



# Waterborne Transport



# HORIZON EUROPE

## Workshop:

“Horizon 2020 Research and Innovation  
delivering smart, green, safe and  
competitive waterborne transport”

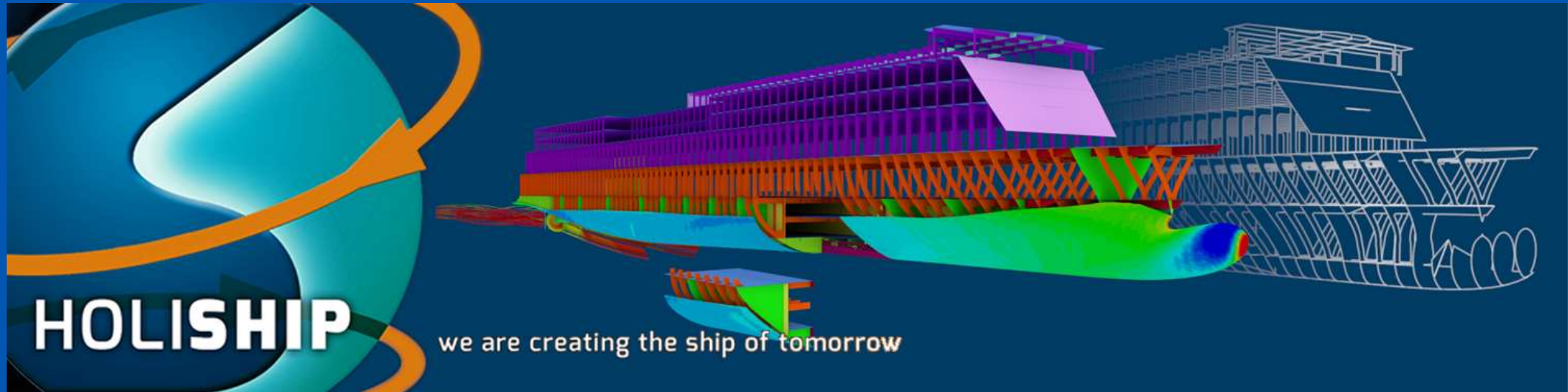
07/02/2022 | 09:30 – 16:15

Residence Palace (Brussels) and online

**Jochen Marzi**

Director, Manager EU Research  
Relations

**HOLISHIP**



## The HOLISHIP Project

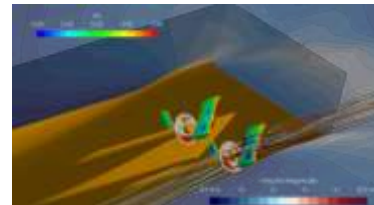
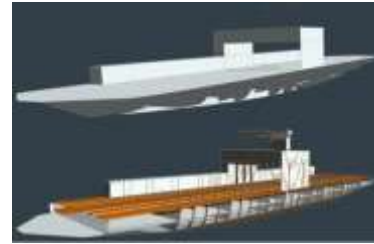
*Jochen Marzi, HSVA*



