FOCUS:ON
LAST MILE
ON THE WATER

AVATAR Conference

04.05.2022 | Hamburg

Interreg North Sea Region AVATAR
European Regional Development Fund
EUROPEAN UNION

Logistik-Initiative Hamburg

INTRODUCTION: LOGISTICS INITIATIVE HAMBURG

- Hamburg-based cluster organization
- public-private partnership with the City of Hamburg
- 500+ members, largest institutionalized logistics cluster in Europe

What we do

- linking logistics industry, administration & politics & research
- ensuring and fostering innovation transfer and capacity building
- this includes information, marketing, events, conferences, working groups, funding support and also national and EU innovation projects

No member yet? We're happy to welcome you in our network.
https://www.hamburg-logistik.net/die-lihh/mitglieder/mitglied-werden/

AGENDA

01 **Welcome & introduction** | Thomas Brauner, Logistics Initiative Hamburg

02 **New market opportunities for inland waterway transport – The new thematic report by CCNR & the European Commission** | Athanasia Zarkou, CCNR

03 **AVATAR project – an overview** | Dr. Tom Pauwels, POM East-Flanders, Lead Partner of the AVATAR project

04 **AVATAR project - Urban vessel development, automation, and fleet coordination** | Prof. Peter Slaets, KU Leuven

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AGENDA

05 **Hamburg's strategy for the Last Mile |** Hendrik Lüth, Free and Hanseatic City of Hamburg, Ministry of Economy and Innovation

06 **Water Cargo Barge – Presenting the results of the feasibility study for Hamburg** | Julius Kuechle, Fraunhofer CML

07 **What's next? - An outlook** | Thomas Brauner, Logistics Initiative Hamburg

08 **Time for networking** | End of the event: 17:00 h

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NEW MARKET OPPORTUNITIES FOR INLAND WATERWAY TRANSPORT – THE NEW THEMATIC REPORT BY CCNR & THE EUROPEAN COMMISSION

02

ATHANASIA ZARKOU, CCNR

Interreg North Sea Region AVATAR European Regional Development Fund
EUROPEAN UNION
Logistik-Initiative Hamburg

New market opportunities in inland navigation transport –

Why are they needed ?

Where might they appear ?

Which obstacles lay ahead ?

Focus:on – Last mile on the water 4 may 2022

Athanasia Zarkou (CCNR), Junior Economist

CCNR
CENTRAL COMMISSION
FOR THE NAVIGATION OF THE RHINE

01

Why are new markets for inland navigation needed ?

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FOR THE NAVIGATION OF THE RHINE

Why are new markets needed ?

Decrease or saturation of existing IWT markets

- **Bottlenecks both on the demand side as well as on the supply side…**

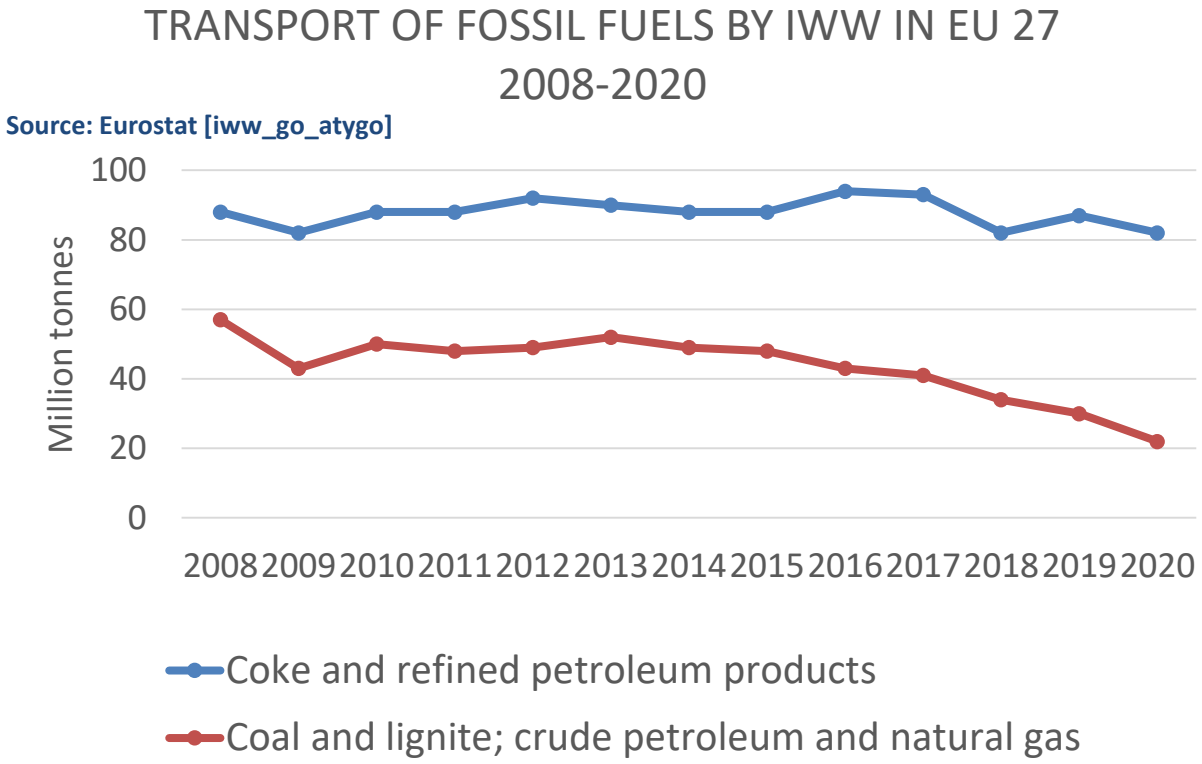
Demand side	Supply side
Several goods segments have reached saturation or even decline	Difficult navigation conditions (intensification expected with climate change)
Energy transition changes product portfolio	Low water asks for a diversification of areas of operation of inland vessels towards city or urban logistics (for instance) where water levels are less critical
Structural slowdown in world trade	

- **Importance of identifying new markets to which the inland navigation sector will need to adapt in order to keep market shares at least constant**

- **Urban IWT – an example where a smooth adaptation will require a change in…**
  - type of cargo (e.g. parcels instead of mass cargo),
  - areas of operation (city logistics instead of cross border transport)
  - range of logistics (short-distance instead of long-distance transport),
  - types of vessels (smaller vessels instead of larger vessels).

Why are new markets needed ?

Decrease or saturation of existing IWT markets – the case of fossil fuels



- **Fossil fuels in IWT appear both in dry form as coal and in liquid form as petroleum products.**
- **Energy transition is already underway and fossil fuels transport is strongly affected.**

- **With the phasing out of coal in the German energy sector, IWT in Western Europe will loose at least 15 mio. tonnes of cargo within the next ten years.**
- **Petroleum products are following next, as the electrification in the automobile sector is gaining momentum.**

02

Where are new markets for IWT likely to appear ?

CCNR
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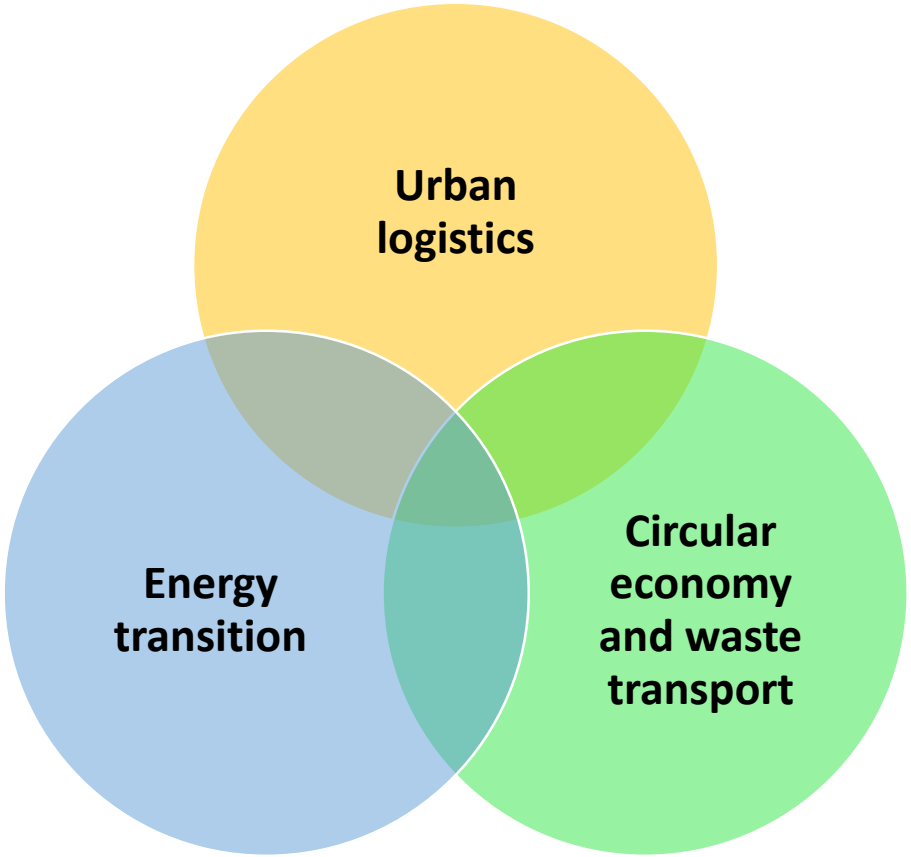
Main drivers and new IWT markets

Main drivers:

1/Saturation of existing transport infrastructure in cities

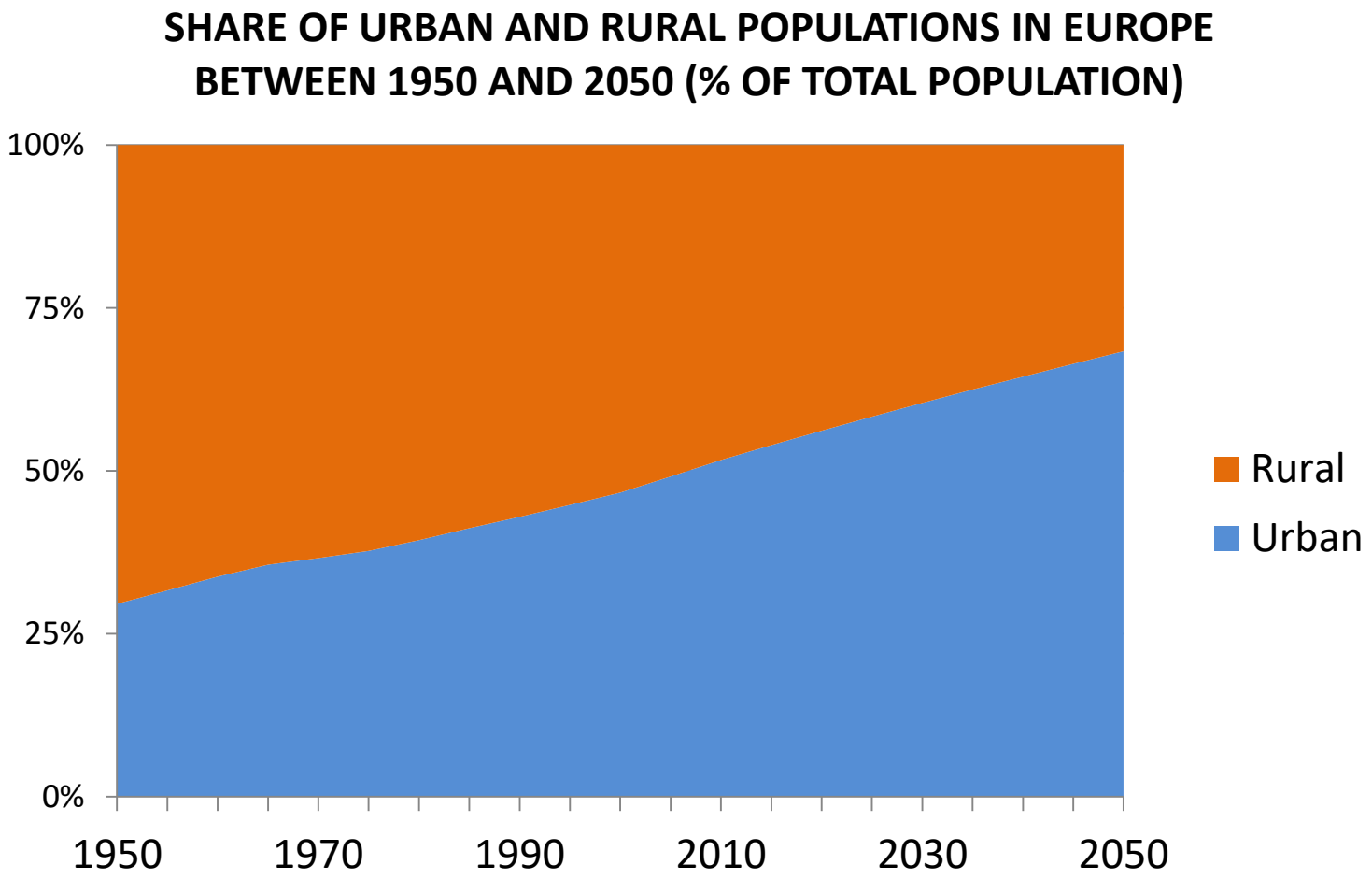
2/Greenhouse gases and pollutant emissions overall and in cities

3/Rising pressure to improve sustainability of our economies



Source: CCNR

Urban freight transport by inland vessels – demographic Trends



Source: World urbanisation prospects – United Nations, Department of Economic and Social Affairs, Population Division (2018)

Urban passenger and freight transport by inland vessels – Examples

A few examples – non exhaustive list

Brussels (BE)

- Canal shuttle (*Waterbus*) sailing on the Zenne canal between Brussels and Vilvoorde (10 km)
- For commuters, passengers, tourists
- Around 40,000 passengers / year

Amsterdam (NL)

- Parcel delivery barge *Holland's Glorie*, operative since 2017
- Airport ➡ Electric trucks ➡ Ship ➡ Bicycles
- Navigates twice a day

Paris (FR)

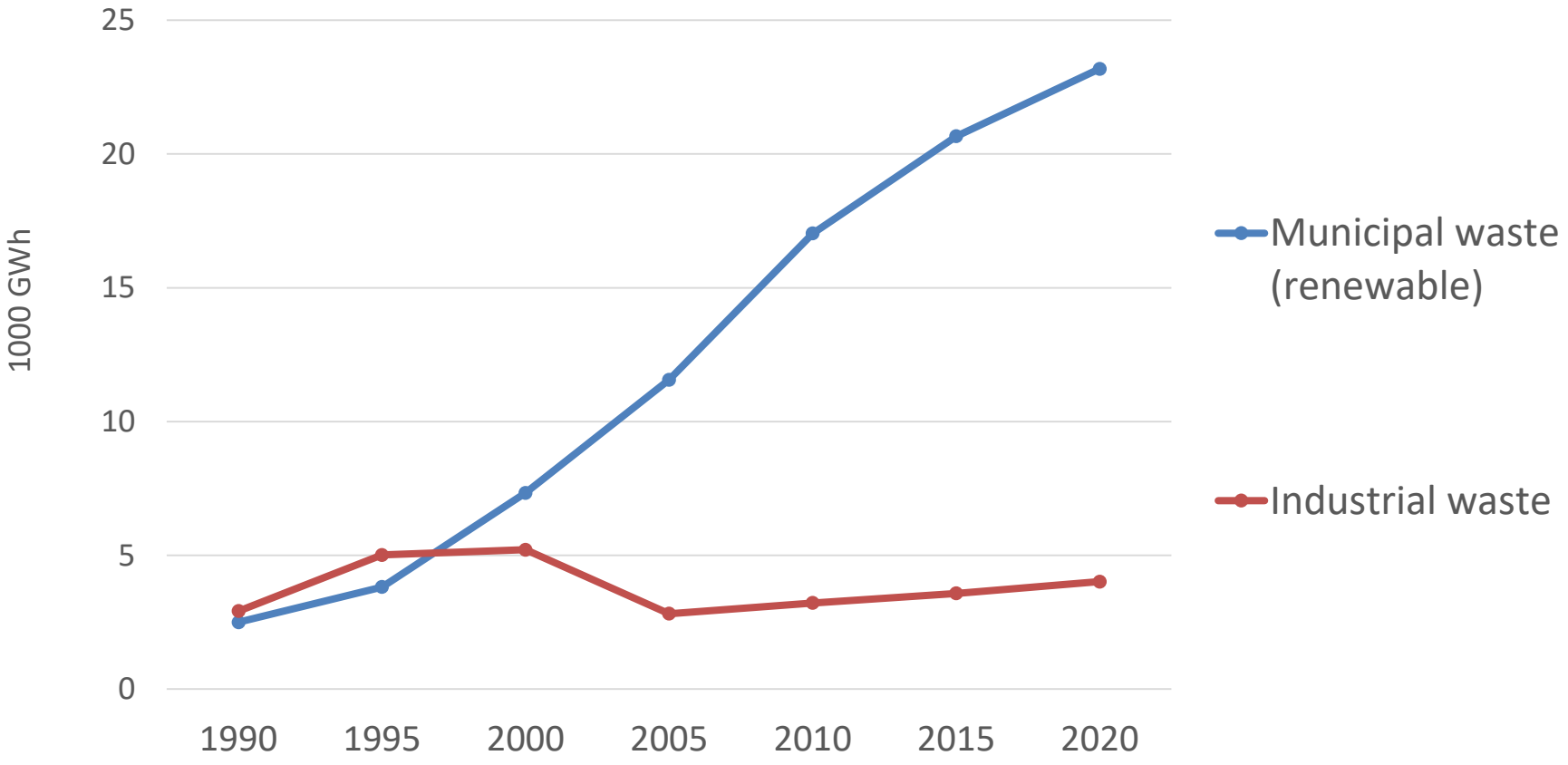
- Supermarket chain *Franprix* uses barges for transporting grocery products from warehouses 20 km south of Paris city centre to the Eiffel tower.
- The system saves 450,000 road kilometres per year.

