Development of modular composite walls in the RAMSSES project

E-LASS meets MariLight – Seminar on Lightweight Applications at Sea
30.01.2020
Atlantic Hotel Universum, Bremen

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MEYER WERFT
PAPENBURG 1795

Agenda

Meyer Werft – The shipyard and its Products

Lightweight design – WHY

EU-Project RAMSSES

Current Status of WP13

- Specifications and Conditions
- Demonstrators
- Design
- Testing

Summary and outlook

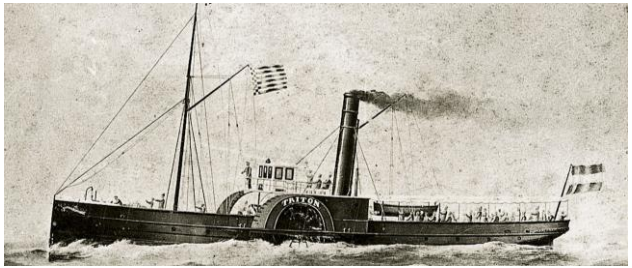
Shipyard History

1795-1841 | Willm Rolf Meyer founded a timber shipyard 225 years ago

1841-1876 | Franz Wilhelm Meyer

1872-1920 | Joseph-Lambert Meyer

Pioneering spirit → iron ships with steam machines



1920-1951 | Franz Joseph Meyer

1920-1924 | Bernhard Meyer

1951-1977 | Godfried Meyer

Production of first gas tankers

1941-1998 | Joseph-Franz Meyer

1985 | Launch of the „Homeric“,

the shipyard‘s first cruise ship

MEYER WERFT today

Since 1982 | Bernard Meyer
Since 2012 | Dr. Jan Meyer
Since 2016 | Tim Meyer
Since 2017 | Thomas Weigend

Array of products - Ship types

Cruise Ships	River Cruise Ships	(Cruise) Ferries	Passenger Ships	Research Vessels
				
Ships: 49 (+ 9)	Ships: 68 (+ 6)	Ships: 32	Ships: 24	Ships: 1

Island Ferries	Gas Tankers	Livestock Carriers	Container Ships
			
Ships: 30	Ships: 57	Ships: 27	Ships: 4

Lightweight design – WHY

Reduction of the ship‘s weight by using fiber reinforced polymers:

- Less fuel/energy consumption
- Less emissions
- Less draught
- Better stability
- More passengers/payload
- More/heavier attractions on the upper deck
- Reduction of maintenance costs
- Improvements of the design possibilities – modern and complex designs are possible
- Functional integration
- Possibilities to react late in the production process to customer wishes

➢ Lightweight design – a design philosophy with increased performance per definition

RAMSSES - Realization and Demonstration of Advanced Material Solutions for Sustainable and Efficient Ships

01.06.2017
31.05.2021

Budget: €13.5 M
Funding: €10.8 M

36 partners
12 countries

www.ramsses-project.eu

Innovative Materials for Ships:

- less fuel and emissions
- efficient and competitive
- safe and comfortable
- smart and functional

All relevant materials and processes

composites | HS steel | Fabrication | Assembly | Outfitting

Properties relevant for approval and customer acceptance

Mechanics | Fire | Corrosion | Noise, vibration | Comfort | Costs | Emissions | LCPA

RAMSSES – MW Work Package
Integration of system for internal walls and superstructure of cruise ships into shipyard processes

Close Collaboration with InfraCore Company, SAERTEX and CMT to:

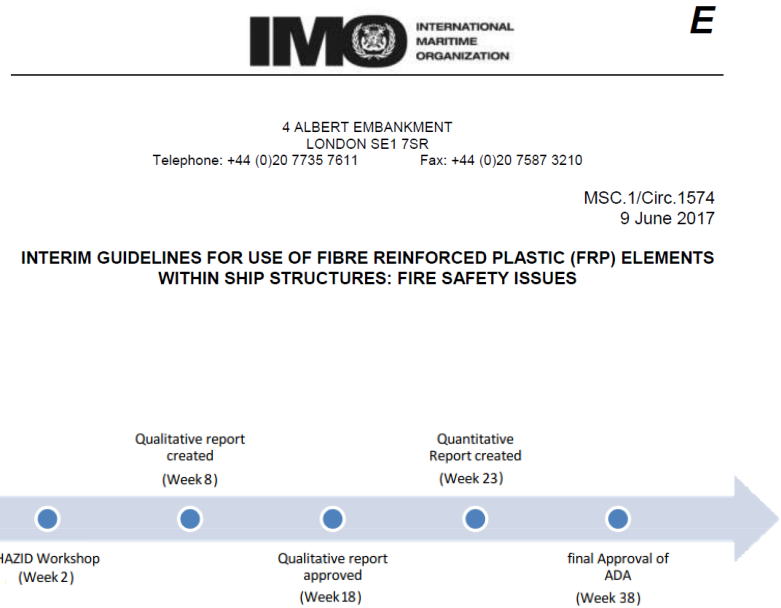
- Develop highly efficient shipyard process for adaptation, assembly and outfitting of a modular system
- Performing numerical and analytical analysis to pass the requirement on the heat insulation, eigenfrequency, deformation, maximum width and weight of the composites wall panels
- Development of a design catalogue for quick assembly and joining technology between steel and composite component for series production
- Assessment of the influence on the production process

