ESTECO um 2018
23rd » 24th MAY
» TRIESTE, Italy
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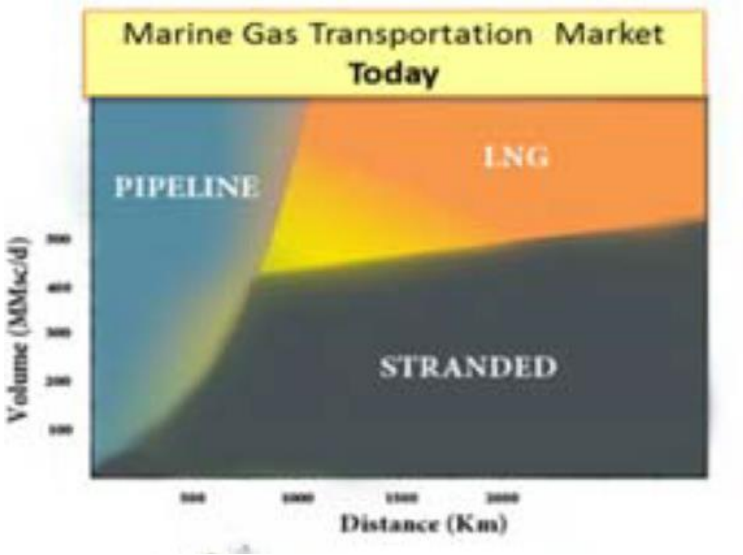
ESTECO Technologies applied in the GASVESSEL project

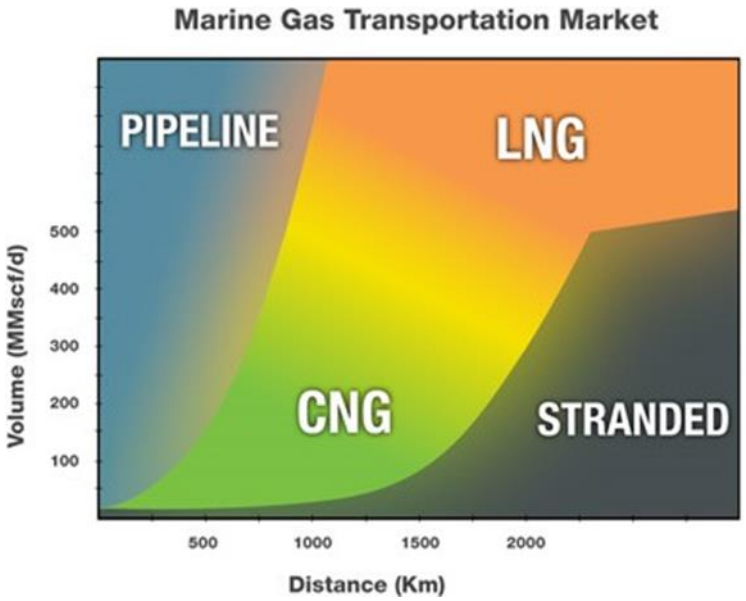
Spartaco ANGELINI

NAVALPROGETTI S.r.l

Trieste - Italy

Background: gas transportation





- Big reservoir / distance LESS than 1000 km → pipeline
- Big reservoir / distance MORE than 1000 km → LNG carrier

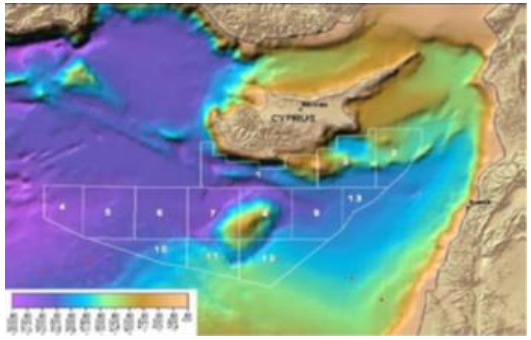
- Limited reservoir / distance less than 1000 km → no proven technology economically viable at the moment
- Containment cylinders based on existing technologies too small and too heavy

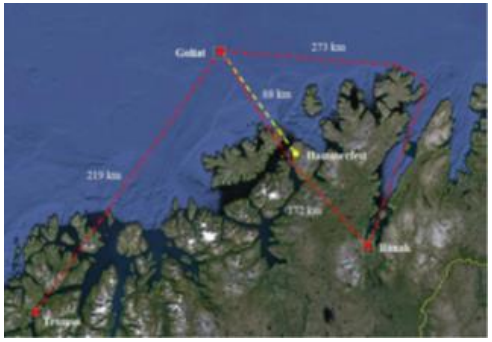
European Commission

- CONSORTIUM formed by 13 Partner Companies
- 8 Countries represented:
  Belgium, Cyprus , Germany, Greece, Italy, Norway, Slovenia, Ukraine
- Project duration: 48 months (started June 1st 2017)
- EU contribution = Project's financial value = 12 M€

