FEASIBILITY STUDY FOR MANEUVERS AT DALHOUSIE'S WEST TERMINAL BY PANAMAX AND LAKERS

Maritime Simulation and Resource Centre

A division of

Corporation of the Lower-Saint-Lawrence Pilots
Quebec, Quebec, Canada
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April 2025

Modeled berth of the Dalhousie West Terminal

« Une division de »
« A division of »

EXECUTIVE SUMMARY

EcoRock Dalhousie is currently performing feasibility and environmental impact studies on a new project that will exploit and export pozzolan. The intention is to export the material by ships from the Dalhousie West Terminal.

The ships that will transport the Pozzolan will be larger than those currently operating at this terminal. Therefore, there is a need to perform a feasibility study concerning the passage through the approach channel and berthing and unberthing maneuvers at the West Terminal dock.

The goals of these simulations were to:

- Validate that these vessels can transit the approach channel safely;
- Estimate the space required off the dock for starboard-side docking maneuvers;
- Establish environmental limits for docking and undocking;
- Assess the effectiveness of existing navigational aids and propose modifications if required;
- Determine or confirm the requirements for tug assistance;
- Record the Swept paths left by the ships during all simulations and deliver them with the final report so that engineers can determine the area that will need to be dredged.

In order to validate the various elements of the project, EcoRock Dalhousie called on the Maritime Simulation and Resource Centre (MSRC) to undertake a series of simulated maneuvers in the approach channel and at the West Terminal dock.

For the purpose of this study, two ships were chosen for their characteristics similar to the real vessels. The characteristics of each model are briefly given in the chapter Ships Modelled and in Appendix 2, where detailed information is given. One Z-Drive tug model was also selected, and the bollard pull adjusted to 50 tons maximum to represent reality.

The wind and the current for each simulation were chosen by the pilot. 13 simulations were carried out on the MSRC's simulator. These simulations took place on April 22 and 23, 2025 and they consisted of berthing, unberthing maneuvers under various environmental conditions, ships in ballast and loaded.

Details and explanations will be included in the final report.

The first recommendation issued by the pilot was not to attempt berting if the wind is above 20 knots.

Also, for berthing, the pilot recommends bringing the vessel off the dock in such a manner that, when it completes its 180° turn to dock starboard side to, it is parallel to the dock without having to move forward or backward to get into position.

The pilot also recommends that the approach for berthing should be started at slack water so that the flood current begins once passed the red buoys.

For unberthing, the pilot recommends not departing under a beam wind above 20 knots. However, the vessel may undock under a maximum parallel wind of 25 knots.

Tug requirements were determined.

There were no recommendations made for additional navigational aids.

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1. OVERVIEW

The purpose of this study is to determine if Laker and Panamax type vessels can safely transit the approach channel to the western terminal and what maneuvering space they will need for berthing and unberthing maneuvers at this terminal. The operational limits will also be assessed or confirmed.

Figure 1 : *Approach channel to the West terminal.*

The maneuvering space is where the ships perform their 180° turn to dock starboard side to. The dock orientation is about 102°/281° for a docking length of about 210 meters (*not including the dolphins*).

The West terminal is well protected from the elements except that the approach channel is opened to the ESE. The fetch from that direction is about 100 km long, so waves can be a problem during the approach with East to Southeast winds. Once moored, the vessel is protected.

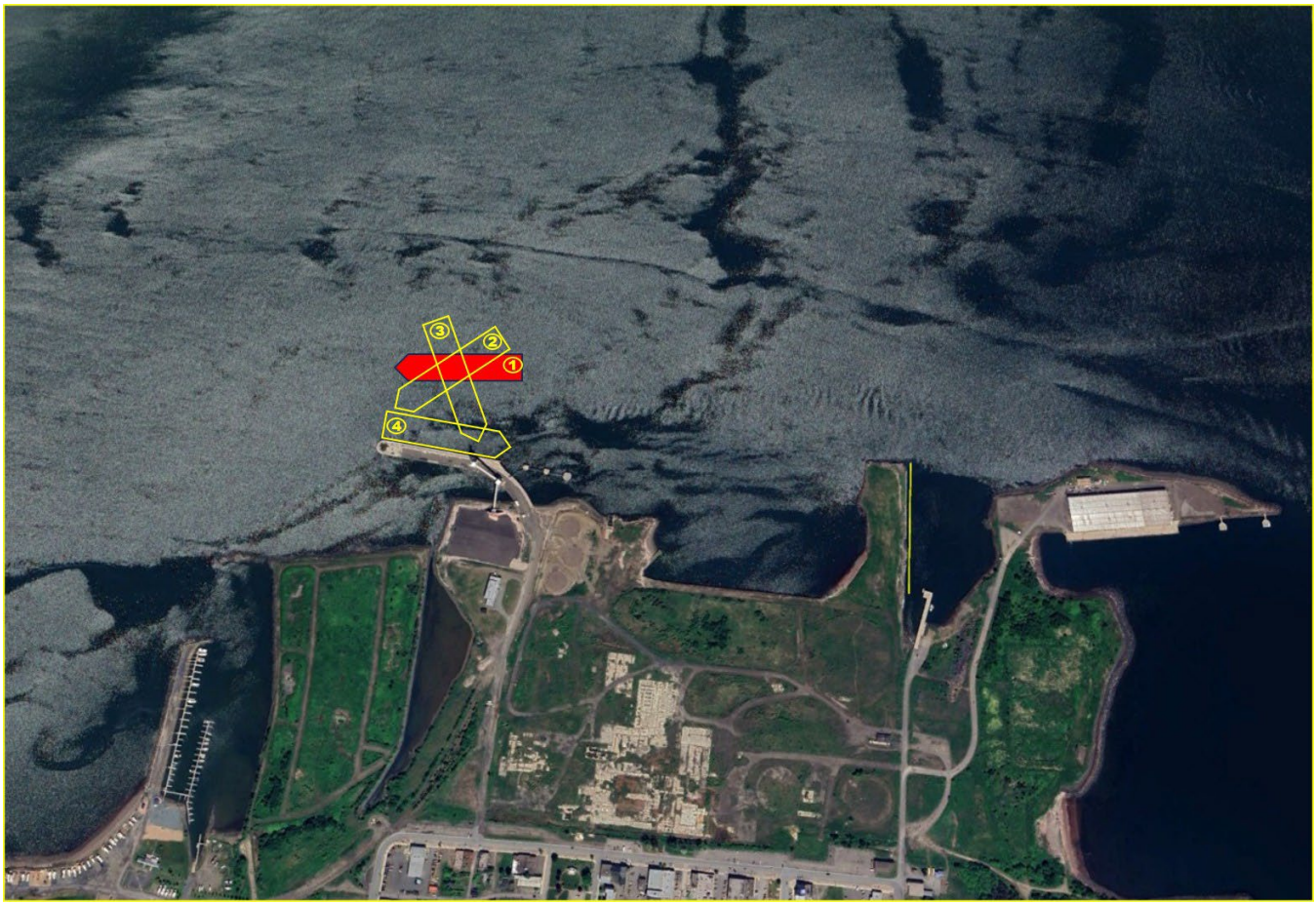


Figure 2 : *Approximate turning maneuver of a Panamax berthing at the West terminal.*

2. THE MARITIME SIMULATION AND RESOURCE CENTRE (MSRC)

SUMMARY OF MSRC ACTIVITIES

The full mission navigation simulator is owned by the Corporation of Lower St. Lawrence Pilots (CLSLP) and is operated by the MSRC (a division of the Corporation).

The MSRC's mission is to ensure training and development for pilots belonging to the CLSLP and to share its expertise in simulation with other pilots and maritime professionals.

MRSC has a unique specialization in North America with regards to navigation safety.

THE FULL MISSION SIMULATOR

The study was done on the MSRC full mission simulator. This Class A simulator is approved by the classification society Dest Norske Veritas (DNV). It consists of an integrated wheelhouse, equipped with state-of-the-art navigation instruments and an uninterrupted 360° field of vision.

Three other ship wheelhouses can be added to the same exercise, allowing for realistic interaction between four ships. These additional vessels are typically manned by tug masters and may also be operated by merchant or military captains. Technically, it is also possible to simultaneously perform four (4) different exercises, one for each wheelhouse and this, in four (4) different geographical databases.

Figure 3 : *View of bridge A – Vessel about to dock starboard side to.*

A meeting room is adjacent to the navigation bridges E, F, G and to the operator's station, allowing observers to view the progress of maneuvers in real time. A second meeting room is attached to the main bridge, but can be used for any bridge if required.

Because of the limited number of participants, it was not necessary to use these facilities.

Figure 4 : *Operator station, next to Bridge A.*

3. MODELED AREA/PREPARATORY WORK

The MSRC development tool was used to adapt the existing Dalhousie database for pilotage purposes and particularly, for berthing and unberthing maneuvers.

A pilot from the Atlantic Pilotage Authority (APA) and a retired pilot from the St. Lawrence River Pilot suggested a list of possible scenarios that could be used to fulfill the objectives of the Mandat.

The programming and validation of all the exercises were carried out by the MSRC.

The selected vessels have been previously tested by the MSRC team.

The validation, integration and verification of all these elements were carried by the MSRC team.

There is no data base current for this area, so the current vectors were introduced on the go in order to represent the reality.

To properly assess the dredging area required, the water level was set at 15 meters so that the ships would not run aground even if they exceed the 10 meters sounding lines. The swept paths will then show the exact area covered by the maneuvering vessels.

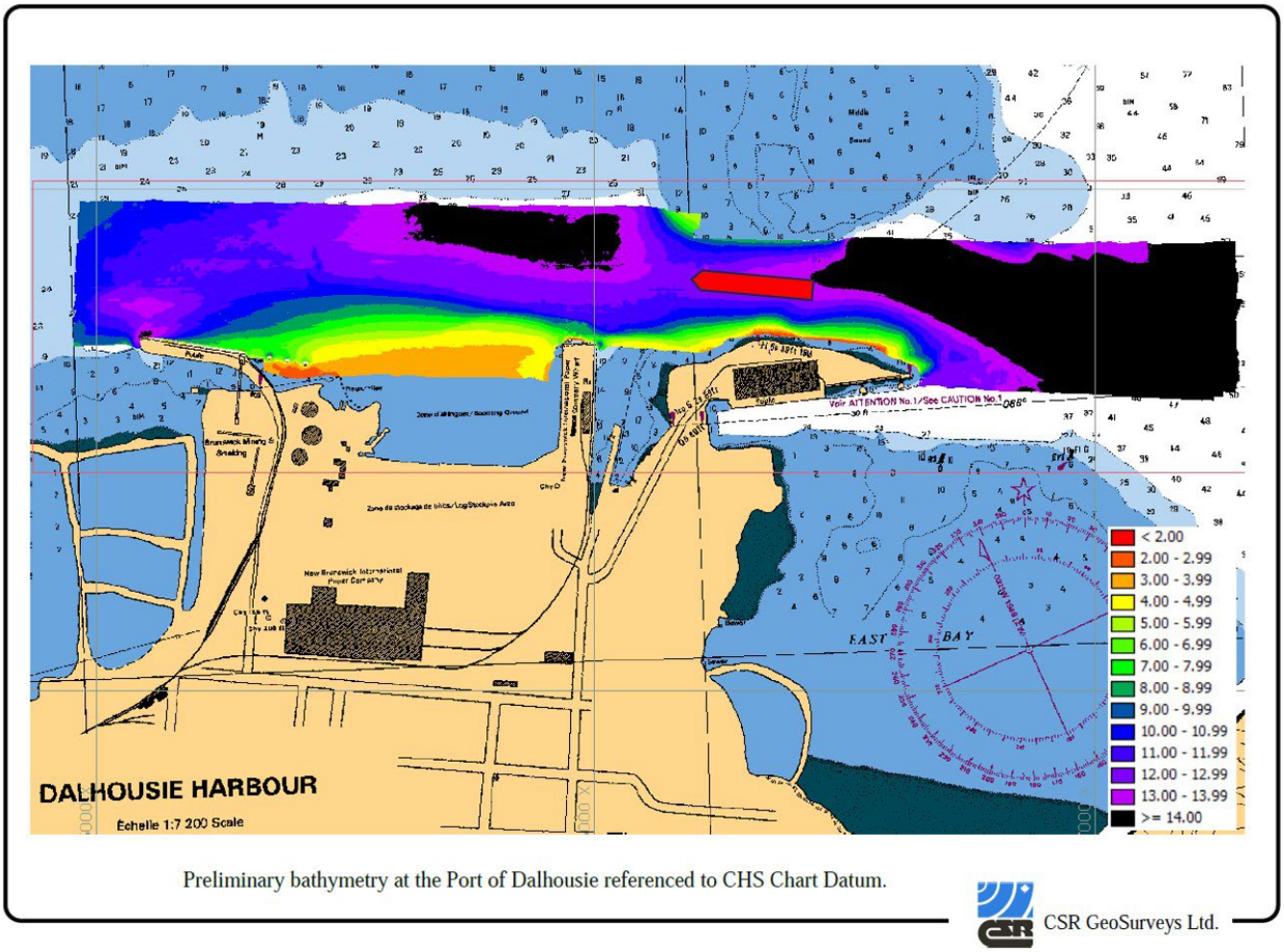


Figure 5 : *Outlines of a Panamax in the narrowest part of the approach channel.*

At the request of the pilot, important existing visual marks were added on the heights south of the West Terminal by the MSRC'S GIS specialist. These navigation marks consist of two tanks which, when aligned, point closely to the western end of the dock.

Figure 6 : *Tanks aligned.*

During the turn, when the 2 tanks on the heights align, they indicate that the ship's stern is about in line with the west end of the dock which helps the pilot during the long 180° turn. If the closest tank opens to the left, it means that the ship stern is too far to the West.

The Kongsberg simulator uses the Phillips spectrum for waves generation, but a waves file can be produced in certain situations (*local particularities*). It should be noted that in this case, the waves off the berth do not affect significantly the conduct of the vessels. Waves will be as generated by K-SIM algorithms. Off the berthing area, winds and current are the main factors influencing the evolution of ships during berthing and unberthing maneuvers.

4. MODELED SHIPS

For this study, the 2 vessels selected have the characteristics of the vessels expected at the terminal. They are briefly described in Table 1. More data can be found in Appendix 2. The tug boat maximum bollard pull was reduced to 50 tons for this study.

Table 1 : *Vessels main characteristics.*

SHIPS	LENGTH	WIDTH	DRAUGHT	DEADWEIGHT	PROPELLER	RUDDER	BOW THRUSTER
	m	m	m	Tons			
BKCS15 *Quebec Hercules*	229	32.3	12.7/12.7(L) 8.5/10.5(B)	81760	1 right-handed	Conventional	No
BKCS05 *Quebec Electra*	222.5	23.08	8.08/8.08(L) 4.5/6.9(B)	36560	1 left-handed variable pitch	Conventional	1 (1000 hp)
TUG 30 *Seaspan Eagle*	28.2	11.7	5.3/5.3	600	2 Z-Drive, azimuthal propellers	Bollard pull: 87.2 T (Limited to 50 T)	No

Figure 7 : *Quebec Hercules*

Figure 8 : *Quebec Electra*

Figure 9: *Tug 30*

5. TEAM MEMBERS

Table 2 : *From left to right, the team members who carried out this study.*

NAME	FUNCTION	REPRESENTING
Paul Racicot	Director	MSRC
Guy Rousseau	President	EcoRock Dalhousie
Byron McLean	Pilot	Atlantic Pilotage Authority
Jonathan Verbuyst	Marine superintendent	Atlantic Pilotage Authority
Marie-Eve Lessard	Simulator operator	MSRC
Captain Simon Rivard	Simulator operator	MSRC
Alain Victor	Redactor	MSRC
Daniel Hriscan (*Not in picture*)	Simulator operator	MSRC

Figure 10 : *Group Picture*

6. INITIAL ASSUMPTIONS

During the meetings and discussions prior to the study, it was agreed that the pilot would perform berthing and unberthing maneuvers with the two selected vessels. These maneuvers will be performed in various wind conditions.

