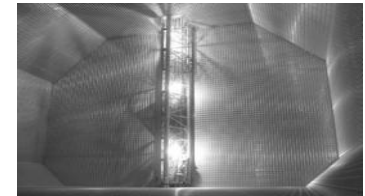




# Membrane CCS for LPG Carrier

**INTERTANKO**



04/04/2017

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Excellence

Innovation

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Transparency

# Disclaimer

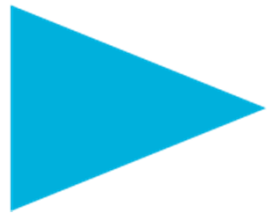
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# Agenda

- ▶ **GTT presentation**
- ▶ **GTT technology presentation**
- ▶ **GTT services**





# GTT Presentation



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# GTT in brief

## ▶ Profile

- ▶ A leading engineering company
- ▶ Expert in liquefied gas containment systems
- ▶ More than 50-year track record

## ▶ Activities

- ▶ Designs and licenses membrane technologies for containment of liquefied gas during shipping or onshore and offshore storage
- ▶ Provides design studies, construction assistance and innovative services

## ▶ ~ 380 highly qualified people<sup>(1)</sup> worldwide

(1) As at 31<sup>st</sup> March 2016



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# Membrane references for multi-gas

## Pythagore (Ethylene)

630m<sup>3</sup> Mark I CCS  
owned by Gazocéan



## Ben Franklin (LPG)

120,000m<sup>3</sup> Mark I CCS  
owned by Gazocéan

## Descartes (LPG)

50,000m<sup>3</sup> Mark I CCS  
owned by Messigaz



## Annabella (LPG)

35,000m<sup>3</sup> NO82 CCS  
owned by Chemikalien Seetransport



## Shinryo Ethylene Maru (LPG)

1,100m<sup>3</sup> Mark I CCS  
owned by NYK

**GTT has provided designs for sea transport  
of Ethylene and LPG**



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# Membrane on-going projects with LPG

## ▶ Shell FLNG for Prelude

- ▶ Two-row Mark III : 6 LNG tanks with a total capacity of 220,000m<sup>3</sup>
- ▶ Two-row Mark III : 4 LPG tanks with a total capacity of 90,000m<sup>3</sup>



Shell Prelude FLNG, Australia, featuring two-row MkIII membrane CCS

## ▶ Reliance LEG/LPG Carriers

- ▶ 4 Mark III tanks with a total capacity of 87,000m<sup>3</sup>
- ▶ Designed for multiple gases (possibility to transport 2 different gases during the same voyage) : Ethane, Butane, Propane, Propylene

**Underline GTT's competitiveness of its containment systems for transporting different types of cryogenic liquid gas**



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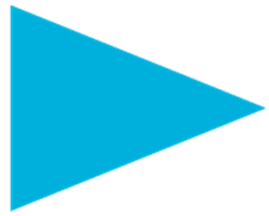
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# GTT TECHNOLOGY PRESENTATION



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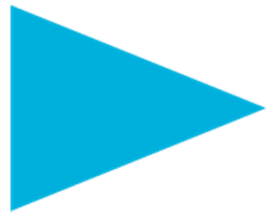
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# MEMBRANE CCS



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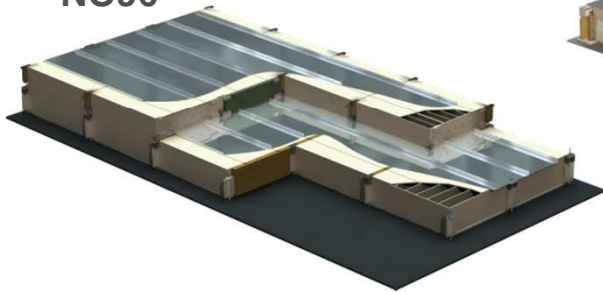
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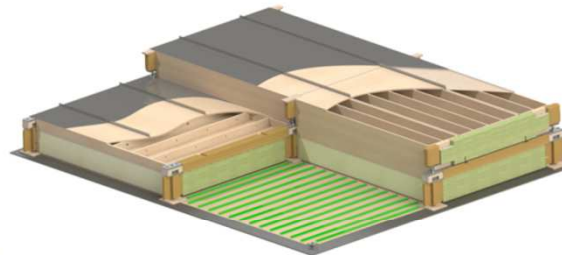
# The existing Membrane solutions

