

Newsletter Shallow Water

Knowledge Centre Manoeuvring in
Shallow and Confined Water

Flanders
Hydraulics



Flanders
State of the Art

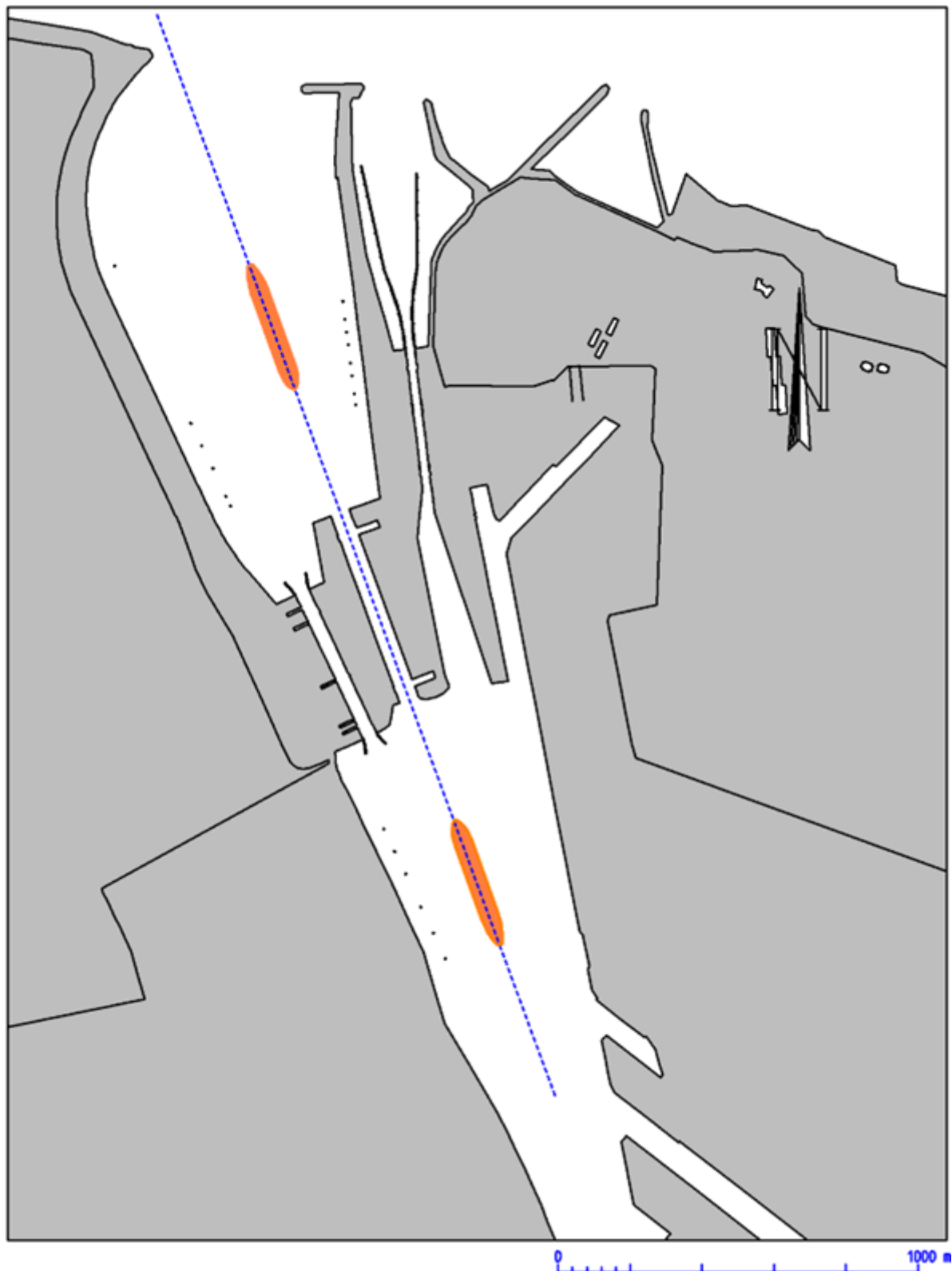


November 2024

This is the 59th newsletter of the Knowledge Centre Manoeuvring in Shallow and Confined Water, which is a collaboration between Flanders Hydraulics and the Ships and Marine Technology Division at Ghent University. In this newsletter, we have an item on the New Lock Terneuzen, on experiments studying the forces on seaweed nets and on simulations that were carried out for the Opening Ceremony of the Paris Olympic Games.

