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Innovative regional industrial cluster

WACHSTUMSKERNE UNTERNEHMEN REGION
Die BMBF-Innovationsinitiative Neue Länder

nordic yards

# Nordic Yards and innovative solutions for (LNG) in Arctic regions


MarTech – LNG

*09.01. – 10.01.2014 Technologiezentrum Warnemünde*

# Contents

# Nordic Yards overview
# Company structure




» **Owner:** Nordic Yards is a privately owned group of companies

» **Start-up:** Mid 2009: Take over of the yards in Wismar and Rostock-Warnemünde (Asset Deal)

# Nordic Yards overview
# Facilities | Warnemünde



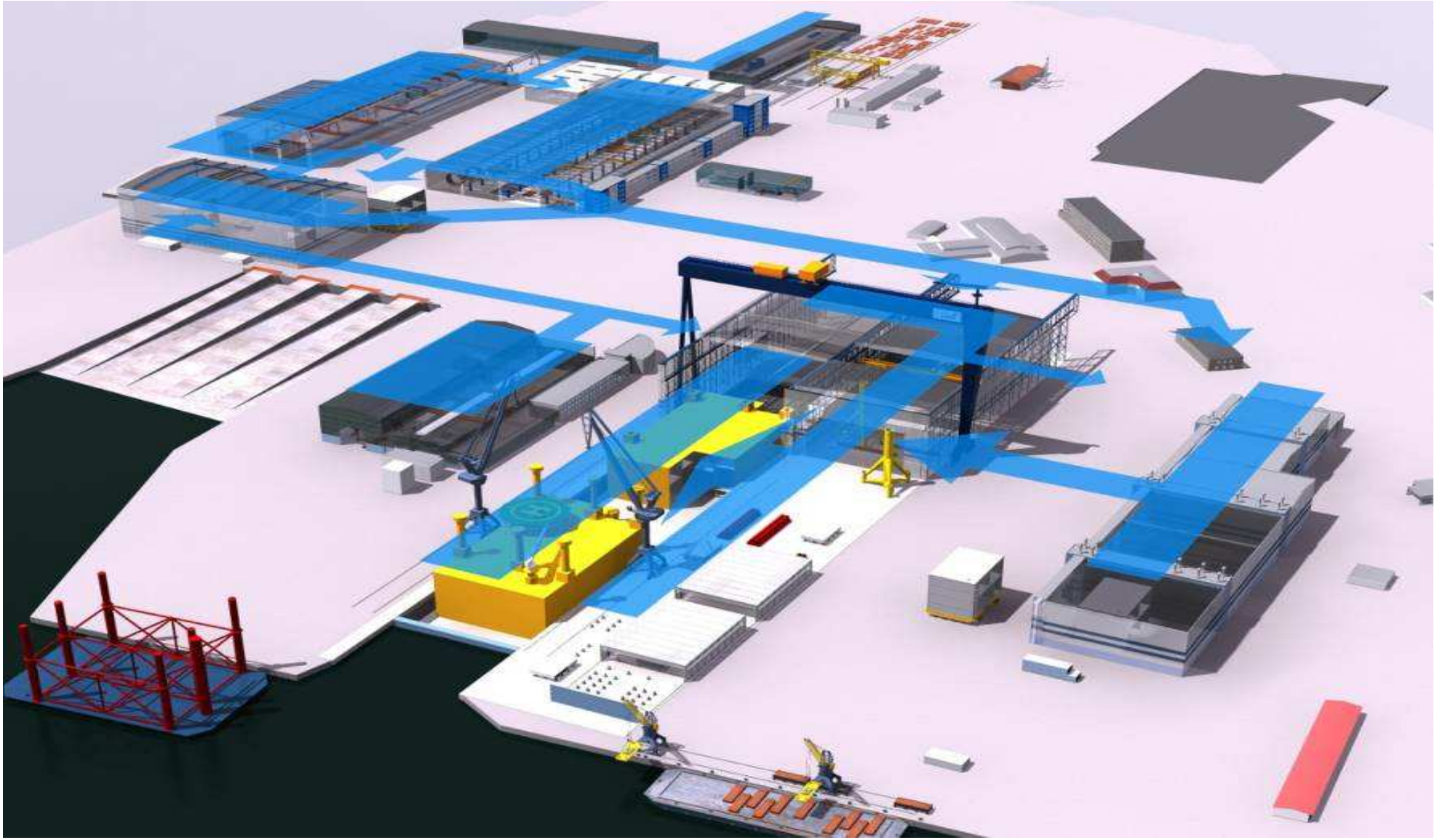


- **Shipyard area:** 850,000 sqm, 85,000 sqm roof-covered
- **Dry dock:** length 320 m x width 54 m x height 80 m
- **Crane capacity:** 600 t
- **Hook height:** 77 m

- Special dry dock assembly procedures for large-scale offshore projects
- extensive areas for transport, temporary storage and final assembly
- very high colouring and conservation capacities
- high steel throughput (up to 55,000 t per year)

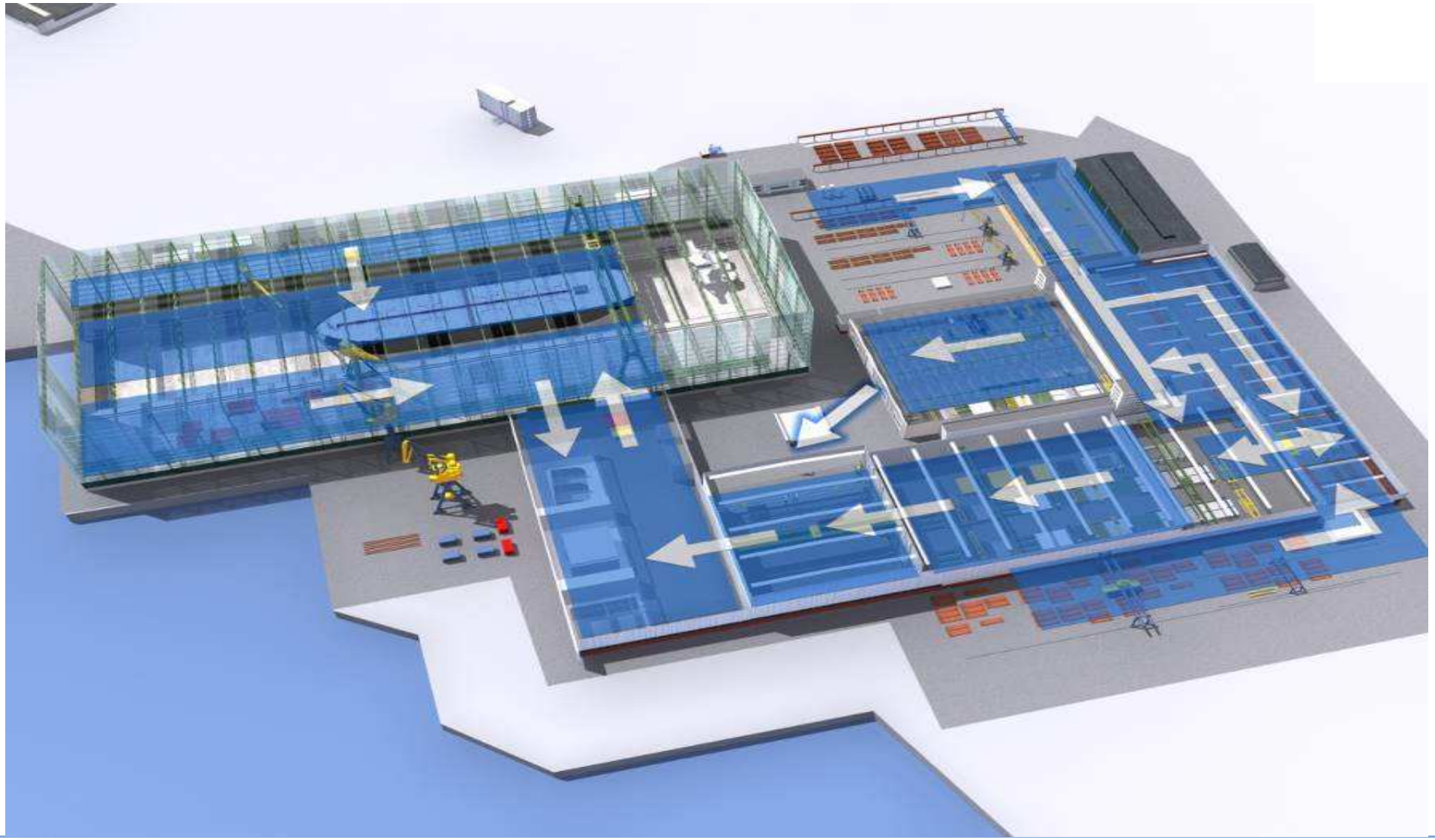
# Nordic Yards overview
# Warnemünde | Production workflow