Berlin (DE)

- Waterways in the region of Berlin are massively underutilized.
- Technical University of Berlin is developing small autonomous vessels for a decentral, clean and water orientated city logistics (*A-SWARM*)

New cargo flows stimulated by circular economy strategies

ELECTRICITY GENERATION FROM WASTE IN THE EUROPEAN UNION 28
1990-2020



Source: International Energy Agency, Data and Statistics

Waste transport by IWT and recycling – best-practice examples

Selected cities where circular economy activities are carried out by barges

London (UK)

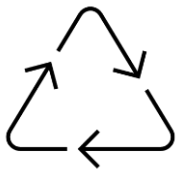
- Barge transport of household waste by a recycling company on the Thames.
- 731 k tonnes by barge in 2020
- Recycling of waste to electricity for 155,000 homes in London

Paris (FR)

- Barge transport of household waste and paper by a public service company on the Seine.
- 300 k tonnes in 2020 by barge
- Recycling generates electricity

Lyon (FR)

- Floating waste disposal centre
- Financed by the Lyon metropolitan area
- 90% of the waste is transformed into new products (mainly furniture)
- 300 tonnes of waste per year collected



03 Which obstacles lay ahead for IWT to conquer new markets?

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New markets in IWT – Challenges and Obstacles

Challenges and Obstacles for new IWT markets

Challenges for urban waterway transport (including waste transport):

- Economic viability is not always given, as road transport faces lower costs and is easier to implement.
- Automation could lead to lower staff costs due to less navigation personnel on board
- From a technological viewpoint rather challenging, as a river is a system with changing physical properties (currents, depths, etc.)
- Strong competition for space in cities between logistics, tourism and the housing sector
- Road transport culture in logistics and lack of knowledge about IWT

Source: CCNR

THANK YOU VERY MUCH FOR YOUR ATTENTION

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AVATAR PROJECT – AN OVERVIEW

DR. TOM PAUWELS,
POM EAST-FLANDERS,
LEAD PARTNER OF THE AVATAR PROJECT

03

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Sustainable urban freight transport with autonomous zero-emission vessels

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Project AVATAR

Last mile innovation through urban highly autonomous & zero-emission inland waterway transport solutions

Tom Pauwels, POM Oost-Vlaanderen

4/5/2022

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European Regional Development Fund
Sustainable urban freight transport with autonomous zero-emission vessels
EUROPEAN UNION

QUICK FACTS (I)

- EU **innovation project** on **urban, highly autonomous & zero emission** water-bound cargo transport solutions for last mile distribution
- Funding scheme: **co-financed by the European Union** from the EU Interreg North Sea Region (European Regional Development Fund)
- Project period: May 2020 - June 2023
- Project budget: Total EUR 2,83 million, 50% of which EU (ERDF) funding
- https://northsearegion.eu/

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Sustainable urban freight transport with autonomous zero-emission vessels
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QUICK FACTS (II)

- **10 project partners from 4 countries** (Netherlands, Germany, Sweden, Belgium): *of which*: 3 universities, 5 SME's & 2 cluster organisations / innovation agencies
- Combined economic, engineering and energy expertise (multidisciplinary approach)
- **A**utonomous **V**essels, cost-effective tr**A**nshipmen**T**, w**A**ste **R**eturn

POM Oost-Vlaanderen
Logistics Initiative Hamburg
KU LEUVEN
Carl von Ossietzky universität Oldenburg
HOUT & BOUW OPLEIDINGSCENTRUM
www.vanwingen.be
TU Delft
SEAFAR
SSPA Your Maritime Solution Partner
URBAN WATERWAY LOGISTICS

WHY URBAN IWT?

MOTIVATION

- Many European cities have a large & branched waterway network (< CEMT I) that was built for and originally used for cargo transport
- Today: Predominantly recreational navigation / use, waterways generally not economically viable for freight distribution → underutilised
- At the same time: road congestion, increasing competition for urban space and need for sustainability in urban commercial transport
- AVATAR project **aims to tackle those challenges by developing, testing and assessing adequate technologies and business models for urban autonomous zero-emission IWT**


Ghent

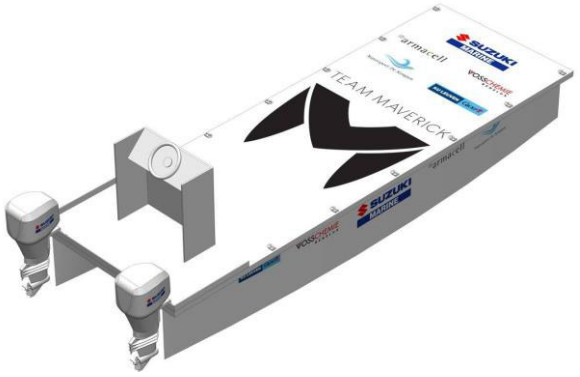

Amsterdam


Hamburg

DEVELOPMENT OF

AUTONOMOUS VESSELS (I)

Source: KU Leuven



- AVATAR develops 2 vessels for pilots in a 3-step approach
- In a **first step**, AVATAR is currently converting an existing 1 ton vessel ("MAVERICK") and expanding the automation level (0 → 2 to 3) of this vessel in Leuven (Belgium)
- **The MAVERICK test catamaran** from KU Leuven is currently being equipped with perception sensors (LiDAR, stereo cameras, GNSS, IMU), fully electric drive system & onboard computer + PLC

Interreg North Sea Region AVATAR
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Sustainable urban freight transport with autonomous zero-emission vessels

DEVELOPMENT OF

AUTONOMOUS VESSELS (II)

- In a **second step,** a newly built vessel with a capacity of approx. 25 tons is being developed
- The aluminum hull has been built in a Dutch shipyard, the fully electric drive system will be integrated in Ghent (Belgium) starting in Q3/2021
- Expected completion: Q2/2022
- For this vessel, the sensor technology and learnings from the Maverick will be scaled up and subsequently implemented onto the new vessel
- SEAFAR will implement their existing technology
- SSPA is experienced in logging and analyzing all movements of the vessel

The AVATAR vessel will be similar to the „Green Wave“ vessel from the #IWTS2.0 project

Source: #IWTS2.0 project

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DEVELOPMENT OF

AUTONOMOUS VESSELS (II)

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DEVELOPMENT OF

AUTONOMOUS VESSELS (II)

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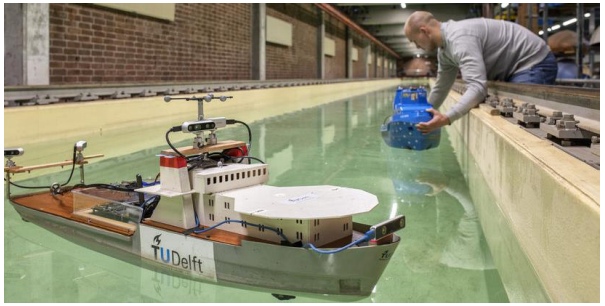
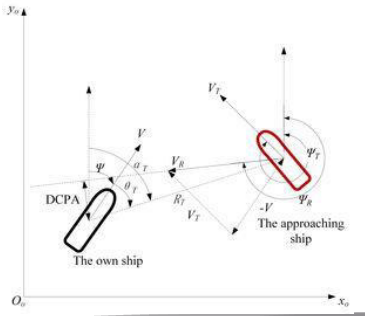
DEVELOPMENT OF

AUTONOMOUS VESSELS (III)

RAS RESEARCHLAB AUTONOMOUS SHIPPING

- In parallel, as a **third pillar**, research on vessel-to-vessel communication & multiple vessel coordination is being carried out with small-scale research vessels developed and equipped at the TU Delft Research Lab for Autonomous Shipping (RAS)
- University of Oldenburg is researching and developing remote control systems (control center, vessel-to-shore communication & communication layer) for the project





Source: TU Delft, University of Oldenburg

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PILOTING AND TESTING THE

AUTONOMOUS VESSELS

- After finalizing the development of the 1 ton Maverick vessel as well as the 25 ton vessel, both **vessels are planned to be tested within several pilot demonstrations** in the project partner regions in 2022/23
- Testing locations for those demonstrations are either already available or are currently being defined in Ghent, Leuven, Delft and Hamburg
- At least 3 pilots will be carried out, depending on the findings of use case development and local interest

USE CASE & BUSINESS CASE DEVELOPMENT

MARKET REVIEW

- Some solutions already exist today, where barges are being used for city freight distribution
- AVATAR has published a market review (30+ cases) on this matter → available online https://northsearegion.eu/avatar/activities/results/
- Currently, AVATAR project partners are identifying and developing use cases for Ghent & Hamburg and assessing the benefits of highly autonomous vessels in terms of economic viability
- **AVATAR invites any stakeholder, public or private, interested in discussing potentials of such transport solutions to get in touch!**

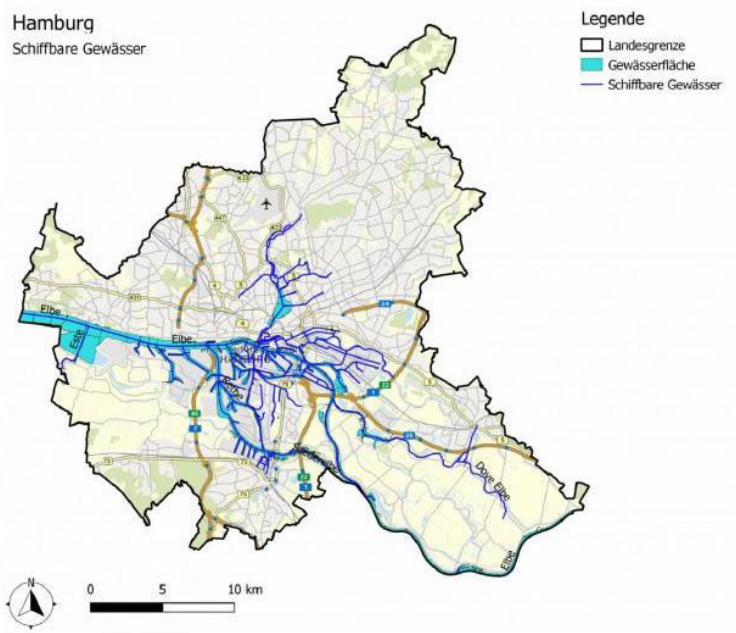
AVATAR is a project co-funded by the Interreg North Sea Region programme 2014-2020

STATUS

HAMBURG USE CASES

WaCaBa Water Cargo Barge

- Logistics Initiative Hamburg and City of Hamburg have partnered for the identification of use cases by creating the “**WaCaBa” concept**
- For this, an in-depth Feasibility Study has been carried out by the researchers from Fraunhofer
- The **study** has been published in 02/2022 and is **available online here**



Source: City of Hamburg

- Workshops & discussions with possible local users have been jointly carried out and led to two use cases that are currently developed into follow-up projects (CEP service providers, retail food & non-food)

STATUS

GHENT USE CASES: TRANSPORT AND ENERGY

- Close alignment with City of Ghent and The Flemish Waterway - 2 year exemption permit for a testbed has been approved
- Transport use cases: construction, horeca, retail, office equipment government, parcel delivery
- Energy use case: Business case development to **integrate hydrogen powered charging stations** in one or more cases, pilot in preparation for 2023
- Solution: ICE CHP (Internal combustion engine & combined heat and power) system running on H2
  - Opportunity: storing green electricity produced in Ghent during the day to charge electric vessel(s) at night
  - Use of waste heat e.g. in logistics buildings to increase (cost) efficiency
  - Determining location and users of charging station

Source: E. van Wingen

OTHER TOPICS

DESK RESEARCH

- Innovative transhipment techniques
- Last mile distribution
- Open source vessel
- Artificial intelligence and computer vision
- Urban IWT alliance partnership

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Sustainable urban freight transport with autonomous zero-emission vessels

NEWSLETTERS

PROJECT NEWSLETTER NO. 1
July 2021

Welcome to the AVATAR Newsletter | First year of project work, first publications | Solar Impulse Effcient Solution Label | Multi-project webinar on autonomous shipping

On our own account: AVATAR Newsletter launched

Picture: AVATAR project

09.07.2021 – The AVATAR project has now been running for about one year and the first results and deliverables have recently been published. To mark this occasion, the AVATAR project consortium is now publishing project newsletters at regular intervals, about three to four times a year, in which the main events, results, progresses made and general topics relating to the project are going to be addressed. You can find this and all subsequent newsletters on the AVATAR website.

Read more here: AVATAR website

Project partner E. Van Wingen awarded with "Solar Impulse Efficient Solution" Label

Picture: Solar Impulse Foundation

02.07.2021 - AVATAR project partner E. Van Wingen has been awarded the "Solar Impulse Efficient Solution" label for its solution of environmentally friendly energy and heat production using an ICE-CHP system. The same system will be used in the future within the AVATAR project to power the vessel currently under construction.

Read more here: LinkedIn & E. Van Wingen website

PROJECT NEWSLETTER NO. 2
November 2021

Welcome to the AVATAR Newsletter No. 2 | New project partners | Presentations and meetings | Learning from each other

On our own account: AVATAR Newsletter No. 2 launched

Picture: AVATAR project

22.11.2021 –The AVATAR project consortium is publishing project newsletters at regular intervals, about three to four times a year, in which the main events, results, progresses made and general topics relating to the project are addressed. In this newsletter, 3 new project partners are welcomed, an overview of presentations and meetings is given and it is shown how project partners align and interact.

Read more here: AVATAR website

AVATAR welcomes 3 new project partners

SEAFAR · SSPA Your Maritime Solution Partner · URBAN WATERWAY LOGISTICS

Picture: AVATAR new project partners

01.09.2021 – AVATAR welcomes 3 new project partners: SEAFAR, SSPA and Urban Waterways Logistics. Welcome on board! Thanks to Interreg North Sea Region, it was possible to extend the current AVATAR project.

In the project extension, focus lies also on innovative transhipment techniques, last-mile distribution, open source vessel, artificial intelligence, computer vision and the creation of an urban IWT alliance partnership. All themes are related to the setup of a market proof foundation of an autonomous fleet.

SEAFAR is a Belgian, innovative independent ship management company, offering services to operate unmanned and crew-reduced vessels for ship owners and shipping companies. SEAFAR develops technology to remotely operate automated vessels for inland and coastal shipping. Introducing SEAFAR represents the possibility to scale up the project by an industrial partner. SEAFAR will test the new AVATAR vessel with their equipment.

PROJECT NEWSLETTER NO. 3
May 2022

Welcome to the AVATAR Newsletter No. 3 | Milestone! | Dissemination events | Publications

On our own account: AVATAR Newsletter No. 3 launched

Picture: AVATAR project

04.05.2022 –The AVATAR project consortium is publishing project newsletters at regular intervals, about three to four times a year, in which the main events, results, progresses made and general topics relating to the project are addressed. In this newsletter, an overview is given of several dissemination events and publications. An important milestone has been achieved (hull of the new AVATAR vessel), alignment took place with other projects and info on use cases is shared.

Read more here: AVATAR website and LinkedIn

Multimodal Urban Days Ghent

Picture: AVATAR project

16.11.2021 – One of the ambitions of the AVATAR project is to define and assess business cases for city freight distribution in the city of Ghent, using highly autonomous vessels. Therefore, an AVATAR colloquium was organized about the possibilities to integrate regional and local transport of construction materials (16/11/2021, havenhuis Gent). Speakers were invited from the government (City of Ghent, North Sea Port), European projects (AVATAR and ST4W), a local project (Via Pallettol) and private stakeholders (construction dealers, real estate companies). Not only technical issues were discussed, but also economic and energy issues. In total, 40 participants joined the colloquium.

There is a strong belief in Ghent by policy makers that using waterways for city freight distribution for construction materials can be successful, but there are still some points of attention. Reference is made to the need for appropriate loading and unloading equipment, but also the need for a reliable water level in the city.

