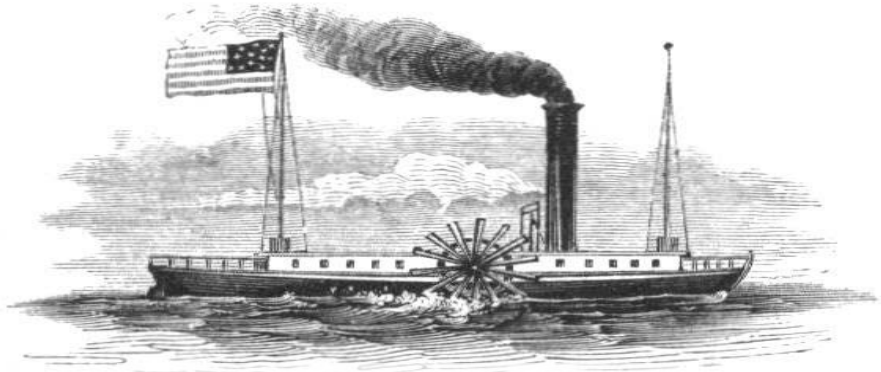
Holistic Ship Design Optimisation
The HOLISHIP Project

Jochen Marzi, HSVA

Background

1807



Fulton's Clermont

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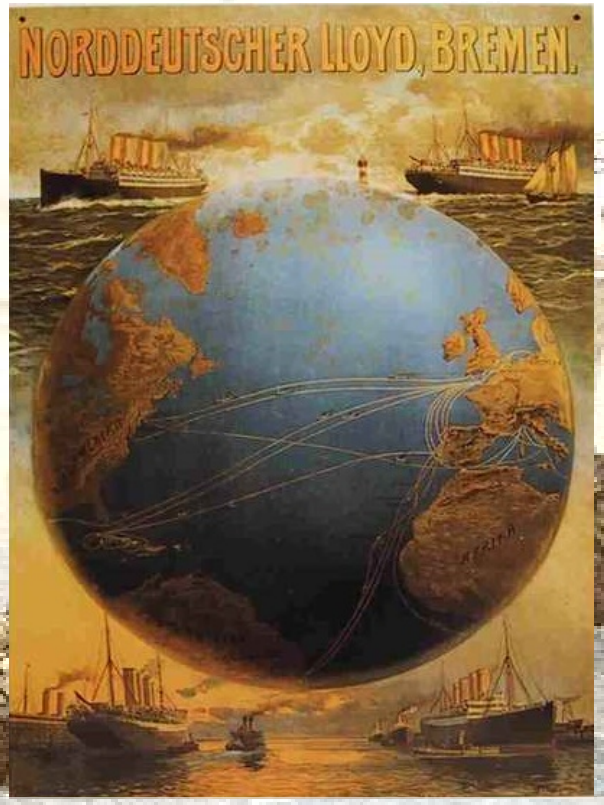
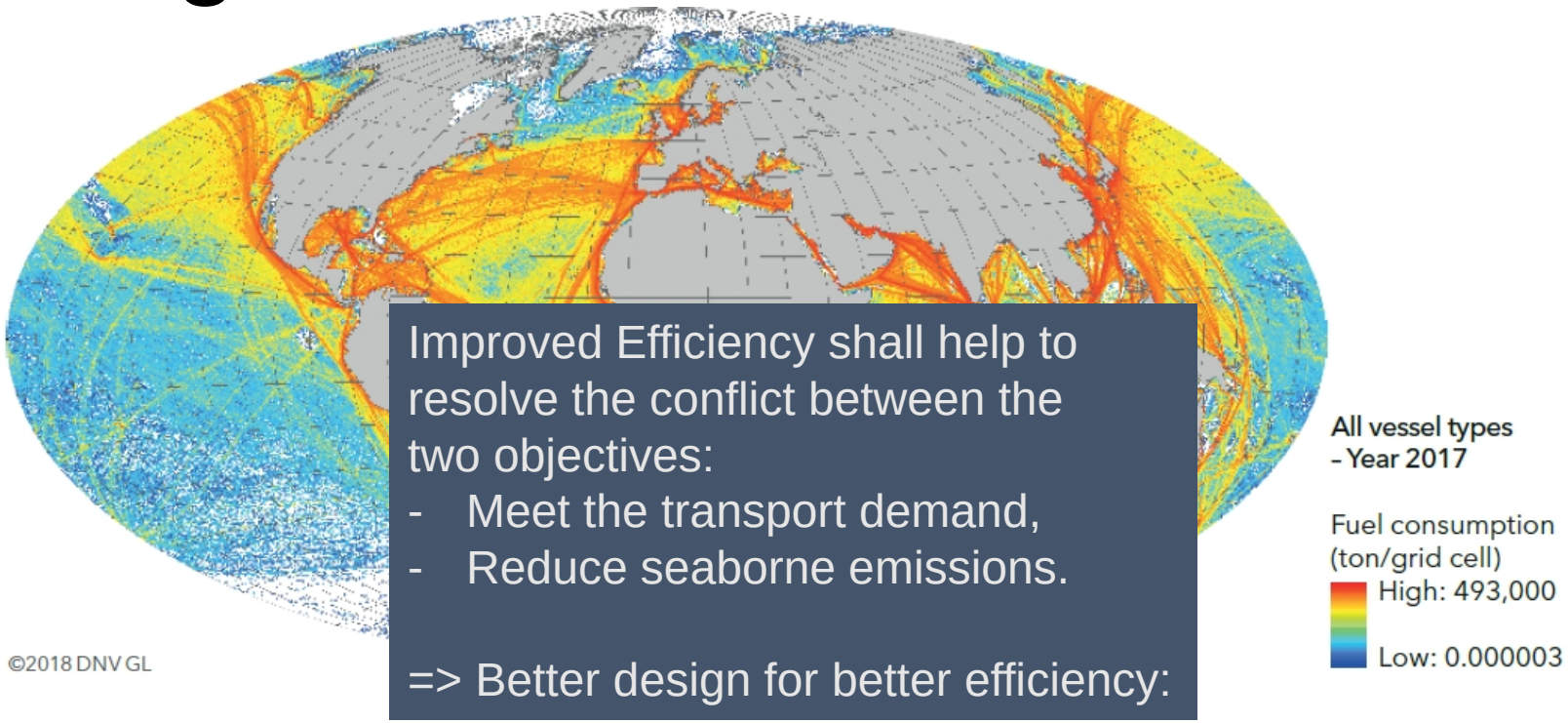