# Nordic Yards overview
# Wismar | Production workflow





# Company profile
# Maritime expertise since 1946



**Warnemünde:**
First ocean-going ship delivered

**Wismar:**
**Seagoing passenger ships – Ivan Franco-Series**
At the time the largest of its type delivered by a German shipyard

**Wismar:**
**C**ombined container passenger ship PCV 400

**Warnemünde:**
Semi-submersible, self-positioning drilling platform CS 30 “Stena Don"

**1946: Foundation of the yards in Wismar & Warnemünde**

**1951** | **1957** | **1964 - 1972** | **1978 - 1982** | **1986 - 1989** | **1995** | **2000** | **2001** | **2009: Nordic Yards**

**Warnemünde:**
First ship constructed of steel

**Wismar:**
**Reefer and transport ships – Type: Kristall**
**Insulation** method is the cutting-edge technology at the time


**Wismar:**
**Rail freight ferries type EGF**
**Very short turnaround time**


**Wismar/Warnemünde:**
**CV 5500**
Largest container ship built at the yards

# Nordic track record 2009 - 2013



- » **Global offshore market leader** in the HVDC converter platform segment
- » **Ferry champion**: supplier of the world‘s largest RoPax ferries
- » **First-class construction facilities**: the most modern roofed dry dock facilities in Europe
- » **Top Employer**: one of the largest employers in the Baltic region
- » **Deliveries and orders** in the past four years:


| RoPax Ferries | BorWin 2 | HelWin 1 | Arctic Tanker | SylWin 1 | Wind Turbine Service Vessel | Rettungs- u. Bergungsschiffe | DolWin 3 | Icebreaker Deckhouse |
|---|---|---|---|---|---|---|---|---|

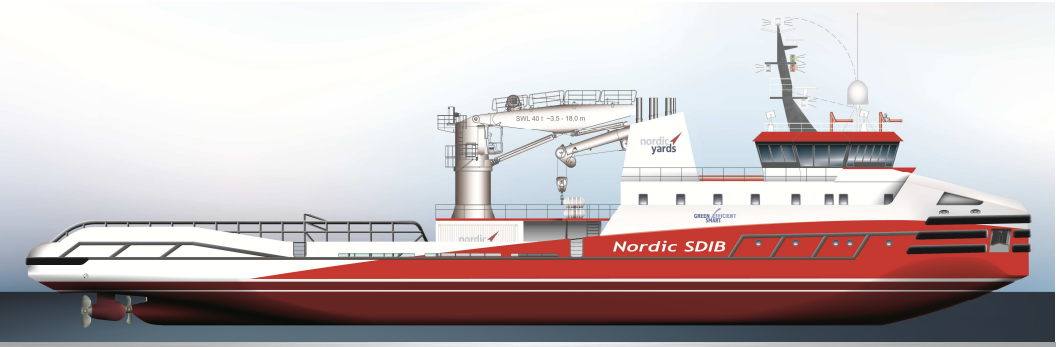
# Nordic business units 2013



# Nordic Arctic Projects




B047 | Nordic AC-IB 1400 | Ice-breaking container ship




B048 | Nordic SDIB | Icebreaker


B073 | Nordic ALNGC 175 | LNG-Carrier

# POLAR



## Production-Operation-Living-Arctic-Region

### POLAR – Modular construction system

- »Systems development
- »Interface development
- »System integration


### 13 alliance partner

nordic yards, EEW, µ, Universität Rostock, Traditio et Innovatio, Fraunhofer IPA, KLH SELCKGROUP, NK Neptun - Stahlkonstruktions GmbH, K, KAEFER, SIMAWIS Maritime Wirtschaft Schiffbauforschung, ILK Dresden, R&M Ship Tec, IMG

# Key points

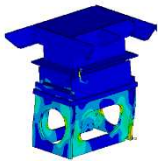


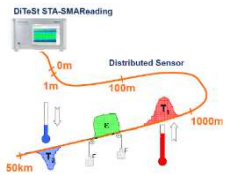
## Technology platform

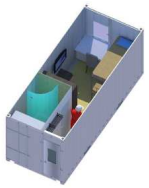
**Modular system for transportation, storage and processing of gas under extreme environmental conditions**

### System technology

| Special ships and offshore structures | Topside Equipment | Tank periphery | Living quarters and Service Module |
|---|---|---|---|





### Production


LNG - Carrier

FPSO / FSO

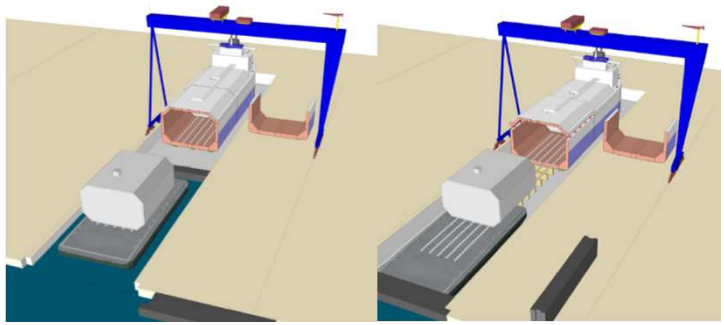

Offshore- Conveyor systems

# Key points - POLAR?

## IMG GmbH

- System Engineering for welding equipment
  - Laser-hybrid welding equipment
  - Automatic welding equipment for arctic ship structures
- System engineering for transportation of heavy load blocks / units inside and outside of arctic region



