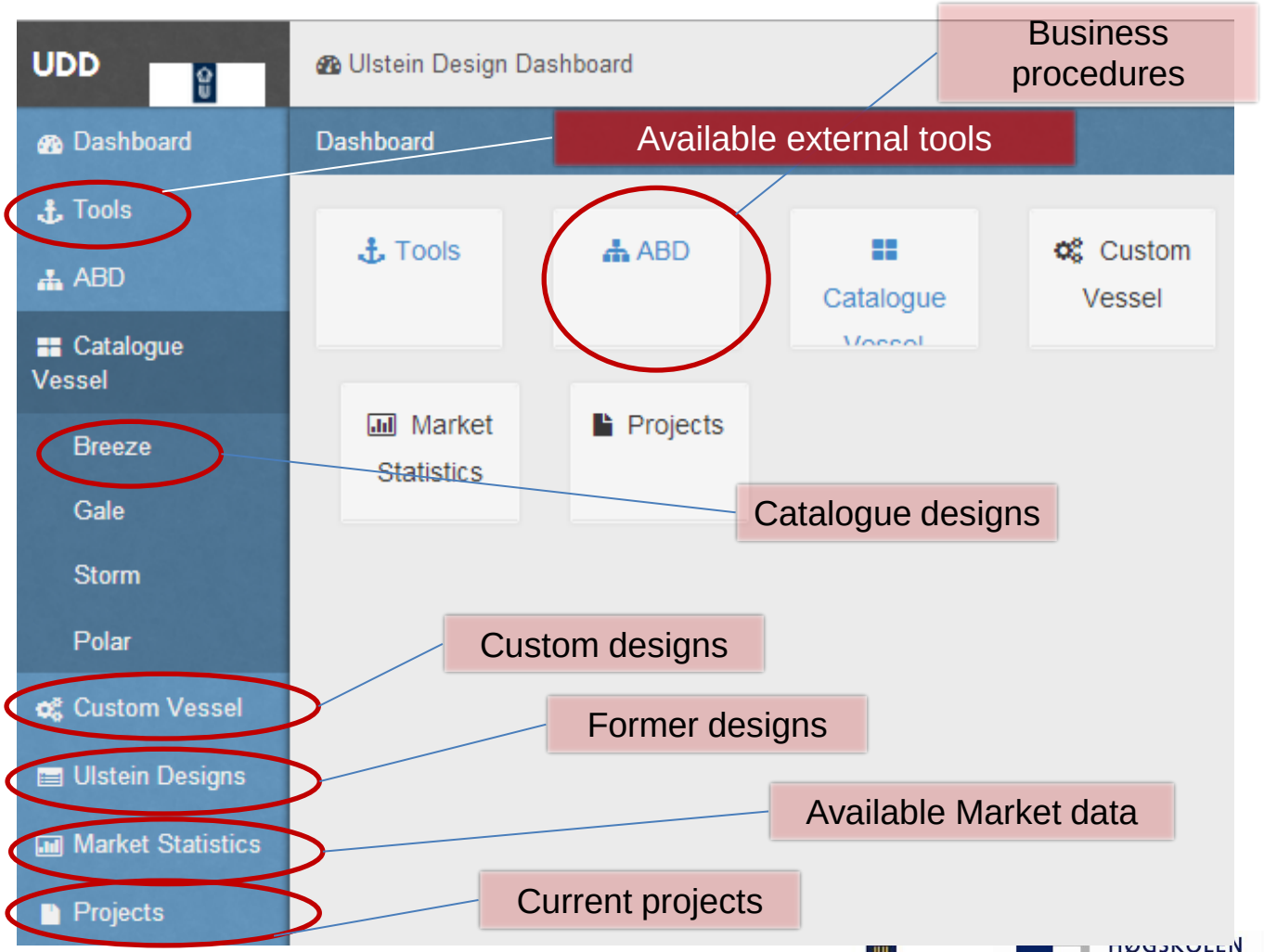
ULSTEIN DESIGN DASHBOARD (UDD)

Objectives:

1. **framework for design and engineering of Offshore Vessels**
2. integrate the framework with the current module work
3. Test and implement



ULSTEIN DESIGN DASHBOARD (UDD)

Objectives:

1. framework for design and engineering of Offshore Vessels
2. **integrate the framework with the current module work**
3. Test and implement

Gradual implementation with current procedures and modules

Work decomposed in small tasks (1-4 weeks max for each «chunck»)

Ulstein departments as «clients & planners»

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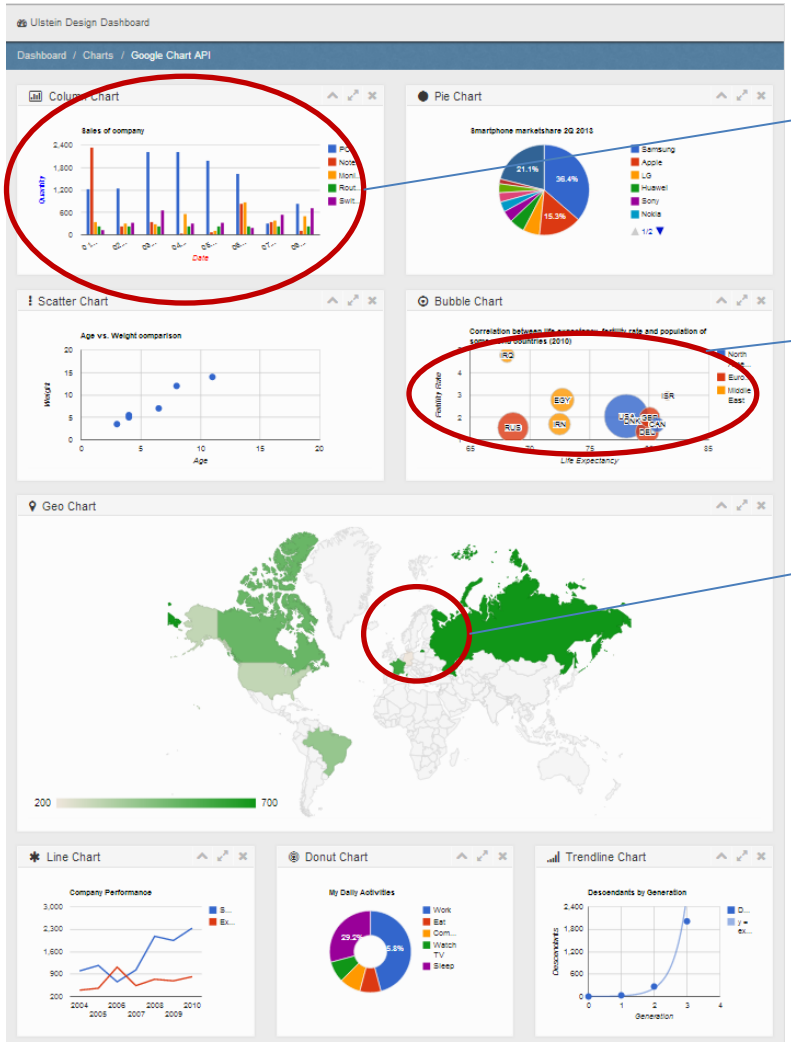
ULSTEIN DESIGN DASHBOARD (UDD)

Objectives:

1. framework for design and engineering of Offshore Vessels
2. integrate the framework with the current module work
3. **Test and implement**



Fall 2014 as period for «try and error»

What should we test first? Priorities?

UIN, UDS, UPC, UVE

In other words: which <u>relevant information</u> should we starting focusing?

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CATALOGUE VESSEL INTO UDD

Which relevant information should be handled?

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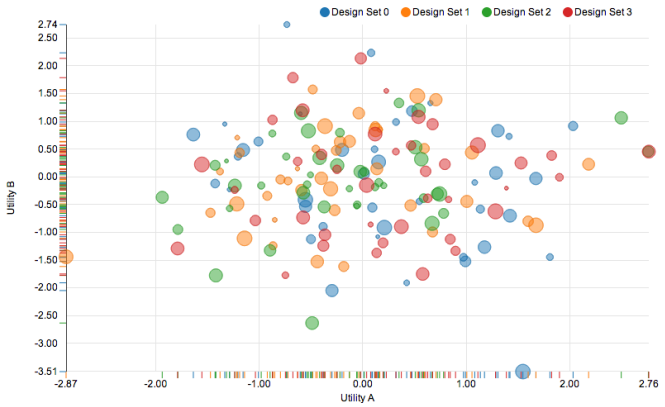
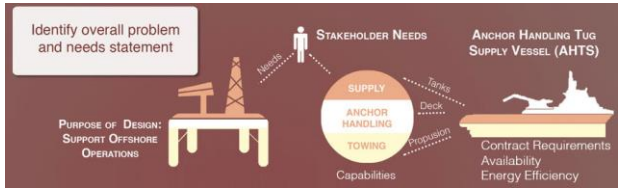
Benchmark Comparison?



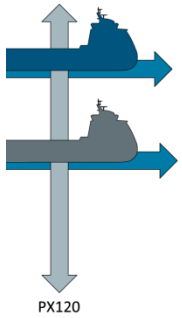
Owners' requirements?



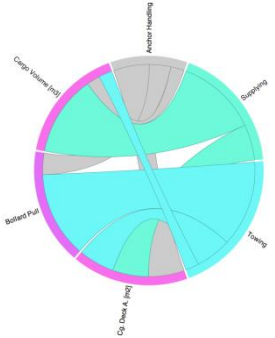
Capability	A. Handling	Supplying	Towing	Total
Cargo deck area [m^2]	500	500	500	1500
Bollard pull [MT]	50	0	200	250
Cargo volume [m^3]	500	3000	500	4000

Parametric Models?

