

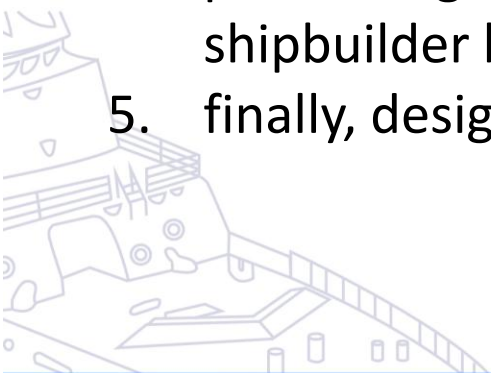
A FRIGATE IN TEN YEARS – CHALLENGES AND OPPORTUNITIES

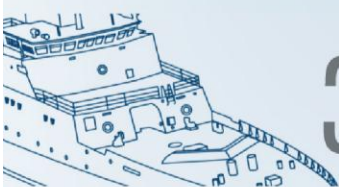
Thomas Lamb



These approaches range as follows:

1. purchasing the complete new ship(s) from an experienced foreign naval shipbuilder,
2. purchasing the complete ship(s) based on an existing design from experienced foreign naval shipbuilder,
3. contracting with an experienced foreign naval shipbuilder to either prepare a new design or to select an existing design and to for them to build the first ship with the acquiring country building all remaining ships with technical assistance from the selected shipbuilder,
4. purchasing an existing design and technical assistance from a foreign shipbuilder but building all the ships in the acquiring country, and
5. finally, designing from scratch and building in the acquiring country.

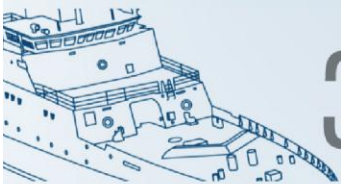




Projected Military Ship Production, 2003–2012

Source RAND Report

	Export			Domestic Use		
	Number	Value (\$ millions)	LSW Tons	Number	Value (\$ millions)	LSW Tons
Germany	56	10,713	96,040	21	5,799	44,144
France	25	6,405	47,570	17	13,015	146,302
Russia	20	5,000	36,025	0	0	0
Spain	6	2,035	31,343	7	2,195	26,735
The Netherlands	9	1,780	8,500	4	1,585	24,759
United Kingdom	2	650	3,000	22	17,340	235,140
United States	2	53	174	66	56,172	776,446
South Korea	1	30	1,500	7	4,905	24,500
Japan	0	0	0	16	11,090	79,125
Italy	0	0	0	18	5,289	75,170
China	0	0	0	8	3,230	26,875
Australia	0	0	0	1	650	3,051
Sweden	0	0	0	3	375	1,431
Taiwan	0	0	0	1	320	2,769
Israel	0	0	0	11	55	550
Total	121	26,666	224,152	202	122,020	1,466,997
Not Reported	23 vessels valued at \$13,225 million and displacing 86,291 tons LSW.					



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Comparison of Military and Commercial Ship Cost

Source RAND Report

		Average Cost per LSW Ton (\$)
Military		
SSK	Type 212A (German Navy)	346,667
	Type 214 (export)	323,529
	Scorpene (export)	141,379
	Type 209-1400 (export)	103,164
SSN	Virginia class	250,000
	Astute	184,615
Aircraft carriers	WASP LHD	69,767
	CVN 77	67,004
Destroyers	DDG 51 class	167,644
	Project 093 (Chinese)	153,846
	Type 45	141,343
	Project Horizon	122,000
Frigates and corvettes	Multimission Frigate (French Navy)	70,833
	MEKO ANZAK	100,156
	La Fayette (export)	122,807
Patrol	UK OPV for Brunei	216,667
	MEKO A-100 (export)	17,625
Commercial		
World Market	Cruise ship	10,000
	Chemical product tanker (small)	2,838
	Container ship	3,100
	Oil product carrier	1,630
	Bulk carrier (small)	1,259
	Bulk carrier (medium)	884
	Crude oil tanker (medium)	2,203
United States	Jones Act crude oil tanker (medium)	6,925



