



Aalto University
School of Engineering

MEC-E1004 Principles of Naval Architecture

Mid term revision

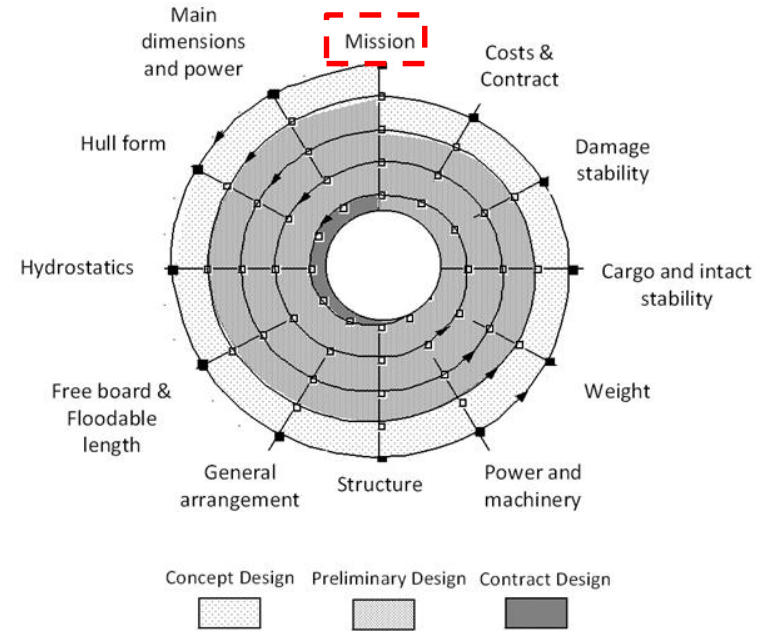
Exam rules of engagement

- Open book, you may use the web and any calculator you like
- You might have to use the xls sheets you have been using for your assignment
- You cannot text or call each other
- Your camera has to be open at all times
- Multiple choice and essay questions to be answered over 3hrs
- 5 questions corresponding to lectures 1 – 5 + one bonus question
- You have to submit online and on time !!!

Lecture 1 – The design context

After the lecture, you will be able to:

- *List factors that need to be considered when defining the design context for a ship design project*
- *Define the design context of your project ship (constraints and variables)*
- *Describe the different stages in design and the design spiral*



Design constraints

Regulatory constraints

- International Regulations
- Classification Society Rules
- National / Flag state requirements
- Local speed limits to limit swell, or to reduce the risk of collisions

Physical constraints

- Ship size and draft limits set by the route/ports, shipyard facilities, etc.

Technical constraints

- Technical limits of building material
- Limits of batteries
- Etc.



Design constraints

...perceived constraints must not prevent you from thinking outside the box

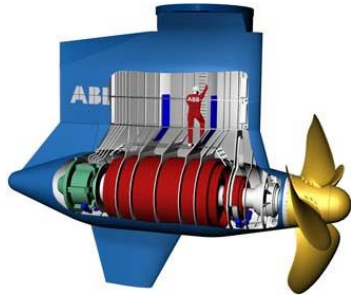
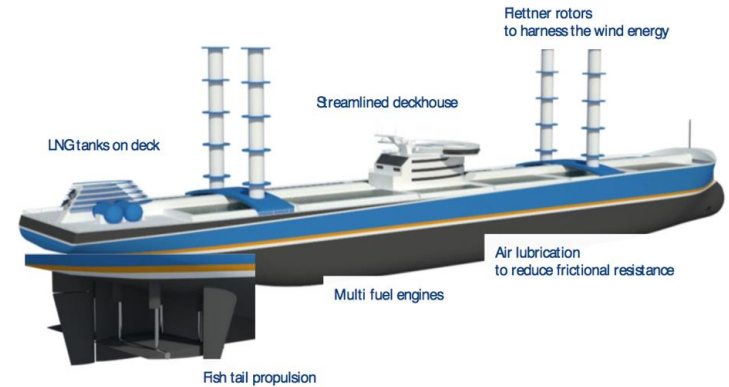


