INNOVATIVE INLAND WATERWAY VESSELS FOR THE DANUBE REGION

Vasile Giuglea (Ship Design Group)

This project is co-financed by the European Union.

SHIP DESIGN GROUP GALATI

INNOVATIVE INLAND WATERWAY VESSELS FOR THE DANUBE REGION

7th Meeting of the Working Groups of [illegible] 1a - Bucharest, 24th May 2016

CONTEXT

Some important facts:

- Danube become to be an EU waterway
- Safety and environment Regulations come in waves
- The structure of transportation demand is changing
- The actual fleet on Danube goes to the end of lifetime

Actions in progress:

- EU programs and strategies for fleet development
- Organizations and workgroups
- Meetings of experts (including the present meeting)
- Companies involved in R&D (including SDG)

OBJECTIVES

Required characteristics of inland vessels:

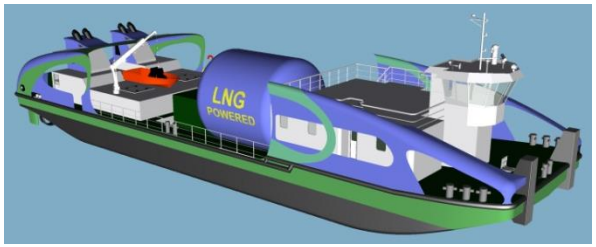
- Fuel efficient
- Environmental friendly
- Adapted to market requirements
- Adapted to waterway conditions
- Low cost of investment
- Good looking ships

R&D directions:

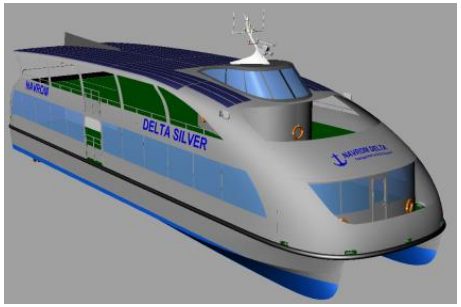
- Improvement of hydrodynamic characteristics (of hull and propulsion)
- Use of alternative fuels
- High efficient engines
- Special materials and structures
- Better transport management