New Lock Terneuzen

On October 11th 2024 the New Lock Terneuzen was officially inaugurated by His Majesty King Willem-Alexander of the Netherlands and His Majesty King Philippe of Belgium. The New Lock Terneuzen is a Neopanamax lock combines a length of 427 m with a width of 55 m and a depth of 16.0 m referred to the lowest water level at the canal side. The New Lock Terneuzen allows tide independent levelling of ships with a draft of up to 12.5 m, which is the actual maximum draft on the Canal Ghent-Terneuzen, and a tide dependent draft of 15.0 m. The opening of the New Lock Terneuzen is a milestone for the nautical accessibility of the maritime ports of Terneuzen and Ghent, both part of North Sea Port. Furthermore the increased lock capacity in Terneuzen will reduce the downtime for inland navigation on the Rotterdam-Paris inland waterway route. Jeroen Verwilligen and other researchers associated with the Knowledge Centre have been involved in the design of the New Lock Terneuzen and research into the future accessibility of the Canal Ghent-Terneuzen. In 2009, it was decided to develop the New Lock Terneuzen within the existing boundaries of the lock complex, replacing the existing middle lock which dated back to 1910. Shortly after this decision was made, Flanders Hydraulics (FH) performed full mission bridge simulation studies to define the nautical design of the lock. Different alternatives for the orientation and position of the lock were evaluated, resulting in an optimized nautical design. This preliminary design (see Figure 1) corresponds exactly to the final layout of the lock. Also in the detailed design of the lock, Flanders Hydraulics assisted in the design of the lock fendering and the emergency berths.



The lock levelling of the New Lock Terneuzen is performed by means of two bottom grids. Scale model experiments performed by Deltares revealed that large ships may experience important forces due to density effects when levelling the lock with fresh water from the canal side. The Ships and Marine Technology Division at Ghent University performed Dynamic Mooring Analyses for different ships at different levelling conditions in order to assess the impact of these forces on the ship motions and line forces and to evaluate mitigation measures. In the near future the effect of lock levelling on ships in the New Lock Terneuzen will be evaluated using on-site measurements. The New Lock Terneuzen also opens the possibility for larger vessels to arrive to the Canal Ghent-Terneuzen. In fact, the first ship that passed the New Lock Terneuzen during the inauguration on October 11th had a beam of 38 m and is the widest

ship that ever reached the Canal Ghent-Terneuzen. Nevertheless this ship had a draft of 11.0 m which is significantly less than the maximum draft of 12.5 m that is presently allowed on the Canal for ships with a beam of up to 37.0 m. Flanders Hydraulics and the Ships and Marine Technology Division at Ghent University have thoroughly assessed the accessibility of the Canal Ghent-Terneuzen for ships wider than 37.0m. In 2017 full-scale measurements were performed on a 37.0 m wide bulk carrier in order to validate the bank effect model that is available in the simulators of FH. In 2021 the accessibility of cape size bulk carriers was evaluated based on both theoretical analysis of bank effects and full mission bridge simulations. This research revealed that cape size bulk carriers on the Canal Ghent-Terneuzen will come with important boundary conditions regarding the ship speeds, piloting and positioning of the ship and will have an important impact on the overall capacity of the canal. In 2024 Flanders Hydraulics performed another simulation study to investigate the accessibility of bulk carriers and tankers with a beam up to 38.5 m. Based on this study the boundary conditions for test voyages with these ships with a draft up to 12.5 m were defined. The test voyages are expected to be initiated as soon as the New Lock Terneuzen is fully operational.