Image credit ABB

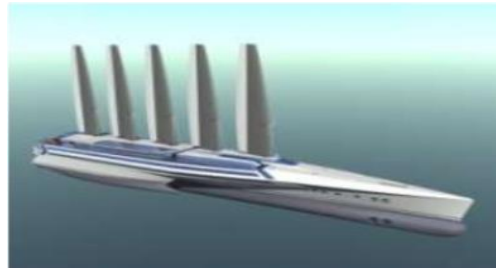
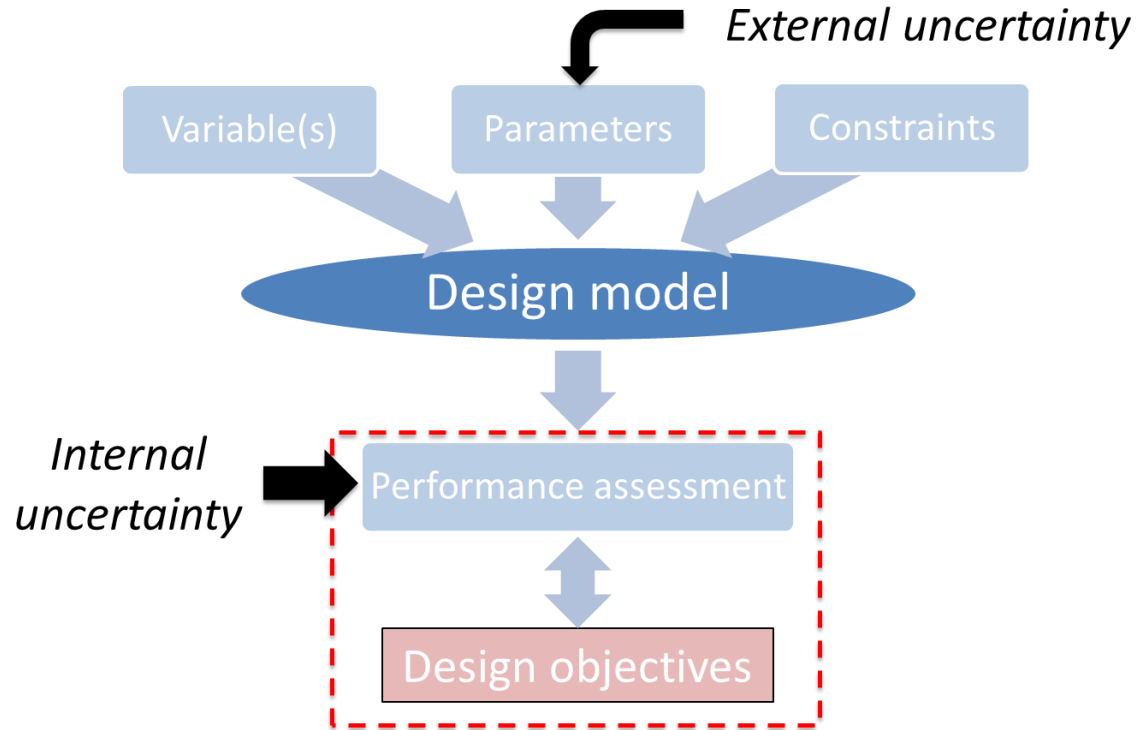


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Lecture 2 – Reference ship & data

- *List and explain the different principles of categorizing a ship*
- *Categorize the ship you design in your group project*
- *Explain the use of reference data*
- *What is a reference ship ?*
- *Terminology !!! (Speed, weight, tonnage, flags of convenience)*
- *Can you mention any ship category/type? For what design purpose(s) is it useful to divide ship into categories?*
- *Can you mention any drawbacks of using reference data/ships?*