FREM Frigate



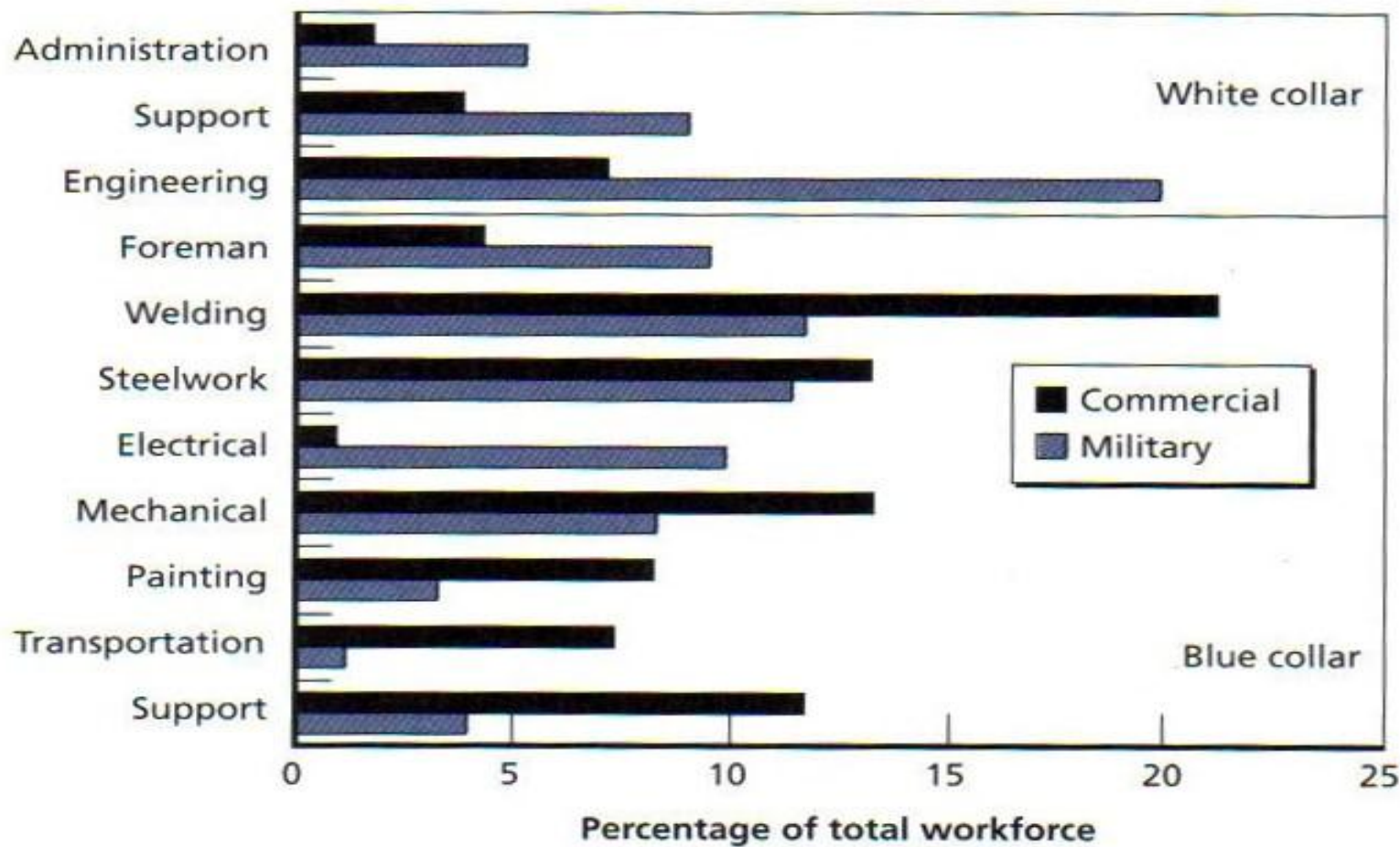


British TYPE 26 Frigate



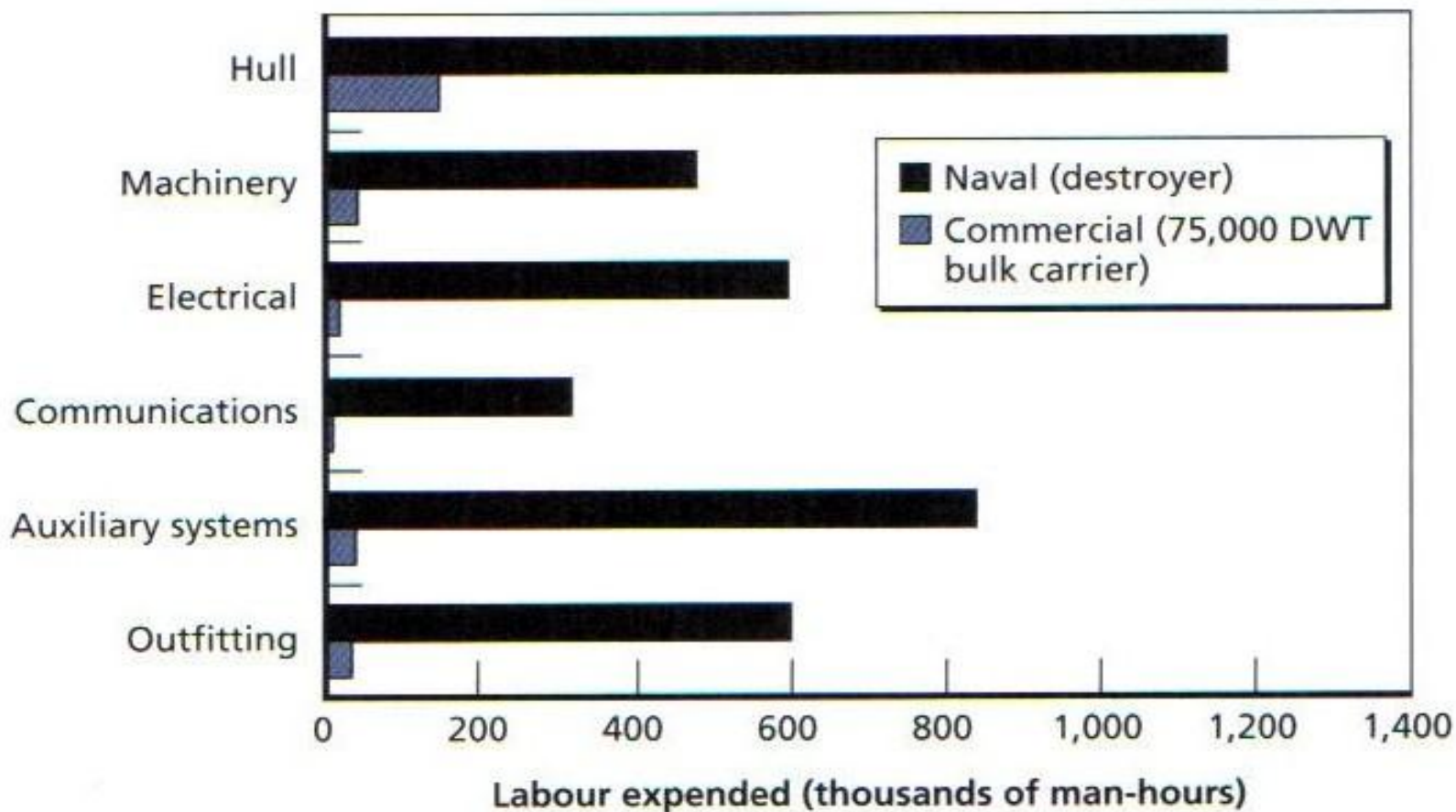


Distribution of Skills Available Differs Between Commercial and Military Construction Yards