# Objectives

## The Project

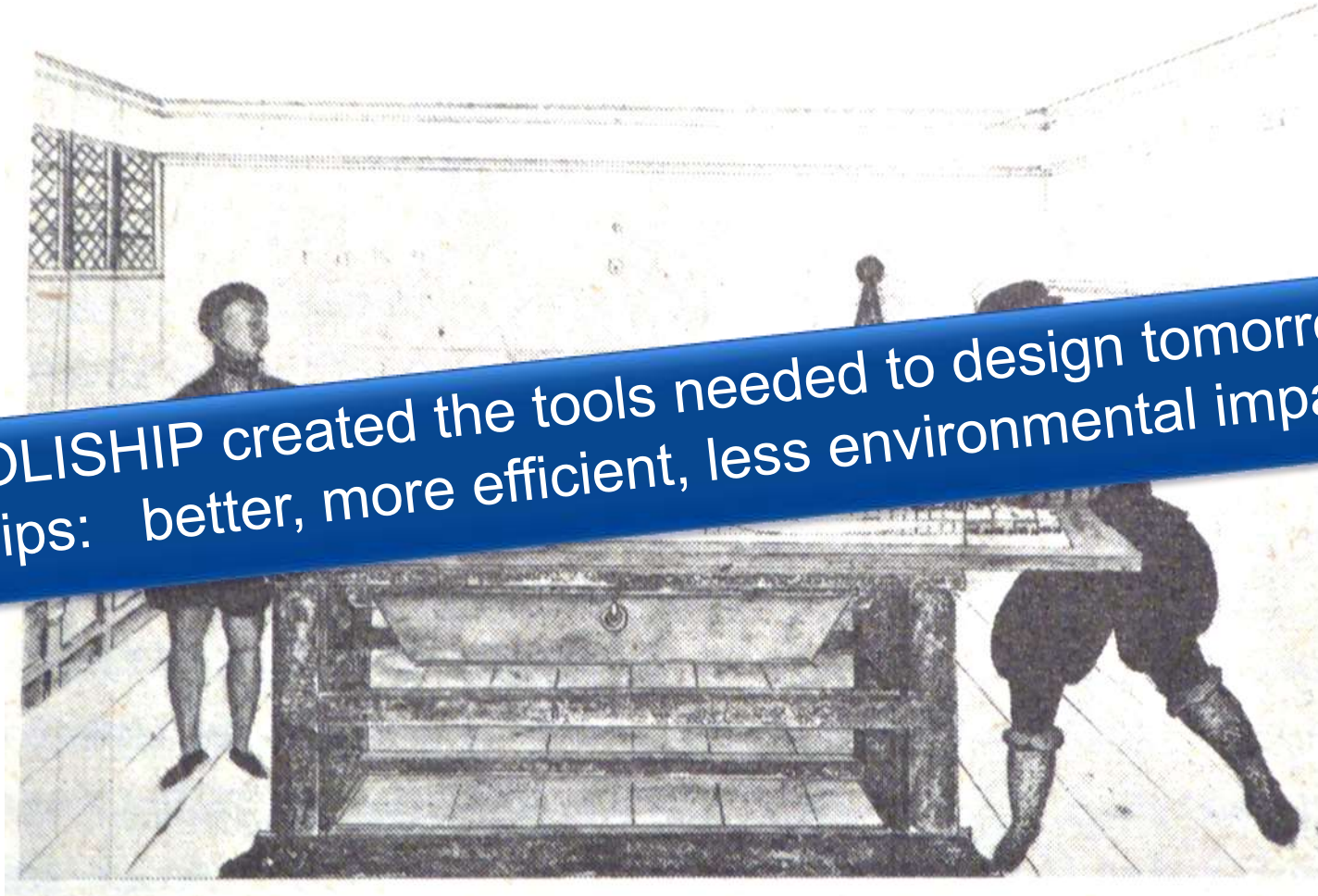
- The need for complex products triggers the need for advanced and innovative design methods.
- HOLISHIP responds to urgent industry needs by developing advanced and innovative design methods which ...
- ... integrate all design (and operational) technical disciplines at an early design stage while at the same time considering:
  - life-cycle cost,
  - environmental impact,
  - technical and regulatory constraints
- The result is a set of homogeneous integrated software platforms for all design phases and optimisation for the entire life-cycle of the product including virtual testing.





# Advanced ships need advanced Design Tools

HOLISHIP created the tools needed to design tomorrow's ships: better, more efficient, less environmental impact.







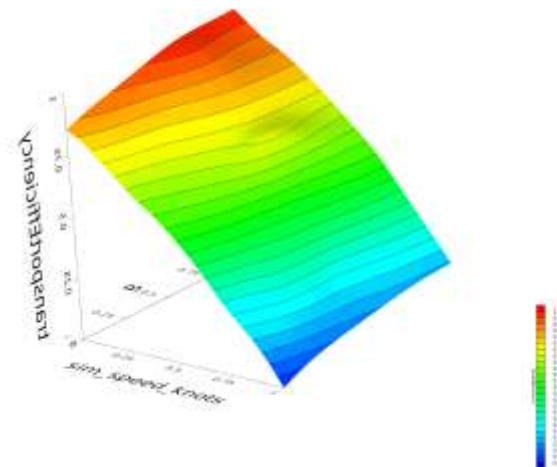
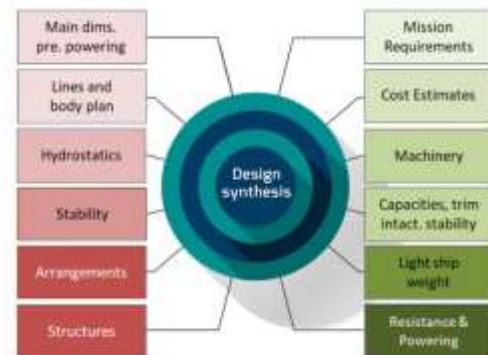
# The Team

