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North Sea Region  
AVATAR

European Regional Development Fund  
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

15/12/2022



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# 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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Thinking Growth



Eco-innovation



Sustainable NSR



Green transport and mobility





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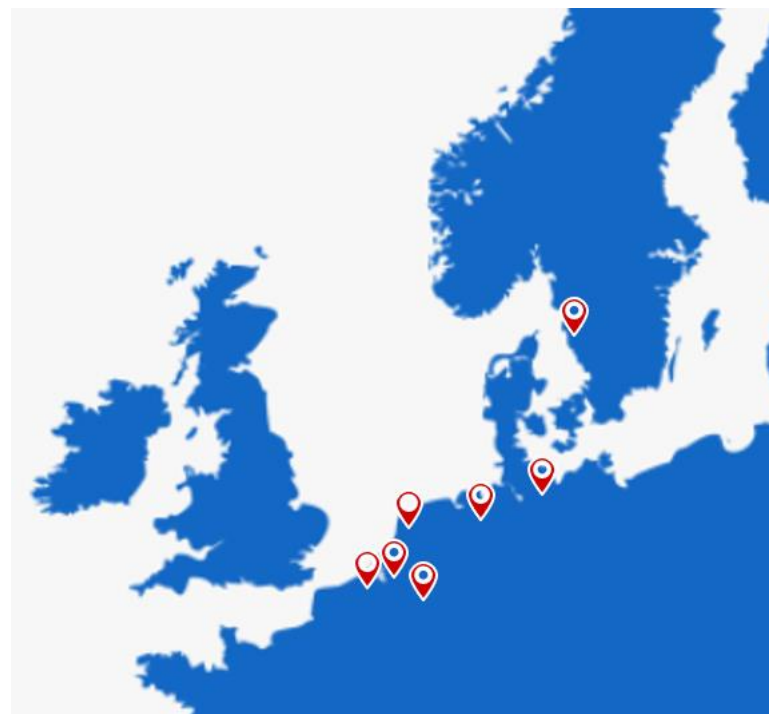


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# QUICK FACTS (II)



- **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)
- **Autonomous Vessels, cost-effective trAnshipment, wAste Return**





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WHY URBAN HIGHLY AUTONOMOUS 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
- Lack of skippers and search for economically viable system
- AVATAR project **aims to tackle those challenges by developing, testing and assessing adequate technologies and business models for urban autonomous zero-emission IWT**







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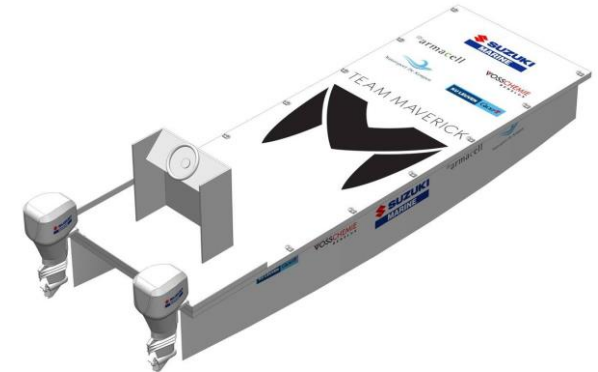
DEVELOPMENT OF