- ▶ Technologies optimized for LNG transport

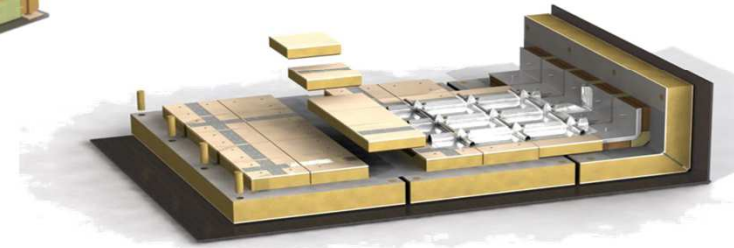
NO96



NO96-L03



Mark III & Mark III Flex



- ▶ Already suitable for multi-gas transport
  - ▶ But need to be adapted to reach other markets

**New CCS development to address the specific needs of the LPG market**

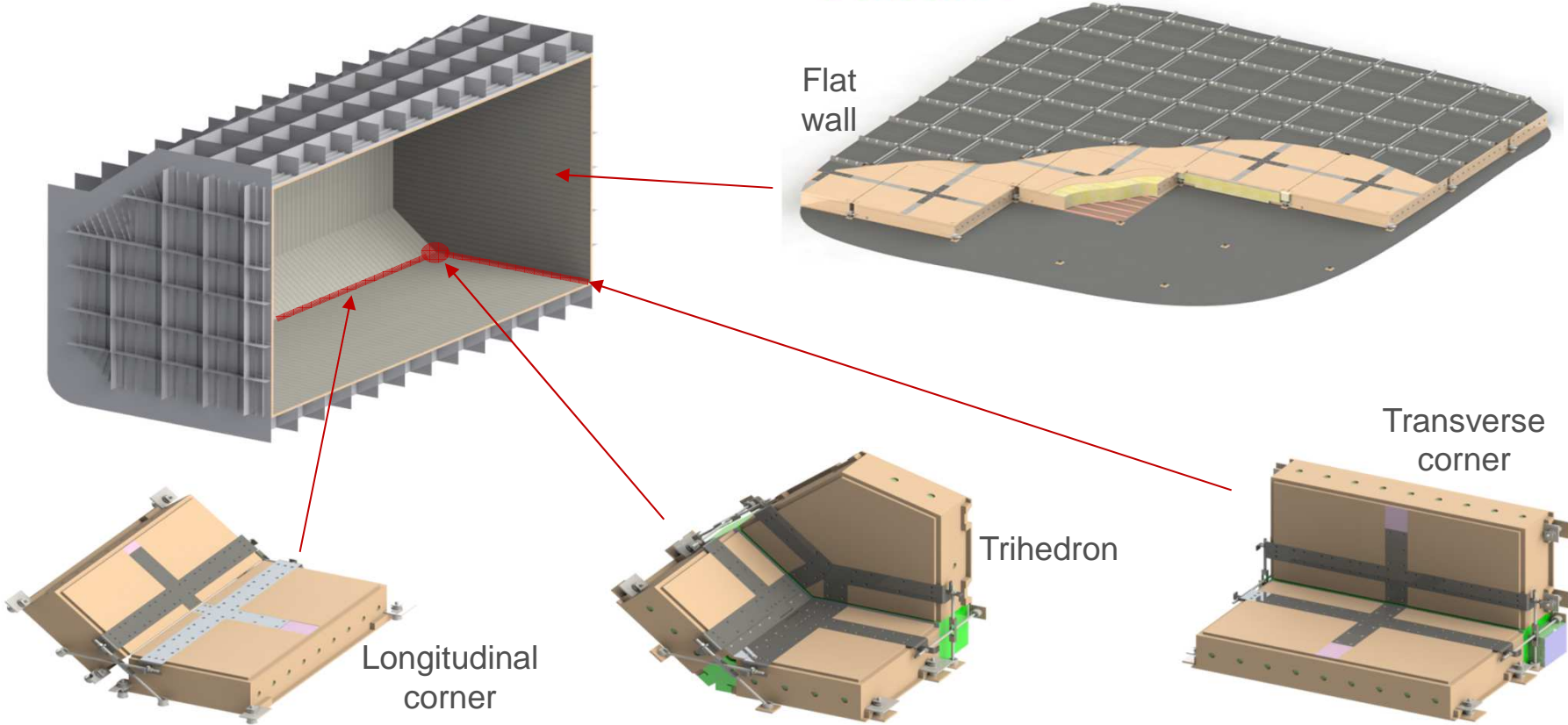
# Our new solution for LPG transport

- ▶ **GTT's sea proven solutions for Butane, Propane, Propene, Butadiene, ...**
  - ▶ Membrane CCS
    - ▶ Temperature at primary barrier level > **-55°C**
    - ▶ Liquid density < **700kg/m<sup>3</sup>**
  - ▶ **Reduced construction cost** and planning for Shipyard
    - ▶ Simplification of CCS design
    - ▶ Standardization of CCS components
  - ▶ **Reduced operational costs** for Shipowner
    - ▶ Optimization of operation duration
    - ▶ Reduction of lightship weight

