AEGIS Newsletter N$_o$ 2, June 2021.

AEGIS: The new sustainable and highly competitive waterborne logistics system for Europe.

The Advanced, Efficient and Green Intermodal Systems (AEGIS) project will leverage a multidisciplinary team to integrate new innovations from the area of Connected and Automated Transport (CAT) to design the next generation sustainable and highly competitive waterborne transport system in Europe. This includes more diverse sizes of ships and more flexible ship systems, automated cargo handling, ports and short sea shuttles, standardized cargo units and new solutions for digital connectivity.

The main objective of AEGIS is to develop a new waterborne logistics system for Europe that leverages the benefits of ships and barges while overcoming the conventional problems like dependence on terminals, high transhipment costs, low speed and frequency and low automation in information processing. AEGIS intends to use new innovations from the area of CAT, including smaller and more flexible vessel types, automated cargo handling, autonomous ships, new cargo units and new solutions for digital connectivity to regain the position that waterborne traditionally had in freight transport. Ships are most efficient when the cargo holds are full. AEGIS will look for ways to attract new cargo, inbound as outbound, to waterborne transport. This requires new types of services, new business models and better logistics systems.

The project is now in month 13 and goes until May 2023.

The project has received funding from the European Union's Horizon 2020 Research and innovation program under Grant Agreement N°859992.

Recent events.

AEGIS, AUTOSHIP and De Vlaamse Waterweg arranged an IWT webinar on automation and autonomy.

The EU projects AUTOSHIP and AEGIS joined forces together with De Vlaamse Waterweg and successfully arranged an online webinar on automation and autonomy in inland navigation logistics on April 20th. About 150 people participated in the event!

The questions investigated in this workshop were:

- *How will automation and autonomy contribute to efficient and sustainable inland navigation cargo transport in Europe?*
- *What are the challenges and what are the solutions that these initiatives propose?*

The EU projects AUTOSHIP, AEGIS, NOVIMAR and AVATAR and the ship management company SeaFar were presented and there was a very fruitful panel debate following the presentations. The panel consisted of moderator Ann-Sofie Pauwelyn (De Vlaamse Waterweg) and the five participants:

- AUTOSHIP: Antoon Van Coillie (Zulu Associates)
- AVATAR: Senne van Baelen (KU Leuven)
- SeaFar NV: Louis-Robert Cool
- NOVIMAR: Edwin van Hassel (University of Antwerp)
- AEGIS: Mads Bentzen Billesø (DFDS)

Thank you to the presenters/panelists and the moderator! A recording of the workshop follows under:

https://youtu.be/1d9FgEVV8ws

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Recent publications.

The very first public AEGIS project report was submitted and published beginning of June 2021, written and produced by Port of Aalborg and Port of Vordingborg, Denmark. The title is Potential transfer from road transport to short-sea-shipping in Denmark and examines the potential gross volume that can be shifted from road transport to short-sea-shipping in Denmark, categorized by different goods types.

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AEGIS vessel concepts being investigated

In the previous newsletter the three use-cases of AEGIS were described briefly: UC-A “Short sea and rural terminals in Norway”, UC-B “Short sea and inland interfaces in Belgium and Netherlands”, and UC-C “Revitalizing regional ports and city centre terminals”. As different as the three use-cases are, as different are the requirements to the new advanced vessels operating in these areas. Ranging from smaller short sea shipping (SSS) vessels for a more frequent, flexible, and resilient waterborne transportation between Rotterdam and the Norwegian west coast (UC-A), over new, highly efficient, and autonomous inland waterway (IWW) vessels for trucks and trailers in use-case B, to flexible, small sized, combined SSS/IWW vessels for a transportation of goods from Denmark into the central European hinterland and vice versa (UC-C). The presented vessel concepts are still in draft phase and will be developed and improved during the progress of AEGIS and in close dialog with the project partners. Low- to zero-emission propulsion concepts and a high level of autonomy, both for sailing and cargo handling operations, are common for all vessels concepts being investigated.