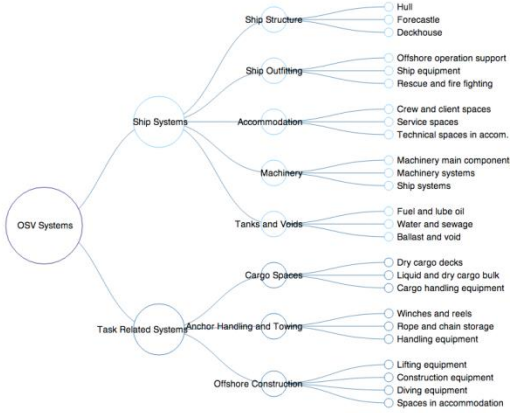
Parameters	Value	Range
Length [m]	100	
Breadth/Length	0.22	
Breadth [m]	22	
Depth/Breadth	0.45	
Depth [m]	9.9	
Draft/Depth	0.7	
$Draft_{Design}$ [m]	6.9	
C_B	0.75	
Powering [kW]	20689	
Price / GT [kNOK/GT]	50	



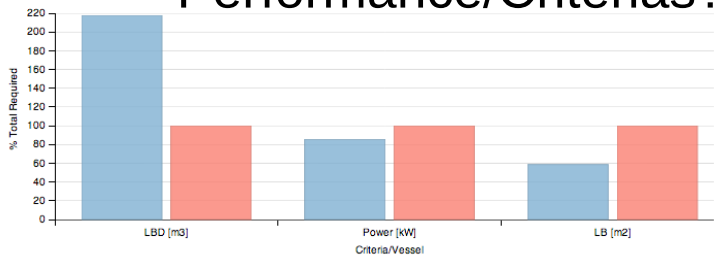
Mission/Capabilities dependencies?



System Breakdown?



Performance/Criterias?

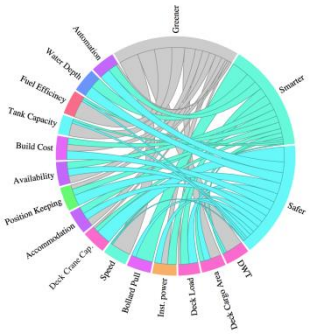


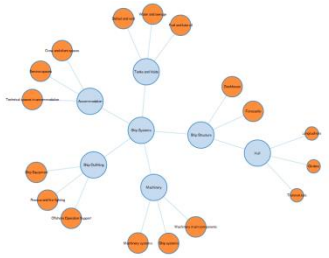
Analyses database?

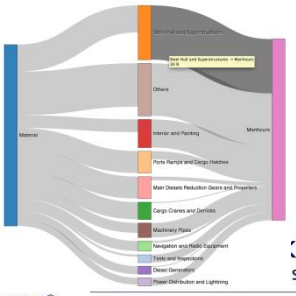
ULSTEIN DESIGN DASHBOARD (UDD)

Bonus Features:

- Online collaborative environment
- Open source
- Features beyond powerpoint /excel
- On the way to very advanced online user interaction:
  - Data driven visualization
  - Virtual prototype







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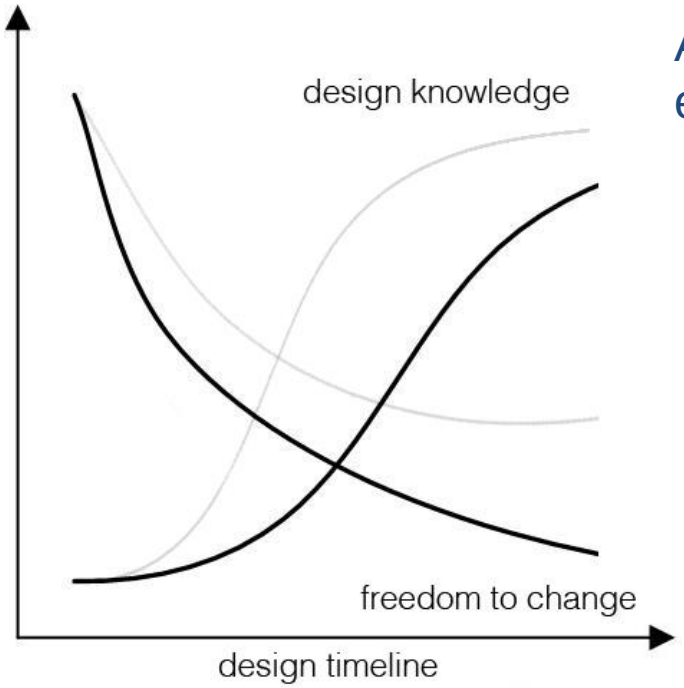
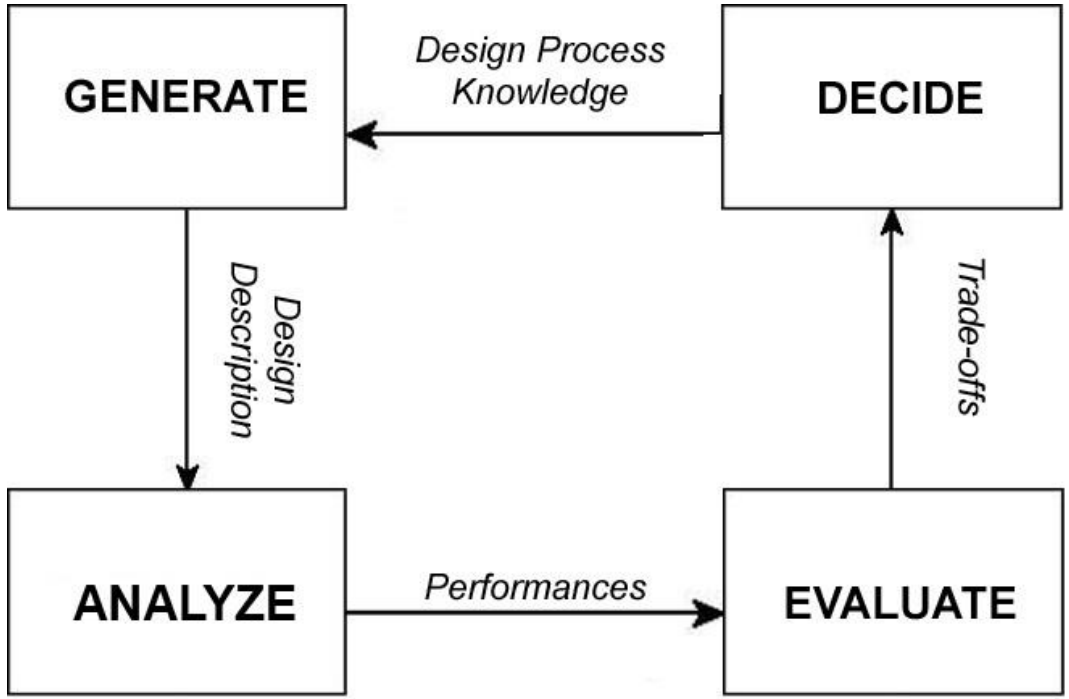
KNOWLEDGE IN CONCEPTUAL SHIP DESIGN



Acquiring knowledge as earlier as possible



Basic design process to acquire knowledge

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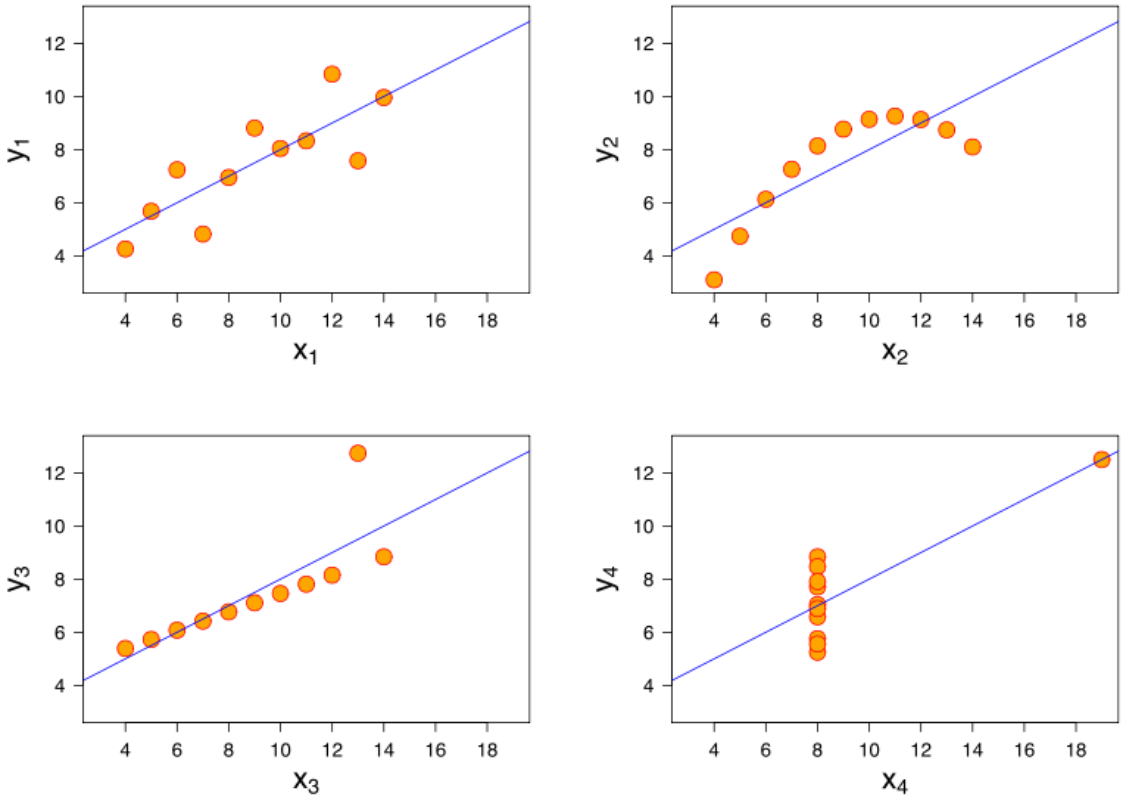
VISUAL REPRESENTATION OF KNOWLEDGE

- **Anscombe's data sets (1973)**

I		II		III		IV	
x	y	x	y	x	y	x	y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

```
Mean of x: [ 9 9 9 9 ]
Variance of x: [ 11 11 11 11 ]
Mean of y: [ 7.5 7.5 7.5 7.5 ]
Variance of y: [ 4.127 4.128 4.123 4.123 ]
Correlation of x-y: 0.816 0.816 0.816 0.817
```



Even the most skilled designer must use visual information to fully grasp knowledge from the data