Steam – shipping becomes the backbone of the world economy

Background



Improved Efficiency shall help to resolve the conflict between the two objectives:

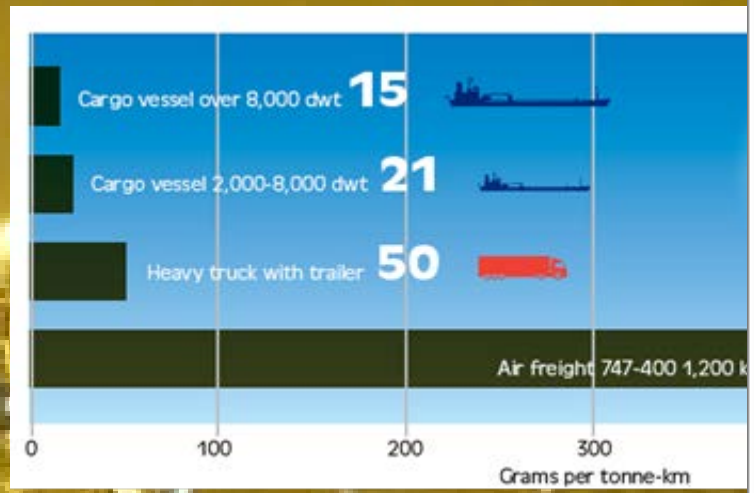
- Meet the transport demand,
- Reduce seaborne emissions.

=> Better design for better efficiency:

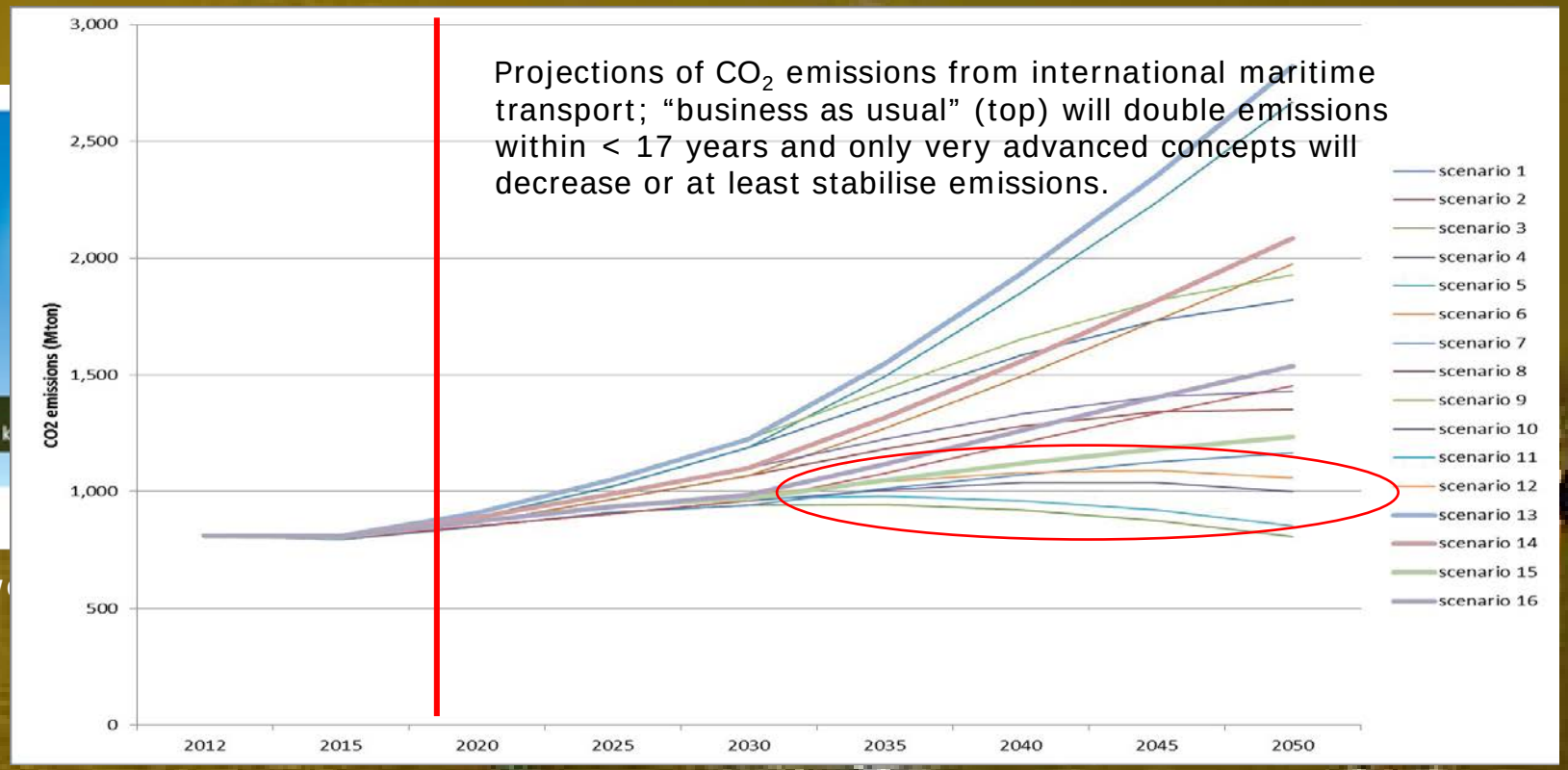
… but international economy hinges largely on seaborne transportation (90% of everything – being “shipped”)

On the Environmental Impact of International Shipping Operations

Intercontinental Shipping is by far the most energy efficient mode of Transport.