The current will be as decided by the pilot. The number of tugs will be determined according to the needs of each simulation. The pilot will indicate the number and working position for each.

The goals of these simulations are as laid out in the overview chapter.

Pilot's comments will be recorded and they will be in the final report in the section of observations and recommendations.

Other participants comments, pertinent to the situation, will also be recorded.

Recommendations, based on pilot's observations and other participants comments will be written.

All pertinent information regarding the various maneuvers will be forwarded to the Echorock Dalhousie representatives with the final report.

7. SUMMARY OF REAL TIME MANEUVERS

7.1 NUMBER AND TYPE OF MANEUVERS

For the purposes of this study, 13 maneuvers were performed and are summarily described in the following table (*for details, see chapter 7.3, Description of Real Time Maneuvers*)

RUNS	BASIC DATA	SHIP	NOTES
RUN-01	Berthing starboard side to the West terminal. Starting about 1 mile from the East terminal, heading 315°, speed 3 knots, light wind, slack water, no other traffic, no tug, 1 bow thruster, port anchor used.	**BKCS05B**	**PASS**
RUN-02	Berthing starboard side to the West terminal. Starting East of the buoyed channel, heading 371°, speed 3 knots, Northwest wind at 20 knots, slack water and beginning of flood passed the red buoys, no other traffic, 1 tug, 1 bow thruster.	**BKCS05B**	**PASS**
RUN-03	Berthing starboard side to the West terminal. Starting East-southeast from the eastern terminal, heading 302°, speed 3 knots, West wind at 10 knots, slack water and beginning of flood passed the red buoys, no other traffic, 2 tugs, 1 on the port shoulder and 1 on the port quarter, no bow thruster.	**BKCS05B**	**PASS**
RUN-04	Berthing starboard side to the West terminal. Starting East-southeast from the eastern terminal, heading 302°, speed 3 knots, Northwest wind at 15 knots, slack water and beginning of flood passed the red buoys, no other traffic, 1 tug on the port quarter and 1 bow thruster.	**BKCS015B**	**PASS**
RUN-05	Unberthing from the West terminal. Northwest wind 15 knots, slack water, no other traffic, 1 tug on the port quarter and 1 bow thruster.	**BKCS015B**	**PASS**
RUN-06	Berthing starboard side to the West terminal. Starting East-southeast from the eastern terminal, heading 302°, speed 3 knots, Southeast wind at 15 knots, slack water and beginning of flood once passed the red buoys, no other traffic, 1 tug on the port quarter and 1 bow thruster.	**BKCS015L**	**PASS**

RUN-07	Berthing starboard side to the West terminal. Starting East-southeast from the eastern terminal, heading 302°, speed 3 knots, Southeast wind at 15 knots, slack water and beginning of flood once passed the red buoys, no other traffic, 1 tug on the port shoulder and 1 tug on the port quarter. Turning to starboard instead of port for docking starboard side.	**BKCS015B**	**PASS**
RUN-08	Unberthing from the West terminal. Northeast wind 20 knots, slack water, no other traffic, 1 tug on the port shoulder and 1 tug on the port quarter.	**BKCS015B**	**PASS**
RUN-09	Unberthing from the West terminal. Northeast wind 25 knots, slack water, no other traffic, 1 tug on the port shoulder and 1 tug on the port quarter.	**BKCS15L**	**PASS (close to the limit)**
RUN-10	Unberthing from the West terminal. North wind 25 knots, slack water, no other traffic, 1 tug on the port shoulder and 1 tug on the port quarter.	**BKCS15L**	**LIMIT**
RUN-11	Berthing starboard side to the West terminal. North-northwest 30 knots. Starting East-southeast from the eastern terminal, heading 311°, speed 3 knots, slack water and beginning of flood once passed the red buoys, no other traffic, 1 tug on the port shoulder and 1 tug on the port quarter.	**BKCS15L**	**LIMIT**
RUN-12	Berthing starboard side to the West terminal. Starting East-southeast from the eastern terminal, heading 311°, speed 3 knots, North-northwest wind at 20 knots, slack water and beginning of flood once passed the red buoys, no other traffic, 1 tug on the port quarter and 1 bow thruster.	**BKCS15B**	**FAIL**
RUN-13	Berthing starboard side to the West terminal. Starting about 1 mile from the East terminal, heading 315°, speed 3 knots, light wind, slack water, no other traffic, no tug, 1 bow thruster, port anchor used.	**BKCS15B**	**PASS (but close to the limit)**

After each maneuver, the pilots' observations were recorded. Recommendations were made as well as relevant comments.

The simulation data sheets indicate the technical parameters of the exercises. However, comments made at the end of the simulations are recorded in the chapter: **7.3 Description of Real Time Maneuvers**.

All the records of the parameters relevant to this study are delivered separately.

7.2 EVALUATION CRITERIA - MANEUVERING RESULTS

At the end of each maneuver, an evaluation of the maneuver is made by the pilots and participants. This assessment is based on the general criteria indicated below.

Note: *This is a standard list used for most simulations. The list being general, it must be understood that the pilot can take into consideration other items specific to the current situation.*

PASS

- The pilot remains in full control of the ship throughout the entire maneuver.
- The ship remains in the channel and/or the turning basin.
- The ship stays clear of obstructions and quay structures.
- When lateral thrusters are used, a good power reserve is always available.
- Docking maneuvers are achieved as planned while maintaining a safe speed without difficulties.
- For undocking maneuvers, the ship leaves the quay smoothly without any risk of inflicting damage to the port installations.
- The combination of anchor/engine/rudder makes the ship crab towards the berth easily.

LIMIT

- The pilot considers that the ship is just barely under control during the maneuver.
- The ship leaves the channel or turning basin, while keeping adequate under-keel clearance.
- The ship gets too close to obstructions and quay structures.
- When lateral thrusters are used, they are close to their maximum capacities.
- For docking maneuvers, the speed of approach is higher than normal. The maneuver can be completed, but with risk of minor damage to the facilities.
- For undocking maneuvers, the ship has some difficulty leaving the quay. The maneuver is completed with some risks of causing damage to the port facilities.
- The combination of anchor/engine/rudder is barely enough to make the ship crab towards the berth.

FAIL

- The pilot loses control of the ship.
- The ship leaves the channel or turning basin with unacceptable under-keel clearance and/or the ship runs aground.
- The ship collides with obstacles or harbour facilities.
- When lateral thrusters are used, they are running at their maximum capacities without succeeding in offsetting the external factors.
- During docking maneuvers, it is not possible to dock the ship, or the ship bumps into the harbour facilities with enough force to cause major damage.
- While getting under way, the ship cannot leave the quay at all or encounters significant handling difficulties that might cause major damage to both the ship and the harbour facilities.
- The combination of anchor/engine/rudder is not enough to make the ship crab towards the berth.

7.3 DESCRIPTION OF REAL TIME MANEUVERS

RUN-01

Note: *The 10-meter depth line does not appear on the instructor's screen because a 15-meter artificial bottom has been set to prevent ships from running aground and this is the case for all simulations.*

Familiarisation run. Unberthing from the West terminal with the BKCS05B (Ballast) docked starboard side to. Light wind*, good visibility, slack water and no other traffic impairing the ship's movements.

No tugs, one bow thruster.

The pilot opened the stern on a forward back spring by giving a kick ahead and hard to starboard wheel. Once the forward spring was on board, the pilot reversed the engine and the vessel started to move back enough to be clear of obstructions forward before moving ahead. The left-handed variable pitch propeller helped in moving the stern away from the dock.

The passage south of the red buoys went as expected.

The maneuver went smoothly, good ship model reaction, nothing particular to report.

Simulation assessment: **PASS**

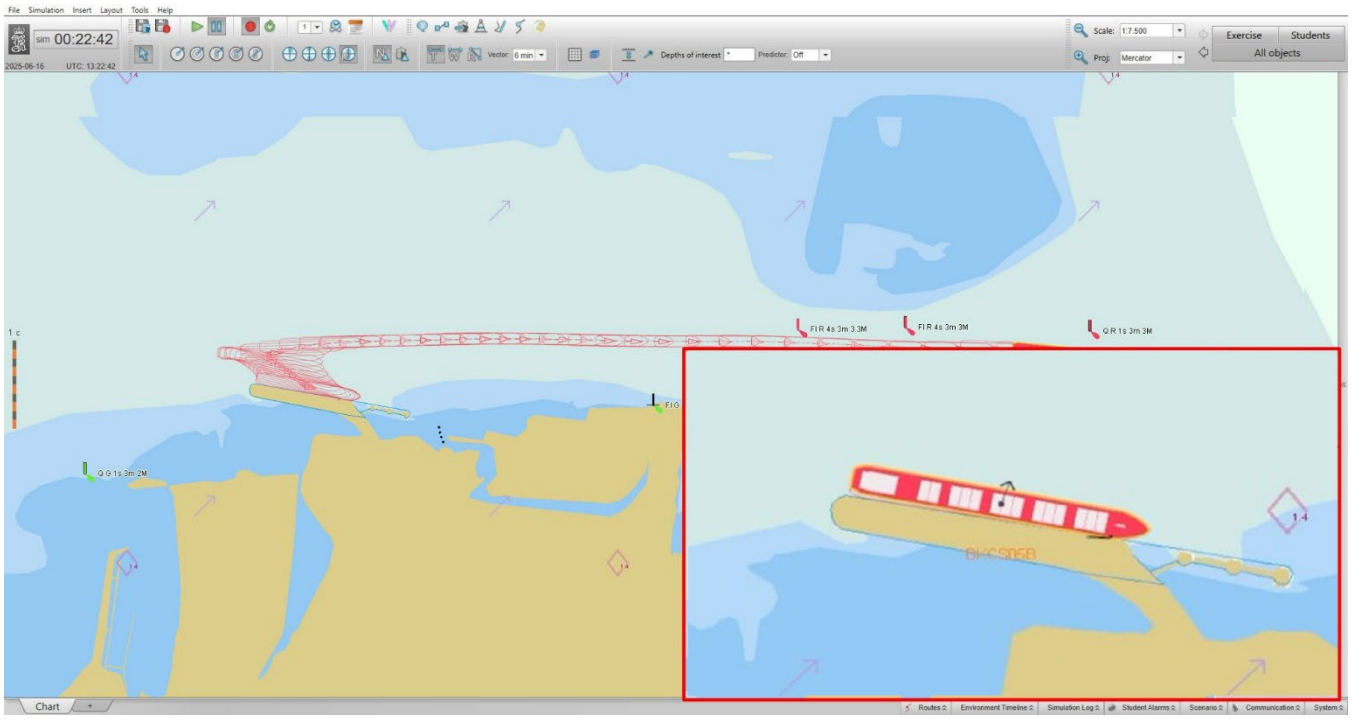


Figure 11 : *Ship's track. The inset shows the ship opening the stern on a forward back spring.*

Note: The swept paths of each simulation will be delivered apart, superimposed on a chart so that the total area used by the ships during their maneuvers can be determined.

**Light wind means a wind less than 5 knots and not impairing the maneuver.*

RUN-02

Berthing starboard side to the West terminal with the BKCS05B (Ballast). Starting position, about 1 mile Southeast of the East terminal on a heading of 315° and at a speed of 3 knots. Light wind, good visibility, slack water and no other traffic impairing the ship's movements.

No tugs, one bow thruster and port anchor used.

Normal passage south of the red buoys at a speed of about 3 knots. Due to the limited maneuvering space in the passage south of the buoys, the pilot kept the ship close to the buoys.

The pilot maneuvered the ship so as to arrive at about one ship's length off the terminal and dropped the port anchor to help control the 180° turn to dock starboard side to the berth. The end of the docking was carried out with the help of a forward spring.

The maneuver was carried out as planned.

Nothing special to report.

Simulation assessment: **PASS**

Pilot comment: Very realistic model reactions.

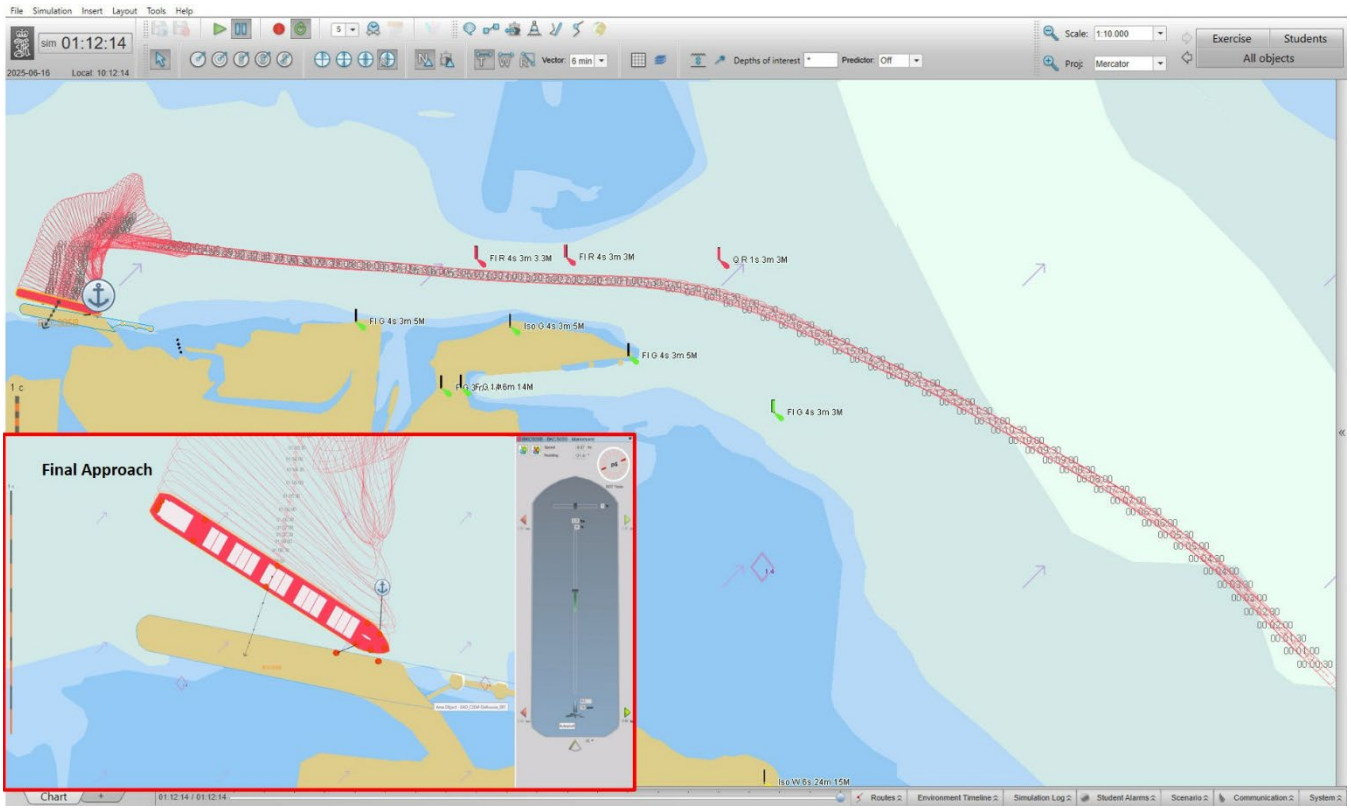


Figure 12 : *Ship's track. The inset shows the ship at the beginning of docking, forward spring ashore.*

RUN-03

Berthing starboard side to the West terminal with the BKCS05B (Laker). Starting position, East of the buoyed channel on a heading of 371° and at a speed of 3 knots. Northwest wind at 20 knots. good visibility, end of ebb, flood starting while passing the red buoys. No other traffic impairing the ship's movements.