# AUTONOMOUS VESSELS (I)



- 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

Source: KU Leuven





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DEVELOPMENT OF

# AUTONOMOUS VESSELS (II)



- In a **second step**, a newly built vessel with a capacity of approx. 25 tons is being developed (OHB, UWL, E. Van Wingen)
- The aluminum hull has been built in a Dutch shipyard, the fully electric drive system will be integrated in Ghent (Belgium) started in Q3/2021
- Expected completion: Q1/2023
- 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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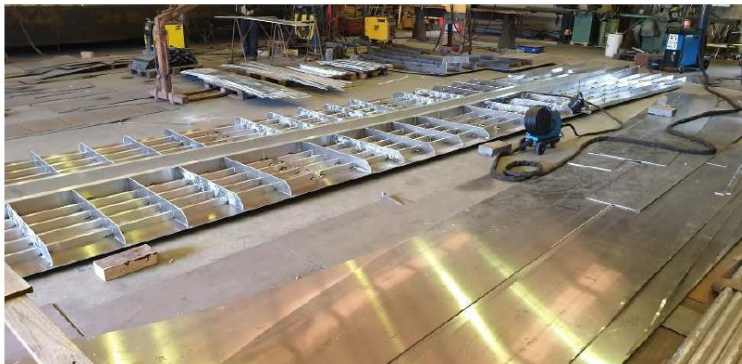
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DEVELOPMENT OF

# AUTONOMOUS VESSELS (II)





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DEVELOPMENT OF

# AUTONOMOUS VESSELS (II)







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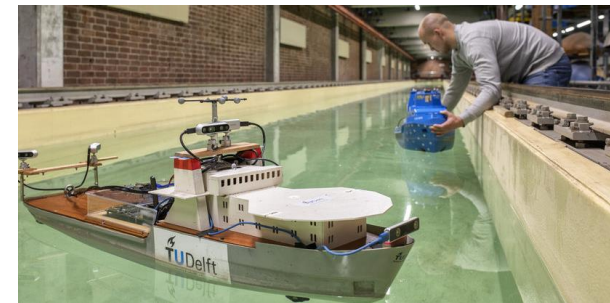
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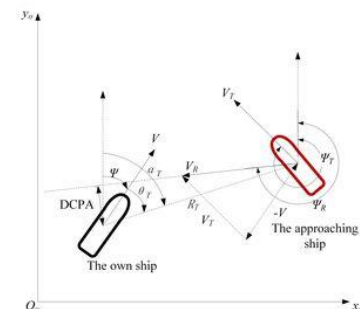
# AUTONOMOUS VESSELS (III)



- 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
- Also TUD demonstrations will be carried out
- At least 3 pilots will be carried out, depending on the findings of use case development and local interest





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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!**



*Market review on city freight distribution using inland waterways*

*Within the framework of the Interreg NSR project AVATAR work package 4, activity 1*

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





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USE CASE & BUSINESS CASE DEVELOPMENT

# STATUS



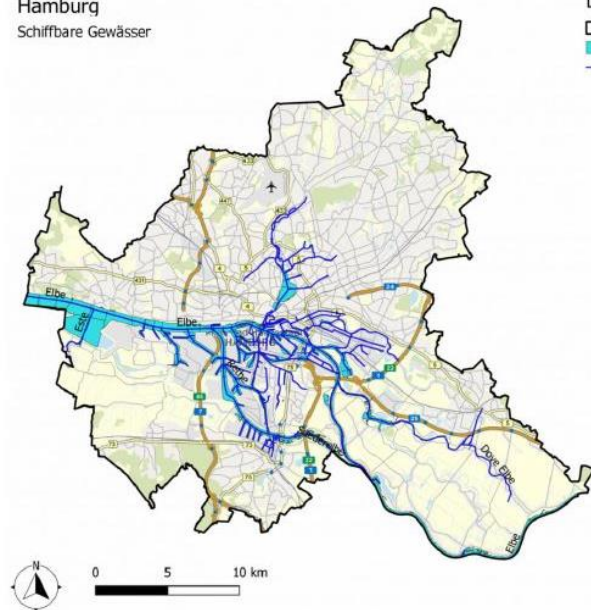
## HAMBURG USE CASES

- 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](#)
- 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)



**WaCaBa**  
Water Cargo Barge

Hamburg  
Schiffbare Gewässer



Legende  
□ Landesgrenze  
■ Gewässerfläche  
— Schiffbare Gewässer

Source: City  
of Hamburg



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USE CASE & BUSINESS CASE DEVELOPMENT