**Same performance and reliability  
as GTT's LNG technologies**



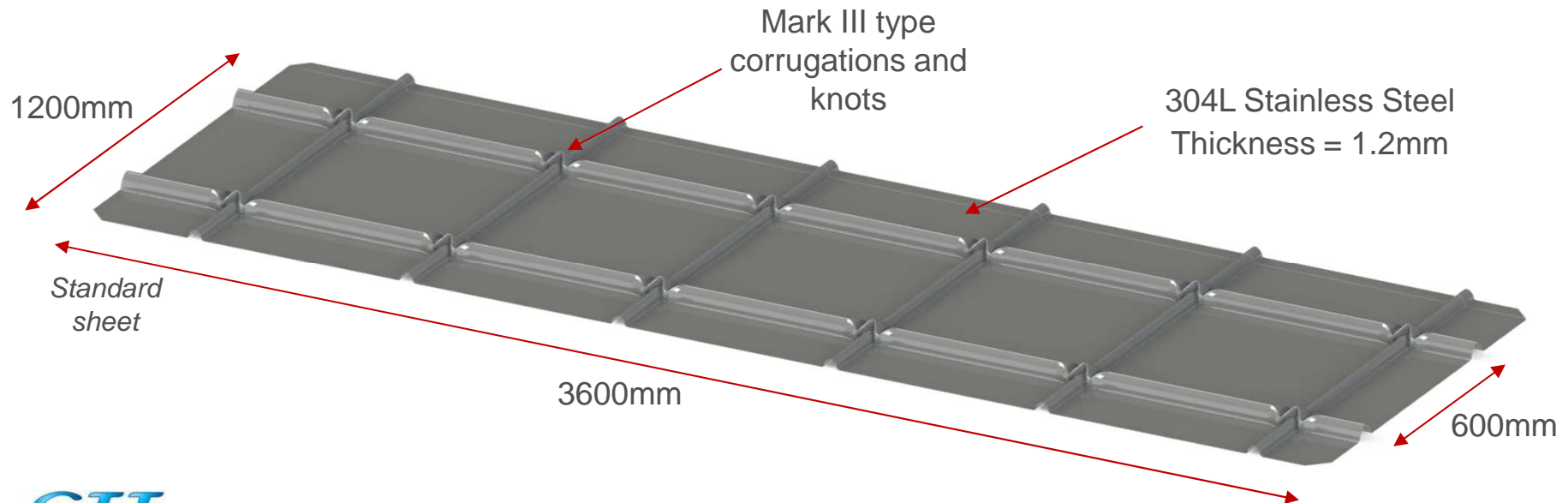
# Membrane CCS for LPG Carrier



# CCS basis of design (1/2)

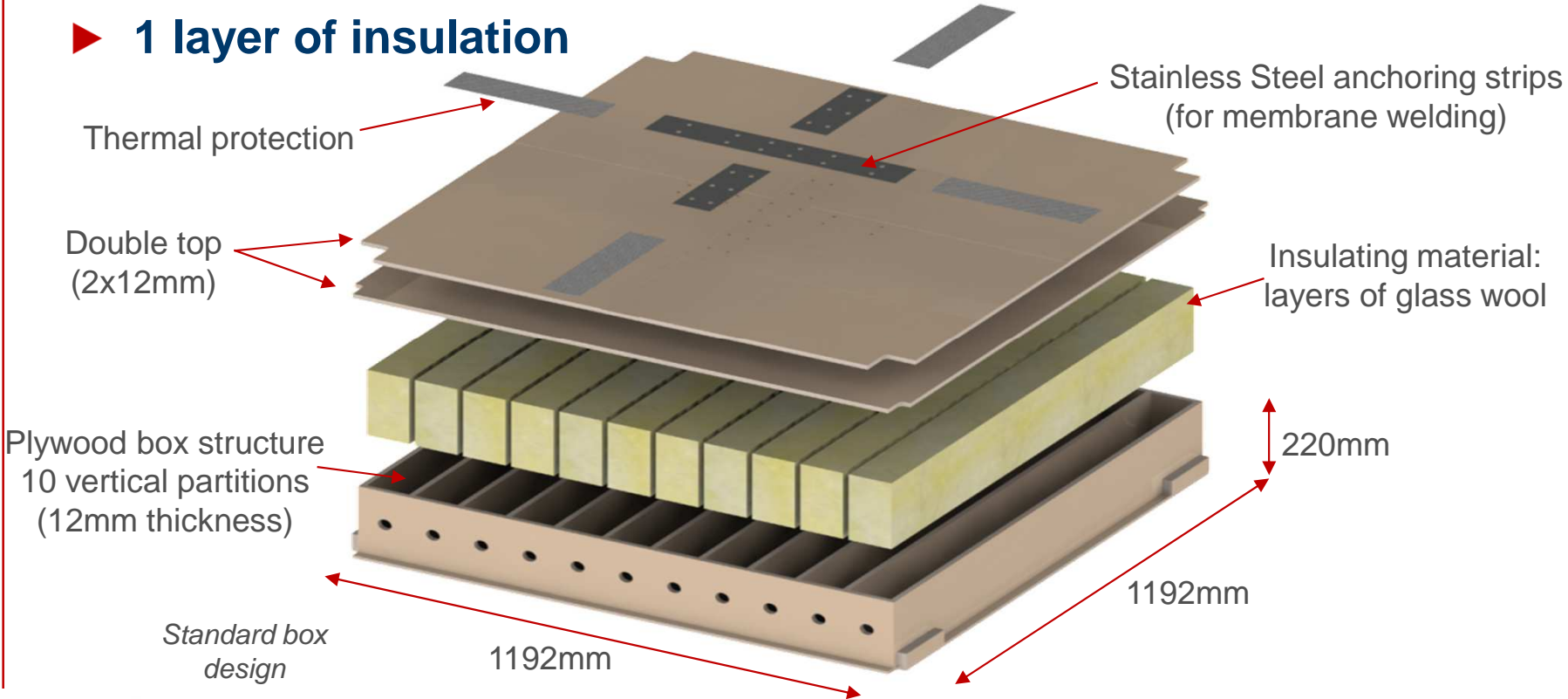
## ▶ Single membrane system

- ▶ Primary barrier: corrugated stainless steel
- ▶ Secondary barrier: inner hull



