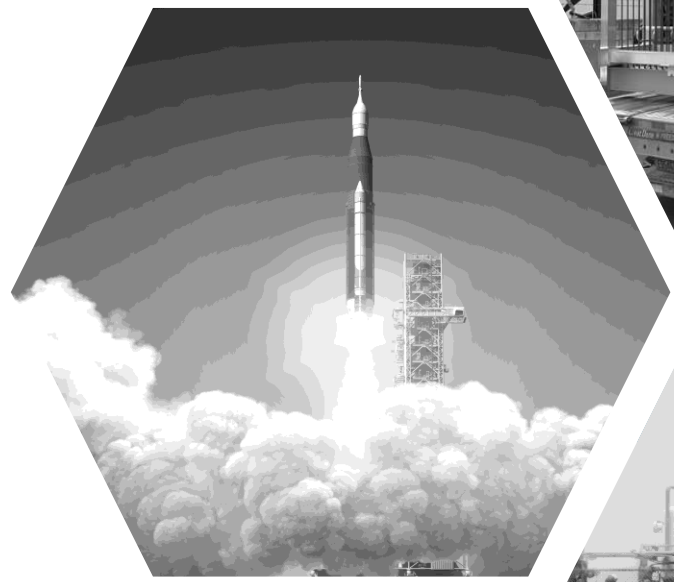
OPW
CLEAN ENERGY SOLUTIONS

DEMACO



DEMACO

Your specialist in **Liquid Hydrogen** infrastructure solutions

CES Mission and brands.

A world-class cryogenic operating global platform, differentiating for serving customer's global needs

OPW CLEAN ENERGY SOLUTIONS a DOVER company

REGO · ACME CRYOGENICS · DEMACO · SPS CRYOGENICS · CPC-Cryolab

ACME CRYOGENICS · CPC-Cryolab · REGO · SPS · DEMACO

OPW CES by the numbers

Global footprint to serve customers over 100+ countries

*In 2022 Dover Corporation made a revenue of **$8.5 Billion, which OPW Clean Energy Solutions is part of.***