One tug on the port quarter, one bow thruster.

Passage South of the buoys at a speed of about 3 knots. Because of the restricted place and the Northwest wind, the pilot kept the ship close to the red buoys. It is better to have the bow closer to the shallow water than the stern.

The pilot maneuvered the ship so as to arrive at about half a ship's length off the terminal and began the 180° turn to port using the bow thruster and the tug pushing on the port quarter.

The maneuver was under control at all times.

The pilot assessed the simulation as successful, but in his opinion, 20 knots wind would be the limit that should not be exceeded.

Simulation assessment: **PASS**

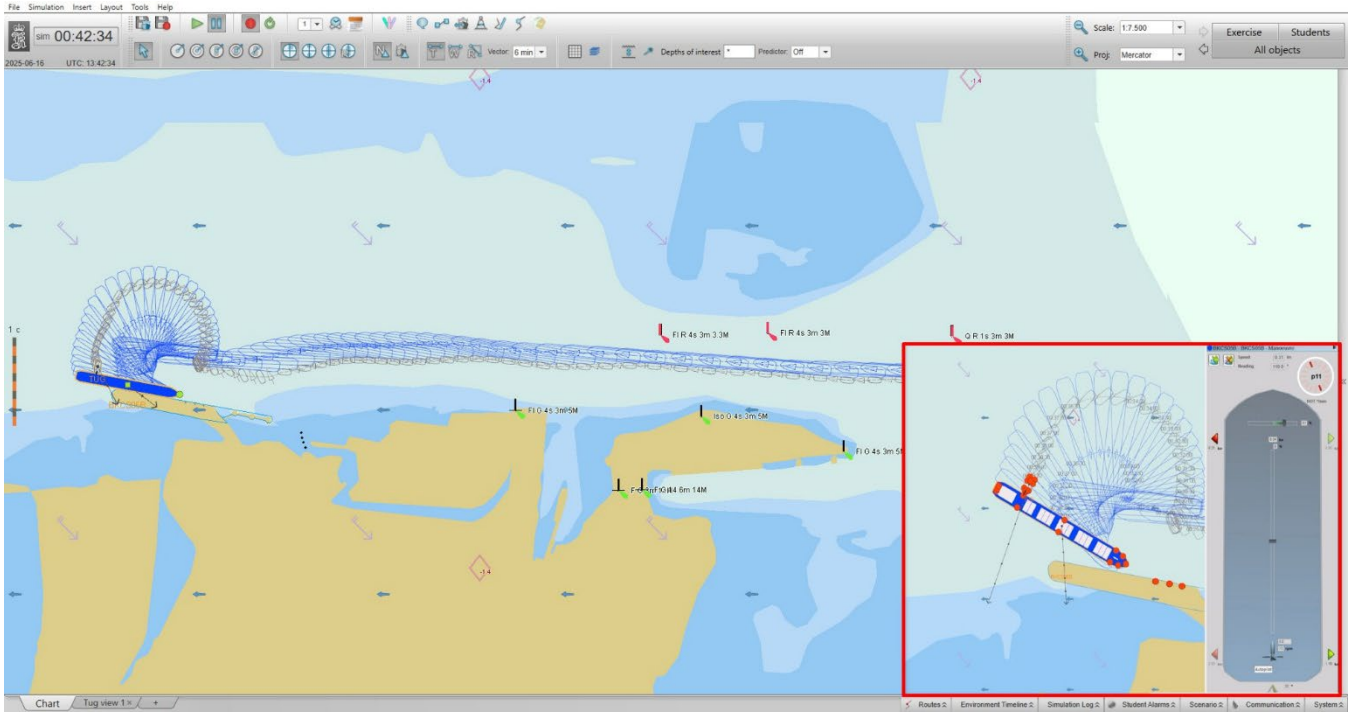


Figure 13 : *Ship's track from the start to the end of the simulation. The inset shows the ship near the end of its 180° turn.*

RUN-04

Berthing starboard side to the West terminal with the BKCS15B (Panamax). West wind at 10 knots, good visibility, slack water, flood starting after passing the red buoys. No other traffic impairing the ship's movements.

Two tugs, one tug on the port shoulder and the second on the port quarter, no bow thruster.

The run started with the ship positioned East-southeast from the eastern terminal on a heading of 302° at a speed of 3 knots.

Ship under control while passing south of the red buoys. The pilot maneuvered the vessel so as to be about 1 ship's length from the dock and began the approach, pivoting the ship to port by about 180°.

Approach to the dock under control, tugs used normally as shown by the graph of forces applied. Normal docking.

Note: The pilot starts the approach at slack water so that the westerly current starts once the ship begins its 180° turn to berth starboard side to. Because of the shortness of the tidal window, in real life, the pilot boat stands by the red buoys and gives the signal to the ship's pilot when it is time to procced inbound.

Simulation assessment: **PASS**

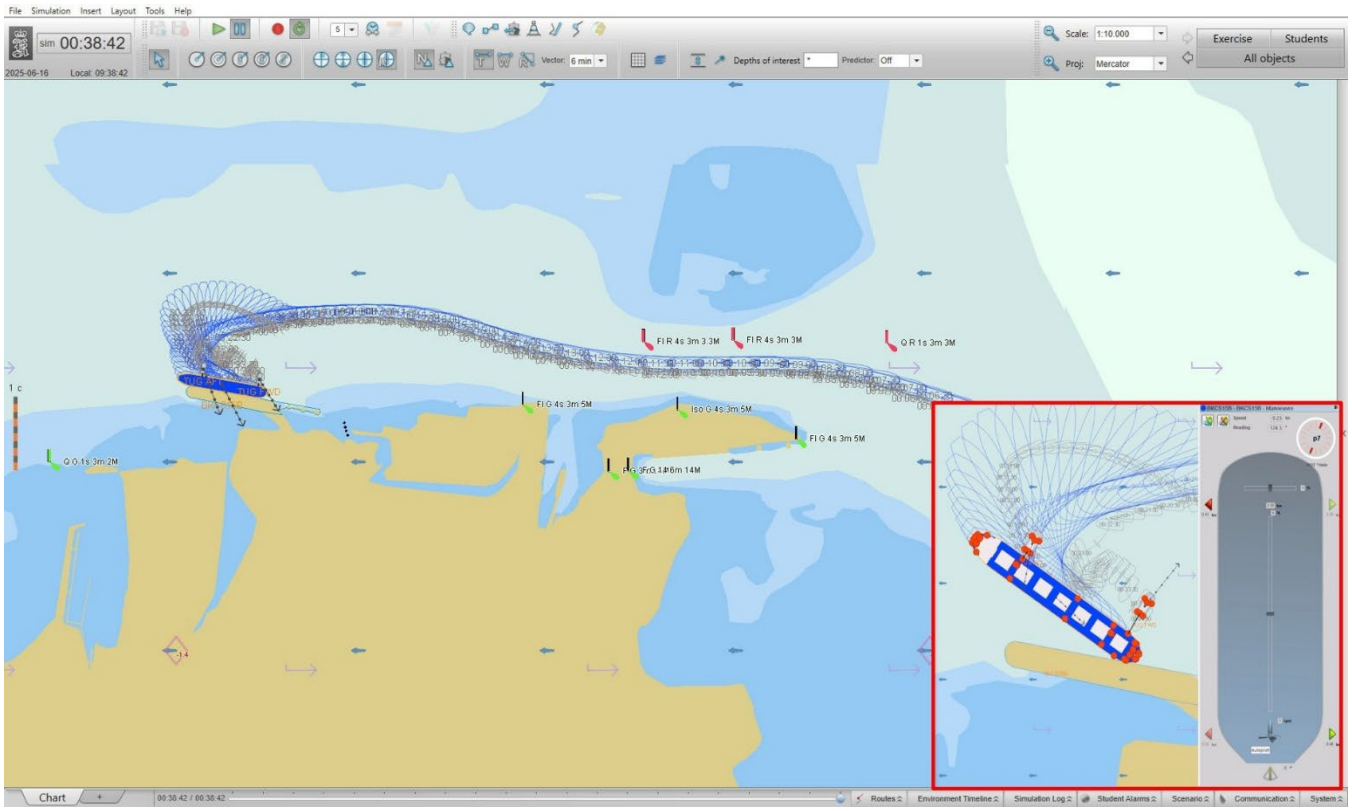


Figure 14 : *Ship's track. The inset shows the moment of first contact with the dock.*

RUN-05

Berthing starboard side to the West terminal with the BKCS15B (Panamax). Northwest wind at 15 knots. good visibility, slack water, flood starting after passing the red buoys. No other traffic impairing the ship's movements.

One tug on the port quarter and one bow thruster.

The run started with the ship positioned East-southeast from the eastern pier on a heading of 302° at a speed of 3 knots.

The narrow passage negotiated without incident. The pilot maneuvered the ship so as to be about 1 ship's length from the terminal and he started the turn using the bow thruster to port and the after tug pushing at 90° on the ship side.

The maneuver went without incident even though the pilot stated that he could have started the turn earlier so as to finish the turn close to the final position.

Simulation assessment: **PASS**

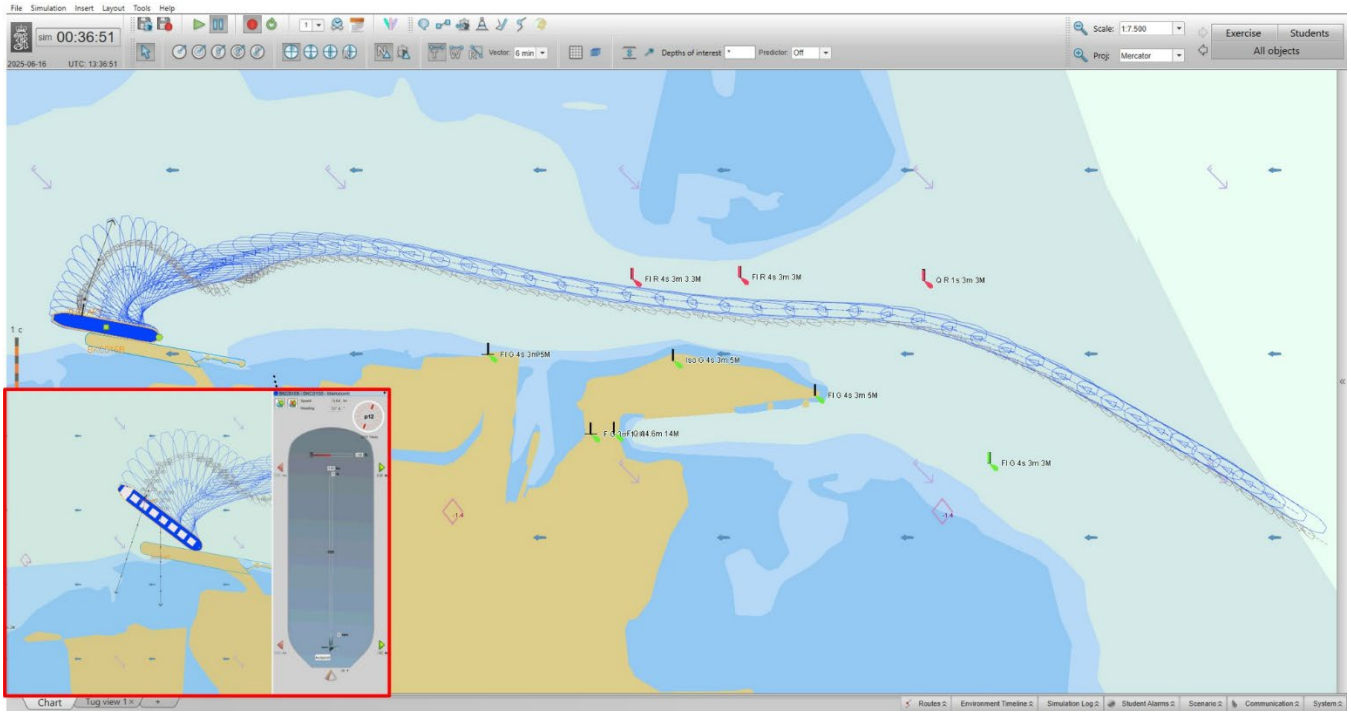


Figure 15 : *Ship's track. Inset showing the moment of first contact with the dock.*

RUN-06

Unberthing from the West terminal with the BKCS15L (Loaded) docked starboard side to. North-west wind of 15 knots, good visibility, slack water and no other traffic impairing the ship's movements.

One tug on the port quarter and one bow thruster.

As soon as all lines were onboard, the pilot made the tug pull slowly on the stern and the bow thruster was put to port. As soon as the stern started to move off the dock, the main engine was ordered astern so that the ship could be moved away from the shallow waters ahead (this area will not be excavated). Once the ship was pivoted in the right direction towards the exit channel, the pilot proceeded ahead and the tug was released. The narrow passage was passed as planned.

Nothing particular to report.

