


MARIN

Challenging wind and waves

**Research for Future Ships and Offshore Structures:
Bridging the Gap Between Design and Operation**



Dr. Bas Buchner, President

SOME RESEARCH INTO OUR JOINT MARITIME HISTORY




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38.000 DUTCH LETTERS IN THE NATIONAL ARCHIVES

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RESEARCH INTO OUR HABITS, HISTORY AND THOUGHTS



Sailing Letters

Leucospermum (1801) Royal Botanical Gardens Kew 2012

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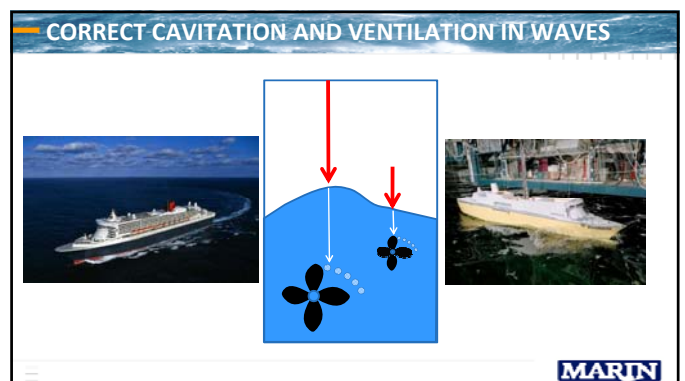
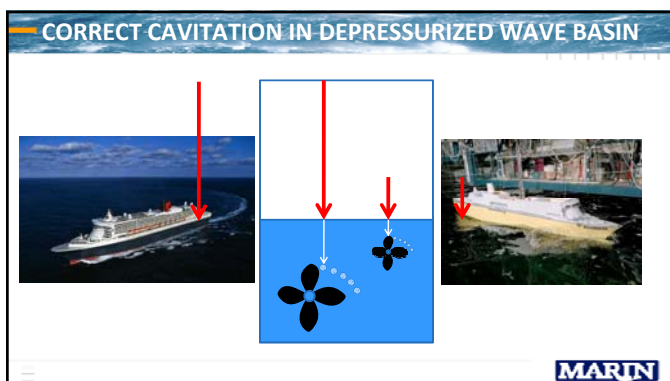
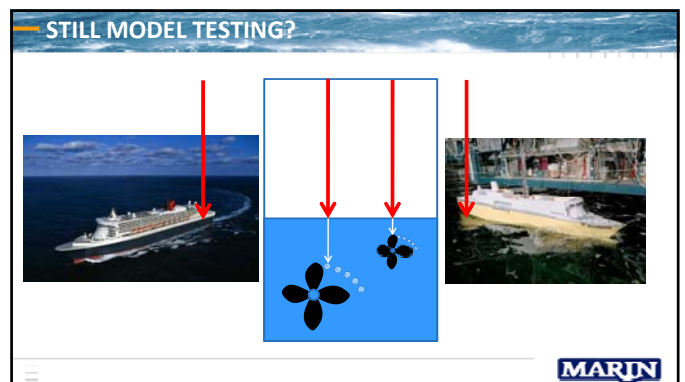
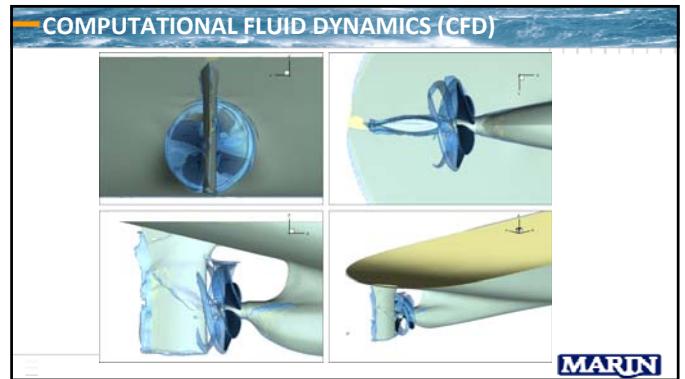
MARITIME RESEARCH INSTITUTE NETHERLANDS (MARIN)