Ships can be divided into categories/types in various ways

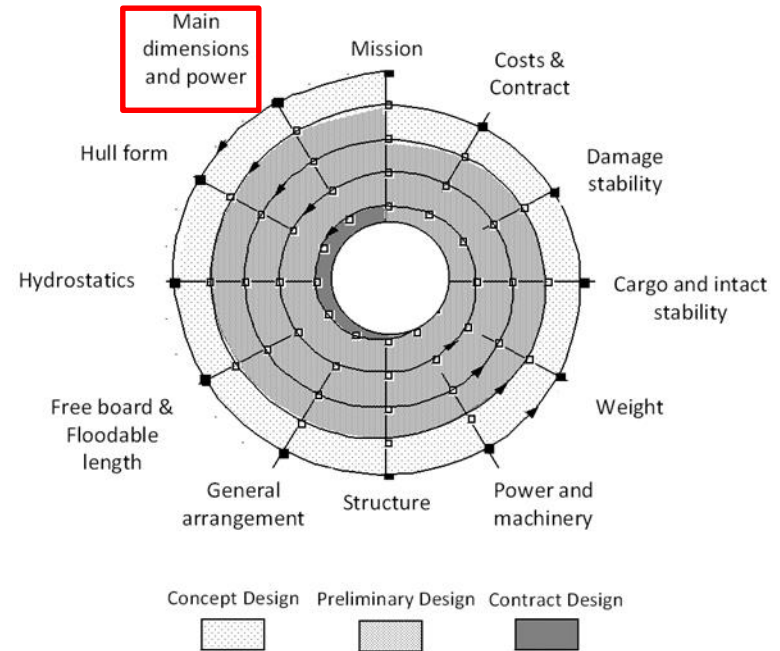
- *Ship mission*
 - Commercial, non-commercial ships, special-purpose ships,...
- *Applied technology*
 - Type of lift / structural solution / cargo handling / propulsion / energy source /...
- *Operational area*
 - Ocean going vessels, inland waterway vessels,...
- *Design limiting factors*
 - Weight/ space / size limited ships
- *Cargo handling system*
- *Number of hulls*
- ...

A ship's main features are largely determined by its category / type

- Categorization is useful e.g. for the selection of reference ships

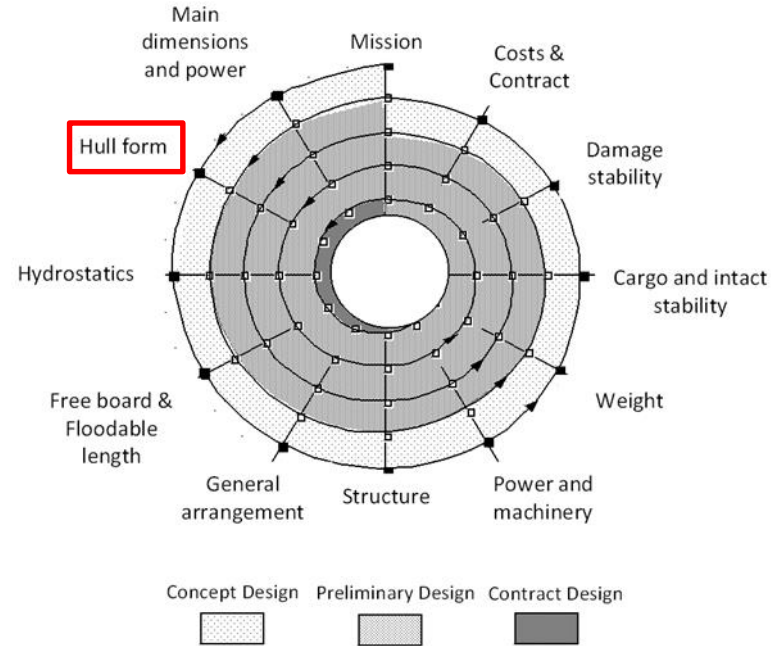
Lecture 3

- *List and define terminology related to a ship's main dimensions*
- *What are the approaches to determine a ship's main dimensions*
- *Apply Normand's number*
- *What it means if a ship's capacity is (a) limited by weight, (b) limited by volume.*
- *What is the difference between worldwide operation and restricted operation ?*