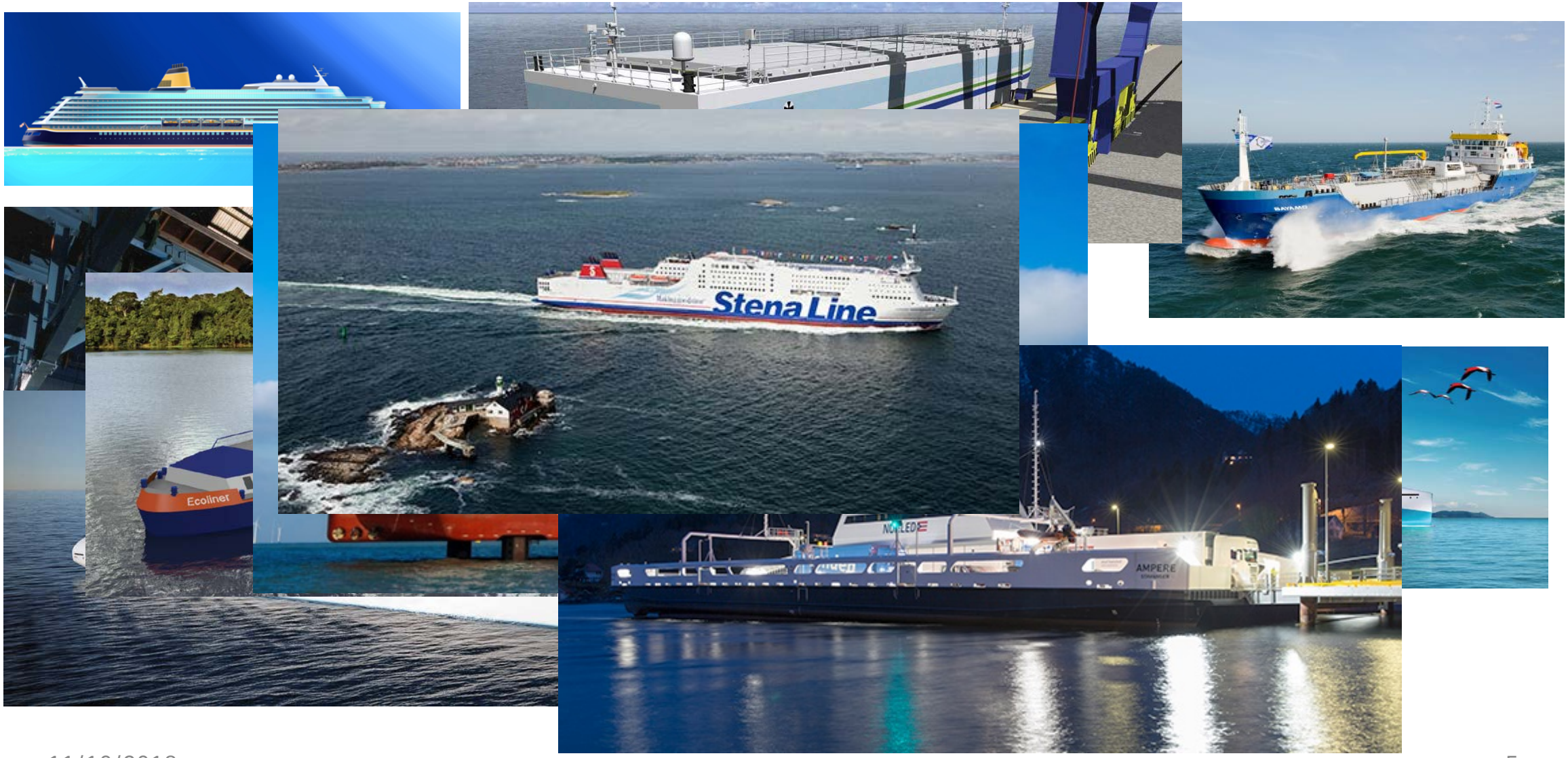


Comparison of CO2 emissions betw
transport modes

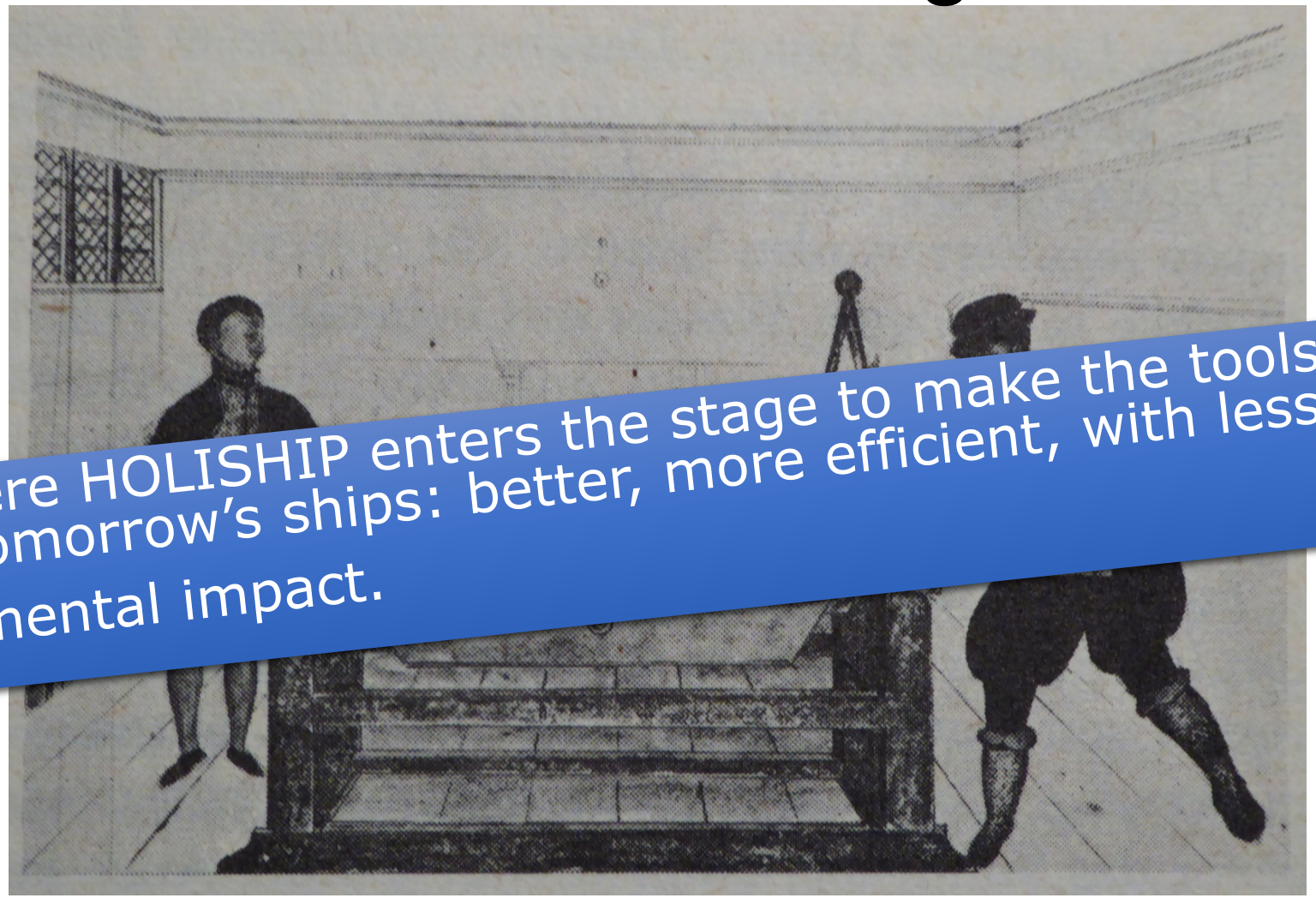


… but forecasts call for significant improvements:
And tomorrow's ships need to be much more environmental friendly.

Tomorrow‘s Ships



… need advanced Design tools



… and here HOLISHIP enters the stage to make the tools needed to design tomorrow's ships: better, more efficient, with less Environmental impact.

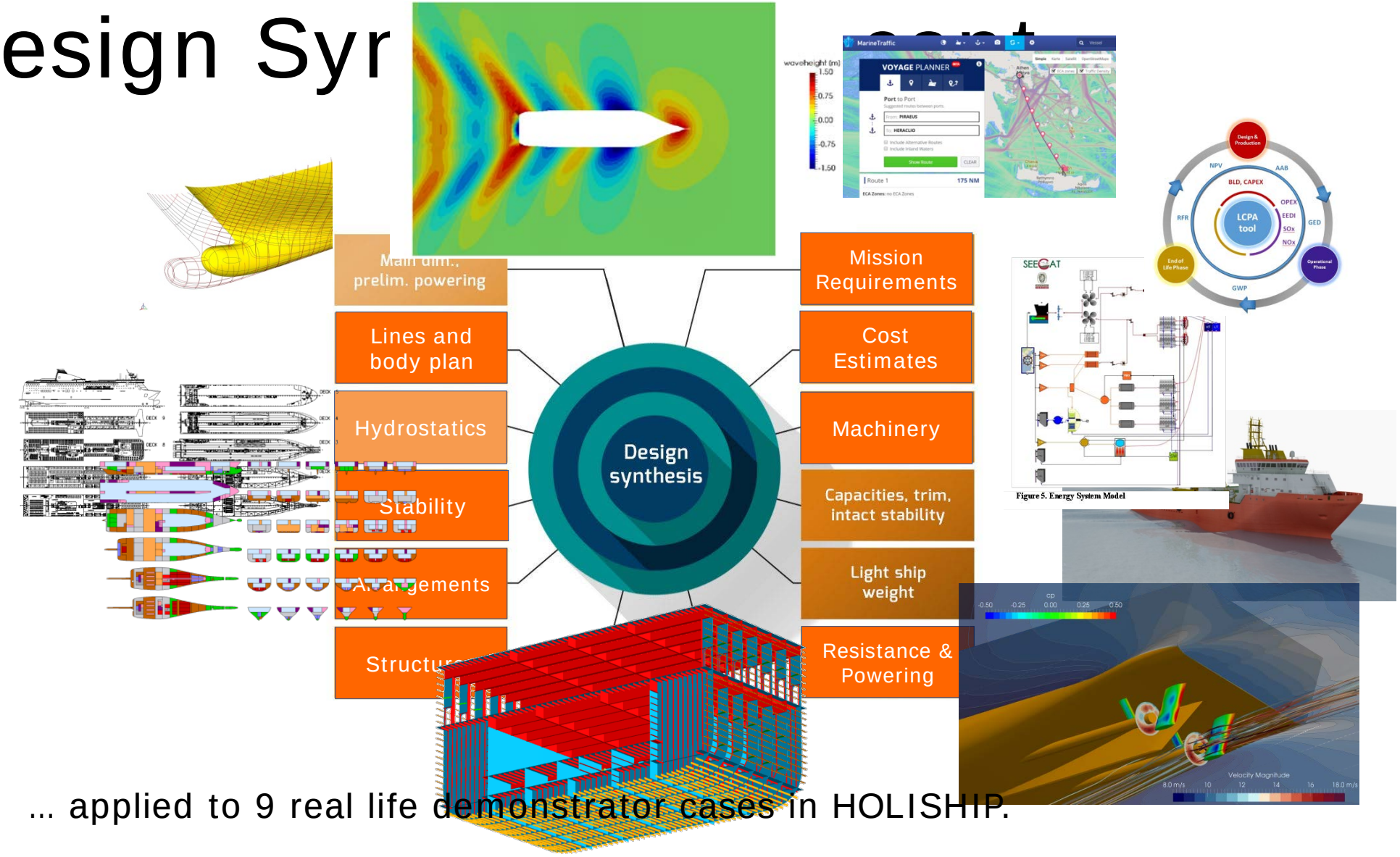
Project HOLISHIP

- 40 Partners
- From 11 EU countries
- Start: 2016-09-01
- Funding: 11.4 M€
- Grant: 689074

Objectives

- Maritime assets / ships, platforms are typically complex one-of-a-kind or small series products.
- Product design needs to reflect constantly extended requirements.
- HOLISHIP responds to urgent industry needs by developing advanced and innovative design methods which …
- integrate all design functional requirements and performance indicators at an early design stage including all relevant (technical) from necessary design disciplines while considering:
  - life-cycle cost,
  - environmental impact,
  - technical and regulatory constraints
- The result will be a set of integrated software platforms for design and optimisation for the entire life-cycle of the product and virtual testing and demonstration.