GET IN TOUCH

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Contact details project partners:
https://northsearegion.eu/avatar/project-partners/

https://northsearegion.eu/avatar/

https://www.linkedin.com/company/avatar-interreg-north-sea-region

AVATAR PROJECT - URBAN VESSEL DEVELOPMENT, AUTOMATION, AND FLEET COORDINATION

PROF. PETER SLAETS,
KU LEUVEN

04

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KU LEUVEN

AVATAR

Urban vessel development, automation, and fleet coordination

Prof. Peter Slaets
Department of Mechanical Engineering, KU Leuven
May 04, 2022

AVATAR premise

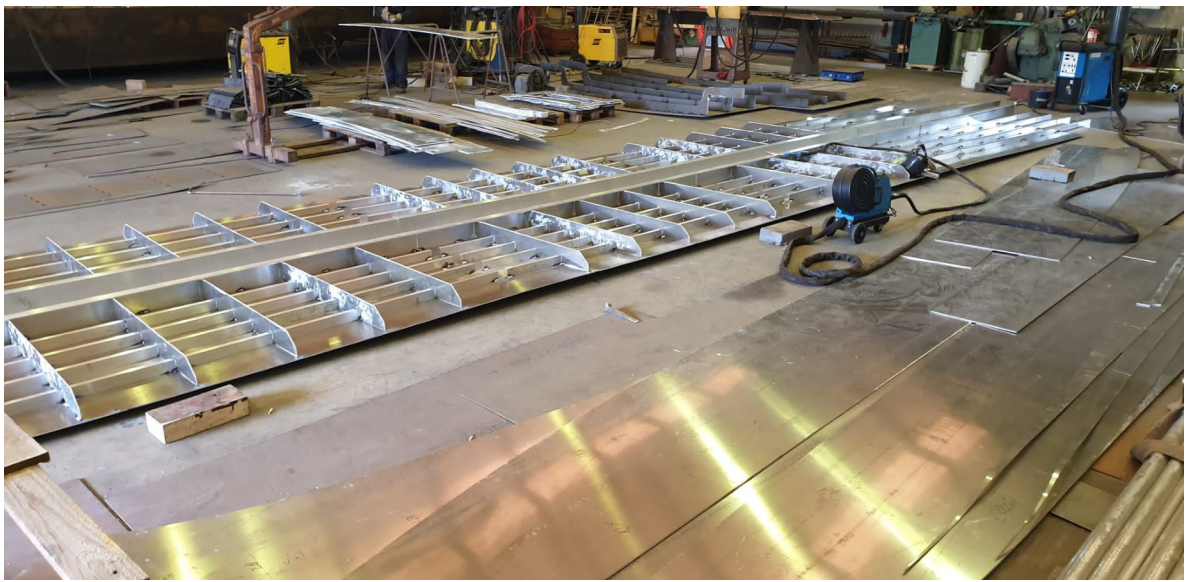
- Europe has a **large, distributed waterway network**
  - rivers and small waterways around cities (< CEMT I)
  - limited integration in synchromodal transport system
  - mostly pleasure craft
- **Small-scale** IWT currently *not* economically viable
  - high relative crew cost
  - limited innovation in past 30 years
- Engineering effort aiming to **unlock potential:**
  - development of all-electric **urban vessel**
  - **increase automation** using research vessels (various scales)
  - research and experiments on **fleet coordination**

Overview main engineering tasks

- Development of new, zero-emission urban vessel
  - ***main participants***:*Knowledge Centre on Wood & Construction, E. Van Wingen*
- Development + automation of research vessel (Maverick)
  - ***main participants***: *University of Leuven*
- Remote vessel control
  - ***main participants***: *Universities of Oldenburg and Leuven*
- Automated fleet coordination (model scale ships)
  - ***main participants***:*University of Delft*
- Situational awareness through modular sensor box on Maverick + AVATAR vessel:
  - ***main participants***: *University of Leuven, Knowledge Centre on Wood & Construction*

New urban vessel

- 20 tonnes
- Hull construction at ship yard
- Incorporate best practices from previous design (IWTS)

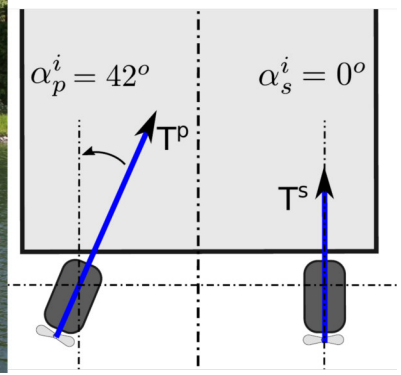


New urban vessel

Current status: drive system integration by E. Van Wingen almost finished

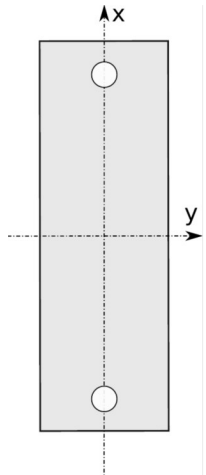
Research vessel (1T): Maverick (KUL)

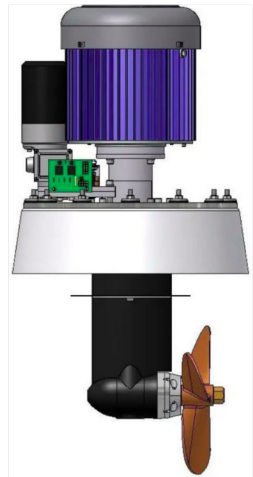
Old configuration

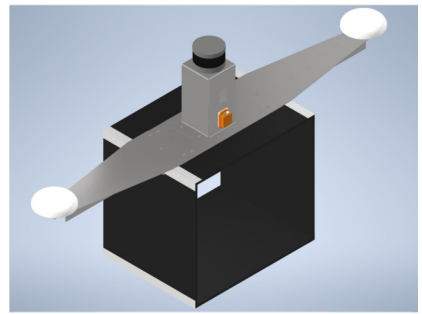


- Stern (2), 42-degrees-rotatable
- Only stern thruster
- **No** automation

New configuration







- Bow + stern, 360-degrees-rotatable
- Automation from level 0 → 2 (or higher)
- Sensor box as mobile perception and localisation unit

Research vessel (1T): Maverick

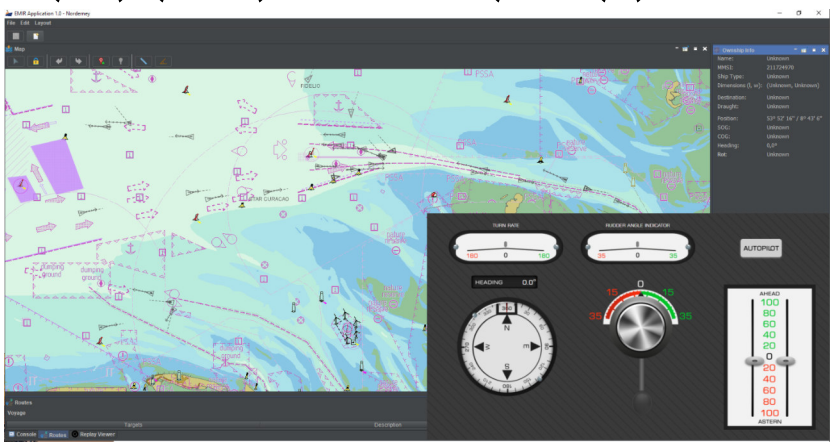
- Mechanical design finished
- Current status: drive train + sensor integration
- In-water testing: this month (May)

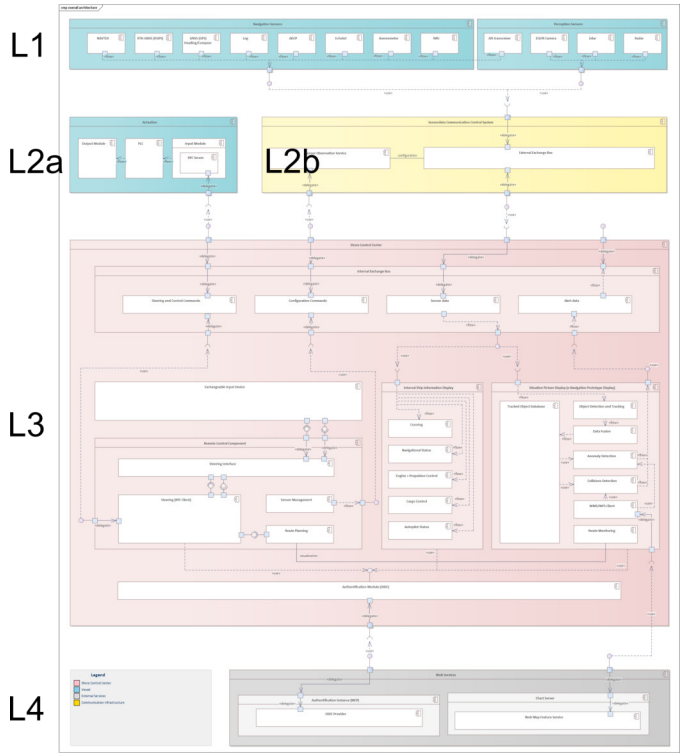
Sensor box

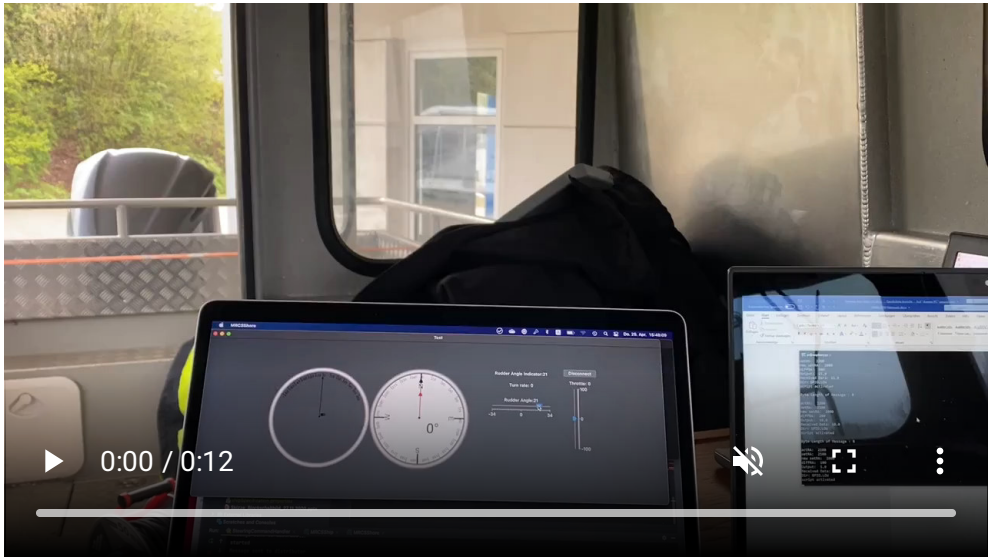
Remote control (UOL)

Overall architecture (top → bottom)

- (L1) Sensors (navigation, perception)
- (L2a) Actuation
- (L2b) Sensordata communication centre
- (L3) Shore control centre
- (L4) (web) services (WM(F)S, authentication, ...)



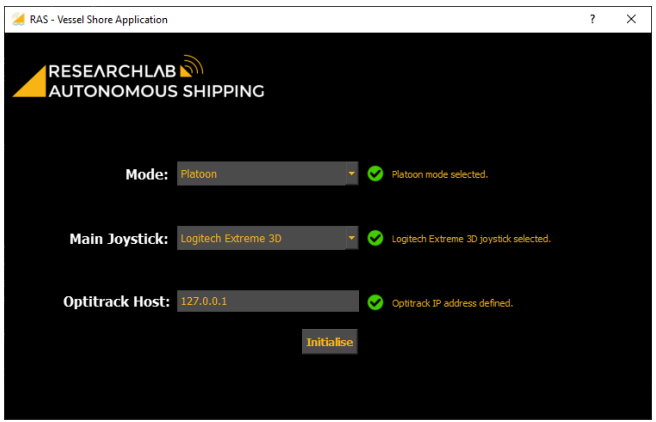


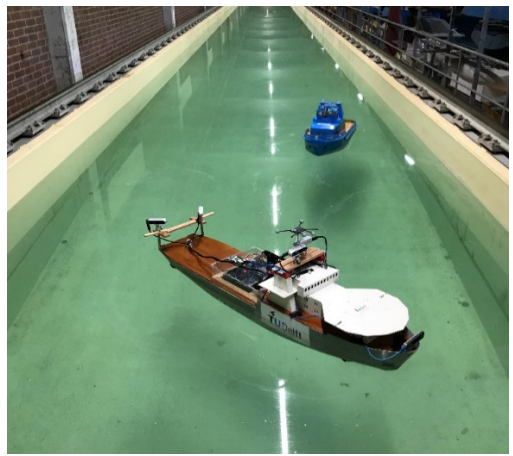


(**Josephine**)

Fleet control and coordination (TU Delft)

- Standardised platform for testing of Guidance, Navigation and Control modules
- Multiple configurations: single vessel, multi-vessel and platoon management

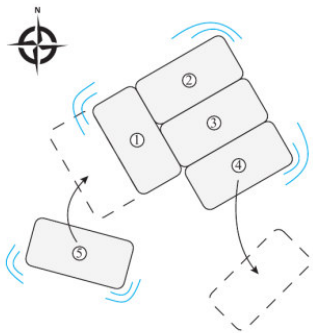




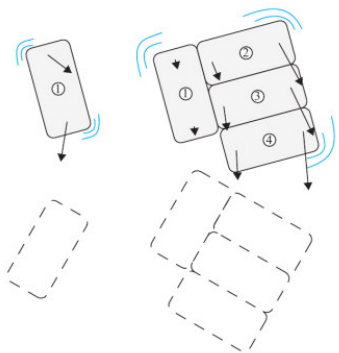
- Validation of the theory developed with lab experiments

Fleet control and coordination (TU Delft)

Platform Configuration



(Platform) Motion Control



HAMBURG'S STRATEGY FOR THE LAST MILE

HENDRIK LÜTH,
FREE AND HANSEATIC CITY OF HAMBURG, MINISTRY OF ECONOMY AND INNOVATION

05

Interreg North Sea Region AVATAR
European Regional Development Fund
EUROPEAN UNION

Logistik-Initiative Hamburg

HAMBURG‘S STRATEGY FOR THE LAST MILE: PROJECT WATER CARGO BARGE FROM THE CITY PERSPECTIVE

Dr. Hendrik Lüth

www.mediaserver.hamburg.de / Maxim Schulz

4 May 2022 | focus:on – Last Mile on the Water (AVATAR conference)

Hamburg

CHALLENGES & STRATEGIC GOALS FOR THE LAST MILE

Hamburg

GROWTH RATE IN PARCEL DELIVERIES DOUBLED IN 2020

Parcel deliveries in Germany:

Total Parcel Deliveries [Million]

Prognosis based on changed consumer behaviour

Extrapolation of pre-2020 growth

City of Hamburg

2017: 95 Mio. parcels

Prognosis 2030:

163 Mio. parcels

Source: BIEK KEP-Studie 2021

DELIVERY TRAFFIC BIG FACTOR IN URBAN EMISSIONS

Share of delivery traffic in total traffic in Hamburg is about 10%-15%,
but urban delivery traffic induces:

- 25% of CO_2-emissions
- 30-50% of emissions of other pollutants (e.g. nitric oxides, particulate matter)

Explanations:

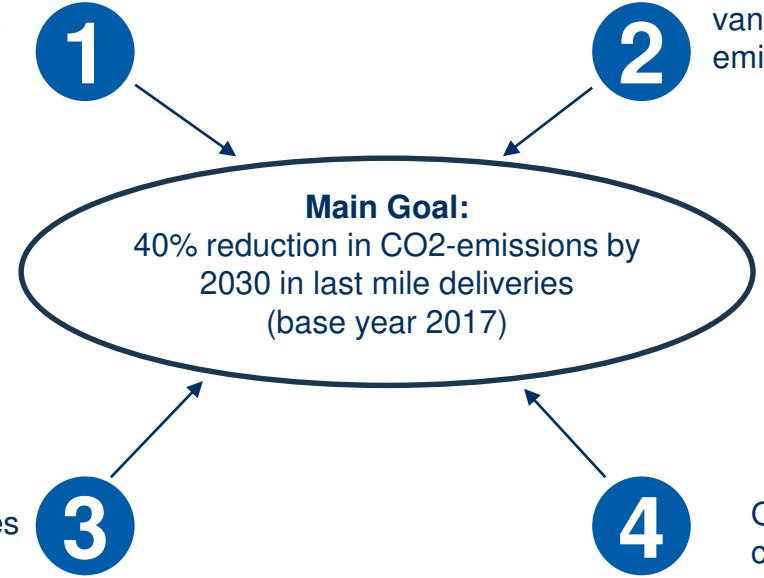
- direct: In general higher emissions of trucks/delivery vans in comparison to passenger cars
- indirect: double parking of delivery vehicles causes stop&go traffic for other traffic participants

Source: PROGNOS-Studie 2019

CLIMATE GOALS FOR 2030 IN THE CEP-SECTOR

25% of CEP deliveries by alternative means of transportation like cargobikes

Under 45% of CEP deliveries by delivery vans/trucks, 95% of remaining vehicles emission-free

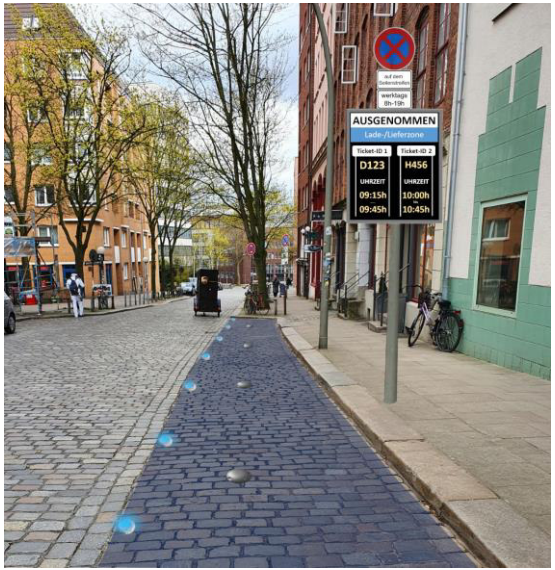


At least 30% of B2C-CEP deliveries go to pickup locations like parcel stations or in-store pick-up locations

Qualitative Goal: Reduce congestion caused by CEP services as much as possible

HAMBURG FOLLOWS SEVERAL APPROACHES TO INCREASE EFFICENCY AND SUSTAINABILITY, EXAMPLES:

Multi-User Micro Hubs



Smart Delivery and Loading Zones

URBAN WATERWAYS: POTENTIAL RELIEF FOR THE LAST MILE?