Transportation scenarios

- Analysis of 3 real-life geo-economical gas exploitation scenarios (East Mediterranean, Barents Sea, Black Sea)





- ESTECO Mathematical model to optimize
  - Ship carrying capacity
  - No. of ship
  - Ship main design parameters
  - Pressure vessels dimensions (diameter and length)
  - Transportation tariff

Design of Pressure Cylinders

PATENTED+ABS AIP ultra-thin stainless steel+carbon/glass

300 bar (70% lighter than any other previous technology)

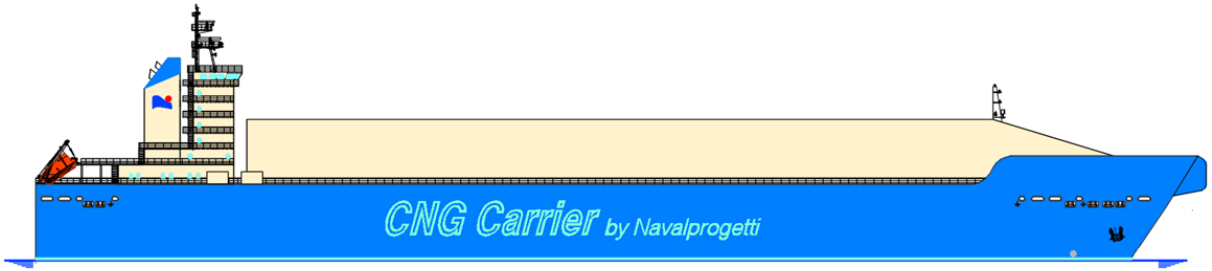
Optimization of winding process by ESTECO

- Pre-industrial Prototyping Pressure Cylinders.Custom built/self designed facility in Italy.

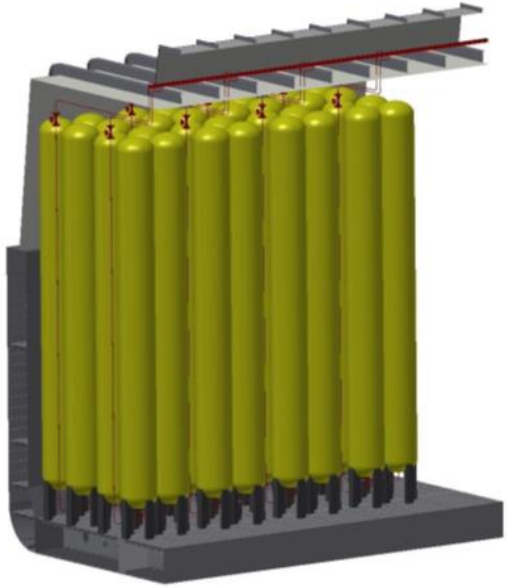
Tests on LOA= 8.0 m, diameter 2.5 m

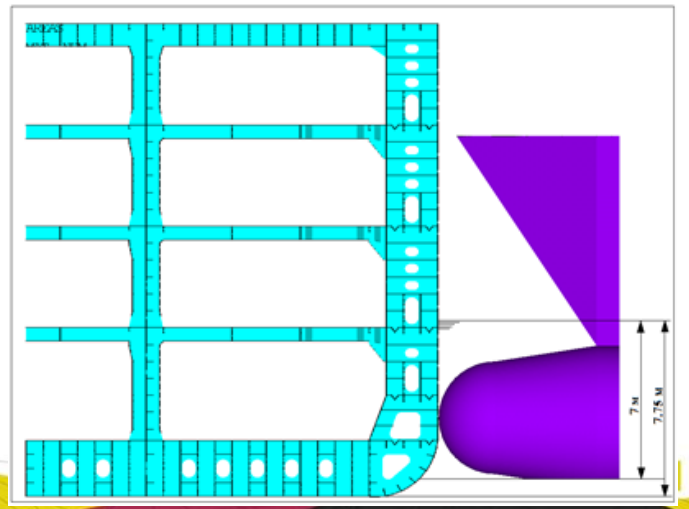
Results valid for LOA=11 m (40’ Container)

CNG Ship Design



CNG Ship Design (AIP from ABS covering concept and safety), Ship deadweight according with ESTECO decision support model, CFD studies of fire and explosions





