Small Craft Construction

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Agenda

- The scenes behind of procurement or craft orders
  - Budget
  - Design work
  - Example
- The background for Small Craft Construction
- Small Craft Construction
  - Content of training course
  - Design Spiral
  - Work Break Down Structure
  - Weight Calculation
  - Goal

Niclas Kling

- Naval Architect, Royal Institute of Technology in Stockholm
- Background in Defense Material Administration in Sweden
- Owner of Poseidon Konsult AB who supports in:
  - Project Management
  - Design
  - Public Procurement
  - Visualizations


Scenes behind procurement

Very often start with requirement or procurement from a buyer

- Public Procurement
  - Budget work to set the cost
  - Setting up specific requirements in a document
- Private procurement
  - Scanned the market to set what is available for a certain price
  - Soft requirements, not well defined certain times

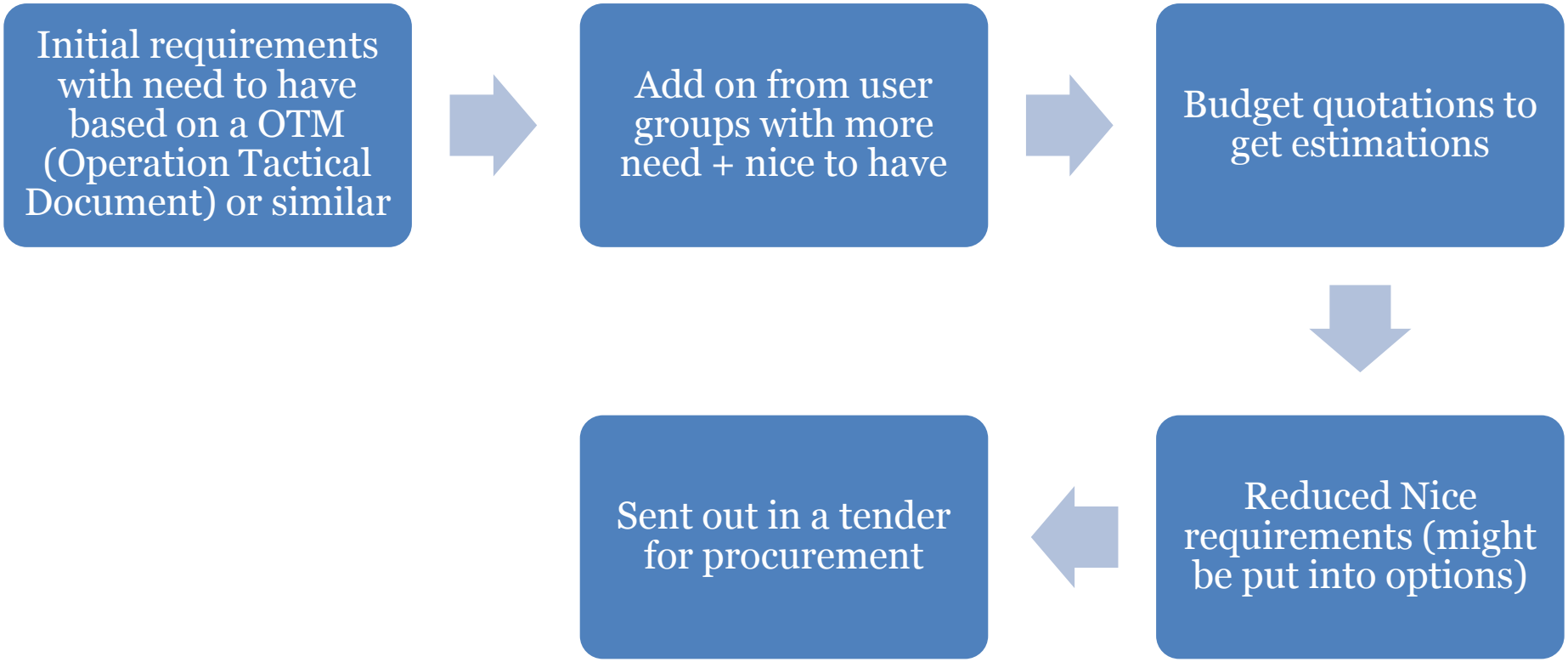
Public Procurement
Budget

Circumstances affecting the budget:

- Often long time in advance
- Limited time for budget work/several projects at the same time
- Budget based on price for platform (optimistic or even excluded project related costs)
- Assumption about similar platform as existing one. (no consideration to ”natural increase in standard” and development of regulations).

