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KOCKUMS

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Naval Composite Technology Transfer

Feasible Transfer of Naval Technology to Commercial Shipbuilding Applications

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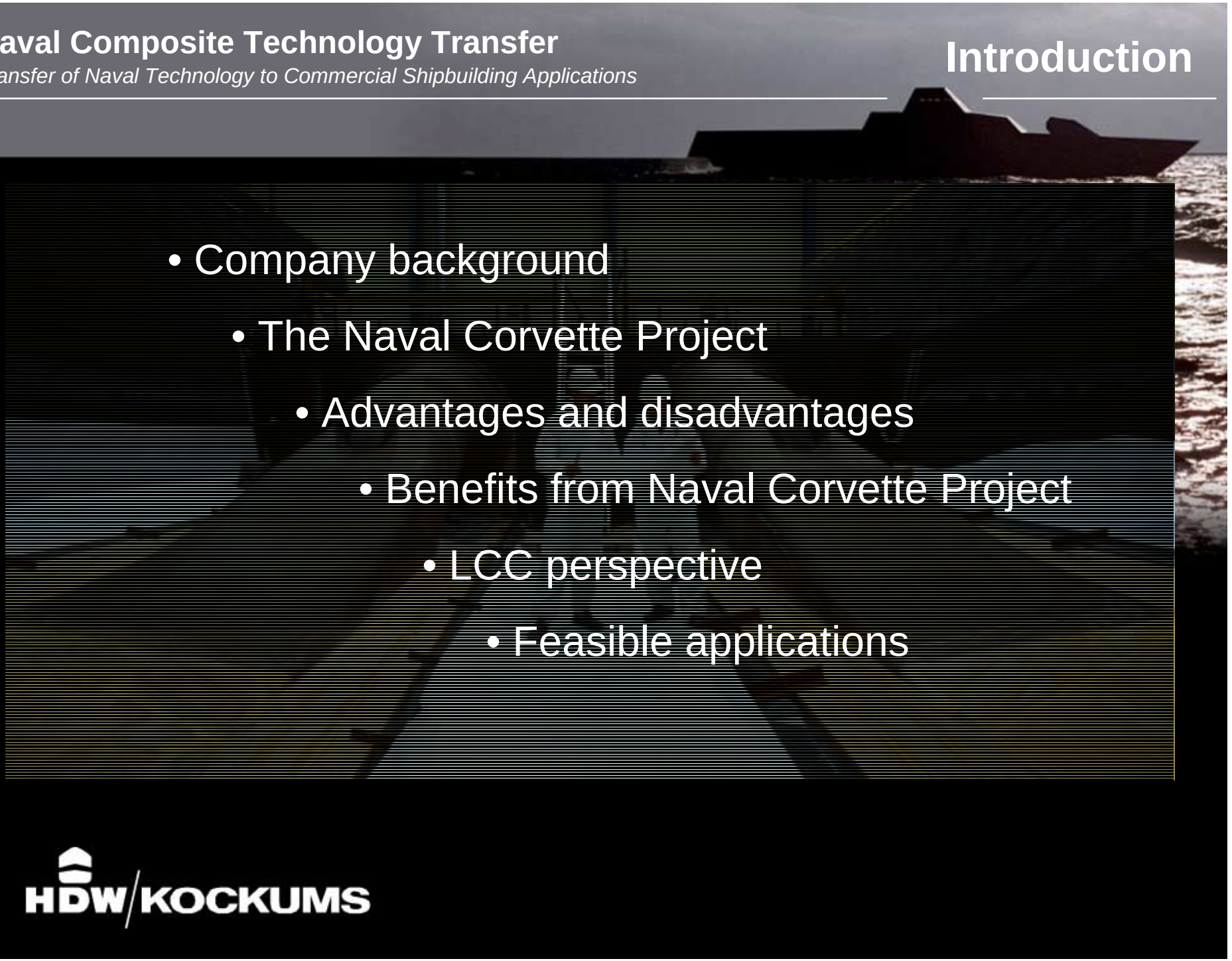
Introduction



- Company background
- The Naval Corvette Project
- Advantages and disadvantages
- Benefits from Naval Corvette Project
- LCC perspective
- Feasible applications

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Transfer of Naval Technology to Commercial Shipbuilding Applications

Composite History

40 Years Experience in
Advanced Composite Ship
Design and Manufacturing

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Composite History

The Visby Class Naval Corvette (2001)

40 Years Experience in
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The Visby Corvette

The world's largest moving object built in CFRP sandwich:

- Length 73 m
- Breadth 10.4 m
- Displacement 600 ton
- Speed 40 knots

Each ship consists of ~160 ton composite materials…

Series of totally five (5) ships...