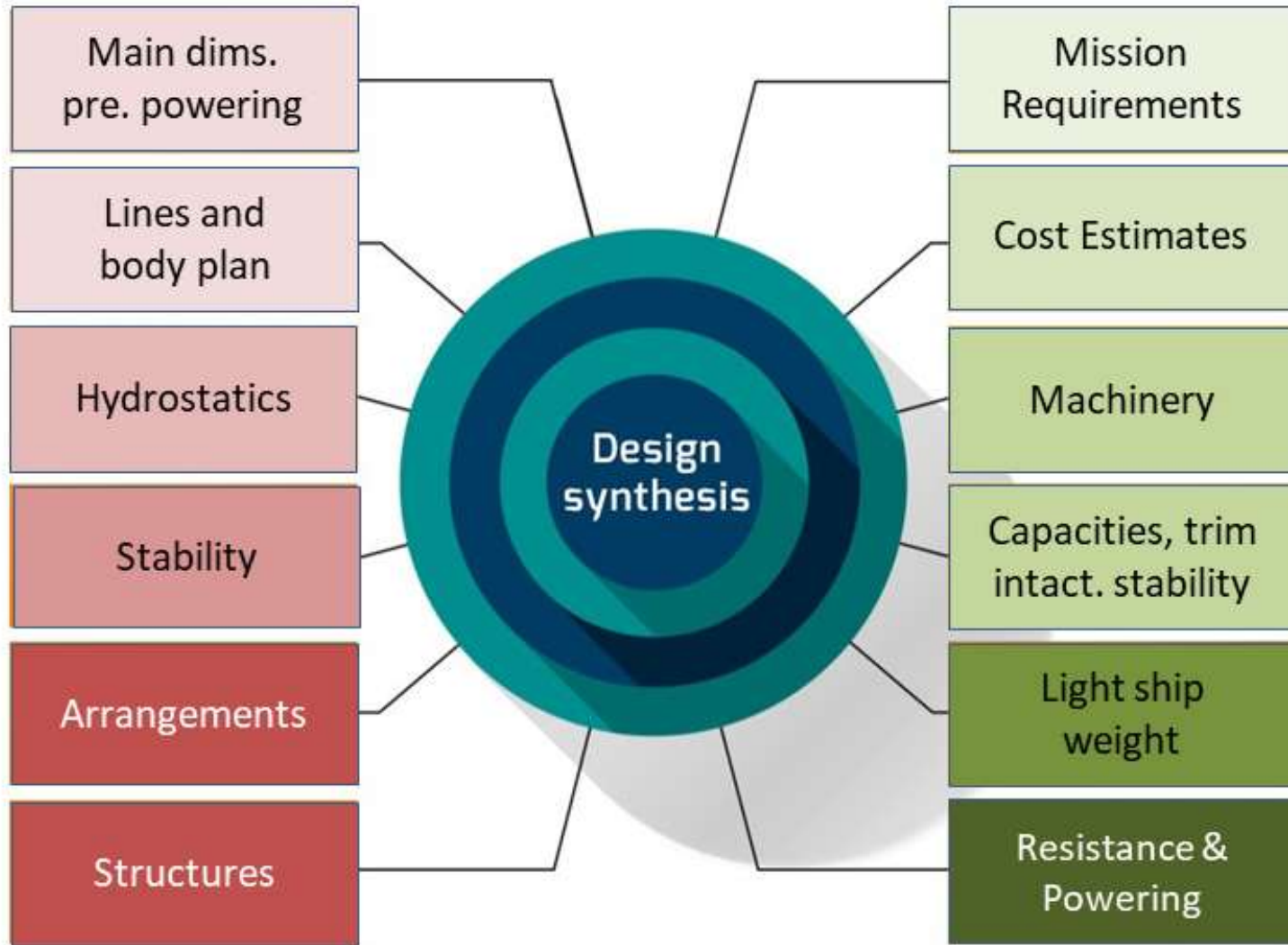
- More than 40 partners (over duration),
- Industry, software developments, research and academia
- Covering all aspects and disciplines of ship design,
- Committed to exploit the results.



# Main project results

- Development of design synthesis concept & approach and platforms,
- Integration of all relevant ship design disciplines
- Development of surrogate models for computationally intensive models
- Use of surrogates for optimisation
- Demonstration of 9 complex application cases ...
- using the platform(s) and integrated tools.