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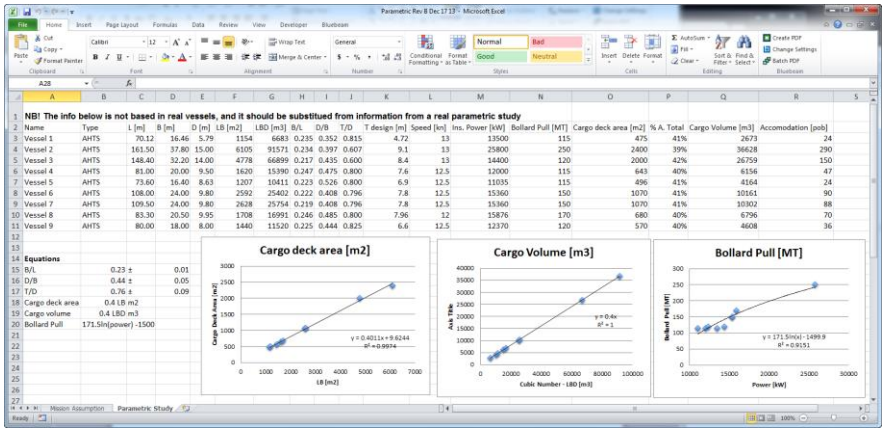
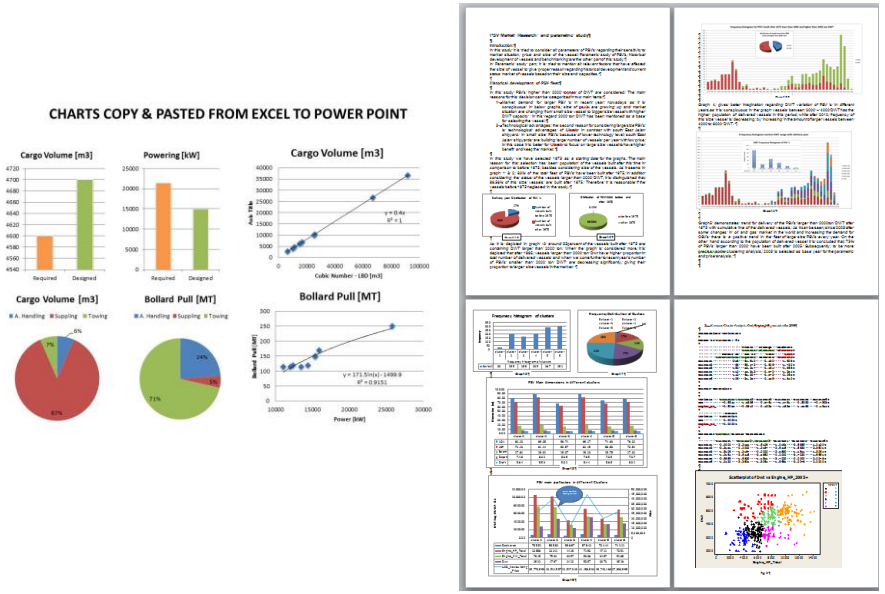
VISUAL REPRESENTATION OF KNOWLEDGE

- Information concentrated, condensed, and processed via spreadsheet-like programs/outline specs
- Complex analyses, such as hydrodynamic and structural, are quickly transformed into a *number in a cell*
- This data is transformed into a large set of charts, which will feed the innumerous reports and presentations created during this process
- Lack of interaction





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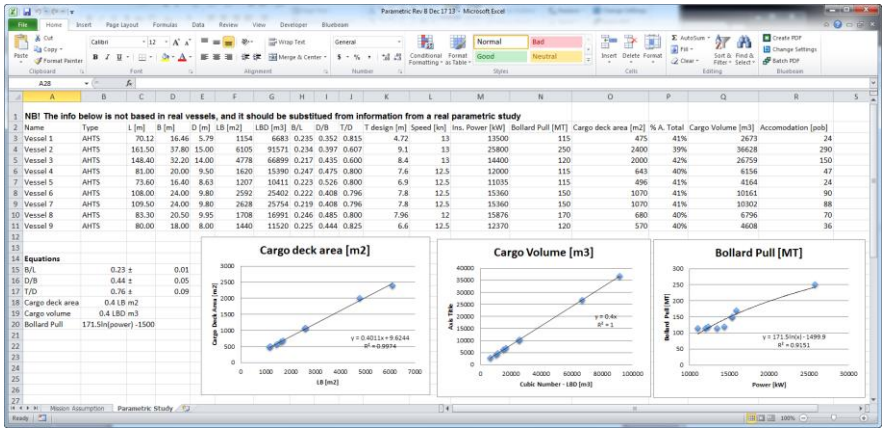
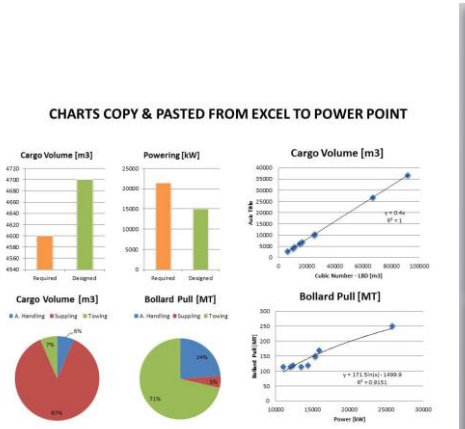
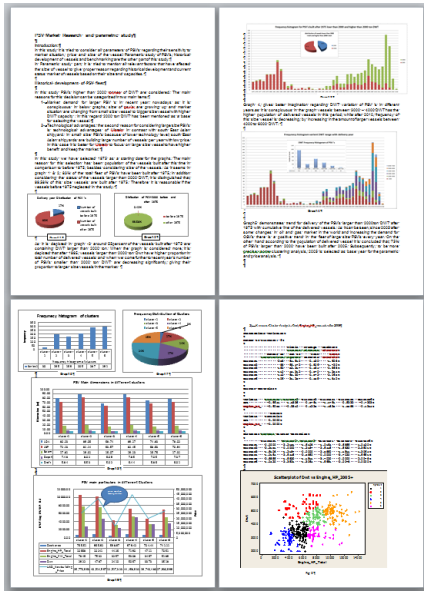
VISUAL REPRESENTATION OF KNOWLEDGE

- Process may be hiding other types of relevant information
- Many data visualizations are created to persuade rather than inform, with ideas disconnected from the context

How can a single stakeholder such as the shipowner, interact with the requirements and the extensive simulation data created for satisfying it, if usually results are presented to her as a picture set, within a folder containing a main .doc report with its many .ppt and .xls sources obscured?







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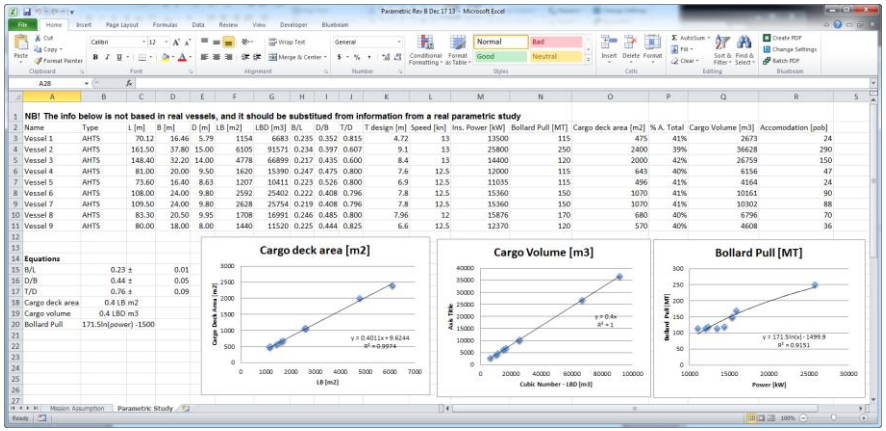
VISUAL REPRESENTATION OF KNOWLEDGE

- Extension of the procedure
- Handling parametric data outside the row versus column format,
- Handling data in an open/readable format
- Progress beyond the passive share of performance evaluation
- Presenting a new type of graph, visualizing parametrically aspects previously handled as static figures.



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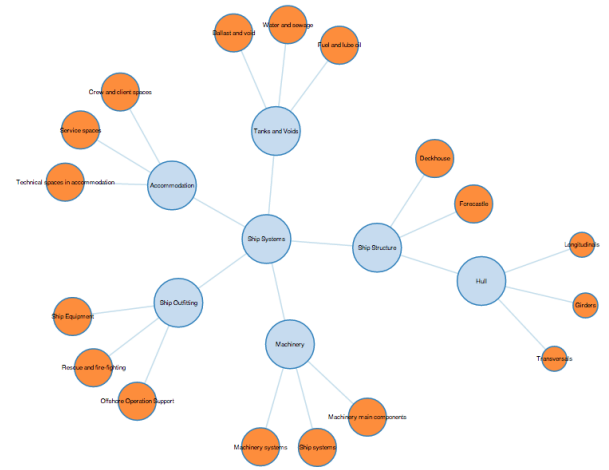


DATA DRIVEN DOCUMENTS (D3)

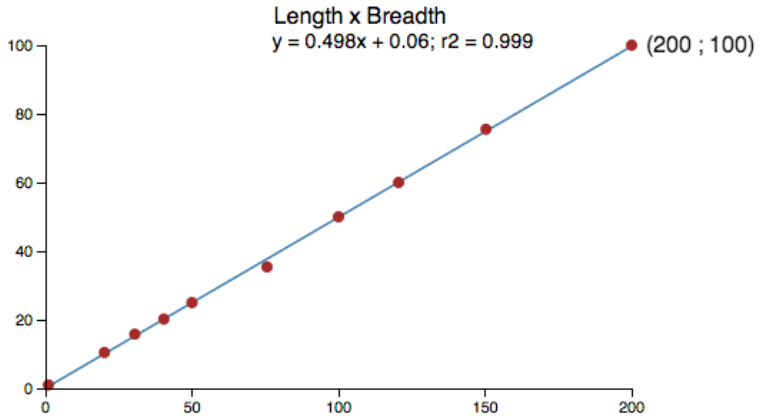
- **JavaScript Library developed initially by the Stanford Visualization Group and today mainly developed by Michael Bostock**
- **Combines powerful visualization components and a data-driven approach to objects manipulation**
- **A representation-transparent approach to visualization for the web.**
- **Direct inspection and manipulation of text-like data, binding input data to HTML document elements.**
- **Efficiency in quickly rendering and animating charts.**