- 'Making ships cleaner, smarter and safer'
- Founded by Dutch Ship owners in 1932
- Independent Foundation
- 375 employees, turnover 45M€ (90% industry)
- 9500 models and 7400 propellers
- Main office and facilities in Wageningen



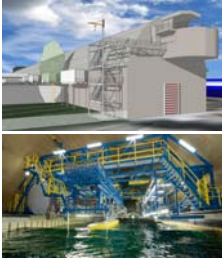


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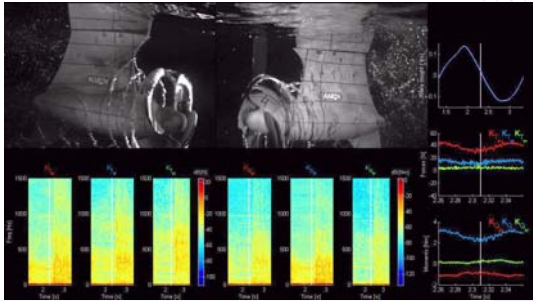
MODEL TESTING IN DEPRESSURIZED WAVE BASIN

- Dimensions: 240 m x 18 m x 8 m
- Pressure: 1000→25 mbar (1/40)
- Wall thickness > 1.5 m
- Wave heights up to 2.0m
- Journalist: "Looks like the CERN Large Hadron Collider in Geneva"



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TESTING OF COMBINED CAVITATION AND VENTILATION



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VISION IN THE 'MARITIME INNOVATION CONTRACT'

Innovation Agenda of the Maritime Cluster in The Netherlands

Resources at sea	Clean Ships	Smart and Safe Shipping	Effective Infrastructure
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MARITIME DEVELOPMENTS

- Clean ships: energy saving (EEDI), emissions, noise, alternative propulsors, LNG as fuel
- Smart and save shipping: safety, control systems, multi-functional ships, autonomous shipping, instrumented ships, new materials
- Resources at sea: Oil and Gas (subsea), Floating Offshore LNG, Renewables (wind, tidal, waves, OTEC, seaweed,...), Deep sea mining
- Efficient infrastructure: interaction ship and ports, logistics, inland shipping, LNG distribution



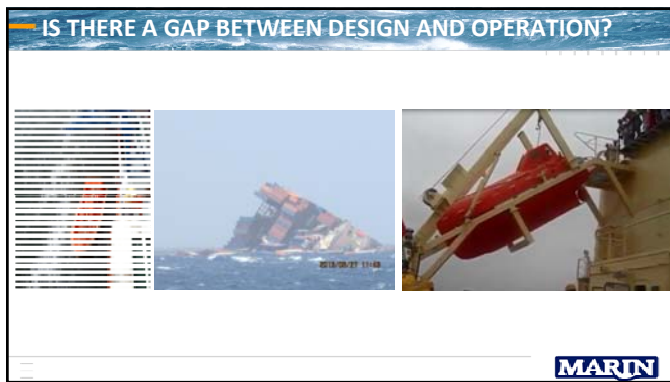
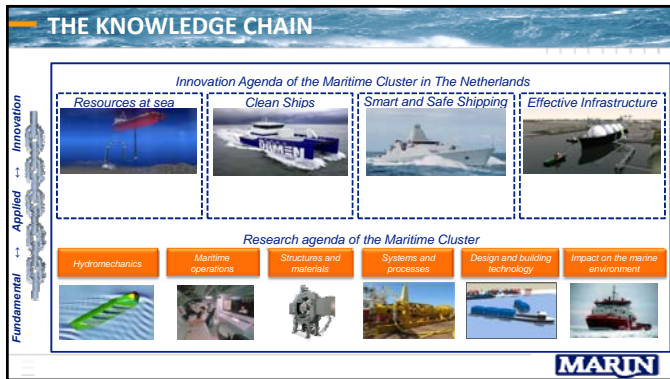
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MARITIME DEVELOPMENTS: COMPLEX PROBLEMS