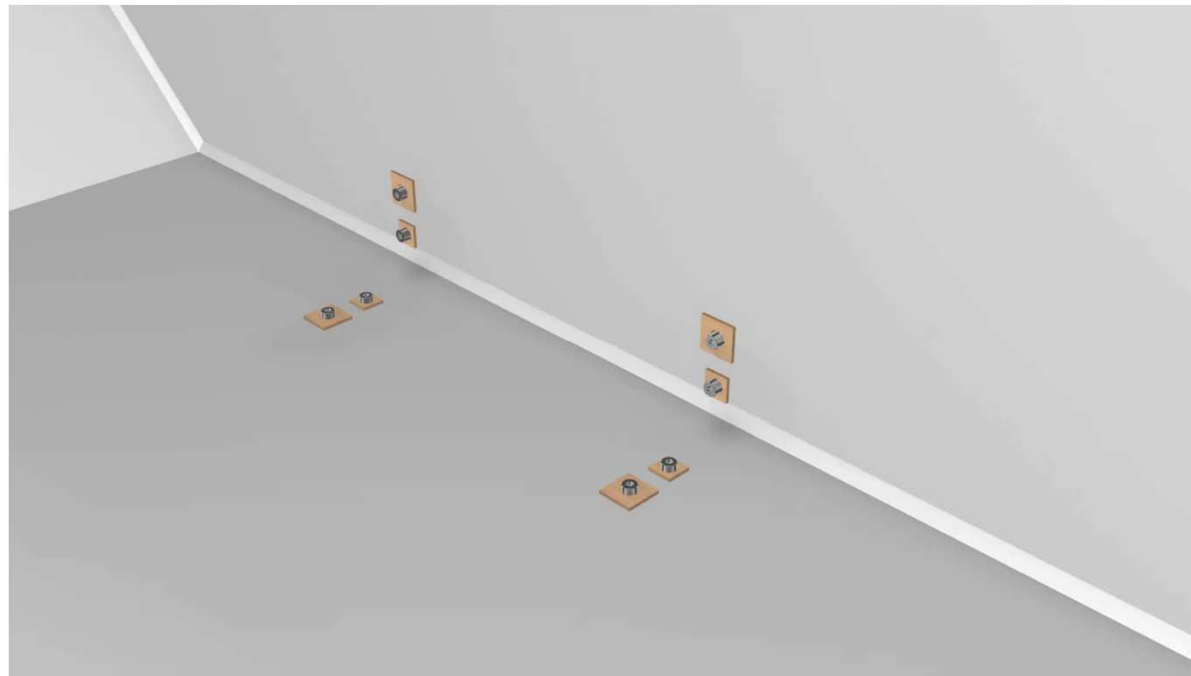
# CCS basis of design (2/2)