15 Locations

750+ Employees

10+ million products/year

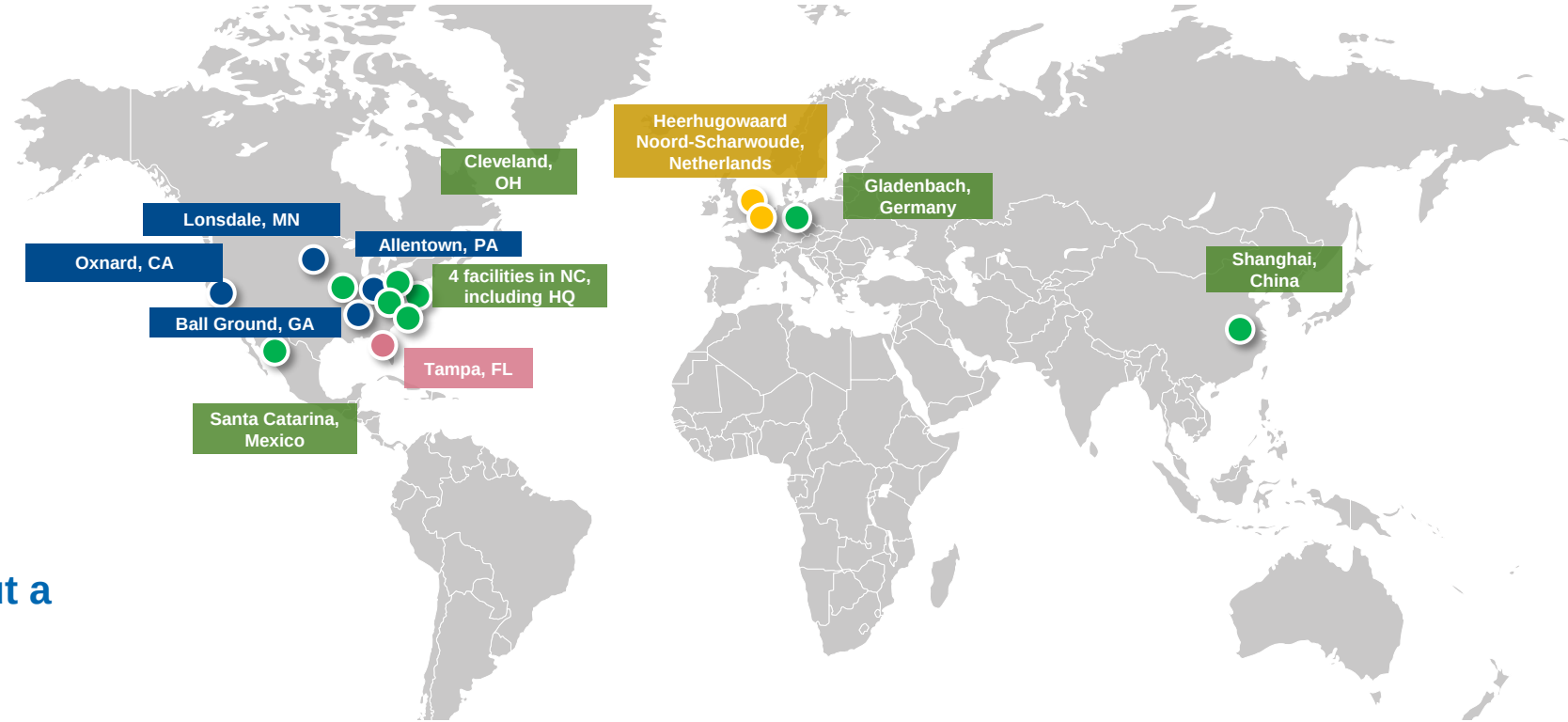
100+ Countries served

7 Design Centers

5,440+ Days (22 years) without a lost time accident

#1 in Safety

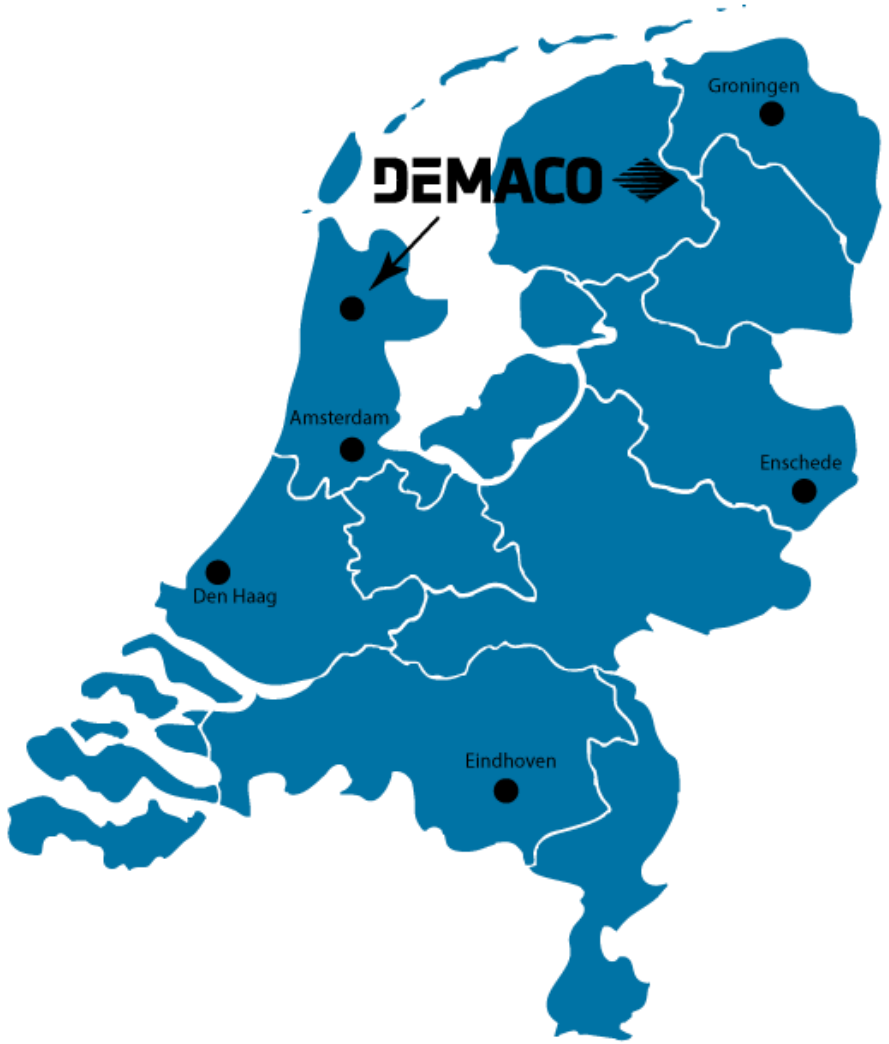
Recipient of Gold 1 – Star Award from CGA (Compressed Gas Association, Standard for Safety in the industry)