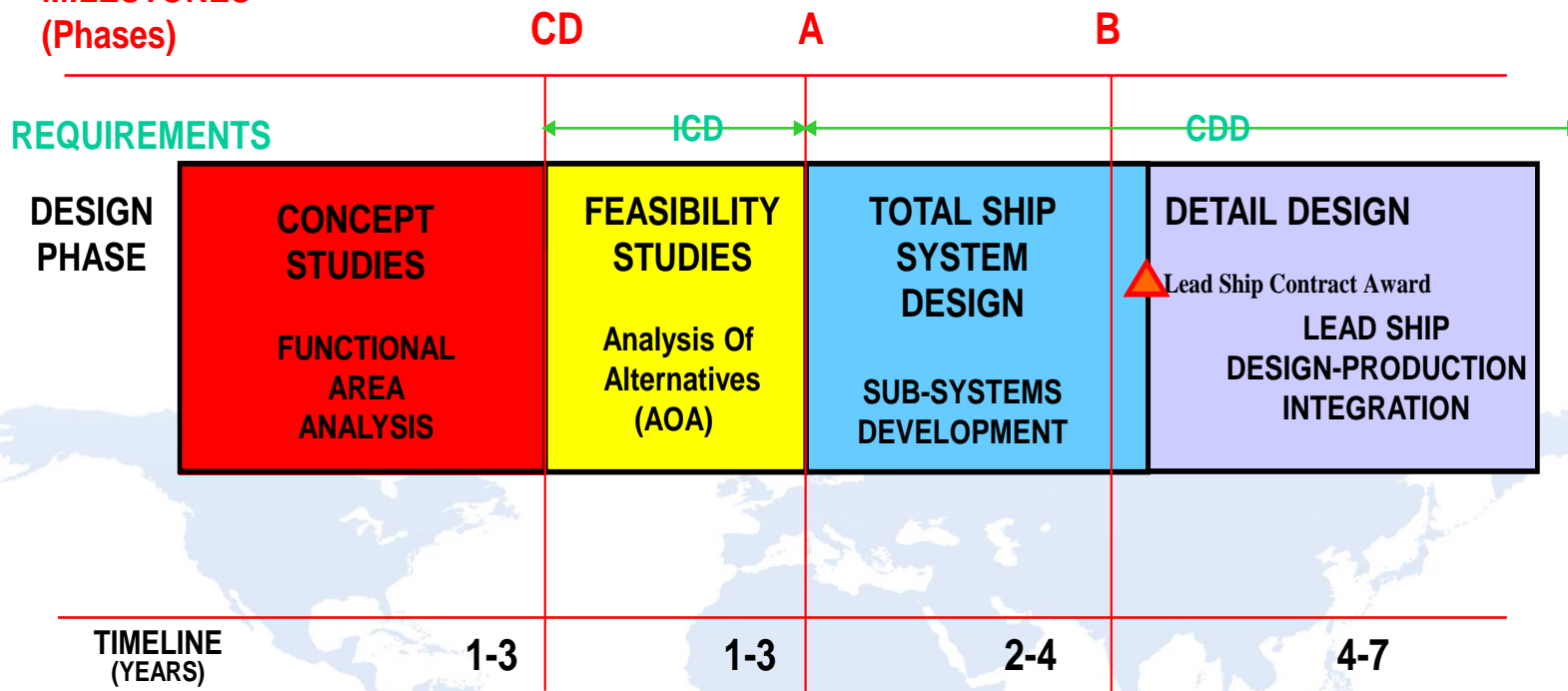
Military Ship Construction Requires a Much Larger Workforce





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MILESTONES (Phases)



CD - CONCEPT DECISION
 ICD - INITIAL CAPABILITIES DOCUMENT
 CDD - CAPABILITIES DEVELOPMENT DOCUMENT



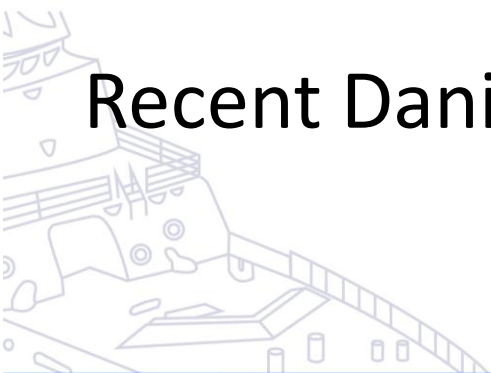
COMPARISON OF SCHEDULES

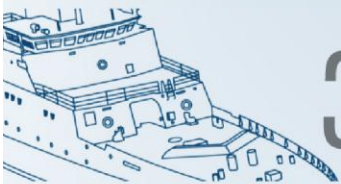
Typical schedule for First of Class Naval Combatant is 10 to 16 years.

For a cruise ship typical schedule is 3 to 4 years'

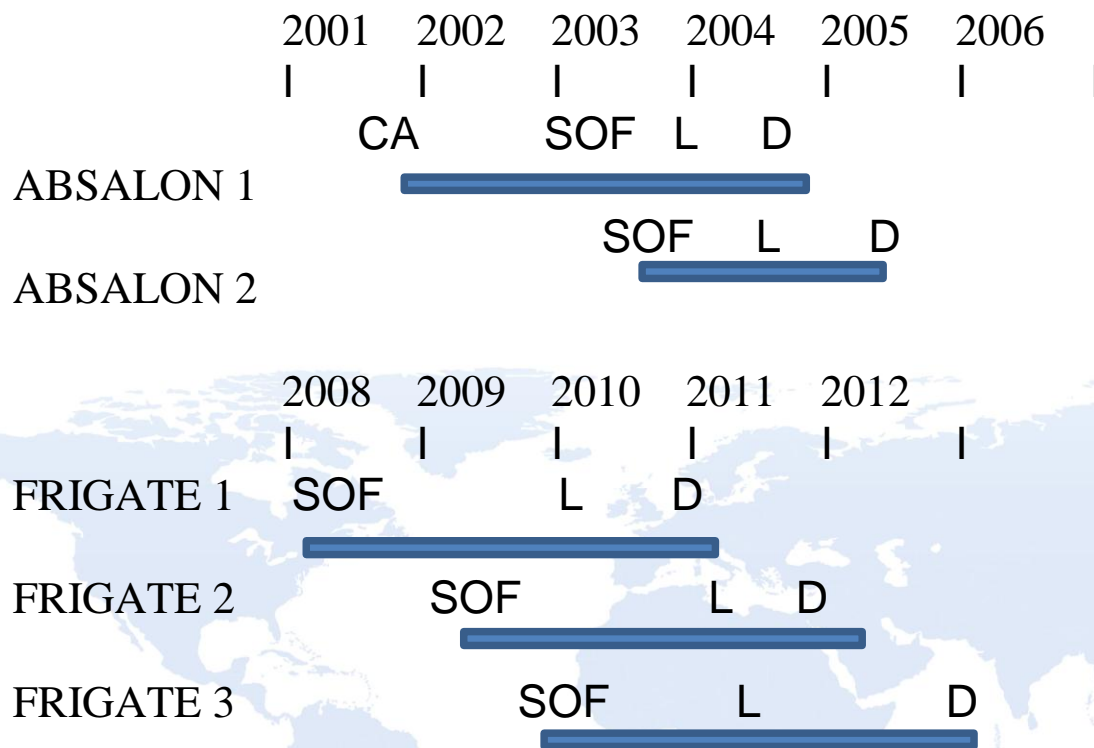
For a commercial ship (not Cruise Ship) typical schedule is 1 to 2 years.