Simulation assessment: **PASS**

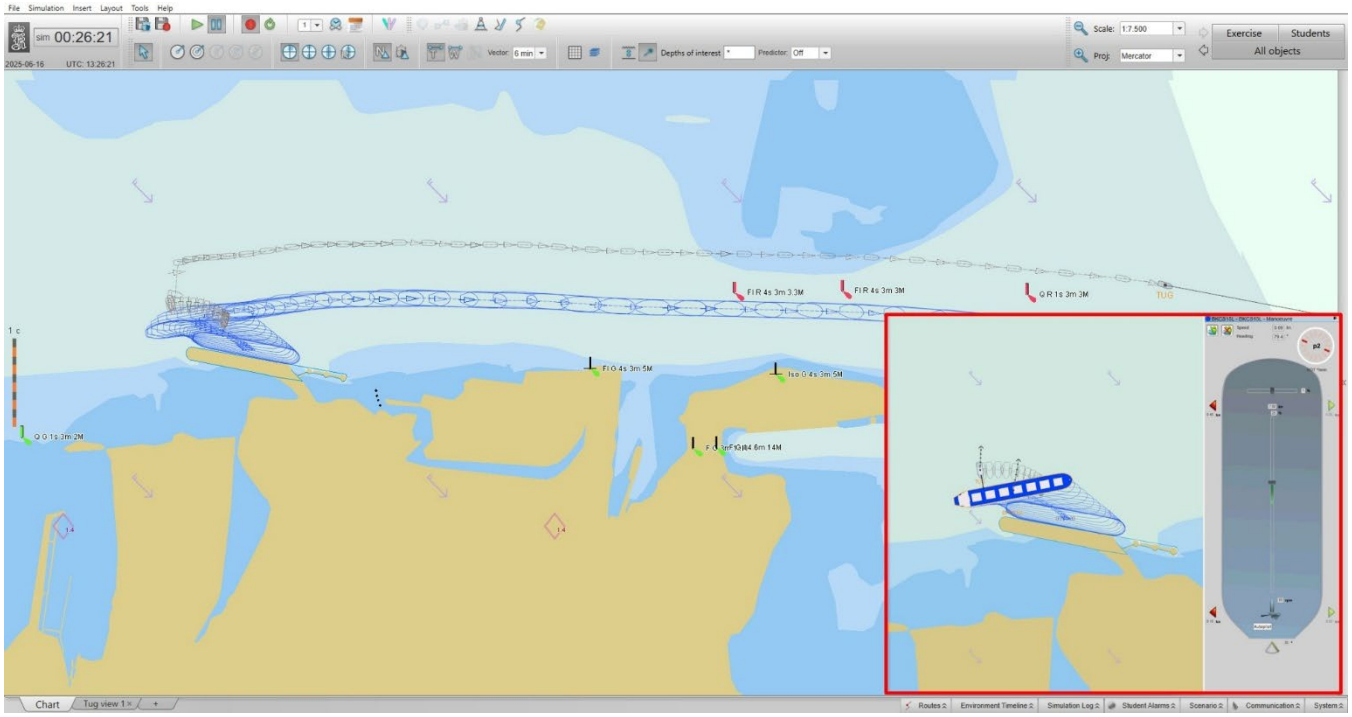


Figure 16 : *Ship's track. Inset showing the departing maneuver.*

RUN-07

Berthing port side to the West terminal with the BKCS15B (Panamax). Southeast wind at 15 knots. good visibility, slack water, flood starting after passing the red buoys. No other traffic impairing the ship's movements.

One tug on the starboard quarter and one bow thruster.

The run started with the ship positioned East-southeast from the eastern pier on a heading of 302° at a speed of 3 knots.

The narrow passage was negotiated without incident. The pilot maneuvered the ship so as to be about parallel to the terminal and he started the lateral approach using the bow thruster and the tug.

Docking normally, nothing particular to report.

Simulation assessment: **PASS**

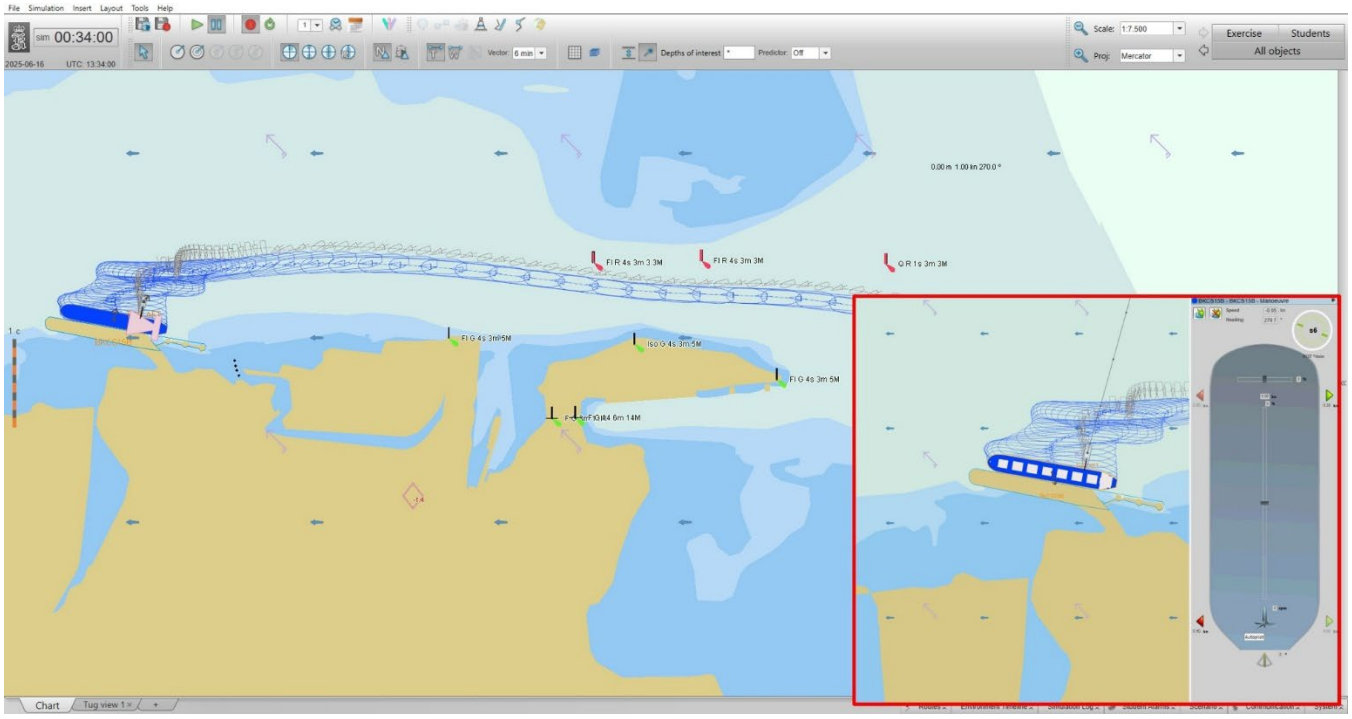


Figure 17 : *Ship's track. Inset showing the final stages of the maneuver.*

RUN-08

Berthing starboard side to the West terminal with the BKCS15B (Panamax). Southeast wind at 15 knots. good visibility, slack water, flood starting after passing the red buoys. No other traffic impairing the ship's movements.

One tug on the port quarter and one on the port shoulder, no bow thruster. The plan is to dock starboard side to, but pivoting the ship to starboard instead of port.

The run began with the vessel positioned East-southeast of the eastern terminal on a heading of 302° at a speed of 3 knots.

The narrow passage off the red buoys was negotiated without incident. The pilot maneuvered the ship so as to be about 1 ship's length from the terminal and he started the turn using the two tugs, the forward one pushing on the ship side and the after tug pulling. Once turned around, the pilot used the two tugs to bring the ship alongside.

This is not the method normally used (turning to starboard instead of port), but it could be if circumstances were deemed favorable.

Simulation assessment: **PASS**

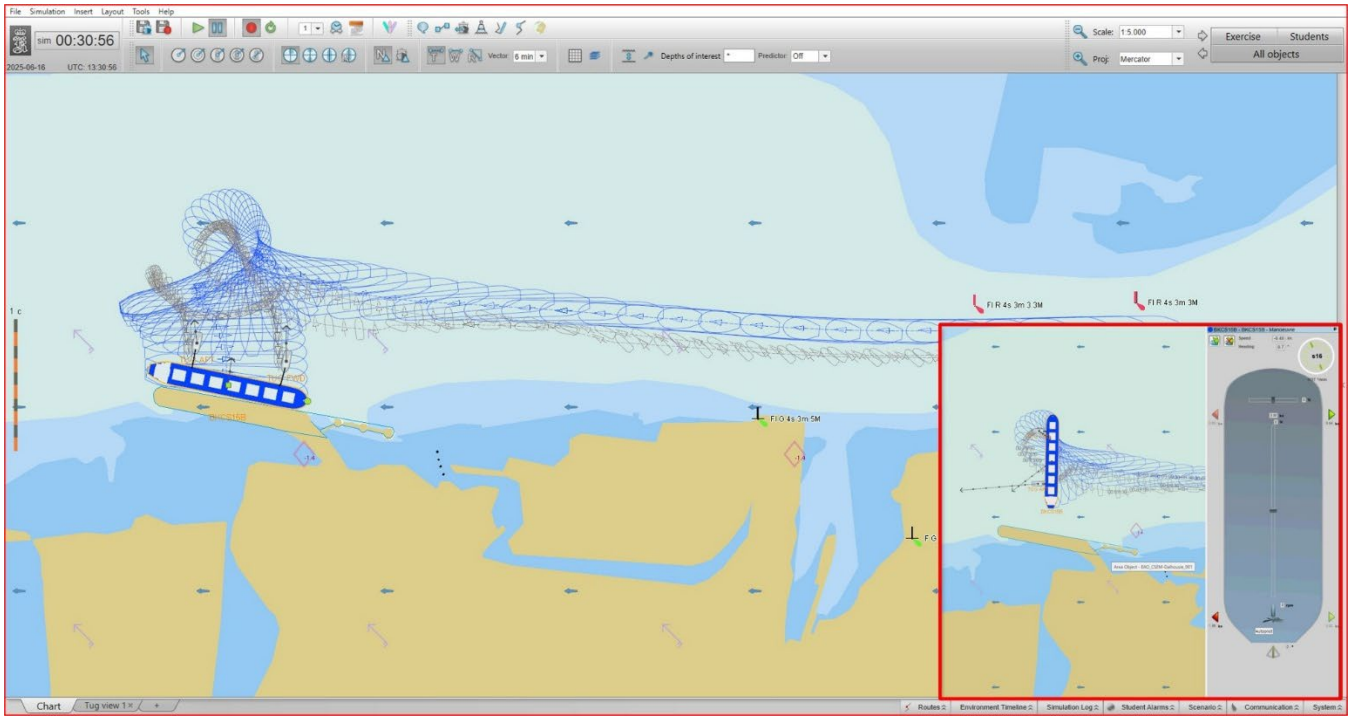


Figure 18 : *Ship's track. The inset shows the vessel about half way into the starboard turn.*

RUN-09

Unberthing from the West terminal with the BKCS15L (Loaded) docked starboard side to. Northeast wind of 20 knots, good visibility, ebb current started once the ship was underway, no other traffic impairing the ship's movements.

One tug on the port shoulder and one on the port quarter, no bow thruster.

As soon as all lines were onboard, the pilot made the tugs pull slowly at first and increased the tugs pull so that the ship begins to move away parallel to the dock. Because of the Northeast wind which tended to hold the ship alongside the dock, the forward tug had to pull full and the aft tug had to pull half in order to bring the ship in a position where it could begin its exit from the port under its own power.

The simulation was successful, but assessed close to the limit by the pilot.

Simulation assessment: **PASS (but close to the limit)**

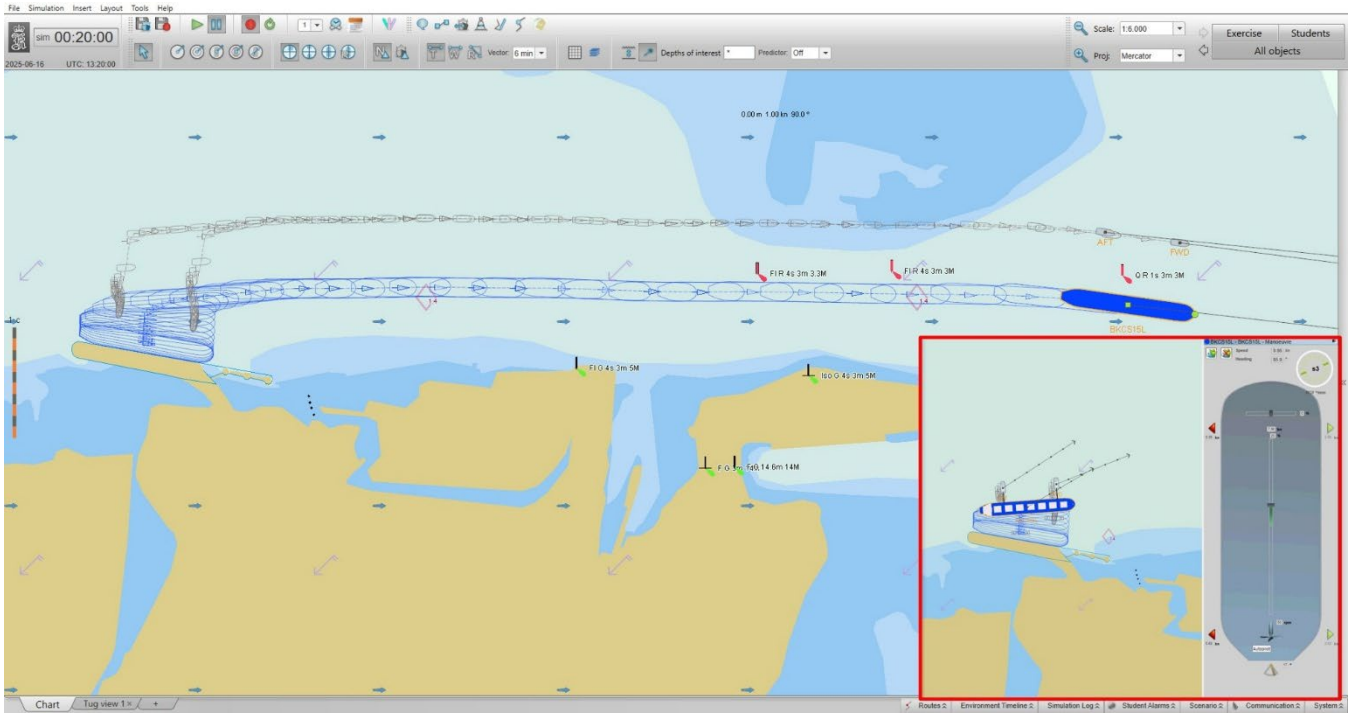


Figure 19 : *Ship's track. The inset shows the situation at the time the tugs were released*

RUN-10

Unberthing from the West terminal with the BKCS15L (Loaded) docked starboard side to. Northeast wind of 25 knots, good visibility, ebb current started once the ship was underway, no other traffic impairing the ship's movements.

One tug on the port shoulder and one on the port quarter, no bow thruster.

As soon as all lines were onboard, the pilot made the tugs pull slowly at first and increased the tugs pull to full to make the ship move away from the dock.

Because of the power that had to be used by the two tugs, the pilot considers this situation as limit.

The simulation was successful, but assessed limit by the pilot.

