
# LNT A-BOX® for large-scale LNGCs

LNT Marine • January 2024

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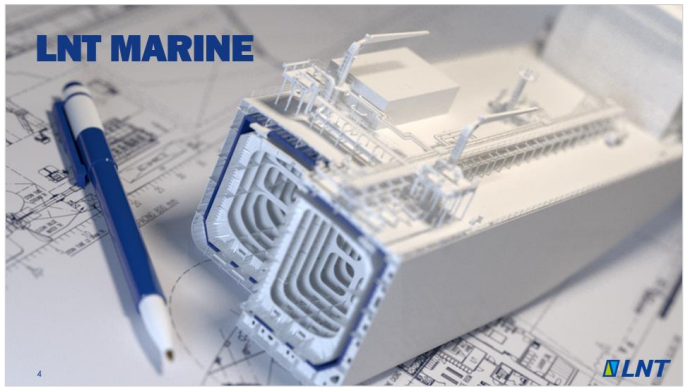
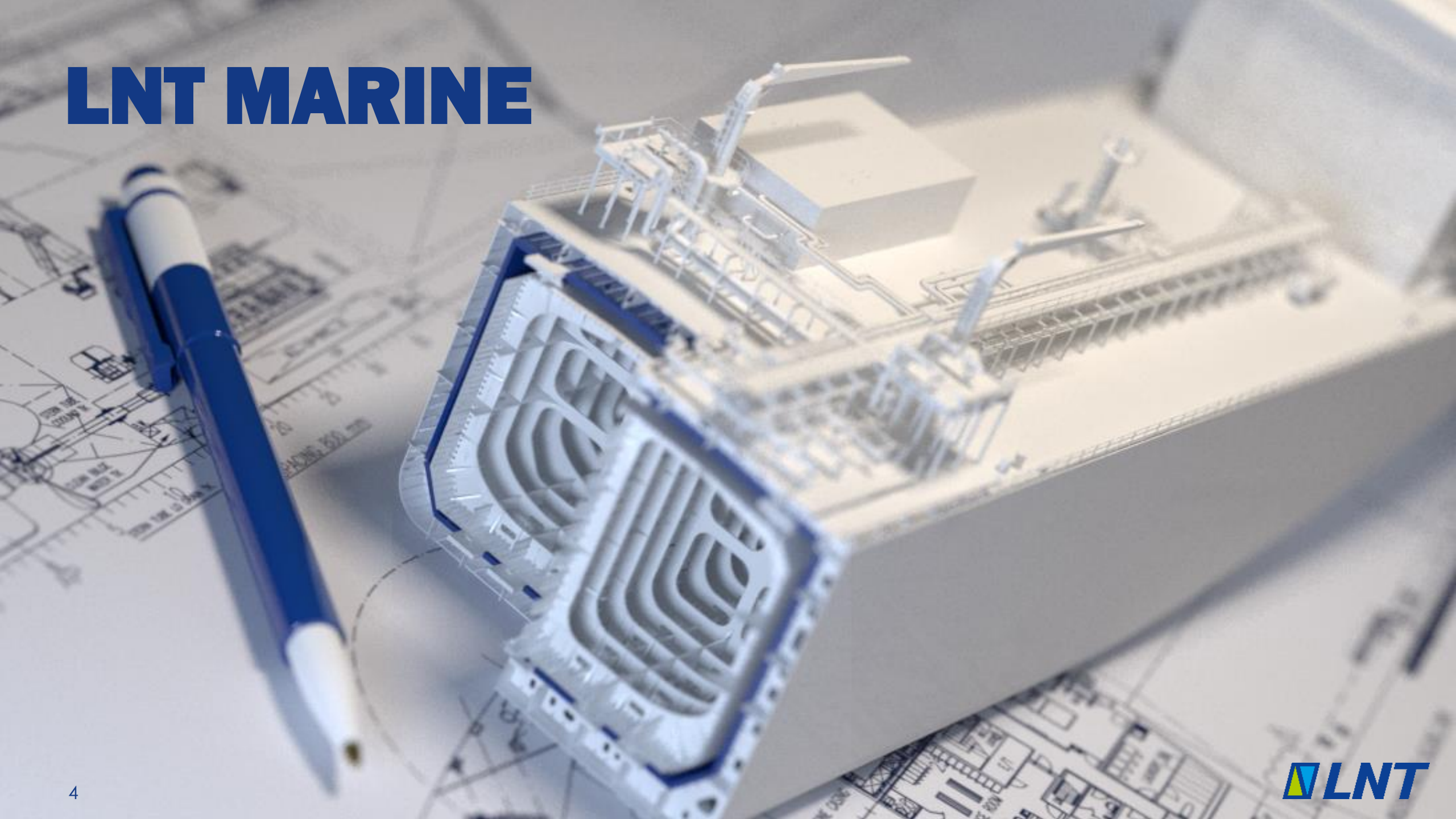
# SECTION OVERVIEW







# LNT MARINE



# LNT MARINE

Enabling Efficient Storage & Transportation of Energy

**What we do**

- **LNT Marine** is a technology and service provider specialized within **liquified gas tanks** and **cryogenic insulation**.
- We develop technology and provide **design & engineering**, **supervision** and **support** as well as **contracting services**.

**Business segments**

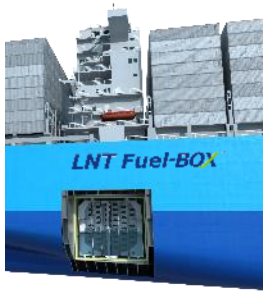
**CARGO CONTAINMENT**

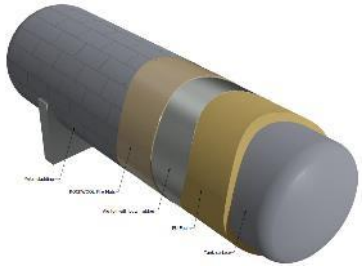
**LNG + NH3 FUEL**

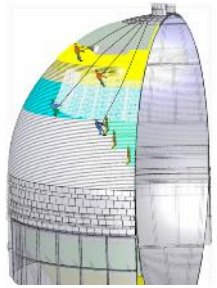

**GAS CARRIER INSULATION**

**Repair services**

**Products & services**



# TRACK RECORD

LNT Marine has a long history and solid track record on delivering a broad range of complex projects and solutions.

**44**
LNG FUEL TANKS

**9**
SMALL SCALE LNGCS

**1**
LNT A-BOX® TYPE LNGC

**18**
MOSS TYPE LNGC REPAIRS

**11**
REEFERS

**1**
JUICE CARRIER







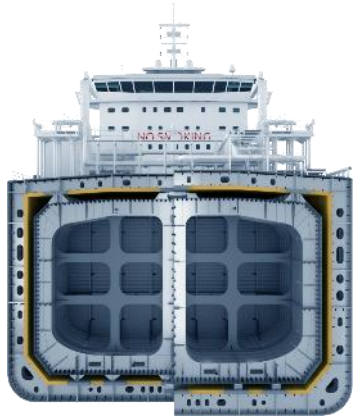


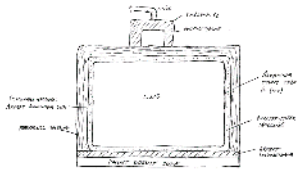


# DEVELOPMENT & COMMERCIALIZATION

LNT A-BOX® from idea to prototype to commercialization

*Since its inception, LNT Marine and its predecessors, have spent the majority of its resources including proceeds from running business to develop and commercialize the LNT A-BOX® technology*





The idea

2006

MGI Established

2009

Insulation AiP

2010

LNG New Technologies Established

2011

1st IPR priority date

2012

MGI THERMO MGI+ThermoService merger

2013

1st system AiP

2014

Successful mock-up

2015

1st LNT A-BOX contract

2016

LNT Merger & rebranded LNT Marine

2017

Preparing for commercialization

2018

1st Gastech presentation

2019

Technology award

2020

Green ship award

1st vessel delivered

2021

HoA IOCs

Large-scale LNGC design

2022

175k AiP

2023

*Start-up / R&D*

*Pilot project & building company*

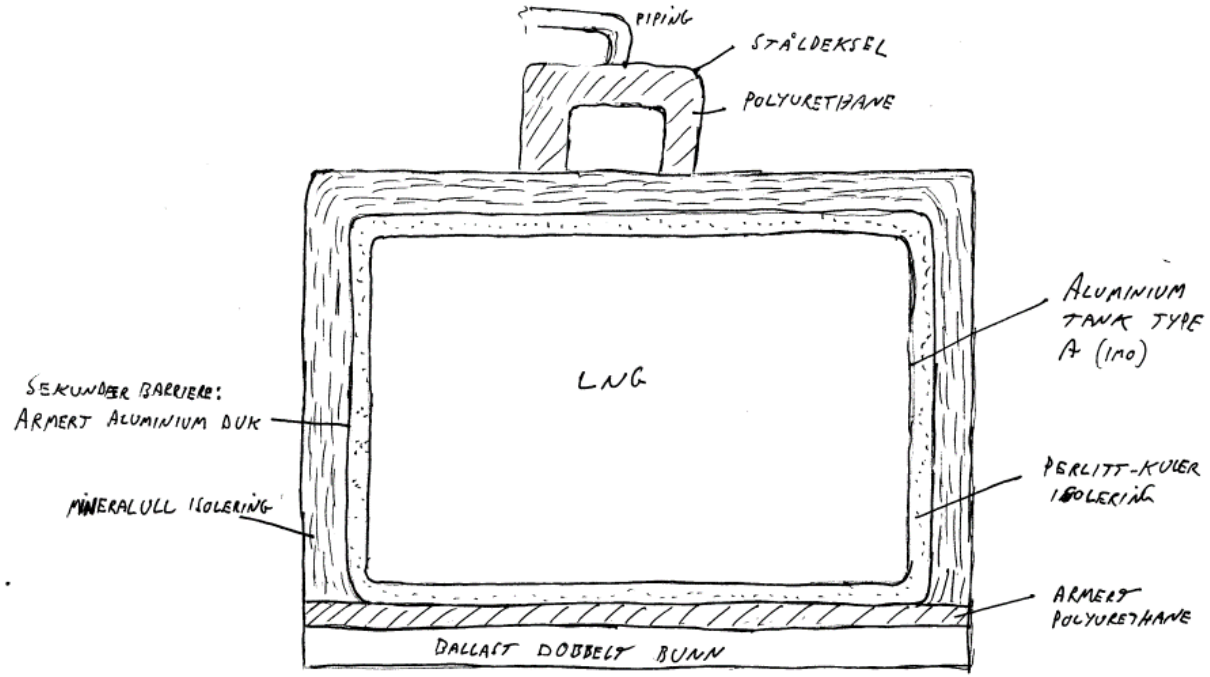
*Ramp up*

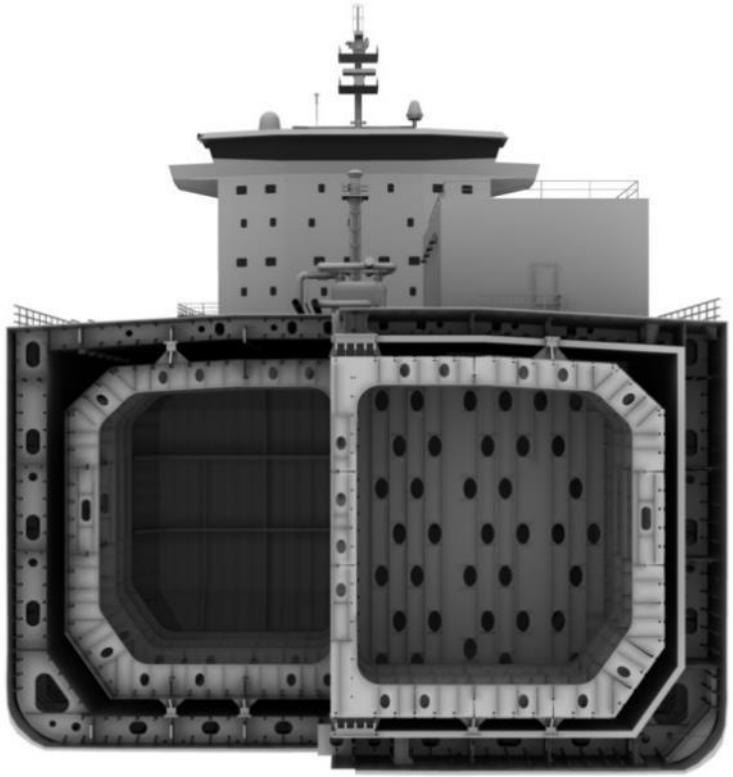
*COVID-19 pandemic*

# LNT A-BOX®

# LNT A-BOX® – THE IDEA

- Develop a simple and efficient cargo containment system for medium to large scale LNG.
- A system that can enable more shipyards to build the LNG carriers.