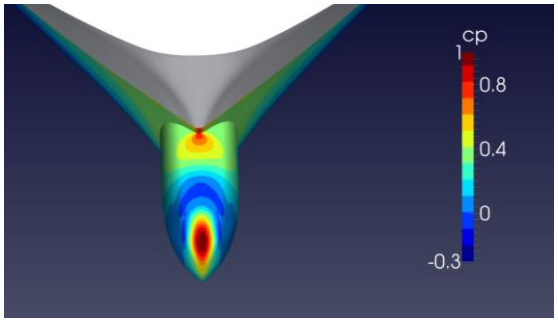
SDG PROJECTS

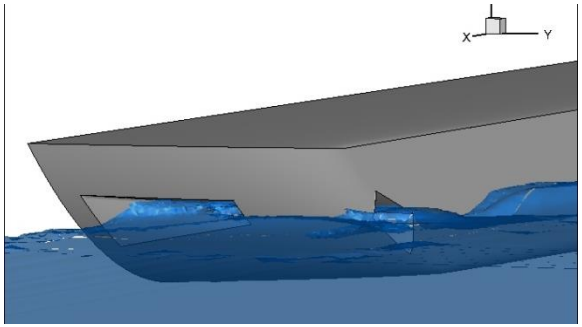
LNG FUELED PUSHER



HIGH EFFICIENT PASSENGER VESSELS





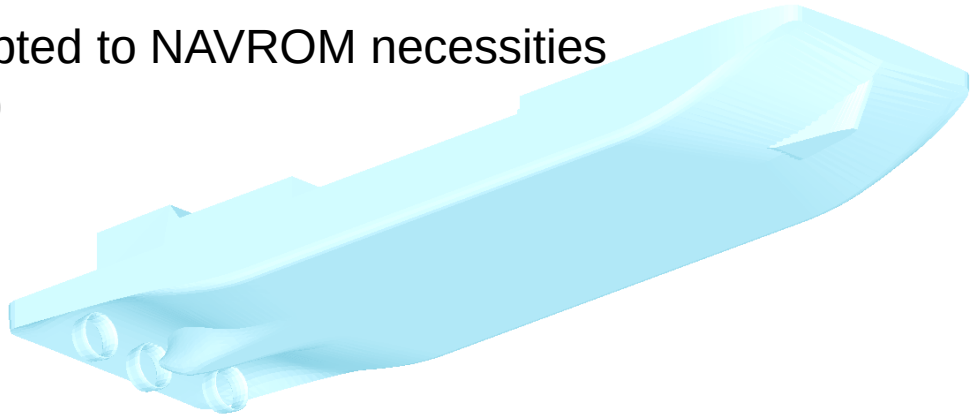


RESEARCH FOR NON-CONVENTIONAL HYDRODYNAMIC SOLUTIONS

LNG FUELED PUSHER

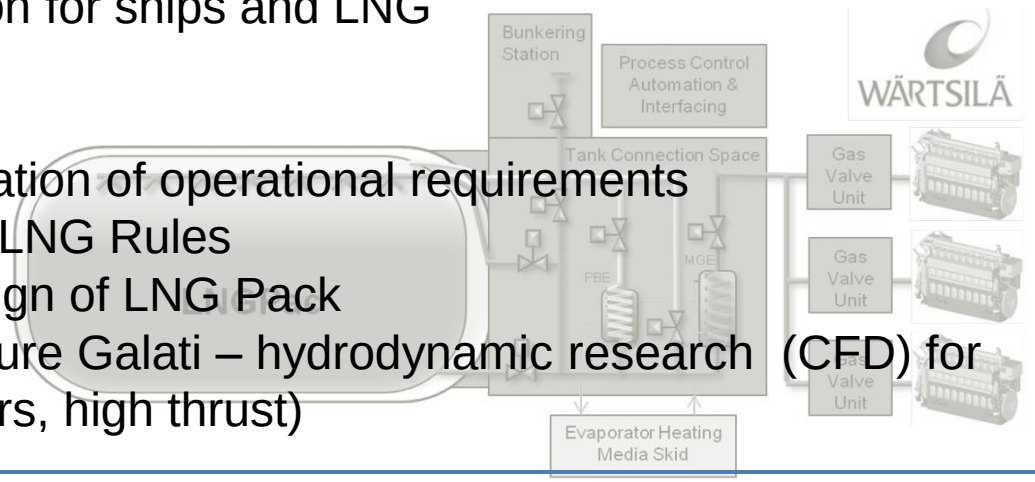
Contractual research, part of “Innovative ship” program and “LNG Master Plan”

Task: Design a modern pusher adapted to NAVROM necessities using dual fuel (DO and LNG)



Requirements:

- Power 2400-3200 HP
- Range 1400 km at 10 km/h
- Draught less than 1.8 m
- Rules EU regulation for ships and LNG



In co-operation with:

- NAVROM Galati – clarification of operational requirements
- Classification Societies – LNG Rules
- WARTSILA – custom design of LNG Pack
- Faculty of Naval Architecture Galati – hydrodynamic research (CFD) for propulsion (three propellers, high thrust)

LNG FUELED PUSHER

Design characteristics

- Two versions: 2x1050 kW (2800 HP) and 3x876 kW (3570HP)
- Custom LNG equipment: WARTSILA "*LNGPac H160-D9*"
- Main dimensions (LxBxT): 42x11.2x1.70 m
- Air draft 7.50 / 5.95 m
- Range in standard operational profile, depend on version

Diesel mode	330/270 hours
LNG	270/200 hours

- Fuel cost saving
- Emission reduction (compared with diesel only):
  NO_x - 60%; SO_x - 95%; PM - 85%; CO_2 - 20%

HIGH EFFICIENT PASSENGER VESSELS

Contractual research, 6 (six) types of vessel in operation, one in design process