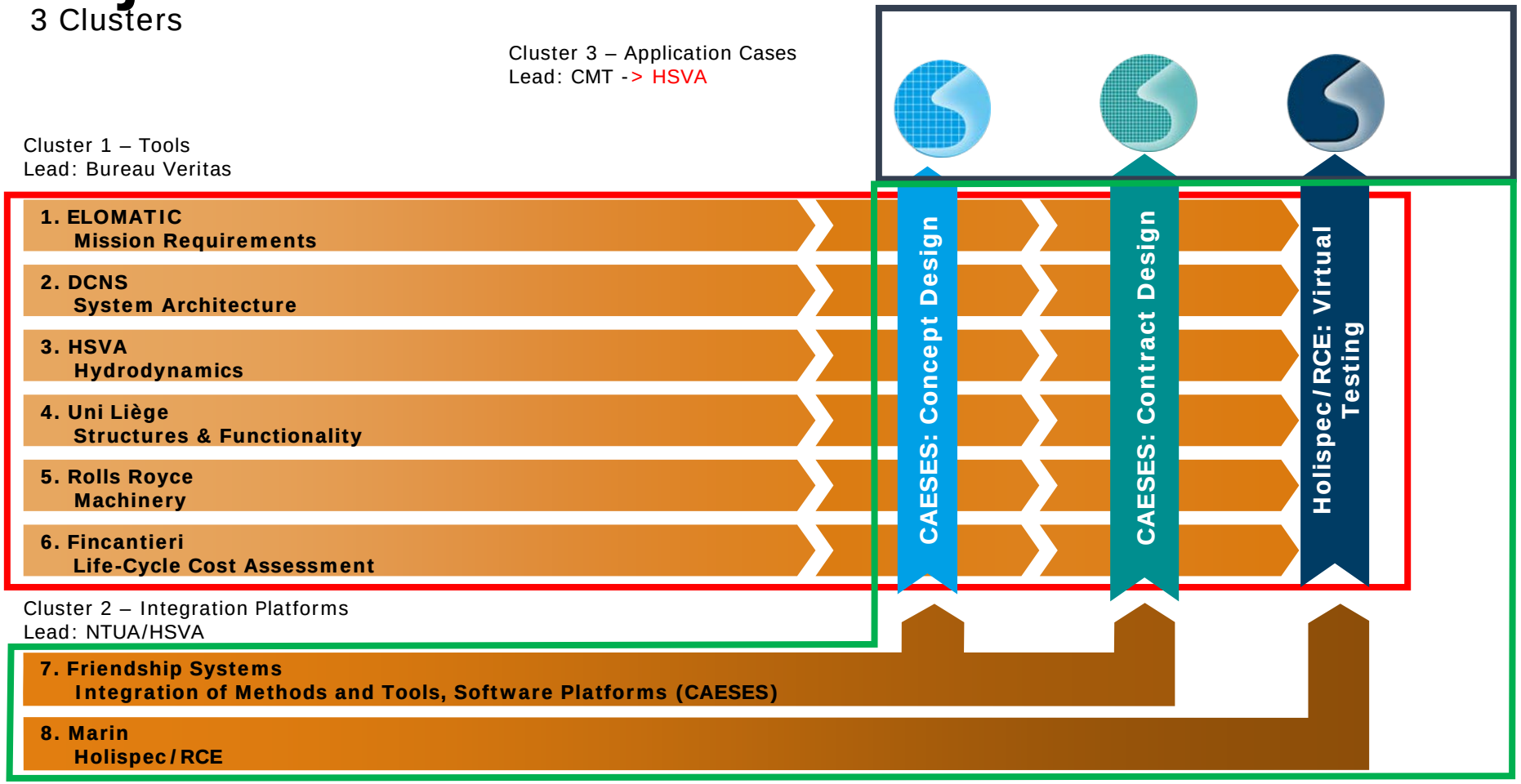
Design Syr



... applied to 9 real life demonstrator cases in HOLISHIP.

Project Structure

3 Clusters



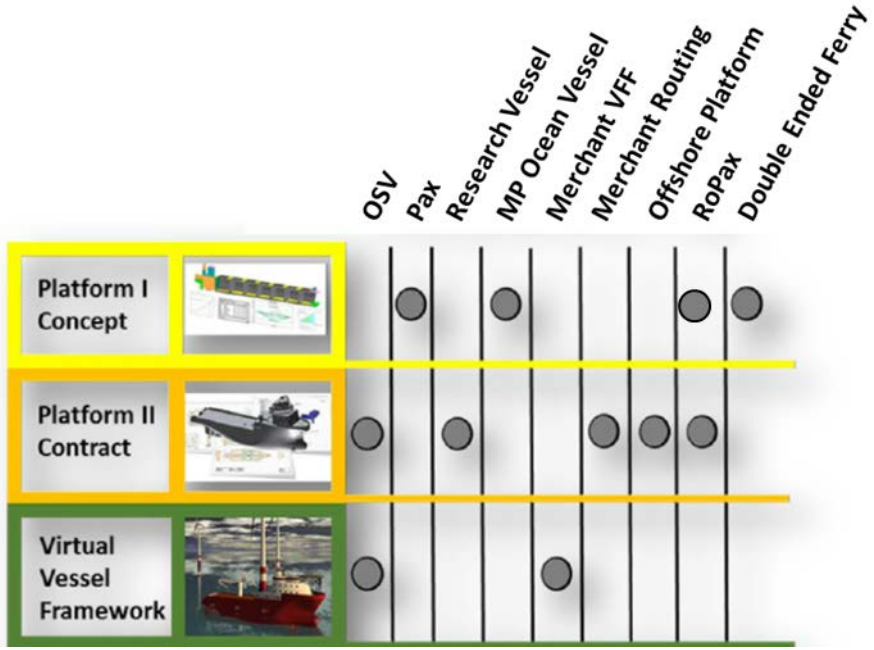
Application Cases – HOLISHIP Demonstrators

1. OSV

2. PAX

3. Research Vessel

4. MP Ocean Vessel



The impact of the tools developed in HOLISHIP will be showcased using 9 different Demonstrators. All of these are characteristic for European Maritime Operations.