- Complex (multi-body) systems and operations
- Control systems and autonomous operations
- Instrumented ships ('Condition Based Monitoring')
- Extreme conditions (Deep, Hurricanes, Arctic)
- Focus on environment ('License to operate')



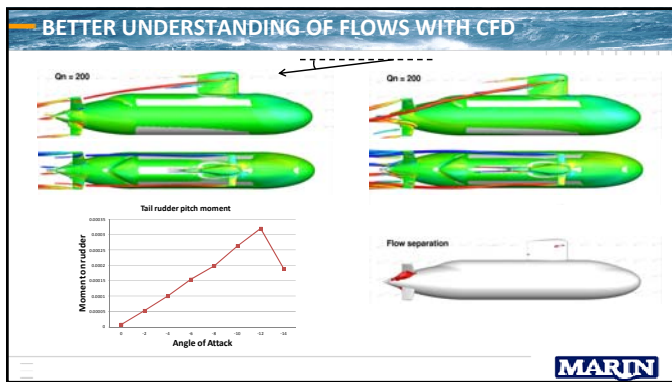
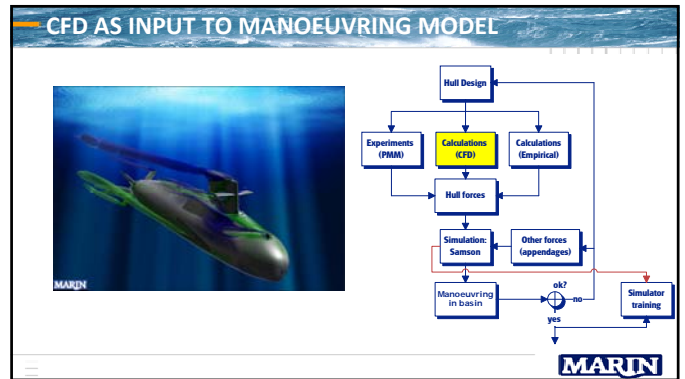
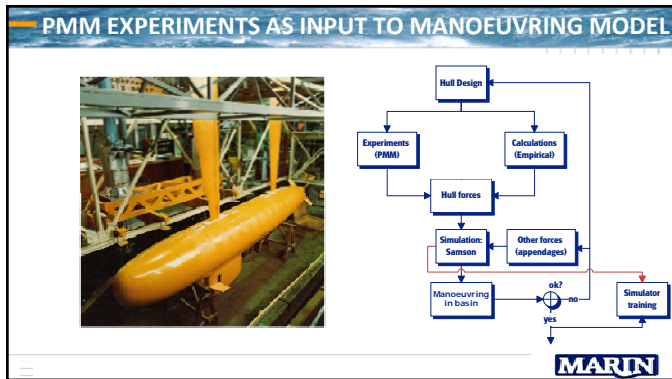
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- ### WE HAVE TO BRIDGE THIS GAP BY:
- Coupling calculations, testing en monitoring in research
 - Linking design to operations (and designers to operators)
 - Multi-disciplinary cooperation through the knowledge chain
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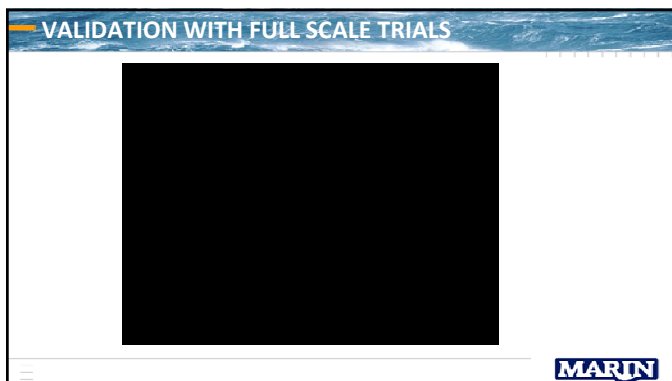


VALIDATION WITH FREE SAILING SUBMARINE MODEL


- Complex dynamic manoeuvres
- Seakeeping at periscope depth
- Emergency manoeuvres
- Auto-pilot design




