Holistic Ship Design Optimisation
The HOLISHIP Project

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Background

1807

Fulton’s Clermont

1900 +

Steam – shipping becomes the backbone of the world economy
Another 100 years later a similar map displays worldwide emissions caused by shipping operations.

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

Improved Efficiency shall help to resolve the conflict between the two objectives:
- Meet the transport demand,
- Reduce seaborne emissions.

=> Better design for better efficiency:
Intercontinental Shipping is by far the most energy efficient mode of Transport.

... 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 Synthesis Concept

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

3 Clusters

Cluster 1 – Tools
Lead: Bureau Veritas

1. ELOMATIC
   Mission Requirements

2. DCNS
   System Architecture

3. HSVA
   Hydrodynamics

4. Uni Liège
   Structures & Functionality

5. Rolls Royce
   Machinery

6. Fincantieri
   Life-Cycle Cost Assessment

Cluster 2 – Integration Platforms
Lead: NTUA/HSVA

7. Friendship Systems
   Integration of Methods and Tools, Software Platforms (CAESES)

8. Marin
   Holispec/RCE

Cluster 3 – Application Cases
Lead: CMT -> HSVA
The impact of the tools developed in HOLISHIP will be showcased using 9 different Demonstrators. All of these are characteristic for European Maritime Operations.
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)
- v-Shallo (by HSVA): Calm-water resistance code, used for resistance analysis
- SEECArt (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
Tool Integration demonstrated

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

- **Damage stability**
  - Input: Hull shape
  - Topology of sections
  - Output: Attained index

- **Steel w. / light weight**
  - Input: Hull shape
  - Topology of sections
  - Output: Steel weight
  - Lightship weight

- **Cost (CAPEX)**
  - Input: Ship type
  - Hull shape
  - Scantlings
  - Yard specific
  - e.g. CAESES feature
  - Output: Cost

- **Hull design**
  - Input: Main dimensions
  - Hull shape
  - Hydrostatics
  - Output: Hull design

- **Wave res.**
  - Input: Hull shape
  - Operational profile
  - Sea states
  - Output: Wave resistance

- **RANSE**
  - Input: Hull shape
  - Operational profile
  - Propeller
  - Output: Resistance and propulsion at full scale

- **CAESES model**
  - Input: Hull shape
  - Operational profile
  - Propeller
  - Output: Resistance and propulsion at full scale

- **ANY external tool**
  - e.g. CAESES feature
  - Output: Added resistance in waves

- **NEWDRIFT+**
  - Input: Hull shape
  - Sea states
  - Output: Added resistance in waves

- **BV Mars / Steel**
  - Input: Hull shape
  - Topology of sections
  - Output: Steel weight
  - Lightship weight
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](http://www.holiship.eu)

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