02

Hamburg

PLENTY OF URBAN WATERWAYS IN HAMBURG

Abbildung 1: Urban Alster channels in Hamburg

Abbildung 2: Harbour basin and channels in the north of the Elbe river in Hamburg

Quelle: OpenStreetMap.org, Lizenz: Creative Commons (CC-BY-SA 2.0)

HYPOTHESIS: USING URBAN WATERWAYS CAN BRING RELIEF TO OVERBURDENED ROAD NETWORK

Status Quo

- Steady increase in transport traffic in the city of Hamburg
- Road freight traffic burdens residents with emissions like particulate matter, nitrogen oxides and noise
- Ongoing redistribution of traffic areas towards bicycles and pedestrians
- Ambitious emission reduction goals of the City of Hamburg
  (Green City Plan, Climate Protection Law, City Strategy for Urban Logistics)

Potentials

- Reduction of emissions (and shift of emissions to areas with less residents)
- Relief for congested urban road networks
- Autonomous driving on waterways potentially easier and less costly than on roads

➢ Feasibility study „Water Cargo Barge“ (WaCaBa); conducted by Fraunhofer CML/IML

THANK YOU!

www.mediaserver.hamburg.de / Andreas Vallbracht

WATER CARGO BARGE – PRESENTING THE RESULTS OF THE FEASIBILITY STUDY FOR HAMBURG

JULIUS KUECHLE,
FRAUNHOFER CML

06

Interreg North Sea Region AVATAR
European Regional Development Fund
EUROPEAN UNION

Logistik-Initiative Hamburg

Fraunhofer CML

Fraunhofer Center for Maritime Logistics and Services CML

Feasibility study on behalf of the City of Hamburg

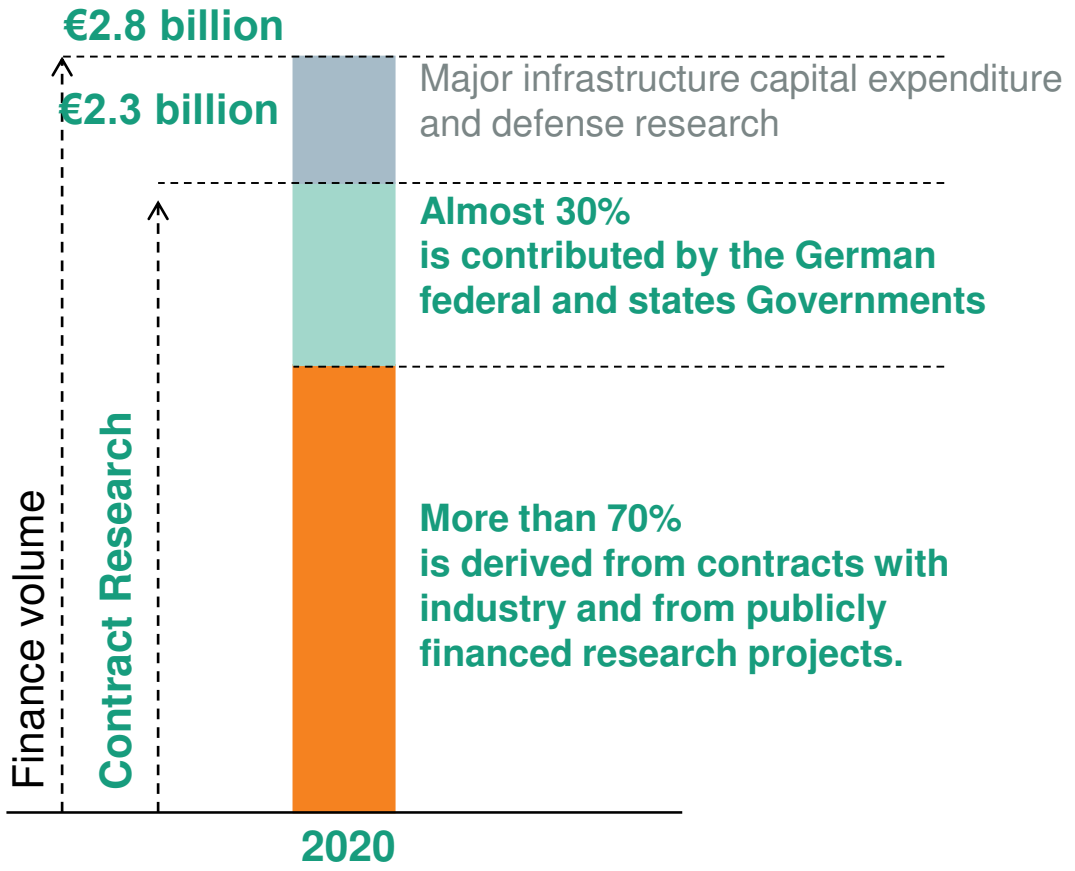
Water Cargo Barge - WaCaBa

The Fraunhofer-Gesellschaft at a Glance

The Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society.

29,000 staff

75 institutes and research units

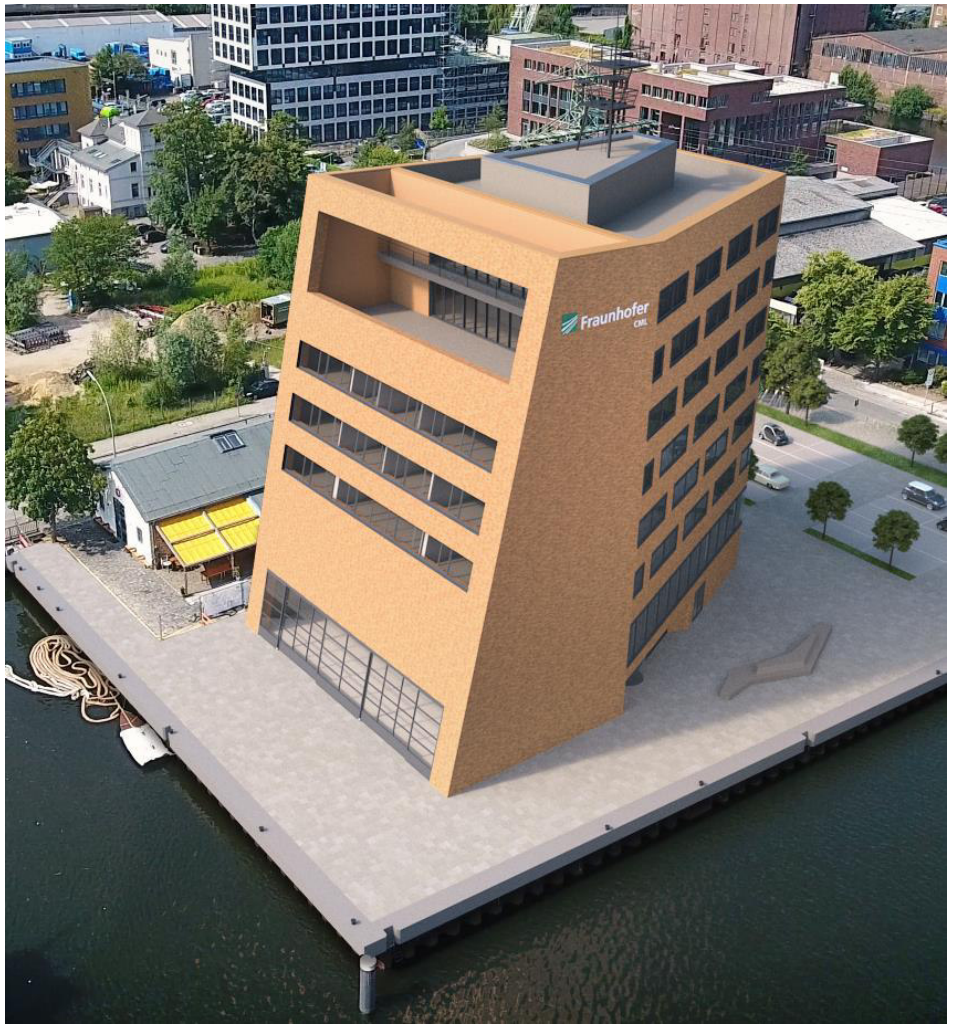


Logistik-Initiative Hamburg

Fraunhofer CML

Fraunhofer CML is rapidly growing as an integral part of the Fraunhofer research community

- **General Information**
  - Applied research in maritime logistics and services
  - Founded 2010 in Hamburg
  - Located at the campus of TUHH
  - Research Network with
    - TUHH
    - Fraunhofer IML
    - Fraunhofer-Gesellschaft
- **Staff**
  - Dynamic growth
  - Various qualifications
  - Director: Prof. Jahn (CML + TUHH)



Fraunhofer CML addresses major challenges along the maritime logistics chain

Research Field

Maritime Logistics Chain

Hinterland	Port	Vessel	Port	Hinterland

Pre-Carriage → Carriage → On-Carriage

Cargo flow

Information flow

Technologies and Systems

3 major challenges currently in focus

1. Productivity
2. Environment
3. Safety and Security

Planning

Processes

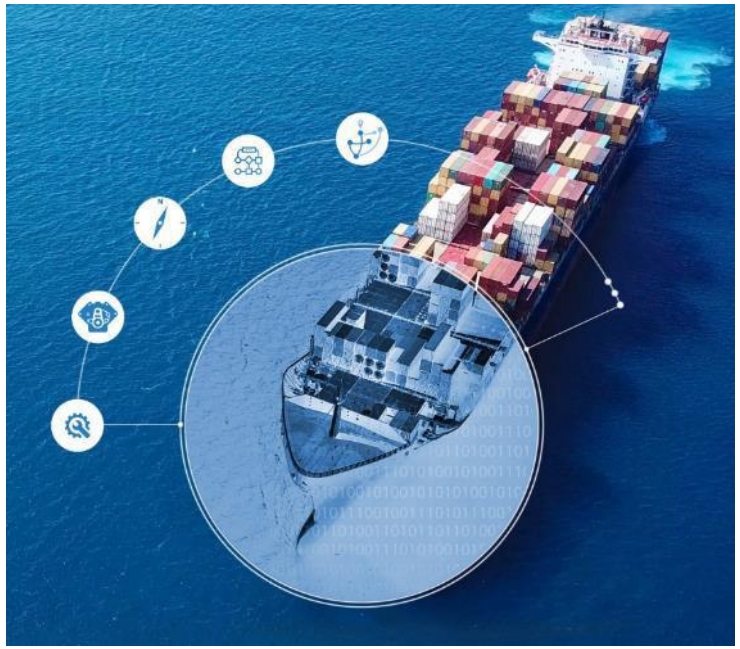
Forecasts

Logistik-Initiative Hamburg

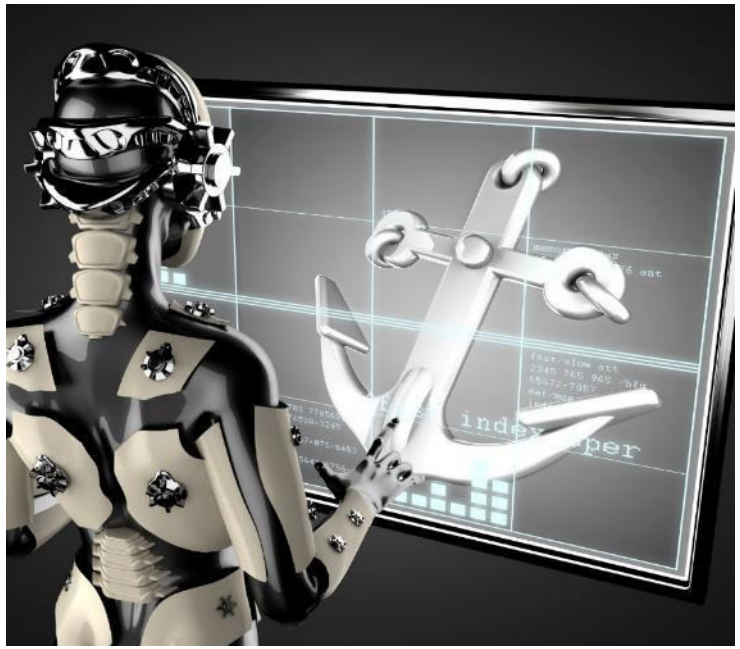
Fraunhofer CML

Fraunhofer Center for Maritime Logistics and Services
Research Areas

Ports and Transport Markets



Ship and Information Management



Sea Traffic and Nautical Solutions

Logistik-Initiative Hamburg

Fraunhofer CML

Ports and Transport Markets
In short

Focus

- Data processing and statistical analyses of traffic volumes and transportation demand
- Simulation-based determination of traffic projections for strategic infrastructure development
- Cost-benefit analyses and infrastructure and technology assessments
- Use of planning tables for visually supported port and terminal planning
- Software applications for process modeling and logistics simulation

Water Cargo Barge - WaCaBa

Design and analysis of an urban logistics concept for Hamburg's inner-city waterways

WaCaBa
Water Cargo Barge

A feasibility study on behalf of the City of Hamburg

Hamburg | Behörde für Wirtschaft, Verkehr und Innovation

Gefördert durch:
Bundesministerium für Verkehr und digitale Infrastruktur
aufgrund eines Beschlusses des Deutschen Bundestages

Logistik-Initiative Hamburg

Fraunhofer CML

WaCaBa – Project summary

March 2021 – October 2021

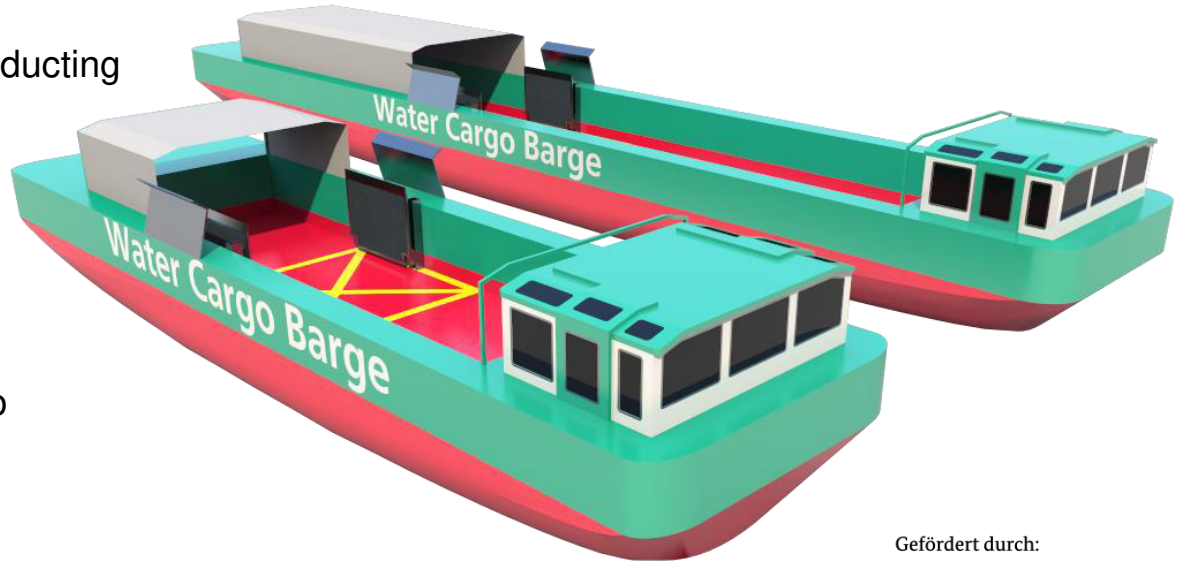
Hamburg | Behörde für Wirtschaft, Verkehr und Innovation

Scope:

- Feasibility study and design of the logistics-system WaCaBa for conducting urban transport services on Hamburg‘s inner-city waterways

Aim:

- Determination of technical, legal and economic feasibility
- Quantification of potential modal shift as well as CO2-savings due to WaCaBa



Gefördert durch:

Bundesministerium für Verkehr und digitale Infrastruktur

aufgrund eines Beschlusses des Deutschen Bundestages

Consortium:

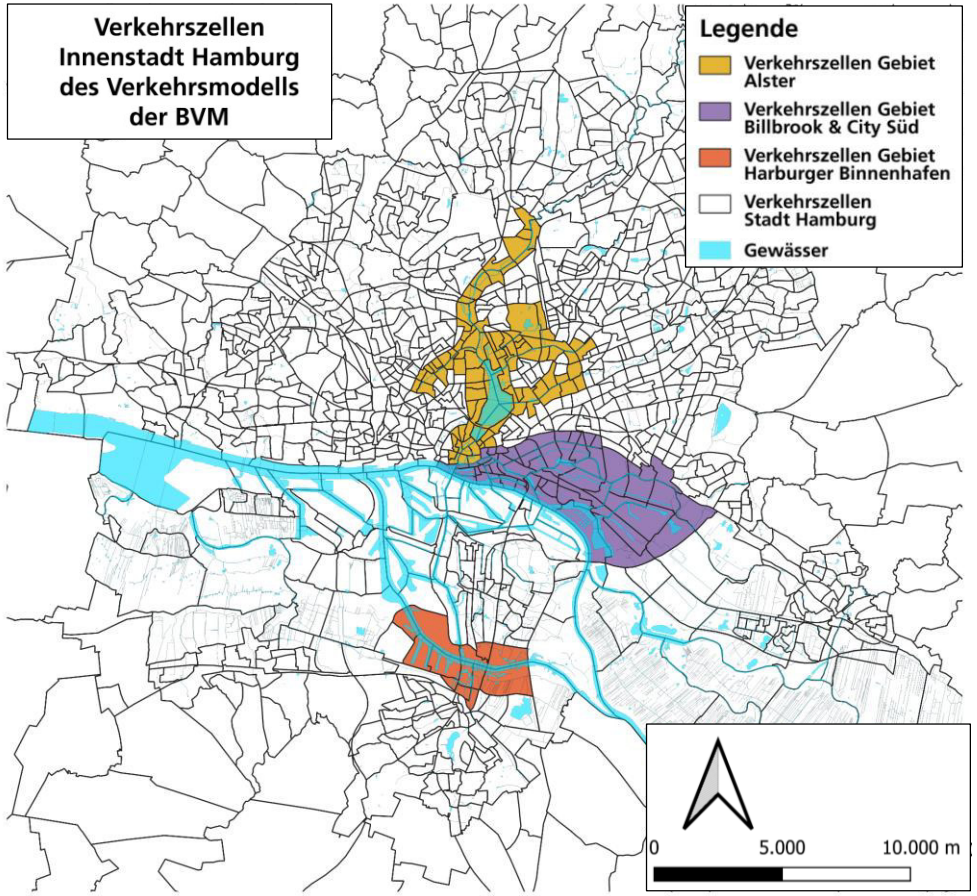
Fraunhofer CML Fraunhofer IML

Analysis of demand

Overview of focus areas

Focus Areas:

- The **Alster** from the lock to the Elbe to the Fuhlsbüttel lock including its canals and canals.
- The area of **Billbrook, Hammerbrook with City Süd** including the tidal canals on the Elbe, the Bille and the Hammerbrook canal system
- The **Harburg** inland port behind the Elbe lock



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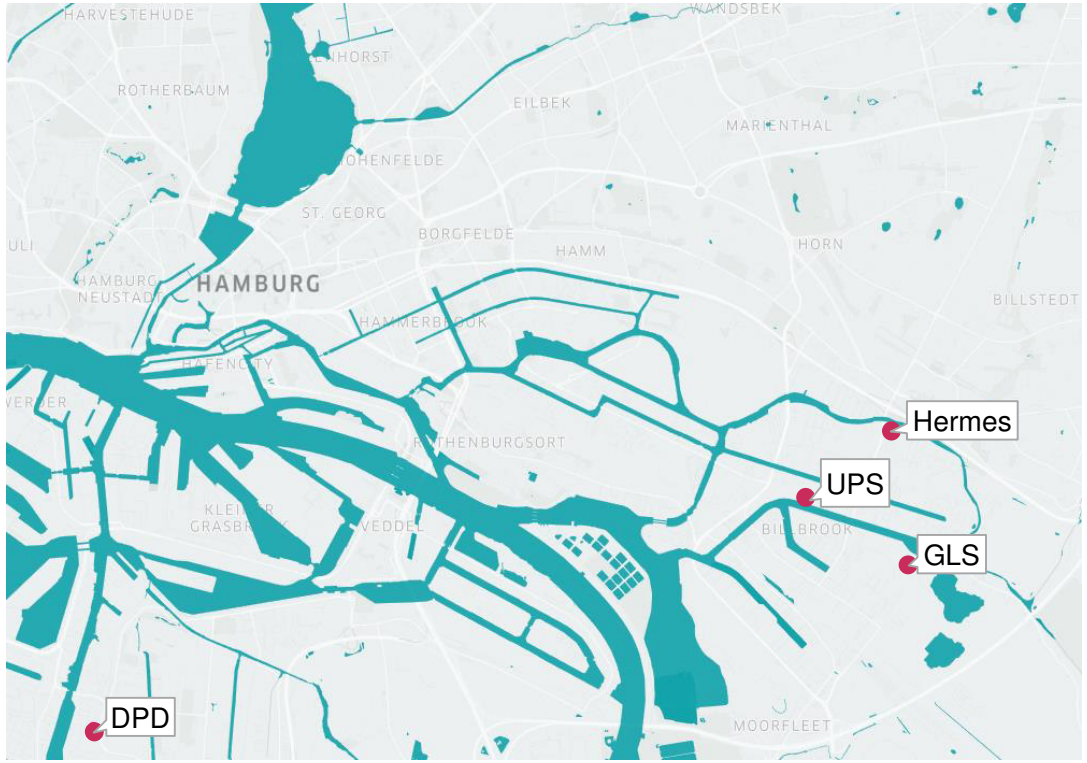
CEP-Dialogue
First appraisal of the WaCaba-Concept



Talks with 4 CEP service providers

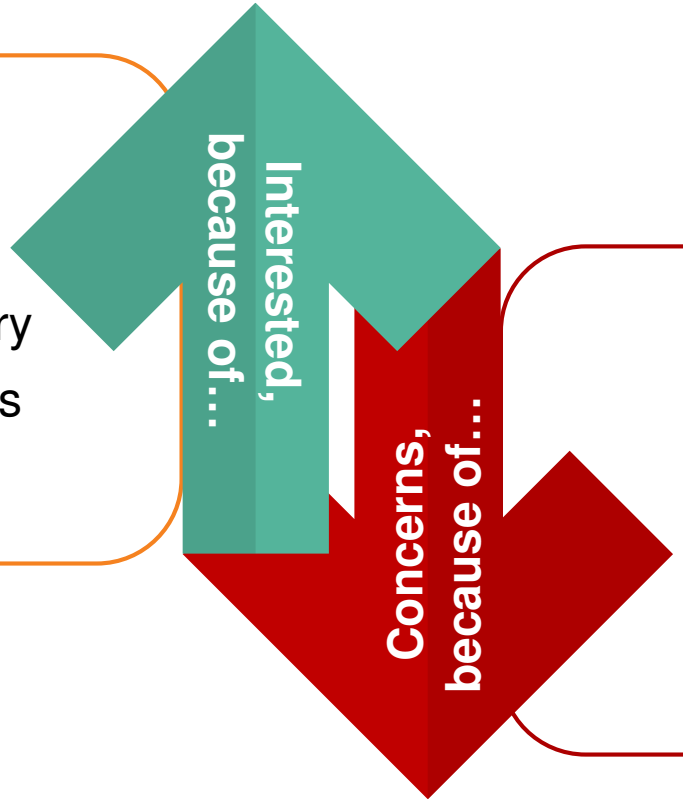
- Interest in delivery areas varies depending on the company (Focus B2B or B2C)
- Areas with a lot of parking search traffic and dense stop rate of high interest, e.g.
  - Außenalster
  - Hafencity
  - City Center
  - Generally, more densely populated residential areas
- Clarification of operator model needed
- Cooperative use of WaCaBa conceivable

Quelle: Own illustration with Bing Maps, 2021

KEP-Dialogue

First appraisal of the WaCaba-Concept

- Land use conflict
- Relocation of transports
- Local low-emission or free delivery
- Water as space for (micro-)depots



- Tidal dependence
- Transport time
- Condition of riverbanks and canals/access to water bodies
- Environmental protection
- Costs for feeder transport

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WaCaBa Water Cargo Barge

Fraunhofer IML

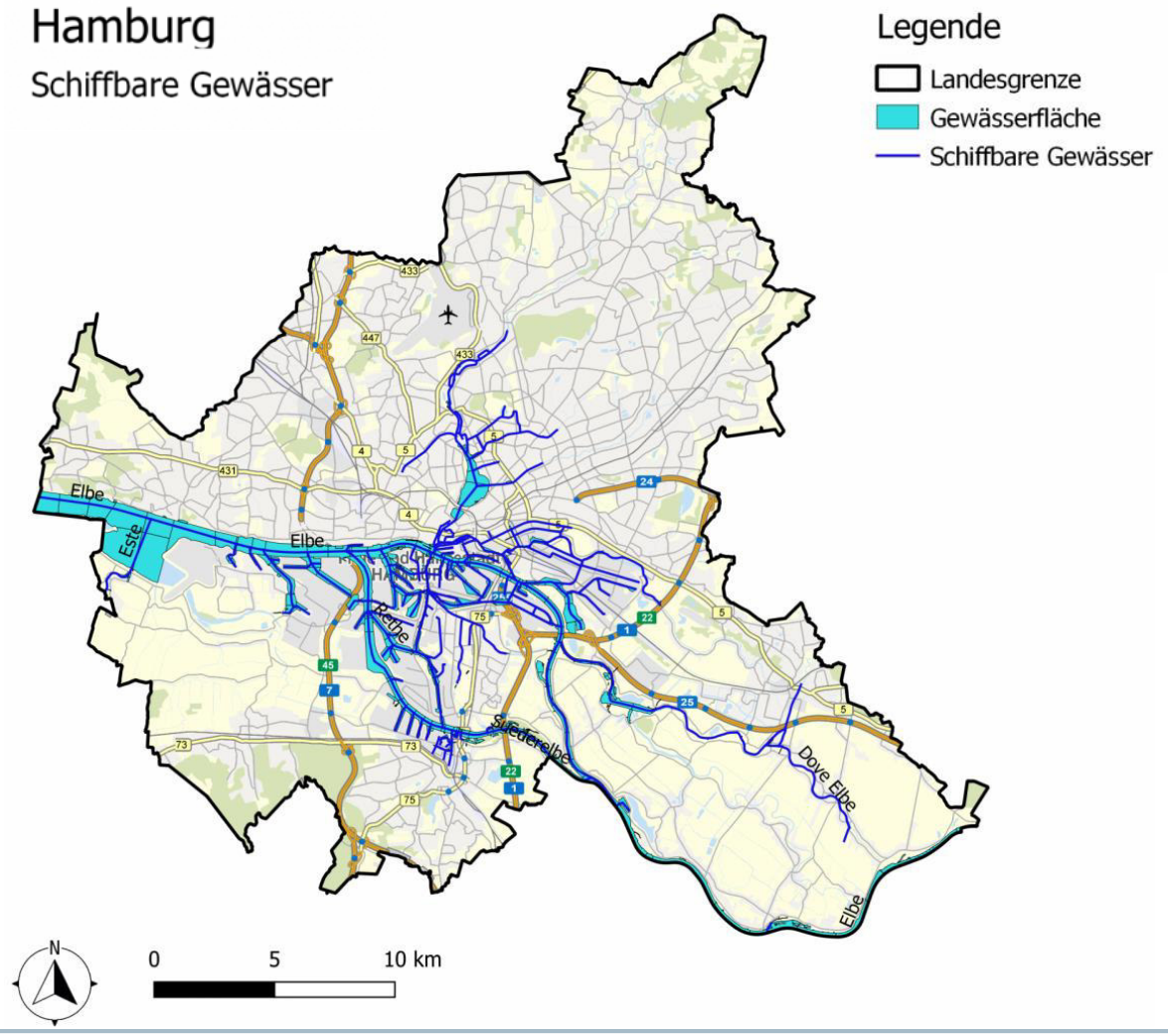
Fraunhofer CML

Feasibility of existing infrastructure

Waterways & moorings

Navigable waters

- According to § 10 HWaG
- Waters navigable under motor
- Partly tidal waters
- Responsible parties for permits under water law vary (HPA, BUKEA & District Offices)



Sources: Own illustrations after [1]; [2]; [3]; [4]

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Feasibility of existing infrastructure

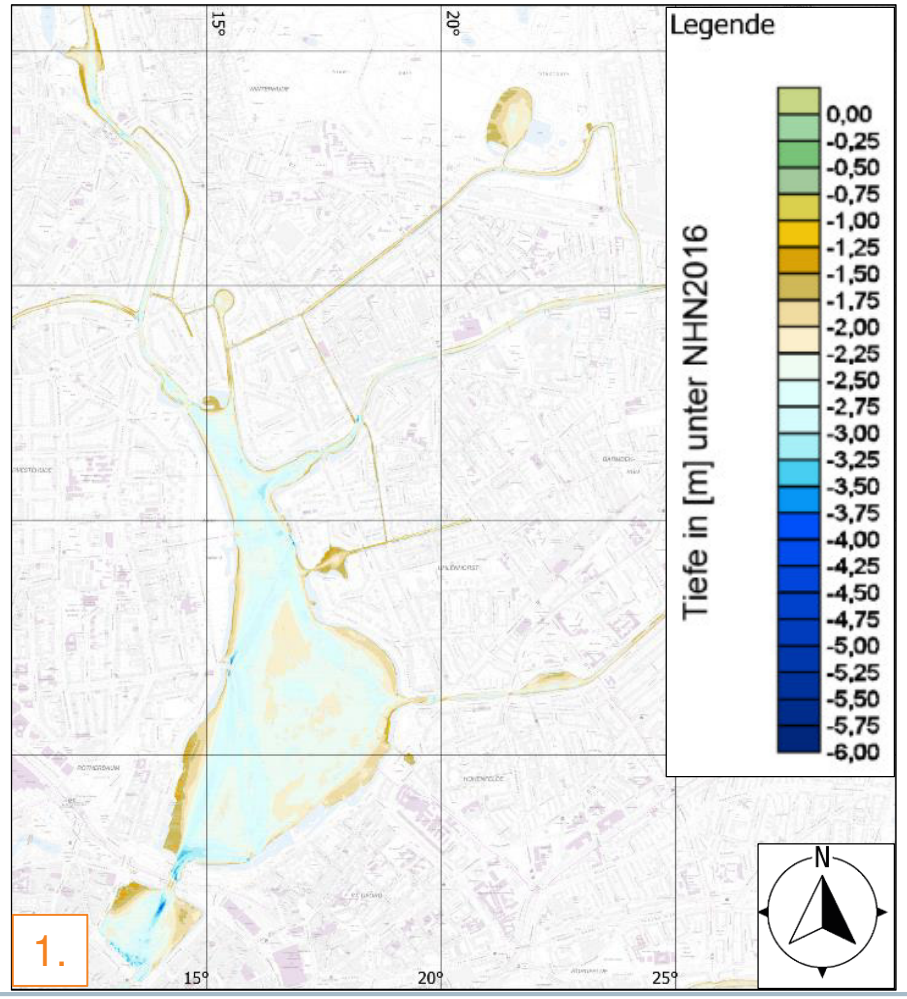
Waterways & moorings

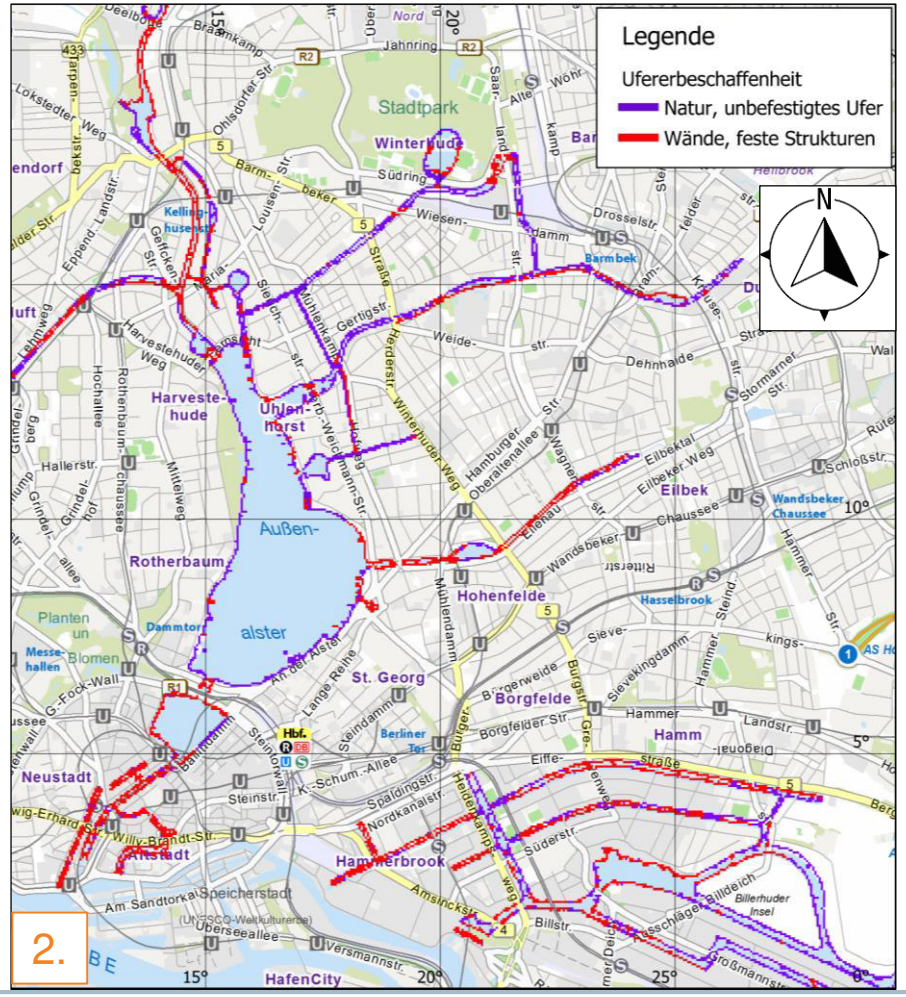
1. Sounding depths

- On behalf of the LSBG

2. Bank conditions

- Nature vs. solid structures





Sources: Own illustration [1]; [2]; [3]; [4]