- Ends up with a fixed price

Public Procurement
Specification, Design work



Specification example

- The speed shall be at least 140 km/h, Should 240 km/h
- It shall be a space for a crew of 4 persons
- It shall have capability to run in icy conditions
- It shall have good maneuverability
- It shall have HVAC (Heat and Ventilation) unit
- It shall fulfill environmental standards and requirements

Normally in the end the major factor in evaluation is the price

Specification example

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Questions

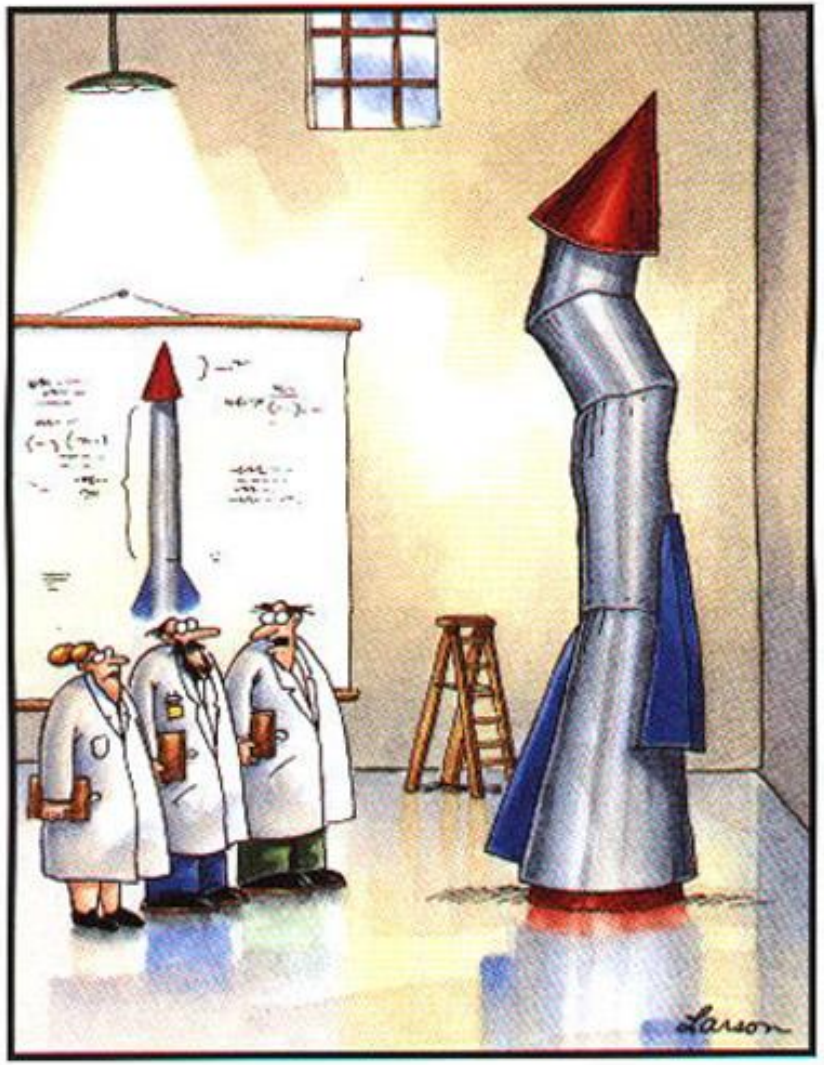
- How to we handle differences between buyer and seller?
- **How do we make a design towards a given specification?**
- **How do we prove that it is according to the specification?**
- **How do we structure the design in order to meet requirements?**

Small Craft Construction

- Not a single subject. Will incorporate all parts in ship design.
- Understand and work according to the Design Spiral
- Understand the equal level principle that:
  - Propulsion – Hull Lines
  - Hull lines – Weight /Displacement
  - Weight/Displacement – Propulsion
- Understand that there is no single truth i.e. several ways to fulfill same requirements
- Give the tools to be able to perform a general “good enough” design
- Give the structure for in work drawings, calculations and documents

Small Craft Construction

- Boat building in most of the cases are not rocket science but needs to be done pretty accurate
- The right tools and curiosity is an important factor for success



"It's time we face reality, my friends. ... We're not exactly rocket scientists."