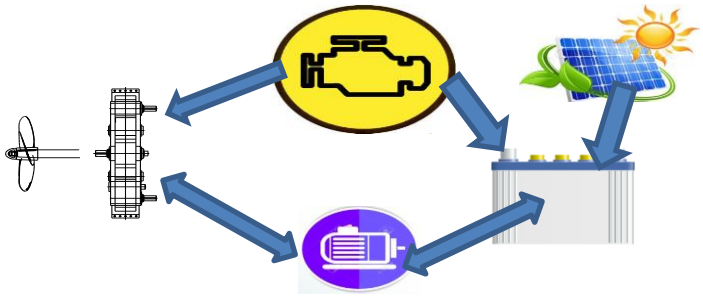
Task: Design a day passenger ship manly for tourism in Danube Delta, lakes and city waterways, capacity 40-100 passengers
Make it comfortable, efficient and environmental friendly

In operation

Ship	Length [m]	Persons	Power [HP]	Speed [km/h]
Vega	9	32	2x150	50
Bucur	16	50	2x65	20
Naiada	16	40	2x150	35
Titan	10	50	2x30	16
Karpaten	25	100	2x95	18
Bega	13	50	2x60	17


Bucur

HIGH EFFICIENT PASSENGER VESSELS

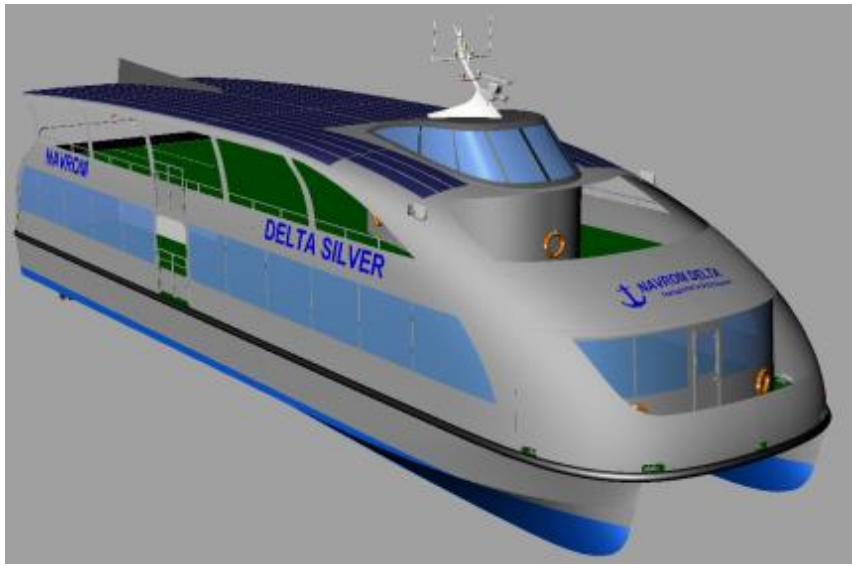


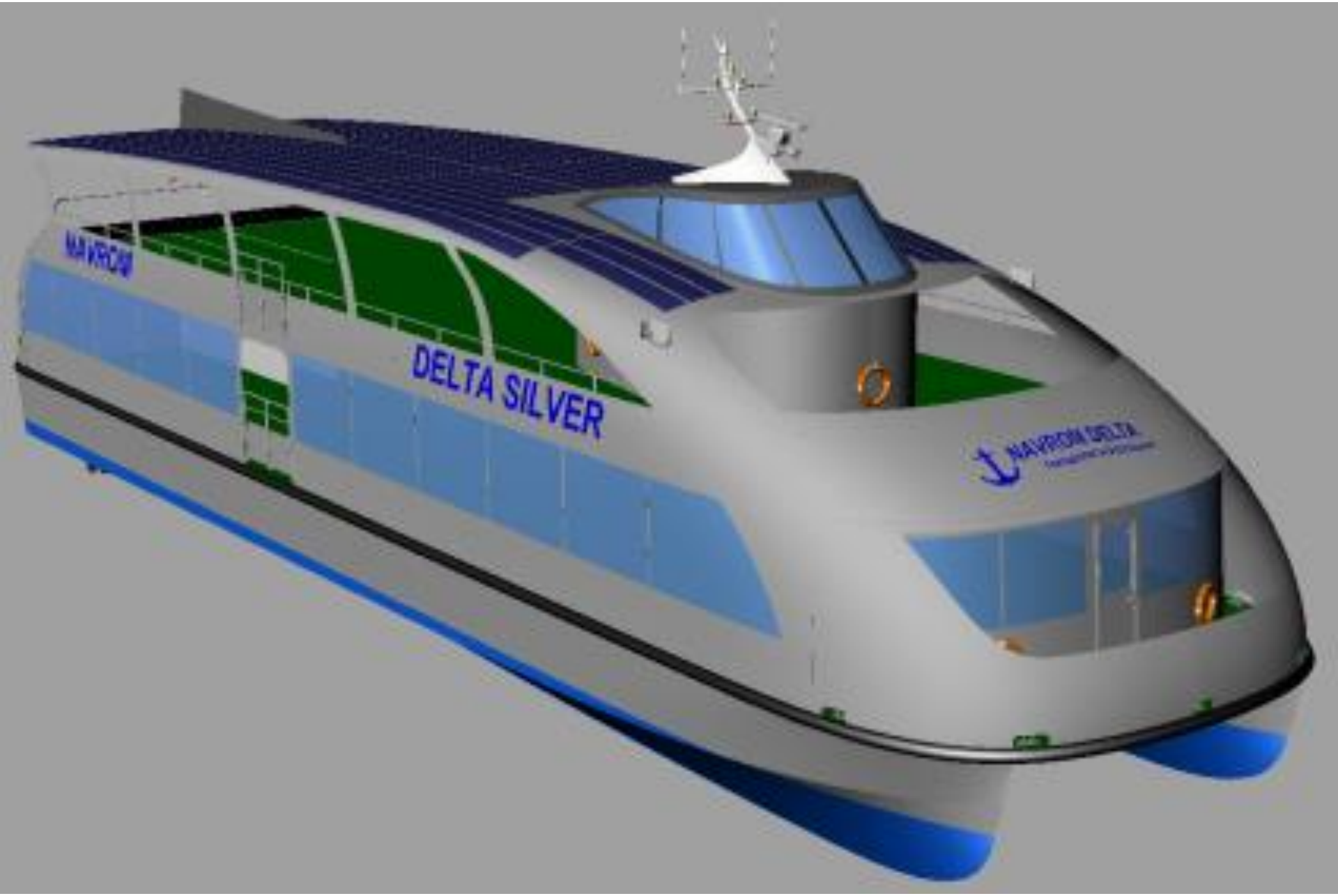
Special characteristics:

- Light construction (in general GRP)
- Catamaran type (more space, less drag)
- Shallow draught
- Hydrodynamic optimization
- Fuel efficient (abt. 25-30 g/pas/km)
- "Bega" and "Titan" have version for Hybrid propulsion (diesel and electric); Allow 4 hours electric propulsion for access in protected areas

Project under development:

Day river passenger ship either for tourism or liner passenger
Light construction (aluminum or GRP)
Medium speed (25-30 km/h)
Capacity 100-150 passengers (on each deck)
Modular arrangement- Liner, cruise, restaurant
Solar panels 40 kW for auxiliary energy