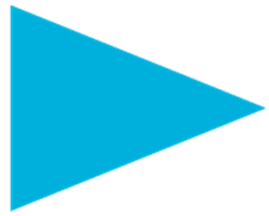
## ► 1 layer of insulation



# Tank corners

- ▶ Based on standardized border boxes





# GTT'S VALUE PROPOSAL



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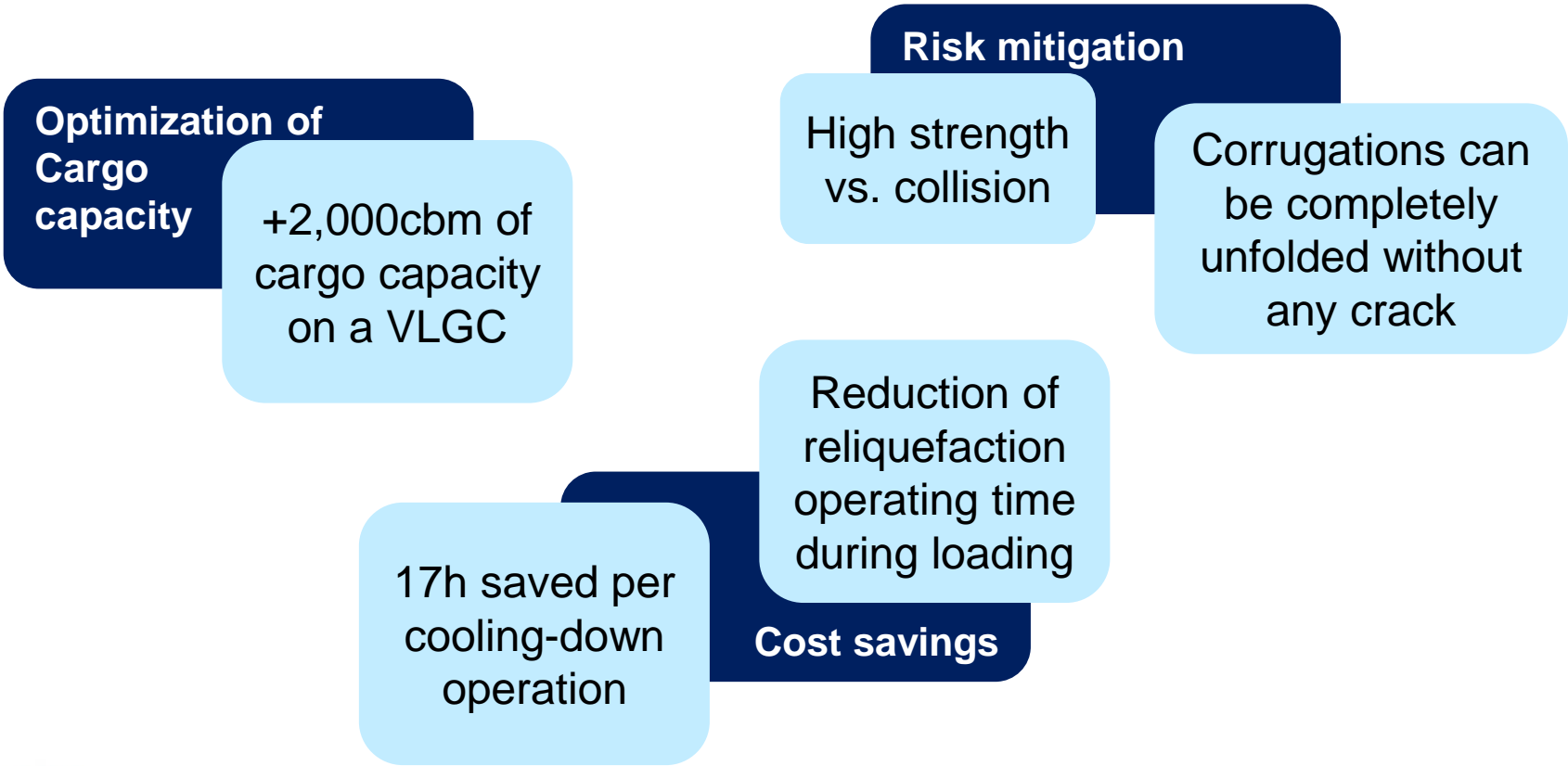
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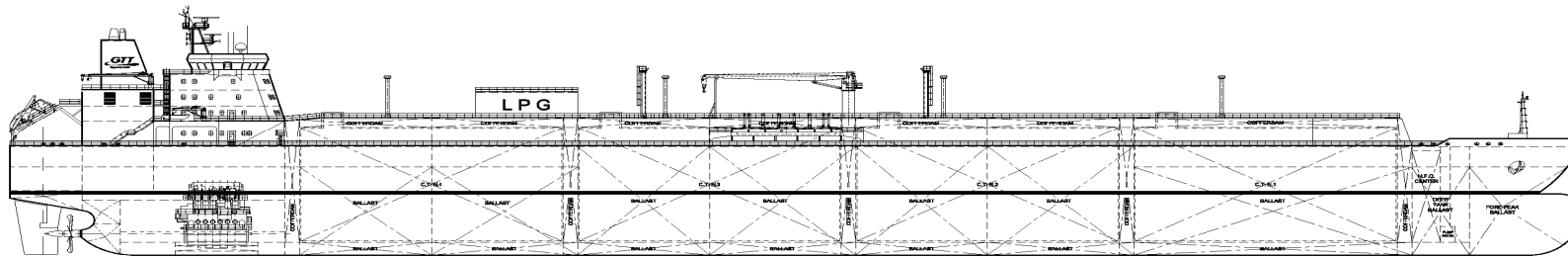
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# GTT's value proposal



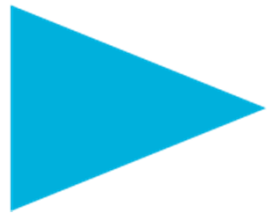
# Example of ship application

## ▶ GTT's Membrane 91k ship design



- ▶ Same design restrictions as a typical VLGC
  - ▶ Length O.A.: 228.6m
  - ▶ Design draft: 11.8m
  - ▶ Breadth: 36.6m
  - ▶ Service speed: 16.5Kn
- ▶ Cargo capacity adjusted on liquid's density
  - ▶ For propane (SG=0.58): **91,700m<sup>3</sup>**
  - ▶ For propene (SG=0.62): 86,000m<sup>3</sup>
  - ▶ Constant draft of the ship