Recent Danish Frigate Program broke the mold!



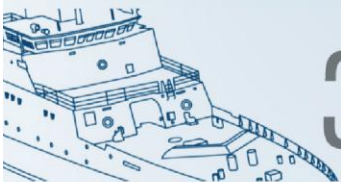


DANISH FRIGATE PROGRAM SCHEDULE

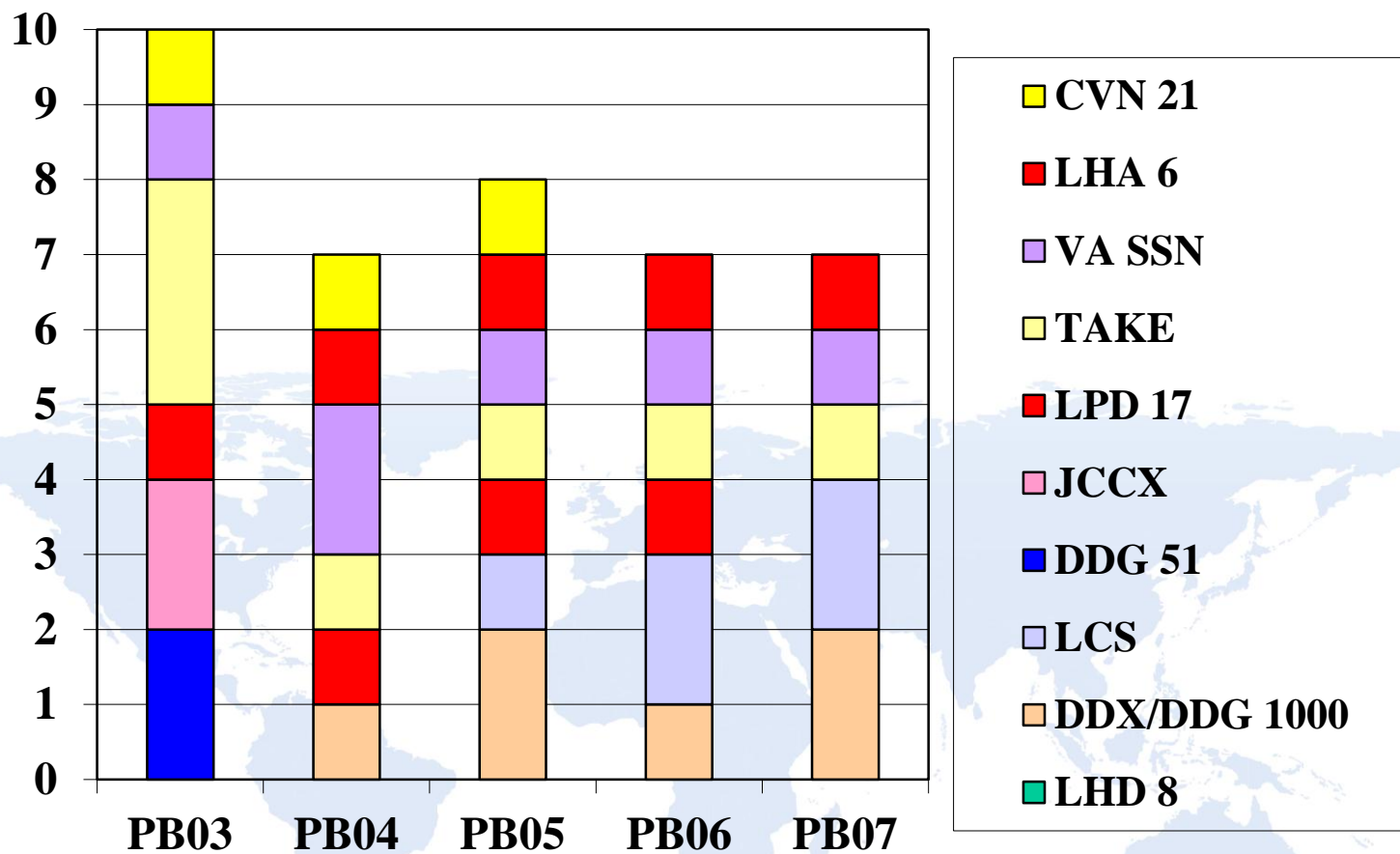


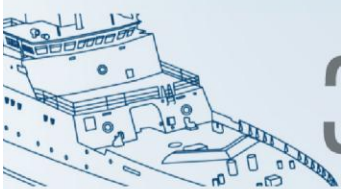
First ship contract Award to Start of Fabrication 14 months
Start of Fabrication to Delivery 20 months (<2 years)

Follow on Frigates construction time 3 years



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US LCS 2 Trimaran





ParaMarine Frigate Design





HOW DOES THIS AFFECT COLOMBIA

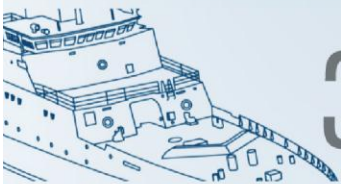
The presentation has deliberately been generic in that the contents apply to any country. How does it all affect Colombia?