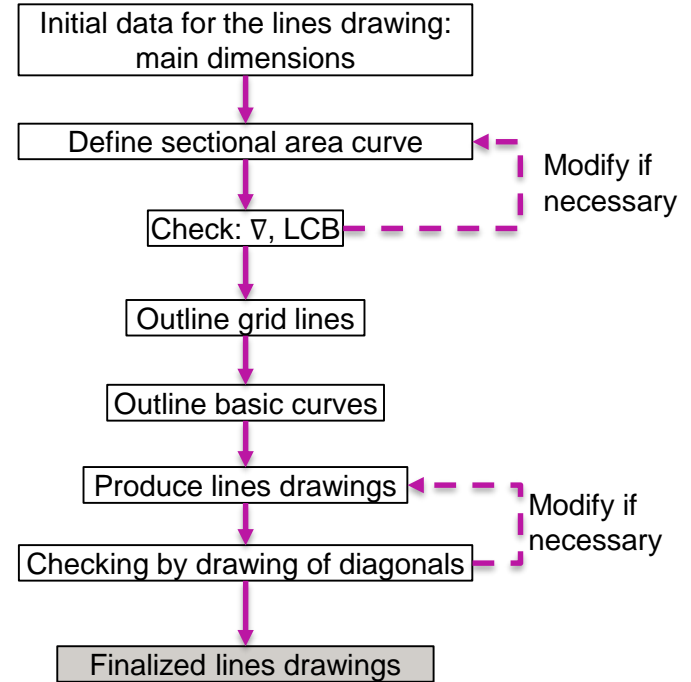
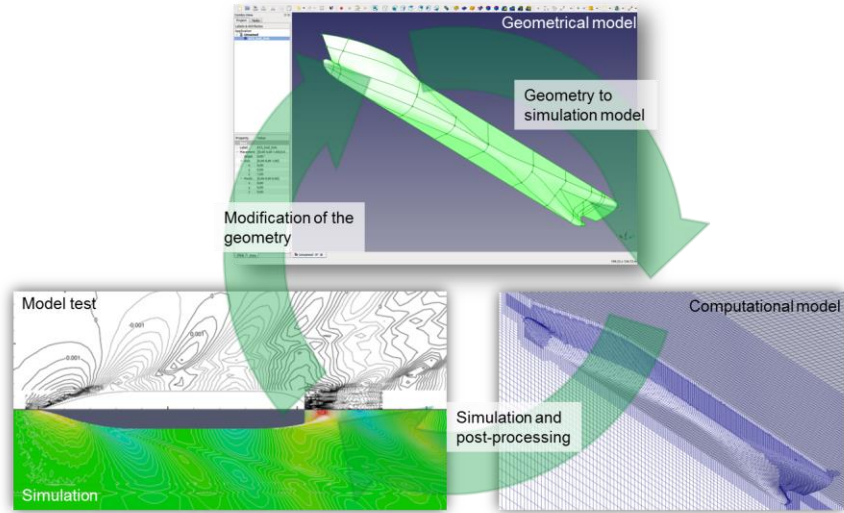


Lecture 4

- *Basic hull form related terminology*
- *The factors that need to be considered when determining the form of a ship's hull*
- *Relationships between form factors*
- *How you can apply the above knowledge to shape your ship's hull*



Traditional process vs simulation based design



Lecture 5

- *What is hydrostatics and why they are important in ship design?*
- *Numerical Integration methods !*
- *Explain and apply basic hydrostatic formulas and methods*
- *Apply Simpsons Rule 1*
- *What is strip theory and why is it used ?*
- *Define the Bonjean curves*