Horizon Europe ULTFARMS Project

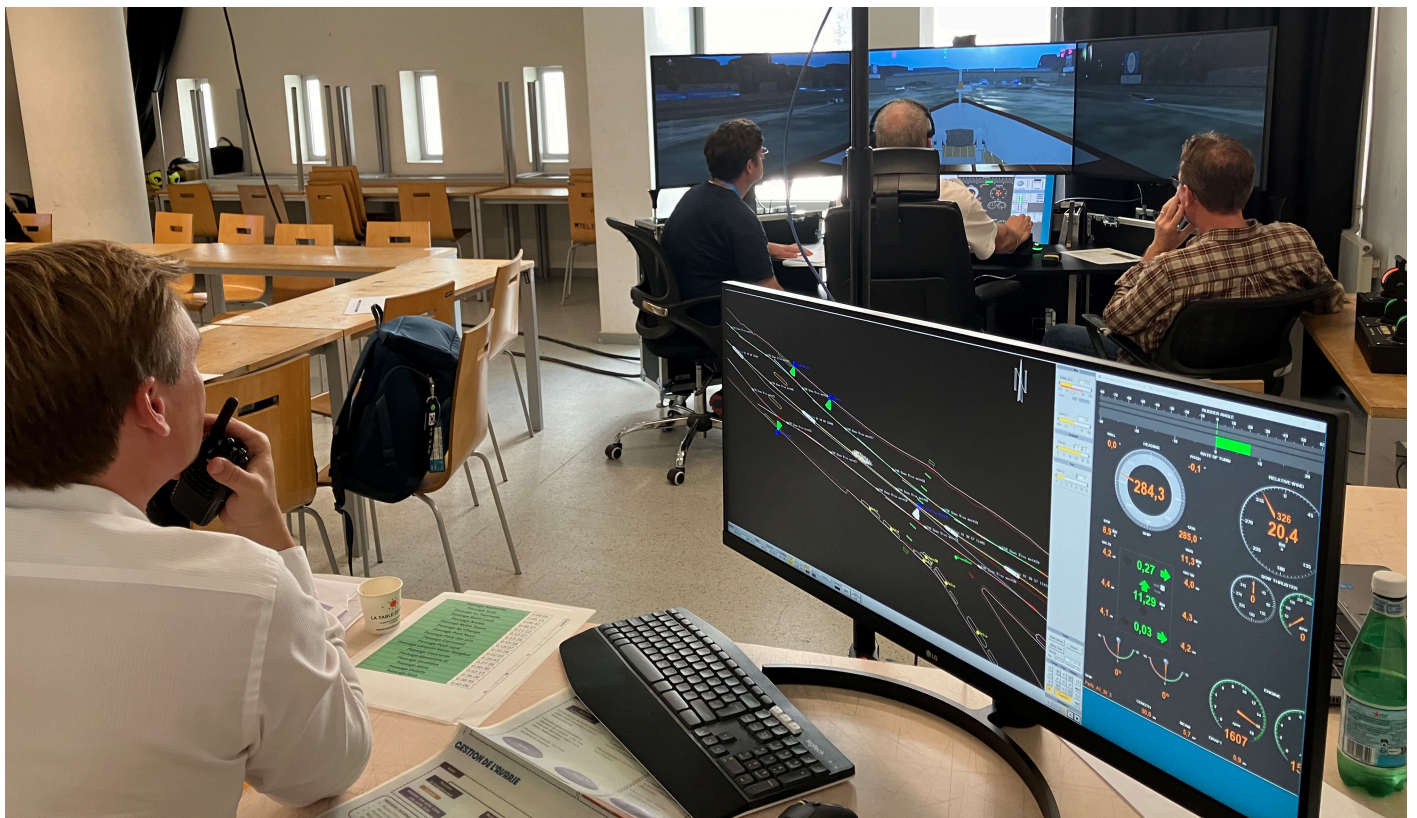
As part of the [Horizon Europe ULTFARMS project](#), experiments were conducted at [Deltares Atlantic Basin](#) to investigate the dynamics of a seaweed net for use in aquaculture subjected to various current and wave conditions. Two identical full-scale nets were examined: 1) a net without seaweed; 2) a net with seaweed surrogates. Four



load cells were installed to measure the forces experienced by the seaweed net. Additionally, wave gauges and electromagnetic current velocity meters were mounted at multiple locations in the basin. The findings from this campaign will contribute to more precise predictions of the hydrodynamic forces acting on mooring and anchoring systems in seaweed aquaculture under wave and current conditions, which Ajie Brama Krishna Pribadi is looking into. This series of physical tests is a collaboration between [Deltares](#) and [UGent](#) ([Ships and Marine Technology Division](#) and [Phycology Research Group](#)) within the [ULTFARMS project](#).



Simulations for the Olympic Games



Simulator training.

In the run-up to the Paris Olympic Games, researchers associated with the Knowledge Centre and the simulator team of Flanders Hydraulics were involved with important training simulations for the Opening Ceremony. On Friday 26 July, as many as 150 boats participated in a spectacular parade on the river Seine in the heart of Paris between the Pont d'Austerlitz and the Pont d'Iéna. Flanders Hydraulics was directly involved in its preparations over six months preceding the event, after an accident beginning of 2024 with a passenger vessel hitting the Pont Sully and the decision by the French Government to train the captains of the parade. Two mobile simulators were installed in Paris in July to introduce all the skippers involved to the 45-minute route the fleet had to follow precisely during the opening ceremony. 'The 'flotte principale' consisted of 85



Simulator team.

vessels that transported the athletes. In addition, there were ships belonging to the organisation, the television crews, emergency services, guidance ships and about 10 spare ships. Every skipper taking part in the parade was trained to sail the entire route on the simulator beforehand. Flanders Hydraulics took the lead with Katrien Eloot and Mats Lemmens involved in designing the simulation environment and the ships. Kristien Seynaeve was in charge of building the mobile simulators. The implementation of all the data was done in collaboration with Marc Mansuy of Ghent University. IMDC did a small assignment to calculate the hydrodynamic model of the Seine for a discharge of $300 \text{ m}^3/\text{s}$. Due to the heavy rainfalls in Europe (and particularly France) in 2024 the discharge during the summer was higher than expected with more effect on the manoeuvrability of the boats. The simulations gained international attention, ranging from articles in several newspapers, such as [Le Monde](#) and [Het Laatste Nieuws](#) (Dutch), an interview with Katrien Eloot on the [VRT](#) and articles in the professional press, such as [Flows](#). [Sharing knowledge](#) is important to tackle not only economic challenges on waterborne transport but also on pleasure crafts and ceremonial events such as the first opening ceremony of the Olympic Games outside a stadium.