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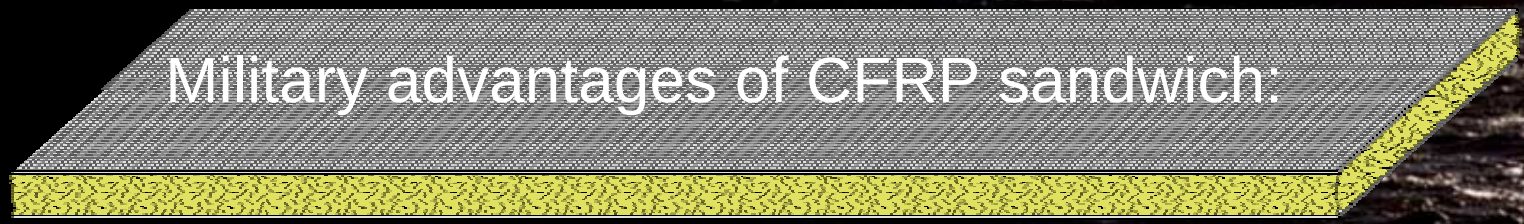
Military Advantages



Military advantages of CFRP sandwich:

- Non-magnetic material (mines)
- Extremely flat surfaces (radar)
- High thermal insulation (IR)
- High underwater shock resistance
- High EMC protection

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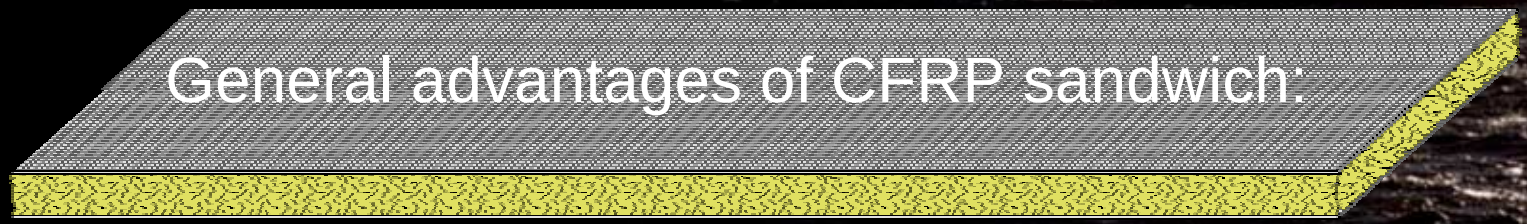
General Advantages



General advantages of CFRP sandwich:

- Low structural weight, which gives (either):
  - *Fuel savings*
  - *Higher payload*
  - *Increased service speed*
  - *Longer range*
- Non-corroding structure (low maintenance cost)
- Built in thermal insulation (also rust proofing)
- Built in acoustic insulation
- Engineered materials for optimised design solutions
- Composites less sensitive to fatigue

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Disadvantages

Commercial disadvantages of composites in shipbuilding:

- Higher acquisition costs
- Combustible material (fire)
- Lack of Class Rules (Lloyd´s, DNV, ABS)
- Complicated QA/QC
- Recycling

Solutions from Naval Corvette Project…

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Solutions and Benefits

Solutions and benefits from the Naval Corvette Project:

- Structural fire integrity
- Influence on Legislation and Class Rules
- NDT methods suited for efficient QA on very large structures
- Studies on disposal of composites

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Solutions and Benefits

Additional benefits from the Naval Corvette Project:

- Material test methods
- Structural analysis methods (FEM)
- Large-scale production of planar sandwich panels
- Rational NC water jet tooling of sandwich panels
- Assembling, housing and post-curing of very large structures