➢ Introduction of FRP material into yard production for cruise ships by building onshore and onboard demonstrator

Specifications and Conditions

FRP Interim Guidelines were approved by MSC 98 in summer 2017

- ➢consistent approach is taken with regard to standards of fire safety of ships
- ➢the level of fire safety afforded by the provisions of SOLAS chapter II-2 is maintained
- ➢Guidelines on alternative design and arrangements for fire safety (MSC/Circ.1002, as amended by MSC.1/Circ.1552)
  - ➢ use of performance-based methods – "equivalence principle"
- ➢4 years of time to use this guideline AND provide good, working examples to SDC / MSC



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E

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MSC.1/Circ.1574
9 June 2017

INTERIM GUIDELINES FOR USE OF FIBRE REINFORCED PLASTIC (FRP) ELEMENTS WITHIN SHIP STRUCTURES: FIRE SAFETY ISSUES

Process accepted by flagstate (Week 1)

HAZID Workshop (Week 2)

Qualitative report created (Week 8)

Qualitative report approved (Week 18)

Quantitative Report created (Week 23)

final Approval of ADA (Week 38)

Specifications and Conditions

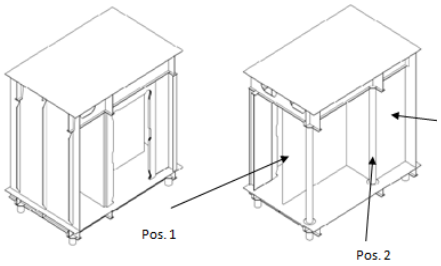
Technical properties:

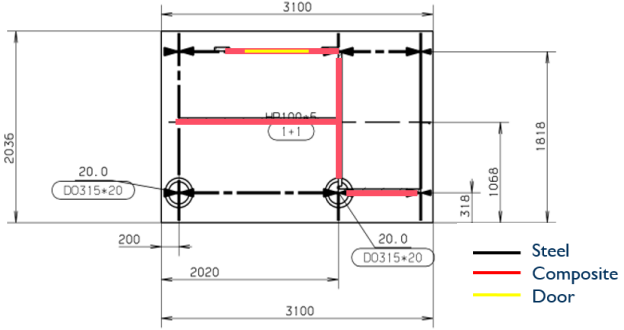
- Accelerations up to 1.5 g
- Fire behavior: 2010 FTP Code Part 2, 5, 10, 11
- Durability against the environment: temperature range -40°C to +80°C and humidity of 95%
- UV and salt water resistant
- Heat / sound insulation and vibration / loadings acc. Ships specification
- Robustness reg. storage and transportation
- Various types of connections, all must provide fire safety properties and no “hot work” disconnectability
- Penetrations and modifications on board without harming worker’s health and specific equipment
- Free of smell after installation

Demonstrators – On-shore

On shore demonstrator:

- Mock-up to assess requirements, especially the connection to the ship structure
  - Composite wall to deck / ceiling
  - Composite wall to pillar
  - T-joint of composite walls / steel wall
  - Butt joint of composite wall to steel wall
  - Corner connection of composite walls / steel wall





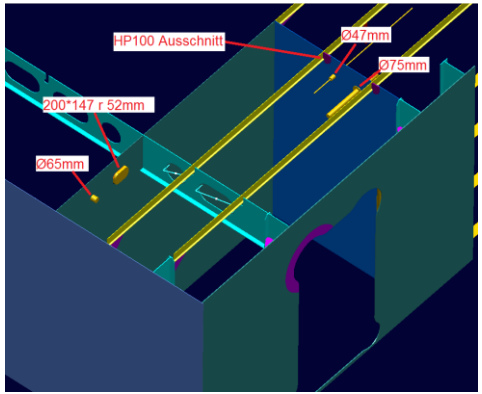
Demonstrators – On-board

Scope:

- Exchanging non load-bearing steel walls which are not able to affect global strength
- Walls are carrying local loads only
- Composite structure is flexible enough to obey the deformation of the ship hull and to bear these deformations

Typical structures are walls of:

- Stores
- Galley / pantry
- Cold rooms
- Technical rooms
- Restrooms
- Superstructures