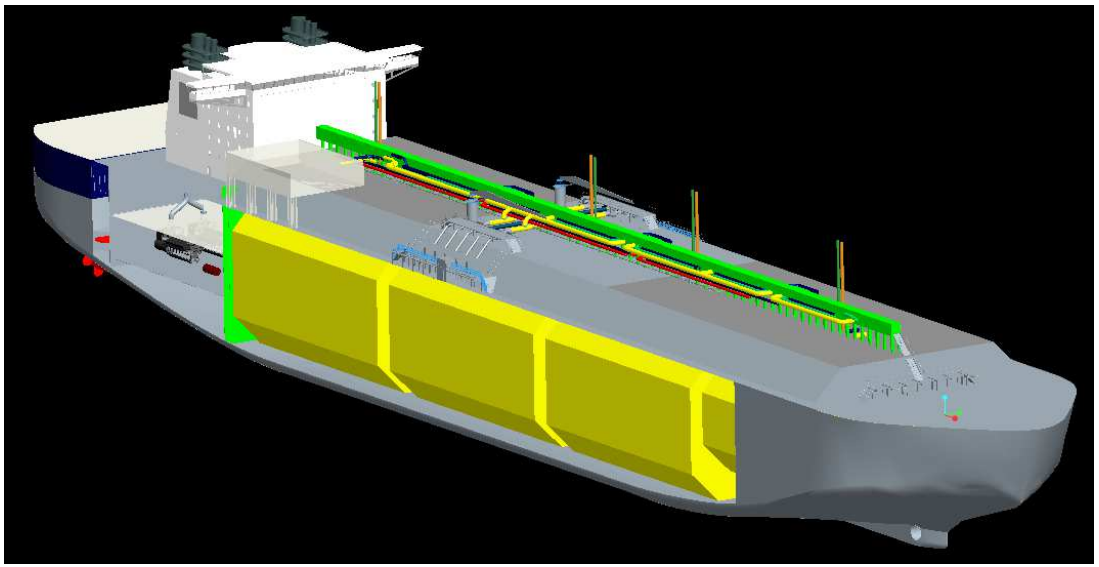


08.December 2011 Slide 13

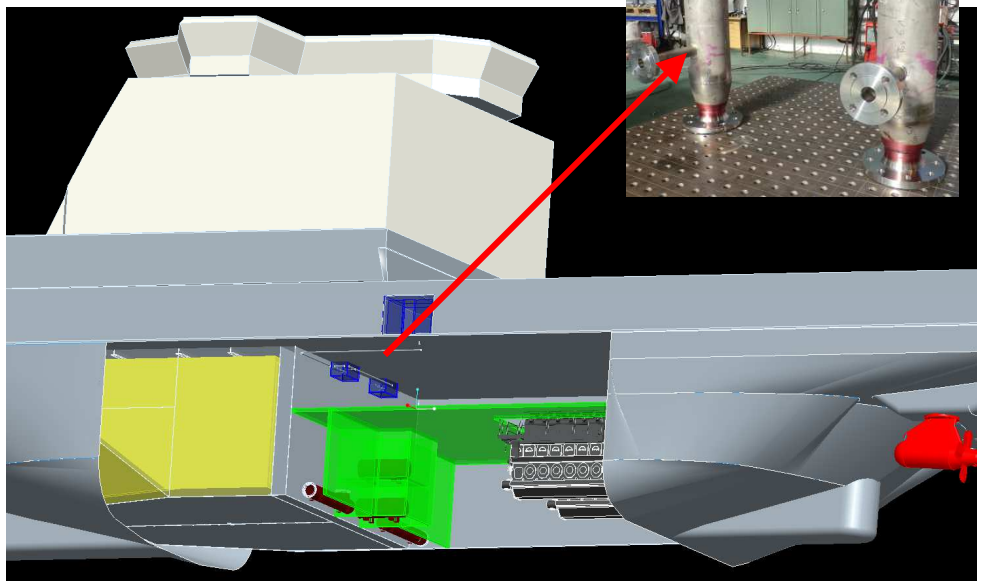
# Key points - POLAR?

Developing of a concep for a Arctic LNG-Tanker designed for the Yamal project

➔ Nordic Yards design



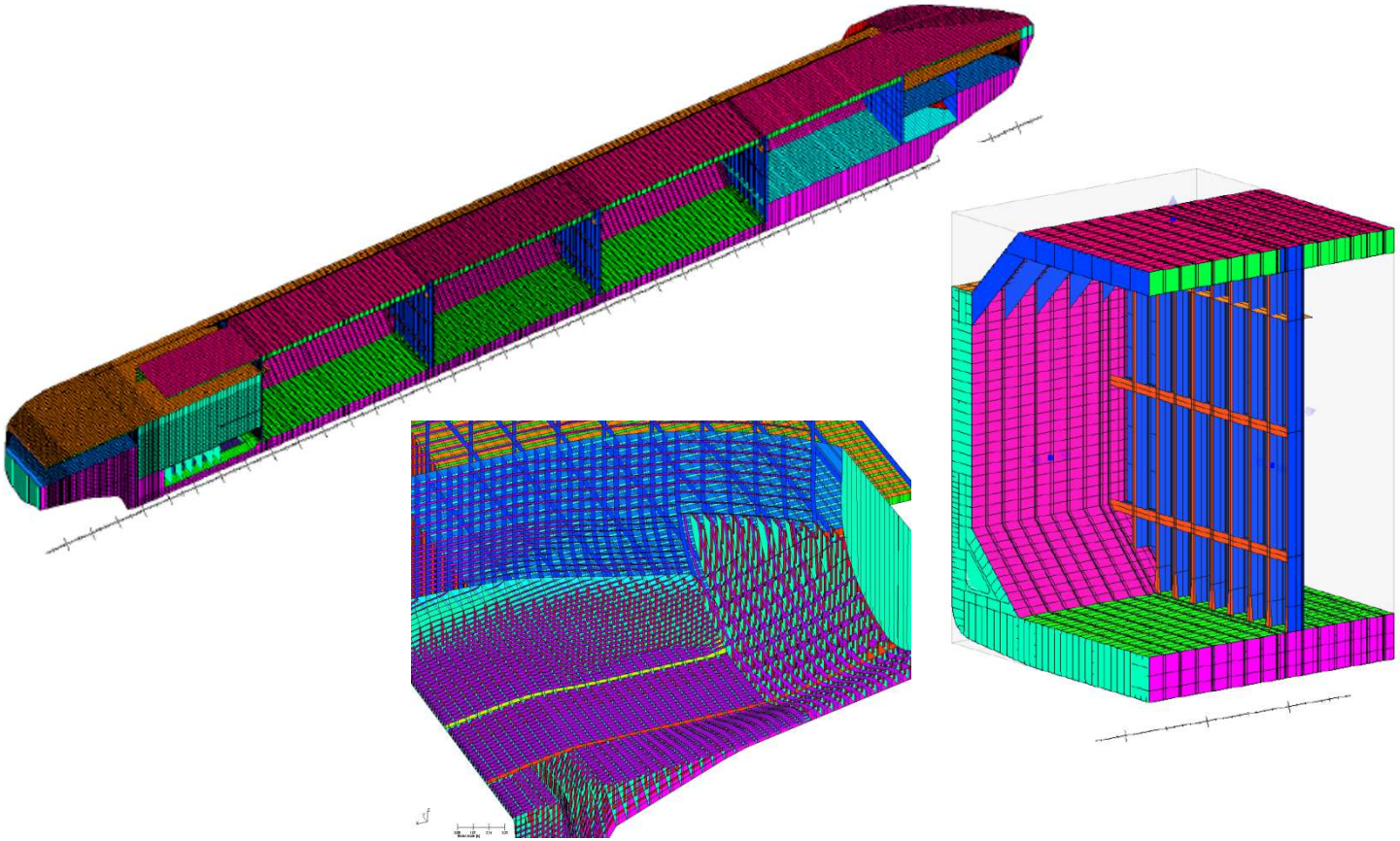
Developing of solutions for Nordic Yards for “LNG as Fuel” with its own LNG tank system and solutions for double-walled pipelines

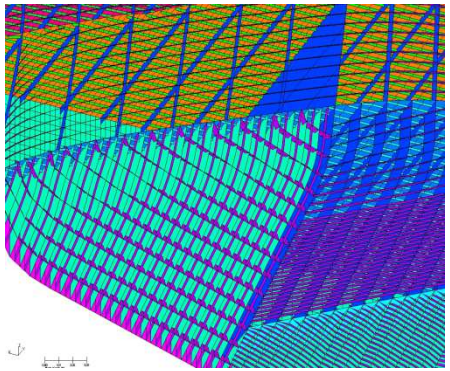


# The role of Nordic Yards in POLAR

- Nordic Yards was team leader in the joint project 2;
- has worked in the development of ship structures for use in the Arctic;
- has its own LNG tank system developed for LNG as fuel;
- a main point for Nordic Yards was to find future solutions for the theme winterization for Arctic ships;
- Improved knowledge on the subject of LNG as Fuel.