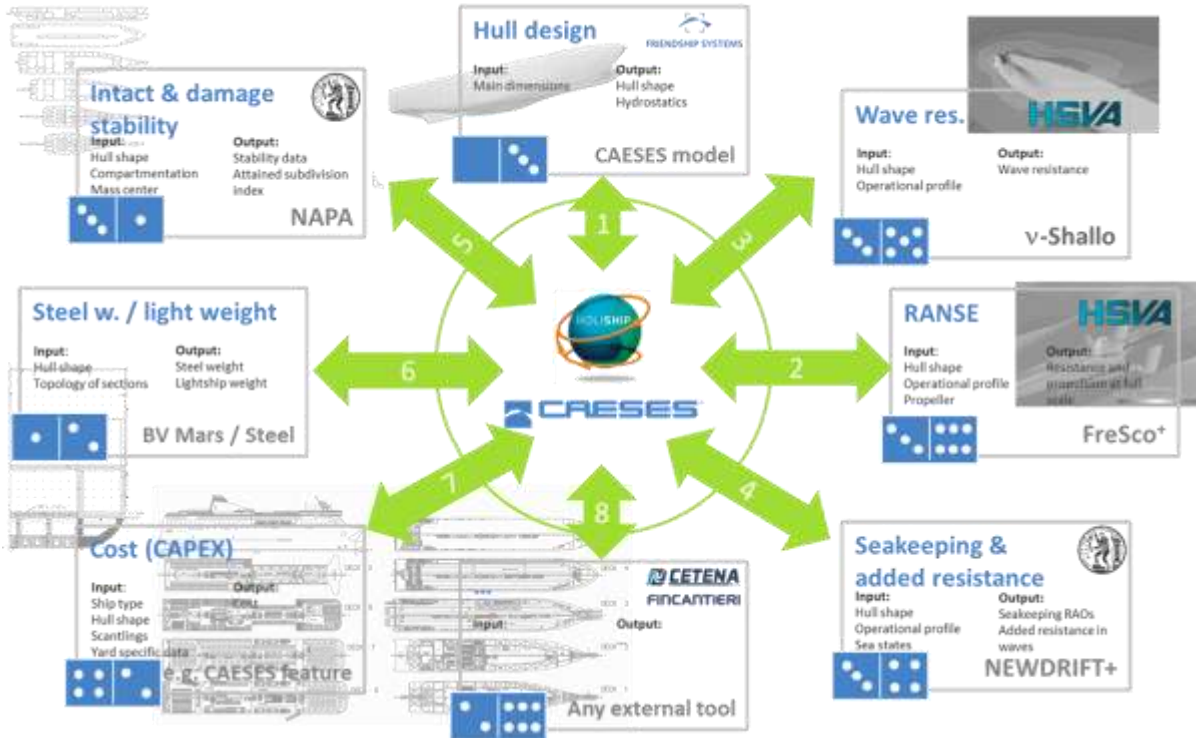


## ***HOLISHIP Design Synthesis,***

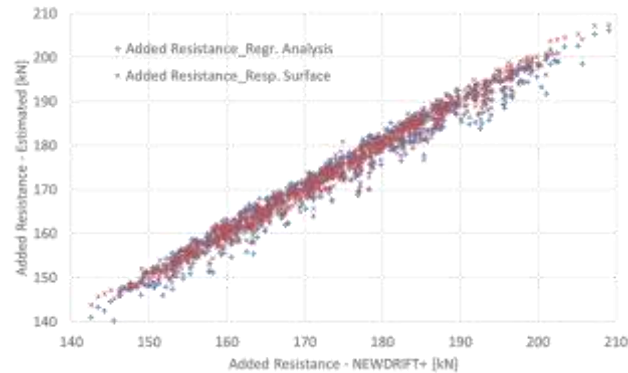
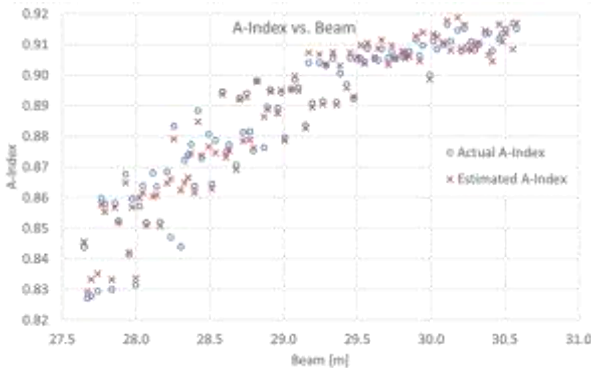
- *Integration of all relevant Design disciplines*
- *Continuous interaction between design disciplines;*
- *Interaction at different layers (increased level of design information).*
- *Consistency check.*



# Surrogate Models



- Complex tools require know-how, time and “availability”
- Licenses, special hardware
- Often hours to days of number crunching involved
- Upfront computing allows the creation of fast surrogate models to be applied in optimisation.







## 9 Application Cases successfully accomplished

1. OSV



2. PAX



3. Research Vessel



4. MP Ocean Vessel



OSV  
PaX  
Research Vessel  
MP Ocean Vessel  
Merchant VFF  
Offshore Optimisation-RR  
RoPAX  
Double Ended Ferry

Phase	OSV	PaX	Research Vessel	MP Ocean Vessel	Merchant VFF	Offshore Optimisation-RR	RoPAX	Double Ended Ferry
Concept Design	○	○	○				○	○
Contract Design	○		○	○	○	○	○	○
Virtual Testing	○						○	