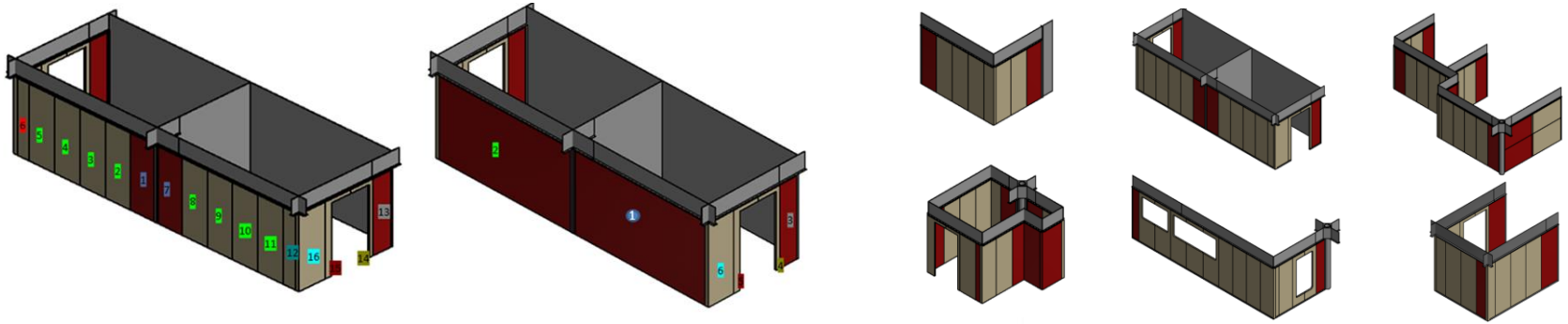


➢ Estimation of a cruise ship with 145.000GT→ 6800m² per ship exchangeable

Design concept

Design:

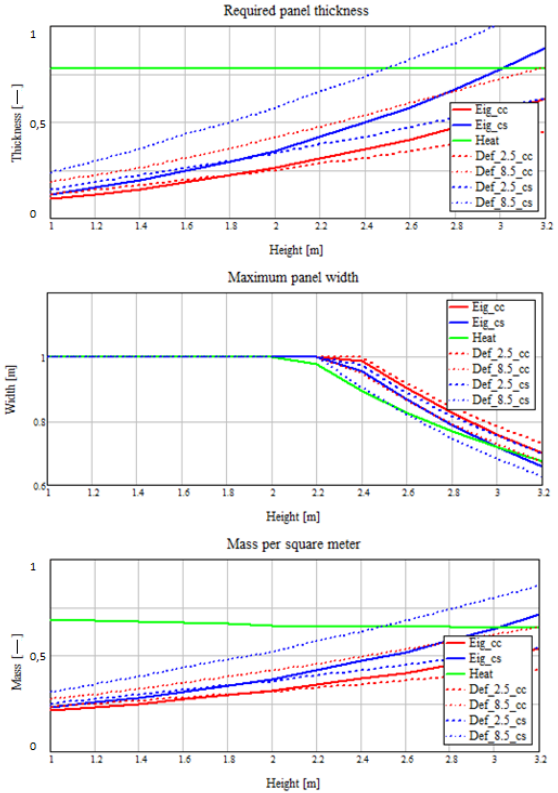
- Modular concept to be able to exchange at least 80% of these walls in a serial production with high potential of standardization
- Standardized & easily to be mounted on-board of the vessel even at a very late stage of production



InfraCore company

Design concept

- Laminate consists of Glass-NCF with Epoxy resin, foam core reinforced by InfraCore Technology and a cork layer
- LEO intumescent layer as the outer protection layer
- Dimensions to ensure late assembly on board (2 persons handling)



Testing

- **Mechanical testing (IFAM):**
  - Density, Reinforcement content & Glass transition temperature
  - Tensile, Compression, ILSS & Shear
  - 80 tests are planned
  - Specimen produced and will be tested Jan/Feb 2020
- **Fire testing (RISE)**
  - ISO 5660-1, cone calorimeter, screening for FRM-test
    - promising values achieved for Part10
  - Part 2, smoke and toxicity
    - HF, HCL, HBr, HCN, Nox, SO2 all OK, but too high values for smoke density Dm and CO
  - Part 5, spread of flame
    - Qsb, CFE & Qp all OK, but Qt value too high
  - Part 10, FRM-test
    - Flashover at 16:35 min
  - Small-scale furnace test, screening for FRD -> Feb. 2020
  - Part 11, FRD-test -> Feb. 2020
- **N&V testing (RISE) -> March 2020**

Impressions Part 10




Impressions Part 10


Summary and outlook

- Design concept & Assembly process is finished
- Assembly process trialed within Part10 test
  - ➢ Panels for On-shore Mock-up in production and will finalize open issues
- Testing is taking place at the moment (mech. + fire)
- Good progress of the material combination to fulfill fire testing requirements
- BUT: Material still requires „fine-tuning“
  - ➢ Further screening tests to determine final stack-up and combination

- Presentation to the owner (on-shore demonstrator)
- Approval process (AD&A) to be started as soon as all issues are cleared
  - ➢ Installation of on-board demonstrator

THANK YOU
FOR
YOUR ATTENTION

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