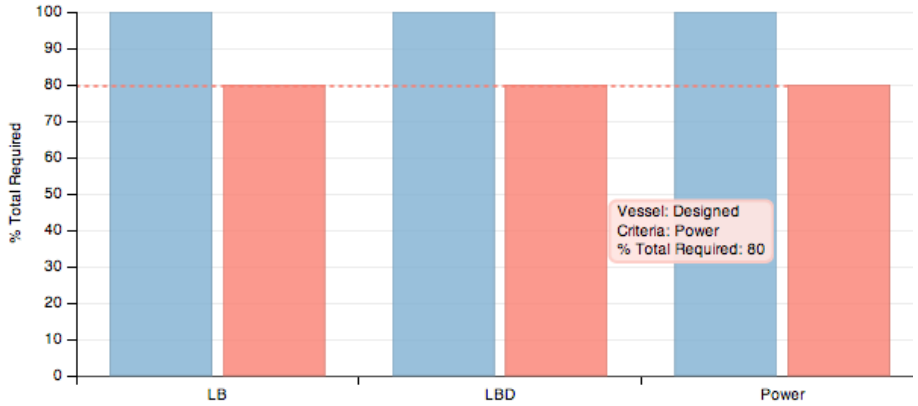
uscience.org/compit2014/

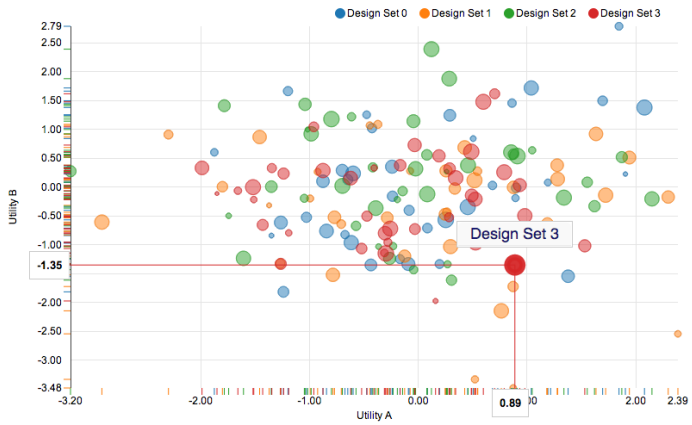
Using D3 during conceptual design allows the user to interact with different visualisations, creating an increased understanding of different variables correlations with each other. It also provides a simple and aesthetically pleasant interface.

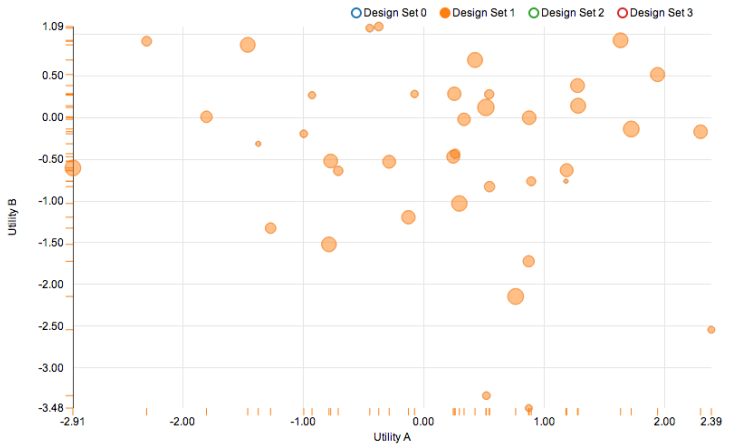
DATA DRIVEN DOCUMENTS (D3)

Basic Features









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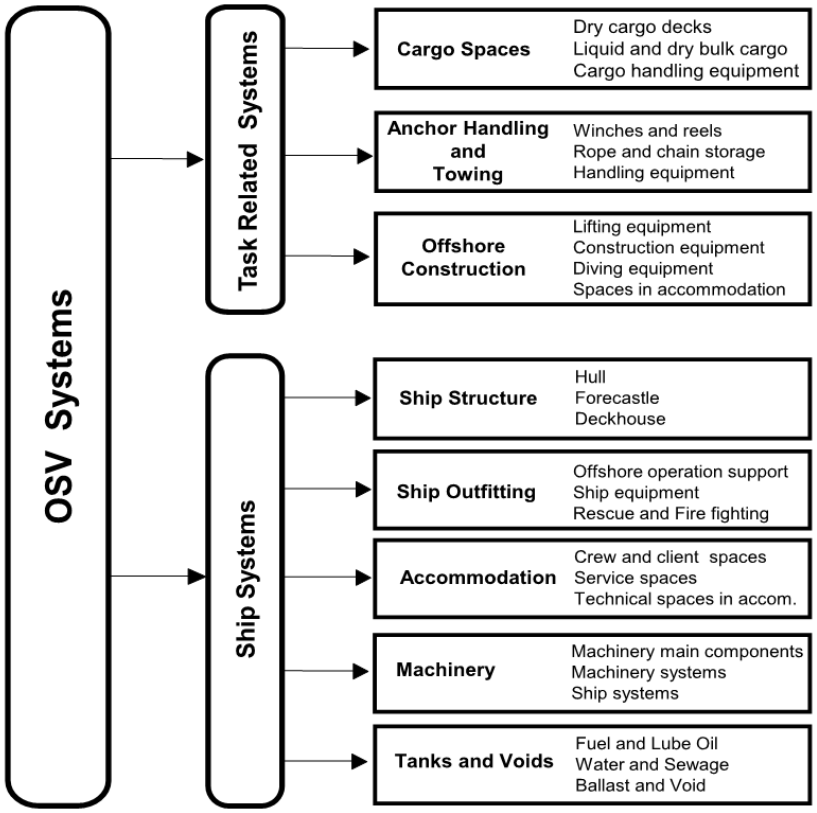
EXTRACTING SHIP DESIGN KNOWLEDGE

Structural Examples

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{ "name" : "Liquid and dry cargo bulk", "parent":"Cargo Spaces"},
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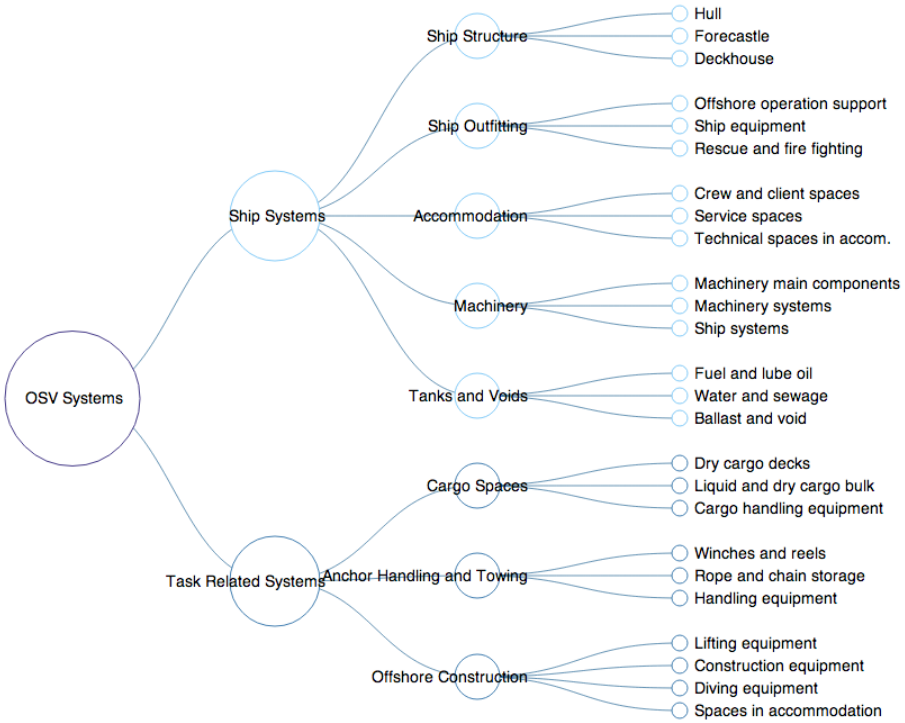
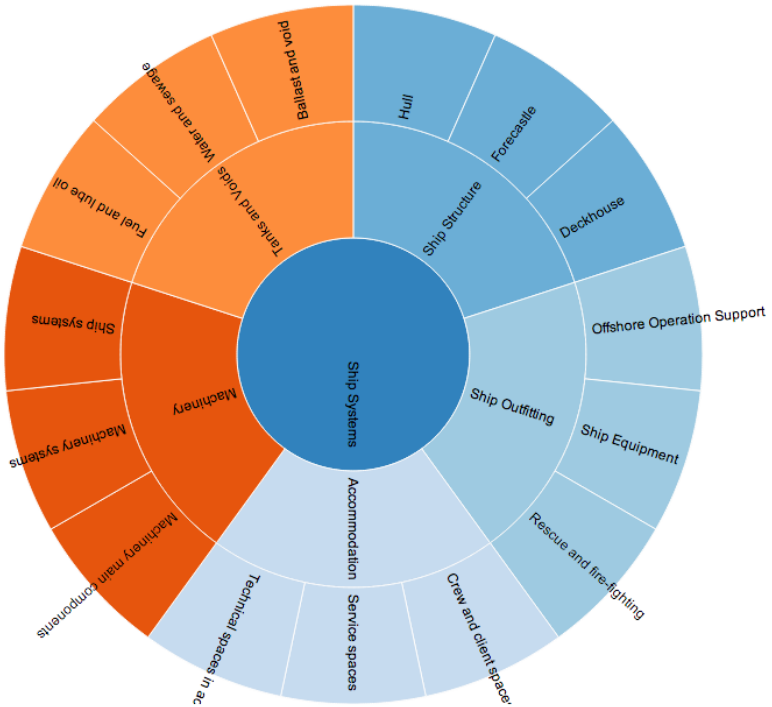
EXTRACTING SHIP DESIGN KNOWLEDGE