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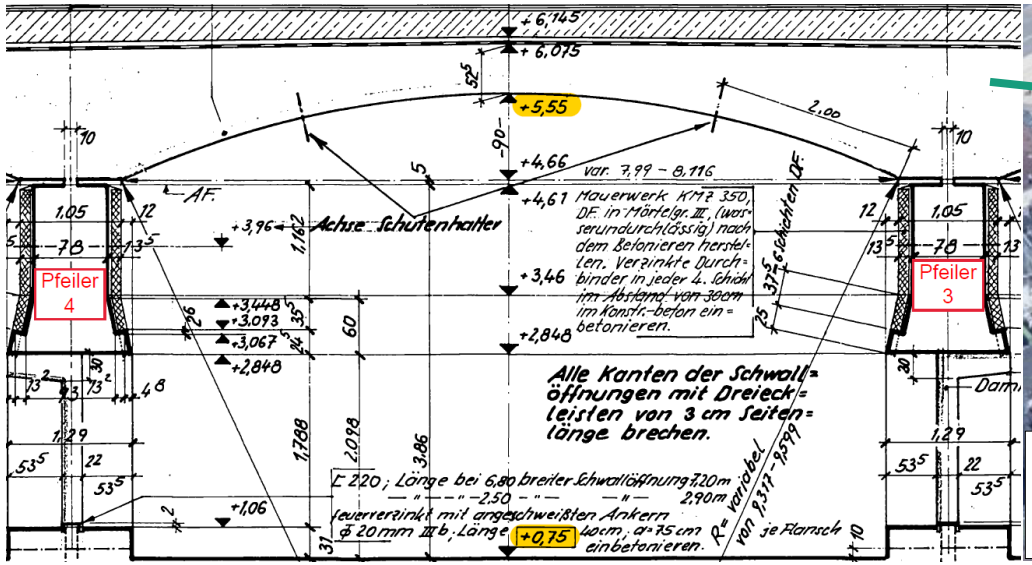
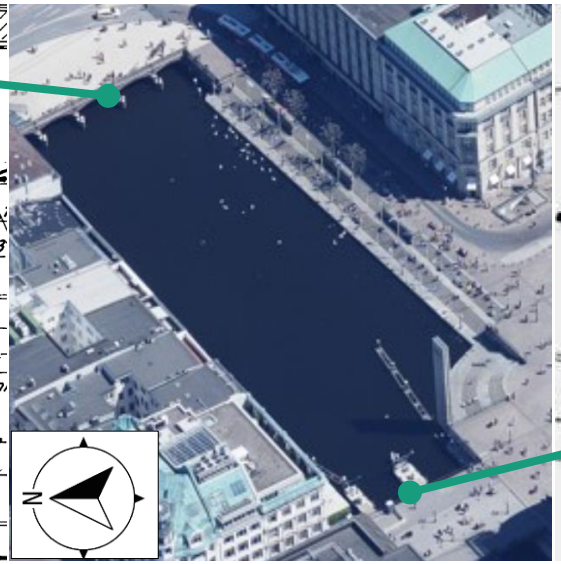
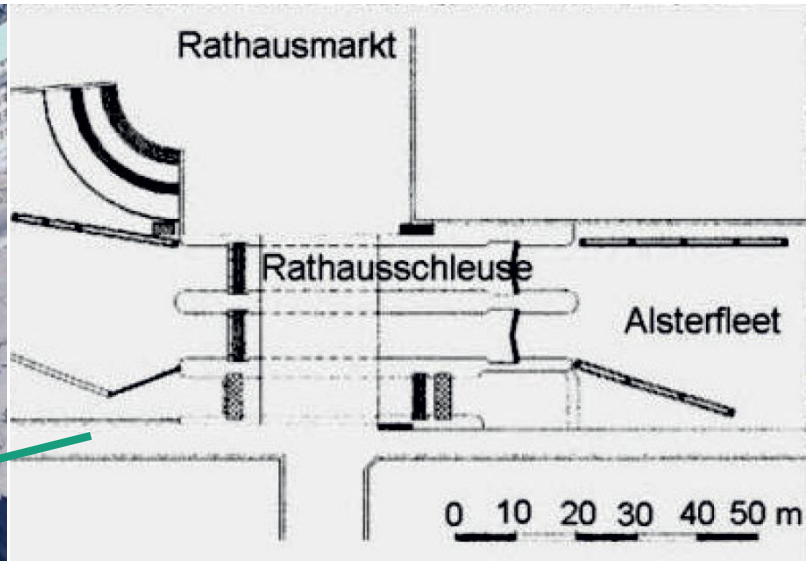
Feasibility of existing infrastructure

Structural size limits







Arc vertex:	5.55 m above sea level	Length:	35.00 m
Mean water level:	3.05 m above sea level	Breadth:	6.40 m

Sources: [5]; [6]; [7]

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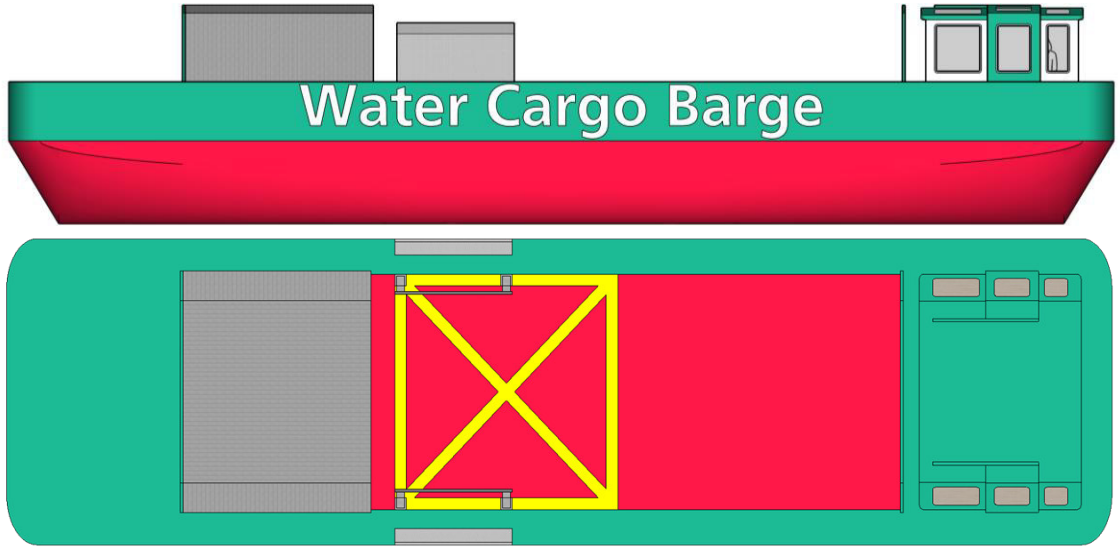
Technical Specifications

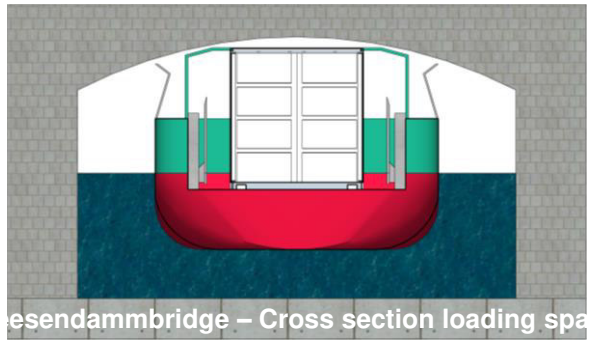
Main dimensions

„Alster-Max“

WaCaBa	Large	Small
Length	31.00 m	18.80 m
Breadth	5.20 m	5.20 m
Draft	1.40 m	1.40 m
Height above Water	2.30 m	2.30 m
Loading space	24.40 x 4.00 m	12.20 x 4.00 m
Payload	107.70 t*	64.09 t*
	241.78 m³	120.89 m³



Reesendammbridge – Front view


Reesendammbridge – Cross section loading spa

*Based on estimated ship displacement/weight.

Source: Own illustration, 2021

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Technical Specifications

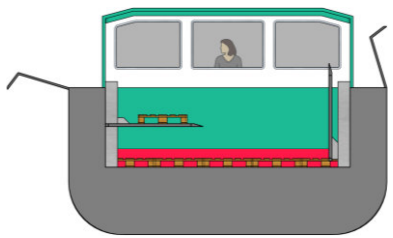
Cargo & handling

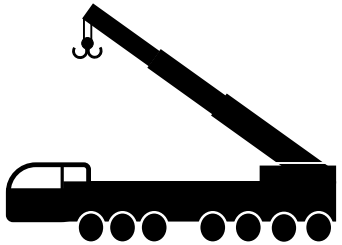
Examples of cargo

- Pallets (EPAL)
- Rolling Units (e.g. Box pallets → CEP)
- Container (10-40 ft.)
- Skip Containers (Bulk Cargo)
- Cargo Bikes, if applicable

Handling

- Accessibility through ramp-lift combination
- Use of external cargo handling equipment





Sources: Own illustration, 2021

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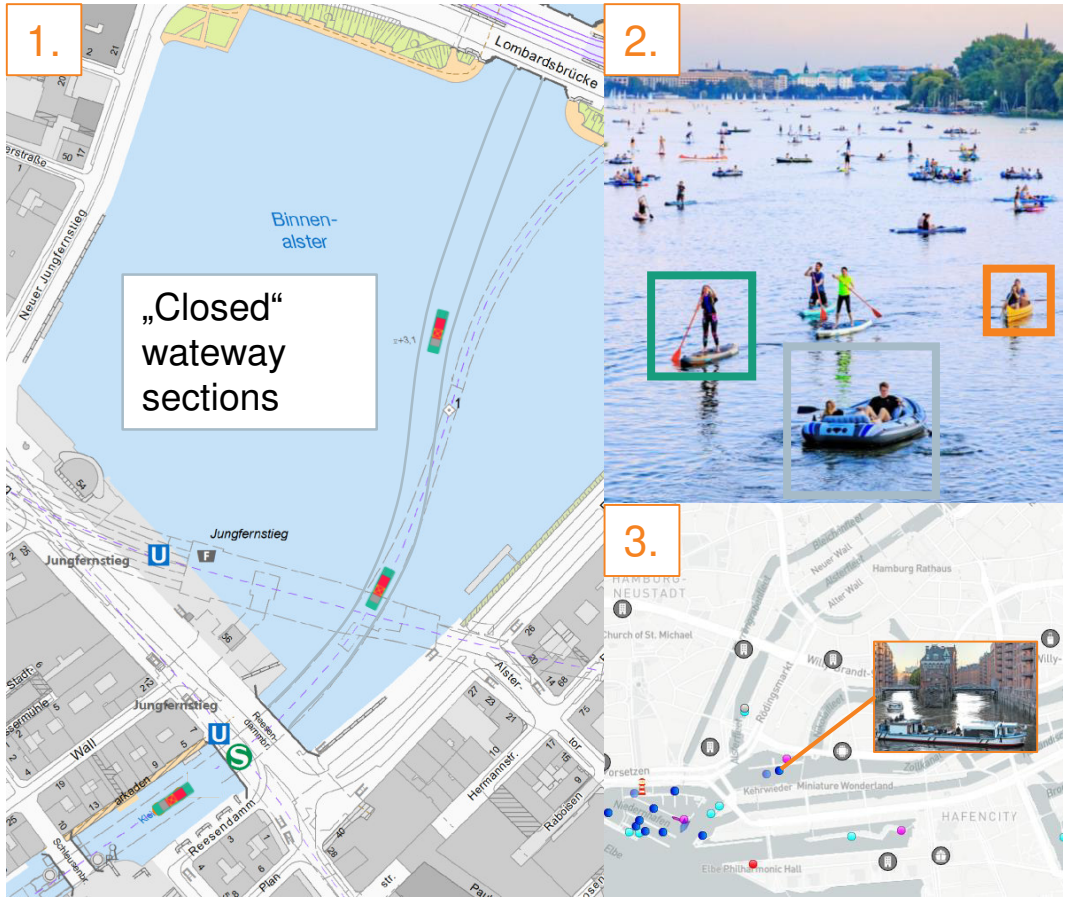
Technical Specifications

Autonomous/unmanned navigation

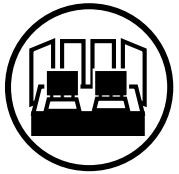


1.Conflict of interest with others regarding an exclusive route; vehicle without "special status" desirable

2.Guidance/object detection technically possible

LiDAR-Sensor/ 360° Kamera

+



Control Center

3.Other ships/users make limited use of predictive assistance systems

Automatic Identification System (AIS)

Sources: Own Illustration after [14]; [15]; [16]; [17]; [18]

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Fraunhofer CML

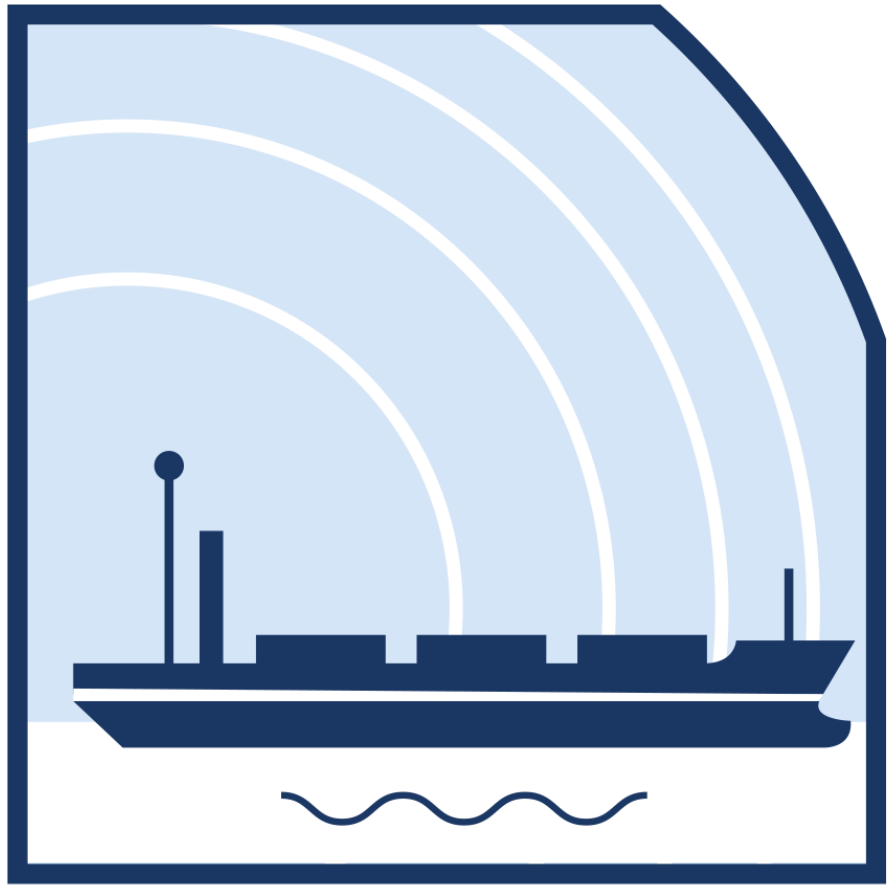
Autonomous/unmanned navigation
Outlook

Current barriers

- Legal frameworks have not been fully developed yet
- Little empiric data on safety exists (while existing data looks promising)
- Unmanned navigation is economically infeasible for a single vehicle due to Remote Control Centre

Future Outlook

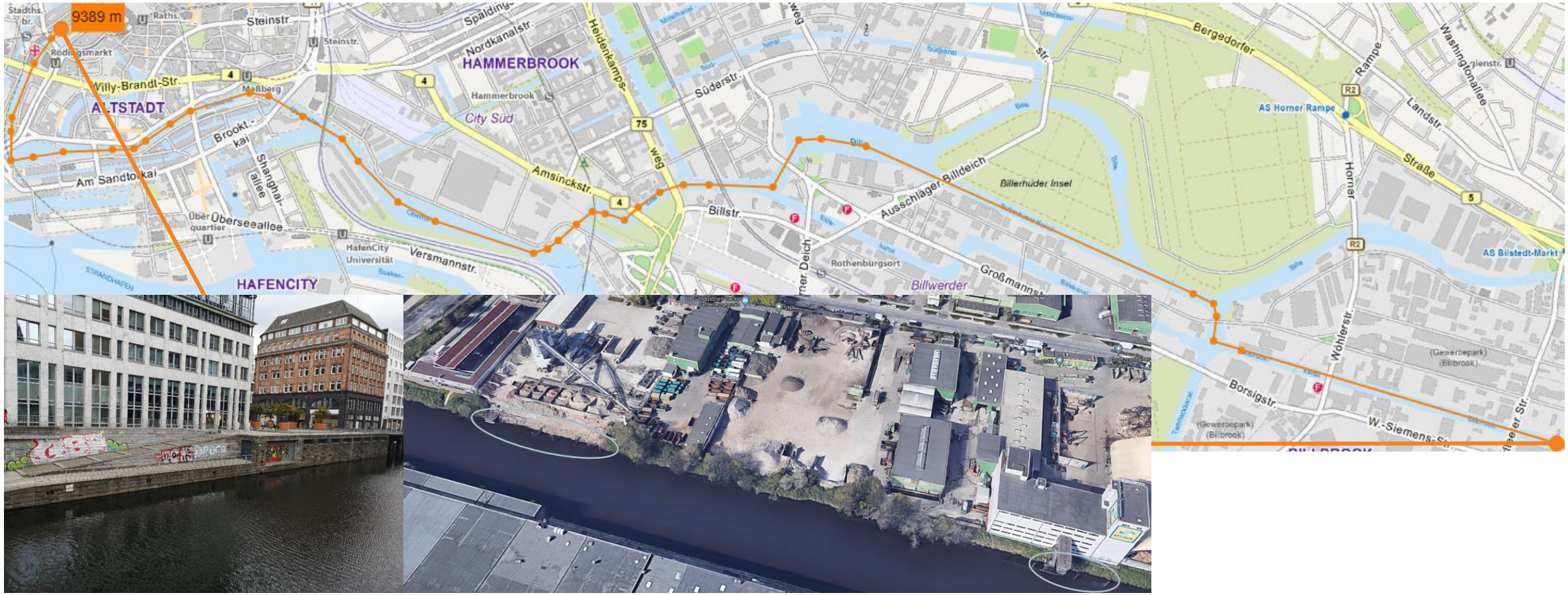
- In a scenario with many autonomous barges, unmanned transport entails significant economies of scale
- Large use cases are needed to reduce uncertainty and generate data for policy makers, insurers as well as prospective investors.