Small Craft Construction

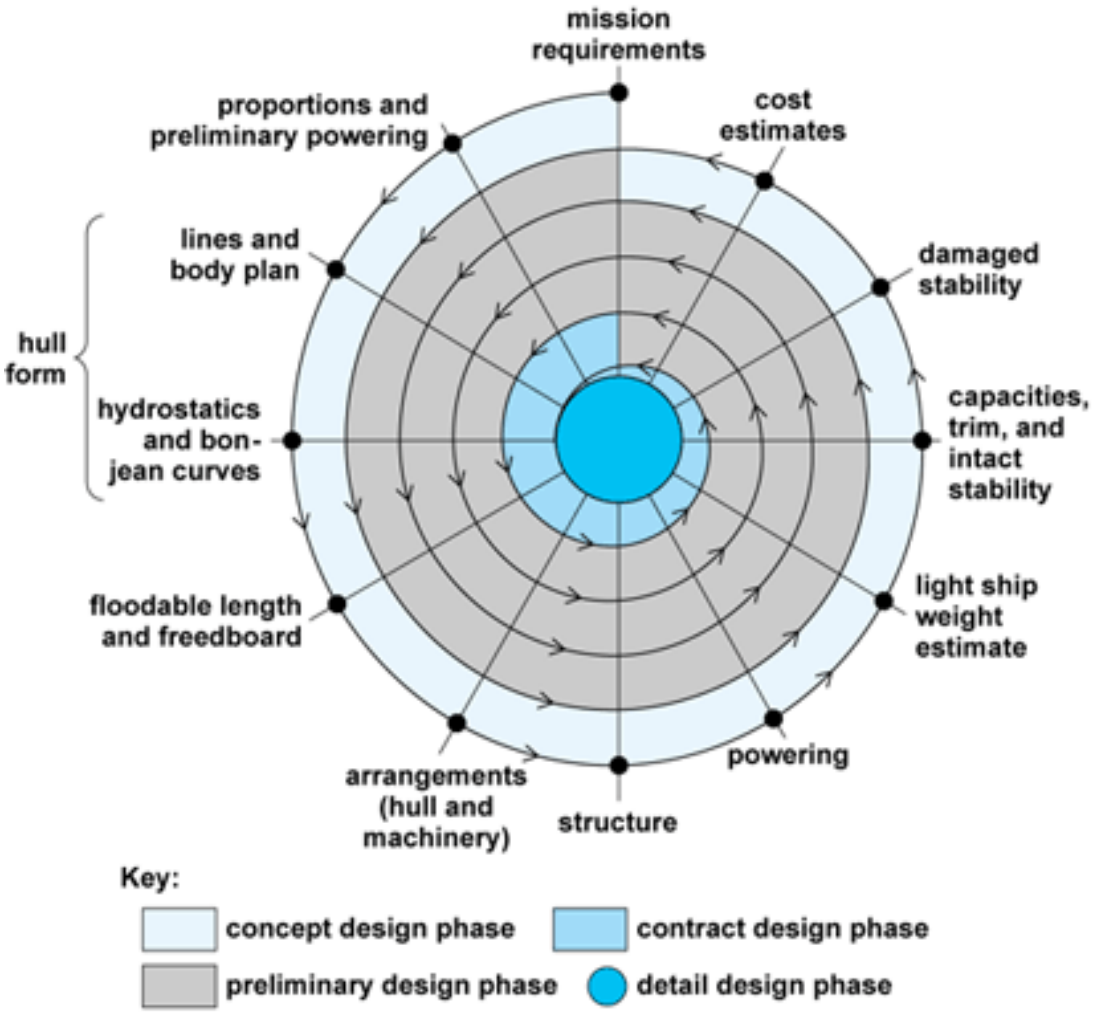
Seminaries

- Design Spiral
- General Arrangement
- WBS – Work Breakdown Structure
- Weight Calculation
- Hydrostatic Discussion
- Propulsion / Choose of main engines
- Rules and Regulations
- Verification and Validation of vessel
- Quality Handling
- Visit to Yard