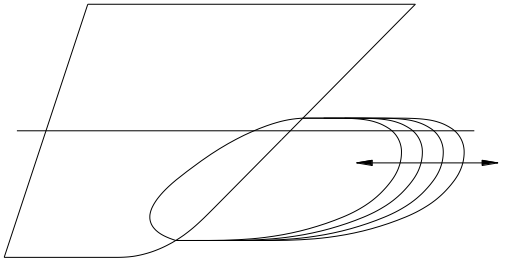


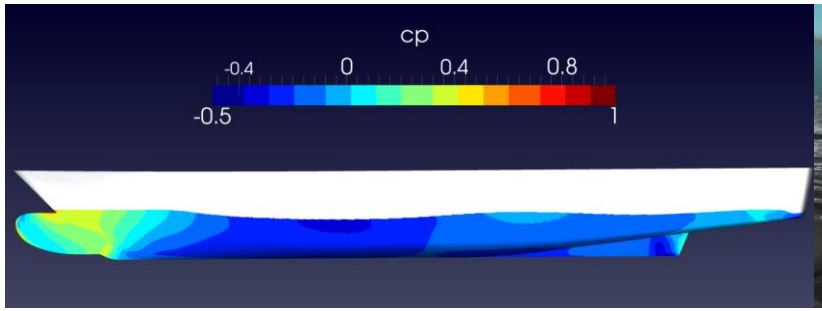

DELTA SILVER

RESEARCH
NON-CONVENTIONAL HYDRODYNAMIC SOLUTIONS

ADAPTIVE BULB

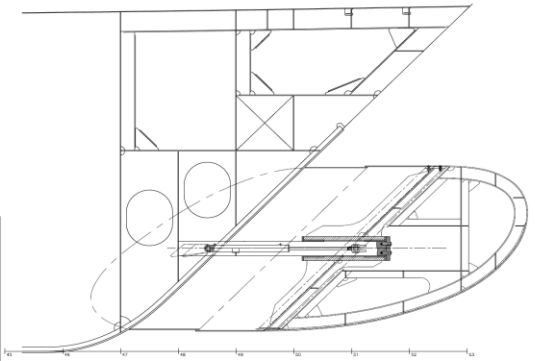
Research in frame of EU project "ADAM4EVE"
Task: Minimize the ship resistance in different operation conditions
Idea: Provide an adaptive bulbous bow (variable length) for inland ships
Test ship: River passenger vessel
Method: CFD simulation + towing tank test
Co-operation with:
- HSVA Germany
- Faculty of Naval Architecture Galati



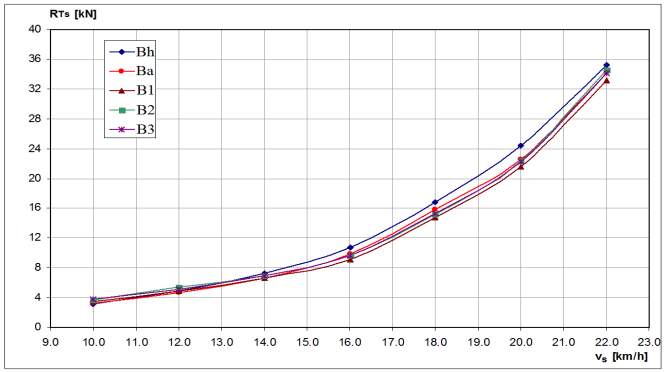


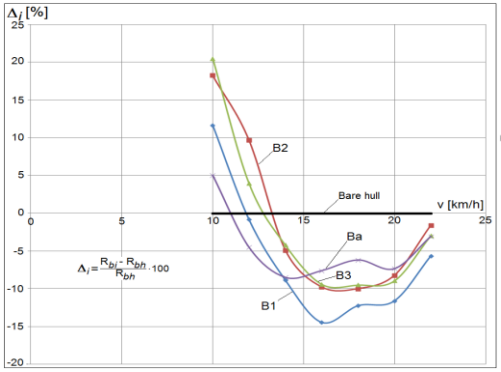
RESEARCH
NON-CONVENTIONAL HYDRODYNAMIC SOLUTIONS

ADAPTIVE BULB



Results:
- Ship resistance in four conditions (bare hull + 4 bulb length)
- Design of mechanism for length adjustment



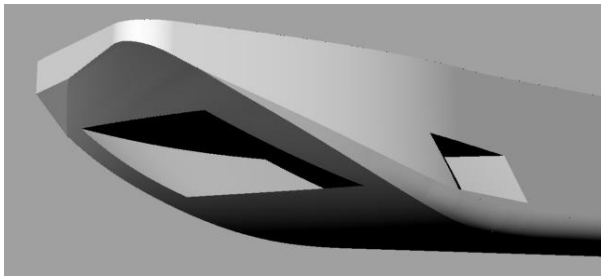


Conclusions:
- in general the effect of bulb represent 5-20% resistance reduction
- depending of speed, the bulb effect is variable with it's length, in range of 5%
- at different speeds, the optimum length of bulb varies
- the length adjustment mechanism is simple, reliable and low cost
- the investment ca be recovered in less than 3 years, depending on operational profile