Simulation assessment: **LIMIT**

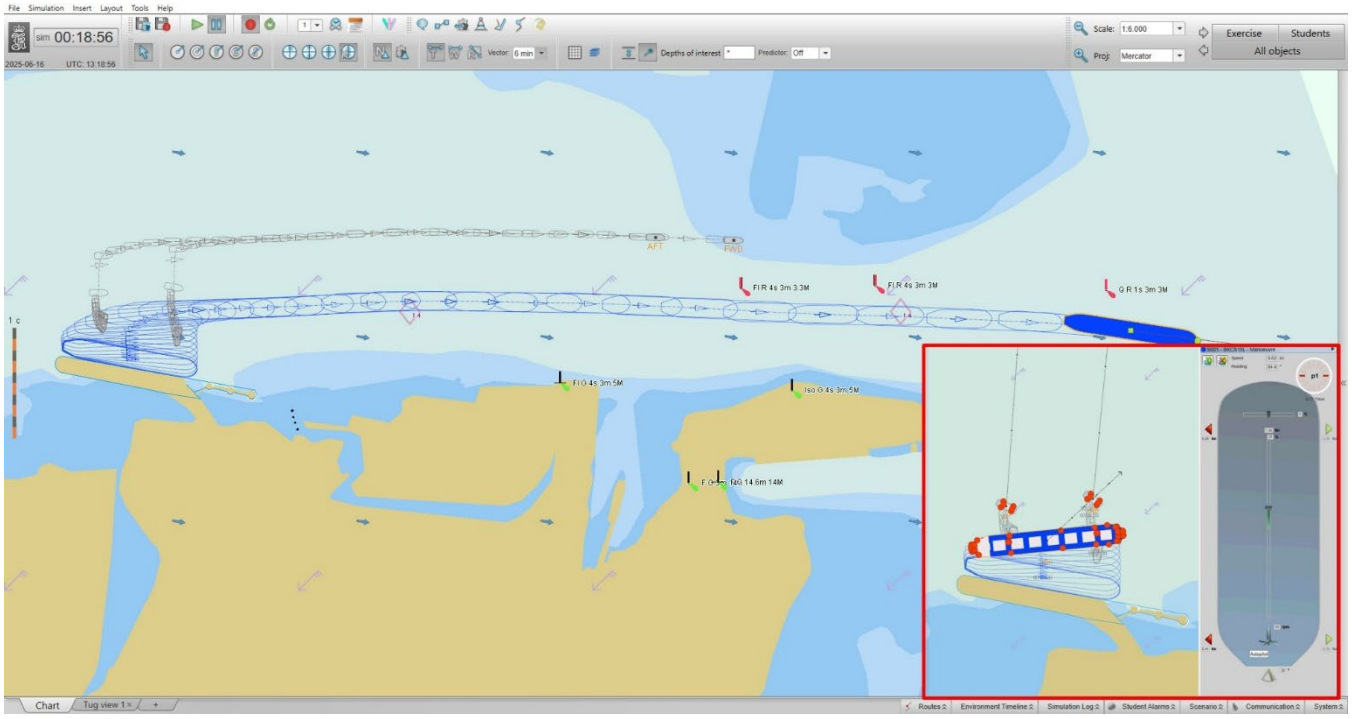


Figure 20 : *Ship's track. The inset shows the situation at the time the tugs were released.*

RUN-11

Same as RUN 10, but the wind direction has been changed from Northeast to North. Unberthing from the West terminal with the BKCS15L (Loaded) docked starboard side to. Wind now from the North at 25 knots, good visibility, ebb current started once the ship was underway, no other traffic impairing the ship's movements.

One tug on the port shoulder and one on the port quarter, no bow thruster.

As soon as all lines were onboard, the pilot made the tugs pull slowly at first and increased the forward tug pull to full and the aft tug pull to half to make the ship move away from the dock. The ebbing being about to start, the pilot put the engine dead slow astern while the tugs were pulling. Precaution taken so as not to be too close to the shallow waters East of the pier.

Because of the power that had to be used by the two tugs, the pilot considers this situation as limit.

The simulation was successful, but assessed limit by the pilot.

Simulation assessment: **LIMIT**

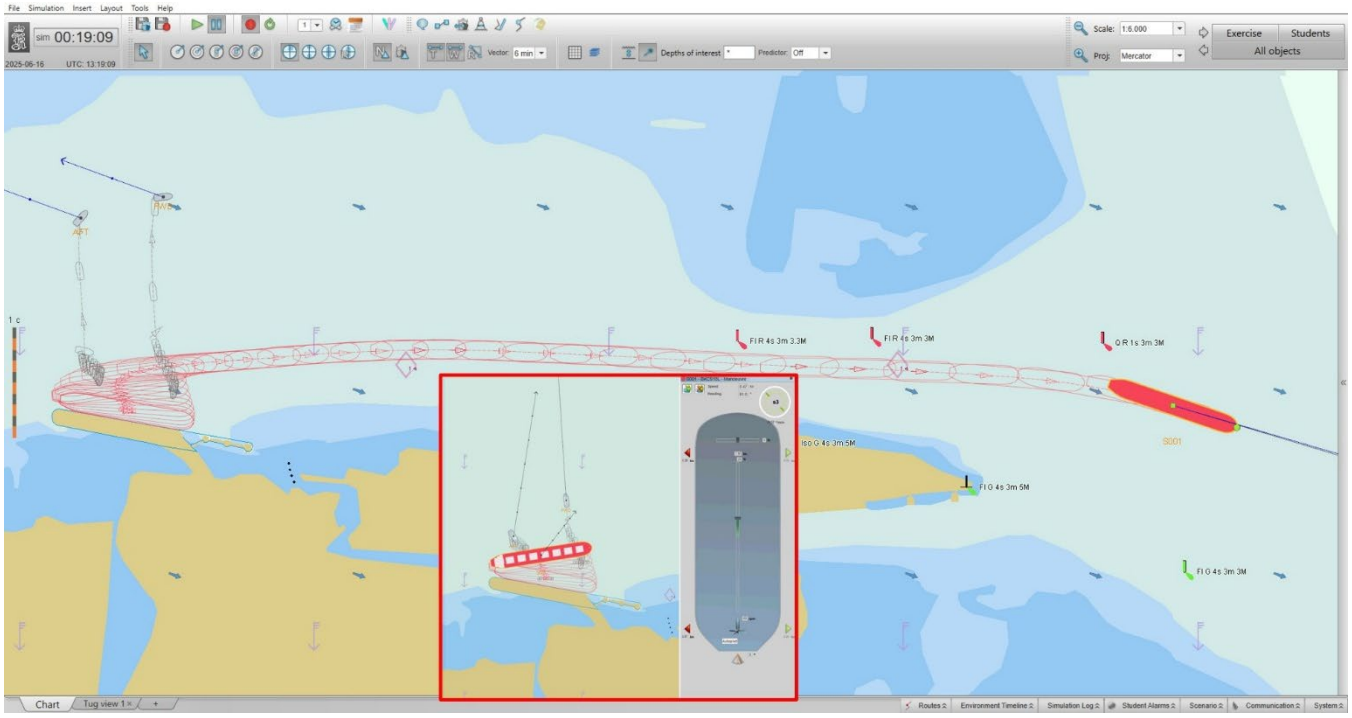


Figure 21 : *Ship's track. The inset shows the situation at the time the tugs were released.*

RUN-12

Berthing starboard side to the West terminal with the BKCS15B (Panamax). North-northwest wind at 30 knots. good visibility, slack water, flood starting after passing the red buoys. No other traffic impairing the ship's movements.

One tug on the port quarter and one on the port shoulder, no bow thruster. The plan is to pivot the ship to port off the dock in order to berth starboard to.

The run began with the vessel positioned East-southeast of the eastern terminal on a heading of 311° at a speed of 3 knots.

The passage, south of the buoys, had to be negotiated at higher speed than usual to maintain control of the position and course. In order to break the forward speed, the pilot used the forward tug in line and pulling to act as a « break ». Because of the strong wind expected to push the ship towards the pier, the pilot maneuvered the ship so as to be more than 1 ship's length from the terminal and he started the turn using the two tugs, the forward one pulling and the after tug pushing. Once turned around, the pilot used the two tugs to bring the ship alongside.

The wind proved to be too strong for the pilot to maintain good control on the final approach. The ship hit the western corner at an angle. Even though the pilot had managed to slow down the speed of approach, it was not a maneuver that could be considered under control.

Simulation assessment: **FAIL**

Note: A pilot would not attempt docking with such a wind, and the simulation showed why.

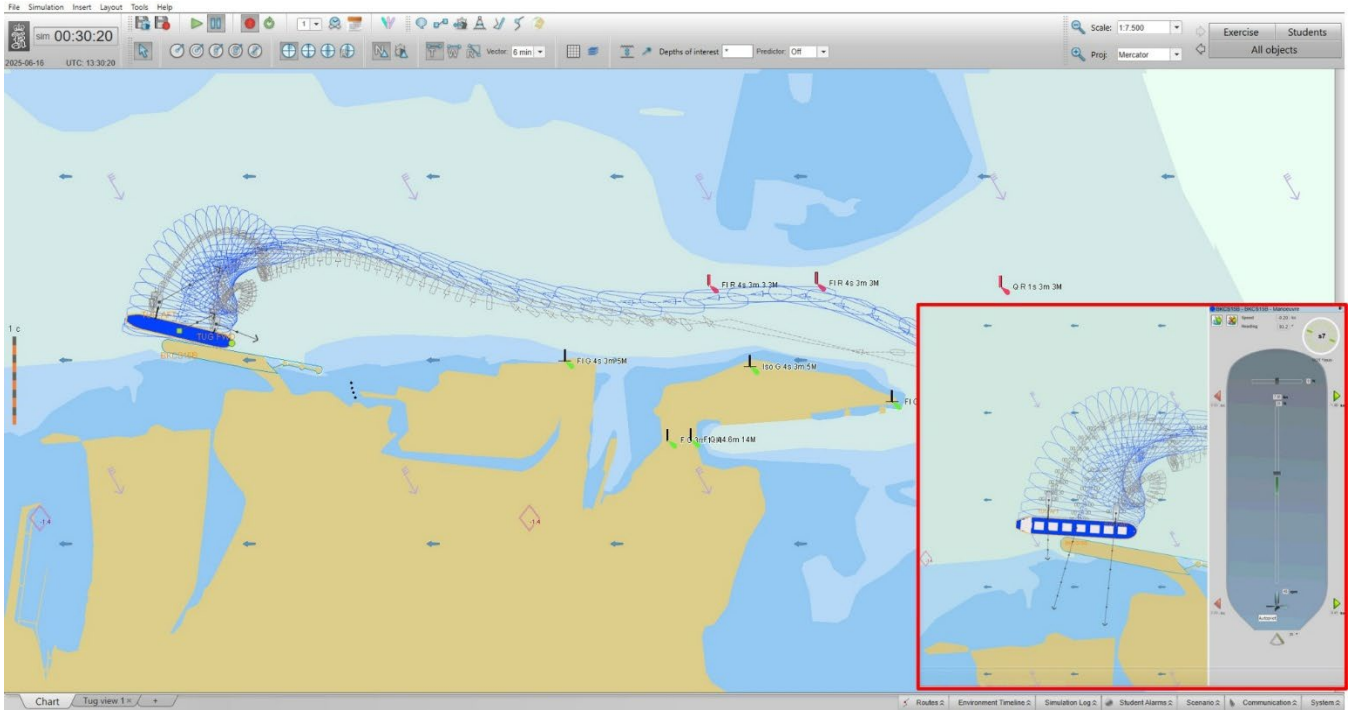


Figure 22 : *Ship's track. The inset shows seconds before contact.*

RUN-13

Berthing starboard side to the West terminal with the BKCS15B (Panamax). North-northwest wind at 20 knots. good visibility, slack water, flood starting after passing the red buoys. No other traffic impairing the ship's movements.

One tug on the port quarter and one on the port shoulder, no bow thruster. The plan is to pivot the ship to port off the dock in order to berth starboard side to.

The run began with the vessel positioned East-southeast of the eastern terminal on a heading of 311° at a speed of 3 knots.

The narrow passage off the red buoys was negotiated without incident. The pilot maneuvered the ship so as to be about 1 ship's length from the terminal and he used the forward tug in line and pulling to act as a « break » before starting the turn using the two tugs, the forward tug pulling and the after tug pushing. Once turned around, the pilot used the two tugs to bring the ship alongside.

Even though the wind was decreased to 20 knots, it proved to be challenging at the time of final approach. The ship made contact with the western corner at a slight angle in spite of the fact that the forward tug was pushing and the after tug was pulling. This shows why the pilots considers wind of 20 knots the limit not to be exceeded.

Simulation assessment: **PASS (Close to the limit)**

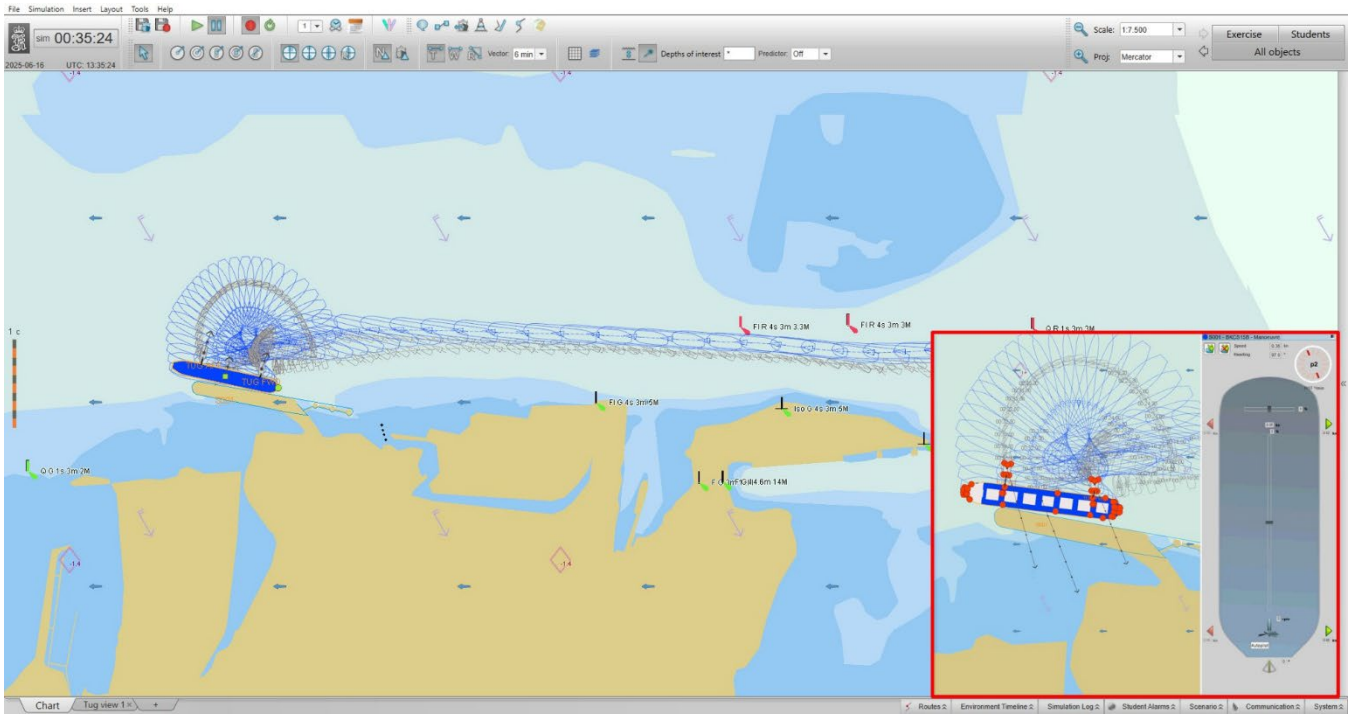


Figure 23 : *Ship's track. The inset shows seconds before contact.*

8. OBSERVATIONS AND RECOMMENDATIONS

After each exercise carried out during this study, some observations, comments and recommendations were made.