Home work

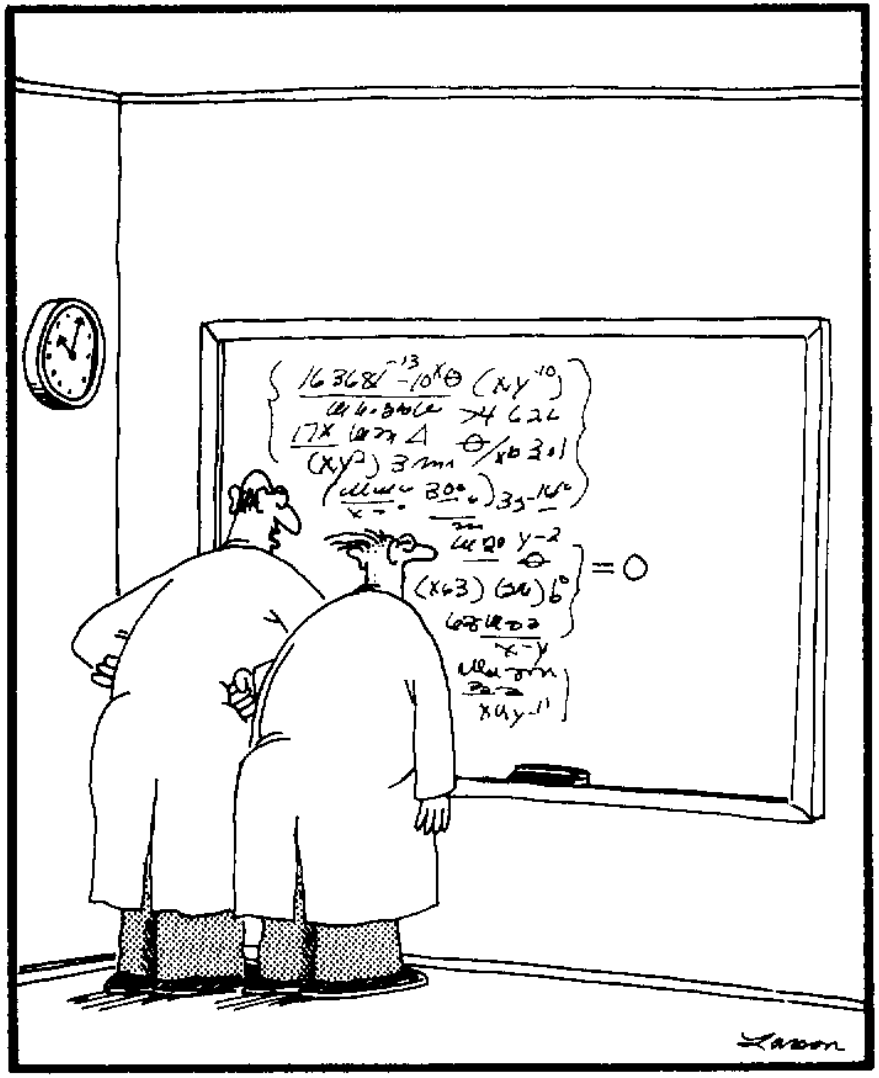
- Design a vessel acc to a technical specification
- Group of 3-4 people in each group
- Checkpoint each month
- Each group shall be prepared for a presentation of 10-15 min each months (3-4 groups will be picked each time)

Small Craft construction Design Spiral



Small Craft construction Design Spiral

- There are no truth in Design i.e. requirements can be fulfilled in many different ways.
- The Design is complex.
- Design is not static i.e. every change will effect the rest of the parameters (more or less).