- **Structural Examples**





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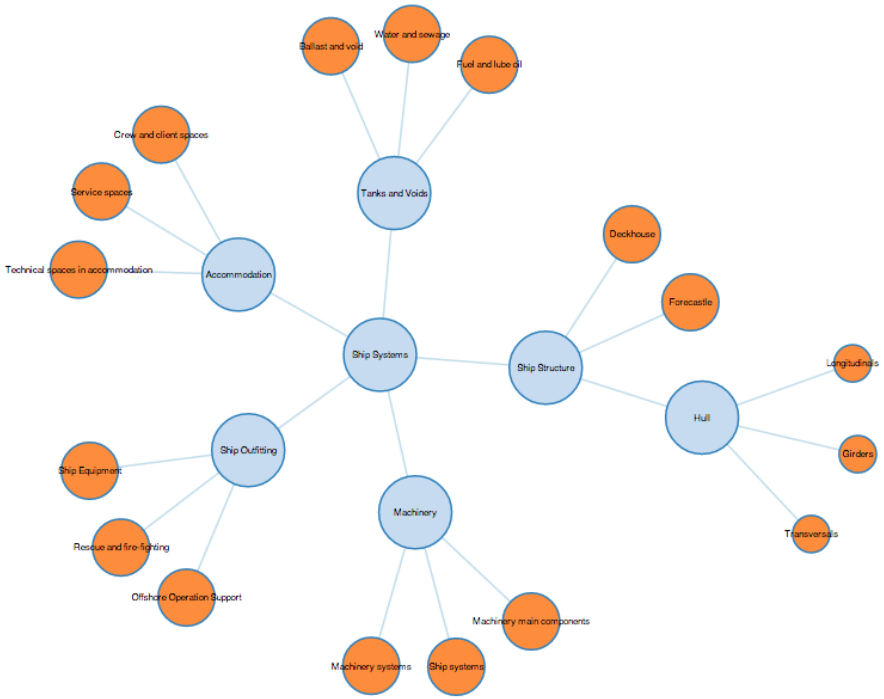
EXTRACTING SHIP DESIGN KNOWLEDGE

- **Structural Examples**



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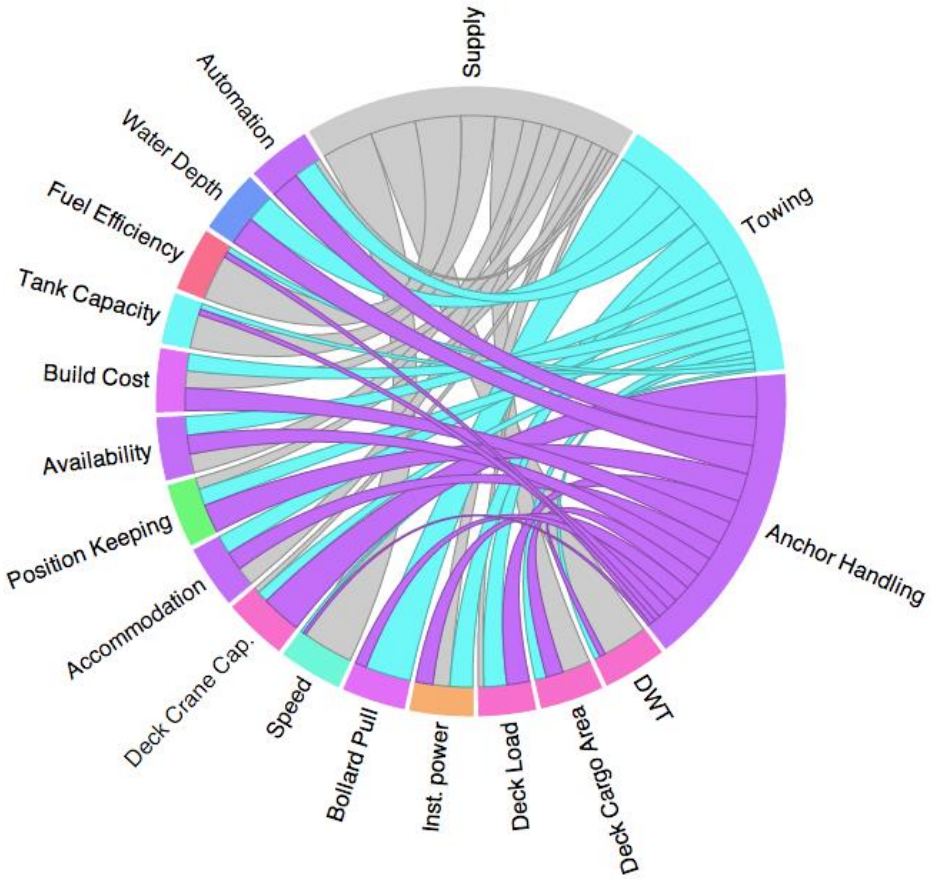
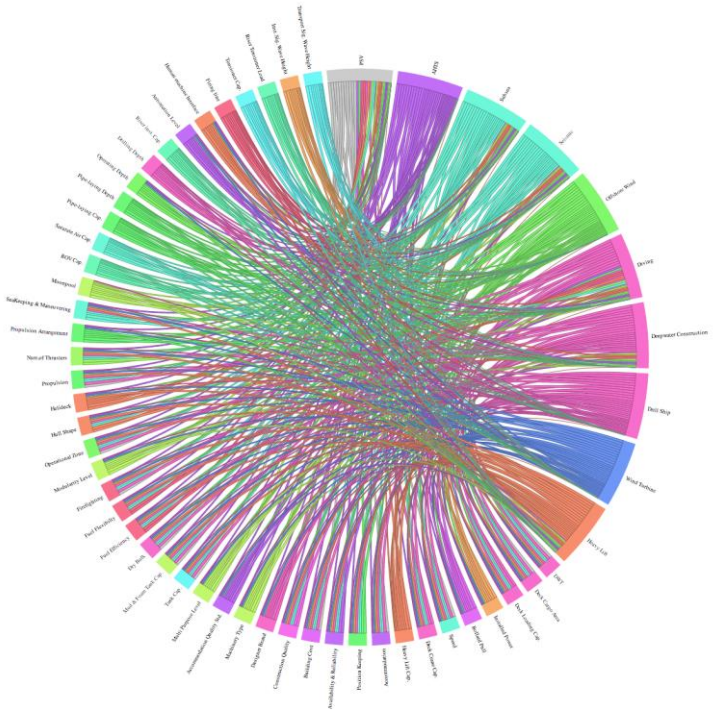
EXTRACTING SHIP DESIGN KNOWLEDGE

- **Design Mapping**





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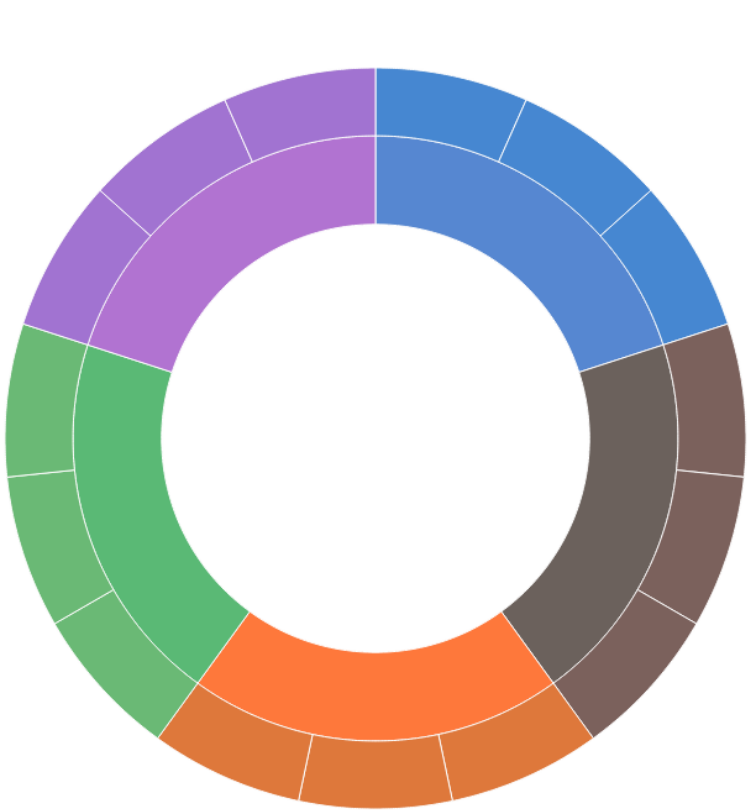
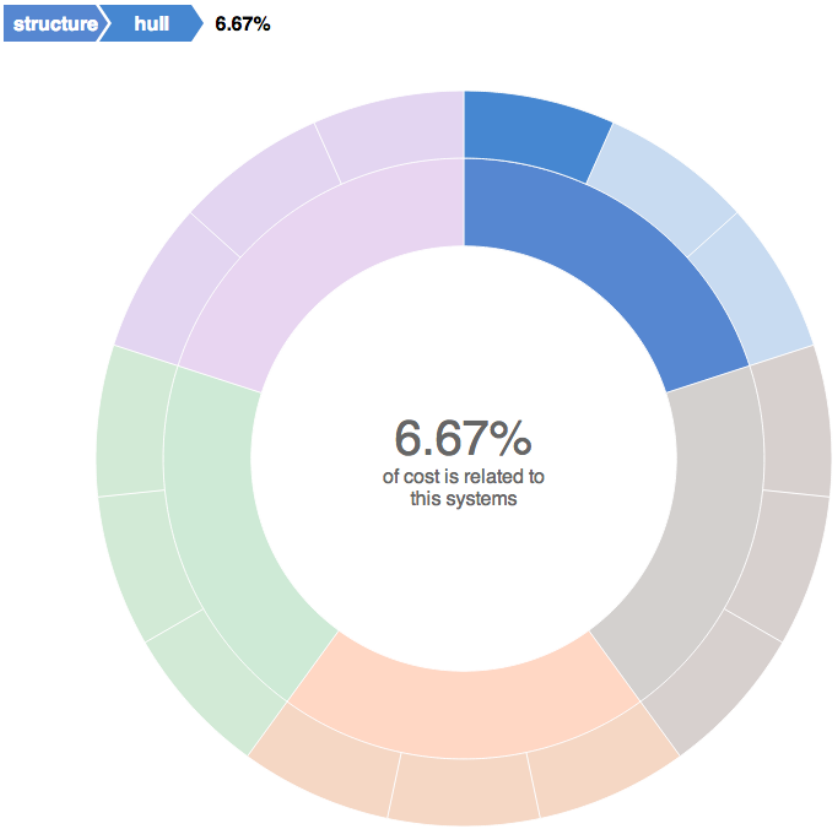
EXTRACTING SHIP DESIGN KNOWLEDGE