ACME CRYOGENICS · REGO · DEMACO · SPS CRYOGENICS · CPC-Cryolab

Organization

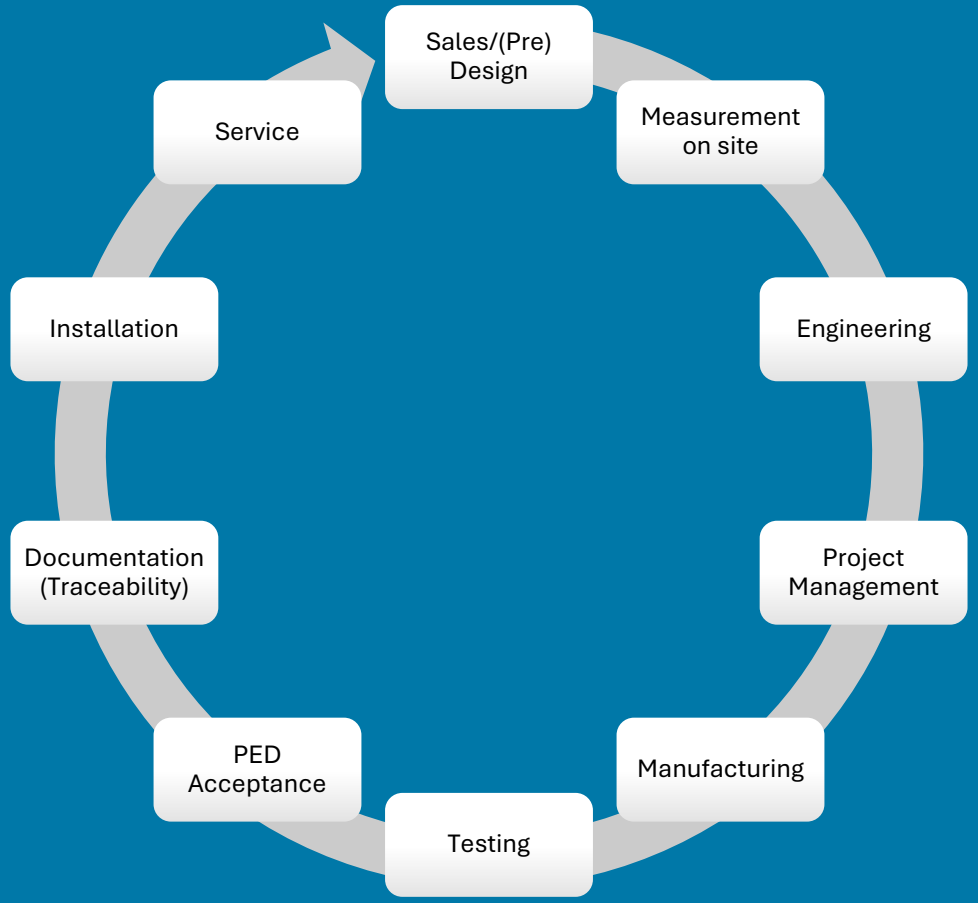
- HQ in the Netherlands.
- 130+ employees.
- Turnover of approx. € 25 mil.
- Total area 10.000 m².