5/6. Merchant Vessel

7. Offshore Structure

8. RoPax

9. Double Ended Ferry

Present Status:

Tools integrated in Platforms (so far)

HOLISHIP Platform (concept, contract) (WP 7, Basis: CAESES)

- COSSMOS (by DNV GL): Engine simulation
- HEXPRESS (by Numeca Int.): Grid generation for viscous flow resistance and propulsion simulations
- MATLAB (by MathWorks): Generic mathematics tools, here integrated for resistance and propeller analysis
- Maxsurf Stability (by Bentley): Intact and damage stability analysis, here used for parametric roll analysis (in connection with Microsoft Excel)
- NAPA (by NAPA Oy): General design tool, used, for instance, for damage stability
- NEWDRIFT+ (by NTUA): Seakeeping code for responses and added resistance in waves
- SHIPFLOW (by Flowtech): Resistance and propulsion analysis on the basis of potential flow theory and RANSE simulations
- ShipX (by Sintef OCEAN): Tool for seakeeping and manoeuvring analysis of ships (and platforms)
- ν-Shallo (by HSVA): Calm-water resistance code, used for resistance analysis
- SEECAT (by BV): Engine / machinery simulation

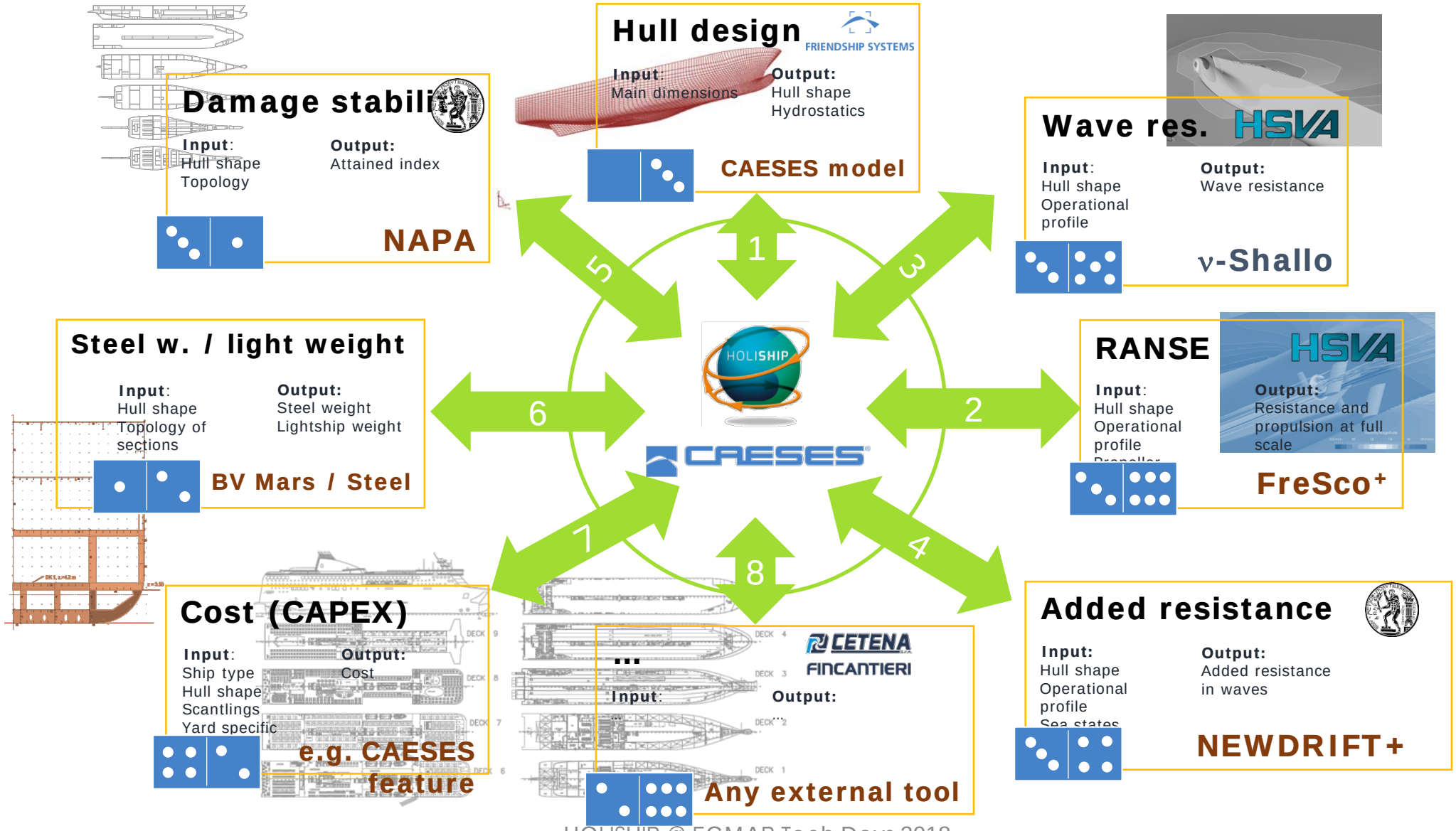
HOLISHIP Platform (VVF) (WP 8, Basis: HOLISPEC/RCE)

- COSMOS (MARIN) - internal vessel arrangement based on Rhino.
- GES (TNO) engineering system simulation tool suite