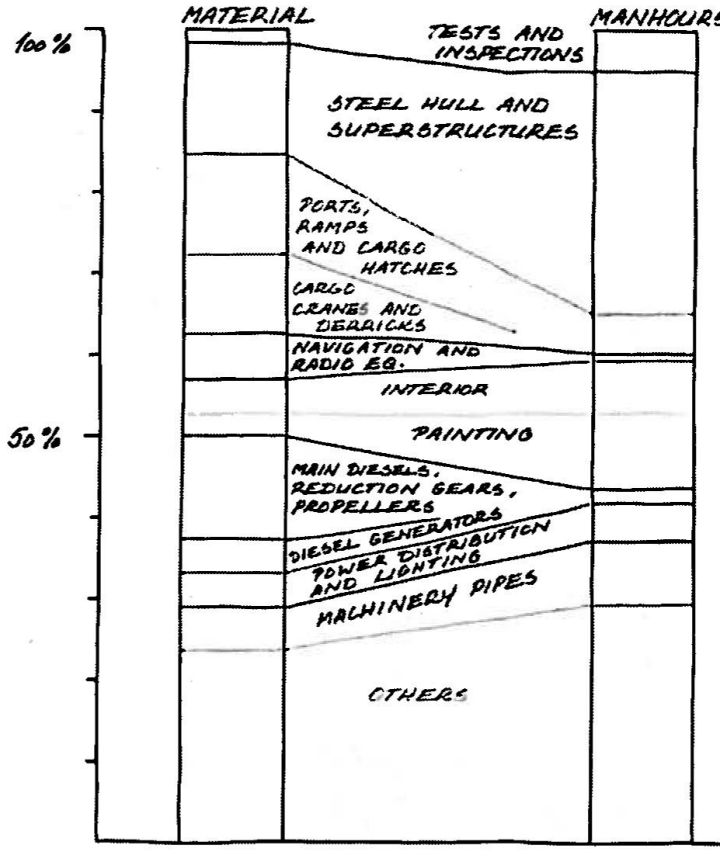
- **Economic Examples**

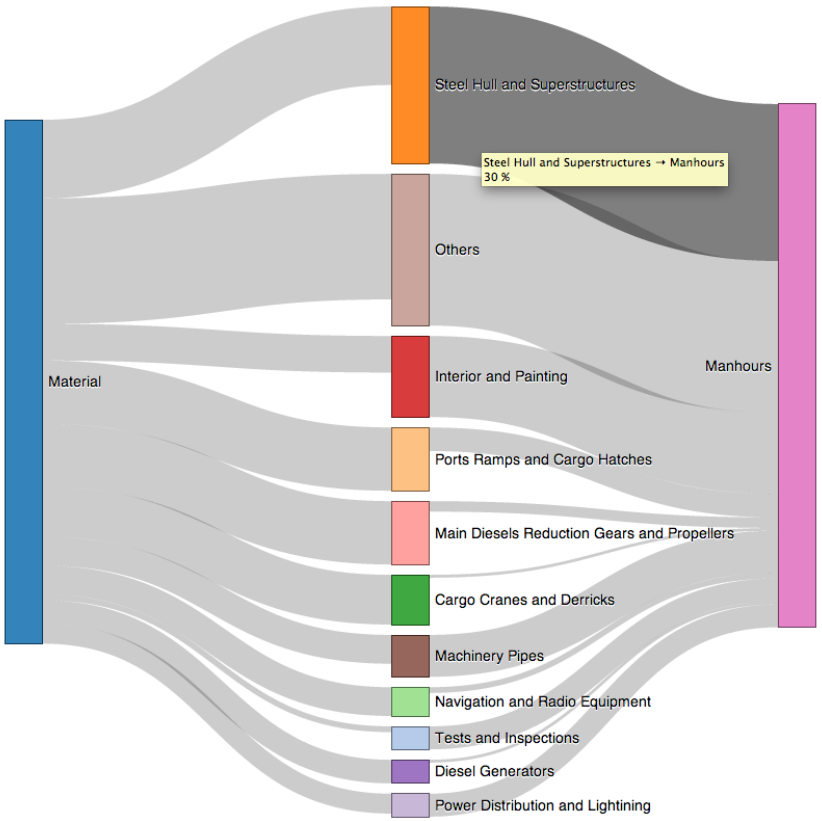




EXTRACTING SHIP DESIGN KNOWLEDGE

- **Economic Examples**





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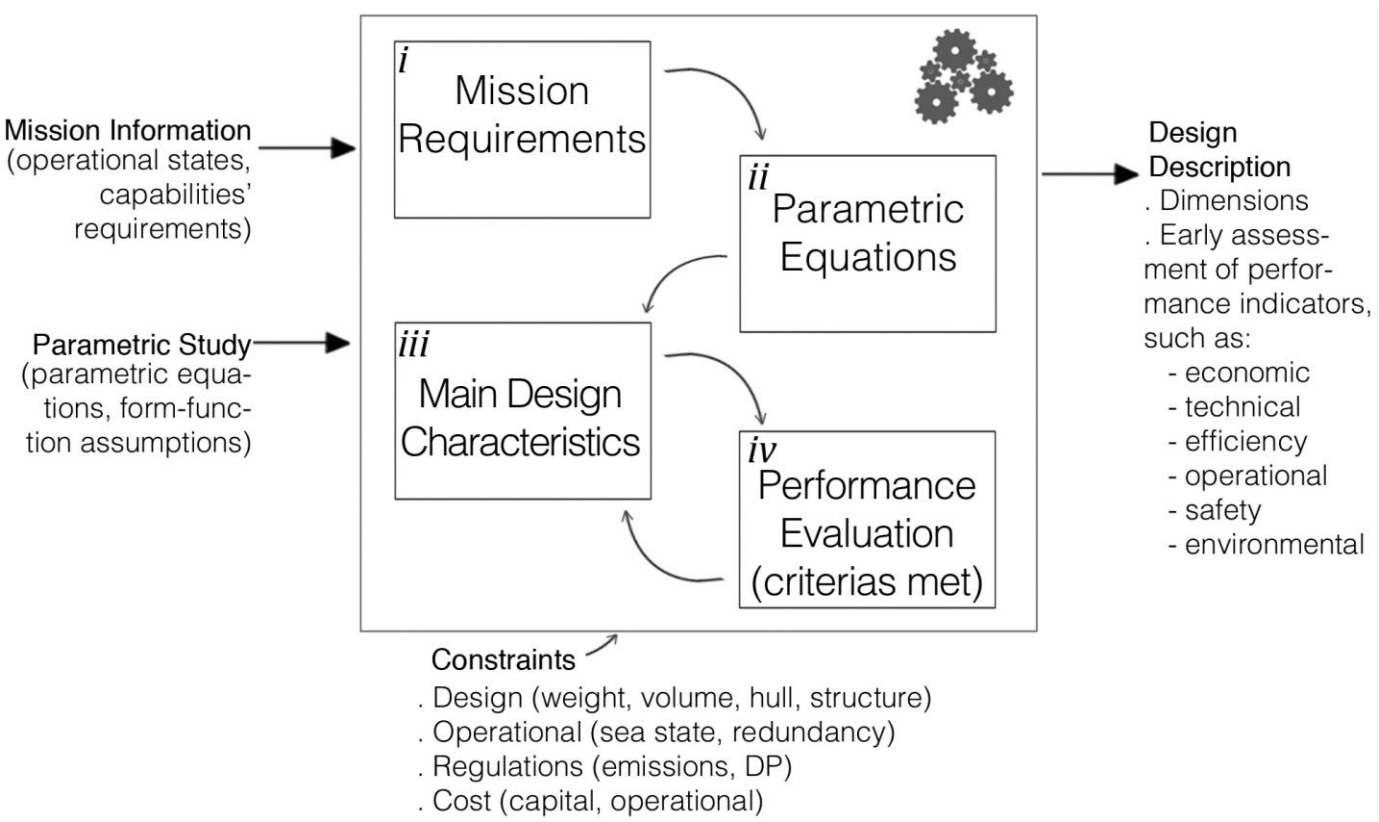
SIMPLE PARAMETRIC TOOL

- **General Methodology**



SIMPLE PARAMETRIC TOOL

- **Simple Example – But containing ALL the parts of the methodology**
- **1st example – EXCEL (pros and cons of the tool)**

1) Mission, Operational States, Requirements and Capabilities

Mission composed of the following operational states' requirements:

Capability	A. Handling	Suppling	Towing	Total
Cargo Deck Area [m2]	1000	300	100	1400
Bollard Pull [MT]	50	10	150	210
Cargo Volume [m3]	300	4000	200	4500

2) Linking Capabilities Requirements to Vessel Parameters

Max. Capability Req.	Total Value Req	Min. Cap. Value	
Cargo Deck Area [m2]	1400	3500	LB [m2]
Bollard Pull [MT]	210	21460	Powering [kW]
Cargo Volume [m3]	4500	11250	LBD [m3]

3) Defining Main Parameters

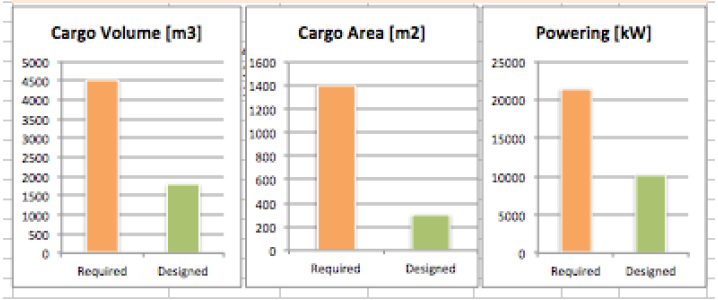
Parameters	Value	Range
L	55.00	
B/L	0.25	
B	13.75	
D/B	0.43	
D	5.94	
T/D	0.68	
T	4.02	
Cb	0.79	
Power	10189.19	
Price / GT (kNOK/GT)	70.00	