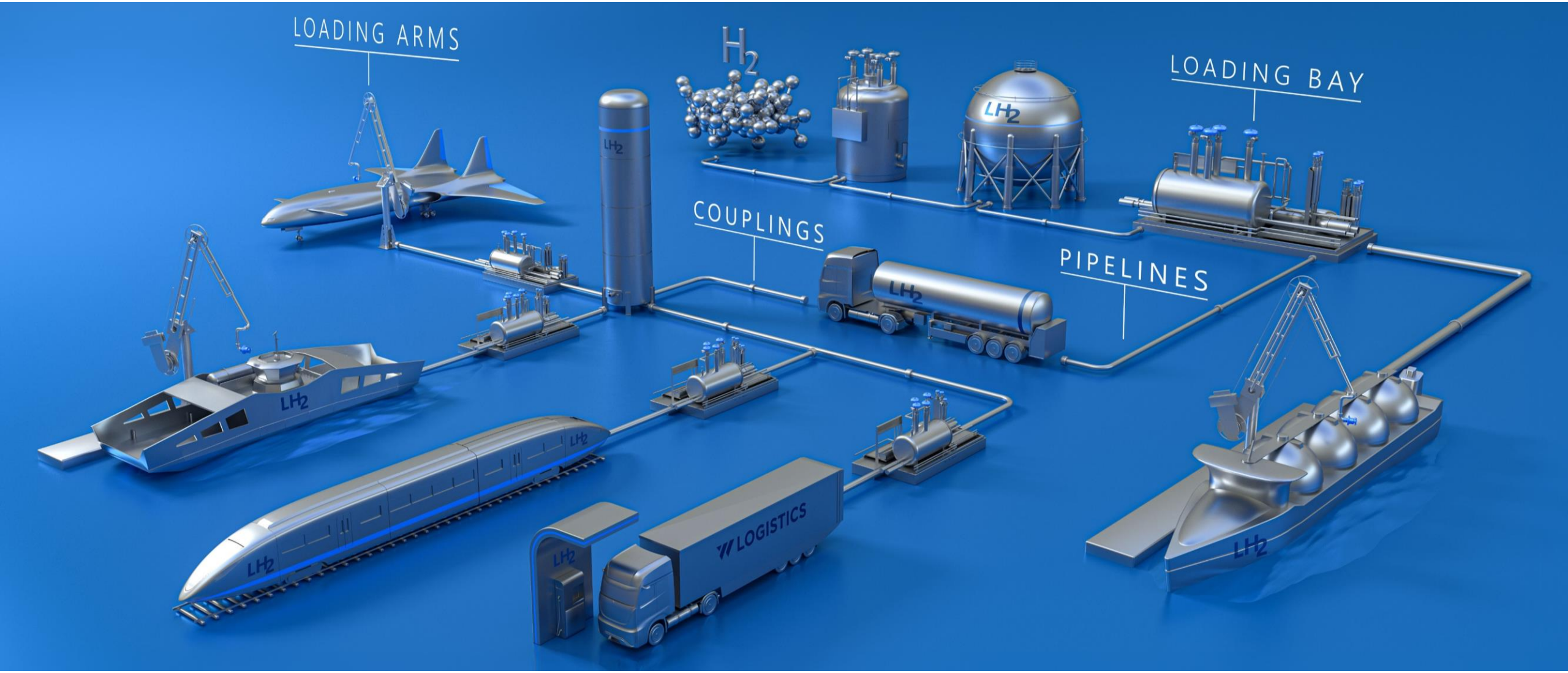
Introduction Demaco

- Demaco was established in 1960.
- Has over 40 years of experience in Cryogenics.
- Performs:
  - Conceptual design
  - Prototyping
  - Detail design
  - Manufacturing
  - Testing
  - Installation