Training real life 20/07/2024

Conferences

We are proud to announce that the 31st ITTC conference will be hosted by Flanders Maritime Laboratory in 2027 in Belgium. Thibaut Van Zwijnsvoorde attended the [30th International Towing Tank Conference](#), which was held from 22 to 27 September 2024 in Hobart, Australia. During the closing ceremony, Thibaut was elected to the Executive Committee. In addition, Jose Villagomez was elected to join the Manoeuvring Committee and Maxim Candries was elected to join the Resistance Committee. Katrien Eloot attended the 2024 International Maritime and Port Technology and Development Conference and the 6th International Conference on Maritime Autonomous Surface Ships (MTEC-ICMASS), which was held on 29 and 30 October in Trondheim, Norway. She presented '[Manoeuvring in shallow and confined water with model predictive track controllers](#)'.

Researchers associated with the Knowledge centre recently published:

Delefortrie, Guillaume Verwilligen, J.; Lataire, E. (2024). The Effect of Asymmetry on the Ship's Squat when Sailing along an Approach Channel, in: Schoonhees, J. S. (Ed.) (2024). Proceedings of the 35th PIANC World Congress 2024. PIANC: Capetown, South Africa. pp.710–717

Delefortrie, G.; Verwilligen, J.; Vantorre, M.; Lataire, E. (2024). Exact and Approximated Solutions to the Critical Ship Speeds in Canals, in: Schoonhees, J. S. (Ed.) (2024). Proceedings of the 35th PIANC World Congress 2024. PIANC: Capetown, South Africa. pp.649–654

Eloot, K.; Mansuy, M. (2024). Manoeuvring in shallow and confined water with model predictive track controllers. J. Phys. Conf. Ser. 2867(1): 012021. doi:10.1088/1742-6596/2867/1/012021

He, H.; Mansuy, M.; Verwilligen, J.; Delefortrie, G.; Lataire, E. (2024). Global path planning for inland vessels based on fast marching algorithm. Ocean Eng. 312: 119172.

doi:10.1016/J.OCEANENG.2024.119172

He, H.; Van Zwijnsvoorde, T.; Delefortrie, G.; Lataire, E. (2024). Implementation of Guidance and Control Algorithms for Ship Models at Flanders Maritime Laboratory. J. Sh. Res. 68(03): 134–150.

doi:10.5957/JOSR.11230034

Mansuy, M.; Candries, M.; Eloot, K.; Page, S.; Swartenbroekx, C.; Bousmar, D. (2024). Improving The Accessibility Of The Walloon Waterway Network For Larger Ships Using Six-Degrees-Of-Freedom Ship Manoeuvring Simulators, in: Schoonhees, J. S. (Ed.) (2024). Proceedings of the 35th PIANC World Congress. PIANC: Capetown, South Africa. pp.1424–1431

Sotelo, M.S.; Boucetta, D.; Van Hoydonck, W.; Delefortrie, G. (2024). Numerical study of the hydrodynamic forces acting on a surface-piercing hydrofoil in natural mud, in: (2024). 35th Symposium on Naval Hydrodynamics: Nantes, France

Verwilligen, Jeroen Eloot, K.; Meire, D.; Delefortrie, G. (2024). Historical Evaluation of the Navigability of the Western Scheldt for Ultra Large Container Ships, in: Schoonhees, J. S. (Ed.) (2024). Proceedings of the 35th PIANC World Congress 2024. PIANC: Capetown, South Africa. pp.770–776

Yang, Y., Eloot, K., Delefortrie, G., El Mactar, O. (2025) Experimental and Numerical Investigations of Ship-Ship Interaction during Overtaking for Benchmarking, Applied Ocean Research, Vol. 154, January 2025, 104325, <https://doi.org/10.1016/j.apor.2024.104325>.

PhD Bart Brouwers

Bart Brouwers defended his PhD Thesis, entitled ‘Monitoring Fluid Dynamics of Mud’, on Monday 4 November. His research concentrated on seeking alternative visualization techniques that can be used for experiments in mud layers. The research was supervised by Prof. Van Beeck (von Karman Institute for Fluid Dynamics) and by Prof. Lataire (Ships and Marine Technology Division at Ghent University) and the experiments were carried out at Flanders Hydraulics.



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