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LINKING COMPUTATIONS, TESTING AND MONITORING



Computations



Testing



Monitoring

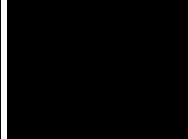
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FREE FALL LIFE BOATS: SAFE AND FAST DEPARTURE



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FREE FALL LIFE BOATS (IN CALM WATER)



Computations



Testing



Monitoring

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FREE FALL LIFE BOATS (IN WAVES)



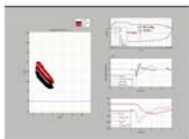
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FREE FALL LIFE BOATS (IN WAVES)

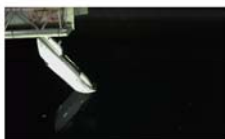


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LINKING COMPUTATIONS, TESTING AND MONITORING



Computations



Testing



Monitoring

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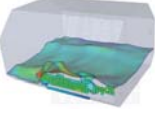
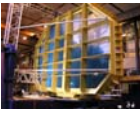


LNG SLOSHING



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LNG SLOSHING: SCALE AND HYDRO-STRUCTURAL EFFECTS







Computations

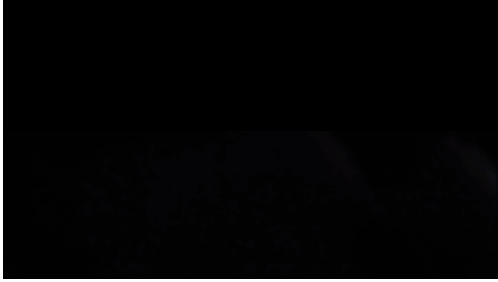
Testing


Large scale

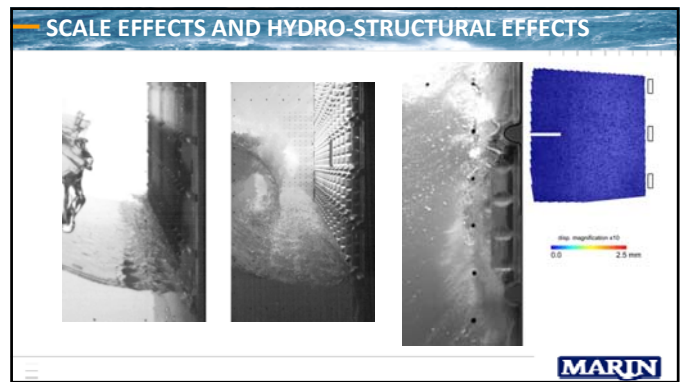
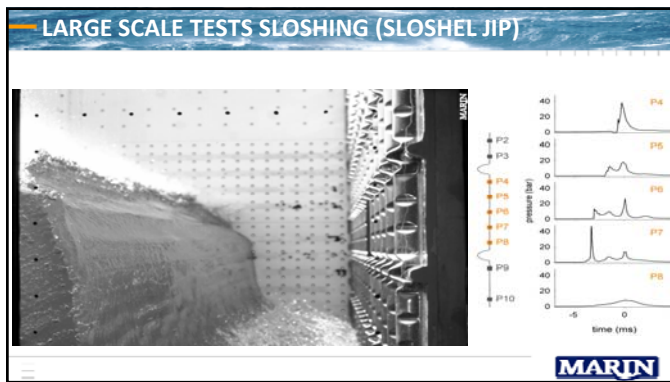
Monitoring?!

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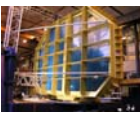


LARGE SCALE TESTS SLOSHING (SLOSHEL JIP)







LNG SLOSHING: SCALE AND HYDRO-STRUCTURAL EFFECTS

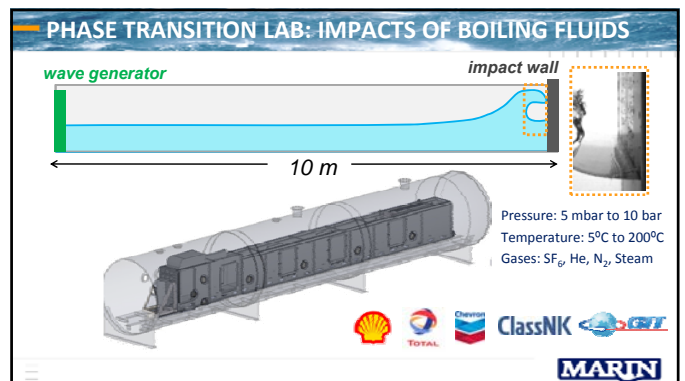
Computations

Testing

Large scale

Monitoring?!