Fortunately Colombia is NOT just entering shipbuilding. In COTECMAR it has a significant shipbuilding capability that has been built up over the past decade.

Throughout this time it has focused on having a strong design and development capability which has tackled more complex ships such as the OPVs and continually improved its knowledge in ship design and shipbuilding processes.

It also has universities that offer naval architecture education and is currently implementing advanced graduate studies.

This obviously reduces the challenges and thus risks discussed above, but there is still a level of challenges and many opportunities for the country in expanding the shipbuilding capability and all the related support that goes with this, such as university education and worker training.



SHIP ACQUISITION SOURCE APPROACH SUMMARY

APPROACH	DESCRIPTION	CHALLENGES	OPPORTUNITIES	RISK
1	Complete Purchase New Design	Normal new program for foreign shipbuilder	None for acquiring country not even technology transfer	Next Lowest
2	Complete Purchase Existing Design	Design may not meet requirements and thus need significant change	Same as 1 but fastest acquisition of ships	Lowest
3	Foreign Design and First Ship Build	How to develop workers with the required skills	Saving in total cost IF acquiring country's labor rate is significantly lower than experienced shipbuilder rate. Learning in foreign shipyard and time to buildup own work force	Medium
4	Foreign existing or new Design Self-Build	How to overcome lack of experienced and skilled workers	Saving in total cost IF acquiring country's labor rate is significantly lower than experienced shipbuilder rate. Long term development of shipbuilding capability	High
5	Self-Design Self-Build	Significant All challenges discussed	Saving in total cost IF acquiring country's labor rate is significantly lower than experienced shipbuilder rate. To join with other countries who need naval ship to share development cost and provide more resources. Long term development of shipbuilding capability	Highest



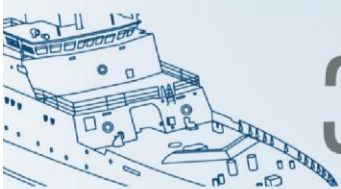
CONCLUSION

From the cost aspect, if the acquiring labor rate is significantly lower (say 1/3) than existing naval shipbuilders' labor rate then there is a potential of 45% saving in labor cost or 25% of total ship cost. This would NOT be achieved for the first or second ships but for the follow on ships. This is a significant reason for building the naval ship in the acquiring country.

The preparing of a new ship design and engineering by the acquiring country designers offers the greatest long term capability generating opportunity but it also is a high risk approach.

Approach #4 offers the best compromise in that it has the lowest design risk (even if extensive changes are made to arrangements and weapons) and it offers the best potential for improving the acquiring country's shipbuilding capability.

However, the introduction of politics will affect the final choice.

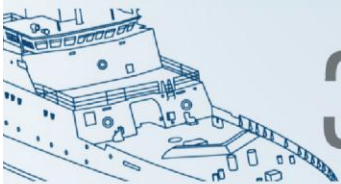


The final advice is:

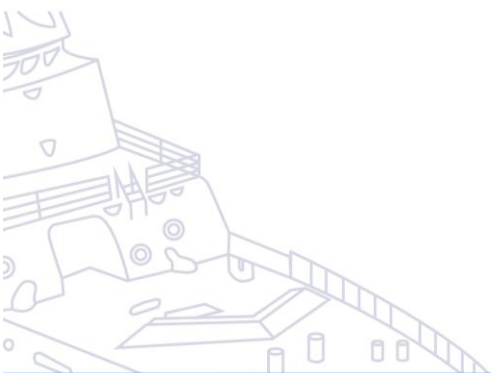
PLAN THE WORK, WORK THE PLAN

**Do not continuously change or
arbitrarily deviate from the plan.**

**Do not start construction until the
design is mature (> 80% Complete)**

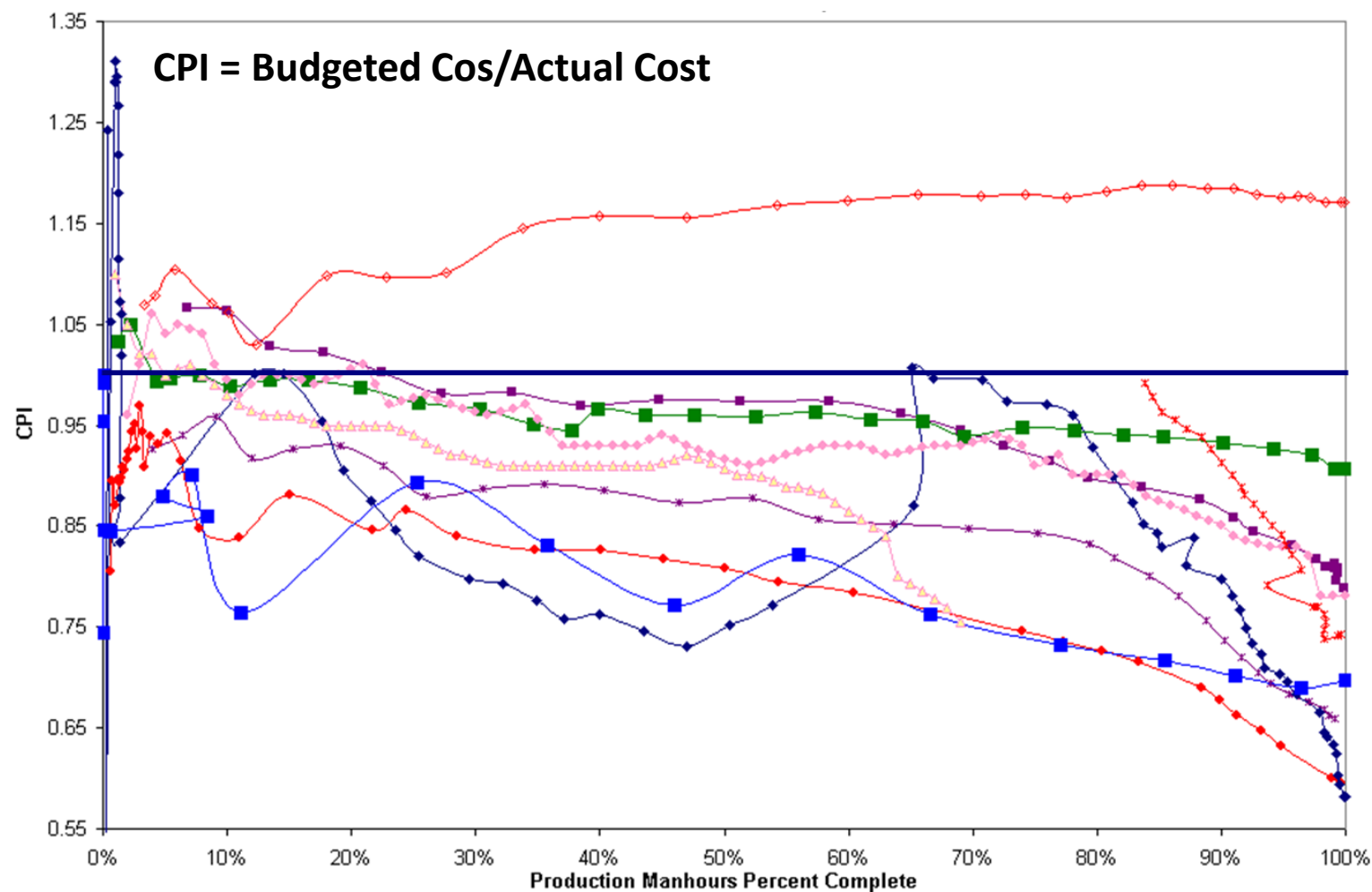


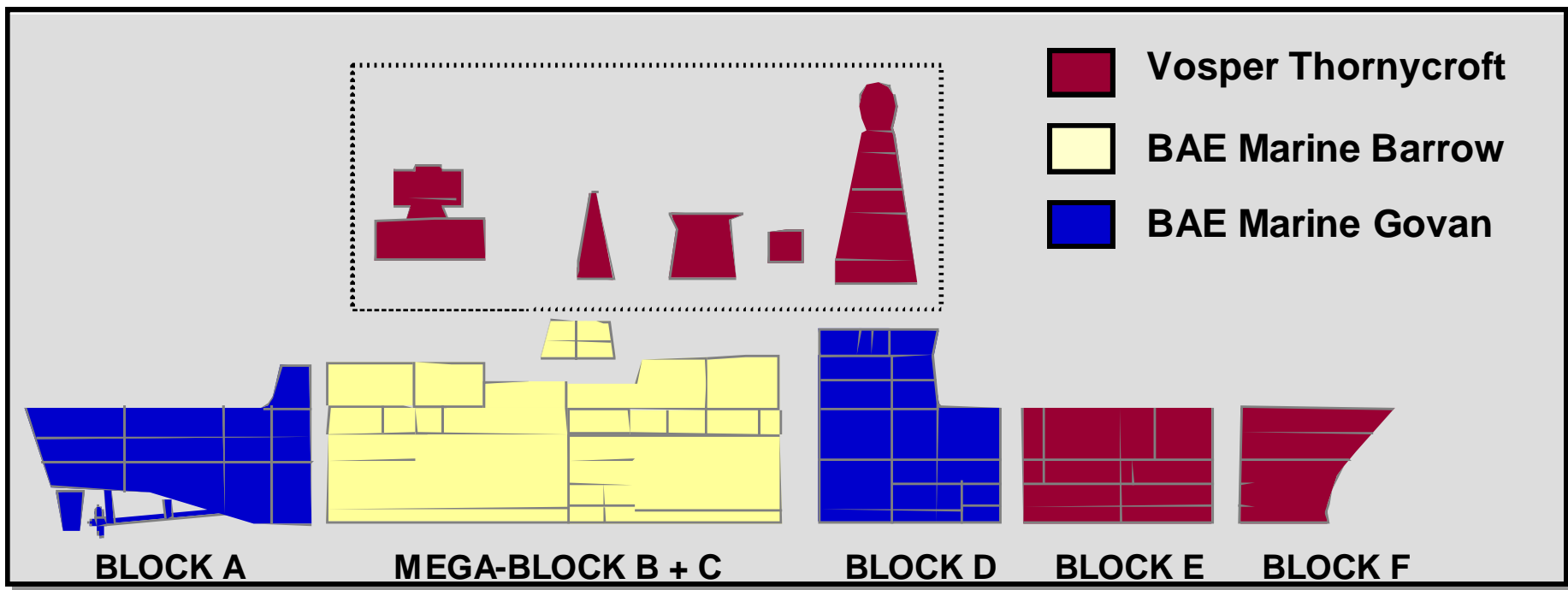
BACK UP SLIDES





Historical Lead Ship CPI Trends





UK MOD TYPE 45 SHIP GRAND BLOCK BREAKDOWN



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UK MOD TYPE 45 SHIP BOW GRAND BLOCK



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UK MOD TYPE 45 SHIP BOW GRAND BLOCK



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BOW SECTION UK TYPE 45 DESTROYER

3

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MID BODY UK TYPE 45 DESTROYER

3

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COMPLETED UK TYPE 45 DESTROYER