Total Intergrated Company



OPW
CLEAN ENERGY SOLUTIONS
a DOVER company



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CPC-Cryolab
REGO
SPS
DEMACO

Hydrogen Introduction Demaco

- Demaco follows the developments in the entire supply chain of Hydrogen
- Cryogenic liquid at -253 °C (ambient pressure)
- Our focus is on the liquid Hydrogen (LH_2) transport, distribution and applications
- Especially Trucks, Marines, Railway and Aerospace have our attention

Liquefaction Facility

- A liquefier is a device that can be used to liquefy hydrogen gas. Hydrogen becomes liquid when it reaches the extremely low temperature of -252.9 °C at atmospheric pressure.

- Demaco was involved in several projects were vacuum insulated pipelines are required for hydrogen liquefaction facilities.

Loading Bay

- The loading bay is the place where LH2 is transported from the storage tank to the filling place for a truck or a ship for long distance transportation.
- The LH2 is transported via vacuum insulated pipelines to the filling location in order to fill the tanks of the truck/ship in an efficient and safe method via the loading bay.
- Demaco is involved in a project in South-Korea to support the uptate of hydrogen in the mobility sector.

Loading Arm

- The Demaco loading arm enables the safe transfer of liquid hydrogen from one tank to another while maintaining its quality. Often this application is used for liquid hydrogen refueling of transport vehicles, such as ships, trucks, or aircraft.
- A standard loading arm consists of a connection to a buffer tank, swivel joints, support construction, and a connection to the transportation vehicle. A loading arm can be a rigid or flexible vacuum insulated pipe.

Vacuum Insulated Transfer Lines (LH2)

- Vacuum insulated transfer lines (Vacuum Insulated Pipelines LH2 VIP) have a double wall; the air between the walls is sucked out. The two walls never touch because spacers keep them apart. This creates a vacuum space and a pressure difference between the vacuum and outside air.
- A vacuum insulated liquid hydrogen transfer line is a rigid pipe with a slim design. All coils are prefabricated for fast and efficient installation. In addition, the pipes are made of stainless steel so that the structures will last for years without any problems.

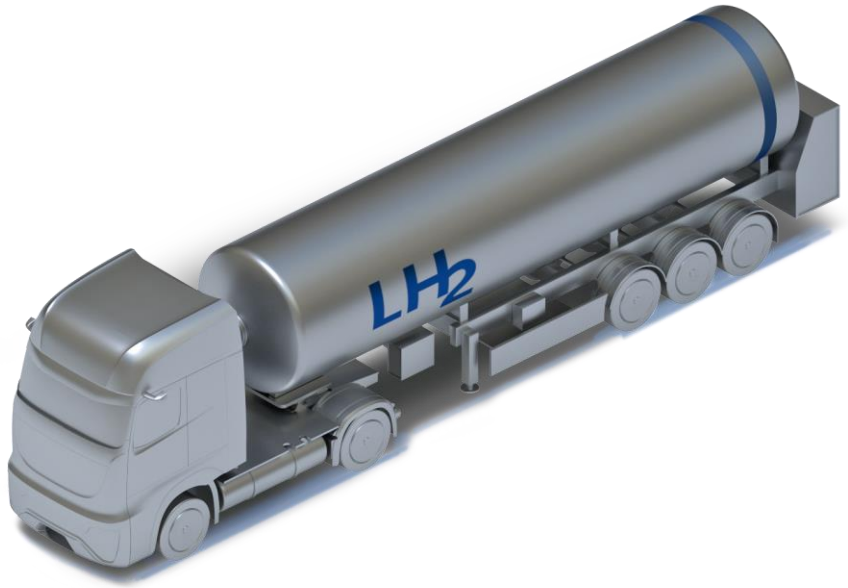
Automotive Applications

Hydrogen in the automotive industry

- Because liquid hydrogen is a very sustainable fuel, many car manufacturers focus on developing hydrogen-powered cars and trucks (equipped with fuel cells or combustion engines). Demaco is actively contributing to the implementation of hydrogen in this industry and supplies all required infrastructures to store and distribute liquid hydrogen for filling stations.