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WE HAVE TO BRIDGE THIS GAP BY:

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- **Linking design to operations (and designers to operators)**
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LNG OFFLOADING: ENGINEERING TO OPERATIONS




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ENGINEERING TO OPERATIONS

CONCEPT → ENGINEERING → OPERATION



Computations Testing Human factor Monitoring

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THE HUMAN FACTOR IN OFFLOADING OPERATIONS



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DEPARTURE ASTUTE CLASS SUBMARINES FROM BARROW



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DEPARTURE ASTUTE CLASS SUBMARINES FROM BARROW

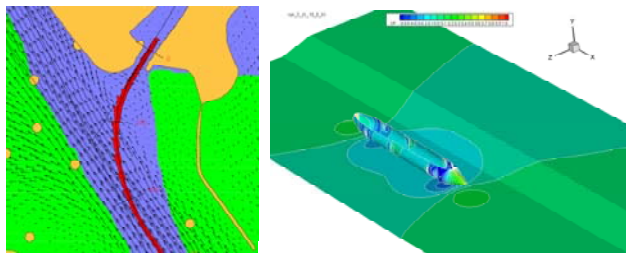


Computations Testing Training Monitoring

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CALCULATION OF WAVES, CURRENT AND BANK SUCTION



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VERIFICATION IN THE BASIN



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TRAINING ON COUPLED BRIDGE SIMULATORS



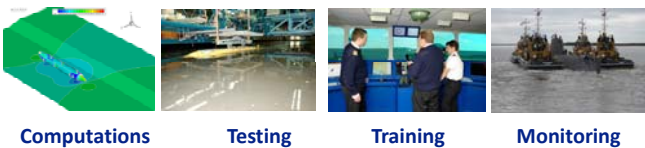
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MONITORING OF REAL DEPARTURE



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COMBINED APPROACH FOR SUBMARINE DEPARTURE



Computations

Testing

Training

Monitoring

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THE HUMAN FACTOR IN ANCHOR HANDLING



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LINKING ENGINEERS TO OPERATORS IN HEAVY LIFTING


ENGINEERING → OPERATION



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SIMULATORS HAVE A PAUSE AND REWIND BUTTON

ENGINEERING → OPERATION



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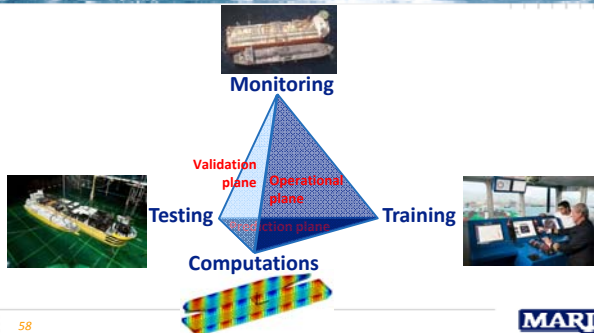
GRAVITY



'Have you ever flown a Sojoez?'
'Only on a simulator.'
'Then you know.'
'I crashed it!'
'It's a simulator. That where it is designed for!'

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INTEGRATED APPROACH NEEDED!



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IN 2020?