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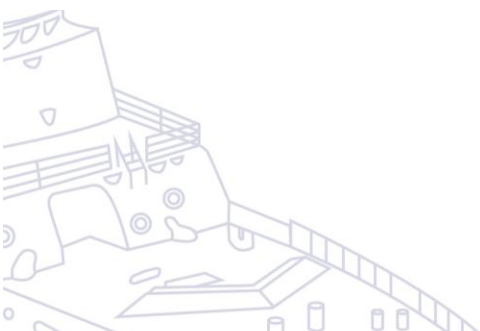
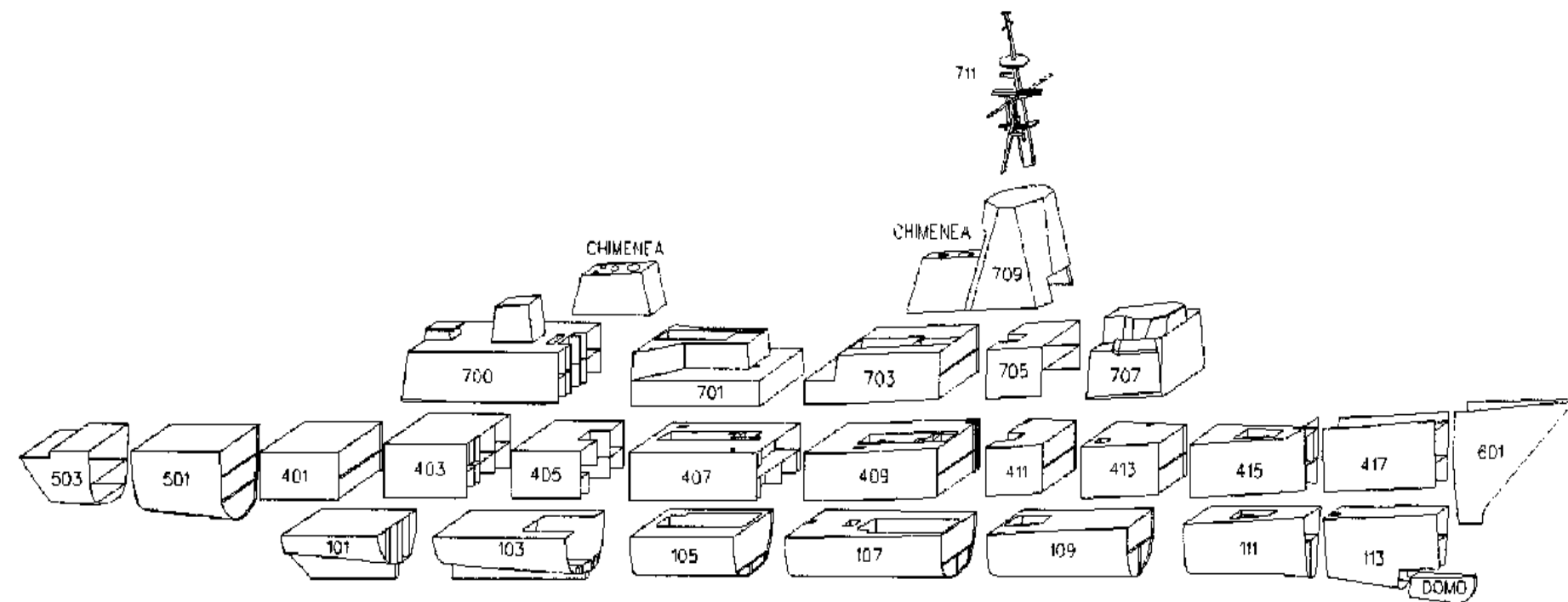
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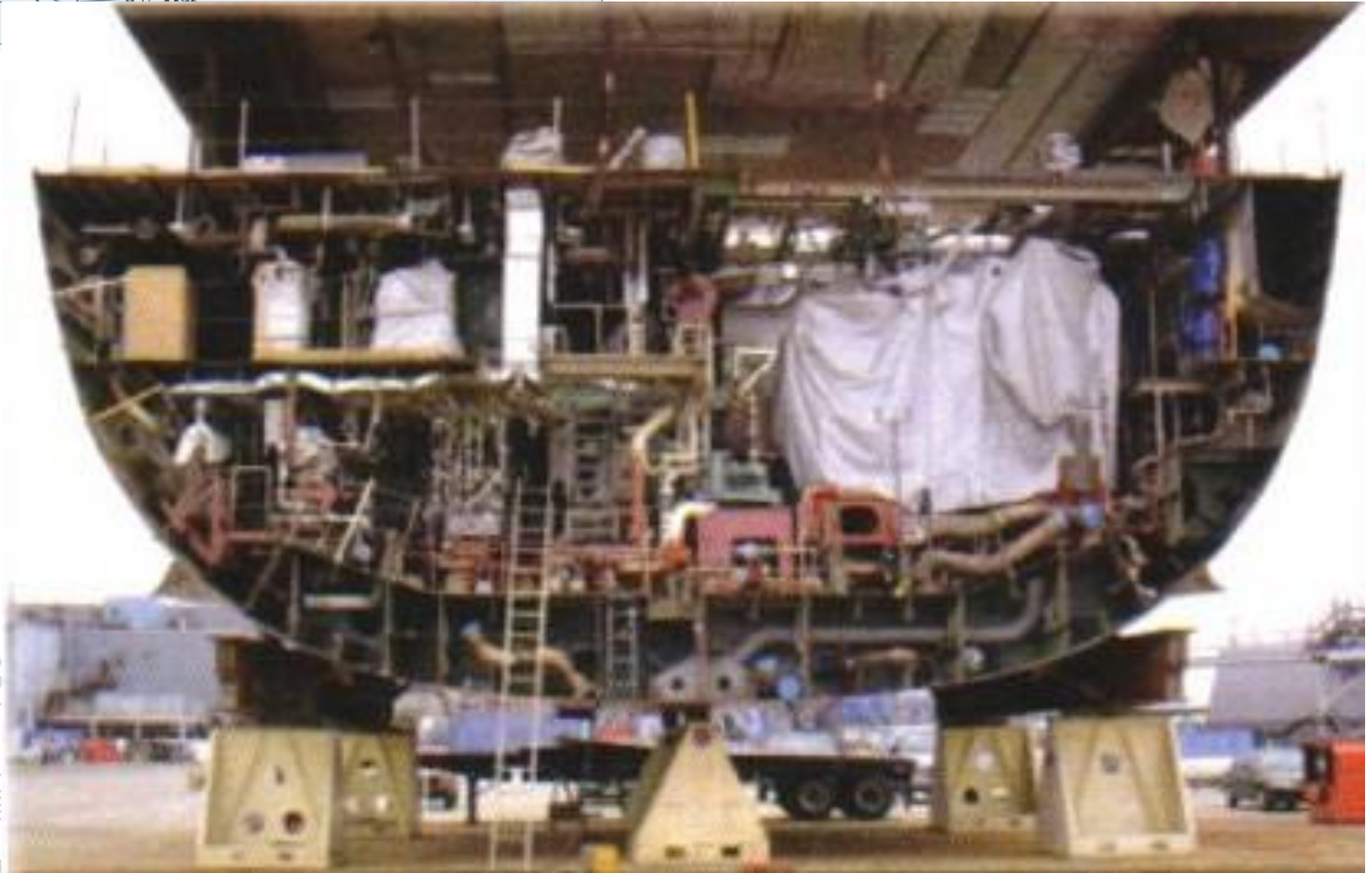
Spanish Built Norwegian Frigate Block Breakdown