Application

- In addition to cars and trucks running on liquid hydrogen, the automotive industry is also developing liquid hydrogen refueling stations and refueling infrastructures for trucks.



Marine Applications

Hydrogen in the marine industry

- Liquid hydrogen is increasingly used as a fuel in the marine industry. Ships running on this sustainable fuel have onboard systems to refuel and distribute hydrogen to the fuel cell. On-shore cryogenic loading arms are part of Demacos expertise. Demaco has extensive experience in designing and building hydrogen systems for the marine industry.

Application

- Hydrogen systems can be installed on different types of ships. Examples include ferries, superyachts, cruise ships but also smaller vessels. Some examples of applications that can be found on these ships are onboard distribution systems and storage tanks. Loading arms are used on the quay to refuel ships; these arms move along with the ship and ensure a safe disconnection in case of an emergency.

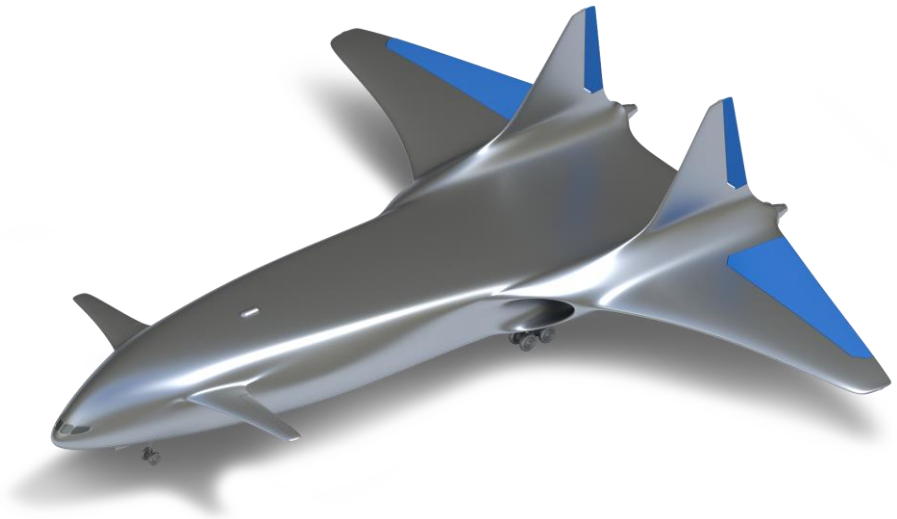
Aerospace Applications

Hydrogen in aerospace

- Liquid hydrogen is vital to both the aerospace and aviation industries. Liquid hydrogen has been used for launching rockets for a long time, but liquid hydrogen planes are relatively new and still in development. Demaco is closely involved in the development of liquid hydrogen-powered aircraft. We also supply onboard systems, refueling infrastructures, and other cryogenic infrastructures to the aviation industry.

Application

- Liquid hydrogen is incredibly versatile and can be used as a fuel for various aircraft and rockets. Liquid hydrogen is also used in test labs and in test rigs; the liquid also serves as a coolant facilitating superconductivity in cables and engines.



Experience & References: LCH4/LH2 Test Facility

- Test facilities are used for testing rocket engines with liquid hydrogen, liquid oxygen, and liquid methane.
- Demaco is involved in the design, engineering, manufacturing of the cryogenic infrastructure (filling and distribution).
- Tests will be able to be carried out with the traditional combination of liquid oxygen and hydrogen as well as with the combination of liquid oxygen and methane.

Experience & References

Cryogenic Infrastructure on production plant of liquid hydrogen:

- Vacuum insulated transfer lines for LH2.
- Loading Bay.
- Vacuum insulated valve boxes.