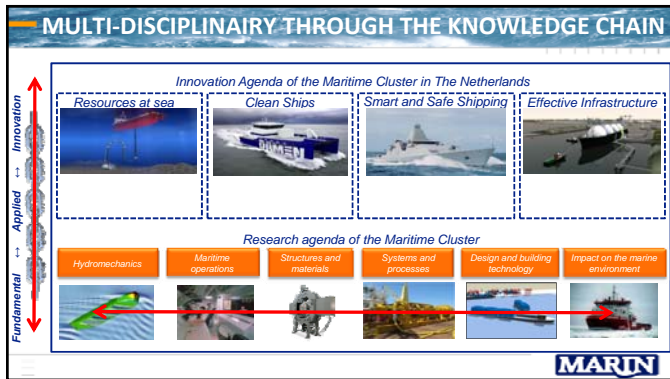


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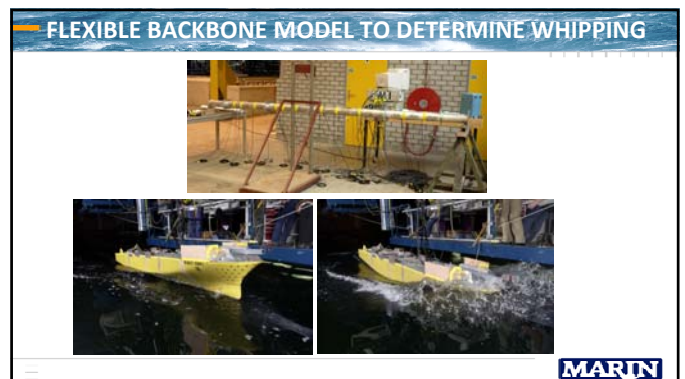
THE CRS MODEL: COOPERATIVE RESEARCH SHIPS (1969)

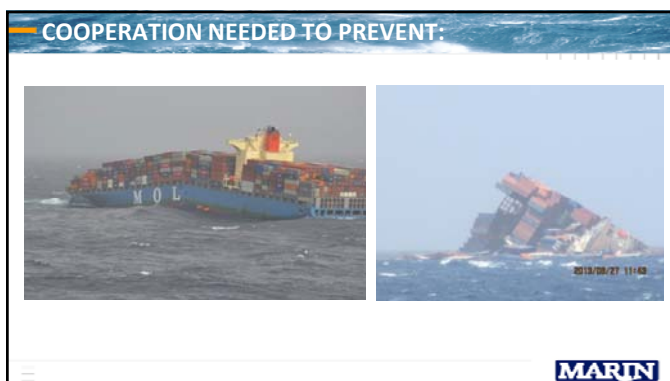
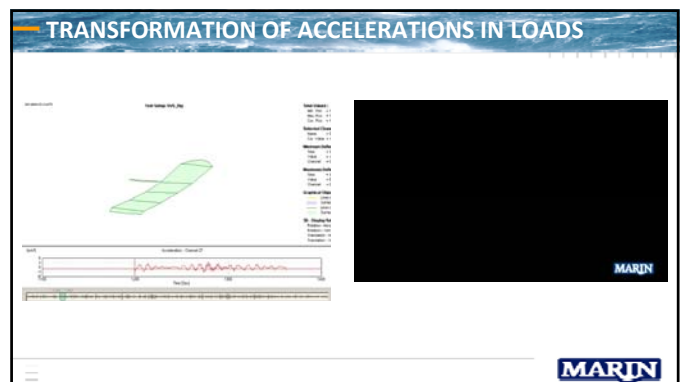
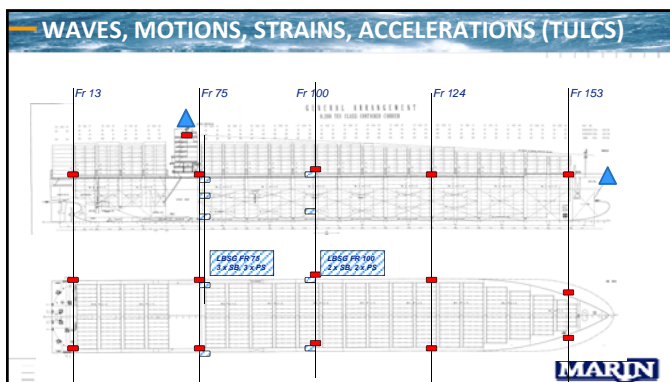
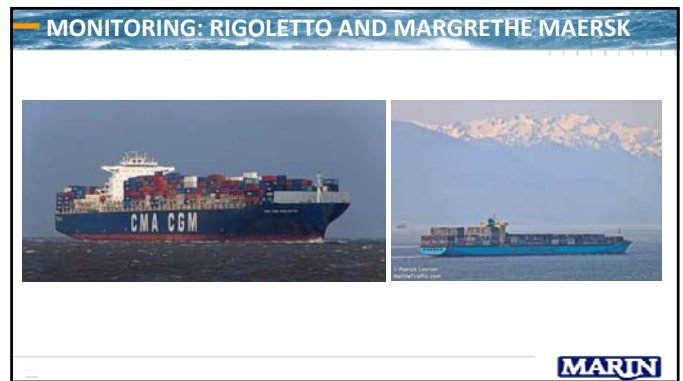
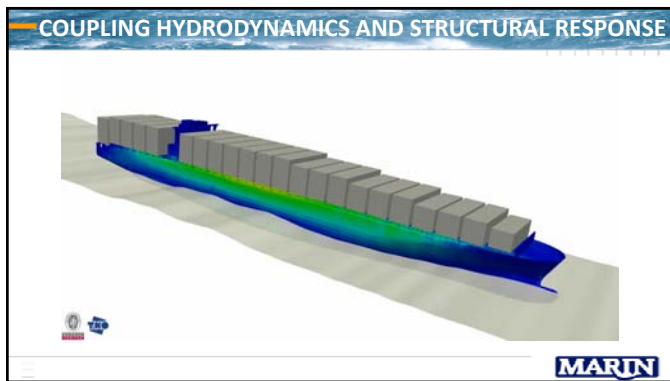
- Model: Long term research community (25 members)
- All members pay a fee → research fund of around 1.5M€/year
- All members decide → 10 research projects in parallel
- Not just joint finance, but joint research.