Sources: Own illustration, 2021

Technical Specifications

Operational Scenario – Reference Route „Billbrookkanal – Neuer Wall“



Sources: [8]; [9]; [10]

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Economic analysis

Costs of operation on reference route

Large & Small WaCaBa

CAPEX* & OPEX**

460 tours/ year
20 years service life
Personnel: 4.5 persons

Large WaCaBa
1.29 €/tkm
0.58 €/m³km

Small WaCaBa
1.99 €/tkm
1.05 €/m³km

3.5 t Truck & 7.5 t Truck

Daily rate of truck
Incl. overheads and vehicle

6 tours/day
1.33 h/tour
Personnel: 1 driver

7.5 t Truck
3.41 €/tkm
0.21 €/m³km

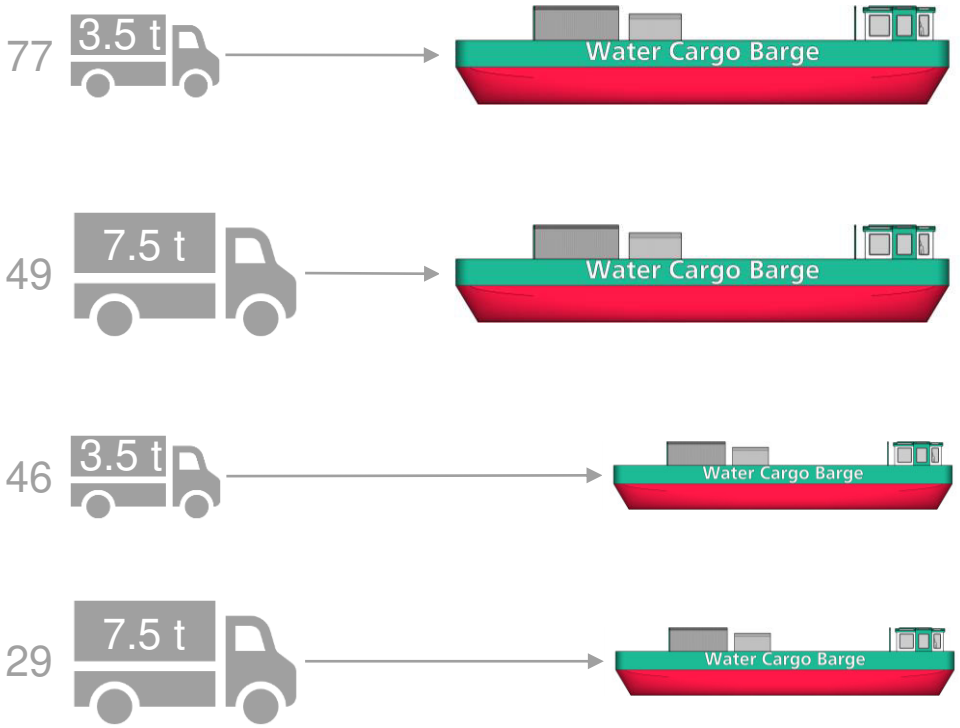
3.5 t Truck
4.88 €/tkm
0.46 €/m³km

* Capital costs incl. ship components, shipbuilding, charging infrastructure
** Operating costs incl. drive energy, technical maintenance, personnel, insurance, battery leasing

Potentials for modal shift

Reduction of truck deployments per tour

Weight-constrained



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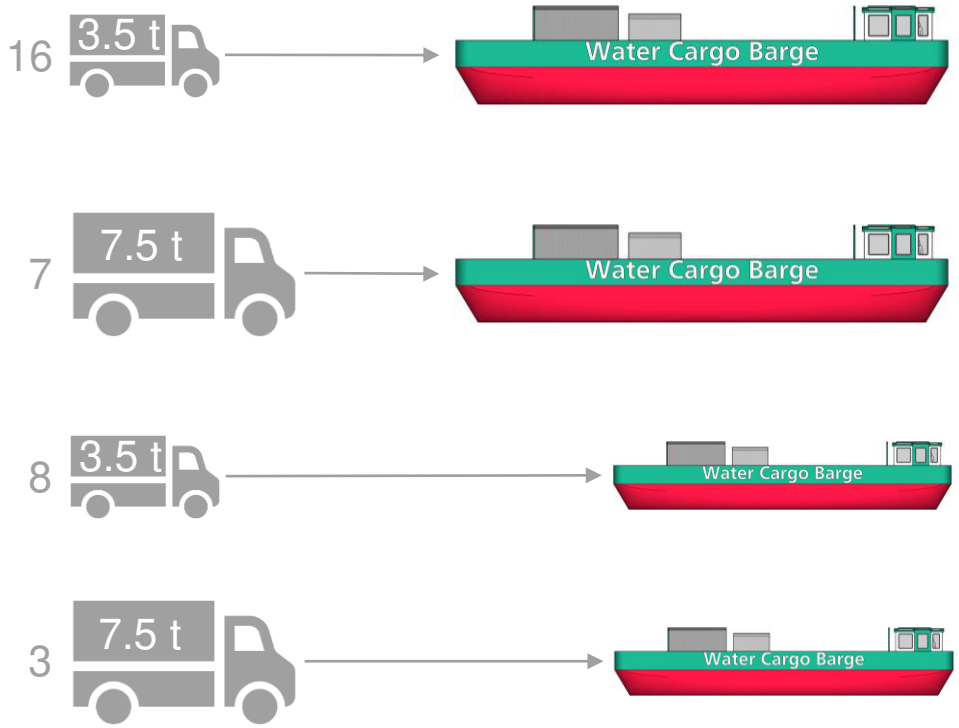
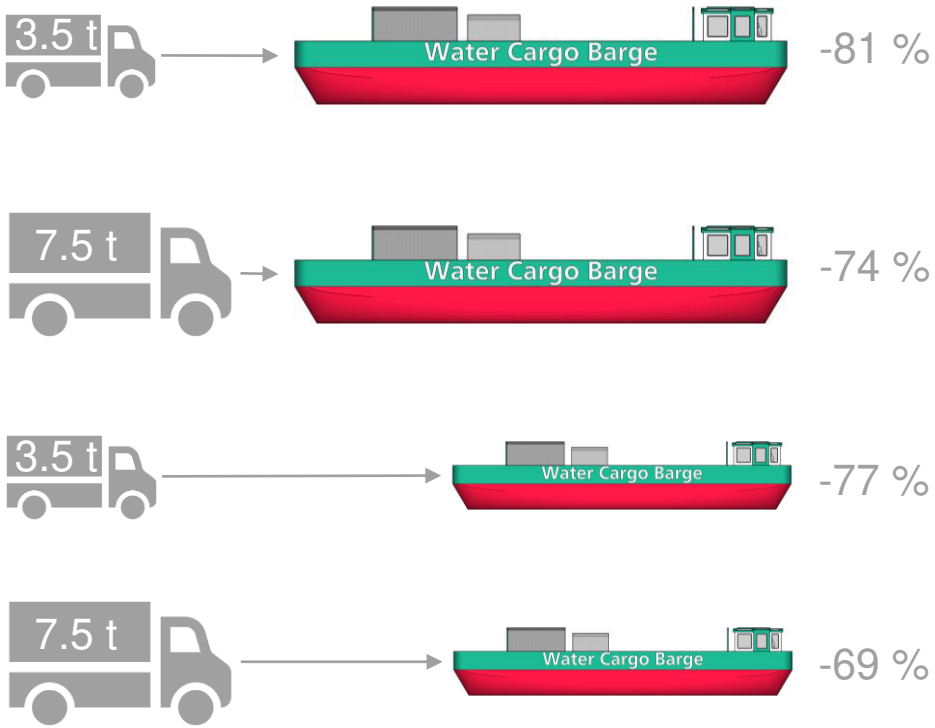


Source: Own Illustration, 2021

Potentials for CO2-Savings

Energyefficiency [kWh] of the WaCaBa in % per ton and m³

Weight-constrained



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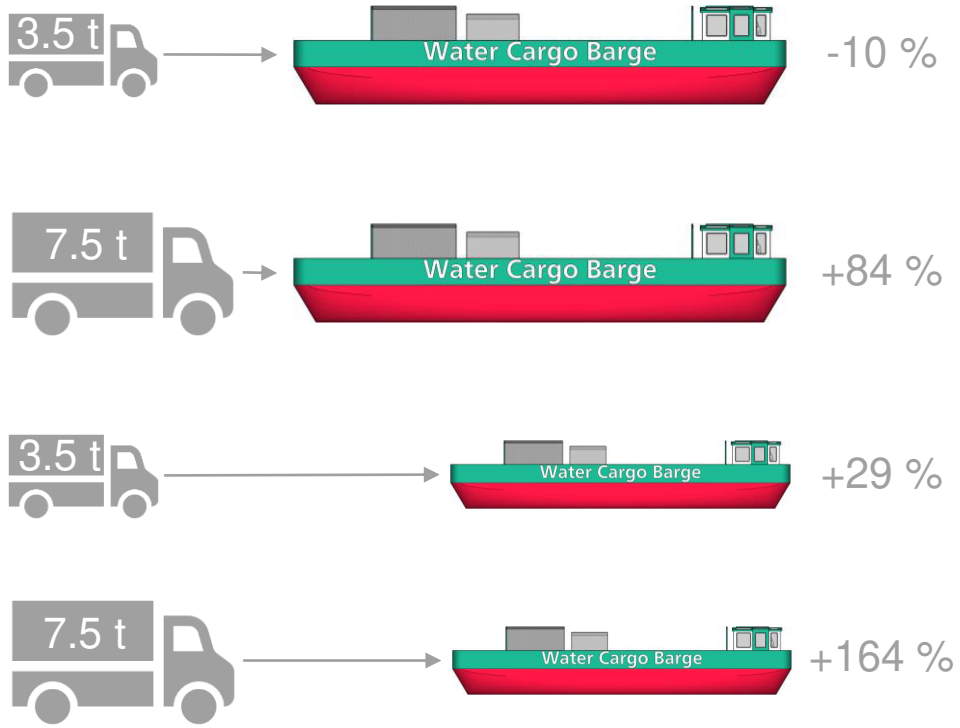
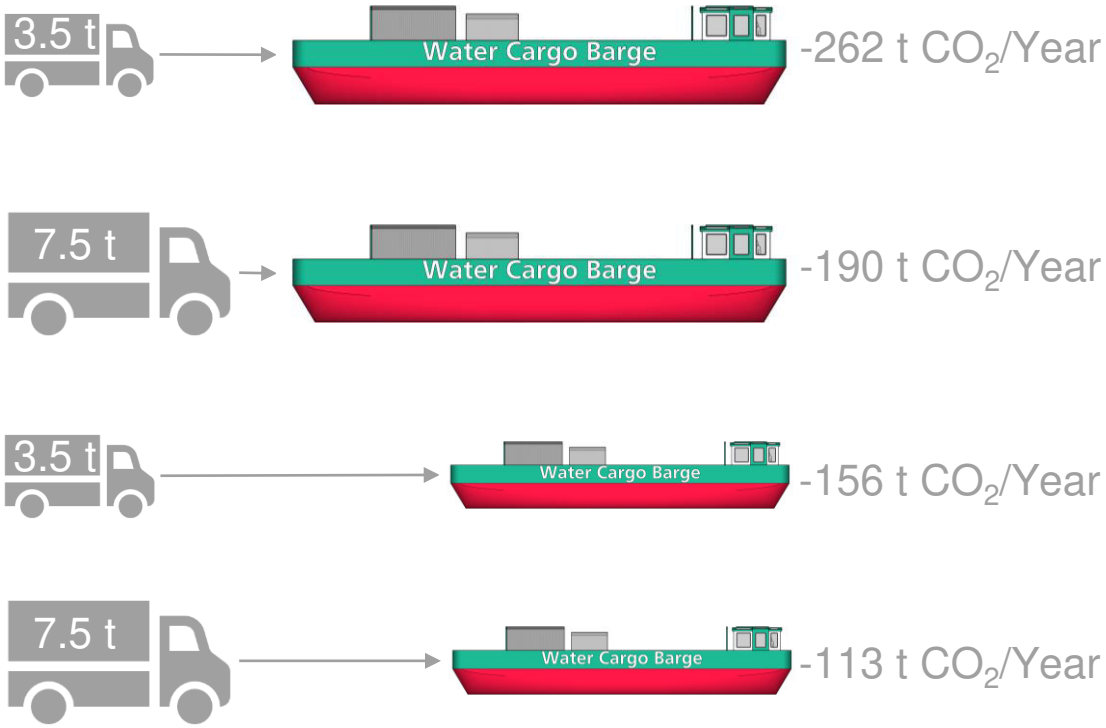


Source: Own illustration, 2021

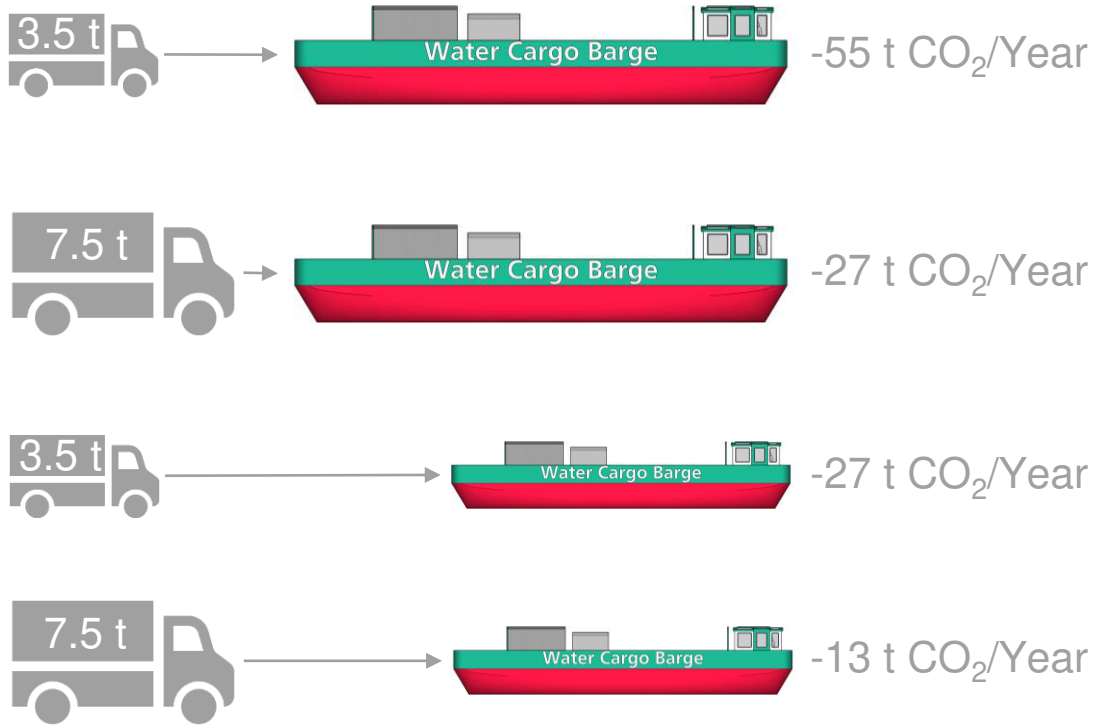
Potentials for CO2-savings

Local CO_2-savings p.a. at 460 Tours/Year

Weight-constrained



Volume-constrained



Source: Own Illustration, 2021

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Appendix I - Legal

Legal

- **Zulassung in Einzelfallentscheidung (WaCaBa/Anlegestellen)**
- **Fragmentierung der Genehmigungs-Stakeholder**
  - Fahrtauglichkeitsbescheinigung (BinSchUO)
    - Generaldirektion Wasserstraßen und Schifffahrt
  - Fahrtgebietsgenehmigungen
    - Schifffahrtspolizeibehörde(n)
    - BUKEA → Alsterschifffahrtsverordnung
  - Betriebssicherheit für beteiligte Personen
    - BG-Verkehr → DGUV Vorschriften