5./6. Merchant Vessel



7. Offshore Platform



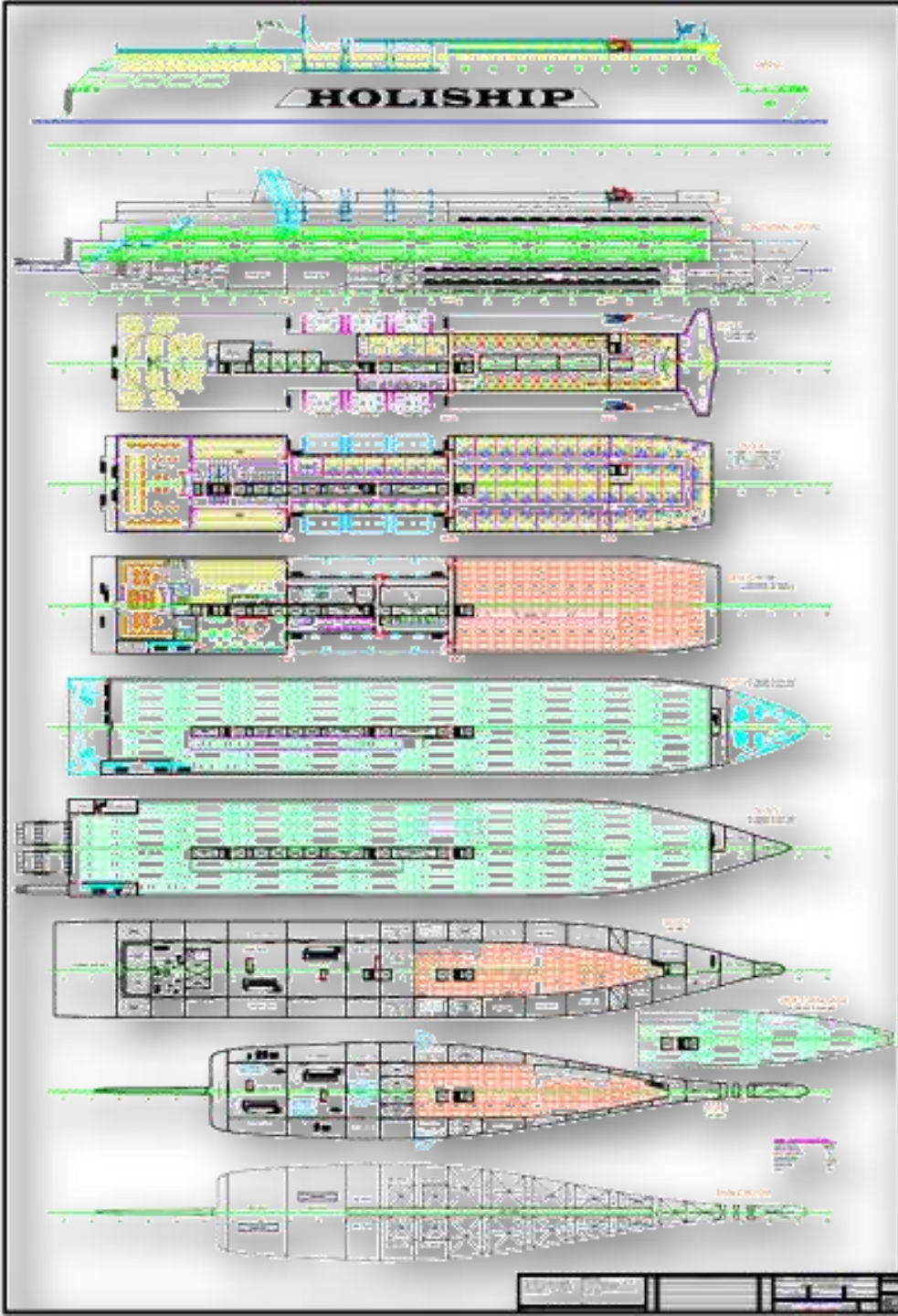
8. RoPAX



9. Double Ended Ferry



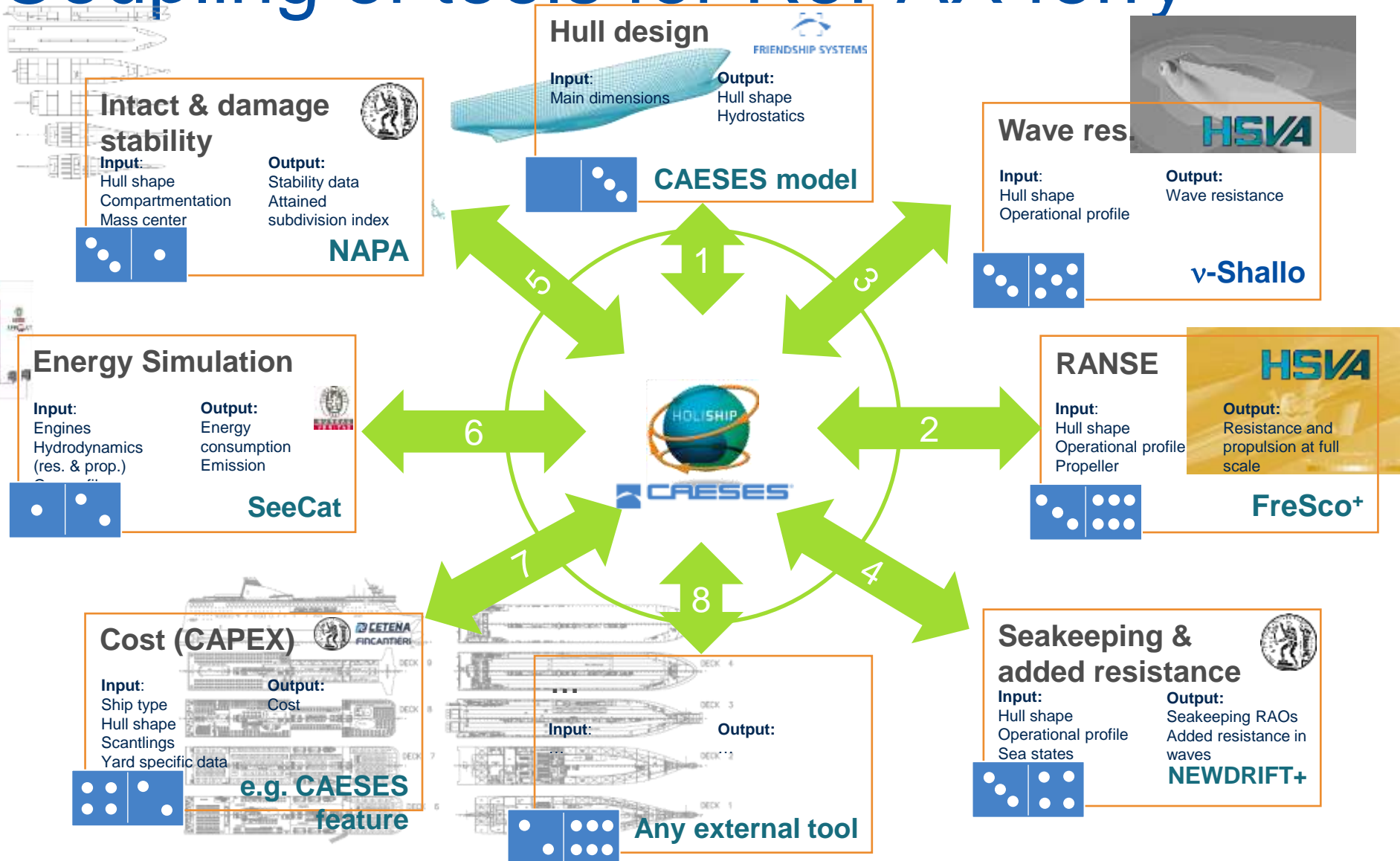
- 9 different industrially relevant Application Cases have been treated.
- These range from large passenger ships to small research vessels and ...
- cover concept as well as contract design and virtual testing.