# Development of ship structures to break ice under Arctic conditions up to 2m ➔ particular in the forebody and afterbody





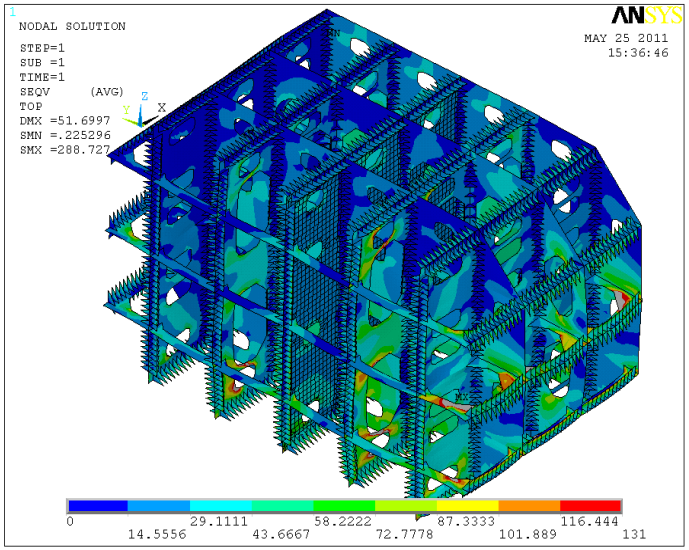
- Hull design with ice strengthening in bow and stern area.
- In the stem bar area is a full cross-section of each frame arranged.
- Ice intermediate frame placed on each half frame
- Longitudinal stringers are placed at a distance of 1.20m in addition
- Local stiffening on the shell ➔ eventual ice blast
- Above the frame floor web frames used on every 2nd frame. The shell itself is reinforced with longitudinal frames.

Closely frame spacing with high and compact frames

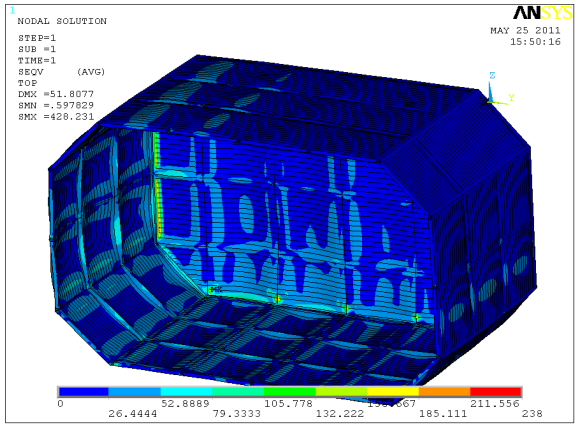
# Development of LNG-Tank A concept to use under Arctic conditions

| Location | Normal and equivalent stress | Shear stress |
|---|---|---|
| Base material | 238 [N/mm²] | 127 [N/mm²] |
| MIG weld | 131 [N/mm²] | 70 [N/mm²] |

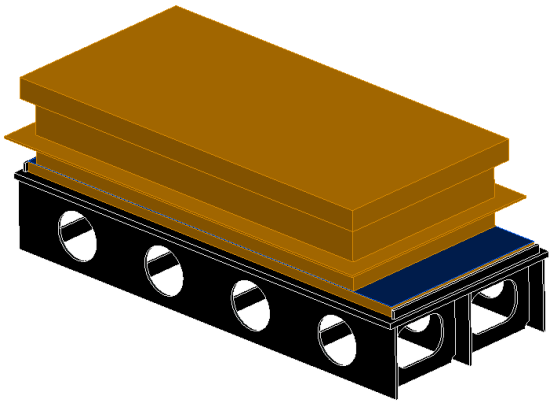
ULS acceptance criteria




VON MISES equivalent stresses, internal structure, stress range 131 N/mm²

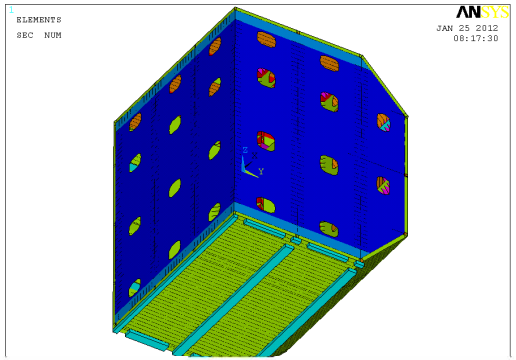



VON MISES equivalent stresses, double hull



Tank supports designed by Nordic Yards

Support Boundary Conditions and Loads




Certificate n° DT4/11/03265
Rev. 0 – 14th December 2011

BUREAU VERITAS

**BASIC CONCEPT APPROVAL CERTIFICATE**
**(Approval in Principle)**

At the request of:

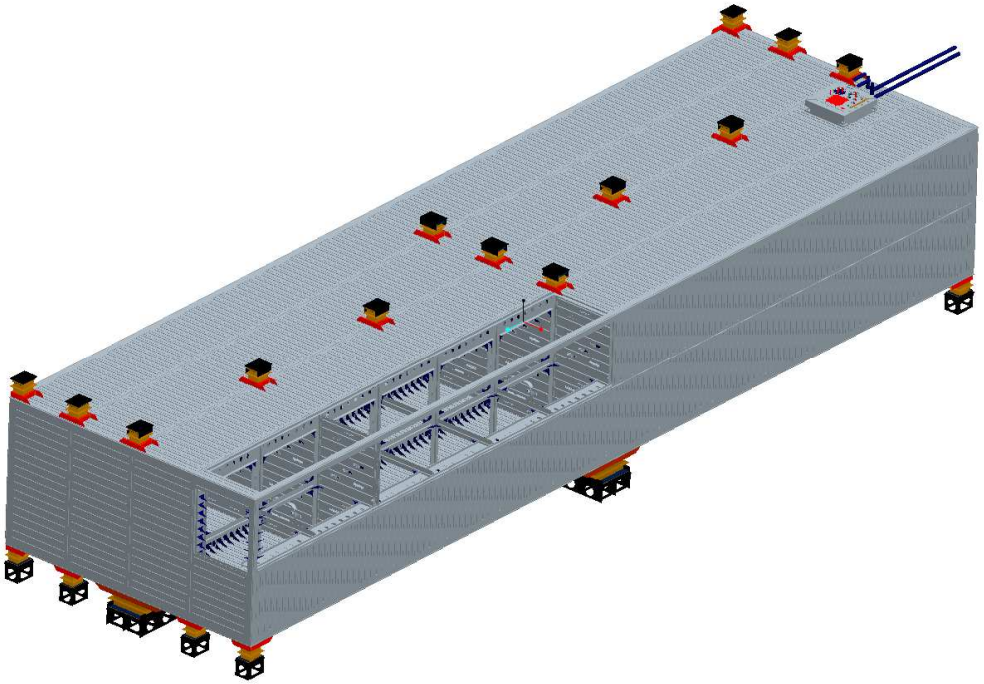
**NORDIC YARDS**

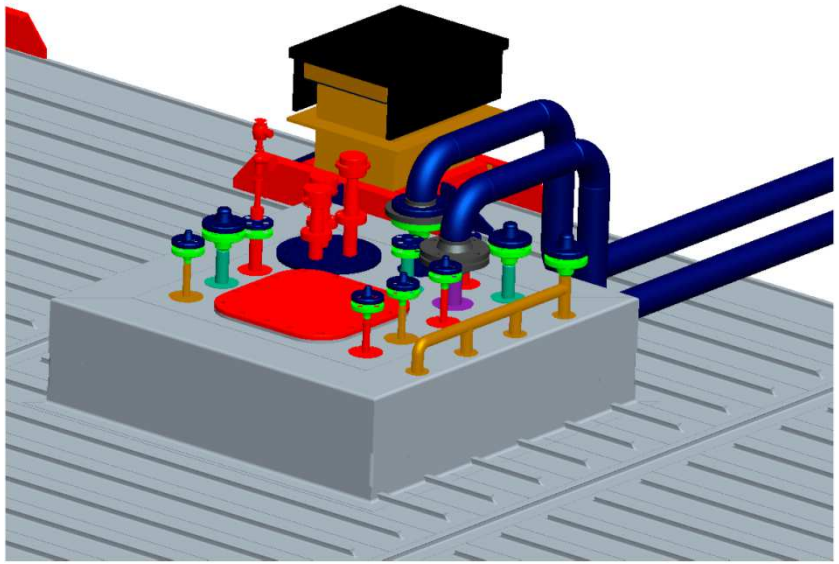
**BUREAU VERITAS**, acting within the scope of the general conditions of the Marine Division (*), declares hereunder that the design of the:

**Prismatic, Self supported LNG containment system**
**ALUMINIUM DOUBLE BARRIER TANK (ADBT)**
**for LNG storage and marine transportation**