# THE FIRST LNT A-BOX® TYPE CARRIER

The idea, from concept to reality – LNT A-BOX®


**Ship:** LNG Jia Xing (ex. Saga Dawn), a 45,000m$^3$ LNG carrier

**Builder:** China Merchants Heavy Industry (Jiangsu)

**Delivered:** January 2020

# LNT A-BOX® – SUCCESSFUL PROOF OF CONCEPT

The first LNT A-BOX® type vessel, the 45,000m$^3$ LNG carrier LNG Jia Xing (ex. Saga Dawn)

- The first LNT A-BOX® type LNG carrier, the 45,000m$^3$ "LNG Jia Xing" ex- "Saga Dawn", was delivered in 2020 and has traded successfully in Southeast Asia since then.
- She has frequented a number of different terminals, including large-scale LNG liquefaction plants, STS from re-export hubs and medium-scale import terminals.
- The vessel also carried part-cargos at around 50% loading and received cargos via ship-to-ship transfer from conventional-size LNG carrier.
- The cargo system has proven its flexibility and operated without any issues. Feedback from owners, charterers and crew has been very positive.
- The performance is within specifications, and the cargo containment system has proven to offer very stable temperature during all operations.

# LNT A-BOX® CHARACTERISTICS

*An un-insulated IMO independent tank type A in an insulated hold space.*

1. **PRIMARY BARRIER**
   Self-supporting IMO independent tank type A

2. **INSULATION & SECONDARY BARRIER**
   Liquid tight insulation system acting as full secondary barrier

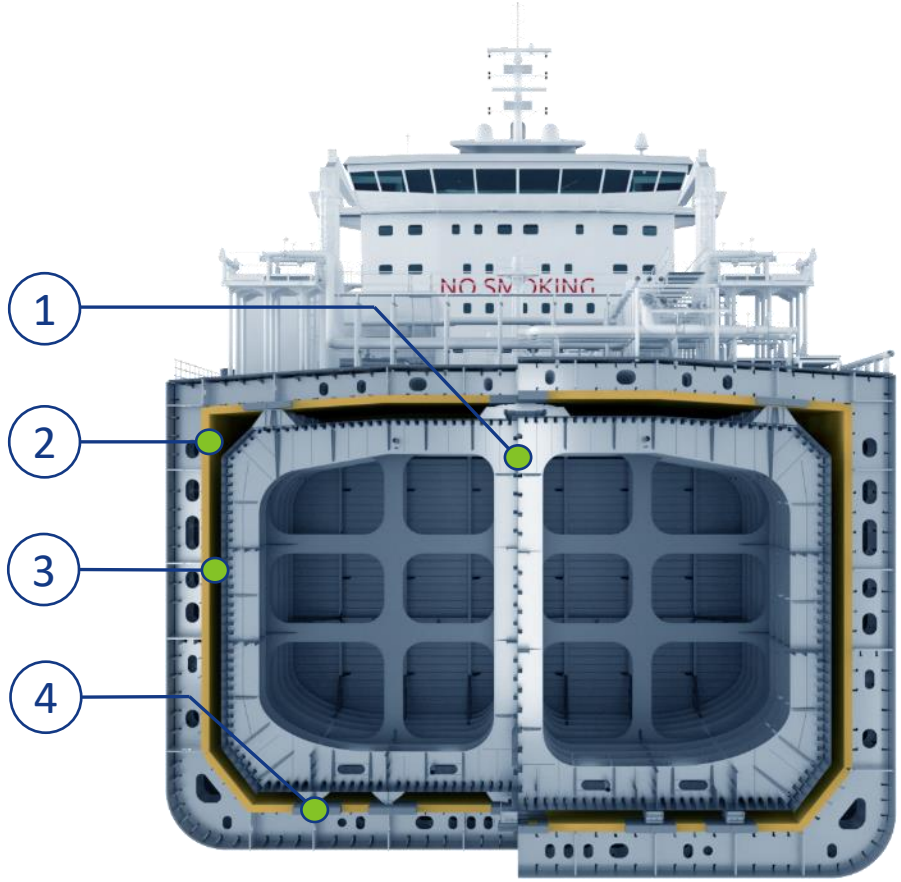
3. **INTERBARRIER SPACE**
   Accessible space between tank and insulation

4. **CARGO TANK SUPPORT SYSTEM**
   Preventing bodily movement of the tank



# LNT A-BOX®

**Flexible | Efficient | Robust**

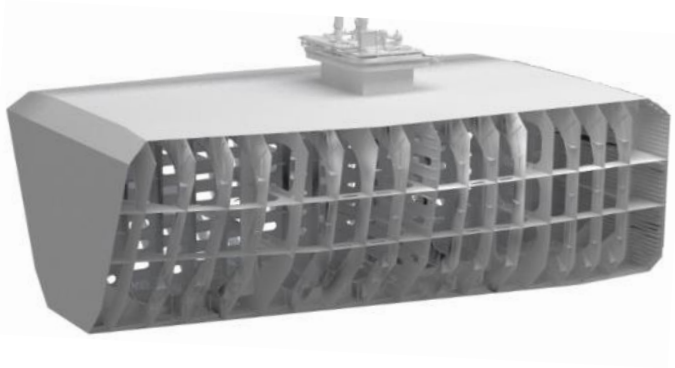



***LNT A-BOX® offers safe and reliable storage and transportation of LNG in bulk.***

LNT

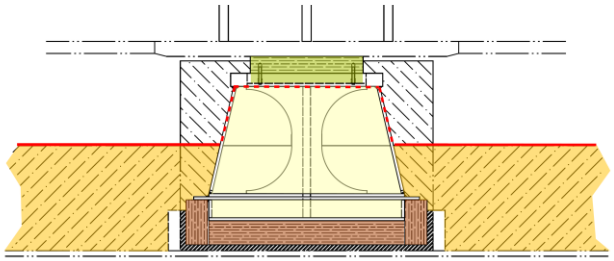
# LNT A-BOX®

System elements and key-characteristics



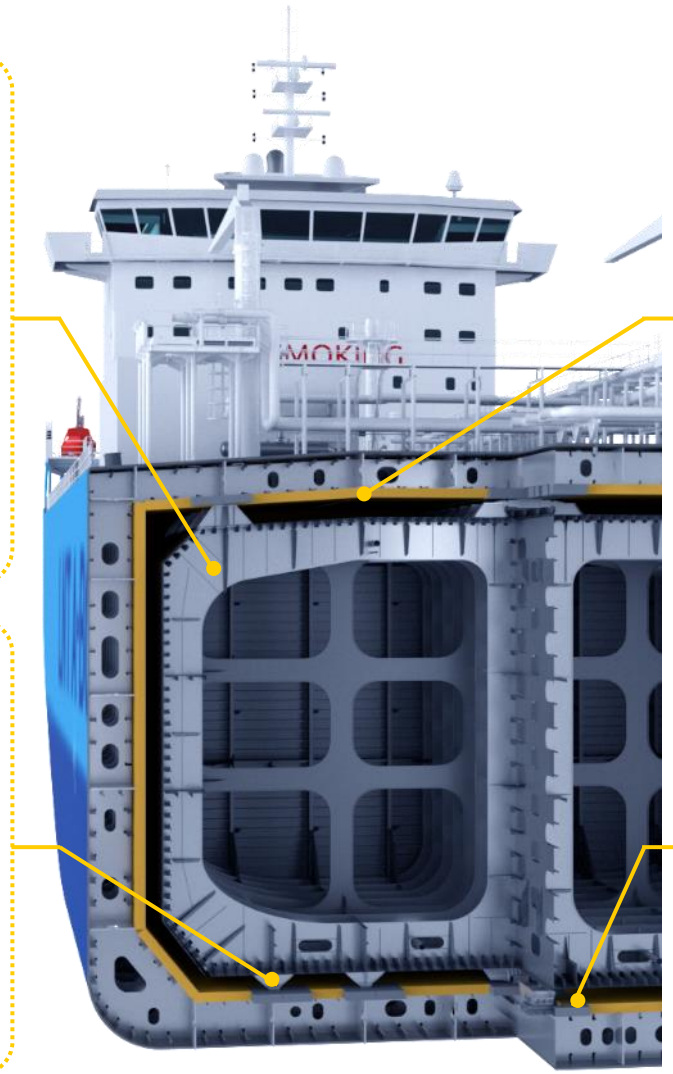
**Cargo tank:**

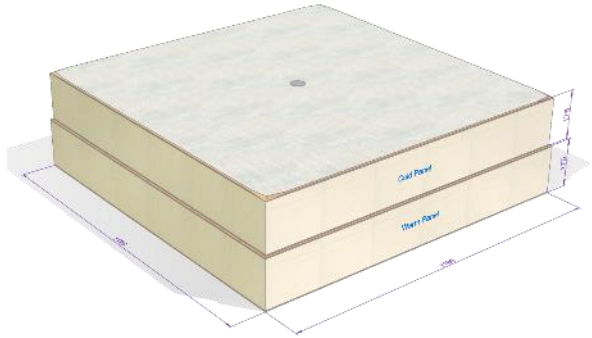
- IMO independent tank type A
- Made from stainless steel, 9% nickel or aluminum



**Tank support system:**

- Thermal break and preventing bodily movement.
- Made from tank material and laminated wood.



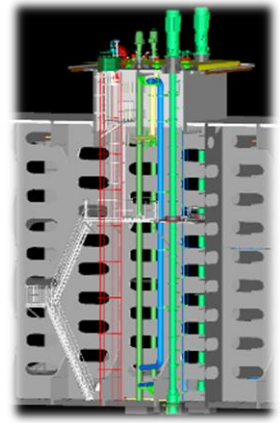


**Insulation & secondary barrier system:**

- Two layers of polyurethane foam panels
- Reinforced aluminum sheet as secondary barrier

**Safety & auxiliary systems:**

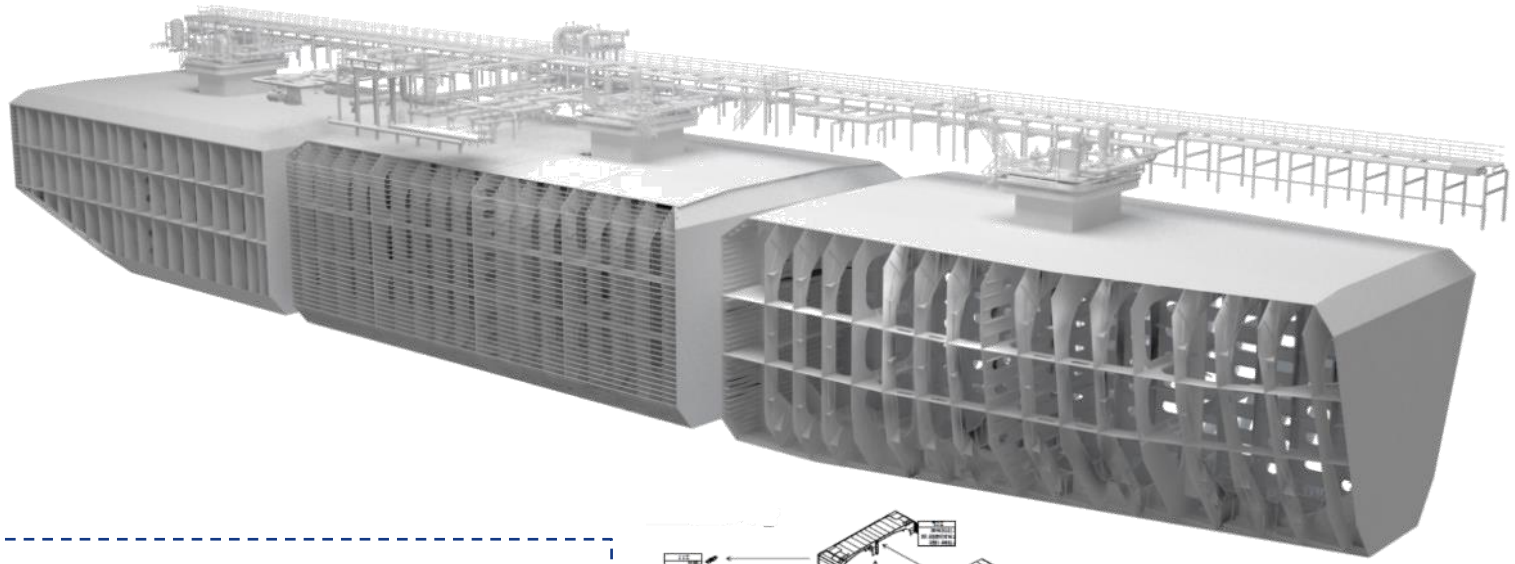
- Arrangement & access
- Atmosphere control (N2)
- Gas detection
- Sounding & alarm
- Bilge systems
- Instrumentation & monitoring



# IMO INDEPENDENT TANK TYPE A

The simplest design according to IMO IGC Code


IMO



**Building friendly**

Type A tanks are constructed primarily of flat surfaces and designed according to classical ship structural procedures

**Qualified yards**

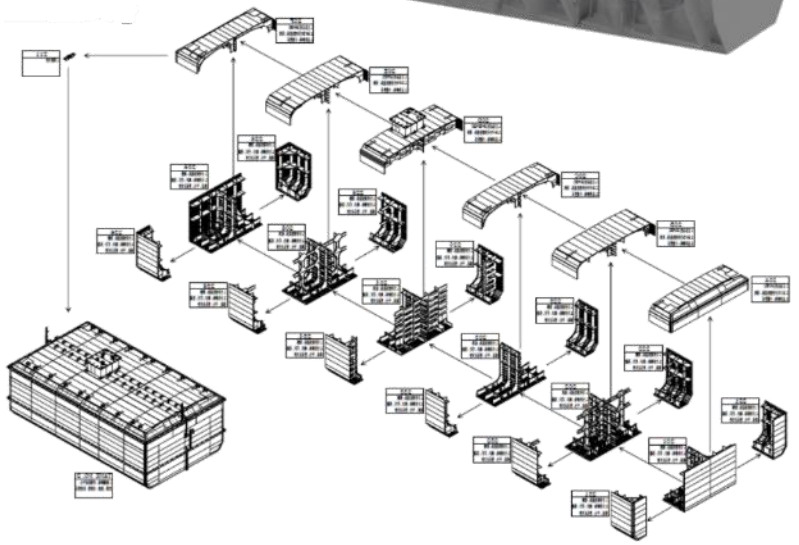
Limited infrastructure requirments at building yard