In UC-A a mother-daughter concept is followed on, for the mother vessel serving the international trade between Rotterdam and the Trondheim fjord region, and the daughter vessel distributing the cargo in the destination area, mostly within the fjord. Containers, that means Load-on Load-off (LoLo), are the cargo type of interest for this use-case. The mother vessel will be comparable small with a capacity of up to 200 TEU. On-board handling systems in terms of cranes or even mobile solutions will allow for a port-independent loading and discharging.

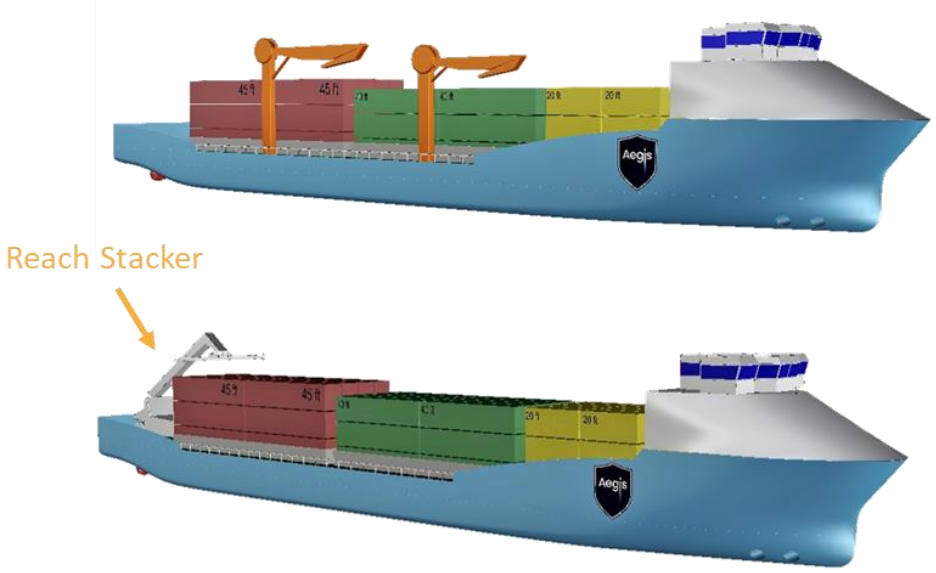

Fig. 1: Draft concept of a small SSS vessel (160 TEU) with on-board cargo handling systems (two cranes or a mobile reach stacker)

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For the daughter vessel, several approaches are under investigation. A pushed convoy will offer a very high degree of flexibility. Barges can be design specific for the type of cargo, or more flexible for mixed cargo, e.g. bulk and containers. Autonomous (de-) coupling from or into the convoy ensures a customer friendly and flexible operation. The barges can serve as extra storage area in ports with limited space. The pusher will be electrically driven supplied by H_2 fuel cells and/or batteries. The barges might carry battery containers to supply the push boat or ship-to-ship transhipment processes.