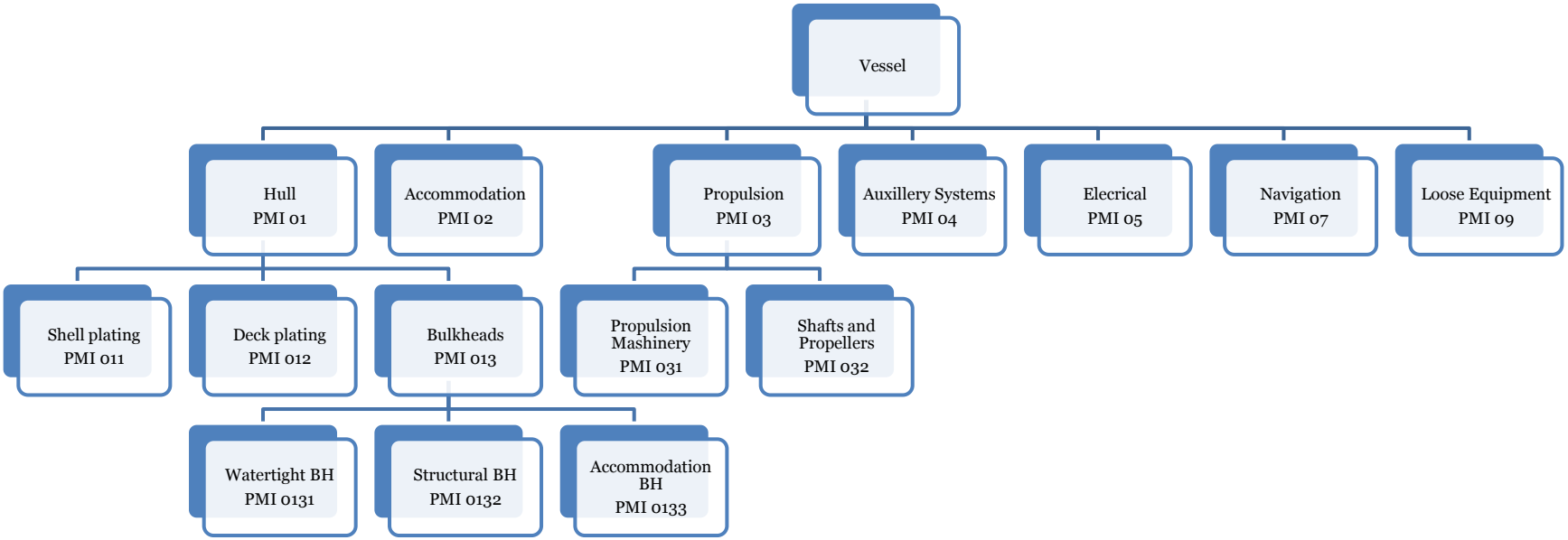


"No doubt about it, Ellington—we've mathematically expressed the purpose of the universe. Gad, how I love the thrill of scientific discovery!"

Small Craft construction
WBS, Work Breakdown Structure

- How to divide the vessel in breakdown structure
- Typical breakdown structures
- Where and how to use the structure
- How to handle documents according to the structure
- How to build projects according to the structure