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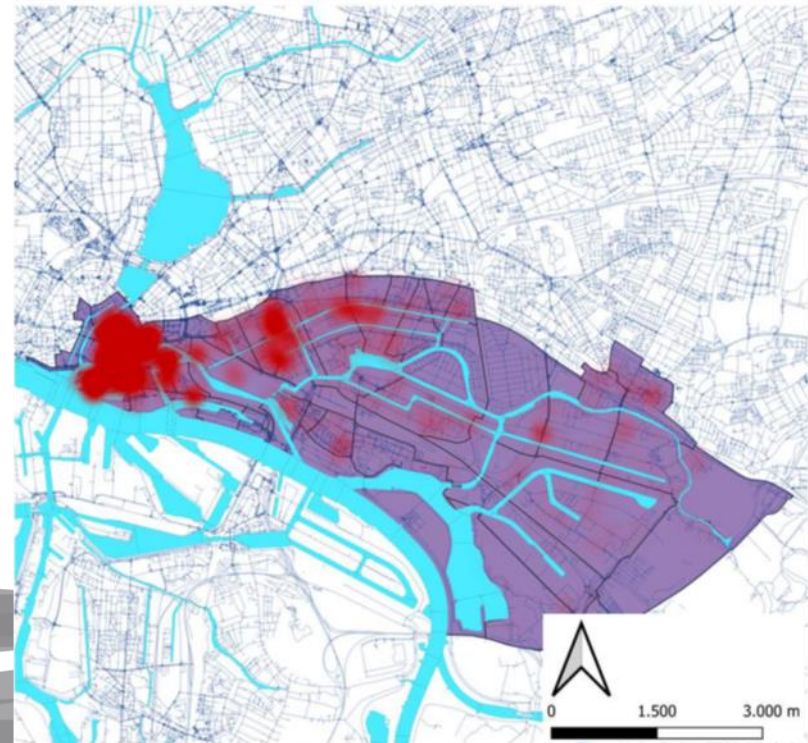
## HAMBURG USE CASES

### “WaCaBa” Feasibility study key learnings:

- The technical and legal feasibility could be confirmed, a “reference barge” has been identified with 107 tons respectively 64 tons max. load capacity based on local infrastructure
- The area of Billbrook, Hammerbrook with the City Süd including the tidal canals on the Elbe, the Bille and the Hammerbrook canal system (purple) has been identified as most suitable area of application within Hamburg.



Company density (red) in Billbrook and Hammerbrook (purple)



Source: Fraunhofer, based on Hoppenstedt Firmendatendank, 2021



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USE CASE & BUSINESS CASE DEVELOPMENT

# STATUS



## HAMBURG USE CASES

### “WaCaBa” Feasibility study key learnings:



- In terms of economical feasibility the concept as of now shows higher operational costs for the IWT city freight distribution than for truck/van distribution, but also very different specific economic valuations, depending on the transported goods and the relation.
- Especially in the courier express parcel industry, however, potential is seen in urban waterways, for example if a transport ship can also be used as a floating micro depot for the fine distribution of parcels with cargo bikes.
- This means that an economic viability could be achieved for suitable goods on suitable routes in conjunction with corresponding control effects of transport policy (e.g. zero emission zones, truck ban zones).
- In terms of unmanned shipping, there is currently a lack of regulatory framework, not only on local level, but on EU level, which will needs to be addressed in the future.
- CO2 savings have been confirmed for all possible relations and case studies investigated within this study.





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USE CASE & BUSINESS CASE DEVELOPMENT

# 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 (market research and cost calculations): 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





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OTHER TOPICS

# RESEARCH



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





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# NEWSLETTERS



## PROJECT NEWSLETTER NO. 1

July 2021



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

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](#)

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

## PROJECT NEWSLETTER NO. 2

November 2021



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## 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



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 transshipment 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



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## 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 Palletto!) 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.







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# GET IN TOUCH



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<https://northsearegion.eu/avatar/>

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