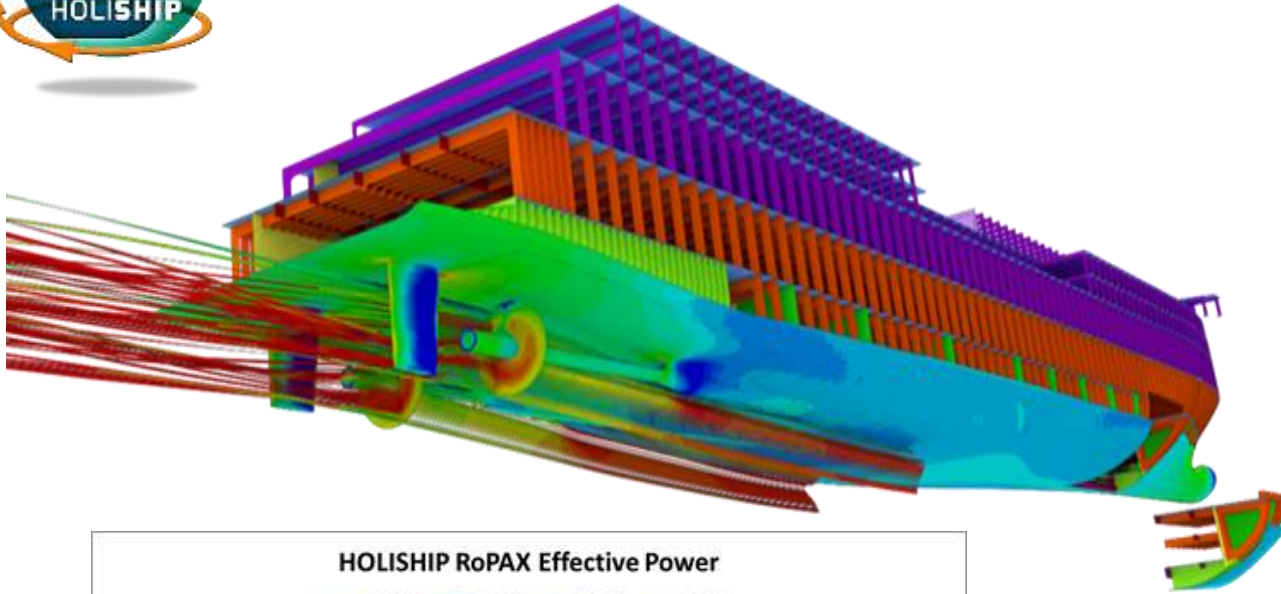
## RoPAX Design Case

- Large RoPAX ferry, operation in the Mediterranean
- Evaluation of different design and (advanced) propulsion concepts.
- Optimisation focussing on hydrostatics and -dynamics, machinery, structure, cost.
- Find the most sustainable and “greenest” solution.