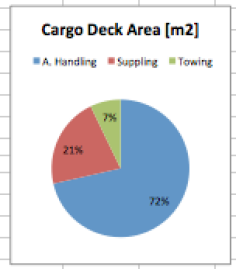
4) Criterias

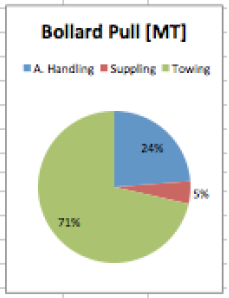
Capabilities	Value	Criteria Met (y/n)
LBD [m3]	4492	No
LB [m2]	756	No
Power [kW]	10189	No

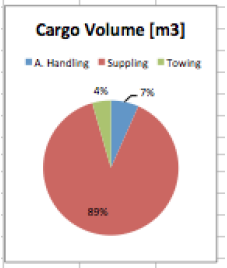
Output - Design Description

Main Characteristics		
Length	55.0	m
Breadth	13.8	m
Depth	5.9	m
Draft	4.0	m
GT	1417	
Cb	0.787	
Displacement	2395	ton
Attributes		
Cargo Volume	1797	m3
Cargo Area	303	m2
Installed Power	10189	kW
Price	99	MNOK









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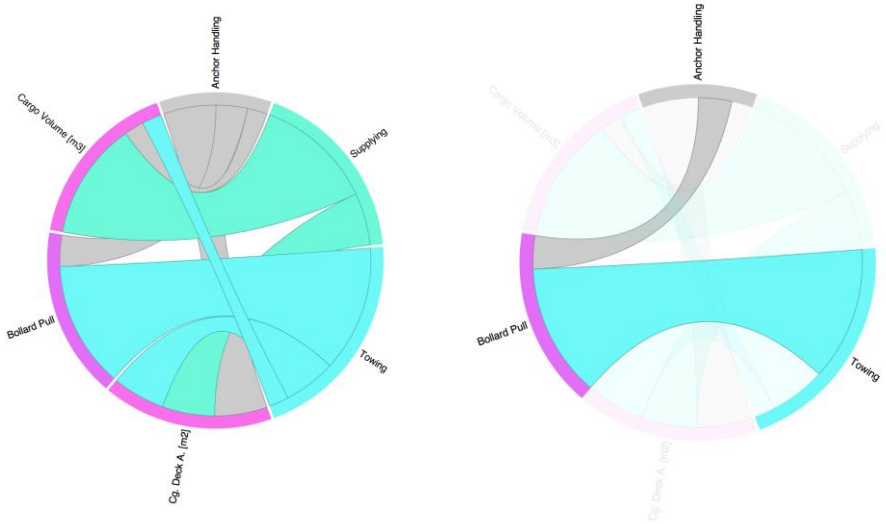
SIMPLE PARAMETRIC TOOL

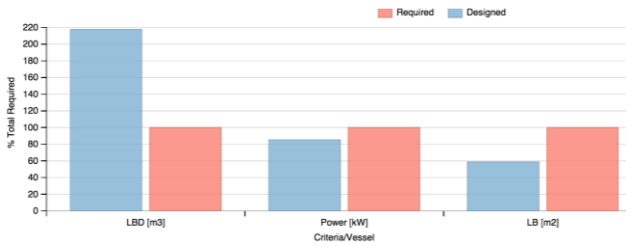
- **HTML + JavaScript**

Capability	A. Handling	Supplying	Towing	Total
Cargo deck area [m^2]	500	500	500	1500
Bollard pull [MT]	50	0	200	250
Cargo volume [m^3]	500	3000	500	4000

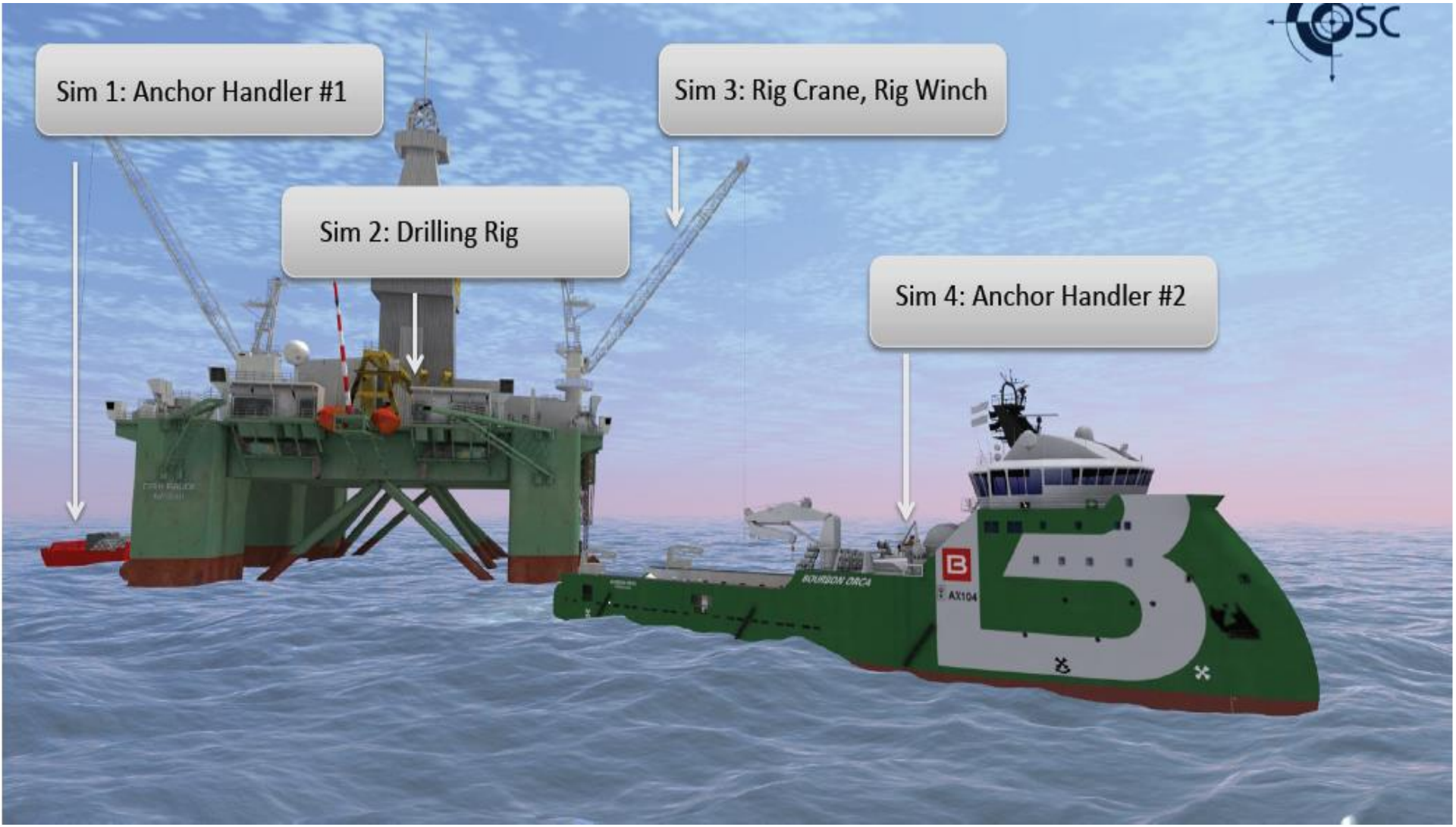
The value of the table connects mission requirements with vessel capabilities.By changing any of the values, the total required capability changes, modifying the criteria and the requirement dependency wheel below.

Parameters	Value	Range
Length [m]	100	
Breadth/Length	0.22	
Breadth [m]	22	
Depth/Breadth	0.45	
Depth [m]	9.9	
Draft/Depth	0.7	
$Draft_{Design}$ [m]	6.9	
C_B	0.75	
Powering [kW]	20689	
Price / GT [kNOK/GT]	50	