All members:

- Perform tasks in research projects
- Participate actively in working groups
- Combine knowledge and experience
- Form a network of specialists

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THE JIP MODEL: JOINT INDUSTRY PROJECTS

- *Model: Project based research for a group*
- To jointly solve problems or develop new methodologies
- Pre-competitive: not about your own (new) product, working with competitors is possible
- Cost effective (you pay 50,000 Euro, your receive 1,000,000 Euro worth of research)
- Results in a 'level playing field'
- Important network of clients, competitors and possible subcontractors

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LAURA JIP: LAUNCH AND RECOVERY

- Wide range of functions in one ship
- Smaller crews
- Use of small craft for intelligence, surveillance, mine countermeasures, oceanography, etc.
- Manned and unmanned (autonomous) crafts
- Operability determined by these crafts
- Interoperability with other ships
- Longer platform lives: changing craft



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LAURA JIP: LAUNCH AND RECOVERY






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LAURA JIP: LAUNCH AND RECOVERY



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PHD MODEL: LINK PHD RESEARCH AND INNOVATION



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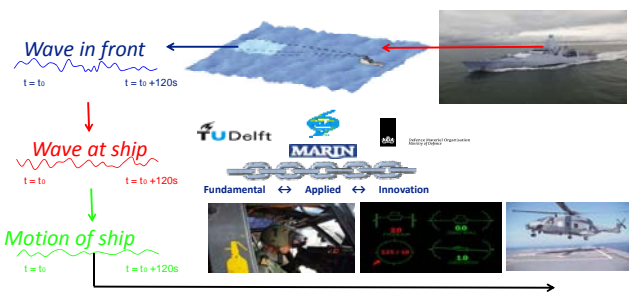
PHD MODEL: SAFE HELICOPTER OPERATIONS



www.prismdefence.com

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USE OF RADAR IN PREDICTION AND ADVICE



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SUMMARY

- Knowledge and application
- Design and operation
- Designers and operators
- Different fields of knowledge
- The tools we use in research
- All players in this field

Knowing is not enough, we must apply.

Willing is not enough, we must do.

Goethe



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