**Qualified workers**

Reasonable welding and construction requirements

**Flexible**

Type A tanks can be designed and built for various densities, design pressure and material grades



# TANK TYPE A – KEY FEATURES

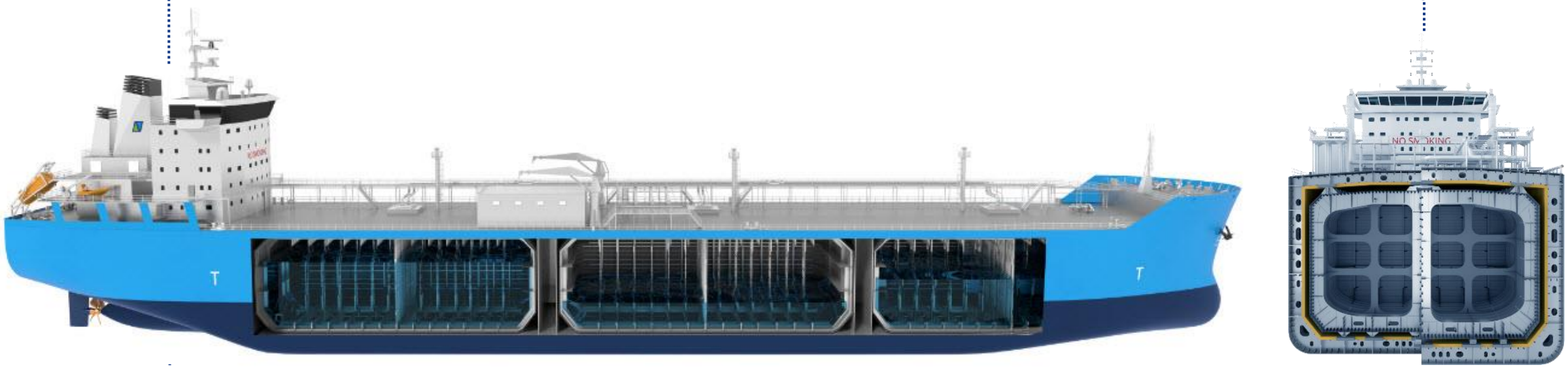
*Independent tank*

*Enabling parallel building activities*

*Prismatic shape*

*Flat deck layout*

*High volume utilization*



*Self-supporting tank structure*

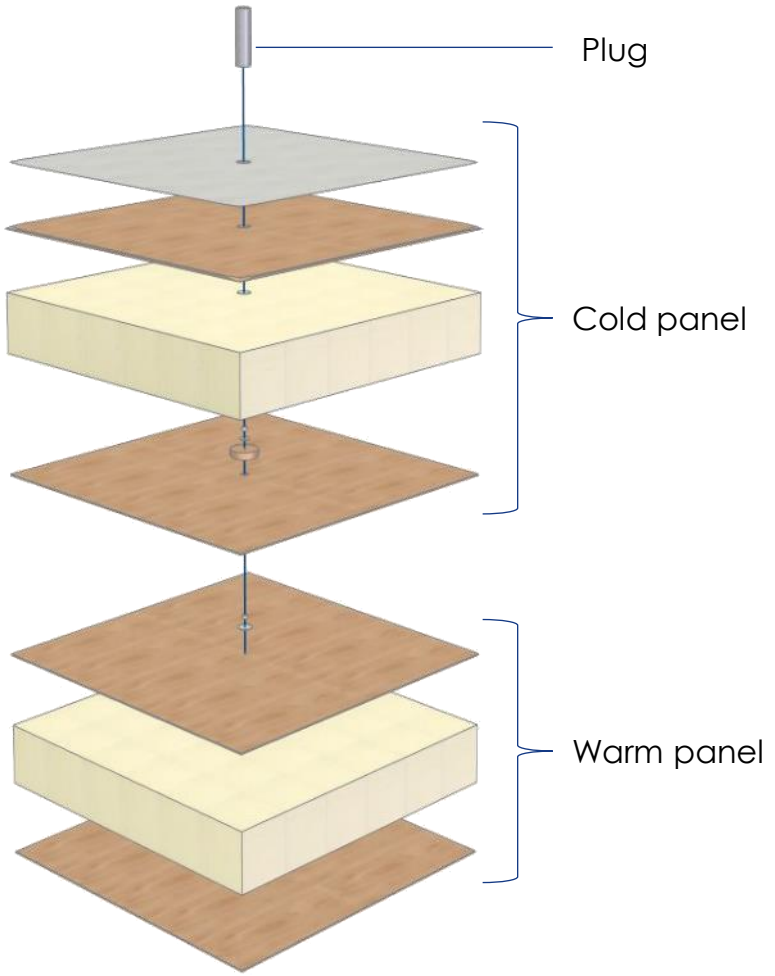
*Internal structure preventing sloshing*

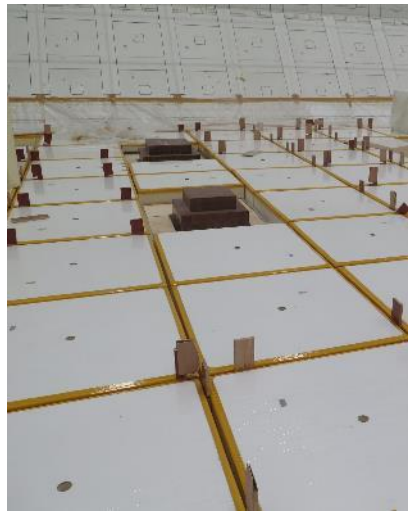
*No filling restrictions*

# INSULATION & SECONDARY BARRIER

A proven panel system

- **Insulation system with full secondary barrier**
  - Two layers polyurethane (PU) panels with plywood on both sides
  - Panels secured to inner hull plating with stud-bolt and an anchoring system
  - Secondary barrier: Alu foil w/ glass-fiber reinforced mesh clothing, bonded to panel surface
- **Managing movement: Hull deflection and thermal expansion/contraction**
  - Panels are fixed in their center point
  - Flexible joints
- **Density of PU foam**
  - Nominal density 40 kg/m3 (optimal thermal density)
- **Thickness/BOR**
  - 45K: 350mm BOR 0.15%
  - 174K: 400mm BOR 0.07%
  - Flexibility to meet customized BOR demand



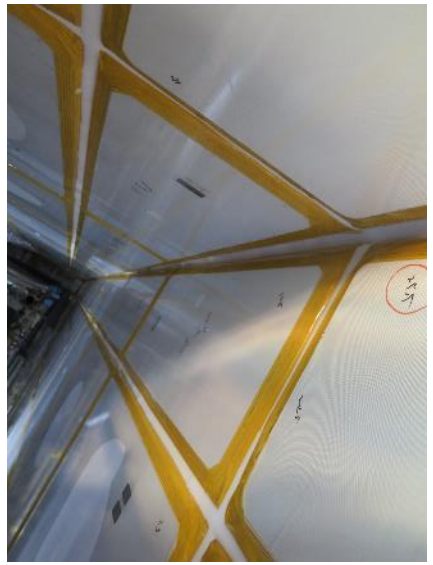
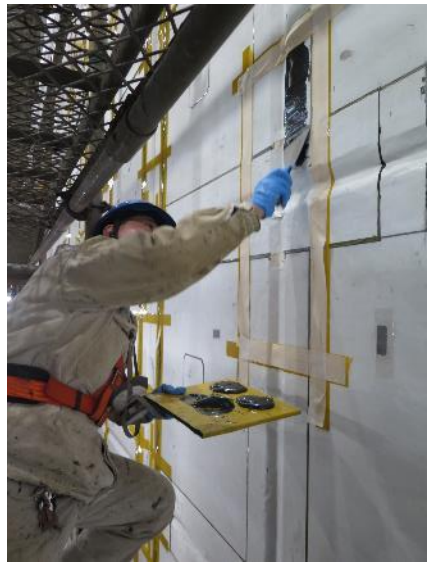



# INSULATION & SECONDARY BARRIER

System installation

- For simplicity of handling and easy installation each section consists of two layers of polyurethane panels fixed at their center point and joined together by flexible joints.

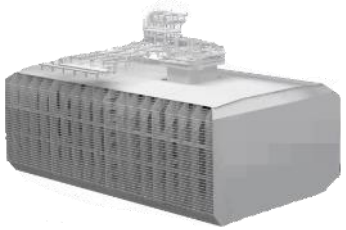


*A flexible system offering simple installation and reasonable tolerance requirements*

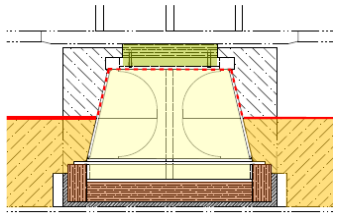
# LNT A-BOX® SUMMARY

Key elements & highlights



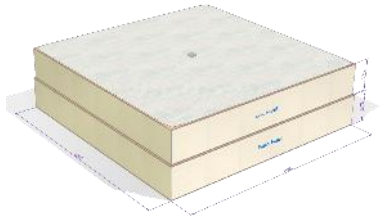
## IMO independent tank type A

- The simplest design and construction according to the IMO IGC code.
- Well proven for decades as the workhorse for seaborne transportation of LPG worldwide.



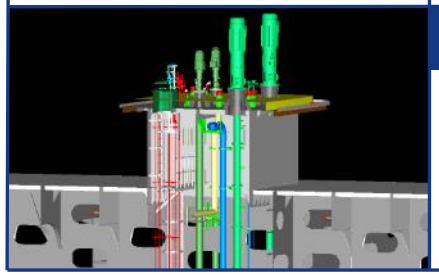
## Cargo tank support system

- Same principles and similar solution as for other independent tank types, including IMO type A for LPG and prismatic type B.



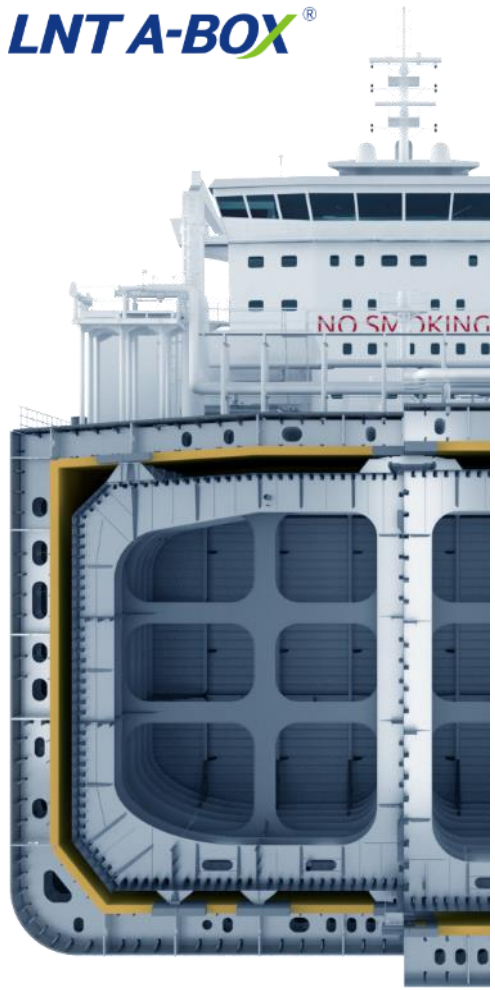
## Insulation & secondary barrier system

- Simple and proven panel design offering flexibility, easy handling and installation, and reasonable tolerance requirements.