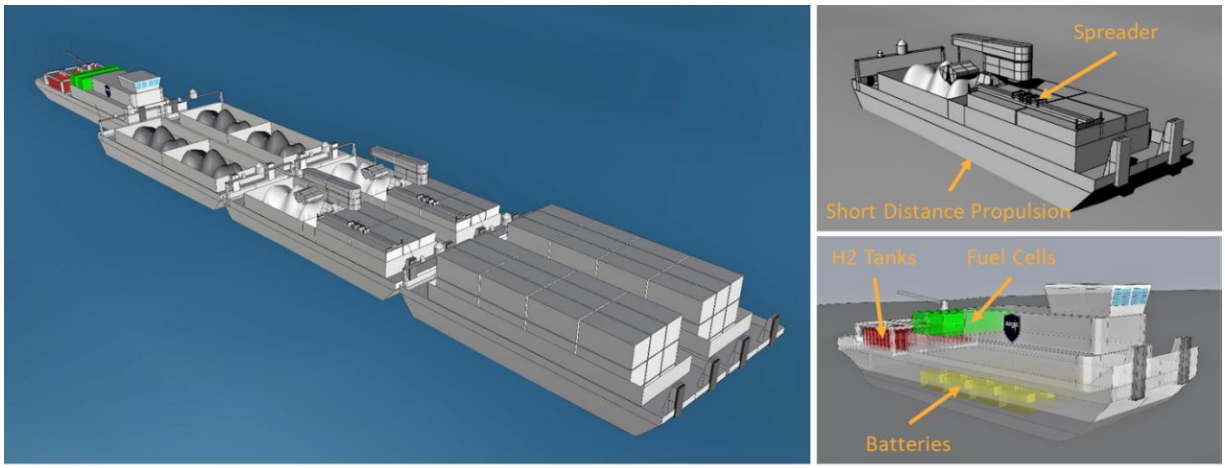

Fig. 2: Draft concept of a pushed convoy with an electrically driven push boat (fuel cells + batteries) and barges with a capacity of 36 TEU or 875 m^3 for bulk

In UC-B road congestions due to truck transportation should be diminished by shifting more volume to IWW transportation. Especially the hinterland of Belgium and the Netherlands offers great potential due to its good network of canals and IWW in general. Roll-on Roll-off (RoRo) vessels are needed for the transportation of trucks or trailers. According to the available CEMT classes, the ports and industry sites called on, and the cargo volume, two different vessel sizes are developed. A small CEMT II RoRo vessel offers space for 12 trailers or 10 trucks in a two-row double decker design. An optional autonomous vehicle (tugmaster/RoRo-tractor) might be on board to enable the transhipment of trailers at sites with no such infrastructure.

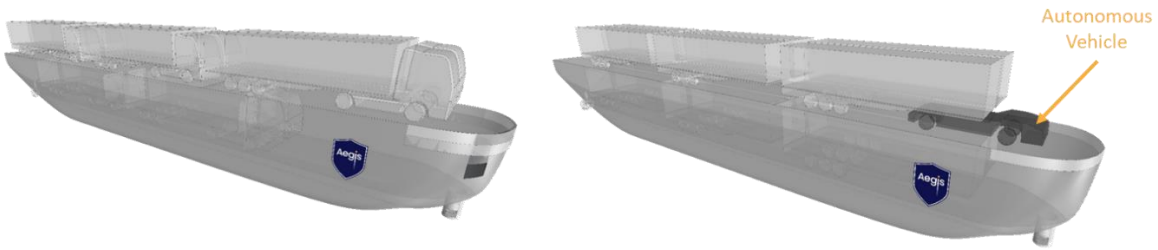

Fig. 3: Draft concepts of small CEMT II RoRo vessels with a capacity of 10 trucks or 12 trailers

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On routes with CEMT class IV to VI bigger RoRo vessels can be used, offering a higher capacity of 38 trucks or trailers. The breadth of such a vessel will be 9.5 m in case of longitudinal loading with some limitations in flexible loading and discharging of the trucks/trailers. If using transversal stowing of trucks or trailers on board, the breadth would increase to 18.1 or 15.0 m, respectively. This would allow for an independent loading and discharging of each cargo unit. For all cases, feasible lifts and ramps need to be developed together with the partner MacGregor.

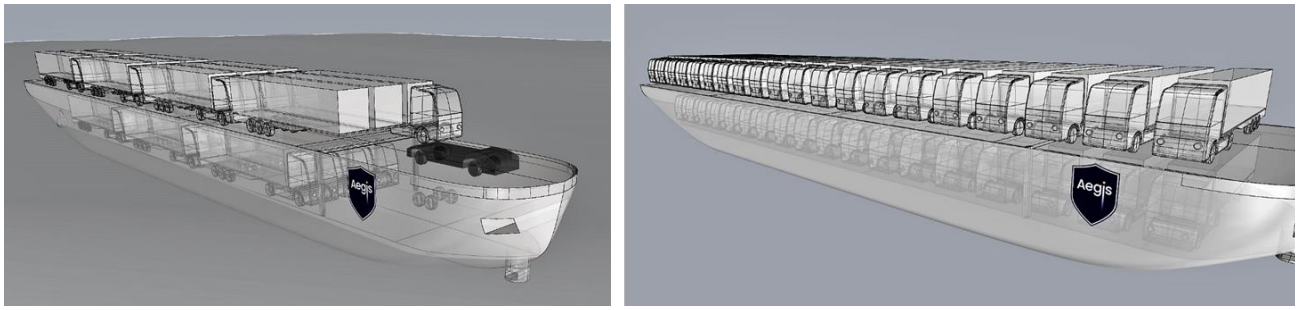

Fig. 4: Draft concepts of bigger CEMT IV and VI RoRo vessels with a capacity of 38 trucks or trailers