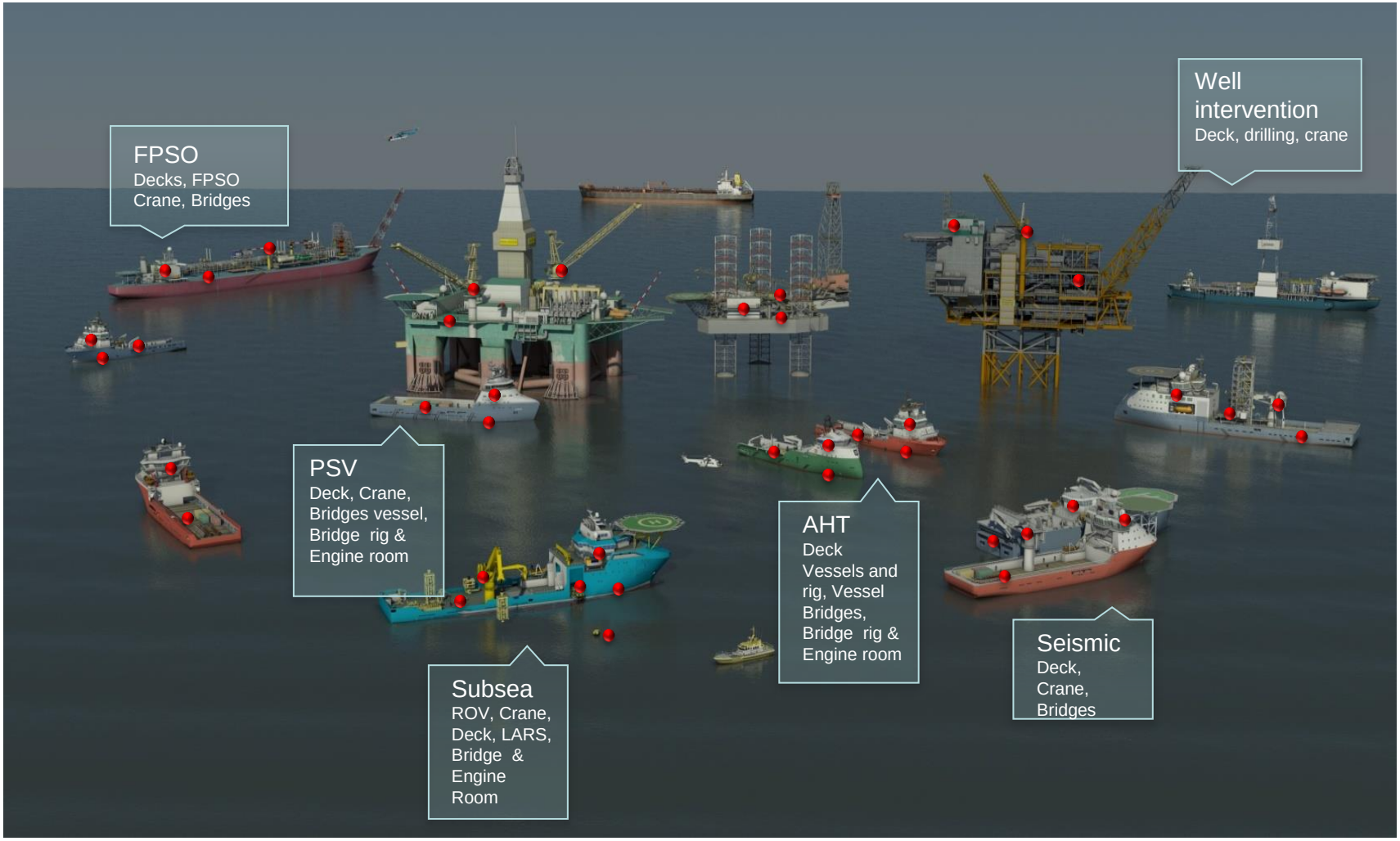




Integrated operations - Ship – Rig - Crane



The virtual continental shelf

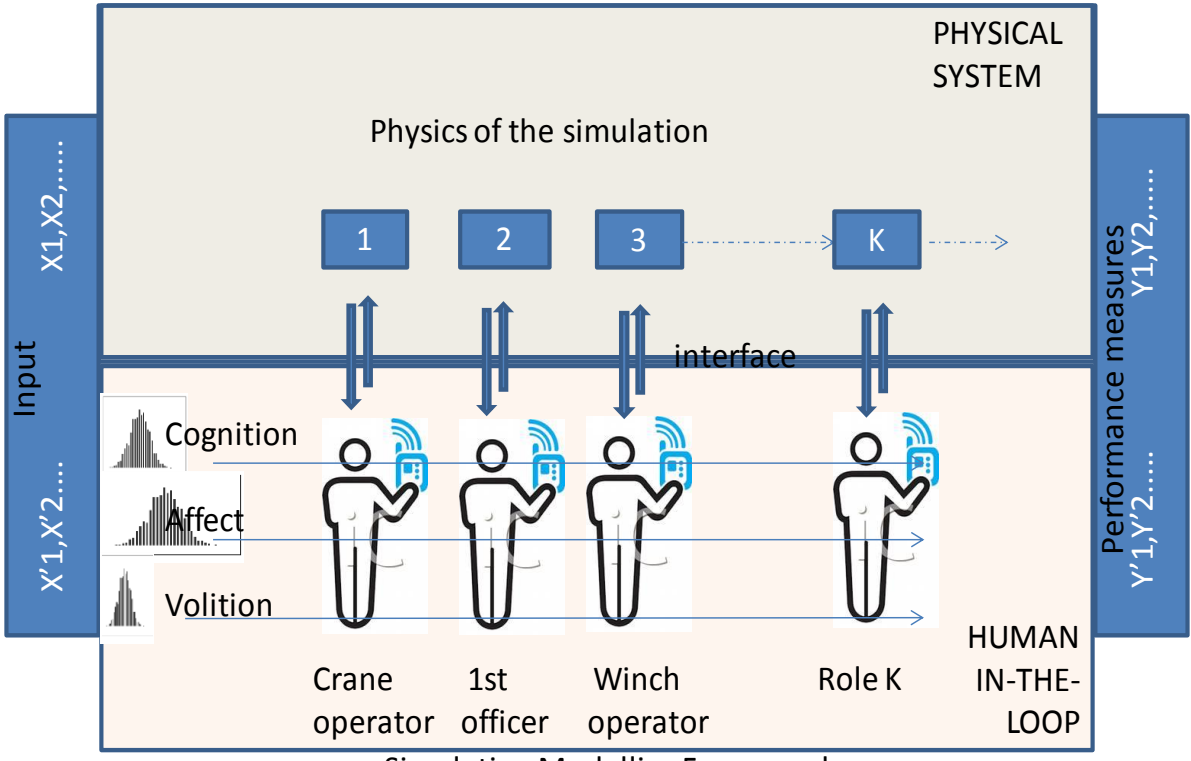


Virtual prototyping of operations

(ship, machinery, equipment and crew)

Human Factors

- ***UTILISATION OF INTEGRATED SIMULATOR FACILITIES FOR SAFETY RISK AND PERFORMANCE ASSESSMENT OF DEMANDING MARINE OPERATIONS***



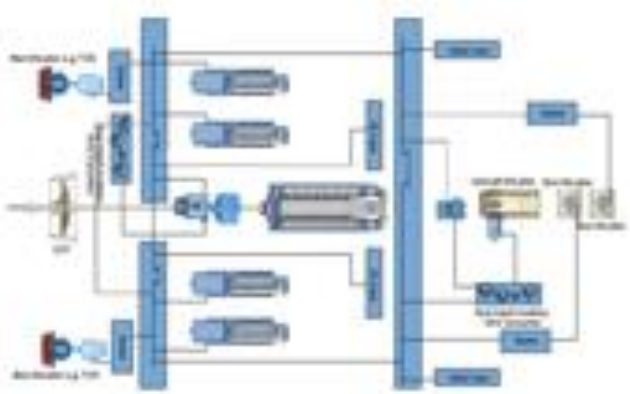
Simulation Modelling Framework

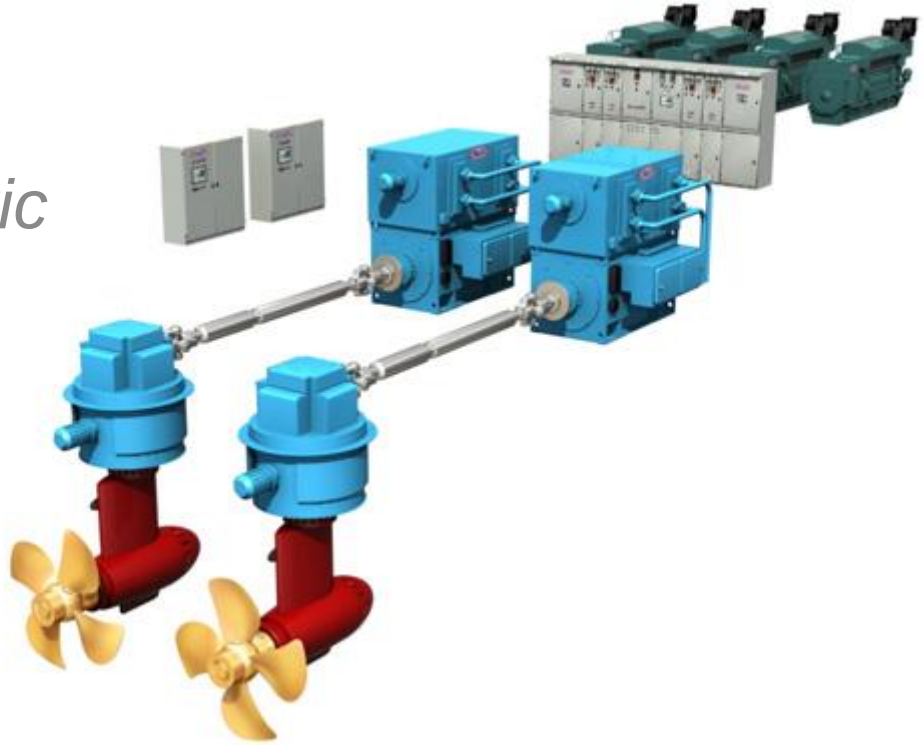
Mechatronics

- *A Flexible and Common Control Architecture for Marine Cranes and Robotic Arms*
- *A Novel Integrated Anti-sway System for Rolls-Royce Marine Shipboard Cranes*
- *A Novel Climbing Robotic System for Ship Anti-fouling, Cleaning and Inspection*

Machinery and Propulsion

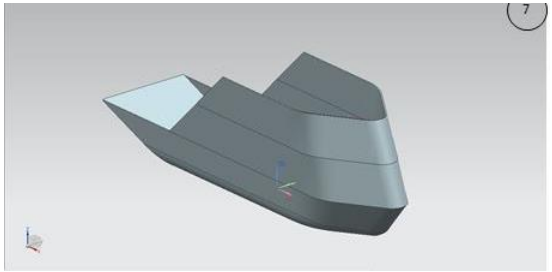
- *Integrated Machinery Systems*
- *Chief engineer*
- *LNG and other fuels*
- *Propulsion for the arctic*

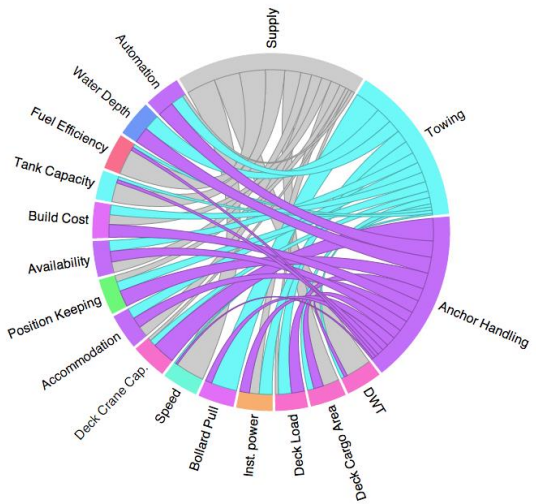




OPPORTUNITIES

- **Inserted in a research/industrial project (HIALS/ULSTEIN)**
- **Learn something on YOUR interest among OUR needs:**
  - Complex Data Handling & Visualization
  - WebGL and D3
  - Javascript / Web Solutions
  - Ship Design Methods
  - Disciplines integration in Conceptual Phase
  - Decision making in early phase (economical/operational/technical issues)
  - 3D Cad/Modeling/Printer
  - Structural & other analysis
  - Other groups: machinery, robotic, operations
- **Idea for a Bachelor Thesis (TCC – trabalho de conclusão de curso)**
- **Credits exchange**
- **Starting with 1-2 months kick-off project**
- **Future opportunity to scholarship**





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