Safety Analysis

- FEM analysis

- Patented Technology PCT/IB2015/050668

- Approval in principle from ABS

ABS

Ref.: TASK#: T1265825
Project# 3374211
Date: 15 April 2015

Certificate of Approval in Principle

As requested by:

NAVALPROGETTI SRL, Italy

ABS has reviewed documentation as specified in ABS letter dated 15 April 2015 for:

New Compressed Natural Gas (CNG) Containment System

and found the system to be satisfactory with respect to the intent of the following:

1- ABS Guice for Vessels Intended to Carry Compressed Natural Gases in Bulk, April 2005 (Updated Feb. 2014)
2- ABS Guicance Notes on Review and Approval of Novel Concepts , June 2003
3- International Standard for Gas cylinders – Refillable composite reinforced tubes of water capacity between 450L and 3000L – Design, construction and testing (ISO 11515:2013)

subject to compliance with the comments in the above letter and the Rules. All drawings, calculations, test reports, and certificates for components are to be found acceptable to ABS for issuing this certificate.

Dimitrios G Kostaras
Vice President of Engineering
ABS Europe Division

By:
Lucio Trevisan
Senior Managing Principal Engineer

ABS CORPORATE, Technology

Yung S. Shin,
Head of Cargo Containment Systems Group

Note: This certificate evidences compliance with one or more of the rules, Guides, standards or other criteria of American Bureau of Shipping or a statutory, industrial or manufacturer's standards and is issued solely for the use of the Bureau, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without ABS approval will result in this certificate becoming void. This certificate is governed by the terms and conditions in the ABS Rules.

Expected Achievements

- Main goal:
  Prove the viability of the CNG concept
  Offer to the market a customizable technology package composed by the pressure cylinder and the ship design

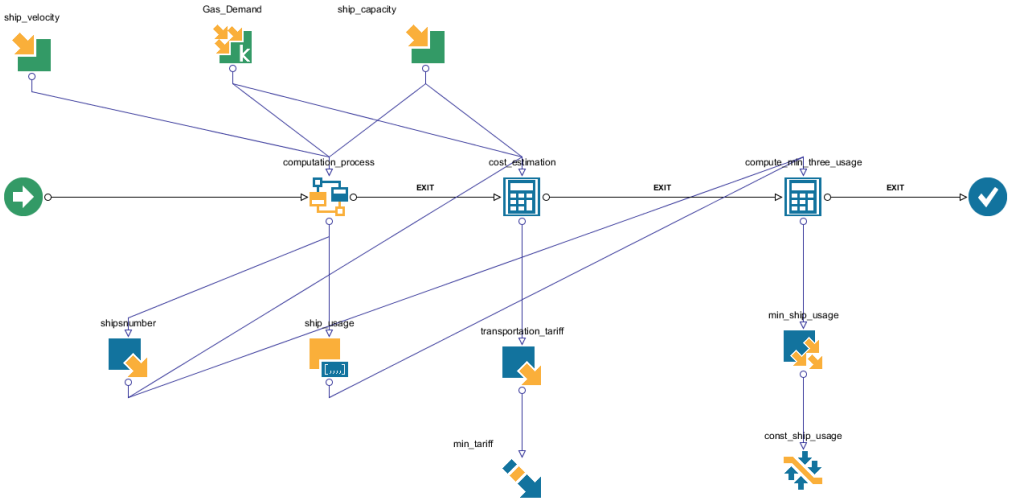
- Introduction of CNG transport at competitive costs where pipeline and LNG is not economically attractive

- Secure and affordable energy supply for Central and South East Europe

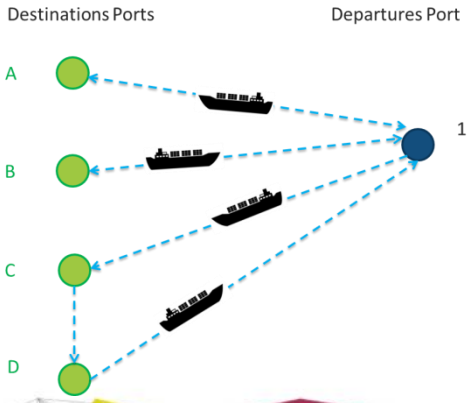
- Europe less dependent on gas import

- Supply natural gas to places where natural gas is not yet part of the energy supply system

Decision support tool creation (modeFRONTIER)



Optimization workflow (modeFRONTIER)