**(for liquefied gases cargo tanks as defined in BV Rules, Part D, chapter 9 and in the IMO IGC Code),**

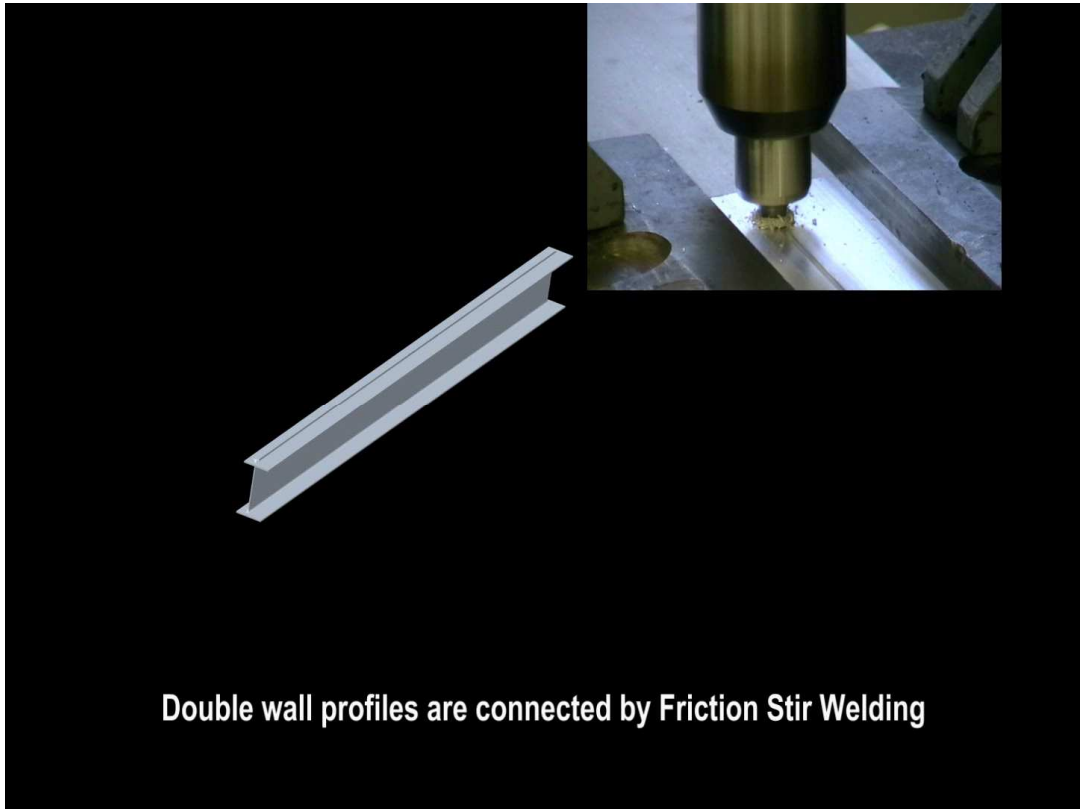
# Development of LNG-Fuel tank system type A based on the ADBT-System ➔ Focus was on the development of the double wall tank dome according to the type A tank system.





The design was tested in a mock-up program.

# Fabrication of LNG ADBT-System / Assembly of LNG-Tank system

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# Development of special winterization design for equipment on deck on Arctic ships.

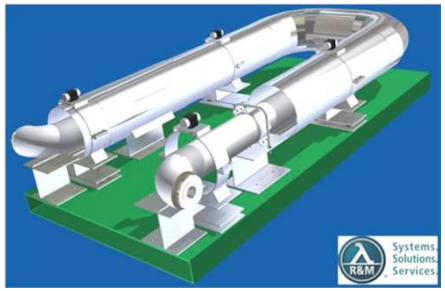
nordic yards

## Input

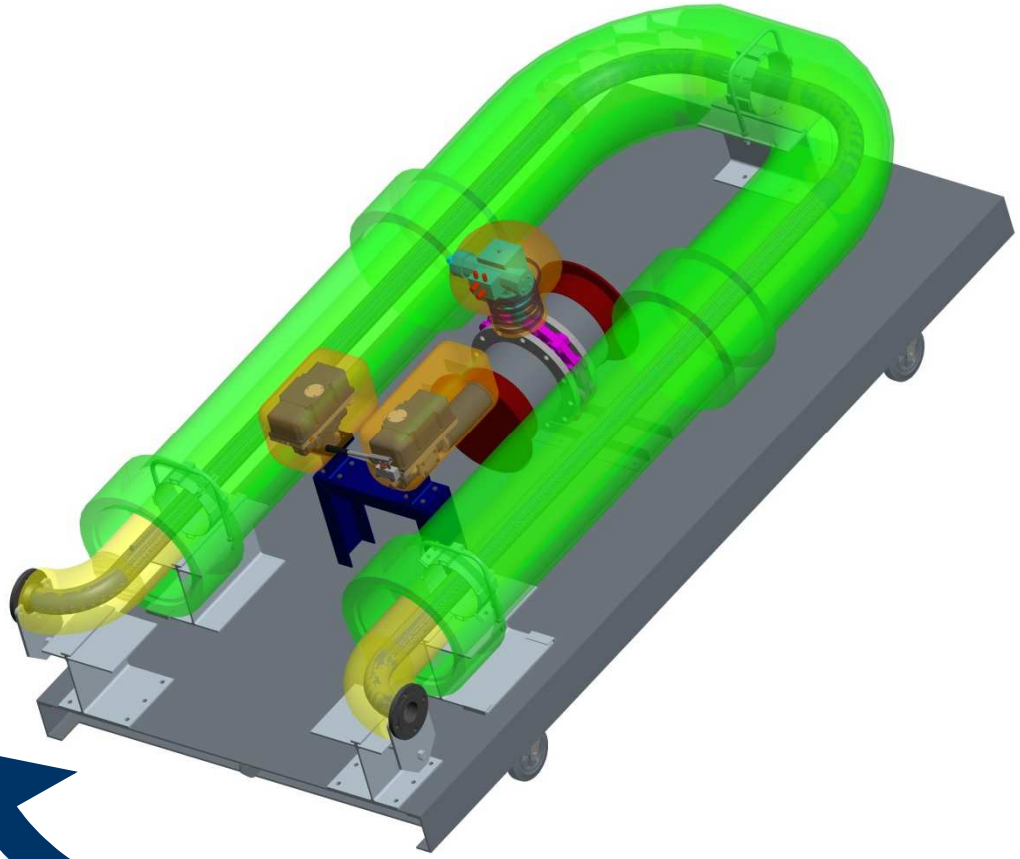
**Anti-icing**
valve DN200
winterization with heating, insulation and persenning