(Prototype) Tool Integration demonstrated

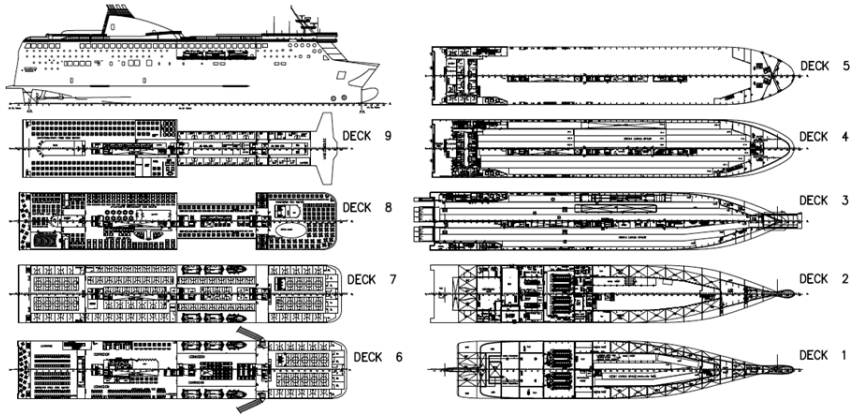
- Tools used in demonstration / RoPAX Application Case
  - Hull Design – CAESES
  - Damage Stability – NAPA
  - Wave resistance & Powering Estimate: ν-SHALLO, *FreSCo*$^{+}$, DB
  - Added Resistance – NEWDRIFT+
  - SEECAT – Energy systems simulation
  - Simplified models for cost, structure, mission req.

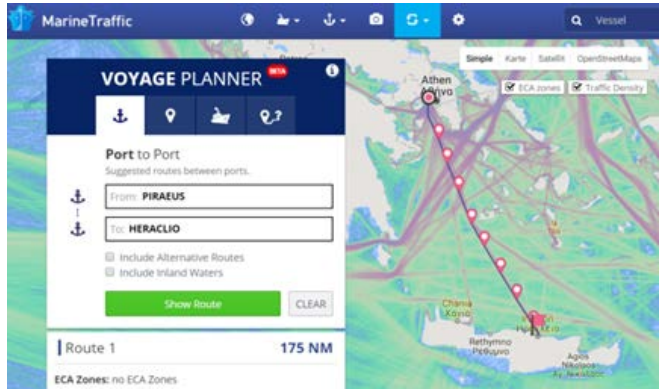
Coupling of tools for RoPAX ferry



What can be achieved?

Effect of Design Optimisation of a RoPAX ferry– Power Requirements





- Hydrodynamic optimisation yields 8.45% power savings over the operational profile.
- Given an annual consumption of 20600 ts of fuel (for 66% utilisation), this translates into …

This translates into 1745 ts fuel savings annually

… and 5584 ts 

less per ship and year.

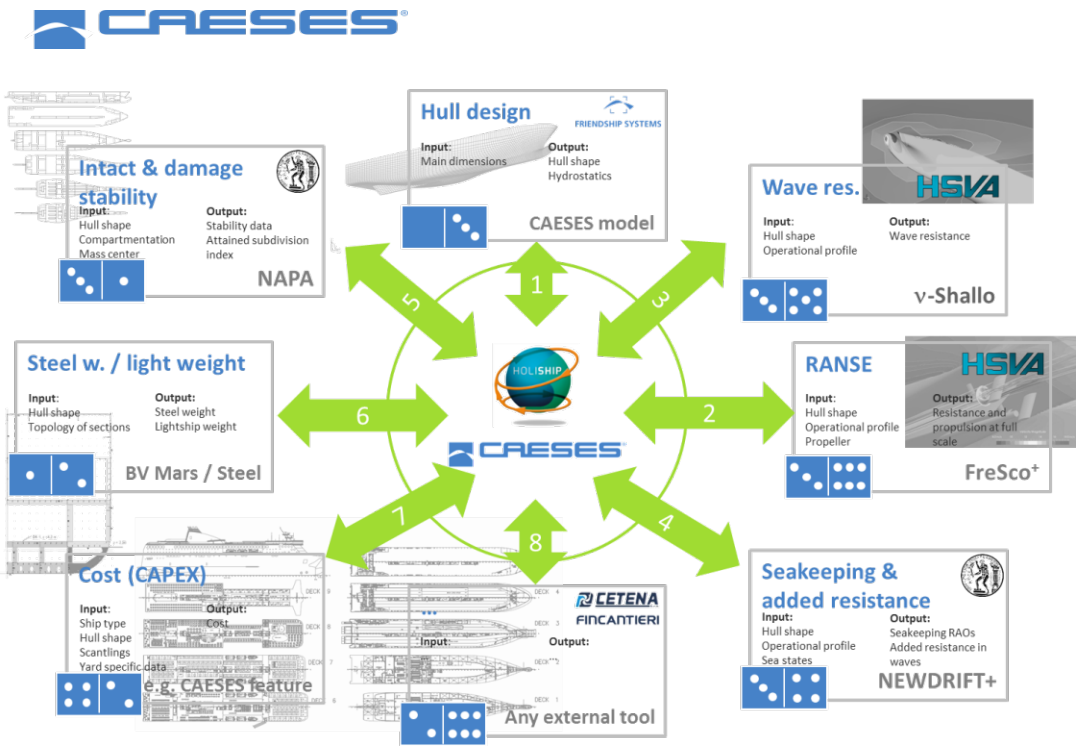
This needs to be considered as fleet level!

Exploitation: Motivation

- It is in the consortium's hands to make the HOLISHIP platform a real standard for the exchange of data and provision of assessment tools within the maritime industry in Europe – let's exploit!