Here is the summary of the observations and recommendations, following these 2 days of simulations.

OBSERVATIONS/GENERAL COMMENTS

The narrow passage south of the red buoys can present as much of a challenge as the berthing itself. Indeed, when the wind induces drift, the bow and stern of the vessel can come dangerously close to the limits. In such cases, it is therefore necessary to proceed at higher speed to reduce drift and maintain directional control. The problem is that the turning basin is only about 3 ship lengths ahead. All of this requires a lot of coordination to get to the right place at the right speed to begin the 180° turning maneuver, taking into account external factors. It is important to be aware that the size of these ships, compared to the maneuvering space, is imposing.

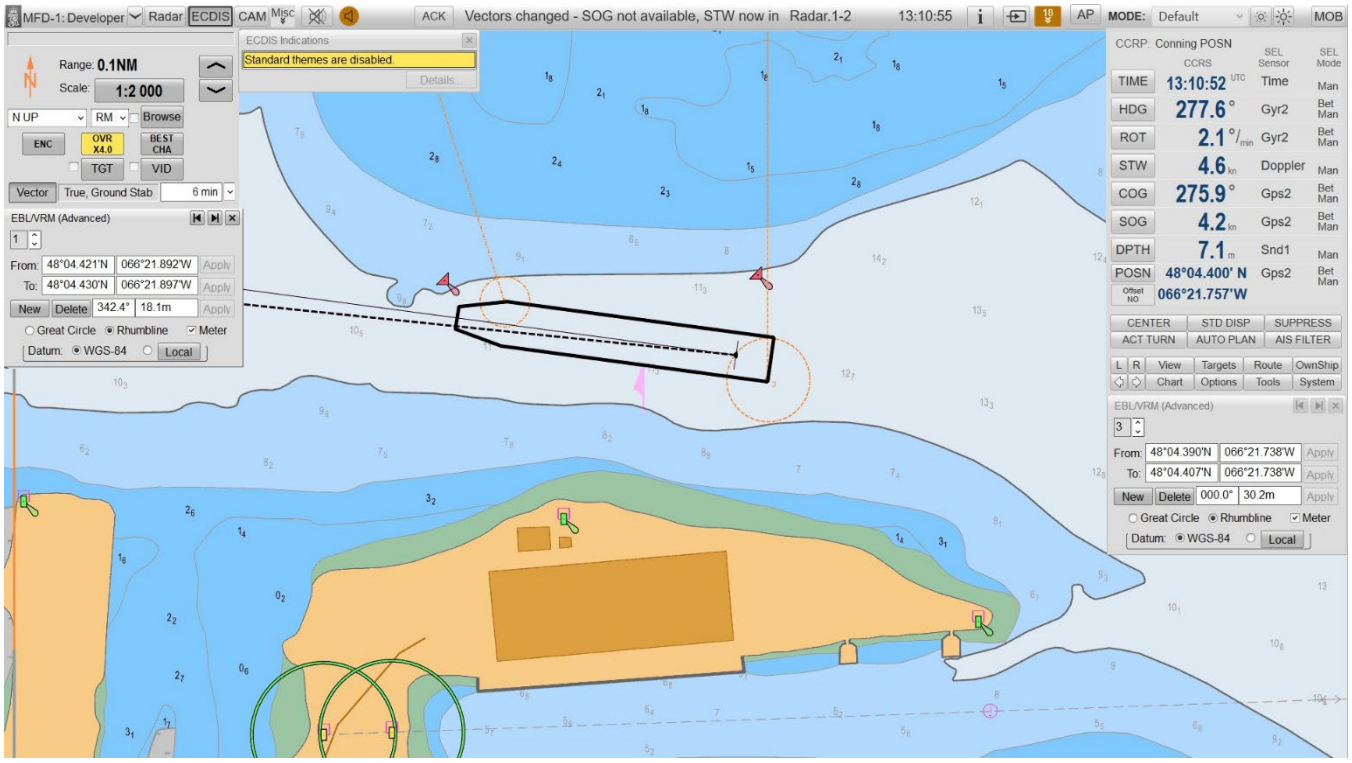


Figure 24 : *Panamax in the approach channel.*

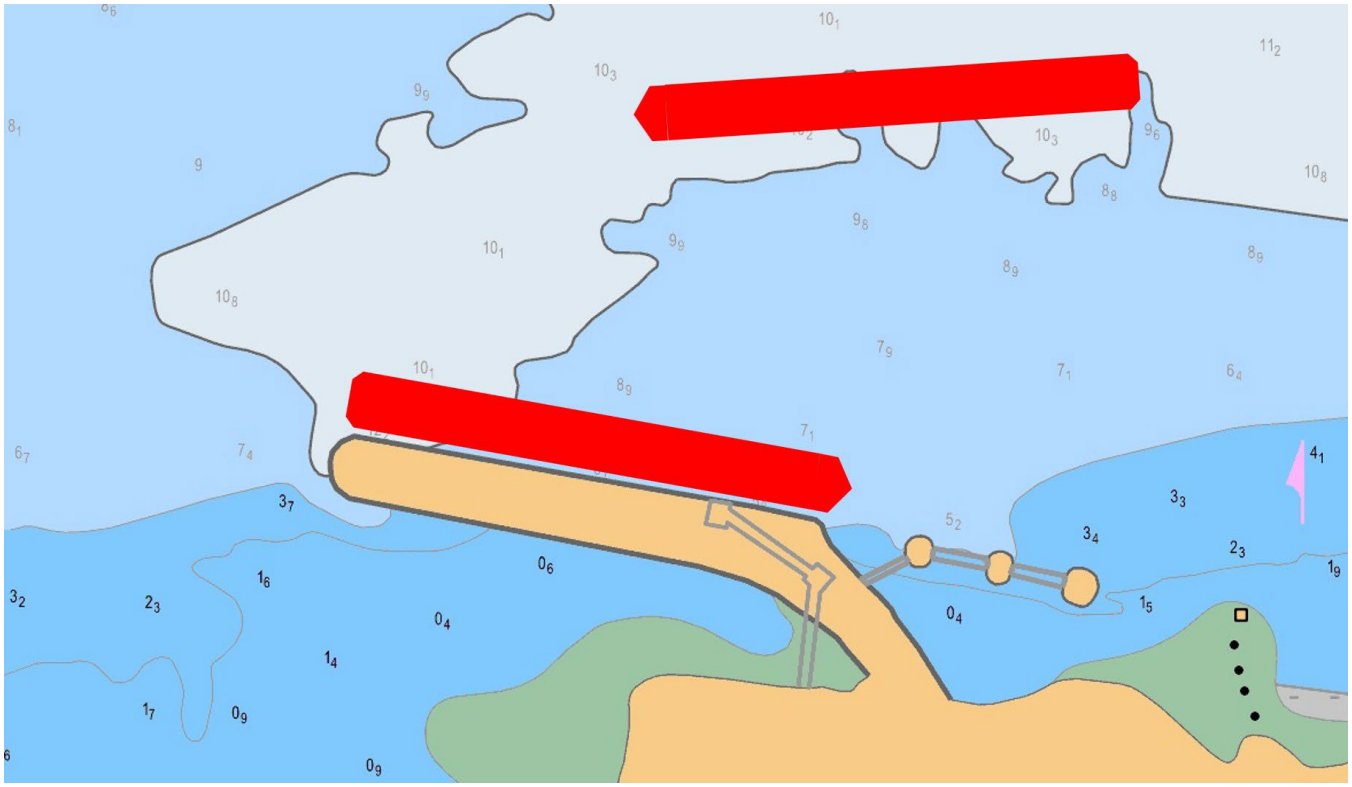


Figure 25 : *10 meters line as it is now (CHS chart). Ship's icons added.*

For the simulations, a 15-meter artificial seabed was created. This was to allow the ships to take up the necessary space for each maneuver without running aground. The traces left by the vessel's hull will then indicate the minimum space to be dredged so that the ships can maneuver without grounding.

If dredging is not carried out to achieve a depth of 15 meters, the maximum draft and minimum under keel clearance will require further investigation as this was not tested during the series of simulations.

The vessel that presents the greatest challenge is the Panamax because of its size, displacement and deep draft. The Panamax's deadweight is more than double that of a laker, and its loaded draft is about 4 meters greater than that of a laker (*Chapter 4, Modeled Ships*).

In situations where the wind does not significantly affect the ship's handling, the 2 tugs, working in conjunction with the ship's engine and rudder, allow the pilot to carry out the docking maneuver safely as shown by the simulations.

The current direction is an important factor that has to be carefully evaluated. When the pilot has to dock a large vessel, he makes sure that the flood current starts once passed the red buoys of the approach channel. Since the tidal window is very short, about 15 minutes, the pilot boat waits near the buoys and signals to the ship's pilot when he can begin its approach. It would be risky to rely solely on calculations because as it is well known, there are variable factors that can influence the results.

These maneuvers, taking into account all the relevant factors (tide, current, wind, space, size of the vessels etc.) have to be carefully planned, but can be carried out by experienced pilots who know what factors they must take into account before proceeding, and who know when and how to judge if the level of risk becomes too great.

For unberthing, the main limiting factor is the wind. If the tug boats can bring the ship off the dock on a proper heading to proceed outbound, the effect of the wind on the loaded moving vessel will not be as important as it would be on a light vessel. Given the risks associated with unberthing in strong winds, the pilot issued a recommendation on wind strength and direction.

There were no recommendations on the navigational aids. Pilots also have their own landmarks and use them in conjunction with the official landmarks to constantly check the position and movement of the ship (*An example can be seen in Modeled Area, figure 6*).

RECOMMENDATIONS

Note: *Wind limits apply to both vessel types used in simulations.*

Berthing

- The pilot recommends not attempting to dock if the wind is above 20 knots.
- For docking, the pilot recommends bringing the vessel off the dock so that when it completes its 180° turn, it is parallel to the berth without having to move forward or backward to get into position.
- For docking, the pilot recommends starting at slack water so that the flood current begins once passed the red buoys.
- The pilot recommends that pilots assigned to maneuver these ships undergo simulator training prior to the expected arrival of these vessels at Dalhousie. The reason for this recommendation is related to the difficult approach conditions due to the restricted maneuvering space, risk mitigation and the near impossibility of having the opportunity for practical training.

Unberthing

- Unberthing in loaded condition is challenging and the pilot recommends not attempting an unberthing under a beam wind above 20 knots. However, the vessel may undock under a maximum parallel wind of 25 knots.

Tug requirements

- Tugs should have azimuthal propellers and a bollard pull of at least 50 tons.
- A Panamax in ballast, equipped with a bow thruster of at least 1500 hp, can berth with the assistance of 1 tug.
- A Panamax in ballast, without bow thruster, can berth with the assistance of 2 tugs.
- A Panamax loaded always requires the assistance of 2 tugs for unberthing.
- Under light wind conditions, a laker equipped with a bow thruster can berth without tug assistance.
- Under light wind conditions, a laker equipped with a bow thruster can unberth without tug assistance.
- Under a wind not higher than the limit established, a laker equipped with a bow thruster can berth with the assistance of 1 tug.
- Under a wind not higher than the limits established, a laker equipped with a bow thruster can unberth with the assistance of 1 tug.

Figure 26 : *Panamax unberthing under Northwest wind.*

9. CONCLUSION

The maneuvers undertaken under different environmental conditions made it possible to establish limits not to be exceeded.

The recommendations are not obligations; they are the minimum criteria based on the pilot's local knowledge, practical experience, good judgement and seamanship. However, in certain circumstances that are assessed on the spot, the pilot and the captain can agree to change them if the situation dictates it.

Figure 27 : *Panamax in the approach channel.*

APPENDIX 1
SIMULATION SHEETS

These sheets contain the technical details of each passage taken on the spot by the simulator operators.

They may also contain concise commentary on the maneuvers.

RUN-01

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-01
Location :	Dalhousie, NB
Date :	22 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☐
Departure Starboard Side to	☑

Departure position :

Latitude :	48° 04.3628'
Longitude :	066° 22.7578'
Heading :	100 °
Speed:	0,0 kts

Vessel Model :	BKCS05B
Tug Model :	

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	225	°
Height :	0,21	m
Period :	2,0	s
Lenght :	3,8	m

No Wind :	☐
Wind Direction :	225 °
Wind Force :	3,0 kts
Wind Gusts:	0,0 kts

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

Number of tugs:	
Duration of exercise :	22m42s

General Comments :

Description of vessel's models used :

Vessel Model :	BKCS05B	**Tug Model :**
Lenght :	222,5 m	**Lenght :**
Breadth :	23,8 m	**Breadth :**
Displacement :	18 500 T	**Displacement :**
Draught Fwd :	4,5 M	**Draught Fwd :**
Draught Aft :	6,9 M	**Draught Aft :**
Propulsion :	Var - Left	**Propulsion :**
Rudder :	Conventionnal	
Bow Thrusters :	1 X 1000 hp	

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	Simon Rivard

RUN-02

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-02
Location :	Dalhousie, NB
Date :	22 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 03.8565'
Longitude :	066° 20.1867'
Heading :	315 °
Speed:	3,0 kts

Vessel Model :	BKCS05B
Tug Model :	

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	225	°
Height :	0,21	m
Period :	2,0	s
Lenght :	3,8	m

No Wind :	☐
Wind Direction :	225 °
Wind Force :	3,0 kts
Wind Gusts:	0,0 kts

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

Number of tugs:	
Duration of exercise :	1h12m14s

General Comments :

AT ABOUT 38 MINUTES DROP PORT ANCHOR

Description of vessel's models used :

Vessel Model :	BKCS05B	**Tug Model :**
Lenght :	222,5 m	**Lenght :**
Breadth :	23,8 m	**Breadth :**
Displacement :	18 500 T	**Displacement :**
Draught Fwd :	4,5 M	**Draught Fwd :**
Draught Aft :	6,9 M	**Draught Aft :**
Propulsion :	Var - Left	**Propulsion :**
Rudder :	Conventionnal	
Bow Thrusters :	1 X 1000 hp	

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	Simon Rivard

RUN-03

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-03
Location :	Dalhousie, NB
Date :	22 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.3855'
Longitude :	066° 20.9820'
Heading :	271 °
Speed:	3,0 kts

Vessel Model :	BKCS05B
Tug Model :	TUG30

CURRENTS, TIDE & WIND

Current :	East 0,5kts	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
Tide:		**Level of water :**	-1,4 m
Flow	☐		
Slack	☑	**Current reference point:**	
Ebb	☐	**Lat. :**	N
		Long. :	W
Waves :	☑ 0%	**Direction:**	90 °
Direction :	315 °	**Force:**	0,5 kts
Height :	0,42 m		
Period :	2,0 s	**No Wind :**	☐
Lenght :	6,0 m	**Wind Direction :**	315 °
		Wind Force :	19,0 kts
Swell :	☐	**Wind Gusts:**	1,0 kts
Direction :	°		
Height :	m	**Number of tugs:**	1
Length :	m		
Period :	s	**Duration of exercise :**	42m34s

General Comments :

Current starting at 0.5kts East and reducing to 0kt after passing last red buoy.
Starting to go West up to 1kt. Rate of change of current 0.1kt/min.