valve with persenning

**De-icing**
two different systems
de-icing system by R&M
versus de-icing with mallet




de-icing system developed by R&M



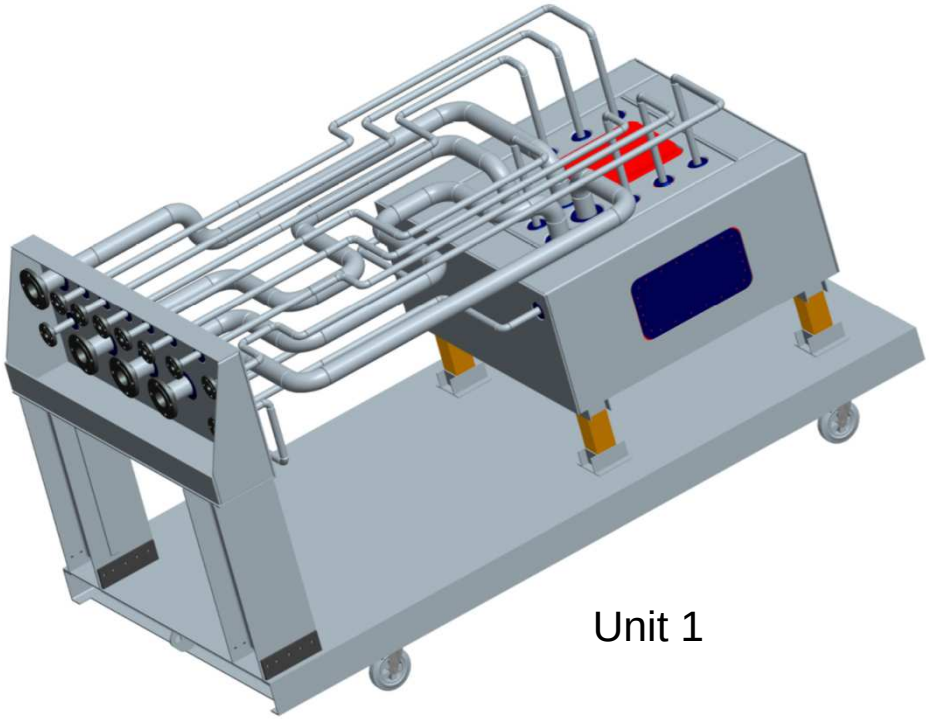
## Output

**Anti-icing**
knowledge about the function of the valve and winterization at -50°C.

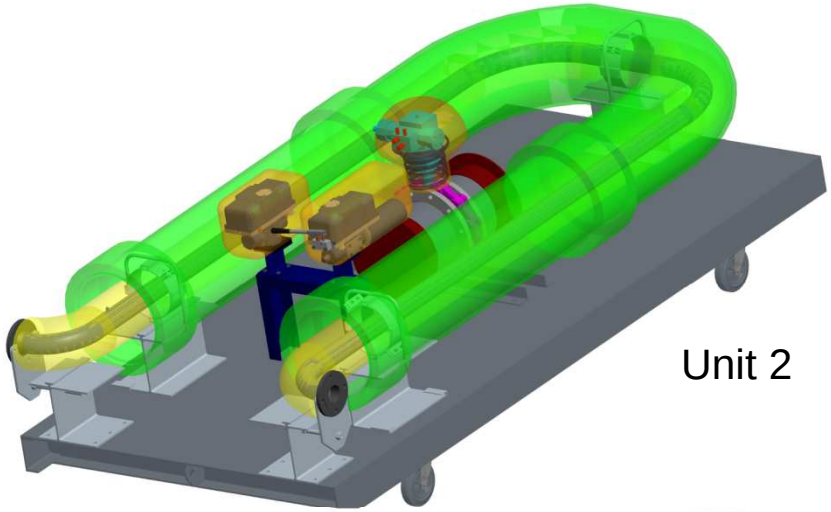
**De-icing**
knowledge of the de-icing system by R&M and visual inspection of the winterization measure after mallet test

# High point last year was the mock-up program ➔ the verification of all (so far) obtained theoretical results.

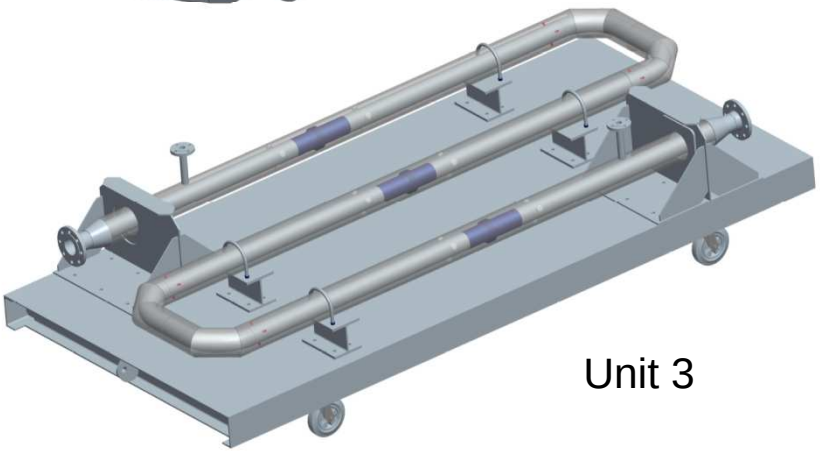
Three large main points



Unit 1

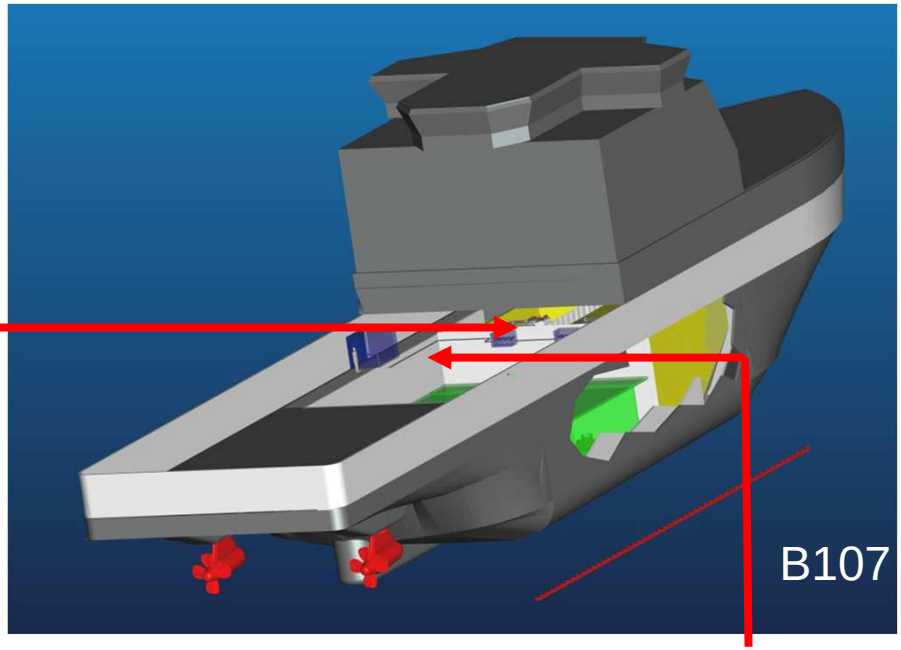


Unit 2

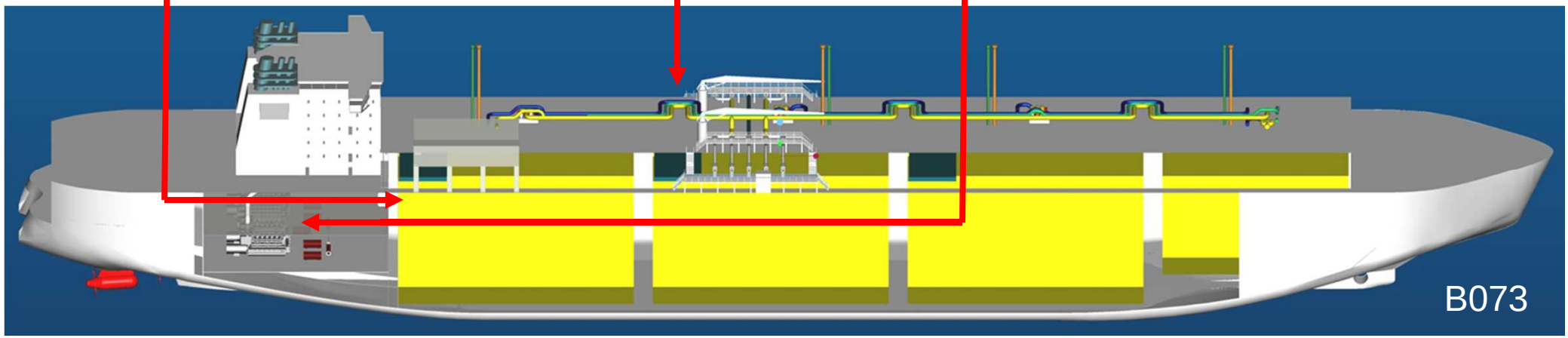


Unit 3

# Components




Fuel Dome (Unit 1)  Expansion Loop (Unit 2)  Double Wall Pipe (Unit 3)