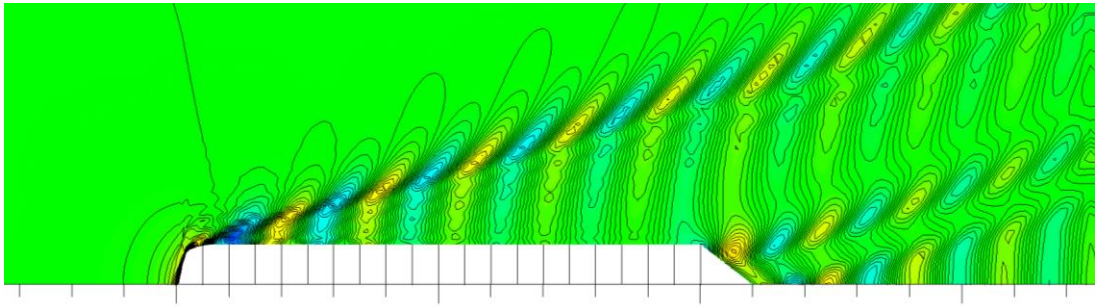
RESEARCH
NON-CONVENTIONAL HYDRODYNAMIC SOLUTIONS

"WHALE MOUTH" BOW

Internal research
Idea: a tunnel in fore part of ship having large B/T ratio (i.e. barges)
Ship: 2000 t dumb barge



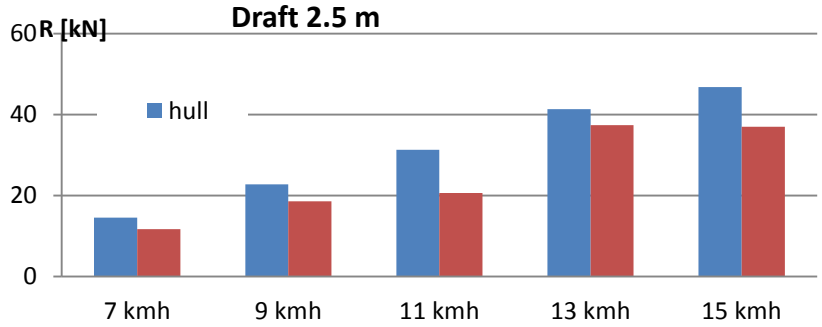
Method: CFD simulation - Viscous flow (Fluent-Ansys)

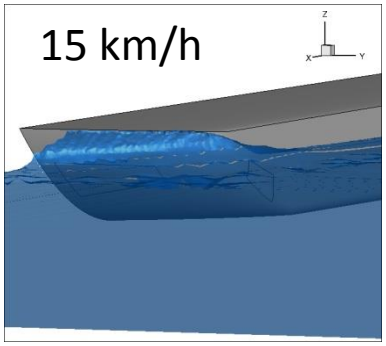


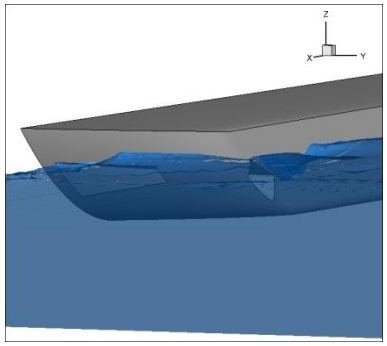
RESEARCH
NON-CONVENTIONAL HYDRODYNAMIC SOLUTIONS

"WHALE MOUTH" BOW

Results: Wave pattern and Total ship resistance calculation in both situation, bare hull and tunnel hull







Conclusions:

- the results looks promising
- a 1/1 scale experiment should be done (towing tank test in Froude hypothesis is not appropriate).

THANK YOU FOR YOUR ATTENTION