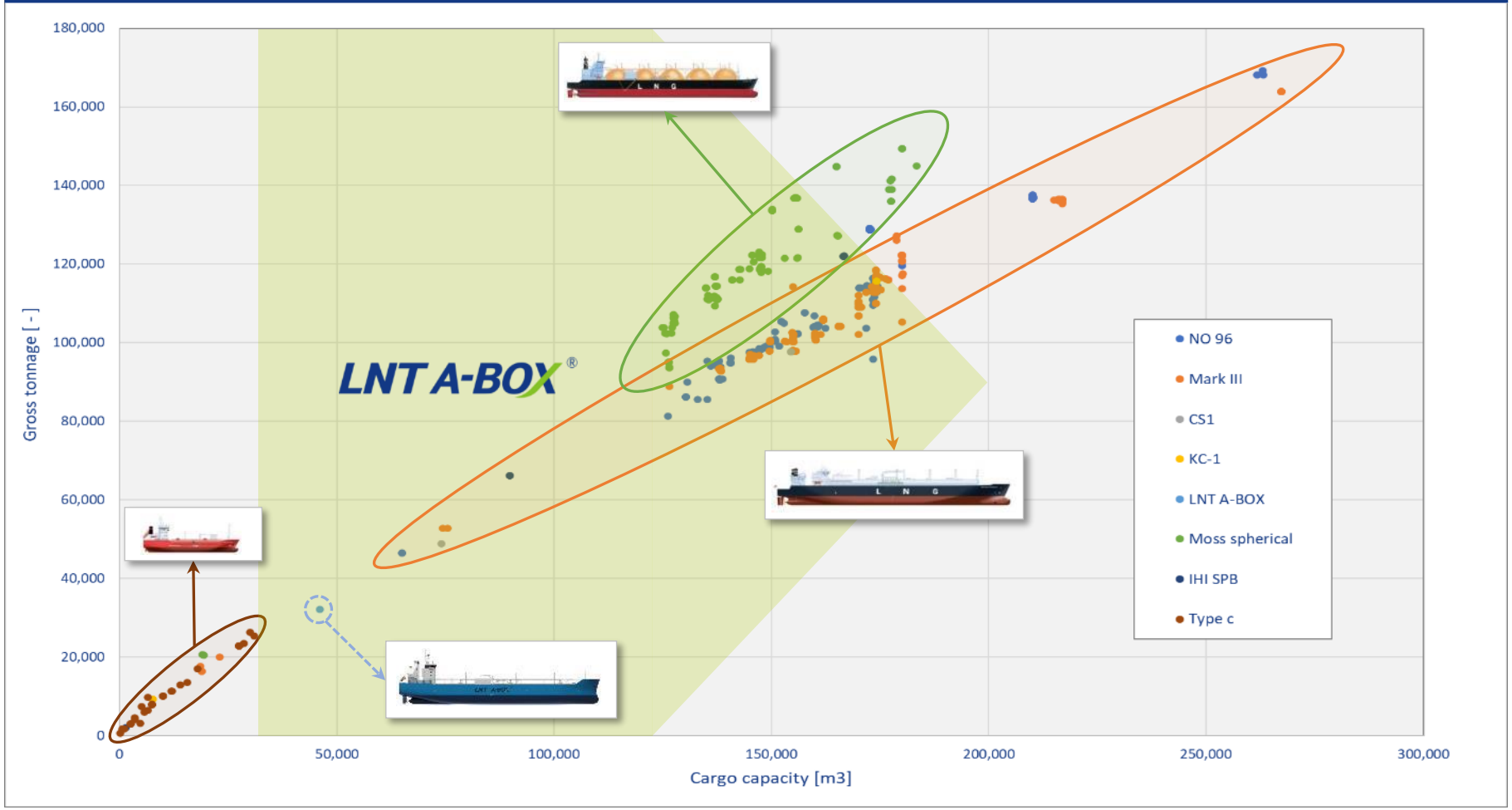
## Safety & auxiliary systems

- A simple set of safety and auxiliary systems to control the containment, based on standard components and equipment.
- Internal structure and bulkheads eliminates need for pump towers.



# LNG CARRIER SEGMENTS & LNT A-BOX® POSITIONING

## LNG Carrier fleet




- The Moss type LNG carriers are famous in the traditional large scale LNG segment.
- This market has however been taken over by GTT membrane systems which today dominate the market for large scale LNG carriers.
- The small scale LNG fleet is dominated by type C vessels.
- In the mid-scale LNG segment, there is limited existing tonnage and no clear market leader.
- LNT A-BOX® has initially been developed for this market, with the 45,000m3 LNG carrier Saga Dawn as the pilot project.
- **LNT A-BOX® is however well suited to be scaled-up.**

Source: LNT Marine plots based on Clarksons fleet list

# LARGE-SCALE LNGCs

# 175,000 m³ LNG CARRIER DESIGN DEVELOPMENT

**CSSC SDARI has developed a design for a 175,000m³ LNG carrier based on the LNT A-BOX® cargo containment system in close cooperation with LNT Marine.**

The vessel is designed, as an ocean-going liquefied gas carrier for world-wide trade with twin screw and driven by two low speed dual-fuel engines, suitable for burning liquefied natural gas.

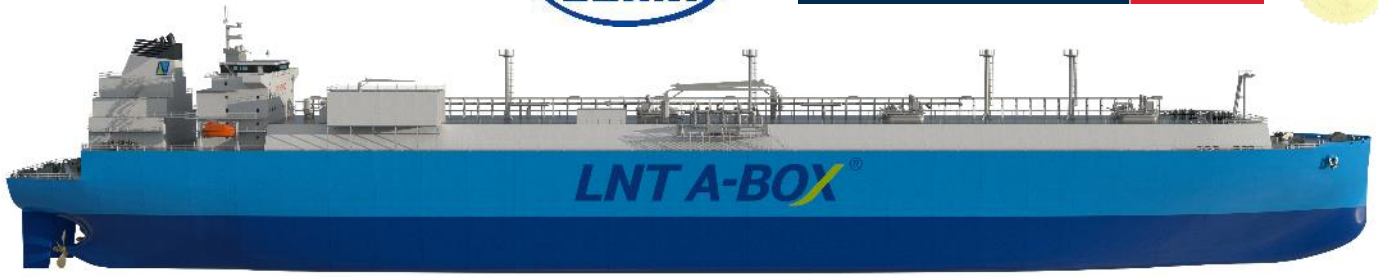
The vessel shall have **four (4)** IMO independent **tank type A** cargo tanks based on the **LNT A-BOX®** technology for the carriage of liquefied natural gas cargoes at fully refrigerated temperature (-163°C). Maximum operating pressure 0.25 bar g at sea and 0.4 bar g in port (harbor condition). The cargo tanks to be designed for maximum cargo density of 500 kg/m³. Tank material to be aluminum alloy A5083-O.


**Key features of the design are:**

- *The cargo tanks with internal structure offers **flexible** filling levels and operation.*
- *The design is **efficient** in terms of hydrodynamic performance and thermal efficiency offering low fuel consumption and low BOR.*
- *The cargo containment system is simple and **robust**, with a self-supporting primary tank and independent full secondary barrier.*

# 175,000m³ LNG CARRIER

CSSC 上海船舶研究设计院 SDARI APPROVAL IN PRINCIPLE ABS




## Key features

- Four (4) LNT A-BOX® aluminum tanks
- Easy maintenance of cargo containment system
- Low BOR about 0.075% per day
- Low methane slip with iCER
- MEGA engine can be used (option)
- Shaft generator / hybrid system, 3-5% fuel saving (option)
- Bow thruster (option)
- SDARI BLS (bubble lubrication system) option

## Main particulars

| | |
|---|---|
| Loa | 294.80 m |
| Lpp | 290.00 m |
| Beam | 45.80 m |
| Depth | 26.50 m |
| Design draught | 11.50 m |
| Scantling draught | 12.50 m |
| DWT at design draught | 80,000 ton |
| DWT at scantling draught | 92,000 ton |
| Endurance | 16,000 nm |
| Complement | 36 crew + 6 Suez |

## Tank capcities

| | |
|---|---|
| Heavy fuel oil | 4,500 $m^3$ |
| Marine gas oil | 800 $m^3$ |
| Fresh water | 400 $m^3$ |
| Water ballast | 50,000 $m^3$ |

## Cargo capacity & equipment

| | |
|---|---|
| Cargo tanks | 175,000 $m^3$ |
| Max. loading rate | 14,400 $m^3/h$ |
| Max. discharge rate | 14,400 $m^3/h$ |
| Cargo pumps | |
| Type | Submerged, el. motors |
| Capacity | 8 x 1,800 $m^3/h$ |
| Ballast pumps | |
| Type | El. motor driven centrifugal |
| Capacity | 3 x 2,500 $m^3/h$ |

## Machinery main components

| | |
|---|---|
| Main engine | 2 x WinGD 5X72DF-2.1 with iCER |
| MCR | 16,125 kW x 89.0 r/min |
| Propeller | 2 x FPP |
| Aux. generators (DF) | 2 x 3,690 + 2 x 2,770 kW |

## Energy efficiency particulars

| | |
|---|---|
| Service speed at design draught (CSR, with 21% sea margin) | 19.5 knot |
| ME fuel oil/gas consumption at NCR | |
| Tier II, diesel mode | 85.54 ton/day |
| Tier III, diesel mode (Based on LCV 50,000 kJ/kg, ISO conditions, excl. engine tolerance) | 85.95 ton/day |
| Tier III, gas mode (Based on LCV 50,000 kJ/kg, ISO conditions, excl. engine tolerance) | 68.13 ton/day |
| EEDI | Phase 3 compliance |

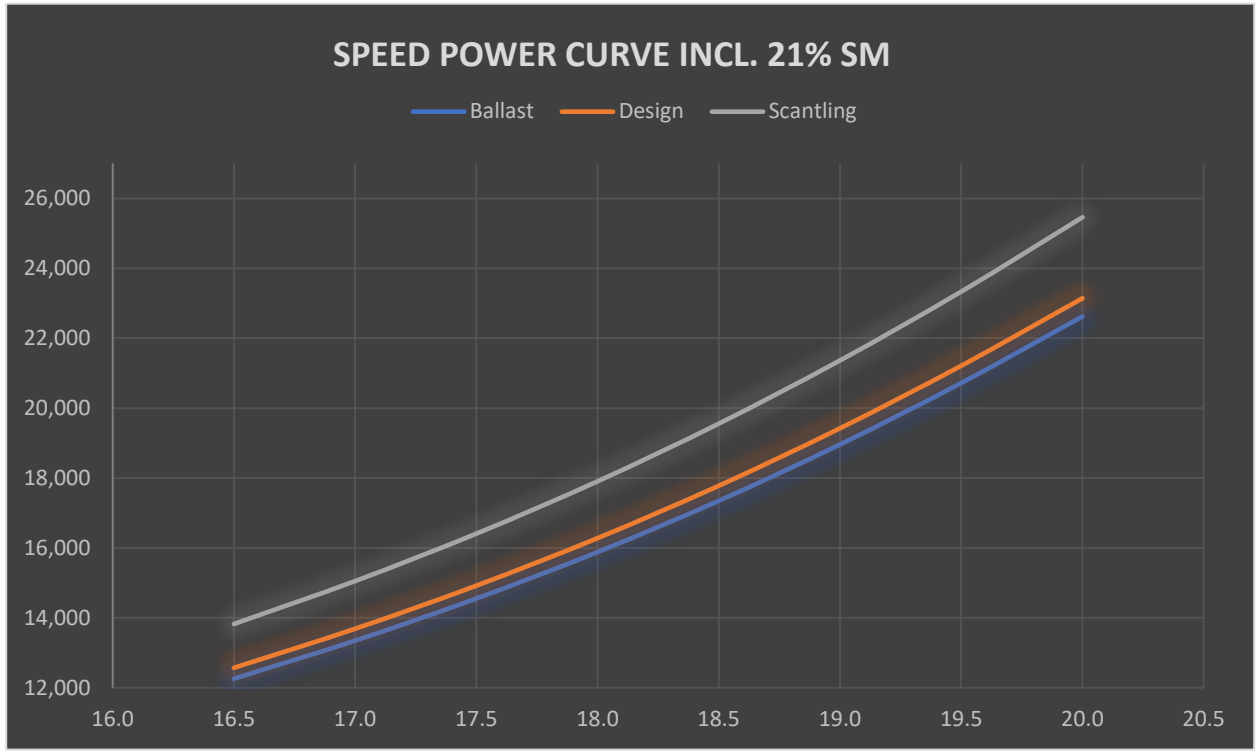
## Classification

ABS +A1, (E), Liquefied Gas Carrier with independent tanks, SH-DLA, SFA(40), +AMS, +ACCU, NBL, DFD, GCU, BWT, TCM, ENVIRO, UWILD, IHM, RRDA, POT, R2, CRC(SC), RW, NBLES, CPS, with descriptive in the record: Ship Type 2G, maximum vapor pressure 0.025MPa at sea and 0.04MPa in harbor, minimum cargo temperature -163°C, or equivalent class notations of other ICAS class.