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Life Cycle Cost

LCC comparison on High Speed Ferry

Length	128 m
Cars	250
Passengers	1000
Lifetime	25 years

Life Cycle Costs:

- Acquisition costs
- Operational costs
- Disposal costs

Three versions:

- Steel / Aluminium
- All Aluminium
- All CFRP Sandwich

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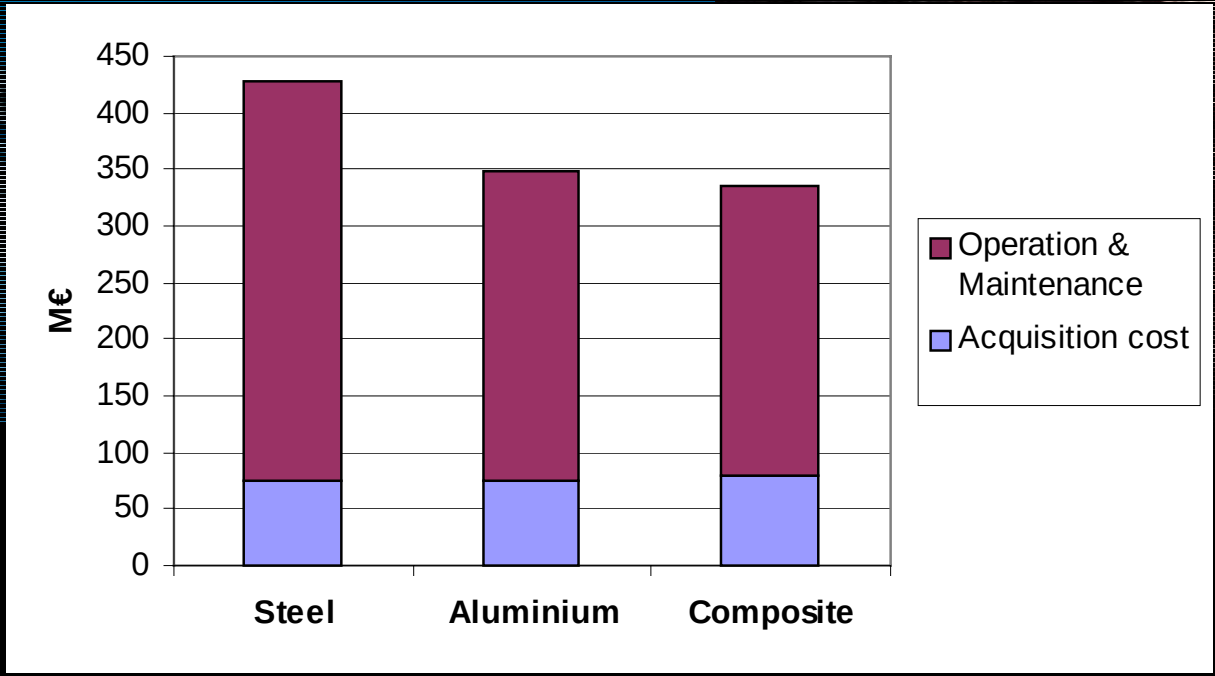
Life Cycle Cost