Small craft Design
Typical WBS, Vessel



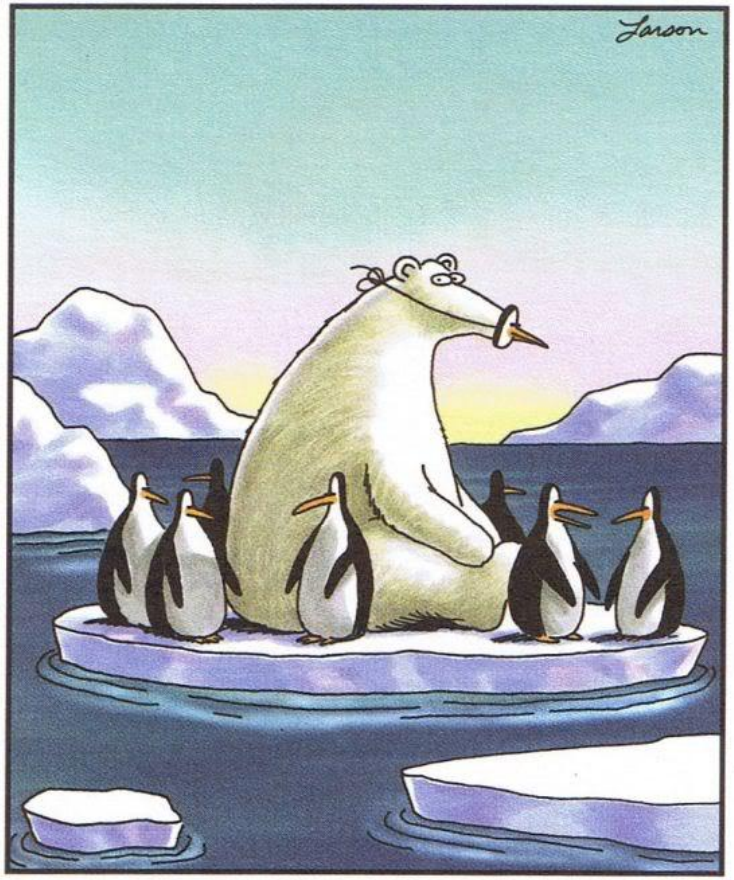
Small Craft Construction WBS, in Structure

1	**Hull**	
01000	General	General
01010		Hull
01020		Materials
01030		Fabrication and machining
01040		Testing
01050		
01060		Documentation
01070		Operation
01080		Maintenance
01090		
01100	Shell plating with frames and girders	General
01110		Shell plating
01120		Transversal stiffeners and web frames
01130		Longitudinal stiffeners and girders
01140		Stems, stern tubes, struts, bulbs, thruster tunnels
01150		Bilge keel, scoops, sea inlets
01160		Bulwark, fenders
01170		
01180		
01190		
01200	Deck with transverses and pillars	General
01210		Forecastle deck
01220		Main deck
01230		Tween deck
01240		Platform deck
01250		Inner bottom
01260		
01270		
01280		
01290		
01300	Bulkheads (Hull)	General
01310		Watertight bulkheads
01320		Structural bulkheads
01330		Accommodation bulkheads
01340		
01350		
01360		
01370		
01380		
01390		

4	**Auxiliary machinery systems**	
04000	General	General
04010		Materials
04020		Fabrication and machining
04030		Testing
04040		
04050		
04060		Documentation
04070		Operation
04080		Maintenance
04090		Miscellaneous equipment
04100	Heating, ventilation and air conditioning installations	General
04110		Heating installations
04120		Ventilation installations
04130		Air conditioning installations
04140		Dehumidification installations
04150		Air cleaning installations
04160		Oxygen installations
04170		Breathing air installations
04180		HVAC cooling water installations
04190		Miscellaneous equipment
04200	Fire extinguishing and sprinkler installations	General
04210		Water fire-extinguishing installations
04220		Foam fire-extinguishing installations
04230		Gas fire-extinguishing installations
04240		Powder fire-extinguishing installations
04250		Sprinkler installations
04260		
04270		
04280		
04290		Miscellaneous equipment
04300	Bilge pumping installations	General
04310		Bilge pumping installations
04320		Daily bilge installations
04330		
04340		
04350		Ballast pumping installations
04360		
04370		
04380		
04390		Miscellaneous equipment

Small Craft construction
Weight Calculation

- How to calculate weights
- How to set up the Weight calculation
- How to handle margins
- How to handle future growth
- Example of weight calculations
- Making a weight Calculation in the Design home work



"And now Edgar's gone. …
Something's going on around here."