LNT

# MODEL TESTING CARRIED OUT




## Model test and fuel consumption prediction

- Design draught tested in model test center
- Ballast and scantling is estimated based on design draught results and CFD
- Results includes 21% sea margins

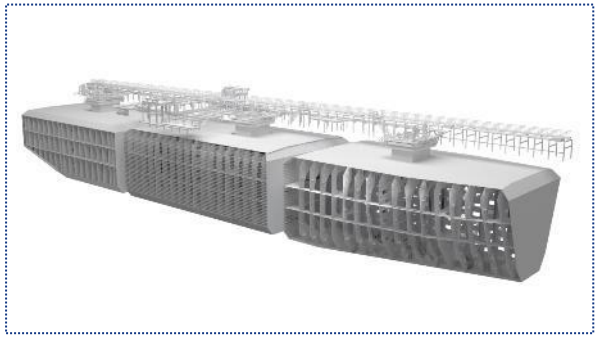
**Fuel Consumption Table**

| | Speed (Knots) | Propulsion Power (KW) | Gas Mode | | Oil Mode(Tier II) | | Oil Mode(Tier III) | |
|---|---|---|---|---|---|---|---|---|
| | | | metric tonnes (LNG)/day | | metric tonnes (MDO/MGO)/day | | metric tonnes (MDO/MGO)/day | |
| | | | M/E | M/E Pilot | M/E | M/E Pilot | M/E | M/E Pilot |
| Scantling draught loading condition | 16.5 | 13825.45 | 44.11 | 0.43 | 55.09 | - | 55.40 | - |
| | 17 | 15053.49 | 47.94 | 0.43 | 59.86 | - | 60.18 | - |
| | 17.5 | 16409.32 | 52.26 | 0.44 | 65.20 | - | 65.55 | - |
| | 18 | 17906.12 | 57.02 | 0.48 | 71.19 | - | 71.58 | - |
| | 18.5 | 19554.89 | 62.42 | 0.48 | 78.12 | - | 78.54 | - |
| | 19 | 21362.74 | 68.64 | 0.51 | 86.29 | - | 86.75 | - |
| | 19.5 | 23331.62 | 75.68 | 0.50 | 96.56 | - | 97.01 | - |
| | 20 | 25456.60 | 83.94 | 0.52 | 108.84 | - | 109.32 | - |
| Design draught loading condition | 16.5 | 12568.59 | 40.31 | 0.42 | 50.27 | - | 50.57 | - |
| | 17 | 13685.00 | 43.68 | 0.43 | 54.55 | - | 54.86 | - |
| | 17.5 | 14917.56 | 47.51 | 0.43 | 59.33 | - | 59.65 | - |
| | 18 | 16278.29 | 51.84 | 0.44 | 64.68 | - | 65.03 | - |
| | 18.5 | 17777.17 | 56.61 | 0.47 | 70.67 | - | 71.05 | - |
| | 19 | 19420.67 | 61.96 | 0.48 | 77.53 | - | 77.95 | - |
| | 19.5 | 21210.56 | 68.11 | 0.51 | 85.57 | - | 86.03 | - |
| | 20 | 23142.36 | 74.98 | 0.49 | 95.50 | - | 95.94 | - |
| Ballast draught condition | 16.5 | 12253.96 | 39.37 | 0.42 | 49.07 | - | 49.36 | - |
| | 17 | 13344.16 | 42.64 | 0.43 | 53.24 | - | 53.55 | - |
| | 17.5 | 14549.76 | 46.36 | 0.43 | 57.90 | - | 58.21 | - |
| | 18 | 15878.63 | 50.56 | 0.44 | 63.10 | - | 63.44 | - |
| | 18.5 | 17346.78 | 55.25 | 0.46 | 68.94 | - | 69.31 | - |
| | 19 | 18959.48 | 60.41 | 0.49 | 75.55 | - | 75.96 | - |
| | 19.5 | 20718.61 | 66.41 | 0.50 | 83.29 | - | 83.75 | - |
| | 20 | 22621.50 | 73.08 | 0.48 | 92.65 | - | 93.08 | - |

-LNG: 50,000 kJ/kg -MDO/MGO: 42,700 kJ/kg
1.The calculation is based on main engine theretically value at ISO condition.
2.The data of fuel consumption unit is metric tons per day.
3.ME type is "WinGD 5X72DF-2.1_12480kW_74rpm_STD"
4. The tolerance of fuel consumption of engine maker's recommendation is not included.

# CARGO TANK DESIGN DEVELOPMENT

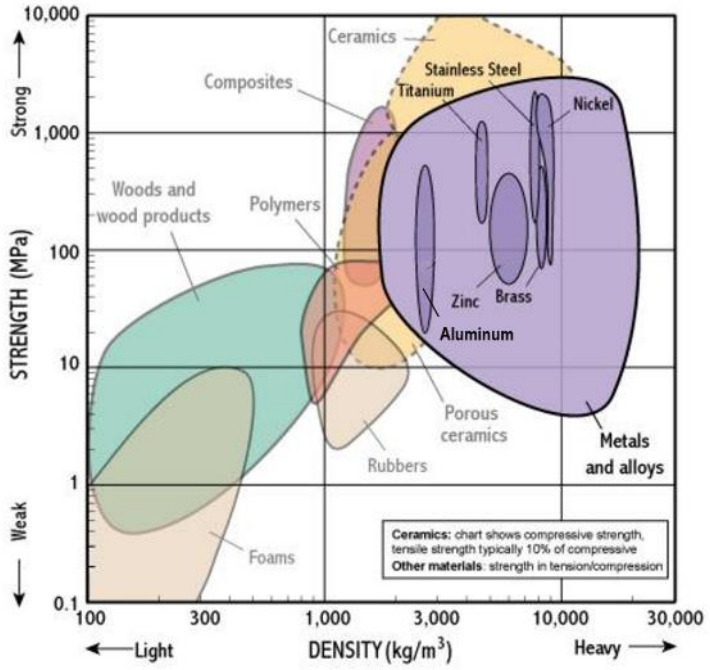
- For carriage of **LNG at -163°C**, the tank material options are **stainless steel**, **nickel-alloys** or **aluminum**. These materials have **different properties** and different **pros and cons**. Important parameters for selection are:
  - *Material density*
  - *Strength*
  - *Weldability*
  - *Thermal expansion coefficient*
  - *Cost*



- For **mid-scale vessels**, **weight** is somewhat **less critical** as we are typically competing with type C pressure vessels. And in addition, minimum plate thickness requirements will absorb some of the theoretical weight savings between different materials.

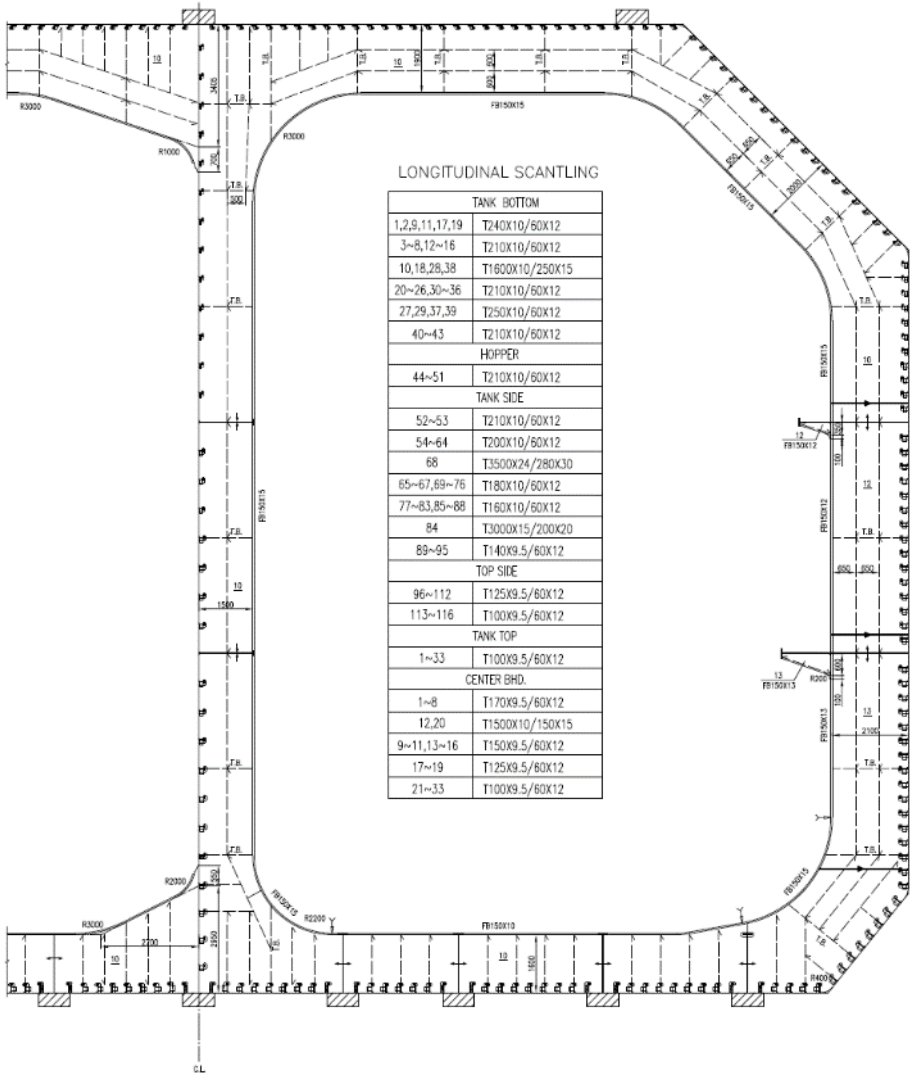
- For **larger size carriers** the different material properties can be utilized more and will have more **significance** for the **weight**. **Aluminum** offers **significantly lower density and weight than steel**.

| Tank Material | Standard | Density | Yield | Tensile |
|---|---|---|---|---|
| | | *[ton/m3]* | *[Mpa]* | *[Mpa]* |
| Stainless steel, 304L S30403 | EN10028-4 | 7.85 | 170 | 485 |
| 9% nickel steel, X7Ni9 | ASTM A240 | 7.85 | 585 | 680 |
| Aluminum, A5083-O | ASTM B209M | 2.67 | 125 | 275 |




*Source: www-materials.eng.cam.ac.uk*

# CONVENTIONAL DESIGN AND FUSION WELD FABRICATION



LONGITUDINAL SCANTLING

| | |
|---|---|
| TANK BOTTOM | |
| 1,2,9,11,17,19 | T240X10/60X12 |
| 3~8,12~16 | T210X10/60X12 |
| 10,18,28,38 | T1600X10/250X15 |
| 20~26,30~36 | T210X10/60X12 |
| 27,29,37,39 | T250X10/60X12 |
| 40~43 | T210X10/60X12 |
| HOPPER | |
| 44~51 | T210X10/60X12 |
| TANK SIDE | |
| 52~53 | T210X10/60X12 |
| 54~64 | T200X10/60X12 |
| 68 | T3500X24/280X30 |
| 65~67,69~76 | T180X10/60X12 |
| 77~83,85~88 | T160X10/60X12 |
| 84 | T3000X15/200X20 |
| 89~95 | T140X9.5/60X12 |
| TOP SIDE | |
| 96~112 | T125X9.5/60X12 |
| 113~116 | T100X9.5/60X12 |
| TANK TOP | |
| 1~33 | T100X9.5/60X12 |
| CENTER BHD. | |
| 1~8 | T170X9.5/60X12 |
| 12,20 | T1500X10/150X15 |
| 9~11,13~16 | T150X9.5/60X12 |
| 17~19 | T125X9.5/60X12 |
| 21~33 | T100X9.5/60X12 |

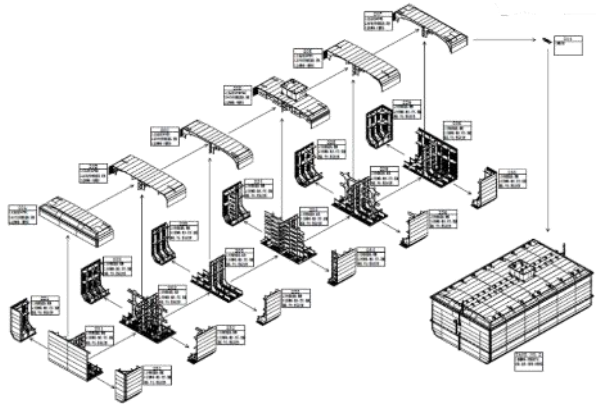
- **Design** based on a conventional design and fabrication process based on welded A5083-O. The tank construction is based on **standard plate and profiles available on the market**. The production methods follow steel construction principles, i.e., panel construction with plate and profiles, sections, blocks and assembly.

- **Welding material** suitable for aluminum. Partly **automated welding for panels** and in general **manual during block stage**. Welding seam location follows standard tank building and refer to plate sizes and connection location points between plates and profiles.

- **Material thickness:**
  - Shell plate: 9-11.5mm
  - T-frame: 12-15.0mm

- **Tank weights:**
  - Tank 1: 876 ton
  - Tank 2, 3, 4: 1,018 ton

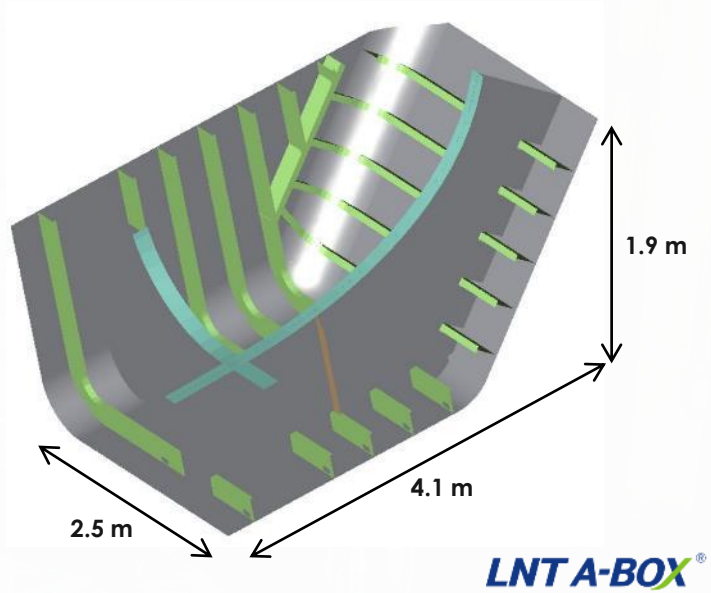
- **Cargo tank volume:**
  - Tank 1: 38,725 $m^3$
  - Tank 2, 3, 4: 45,424 $m^3$



# CHINA FIRST HEAVY INDUSTRIES – MOCK-UP AND PARTNERSHIP


中国一重 CFHI

- CFHI is a **strong partner** with **vast experience** in **high quality manufacturing**, including nuclear sector and pressure vessels for petrochemical industry.




- In partnership with **China First Heavy Industries (CFHI)** and **Minyu Steel** we have prepared an aluminum tank mock-up with representative structural details and welds to verify principles to be used for a full-scale tank. Construction details including shell plate corners, web/girder crossing with details and brackets – all in dimensions similar to that expected for a large-scale tank.