# Conclusion



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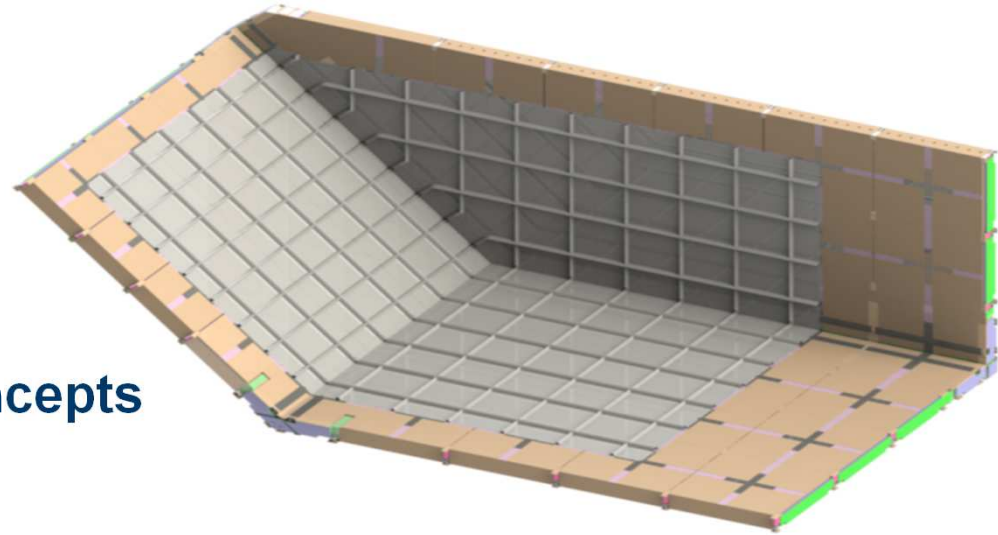
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# Membrane CCS for LPG Carriers

- ▶ **Innovative CCS design**
- ▶ **Based on sea proven concepts**
- ▶ **The coming steps: 2017**
  - ▶ Industrialization of the technology
  - ▶ Mock-up in a Shipyard
  - ▶ General Approval by Classification Societies



# Key features of the Membrane

Low impact of the CCS on the LSW



High strength versus collision

Low heat capacity

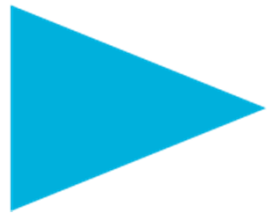


Reduced cooling down time



Not sensitive to thermal shock





# GTT SERVICES



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## Performance & optimisation services

- ▶ **GTT Training** programmes and simulation software: provide high quality, specialist technical training, focusing on CCS and the operations
- ▶ **G-Sim** simulation monitoring software offers a complete simulations of all on-board systems for the management and handling of cargo and proper vessel maintenance

**GTT's follow-up all along the ship life**



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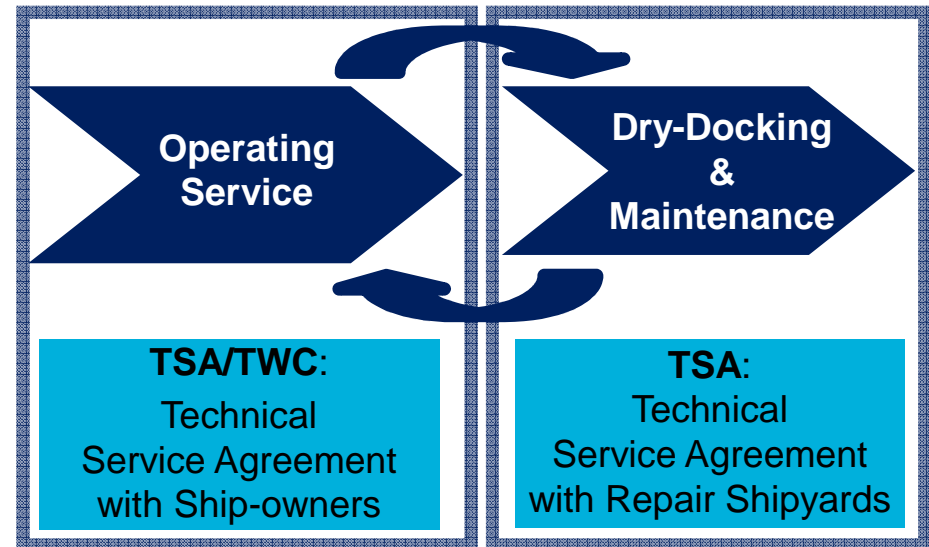
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# Assistance & Intervention

- ▶ **HEARS** (Hotline Emergency Assistance & response Service) for shipowners and their crew to contact GTT's specialists 27/7 to report any incidents and get support
- ▶ **GTT On Site:** assistance of the co-contractors with the maintenance of ships by the shipyards; GTT provide technical expertise as well as maintenance and repair procedures to be followed under its supervision



# GTT Supported Repair Shipyards (20)



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# Thank you for your attention

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