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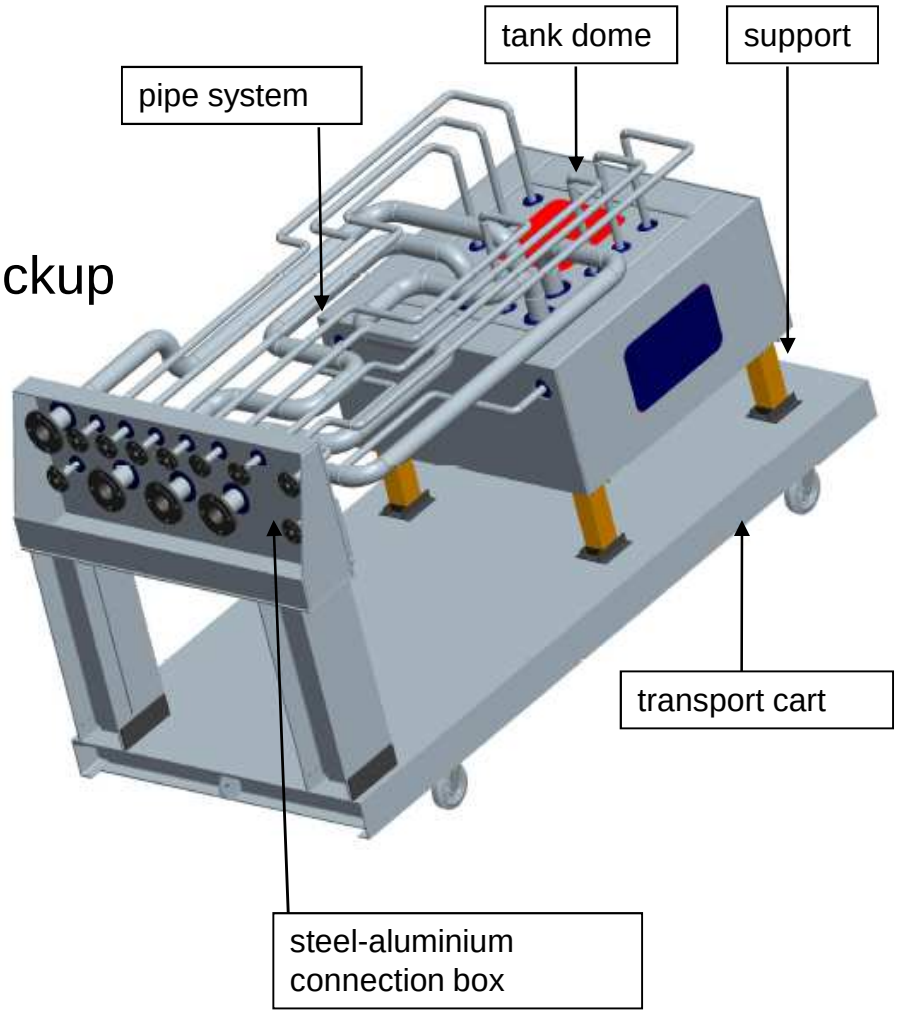
# Unit 1

- » tank dome of an atmospheric pressure LNG-tank (300m³-400m³)
- » scale 1:1 (tank dome and pipe system)
- » dimensions of mockup:
  height:2m / width:1.7m / length:3.5m
  pipe diameter: DN25 & DN80
- » all components of unit 1 are made of aluminium
- » installation of all system-relevant piping within mockup
- » tank dome has a double barrier



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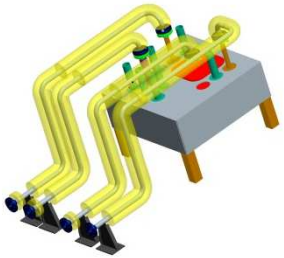
# Unit 1

## Input

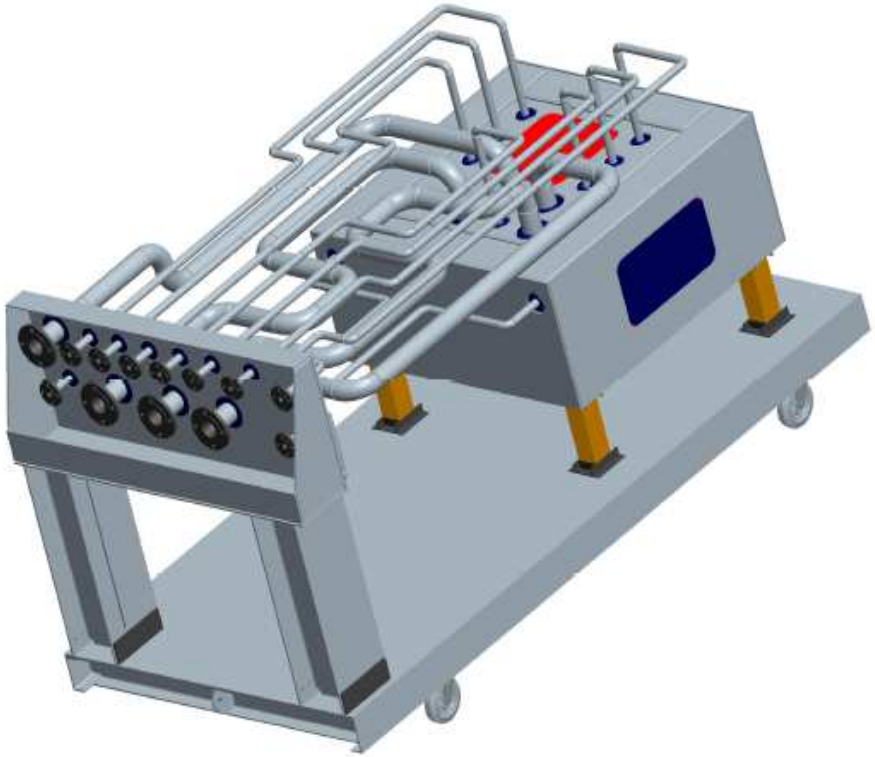
Design
space-saving
close to reality
regulations and rules into account



first design

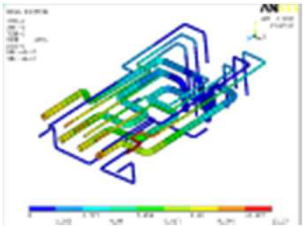
**Welding**
create different WPS
the need to develop test procedures