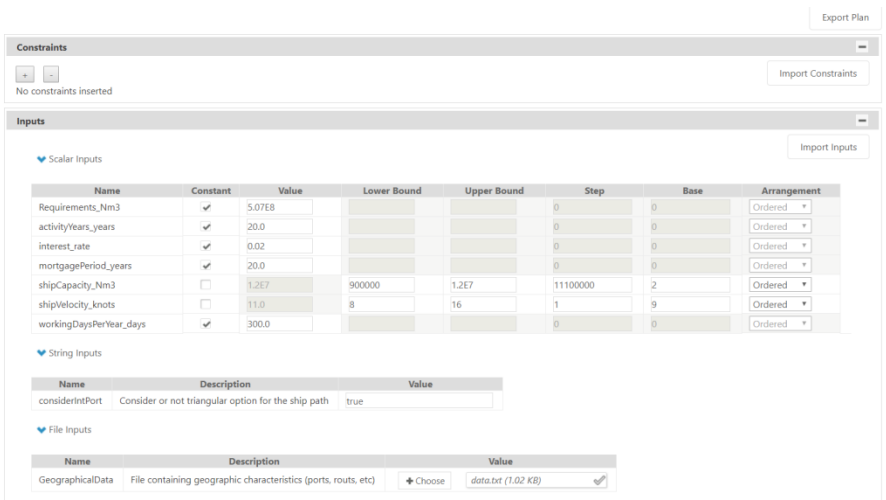
Inputs

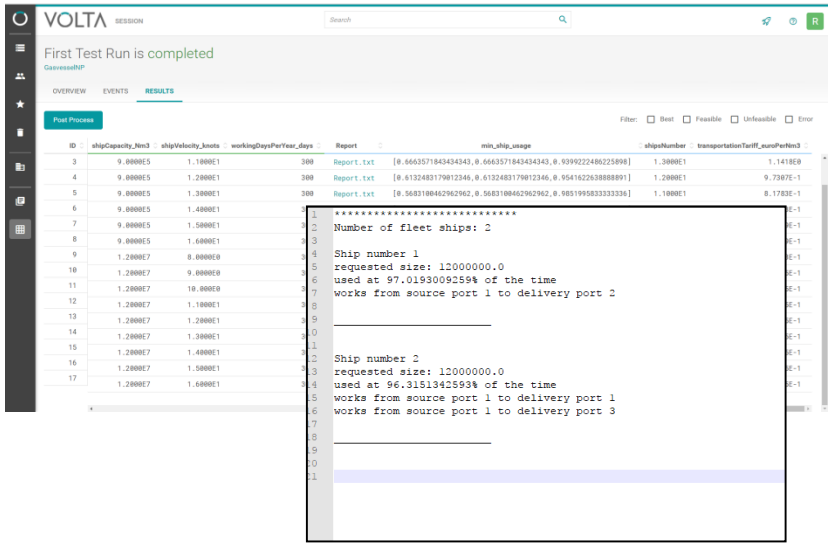
- total gas demand [Nm^3/year] in the local region
- ship velocity [knots]
- ship capacity [Nm^3]
- coastal storage autonomy [days]
- ports distances matrix [Nautical Miles]
- loading and unloading time [hours]
- operational time [hours]
- working days per year [day]

Optimized results

- Number of ships fleet
- Ship usage, [time % over year]
- CNG Transportation tariff [€/Nm^3]
- Gas downstream tariff [€/Nm^3] (include the unloading cost)

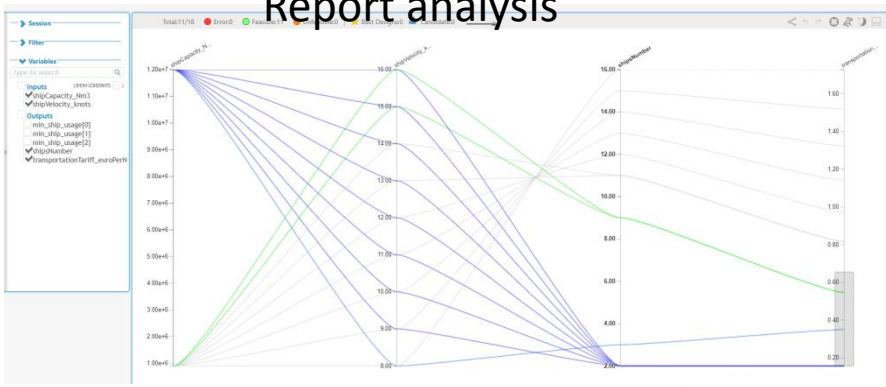
Decision support tool usage (VOLTA)