# Coupling of tools for RoPAX ferry

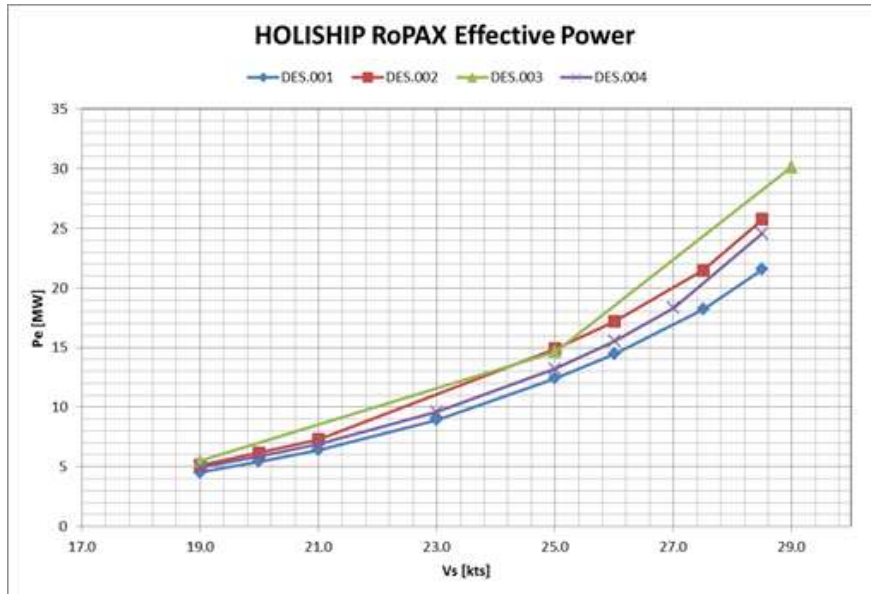






# HOLI(stic-)SHIP Design is Green Ship Technology

- Efficiency is the first step to cut emissions.
- Design determines efficiency.
- Hydrodynamics play a key role ...
- ... but there is a lot more to consider,
- specifically today, if we consider very complex maritime products with extended requirements.



$P_D$  Improvement:  
up to 15%





## ***What has been achieved?***

*The Net Present Value: + 3,0 Mio EUR.*

*Optimisation yields 8.45% power savings over the operational profile.*

*Based on the assumed operational profile this translates into: 1745 ts fuel savings annually*