welding procedure specifikation



## Output

Design
compare theoretical investigations with simulation results

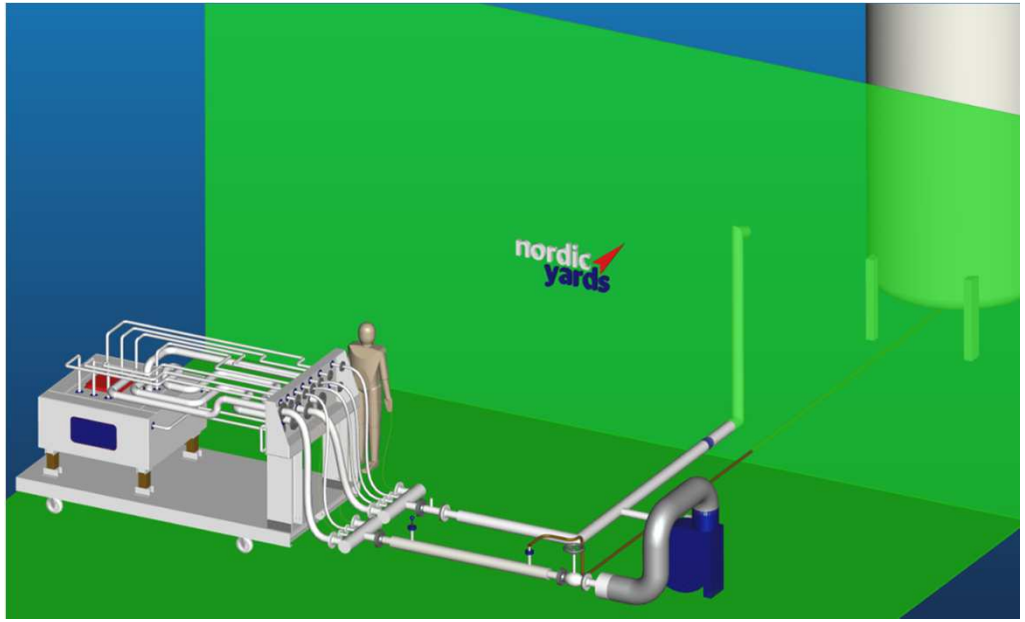


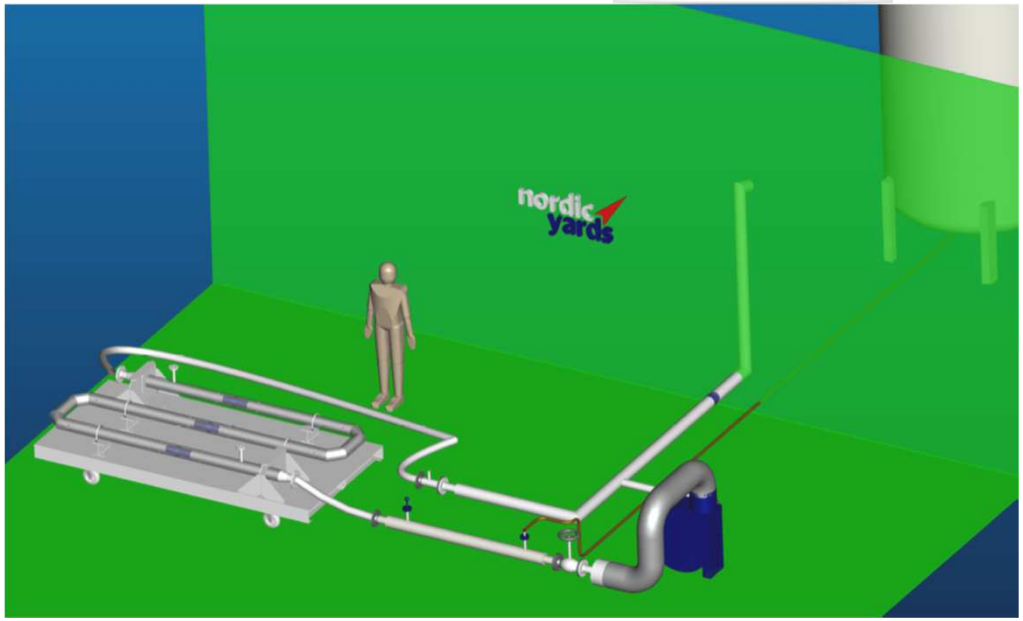
displacement by thermal contraction

**Welding**
qualification of personnel
experience with alternative test procedure like helium leak test

helium leak test with comp. FhG

# Unit 1 and 3 cryogenic tests




CAD-modelling test track Nordic Yards

data test track

- » temperatures down to -190°C
- » blower 2.2kW
- » 11,000l nitrogen
- » dimensions:

  length:15m / pipe diameter: DN80 / DN125

# Unit 1 and 3 cryogenic tests

unit 1 integration in the test track

unit 3 integration in the test track

» nitrogen flow in selected pipes

» cool down: 35h

» 40 measuring points for temperature

e.g.: inside and outside pipe/ inside and outside tank dome/ on connection-box

» nitrogen flow in inner pipe

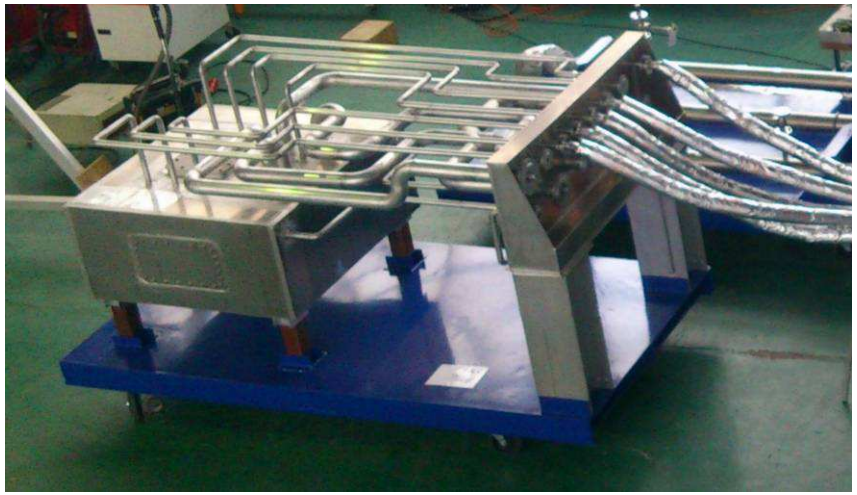
» vacuum in the barrier

» cool down: 1h

» holding time: 1h

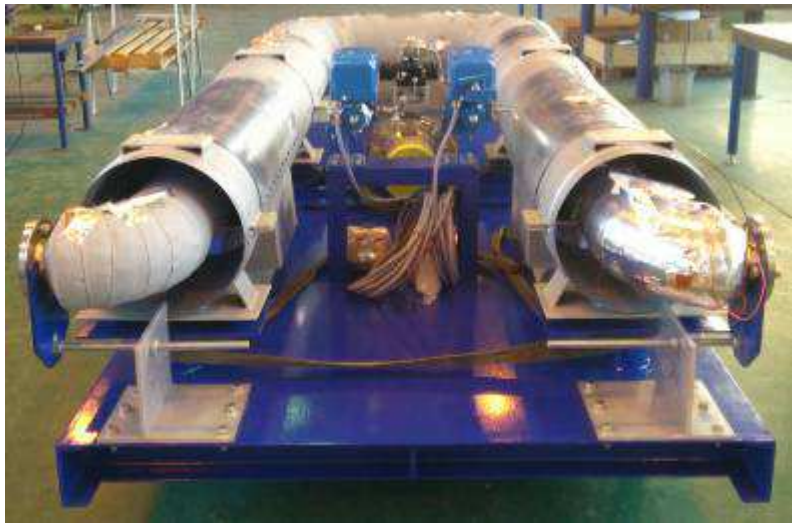
» 40 measuring points for temperature

e.g.: inside and outside innerpipe/ on the bulkhead/ on the double barrier

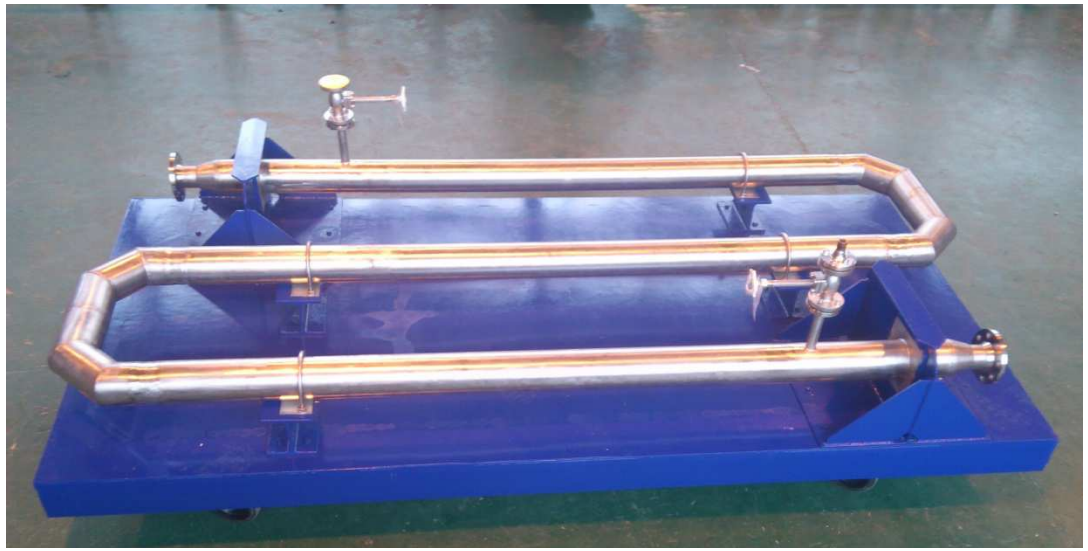


mockup unit 1

# Thank you for your attention !



mockup unit 2



mockup unit 3