LCC comparison on High Speed Ferry



- *22 % lower LCC for composite*
- *Up to 30 % savings in LCC possible*

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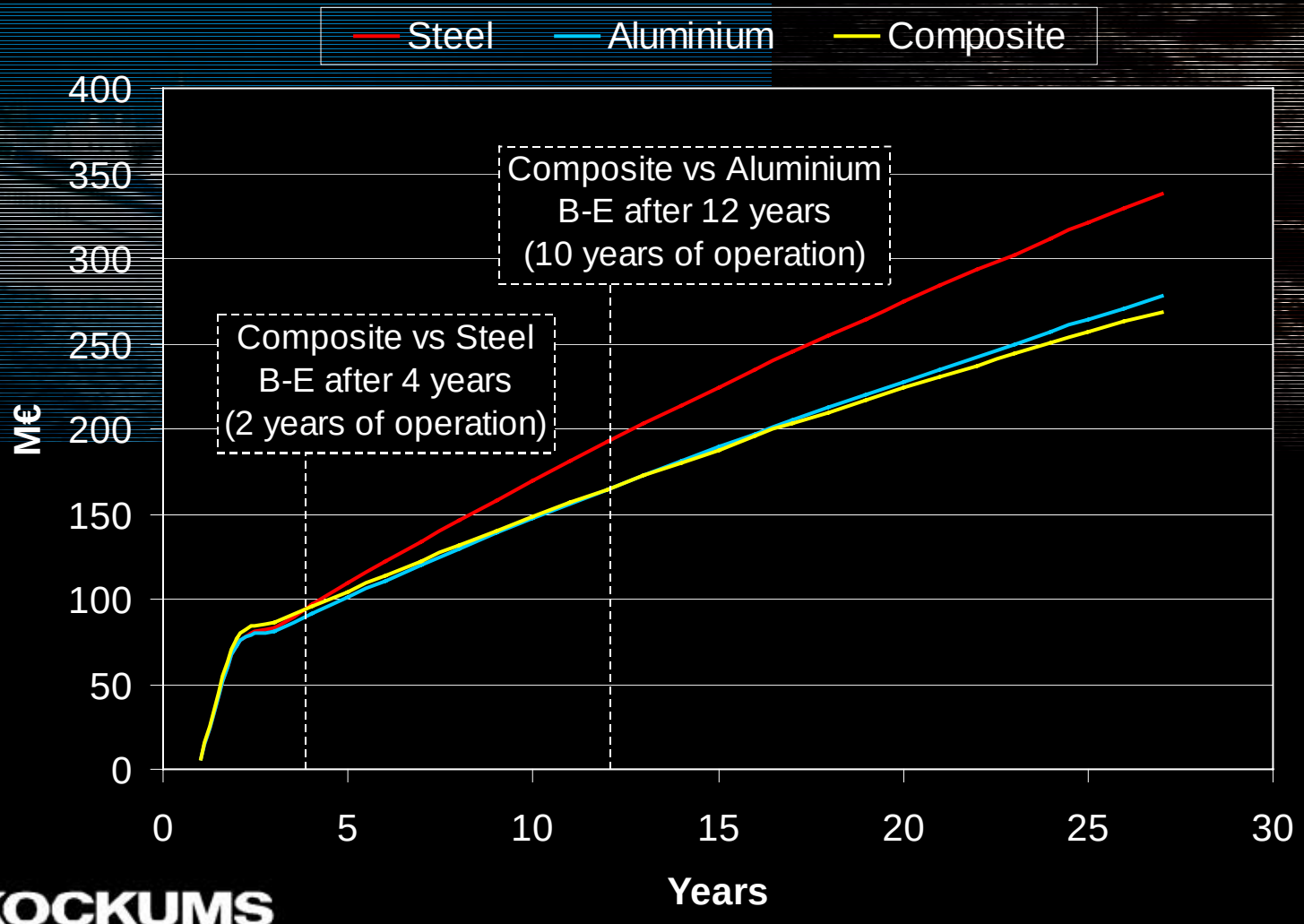
LCC Break-Even

LCC comparison on High Speed Ferry



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Commercial Applications

Superstructures in GRP sandwich?

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Commercial Applications

Cargo (RoRo) decks of sandwich panels?

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Commercial Applications

Cargo hatches of sandwich panels?

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Feasible Advantages

Feasible advantages of CFRP (or GRP) sandwich for commercial shipbuilding applications:

- Fuel savings
- Lower maintenance costs
- Increased hydrodynamic stability

Superstructures

Cargo decks

Cargo hatches

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Superstructures

Pure Car/Truck Carrier

Length	200 m	Deadweight	15 000 tons
Height	50 m	Capacity	6 000 cars

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Superstructures

Composite Superstructure?