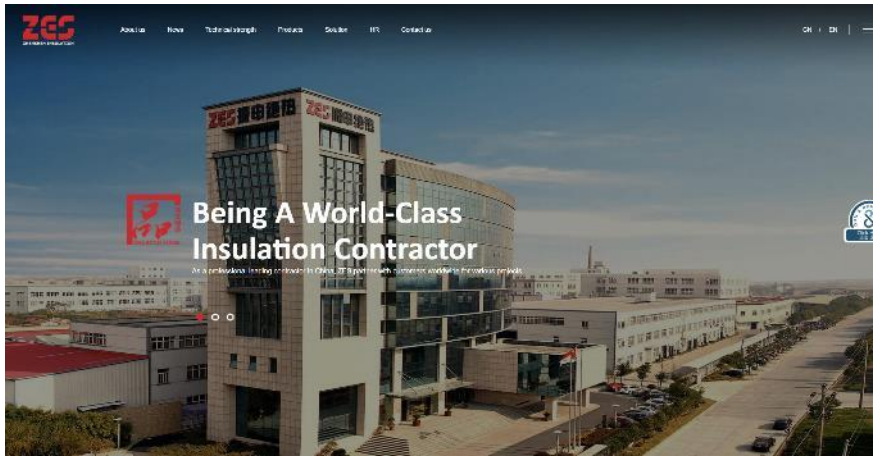


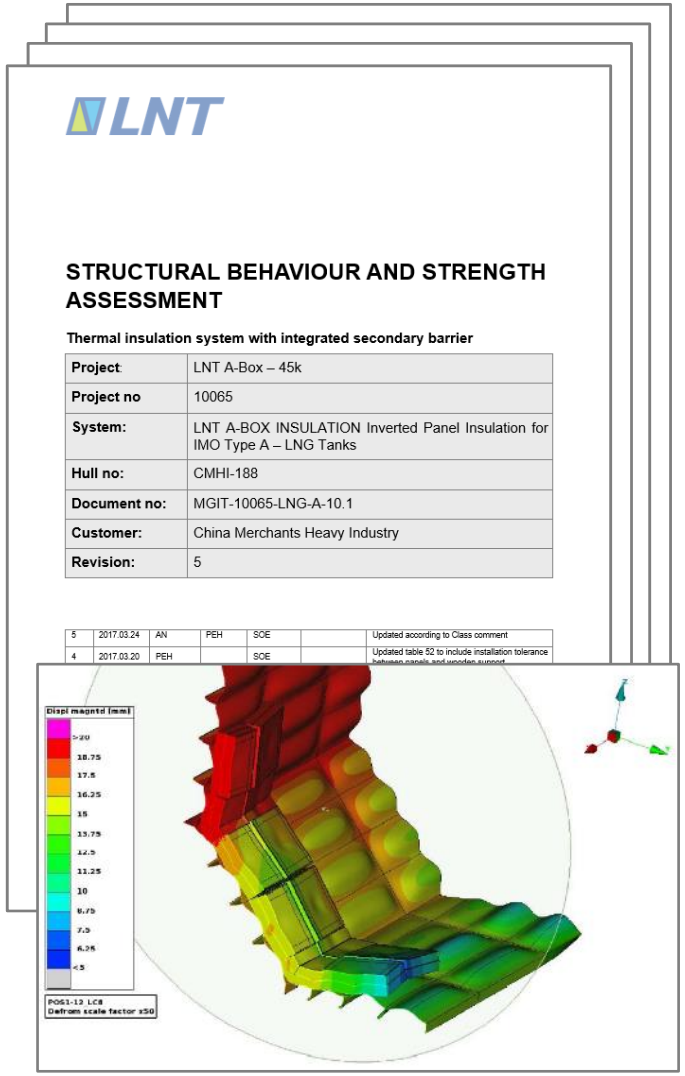
LNT

# PARTNER FOR INSULATION SYSTEM MANUFACTURING

A proven panel system

- ZES Insulation is our existing partner and supplier of insulation panels in China, based in Jiaxing outside Shanghai: www.zhenshen.cn/en
- Well established cooperation with qualified suppliers and subcontractors
- Installation mock-ups executed with major yards for qualification and training.



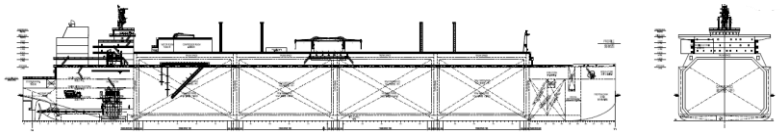





# THE VALUE CHAIN IS READY

Ready to offer the LNG industry an attractive alternative

| Technology | Ship design | Classification | Shipyards | Owners | Charterers |
|---|---|---|---|---|---|
| LNT Marine's LNT A-BOX® system has been proven and is ready to be deployed for large scale LNG carriers. The technology offers attractive advantages | SDARI is the largest design company in China and part of CSSC Group. SDARI has developed the contract design for a 175,000m3 LNT A-BOX® type LNGC. | LNT A-BOX ® has been approved by major IACS class societies. | Multiple yards from major Groups have capability and capacity to build, and more yards can be qualified shortly. | LNG owners have indicated a keen interest to order, own and operate LNT A-BOX® type LNG carriers. | A shortage of ships is expected in the coming years as more LNG production comes on stream requiring more shipping capacity. |



CFHI is a highly qualified tank manufacturer and ready to supply tanks for LNT A-BOX® type vessels.

ZES is a long-standing partner for the fabrication and supply of insulation panels to the LNT A-BOX® system.

# BENCHMARK

# KEY PERFORMANCE INDICATORS & COST DRIVERS

Technical featurs and costs driving life cycle costs

**CAPEX**

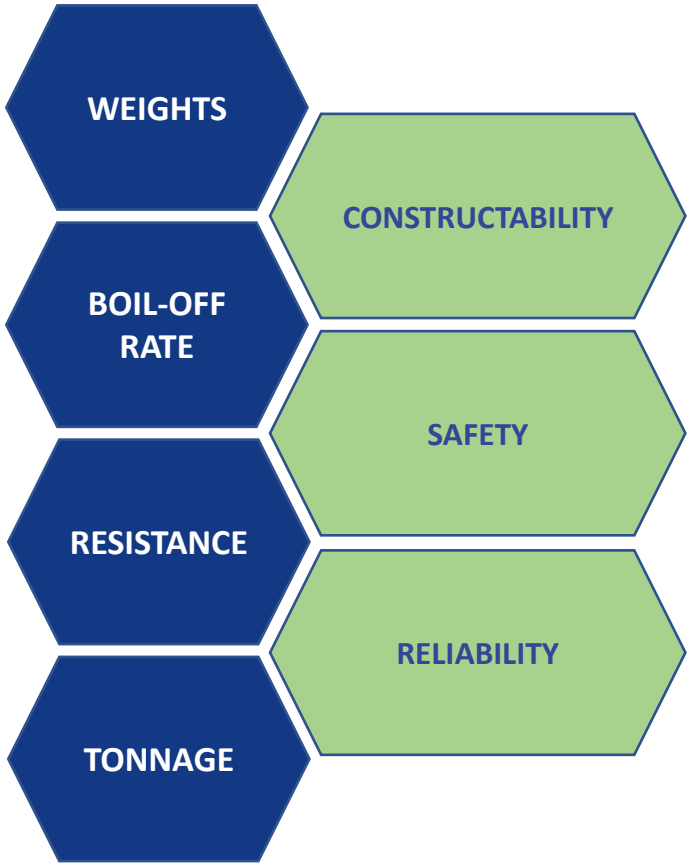
- Complexity and constructability
- Lightweight and tank weight
- Specifications and outfitting

**OPEX**

- Simplicity and robustness
- Reliability and maintenance
- BOG handling

**VOYAGE**

- Hull shape efficiency
- BOR and energy efficiency
- Volume utilization and tonnage

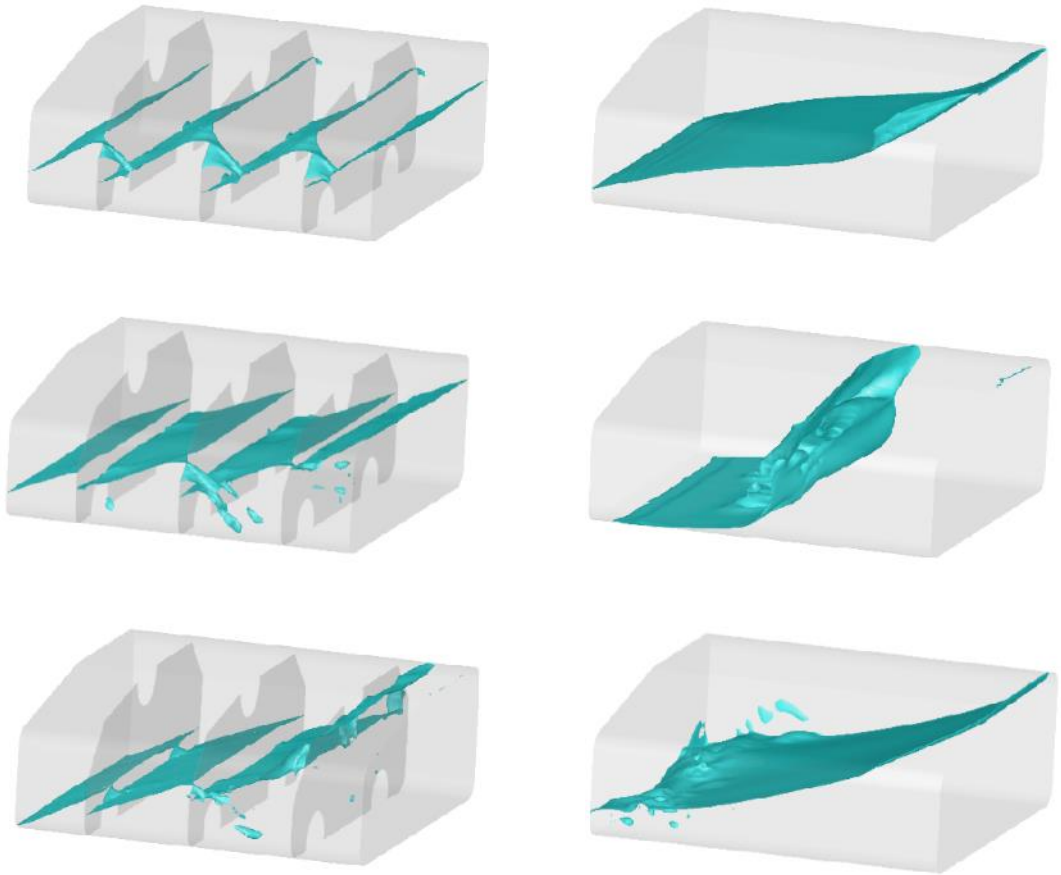


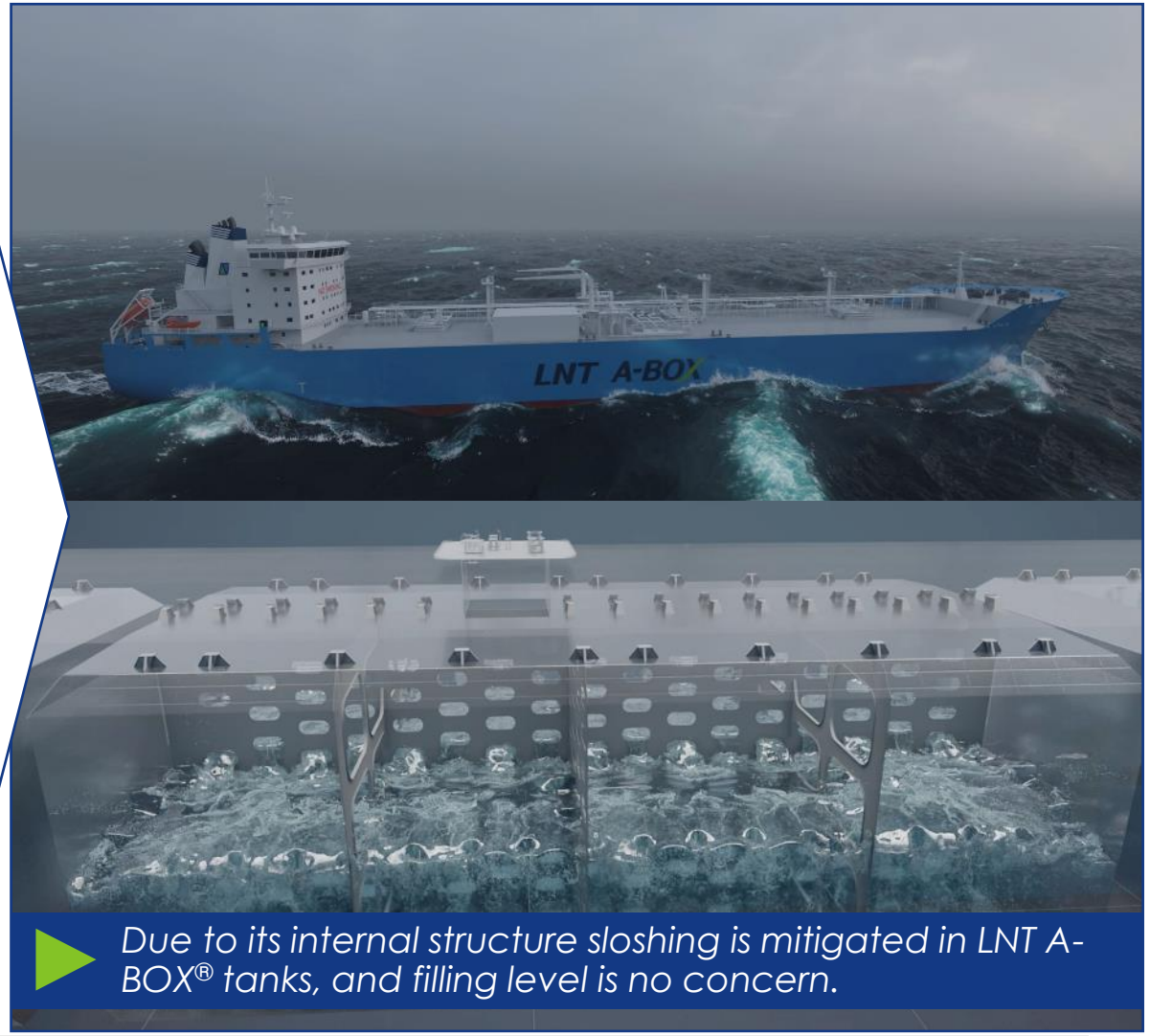
# TANK FILLING & OPERATIONAL FLEXIBILITY