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NAVAL SHIP ON-BLOCK OUTFITTING

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Ships are complex, millions of parts

Level I

TS (the product)



TOTAL SHIP SYSTEM

Level II

Systems



ELECTRONIC WARFARE SYSTEMS

COMBAT SYSTEMS

HULL SYSTEMS

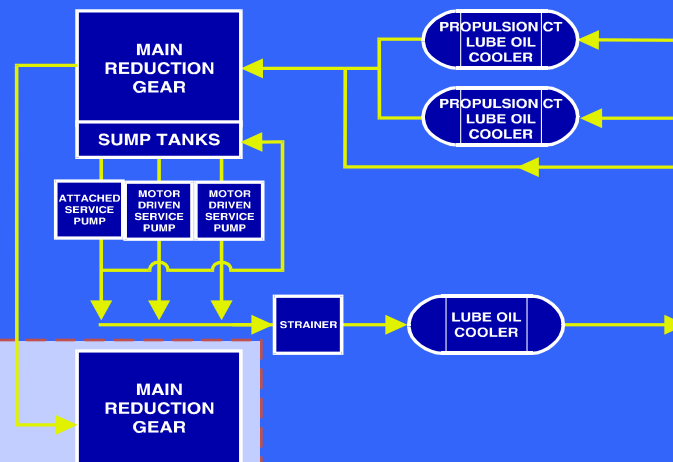
PROPULSION SYSTEMS

Level III

Subsystems

Level IV

Piece-Parts

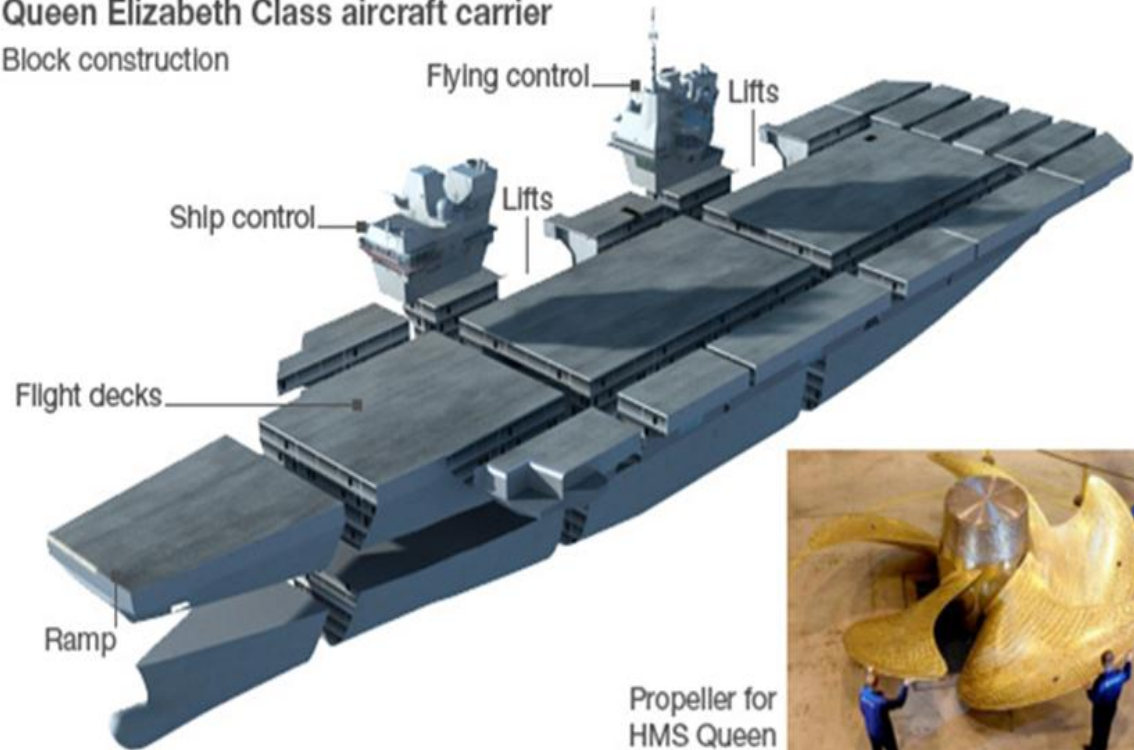




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Queen Elizabeth Class aircraft carrier

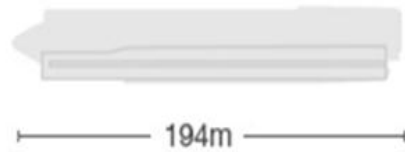
Block construction



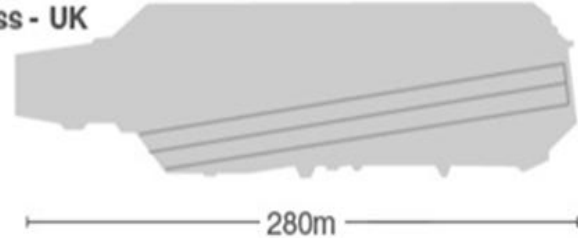
Propeller for
HMS Queen
Elizabeth

Source: Aircraft Carrier Alliance

Invincible Class - UK



QE Class - UK



Nimitz Class - USA