Description of vessel's models used :

Vessel Model :	BKCS05B	**Tug Model :**	TUG30
Lenght :	222,5 m	**Lenght :**	28,2 m
Breadth :	23,8 m	**Breadth :**	11,7 m
Displacement :	18 500 T	**Displacement :**	680 T
Draught Fwd :	4,5 M	**Draught Fwd :**	5,20 m
Draught Aft :	6,9 M	**Draught Aft :**	5,40 m
Propulsion :	Var - Left	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Variable Pitch
Bow Thrusters :	1 X 1000 hp		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	Simon Rivard

RUN-04

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-04
Location :	Dalhousie, NB
Date :	22 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.1609'
Longitude :	066° 20.7936'
Heading :	302 °
Speed:	3,0 kts

Vessel Model :	BKCS15B
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	-1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	270 °	
Height :	0,16 m	
Period :	1,0 s	
Lenght :	2,3 m	

No Wind :	☐
Wind Direction :	270 °
Wind Force :	9,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :	°	
Height :	m	
Length :	m	
Period :	s	

Number of tugs:	2
Duration of exercise :	38m42s

General Comments :

Current starting 0kt and after passing last red buoy Starting to go West up to 1kt. Rate of change of current 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS15B	**Tug Model :**	TUG16
Lenght :	229,0 m	**Lenght :**	30,8 m
Breadth :	32,3 m	**Breadth :**	11,1 m
Displacement :	39 000 T	**Displacement :**	600 T
Draught Fwd :	6,0 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,5 m	**Draught Aft :**	3,54 m
Propulsion :	Fixed - Right	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1600 kW		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	Simon Rivard

RUN-05

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-05
Location :	Dalhousie, NB
Date :	22 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.1609'
Longitude :	066° 20.7936'
Heading :	302 °
Speed:	3,0 kts

Vessel Model :	BKCS15B
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	-1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	315 °	
Height :	0,28 m	
Period :	2,0 s	
Lenght :	4,0 m	

No Wind :	☐
Wind Direction :	315 °
Wind Force :	14,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

Number of tugs:	1
Duration of exercise :	36m51s

General Comments :

Current starting 0kt and after passing last red buoy Starting to go West up to 1kt. Rate of change of current 0.5kt/min.

1 tug and 1 bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS15B	**Tug Model :**	TUG16
Lenght :	229,0 m	**Lenght :**	30,8 m
Breadth :	32,3 m	**Breadth :**	11,1 m
Displacement :	39 000 T	**Displacement :**	600 T
Draught Fwd :	6,0 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,5 m	**Draught Aft :**	3,54 m
Propulsion :	Fixed - Right	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1600 kW		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	Simon Rivard

RUN-06

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-06
Location :	Dalhousie, NB
Date :	22 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☐
Departure Starboard Side to	☑

Departure position :

Latitude :	48° 04.3651'
Longitude :	066° 22.7559'
Heading :	100 °
Speed:	0,0 kts

Vessel Model :	BKCS05L
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	315 °	
Height :	0,31 m	
Period :	2,0 s	
Lenght :	4,4 m	

No Wind :	☐
Wind Direction :	315 °
Wind Force :	14,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :	°	
Height :	m	
Length :	m	
Period :	s	

Number of tugs:	1
Duration of exercise :	26m21s

General Comments :

1 tug and 1 bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS05L	**Tug Model :**	TUG16
Lenght :	222,5 m	**Lenght :**	30,8 m
Breadth :	23,8 m	**Breadth :**	11,1 m
Displacement :	35 100 T	**Displacement :**	600 T
Draught Fwd :	8,08 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,08 m	**Draught Aft :**	3,54 m
Propulsion :	Var - Left	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1000 hp		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	Simon Rivard

RUN-07

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-07
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.1609'
Longitude :	066° 20.7936'
Heading :	302 °
Speed:	3,0 kts

Vessel Model :	BKCS15B
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	-1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	135	°
Height :	0,31	m
Period :	2,0	s
Lenght :	4,4	m

No Wind :	☐
Wind Direction :	135 °
Wind Force :	14,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

Number of tugs:	1
Duration of exercise :	34m00s

General Comments :

Slack water until red buoy. Flood tide up to 1kt at 0.1kt/min.

1 tug and 1 bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS15B	**Tug Model :**	TUG16
Lenght :	229,0 m	**Lenght :**	30,8 m
Breadth :	32,3 m	**Breadth :**	11,1 m
Displacement :	39 000 T	**Displacement :**	600 T
Draught Fwd :	6,0 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,5 m	**Draught Aft :**	3,54 m
Propulsion :	Fixed - Right	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1600 kW		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

RUN-08

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-08
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.4117'
Longitude :	066° 21.7500'
Heading :	269 °
Speed:	3,0 kts

Vessel Model :	BKCS15B
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	-1,4 m

Tide:

Flow	☑
Slack	☐
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	135	°
Height :	0,31	m
Period :	2,0	s
Lenght :	4,4	m

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

No Wind :	☐
Wind Direction :	135 °
Wind Force :	14,0 kts
Wind Gusts:	1,0 kts
Number of tugs:	2
Duration of exercise :	30m54s

General Comments :

Flood tide up to 1kt at 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS15B	**Tug Model :**	TUG16
Lenght :	229,0 m	**Lenght :**	30,8 m
Breadth :	32,3 m	**Breadth :**	11,1 m
Displacement :	39 000 T	**Displacement :**	600 T
Draught Fwd :	6,0 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,5 m	**Draught Aft :**	3,54 m
Propulsion :	Fixed - Right	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1600 kW		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

RUN-09

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-09
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☐
Departure Starboard Side to	☑

Departure position :

Latitude :	48° 04.3651'
Longitude :	066° 22.7559'
Heading :	100 °
Speed:	0,0 kts

Vessel Model :	BKCS05L
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	45 °	
Height :	0,42 m	
Period :	2,0 s	
Lenght :	6,0 m	

No Wind :	☐
Wind Direction :	45 °
Wind Force :	19,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :	°	
Height :	m	
Length :	m	
Period :	s	

Number of tugs:	2
Duration of exercise :	20m00s

General Comments :

Current started at 1kt flood, reducing at rate of 0.2kt/min. Then once underway the current started ebbing up to 1kt at rate of 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS05L	**Tug Model :**	TUG16
Lenght :	222,5 m	**Lenght :**	30,8 m
Breadth :	23,8 m	**Breadth :**	11,1 m
Displacement :	35 100 T	**Displacement :**	600 T
Draught Fwd :	8,08 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,08 m	**Draught Aft :**	3,54 m
Propulsion :	Var - Left	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1000 hp		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

RUN-10

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-10
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☐
Departure Starboard Side to	☑

Departure position :

Latitude :	48° 04.3651'
Longitude :	066° 22.7559'
Heading :	100 °
Speed:	0,0 kts

Vessel Model :	BKCS05L
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	45	°
Height :	0,57	m
Period :	2,0	s
Lenght :	8,2	m

No Wind :	☐
Wind Direction :	45 °
Wind Force :	24,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

Number of tugs:	2
Duration of exercise :	18m56s

General Comments :

Current started at 1kt flood, reducing at rate of 0.2kt/min. Then once underway the current started ebbing up to 1kt at rate of 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS05L	**Tug Model :**	TUG16
Lenght :	222,5 m	**Lenght :**	30,8 m
Breadth :	23,8 m	**Breadth :**	11,1 m
Displacement :	35 100 T	**Displacement :**	600 T
Draught Fwd :	8,08 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,08 m	**Draught Aft :**	3,54 m
Propulsion :	Var - Left	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1000 hp		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

RUN-11

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-11
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☐
Departure Starboard Side to	☑

Departure position :

Latitude :	48° 04.3651'
Longitude :	066° 22.7559'
Heading :	100 °
Speed:	0,0 kts

Vessel Model :	BKCS05L
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	1,4 m

Tide:

Flow	☐
Slack	☑
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	0 °	
Height :	0,57 m	
Period :	2,0 s	
Lenght :	8,2 m	

No Wind :	☐
Wind Direction :	0 °
Wind Force :	24,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :	°	
Height :	m	
Length :	m	
Period :	s	

Number of tugs:	2
Duration of exercise :	19m09s

General Comments :

Current started at 1kt flood, reducing at rate of 0.2kt/min. Then once underway the current started ebbing up to 1kt at rate of 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS05L	**Tug Model :**	TUG16
Lenght :	222,5 m	**Lenght :**	30,8 m
Breadth :	23,8 m	**Breadth :**	11,1 m
Displacement :	35 100 T	**Displacement :**	600 T
Draught Fwd :	8,08 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,08 m	**Draught Aft :**	3,54 m
Propulsion :	Var - Left	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1000 hp		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

RUN-12

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-12
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.2501'
Longitude :	066° 21.1548'
Heading :	311 °
Speed:	3,0 kts

Vessel Model :	BKCS15B
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	-1,4 m

Tide:

Flow	☑
Slack	☐
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	330 °	
Height :	0,75 m	
Period :	3,0 s	
Lenght :	4,4 m	

No Wind :	☐
Wind Direction :	330 °
Wind Force :	29,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :	°	
Height :	m	
Length :	m	
Period :	s	

Number of tugs:	2
Duration of exercise :	30m20s

General Comments :

Flood tide up to 1kt at 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS15B	**Tug Model :**	TUG16
Lenght :	229,0 m	**Lenght :**	30,8 m
Breadth :	32,3 m	**Breadth :**	11,1 m
Displacement :	39 000 T	**Displacement :**	600 T
Draught Fwd :	6,0 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,5 m	**Draught Aft :**	3,54 m
Propulsion :	Fixed - Right	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1600 kW		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

RUN-13

West Dalhousie Terminal, Ecorock Navigational study

Scenario :	SIM-13
Location :	Dalhousie, NB
Date :	23 avr. 2025

Movement

Arrival Port Side to	☐
Arrival Starboard Side to	☑
Departure Starboard Side to	☐

Departure position :

Latitude :	48° 04.2501'
Longitude :	066° 21.1548'
Heading :	311 °
Speed:	3,0 kts

Vessel Model :	BKCS15B
Tug Model :	TUG16

CURRENTS, TIDE & WIND

Current :	Slack Water	**Date simulator :**	16-juin-25
		Hour simulator :	09:00
		Level of water :	-1,4 m

Tide:

Flow	☑
Slack	☐
Ebb	☐

Current reference point:

Lat. :	N
Long. :	W
Direction:	°
Force:	kts

Waves :	☑	0%
Direction :	330 °	
Height :	0,42 m	
Period :	2,0 s	
Lenght :	6,0 m	

No Wind :	☐
Wind Direction :	330 °
Wind Force :	19,0 kts
Wind Gusts:	1,0 kts

Swell :	☐	
Direction :		°
Height :		m
Length :		m
Period :		s

Number of tugs:	2
Duration of exercise :	35m24s

General Comments :

Flood tide up to 1kt at 0.1kt/min.

2 tugs no bow thruster.

Description of vessel's models used :

Vessel Model :	BKCS15B	**Tug Model :**	TUG16
Lenght :	229,0 m	**Lenght :**	30,8 m
Breadth :	32,3 m	**Breadth :**	11,1 m
Displacement :	39 000 T	**Displacement :**	600 T
Draught Fwd :	6,0 m	**Draught Fwd :**	3,54 m
Draught Aft :	8,5 m	**Draught Aft :**	3,54 m
Propulsion :	Fixed - Right	**Propulsion :**	2 X Azimutal
Rudder :	Conventionnal		Fixed Pitch
Bow Thrusters :	1 X 1600 kW		

APA Representative(s) :	Jonathan Verbuyst	**Redactor :**	Alain Victor
Pilot :	Byron McLean	**Simulator Operator :**	Daniel Hriscan
		Simulator Operator :	Marie-Eve Lessard
Ecorock Representative(s) :	Guy Rousseau	**Simulator Operator :**	

APPENDIX 2
SHIP'S CHARACTERISTICS

BKCS05

BKCS15

BKCS05

PILOT CARD

BKCS05

Version K-Sim

Ship's header Quebec Electra

Call Sign CSEM **Deadweight** 36560 tonnes **Year built** 2013

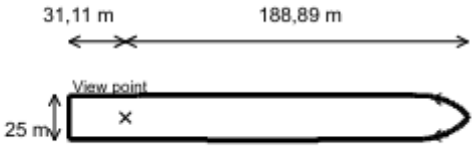
Loading condition: loaded			Loading condition: ballasted		
Draught aft	**Forward**	**Displacement**	**Draught aft**	**Forward**	**Displacement**
8,08 m/ 26 ft 6 in	8,08 m/ 26 ft 6 in	35122 t	6,90 m/ 22 ft 8 in	4,50 m/ 14 ft 9 in	18537 t

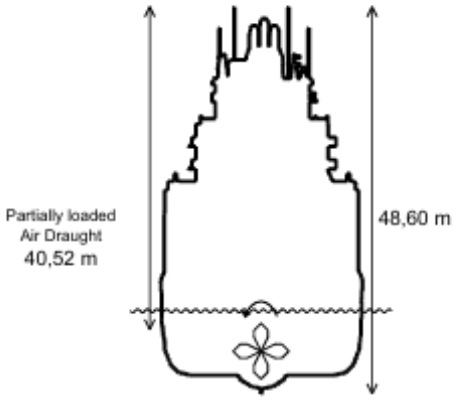
SHIP'S PARTICULARS

Length overall 222,5 m **Anchor chain:** **Port** 10,9 shackles **Starboard** 10,9 shackles

Breadth 23,8 m **Stern** N\A shackles

Bulbous bow Yes **(1 shackle = 27,432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 6252 kW (8500 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	1	115	76%	12,05	12,98
Full Ahead	0,8	105	65%	9,61	10,30
Half Ahead	0,5	90	48%	6,36	6,75
Slow Ahead	0,25	80	24%	3,11	3,26
Dead Slow Ahead	0,125	72	12%	1,52	1,56
Stop	0	72	0%	0,00	0,00
Dead Slow Astern	-0,125	72	-12%		
Slow Astern	-0,25	80	-24%		
Half Astern	-0,5	90	-48%		
Full Astern	-1	115	-57%		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °
Hard-over to hard-over 14,0 s
Rudder angle for neutral effect 0,0 °
Thruster: **Bow** 1x736 kW (1x1000 hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm		10 cm	**Rpm/pitch**
ARPA			**Rate of turn**		
Speed log		**Doppler:**	Yes / No		**Compass system**
Water speed			**Constant gyro error ±** ____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** ____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

WHEELHOUSE POSTER

BKCS05

Ship's header Quebec Electra **Call Sign** CSEM **Gross tonnage** 0 **Net tonnage** 0

Max. Displacement 36000 tonnes, and **Deadweight** 36560 tonnes, and **Block coefficient** 0,85 at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	Ballast
Trial / Estimated	Trial / Estimated
8,1 m forward	4,5 m forward
8,1 m aft	6,9 m aft

STEERING PARTICULARS

Type of rudder(s)	Normal
Maximum rudder angle	35 °
Time hard-over to hard-over with one power unit	28,0 s
with two power units	14,0 s
Rudder angle for neutral effect	0,0 °
Minimum speed to maintain course with engine stopped	N/A kn

ANCHOR CHAIN

	Chain length shackles	Max. rate of heaving shackles / min
Port	10,9	0,395
Starboard	10,9	0,395
Stern	N\A	N\A