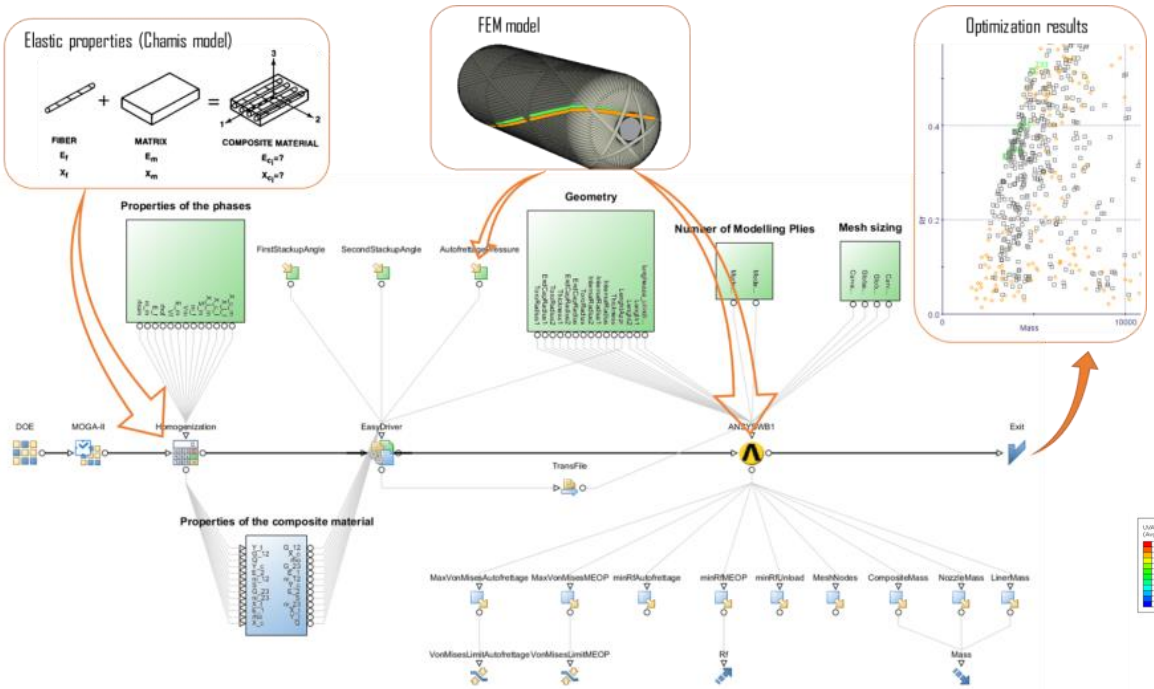


Planner definiton

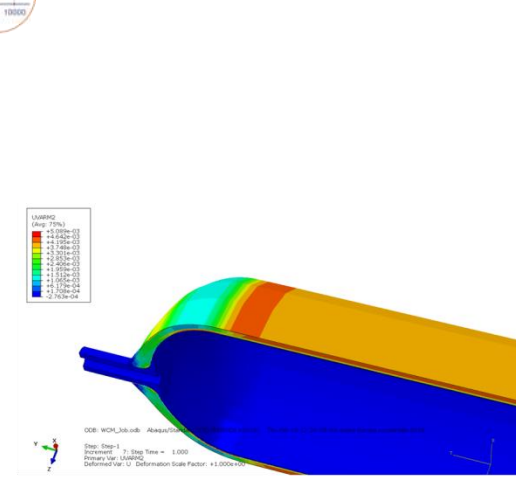
Report analysis



Structural optimization of vessel



Parameterization and integration in modeFRONTIER optimization workflow



Experimental validation (model)

Thanks for your attention

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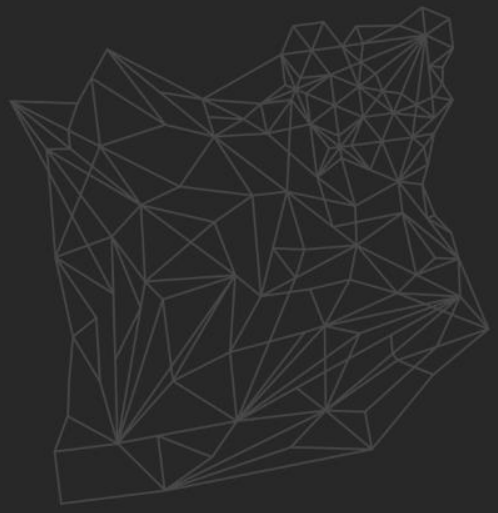

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THANK YOU FOR YOUR ATTENTION

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