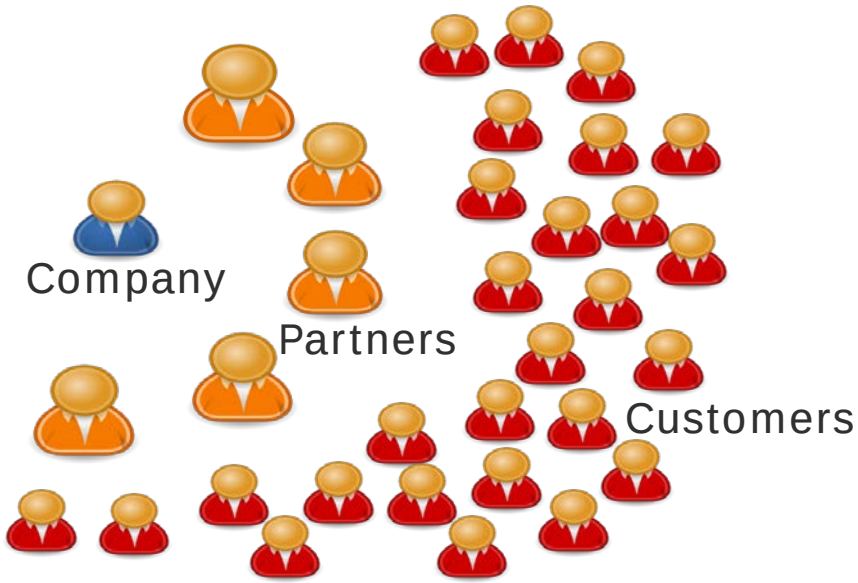
Goals:

- Providing an affordable, well maintained platform to industry, R&D and academia
- Securing maintenance and portability of the platform for many years
- Generating business for partners in their competence domains
- Creating accessibility to high-end technology for non-experts
- Offering services by partners through a public marketplace



Realisation

- Establish a new and independent legal entity that operates the marketplace, markets and licenses the platform and holds a long term OEM license agreement with FSYS
- Grow a partner network of tool and service providers
  - Companies that offer their tools developed on the basis of the platform
  - Companies that offer tools via the web-services of the marketplace
  - Companies that use the platform extensively in-house
  - Companies that want to participate in the business opportunities generated through the platform
  - Make customers of the partners to users of the platform
  - Further increase customer experience and benefits through the platform



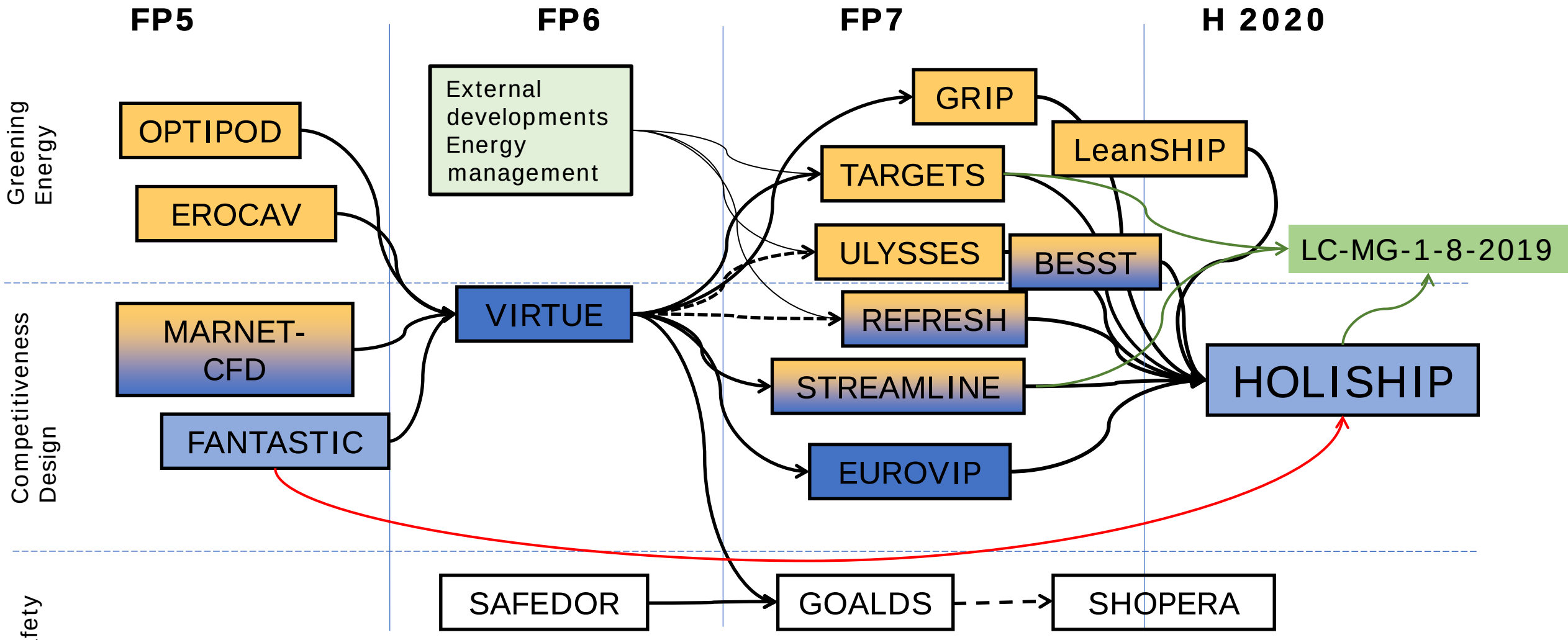
Partners as multipliers

Many users – low cost for the platform

Conclusions

- HOLISHIP set out (in 2016) to develop an integrated, holistic ship design system to cover concept and detailed design as well as operational analysis based on mainly existing s/w tools.
- Today, first prototype integrations have been accomplished in the HOLISHIP Design Platforms.
- The RoPAX ferry example shown will be further detailed in the following presentations from the HOLISHIP project, highlighting also other design disciplines.
- A range of 8 further real life Application Cases will be treated in the following period. An OSV case also shown today will give a feel for the entire range and the relevant design disciplines.
- Exploitation will be an important aspect in the future.
- Most importantly: HOLISHIP does not come “out of the blue”:

Example line of successful developments: Elements of Ship Design



Pre-Requisites are in place for:
Retrofit Solutions and Next Generation Propulsion for Waterborne Transport

Thank you.

Watch this space: **www.holiship.eu**

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