Hamburg | Behörde für Umwelt, Klima, Energie und Agrarwirtschaft

BG Verkehr
Berufsgenossenschaft für Transport und Verkehrswirtschaft

Source: [19]; [20]

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Legal

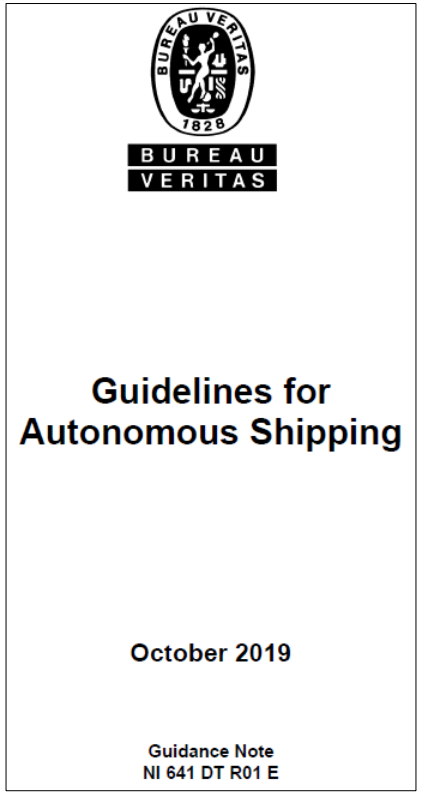
Anlegestellen/Liegeplätze

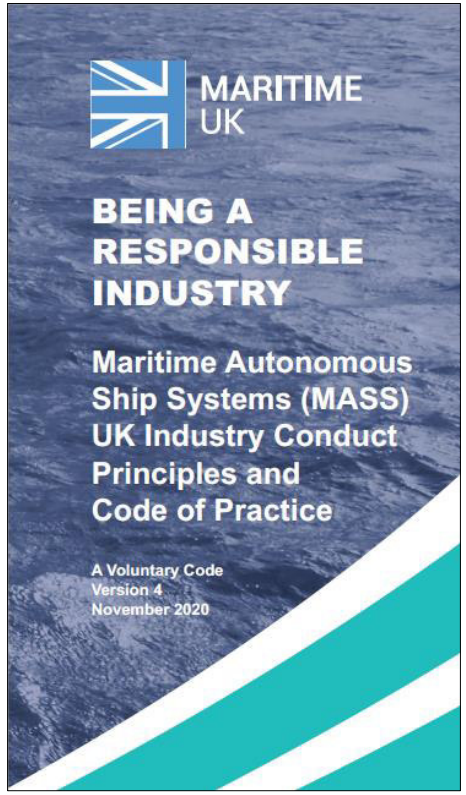
- Einbeziehung der Bezirke & LSBG
- Hafenverkehrsordnung
- Orientierung an DIN-Normen

Unbemanntes Fahren

- Noch keine rechtlich bindenden Vorschriften
- Richtlinien von Klassifikationsgesellschaften

Lloyd's Register, 2017
DNV GL AS, 2018
Bureau Veritas, 2019





Sources: [21]; [22]

Logistik-Initiative Hamburg

Fraunhofer CML

Appendix II – Demand per focus area

Analysis of demand

Area Harburg Inland Port

Traffic

- Residential and office locations in the north results in low freight traffic volumes
- Modeled freight traffic concentrated on Veritaskai

Main market sectors in focus

- All resident industries in area

Result of the survey and the workshop

- Currently no interest in the transport service embodied by WaCaBa

SIC Category	Nr. of Companies	Share
Offices, authorities and associations	168	27.86 %
General services	118	19.57 %
Banks, financial institutions and insurance companies	106	17.58 %
Construction	51	8.46 %
Wholesale	51	8.46 %
Retail	33	5.47 %
Transport and logistics	32	5.31 %
Capital goods manufacturer	22	3.65 %
Consumer goods manufacturer	22	3.65 %
Total	**603**	**100 %**

Analysis of demand

Area Alster

Traffic

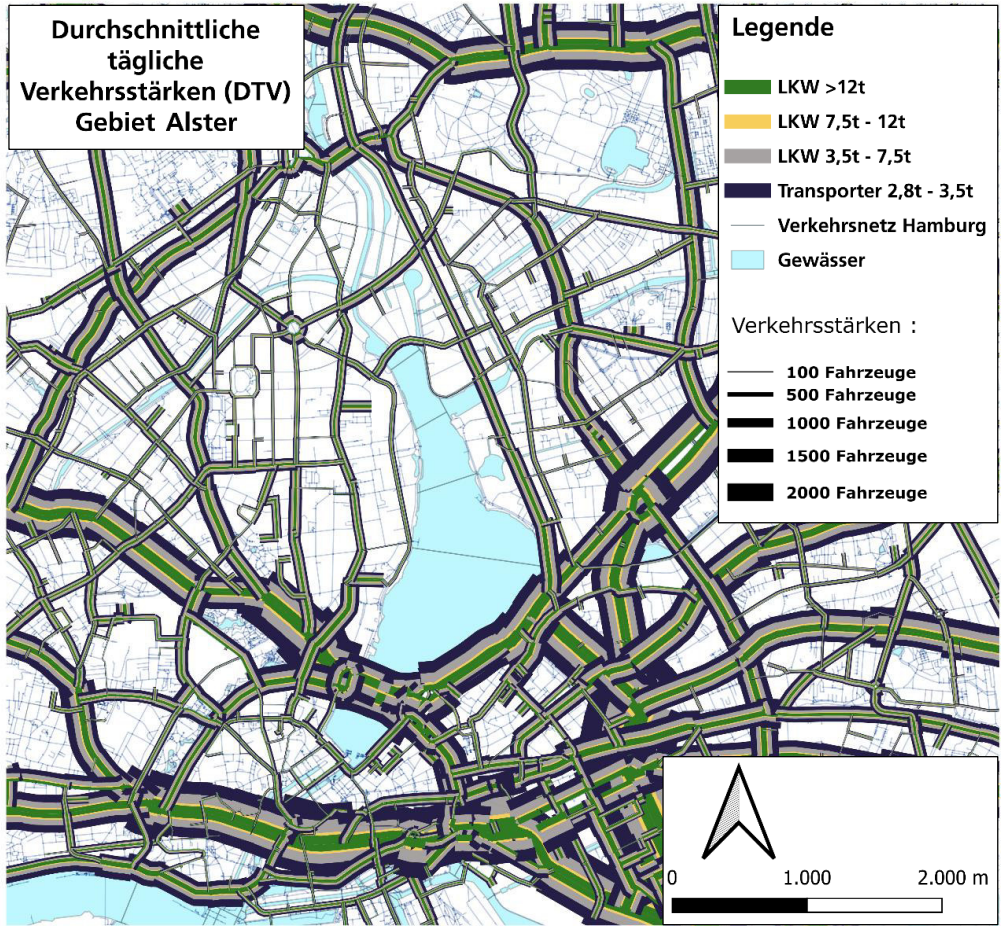
- Low freight traffic load with source/sink on the Alster
- Binnenalster has heavier freight traffic load due to local retail trade

Main market sectors in focus

- Hotel industry & gastronomy
- Wholesale and retail

Result of the survey

- A shift by suppliers to such a solution would generally be supported, but the suppliers themselves are not located near the waterfront



Source: Own illustration after BVM, 2021

Analysis of demand

Area Billbrook & City Süd

Traffic

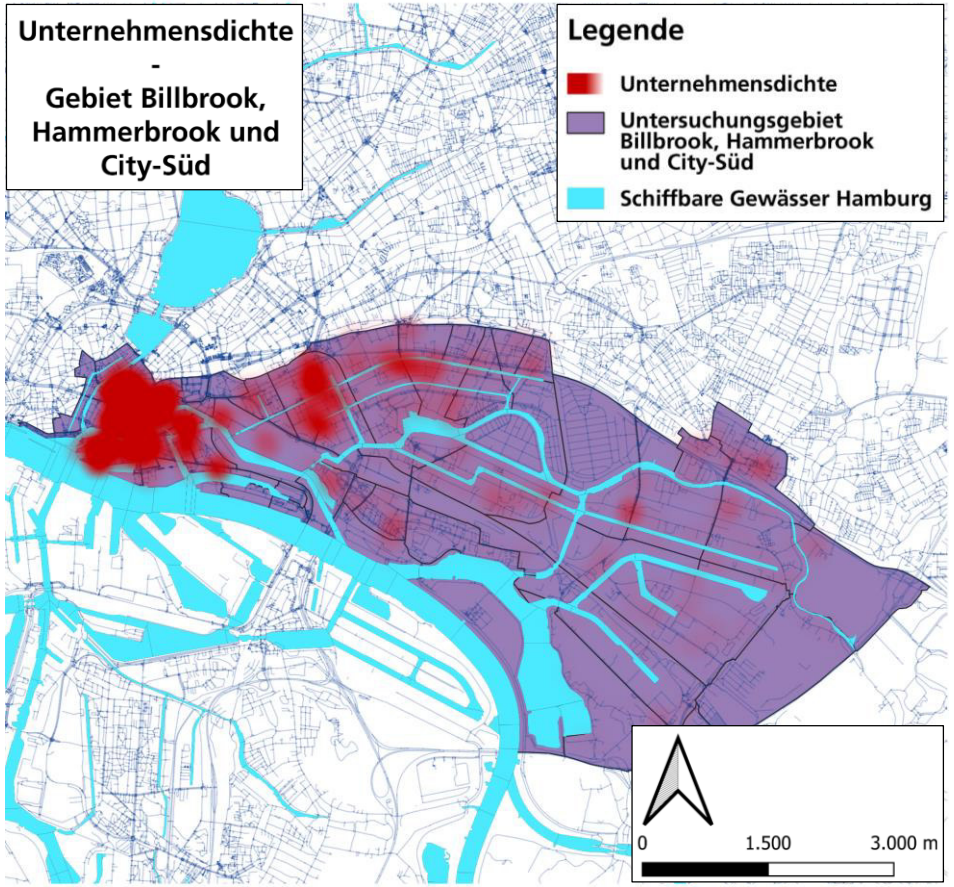
- Sources/sinks in comparatively high number in the area
- High volume of freight traffic suggests potential for modal shift to waterways

Main market sectors in focus

- Transport and logistics
- Wholesale
- Construction

Result of the survey

- Cautious interest from transport & logistics
- Skepticism from construction and wholesale as destinations are largely not located on the waterfront



Source: Own illustration based on Hoppenstedt Firmendatenbank, 2021

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WHAT'S NEXT? - AN OUTLOOK

THOMAS BRAUNER,
LOGISTICS INITIATIVE HAMBURG

07

Interreg North Sea Region AVATAR European Regional Development Fund EUROPEAN UNION

Logistik-Initiative Hamburg

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Based on the AVATAR and WaCaBa research and project work,

- two future use cases for Hamburg as well as
- three future use cases for Ghent

were identified and created into European innovation projects.

They will be elaborated and piloted in Hamburg between 2023 and 2026.

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Hamburg Use Case 1: Parcel delivery Billbrook – HafenCity – City centre

- Key pain point for last mile delivery in city centres are non-existing or expensive retail spaces for micro hubs
- Pilot: Using the AVATAR urban vessel to either transport parcels or e-cargo bikes from the DHL distribution centre to the city centre
- Barge is usable as a “floating & temporary micro hub” from which the e-cargo bikes can directly be loaded or start from the barge directly (if they are already being loaded in the DC)
- The pilot has been created as part of the **EU Horizon Europe project “DECARBOMILE”** and has been approved recently and **will start in September 2022**.

Key stakeholders involved:

Hamburg

Logistik-Initiative Hamburg

Deutsche Post DHL

HOUT & BOUW OPLEIDINGSCENTRUM

TUHH Technische Universität Hamburg

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Hamburg Use Case 1: Parcel delivery Billbrook – HafenCity – City centre

- Proposed route (subject to change) & possible unloading points

Alsterfeet / Neuer Wall incl. existing ramps

Deutsche Post DHL DC, Werner-Siemens Str., directly located at Tidekanal

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Hamburg Use Case 1: Parcel delivery Billbrook – HafenCity – City centre

- Excerpt from the project application
- *"The **choice of a mobile urban consolidation centre (UCC) is mostly related to the real estate space availability**: competition and prices are currently a bottleneck when it comes to implementing UCC for last mile delivery in Hamburg. **Using a city barge** as a mobile UCC **can therefore unlock potentials**, as it functions both as transport unit on the 2nd mile as well as a UCC **without the need of additional transshipment** from a transportation barge to the UCC."*

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Hamburg Use Case 2: Retail supply

- This use case is being developed as part of the EU innovation Project Interreg NSR **“InnoWaTr”**, for which a proposal was submitted 22.04.2022. In case of approval **it will start in autumn 2022**.
- In Hamburg, the „Westfield Hamburg-Überseequartier“ with 200 retail units including gastronomy, hotels, cruise terminal etc. is currently being built in the district of HafenCity.
- It is directly located at the Elbe river and planned to be opened in Q4 2023.
- Currently delivery and disposal transports are mainly planned to be carried out via road transport.

Source: www.ueberseequartier.de

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Hamburg Use Case 2: Retail supply

- We want to develop and pilot a concept for the **supply of a district with retails and restaurants** via urban inland waterway transport (IWT)
- Through this, the potential and feasibility of a IWT city freight distribution for retail supply is being tested. This could in the future lead to a modal **shift from urban road freight transport to zero emission urban IWT**.
- Commodities will mainly be pallets and parcels of all kinds (retail goods from clothing to consumer electronics as well as foodstuffs / fresh products for the restaurants / bars).
- The urban vessel as well as the „city box“ concept as a transportation unit developed / provided by the “Ghent Living Lab” (also part of the project) will both be a suitable and transnational asset to support the Hamburg pilot!

Key stakeholders involved:

TOP MEHRWERT-LOGISTIK

Logistik-Initiative Hamburg

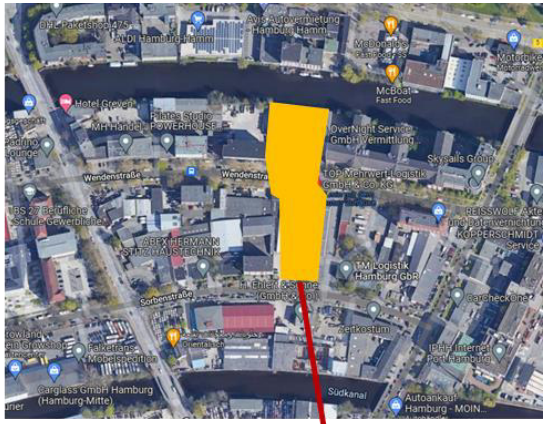
hb HOUT & BOUW OPLEIDINGSCENTRUM

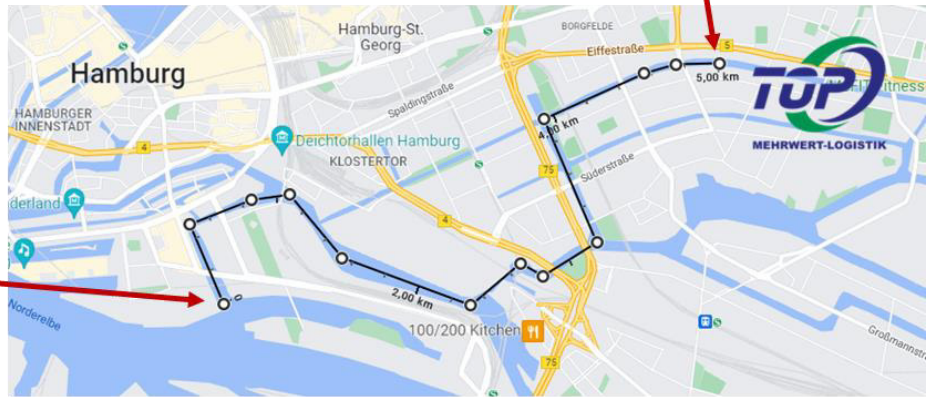
THE KLU KÜHNE LOGISTICS UNIVERSITY

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

Hamburg Use Case 2: Retail supply

- TOP Mehrwert HQ & its warehouse is located in Hammerbrook/Hamm, directly at the waterway „Mittelkanal“; the distance to Überseequartier via water would (depending on the specific route) be approx. 5 km





Source: Google Maps

OUTLOOK: FOLLOW-UP PILOTS AND USE CASES FOR HAMBURG & GHENT

3 Ghent / Flanders Use Cases

- Also as part of the Interreg NSR **“InnoWaTr” project**, **3 use cases** have been identified that **will be piloted in the Ghent / Flanders region** in case the project gets approved
- **Those are:**
- Construction & building materials (interregional and city logistics transport)
- Bio Farmers & local food products (regional & city logistics delivery to several markets in the region) in combination with last mile delivery by cargo-bikes
- Return flows and Waste Collection (region and city level transports)

THANK YOU & HAVE A GREAT EVENING!

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04.05.2022 | Hamburg

Interreg North Sea Region AVATAR
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