(1 shackle = 27,432 m = 15 fathoms)

PROPULSION PARTICULARS

Type of engine Diesel , 6252 kW (8500 hp) Type of propulsion

Engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	1	115	76%	12,05	12,98
Full Ahead	0,8	105	65%	9,61	10,30
Half Ahead	0,5	90	48%	6,36	6,75
Slow Ahead	0,25	80	24%	3,11	3,26
Dead Slow Ahead	0,125	72	12%	1,52	1,56
Stop	0	72	0%	0,00	0,00
Dead Slow Astern	-0,125	72	-12%		
Slow Astern	-0,25	80	-24%		
Half Astern	-0,5	90	-48%		
Full Astern	-1	115	-57%		

Critical revolutions 32 rpm

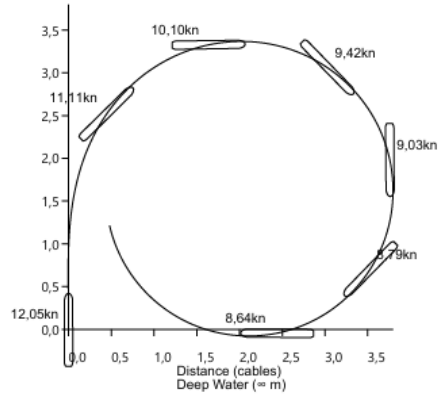
THRUSTER EFFECT at trial conditions

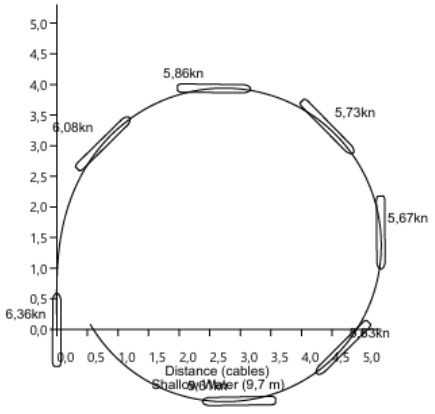
Thruster	kW	hp	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust
Bow	1x736	1x1000	5,0 s	s29,9 °/min	9,8 s
Stern	N/A	N/A	N/A	N/A	N/A
Combined	N/A	N/A	N/A	N/A	N/A

DRAUGHT INCREASE (LOADED)

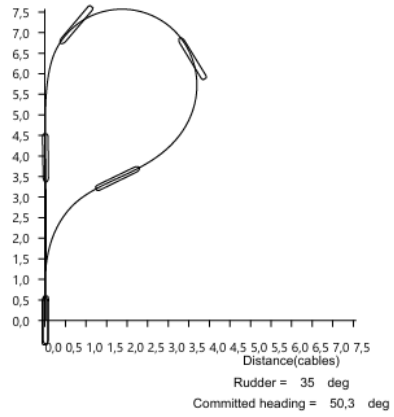
Estimated squat effect		
Under keel clearance (m)	Ship's speed (knots)	Max bow squat estimated (m)
8,1	3,1	0,08
	6,4	0,30
	12,0	0,92
4,0	3,1	0,08
	6,4	0,32

TURNING CIRCLES AT MAX.RUDDER ANGLE(35°)

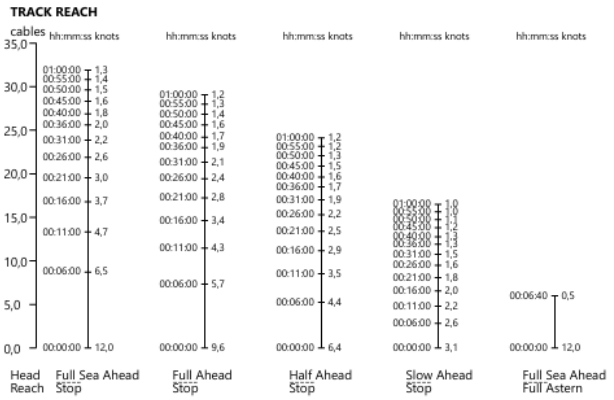




WILLIAMSON TURN

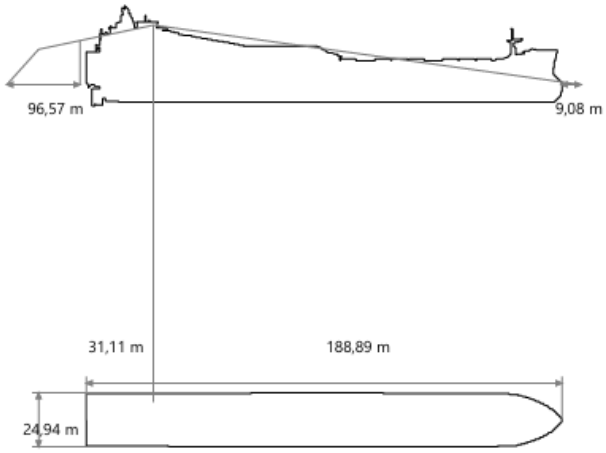


STOPPING CHARACTERISTICS



PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

BLIND ZONE



BKCS15

PILOT CARD

BKCS15
Version

Ship's header Quebec Hercules

Call Sign CSEM **Deadweight** 81750 tonnes **Year built** 2024

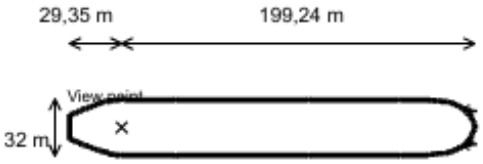
Loading condition: Loaded			Loading condition: Ballast			Loadi
Draught aft	**Forward**	**Displacement**	**Draught aft**	**Forward**	**Displacement**	**Draught af**
12,70 m/ 41 ft 8 in	12,70 m/ 41 ft 8 in	78005 t	8,50 m/ 27 ft 11 in	6,00 m/ 19 ft 8 in	39024 t	10,50 m/ 3

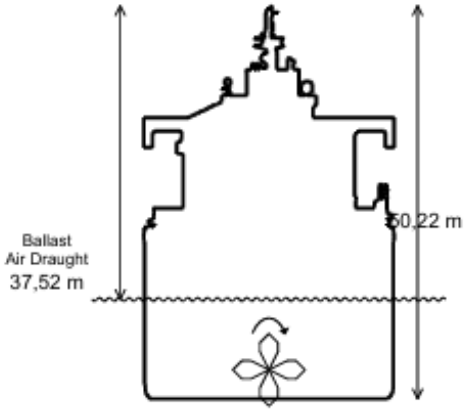
SHIP'S PARTICULARS

Length overall 229 m **Anchor chain:** **Port** 12,8 shackles **Starboard** 12,8 shackles

Breadth 32,3 m **Stern** N\A shackles

Bulbous bow Yes **(1 shackle = 27,432 m = 15 fathoms)**





PROPULSION PARTICULARS

Type of engine Diesel **Maximum power** 12711 kW (17282 hp)

Manoeuvring engine order		RPM	Pitch	Speed (knots)	
				Loaded	Ballast
Full sea speed	1	87	N\A	12,49	12,98
Full Ahead	0,8	80	N\A	11,49	11,96
Half Ahead	0,5	70	N\A	10,02	10,44
Slow Ahead	0,25	53	N\A	7,50	7,82
Dead Slow Ahead	0,125	34	N\A	4,71	4,92
Stop	0		N\A	0,00	0,00
Dead Slow Astern	-0,125	-34	N\A		
Slow Astern	-0,25	-53	N\A		
Half Astern	-0,5	-70	N\A		
Full Astern	-1	-87	N\A		

STEERING PARTICULARS

Type of rudder Normal **Maximum angle** 35 °
Hard-over to hard-over 19,0 s
Rudder angle for neutral effect 0,0 °
Thruster: **Bow** N/A kW (N/A hp) **Stern** N/A kW (N/A hp)

CHECKED IF ABOARD AND READY

Anchors			**Indicators:**		
Whistle			**Rudder**		
Radar		3 cm	**Rpm/pitch**		
ARPA			**Rate of turn**		
Speed log		**Doppler:** Yes / No	**Compass system**		
Water speed			**Constant gyro error ±** ____ °		
Ground speed			**VHF**		
Dual-axis			**Elec. pos. fix. system**		
Engine telegraphs			**Type** ____		
Steering gear					
Number of power units operating					

OTHER INFORMATION:

WHEELHOUSE POSTER

BKCS15

Ship's header Quebec Hercules **Call Sign** CSEM **Gross tonnage** 43240 **Net tonnage** 22460

Max. Displacement 78005 tonnes, and **Deadweight** 81750 tonnes, and **Block coefficient** 0,84 at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	Ballast
Trial / Estimated	Trial / Estimated
12,7 m forward	6,0 m forward
12,7 m aft	8,5 m aft

STEERING PARTICULARS

Type of rudder(s)	Normal
Maximum rudder angle	35 °
Time hard-over to hard-over with one power unit	38,0 s
Time hard-over to hard-over with two power units	19,0 s
Rudder angle for neutral effect	0,0 °
Minimum speed to maintain course with engine stopped	N/A kn

ANCHOR CHAIN

	Chain length shackles	Max. rate of heaving shackles / min
Port	12,8	0,371
Starboard	12,8	0,371
Stern	N\A	N\A

(1 shackle = 27,432 m = 15 fathoms)

PROPULSION PARTICULARS

Type of engine Diesel , 12711 kW (17282 hp) Type of propulsion

Engine order		RPM	Pitch	Speed (knots) Loaded	Speed (knots) Ballast
Full sea speed	1	87	N\A	12,49	12,98
Full Ahead	0,8	80	N\A	11,49	11,96
Half Ahead	0,5	70	N\A	10,02	10,44
Slow Ahead	0,25	53	N\A	7,50	7,82
Dead Slow Ahead	0,125	34	N\A	4,71	4,92
Stop	0		N\A	0,00	0,00
Dead Slow Astern	-0,125	-34	N\A		
Slow Astern	-0,25	-53	N\A		
Half Astern	-0,5	-70	N\A		
Full Astern	-1	-87	N\A		

Critical revolutions 26 rpm

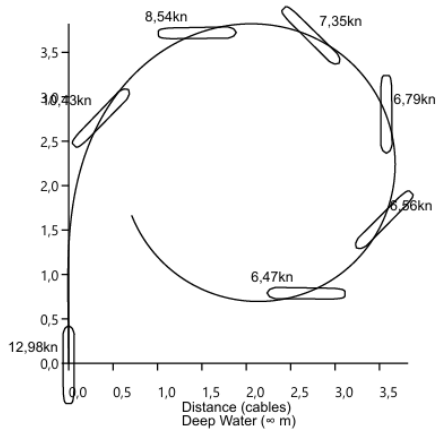
THRUSTER EFFECT at trial conditions

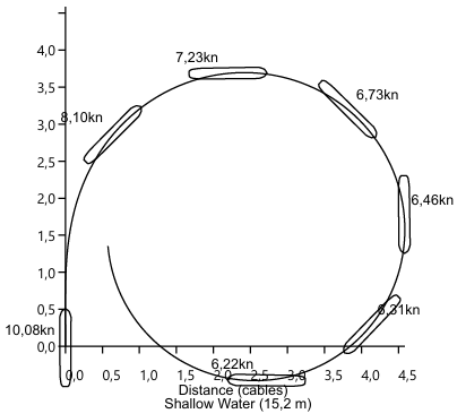
Thruster	kW	hp	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust
Bow	N/A	N/A	N/A	N/A	N/A
Stern	N/A	N/A	N/A	N/A	N/A
Combined	N/A	N/A	N/A	N/A	N/A

DRAUGHT INCREASE (Ballast)

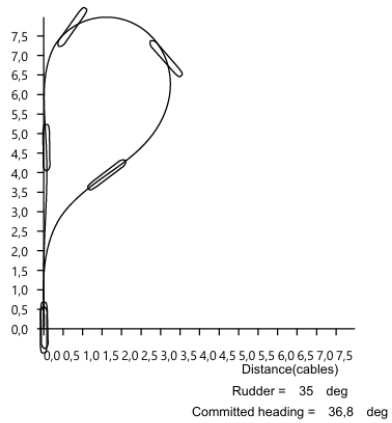
Estimated squat effect		
Under keel clearance (m)	Ship's speed (knots)	Max bow squat estimated (m)
7,2	8,1	0,26
	10,6	0,46
	12,8	0,68
3,6	7,6	0,27
	10,0	0,48

TURNING CIRCLES AT MAX.RUDDER ANGLE(35°)



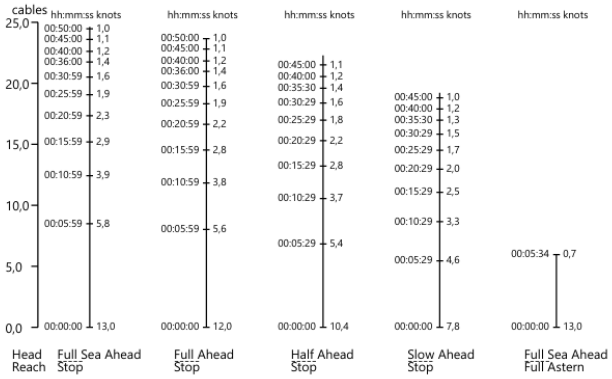


WILLIAMSON TURN



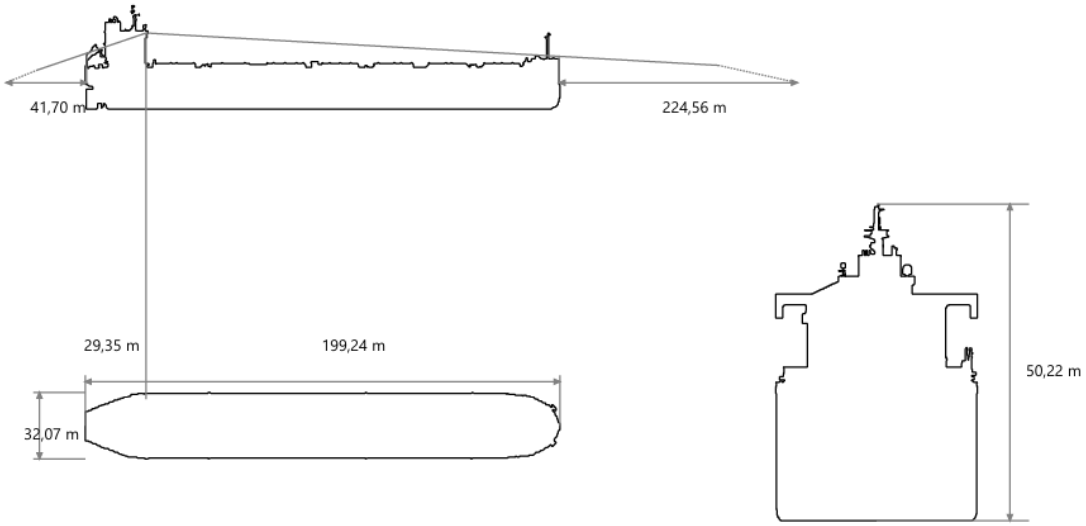
STOPPING CHARACTERISTICS

TRACK REACH



PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

BLIND ZONE



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