LNT A-BOX® offers a robust tank mitigating sloshing

**LNT A-BOX®**
***with internal structure***

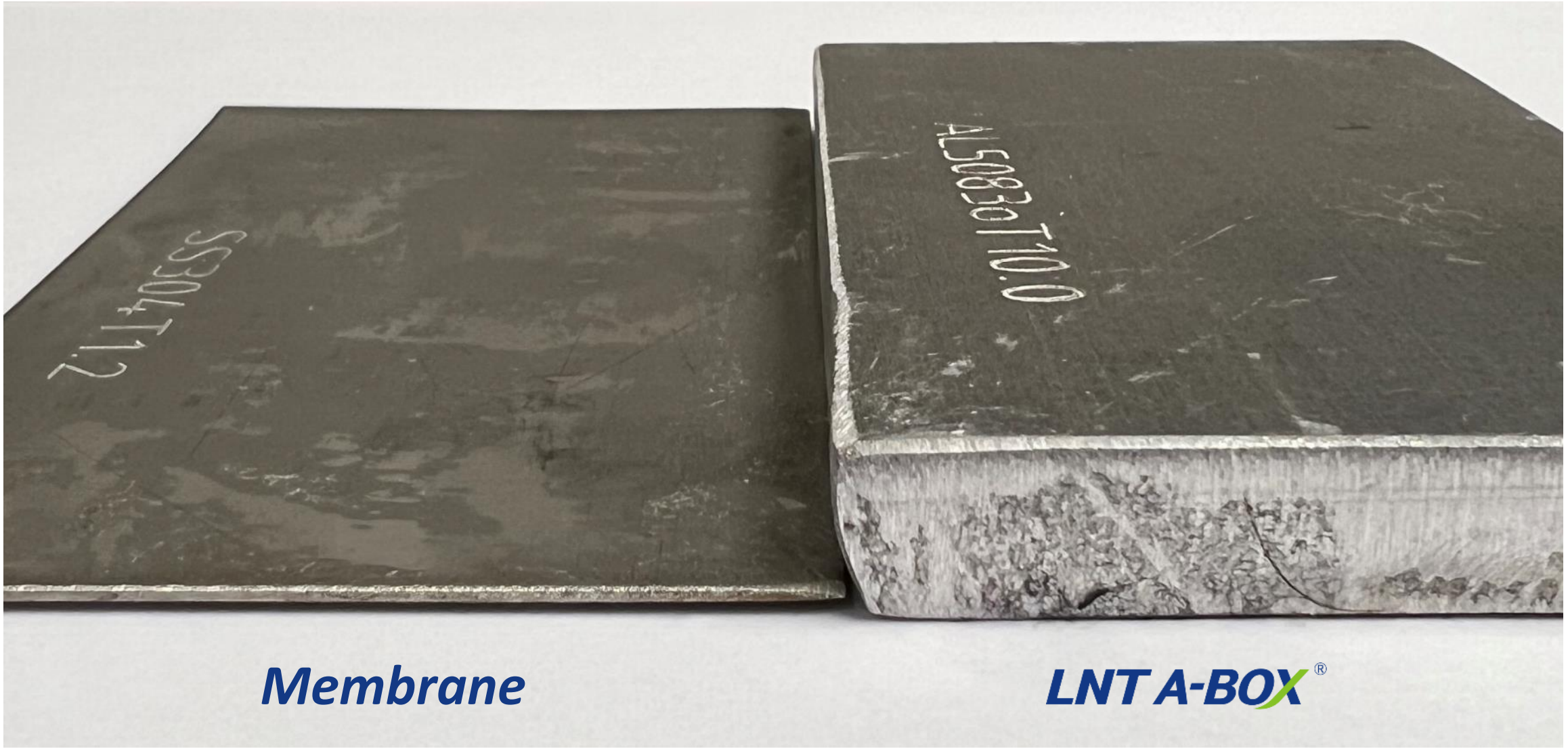
***Membrane systems***
***without internal structure***



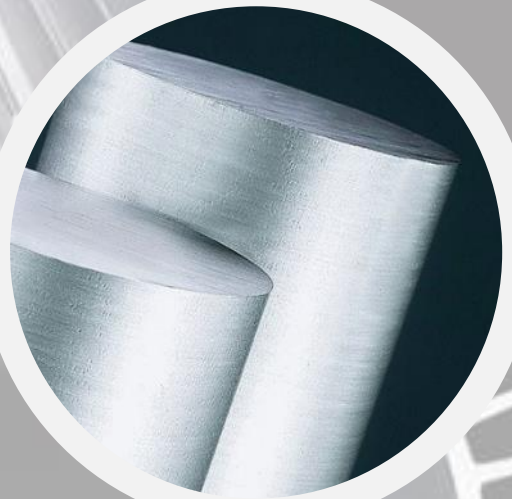



*Due to its internal structure sloshing is mitigated in LNT A-BOX® tanks, and filling level is no concern.*

# MATERIAL AND THICKNESS



# RECYCLING – RESIDUAL VALUE & CARBON FOOTPRINT



Residual value typically in excess of 50% of raw material costs.

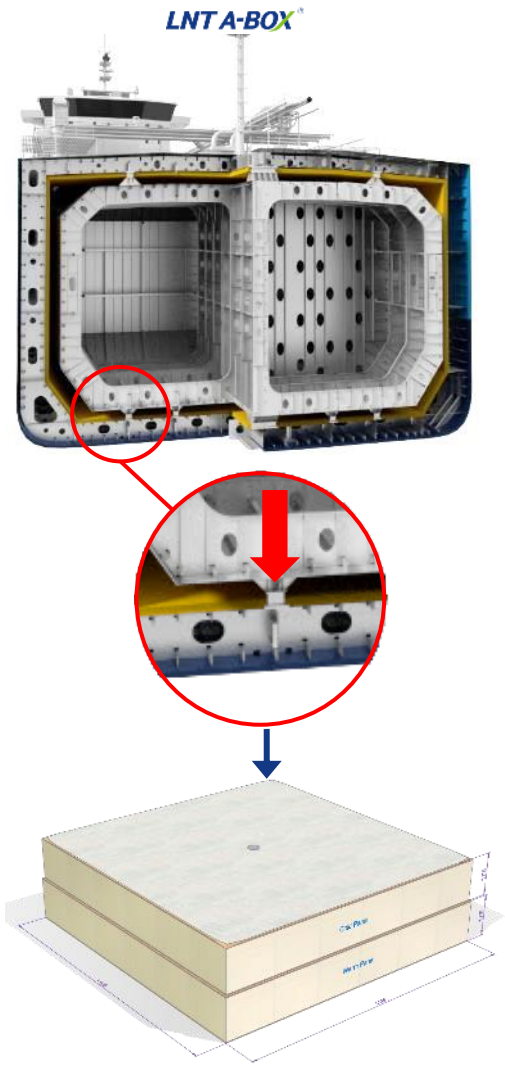
In total some 8-9m USD (2022) per LNG carrier.

"Recycling 1 ton of aluminum saves 6 tons of bauxite and 9 tons of $CO_2$ emissions.

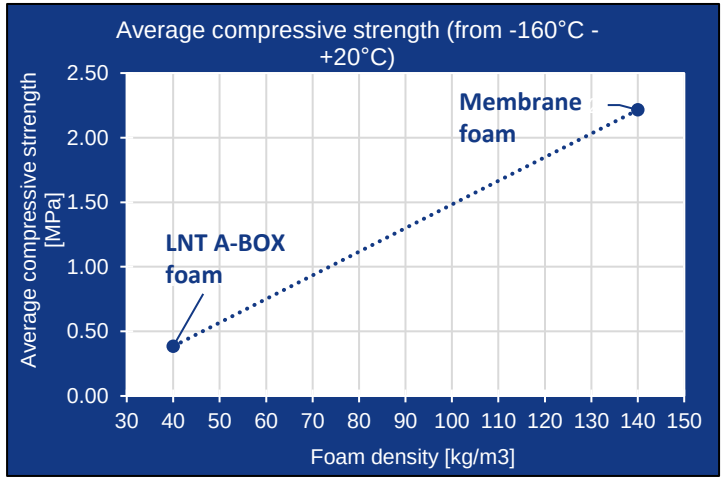
Hence, recycling of the tanks from 1 x LNG carrier with LNT A-BOX® tanks saves 36,000 tons of $CO_2$ ."

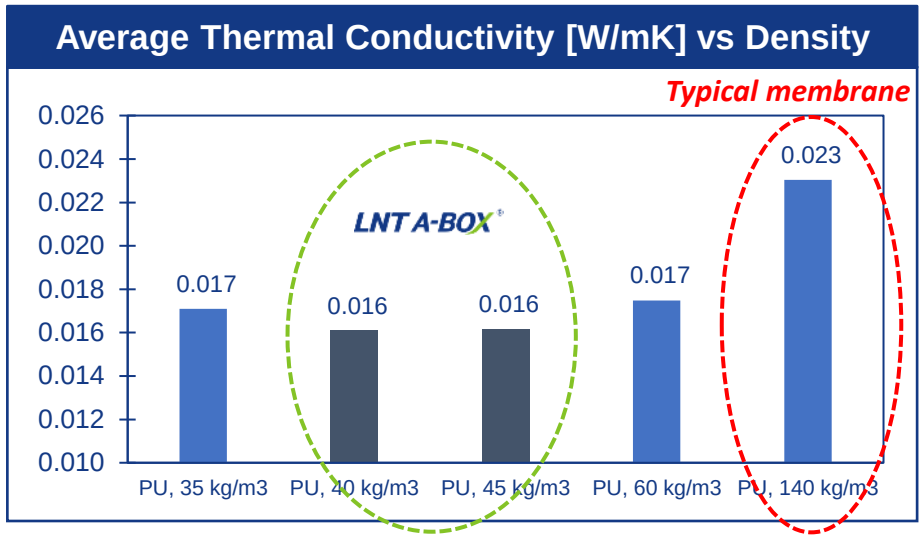
# INSULATION SYSTEM & BOIL-OFF RATE (BOR)

LNT A-BOX® offers market leading boil-off rates







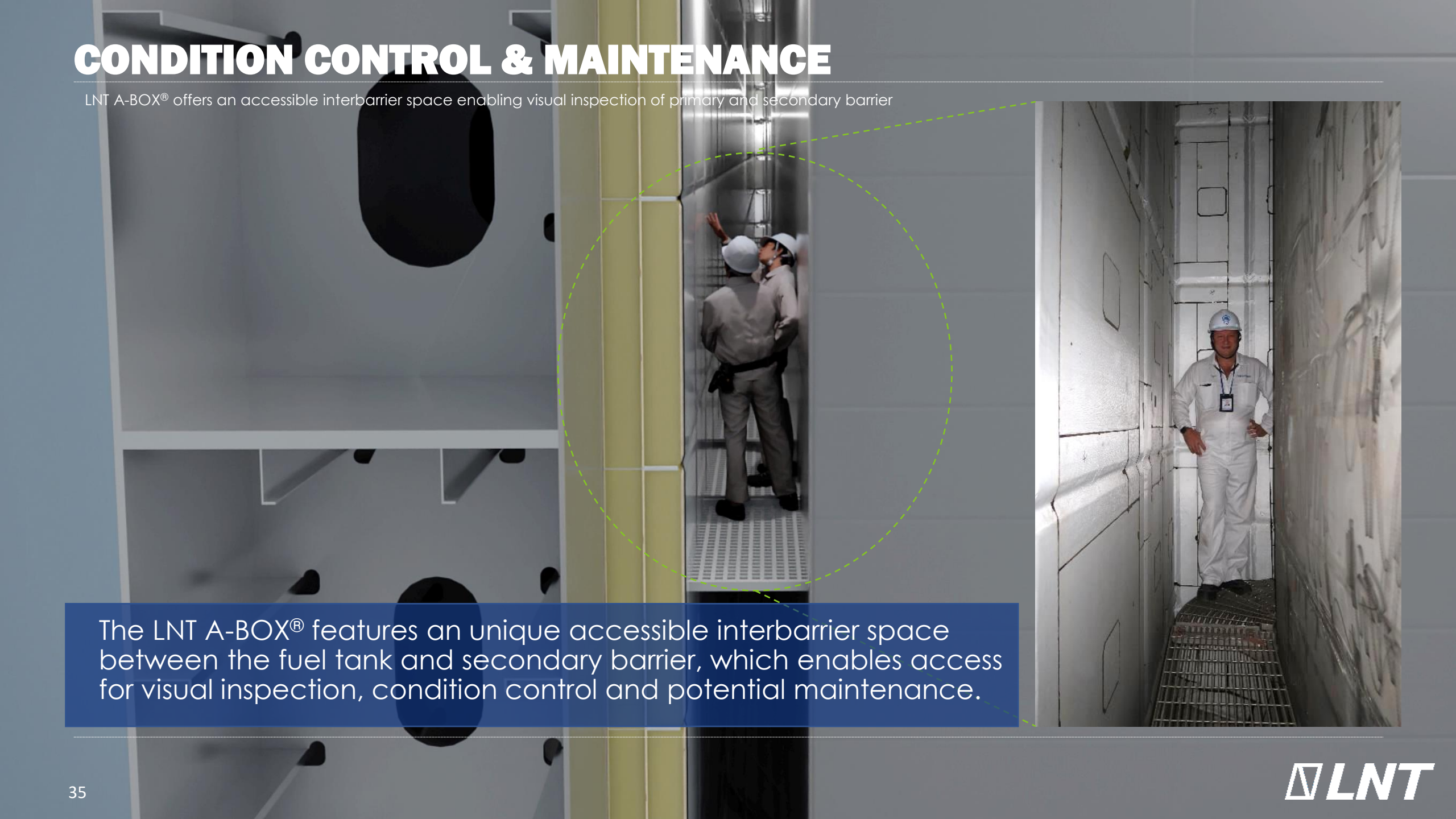




For the LNT A-BOX® the insulation system is optimized for best possible thermal performance.