Small Craft construction
Weight Calculation

Actual weight calculation

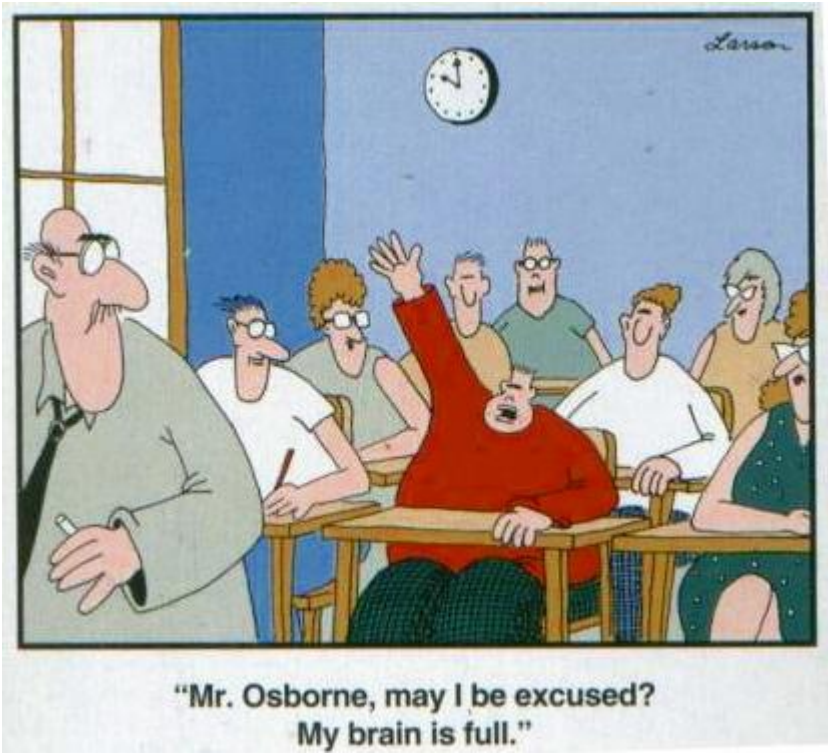
Name	Calculated	Margin	Margin Weight	End Weight	LCG [m] fr. AP	SCG [m] Port CL	HCG [m] o BL	LCG mom [kg*m]	SCG mom [kg*m]	HCG mom [kg*m]
	(kg)	(%)	(kg)	(kg)						
KMI 01 Hull	381966,83	5	19098,34	**401065,17**	23,948	-0,016	3,993	9604652	-6404	1601430
KMI 02 Hull equipment and accomodation	128793,19	10	12879,32	**141672,51**	21,418	-0,126	6,120	3034331	-17816	867056
KMI 03 Propulsion machinery	58150	8	4652,00	**62802,00**	13,622	0,561	3,128	855467	35219	196443
KMI 04 Auxiliary machinery systems	35986	10	3598,60	**39584,60**	24,591	0,630	3,363	973436	24937	133119
KMI 05 Electrical installations	46021	8	3681,68	**49702,68**	18,421	-0,338	3,934	915593	-16794	195537
KMI 06 Weapon and ammunition installations	343	10	34,30	**377,30**	37,776	-0,152	4,510	14253	-57	1702
KMI 07 Navigation installations and computers	3517,75	12	422,13	**3939,88**	19,297	-0,075	9,308	76028	-297	36672
KMI 08 Communications installations	1037,2	10	103,72	**1140,92**	11,848	0,244	10,740	13518	278	12253
KMI 09 Other equipment	8771	10	877,10	**9648,10**	18,884	-0,472	6,569	182190	-4555	63380
KMI 09-2 Consumables diesel/Water/Urea	95500	0	0,00	**95500,00**	30,520	-0,070	3,030	2914660	-6685	289365
KMI 10 Oil recovery equipment	15830	12	1899,60	**17729,60**	30,746	-0,256	3,745	545108	-4536	66390
KMI 11 Diving and protective equipment	3619	10	361,90	**3980,90**	35,352	-0,696	4,890	140732	-2769	19468
KMI 13 Computers	1032,35	10	103,24	**1135,59**	12,235	-0,266	8,359	13894	-303	9492
Total	**780567,32**		**47711,93**	**828279,25**	**23,282**	**0,0003**	**4,216**	19283863	219	3492309

Small Craft Construction
Goal

- An understanding in ship design and also what tools to be used
- The outcome is:
  - Outline specification of the vessel
  - General Arrangement
  - Power predictions
  - Weight Calculation
  - Hull structure calculations
  - A general hull with line drawings

Questions?

"Yes … I believe there's a question there in the back."



"Mr. Osborne, may I be excused? My brain is full."