- Steel superstructure weight ~ 600 tons
- GRP sandwich weight ~ 300 tons
- Lowered VCG

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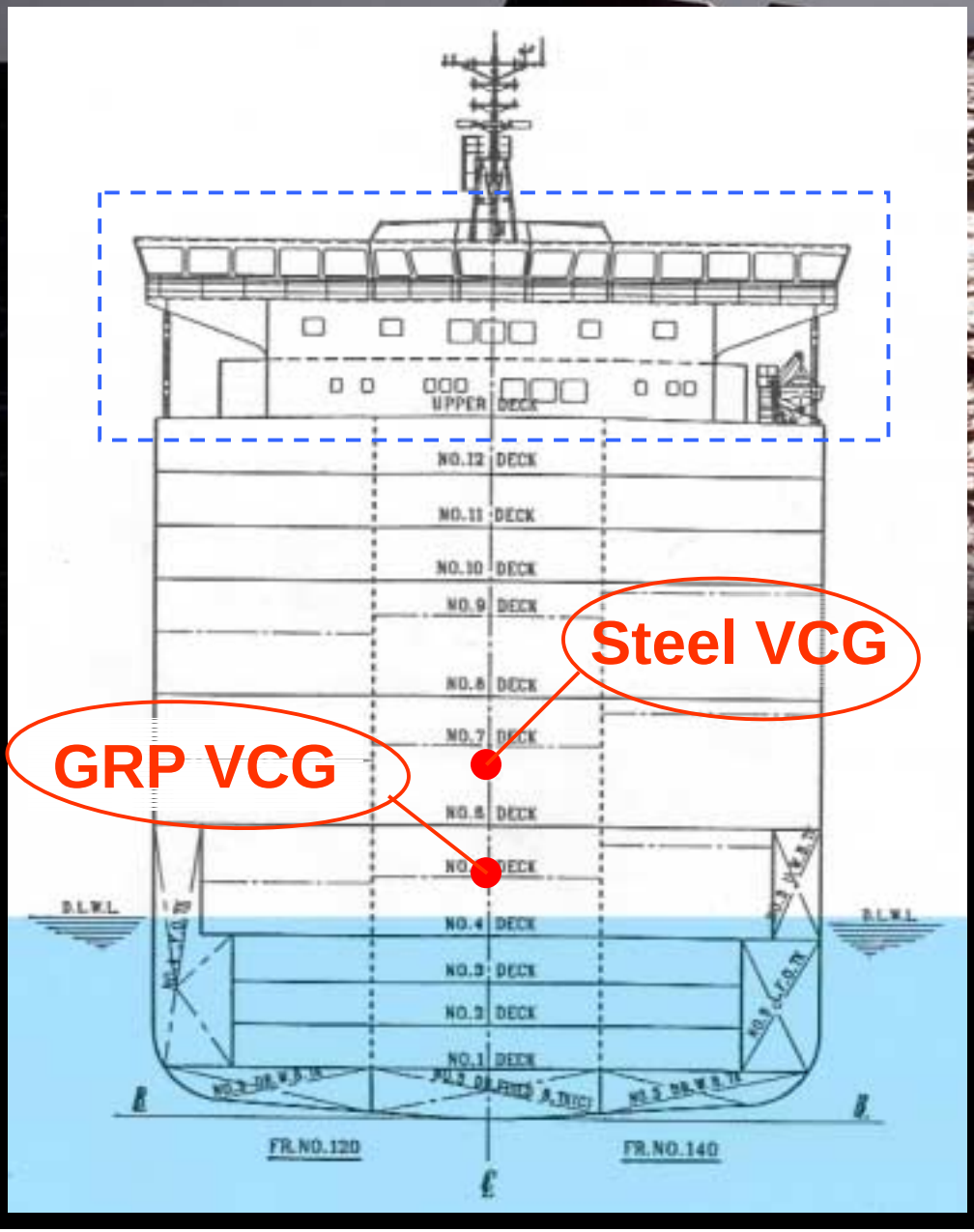
Increased stability

↓

Increased payload!



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Summary

To conclude:

- Advanced composite materials have advantages for commercial shipbuilding applications
- LCC analysis show break-even in a few years
- Beneficial solutions from Naval Corvette project
- Feasible transfer to commercial shipbuilding applications
- Solutions for composite superstructures on steel ships

"A strong Chain of Composite Design and Manufacturing Know-how"

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The End

Thank You !

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