In UC-C the two Danish ports Aalborg Havn and Vordingborg Havn are under close investigation. Due to their mixed cargo upcomes and an increased interest in RoRo, again to avoid traffic jams e.g. in the region of Copenhagen, very different vessels are needed to improve the waterborne transportation. Synergies from the other use-cases can be used as well as very flexible vessel concepts. One approach is the development of combined SSS/IWW vessels to access the European hinterland without an additional transhipment in the bigger coastal ports. This can save time and costs and making the waterborne transportation more attractive. Besides the flexibility of a combined SSS/IWW vessel, mixed cargo such as containers and bulk are one key to success. For RoRo, adopted designs are needed – a mixed container/bulk/trailer vessel is no option. As mentioned, synergies from the other use-cases can be used: For SSS from UC-A, and for IWW from UC-B. Inland vessels would, of course, need some adoptions in hull shape and propulsion. But these kinds of vessels are already sailing between Europe and Great Britain. They are just not “green” and autonomous, which is needed to reach the overall AEGIS goals.

Let’s go for it and make the AEGIS vision happen!

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Key Performance Indicators (KPIs).

A comprehensive set of Key Performance Indicators (KPIs) have been developed in order to assess in a holistic fashion any solutions contemplated in AEGIS, so as to capture the effects of all conceivable cross-linkages and interdependencies and hopefully obtain what we call "win-win" solutions. KPIs represent the criteria under which the set of solutions developed under AEGIS will be evaluated. They include criteria grouped under the following classes:

- Economic KPIs, including cost, profit, logistical efficiency and others.
- Environmental KPIs, including GHG and other emissions.
- Social KPIs, including safety, security, externalities and others.

The KPIs are measurable, concise and compact, relevant, unambiguous and easily understood. The following table summarizes the final comprehensive set of KPIs for AEGIS, which is the result of multiple iterations and discussions with project partners, advisory group members and other stakeholders. Shown are the KPIs that have been deemed as "must have" in those discussions. This does not mean that other KPIs are excluded from further use, however this will depend on the analyses that will take place in future tasks.

Economic		Environmental	Social
CAPEX [€]	Recovery time [h]	CO_2 [Kg of CO_2/tkm]	Accident rate [#]
OPEX [€]	Cargo handling time [TEUs/h]	NO_x [Kg of NO_x/tkm]	Fatality rate [#]
Maintenance costs [€]	Energy consumption [kWh]	SO_x [Kg of SO_x/tkm]	Fire incidents [#]
Port charges [€]	Cargo carried [TEUs/ship]	Particulate matter [Kg of PM_{10}/tkm]	Labor conditions [Work-life balance]
Fuel cost [€/NM]	Percentage of load [Cargo carried/max capacity]	Noise [dB]	Employment [% of change]
Wages [€]	Cargo lost [% of total cargo]	Use of renewable energy sources [%]	Income [% of change]
Cargo unit cost [OPEX/TEUs]	Number of Cyber-attacks [#]		Training [Time/worker]
Loading time [h]	Restored level of performance [%]		
Unloading time [h]	Autonomy level [level]		
Sailing time [h]	Frequency of service [Shipments/week]		
Waiting time [h]	Energy efficiency [%]		
Drive time [h]	Number of container moves [#moves/route]		
Punctuality rate [% of port calls]			

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Consortium.

SINTEF

DFDS

NCL

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MACGREGOR

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VORDINGBORG HAVN

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AALBORG UNIVERSITET

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If you want to learn more about AEGIS, please visit our webpage or LinkedIn page:

aegis.autonomous-ship.org

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