- ✓ *The low BOR gives the possibility for downsizing the BOG handling equipment.*
- ✓ *Minimize energy consumption for BOG handling.*

# CONDITION CONTROL & MAINTENANCE

LNT A-BOX® offers an accessible interbarrier space enabling visual inspection of primary and secondary barrier



The LNT A-BOX® features an unique accessible interbarrier space between the fuel tank and secondary barrier, which enables access for visual inspection, condition control and potential maintenance.

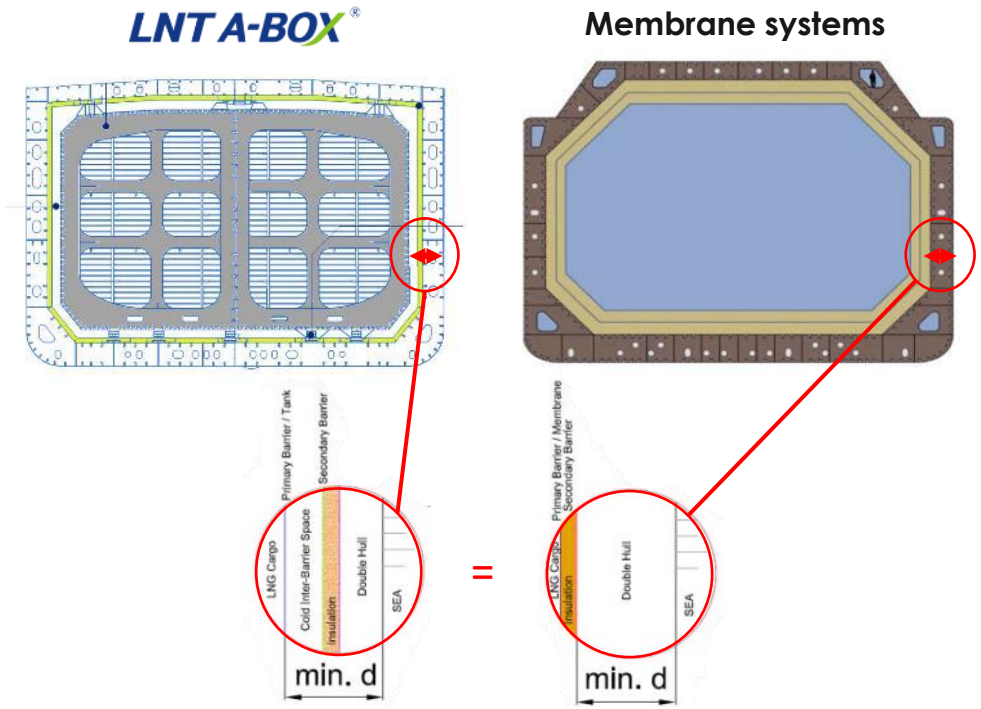
# GEOMETRIC FLEXIBILITY, VOLUMETRIC EFFICIENCY & TONNAGE

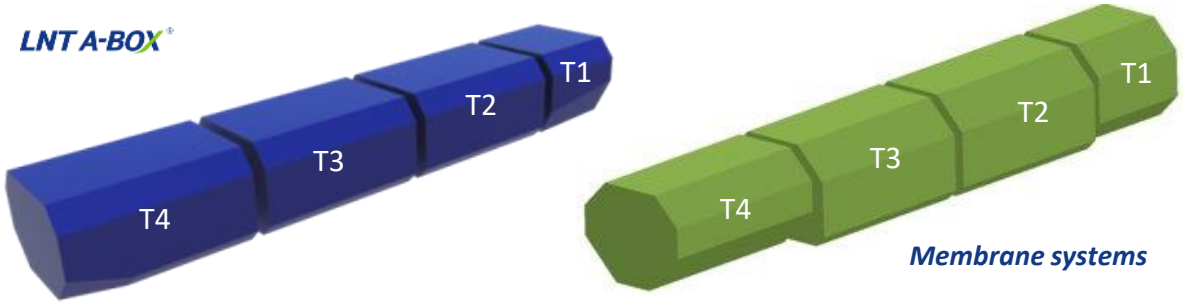
LNT A-BOX® offers market leading volume utilization

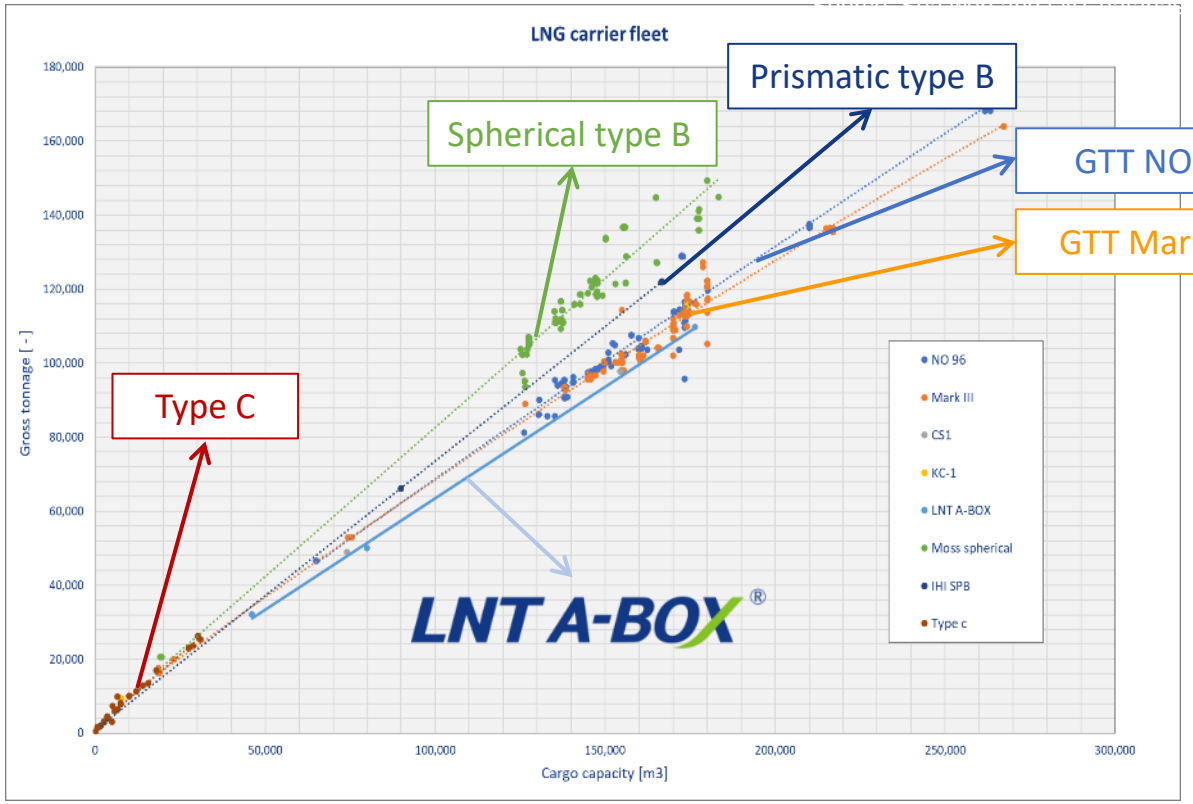
**Geometrical flexibility** of the LNT A-BOX® containment system secure high utilization of the ship hull lines.

**IMO IGC requirement:** Distance to outer shell, β, whichever is less of: d, B/15 or 2 m

- *For independent tank types to the tank primary barrier*
- *For membrane systems to the hold space*



# HULL DESIGN & HYDRODYNAMIC PERFORMANCE

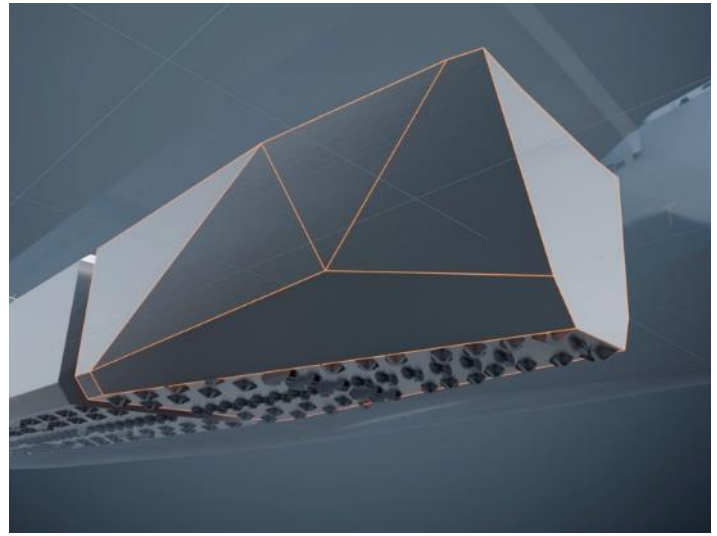
- **Geometrical flexibility** of the **containment system** gives the ship designer freedom to **design an efficient hull form**. SDARI has used a parametric model combined with rich experience of SDARI and CFD evaluations to optimize for **best possible performance**.

- **Model testing** has been carried out and test results as well as preliminary resistance predictions shows ***fuel savings*** compared to other modern large scale LNG carriers, despite slightly higher lightweight of the ship.

    - The SDARI model test results are 5-6% better than membrane NO96 delivered from China 2021

    - The SDARI design assumed to be improved with approx. 2% by increasing the ship length to 299 meter and will then be on same level as latest designs in progress for new buildings in China.

    - For benchmark with Korean designs, design and experience factors from Korean shipbuilding industry must be used as basis.



# ENABLING INCREASED BUILDING CAPACITY & FLEXIBILITY

LNT A-BOX® offering unique solutions for fuel, storage and transportation

## Building capacity & costs

- Simple and cost-efficient design
- Enabling more yards to build the carriers which reduce costs and lead time
- Independent tank construction allows for parallel activities and outsourcing

## Flexibility & Efficiency


- Flexible solution enabling broad range of sizes and applications
- Flexible shape allowing the designer to optimize the hull form and lower the fuel consumption.
- Flexibility with regards to materials, design pressure and density – which means that the tank also can carry ammonia (NH3)
- Low BOR minimize the need for energy intensive reliquefaction of boil-off gas (BOG) and reduce energy consumption.
- High volume utilization and low gross tonnage (GT) ensures low port- and canal fees.

## Robust & safe

- Robust self-supporting primary barrier without any filling restrictions
- Two truly independent barriers accessible for visual inspection and maintenance

# SUMMARY

# CHALLENGING THE MONOPOLY

There is a need for an alternative

## Monopoly with capacity constraints and technical flaws

- The LNG shipbuilding market is suffering from a de facto monopoly when it comes to technology and shipbuilding capacity.
- LNG shipping has for too long accepted to be monopolized by a containment system technology with obvious flaws.

## LNT A-BOX® is proven and removes shipyard capacity constraints

- Based on IMO type A technology and standard design and construction, LNT A-BOX® can be built by many more shipyards.
- LNT A-BOX® will increase shipyard capacity for large LNG carriers in the interest of the entire LNG industry.



# 175,000m³ LNT A-BOX® TYPE CARRIER PROPOSITION

**Attractive CAPEX**

**Early NB slots**


**Market leading BOR**
*From 0.07 %/24h*

**Robust & safe**
*Strong self-supporting structure*

**Accessible barriers**
*Visual control of both barriers*

**Lower life cycle cost**
*High residual tank value and lower OPEX*

**No filling limitations**
*Sloshing mitigated with swash bulkheads*

**Lower gross tonnage**
*2% less, lower canal tolls and port fees*

**Low fuel consumption**
*Lower resistance than existing tonnage*



LNT


THANK YOU
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