Experience & References

Cryogenic Infrastructure for super conductive airplane motor:

- Closed loop cooling system LH2.
- Super conductive rotor design.
- Prototyping and testing.
- Demaco is involved in many research and developments projects.

Actual portfolio

Cryogenic Infrastructure:

- Vacuum Insulated Piping (VIP)
- Rigid
- Flexible
- Couplings
- Valves and intrumentation
- Control systems

Actual portfolio

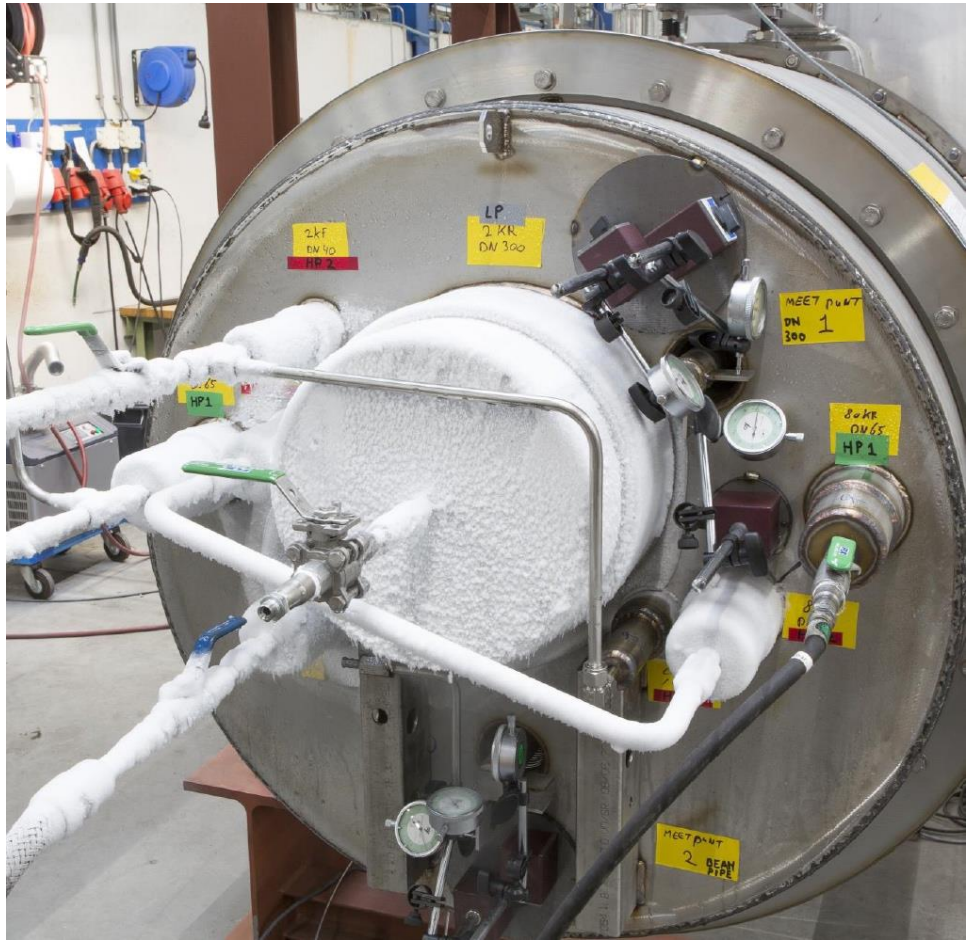
Cryogenic Equipment:

- Phase separators
- Subcoolers
- Flexible
- Filling stations
- H2 Leak detectors

Actual portfolio

Cryogenic Services:

- Feasibility study
- Conceptual design
- Prototyping
- Testing
- Safety
- Installation
- Supervision



Networking Activities

TNO innovation for life

nlr

Hydrogen Europe

DNV

UNIVERSITY OF TWENTE.

kiwa Nederland

TU Delft

TECHNISCHE UNIVERSITÄT DRESDEN

KIT Karlsruher Institut für Technologie

PEM | RWTH AACHEN UNIVERSITY

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