*... or 5584 ts of  reduction per ship and year*



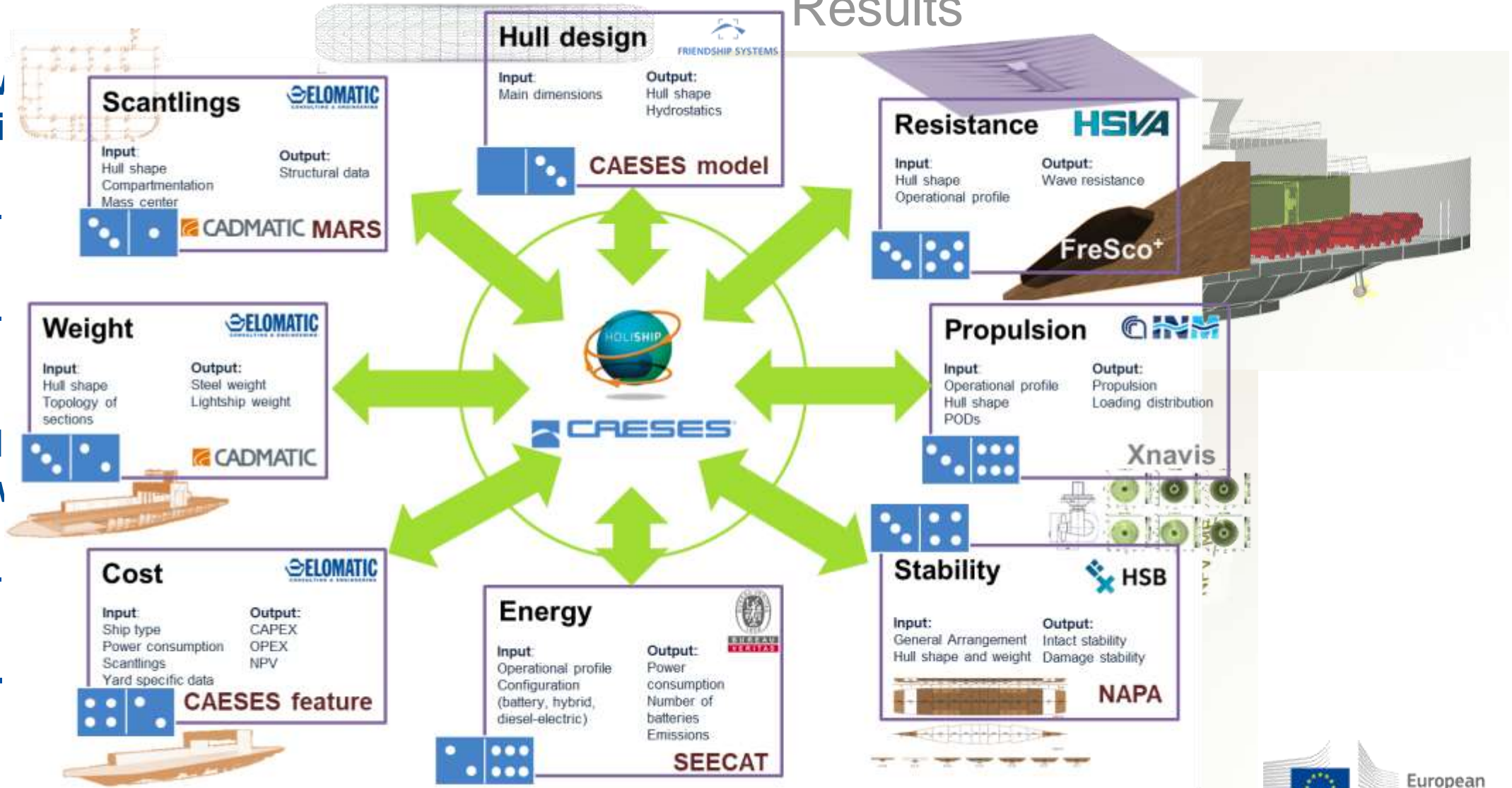
# DE Ferry Design Case

- 1 *h* return trip in Scandinavian waters
- 10 *nm* at a service speed of 13 *kts*
- Length from 110 *m* to 135 *m* and beam from 17.5 *m* to 22 *m*
- Conventional and electric/battery driven propulsion as alternatives

# DOUBLE-ENDED FERRY

Results

- **TV di**
- 1.
- 2.
- **M tv**
- 1.
- 2.

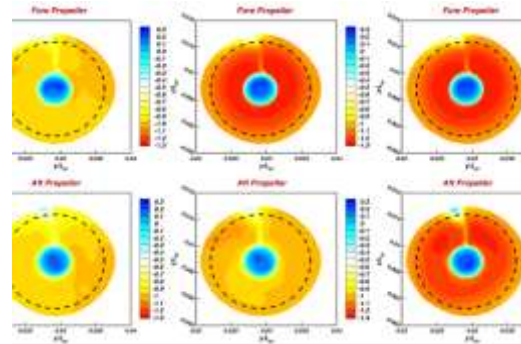




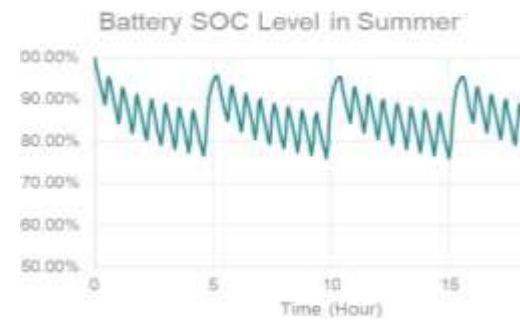
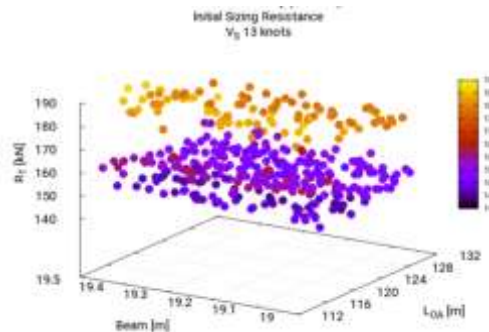
# DOUBLE-ENDED FERRY

Design, Analysis & Optimisation – relevant aspects

Propulsion analysis /  
different  
arrangements



Sizing / resistance



Battery State of  
Charge (SOC) Level  
in Summer



Battery SOC Level  
in Winter



# Concluding Remarks



- Design synthesis and integration of software tools realised via a combined top-down and bottom-up approach
- More than 40 different design tools / exploitable results have been integrated in the platforms and applied in 9 different design application (cases) ...
- ... using Parametric, multi-objective design optimisation thus reaching a new quality.
- Flexible combination of tools as needed for specific design tasks demonstrated
- Replacement of resource-intensive simulations with surrogate models as key element of the design synthesis concept.
- The full story of HOLISHIP has been documented in the 1<sup>st</sup> and 2<sup>nd</sup> Vol. of the “HOLI book” (2020/2021).
- Additional and post-project information at the project’s web site :



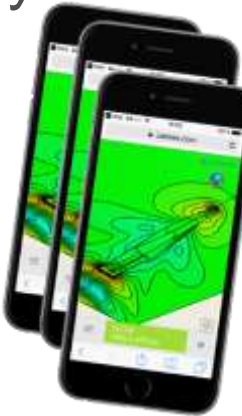
[www.holiship.eu](http://www.holiship.eu)





# Outlook

- A “Market place for ship design tools and services” is planned on the basis of HOLISHIP developments .
- “The market” will offer affordable, well maintained tools for industry and academia.
- Prototype already tested.
- Continuation in Horizon Europe is sought.

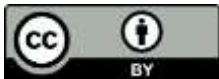


# Thank you

Jochen Marzi – HSVA

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[www.holiship.eu](http://www.holiship.eu)



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