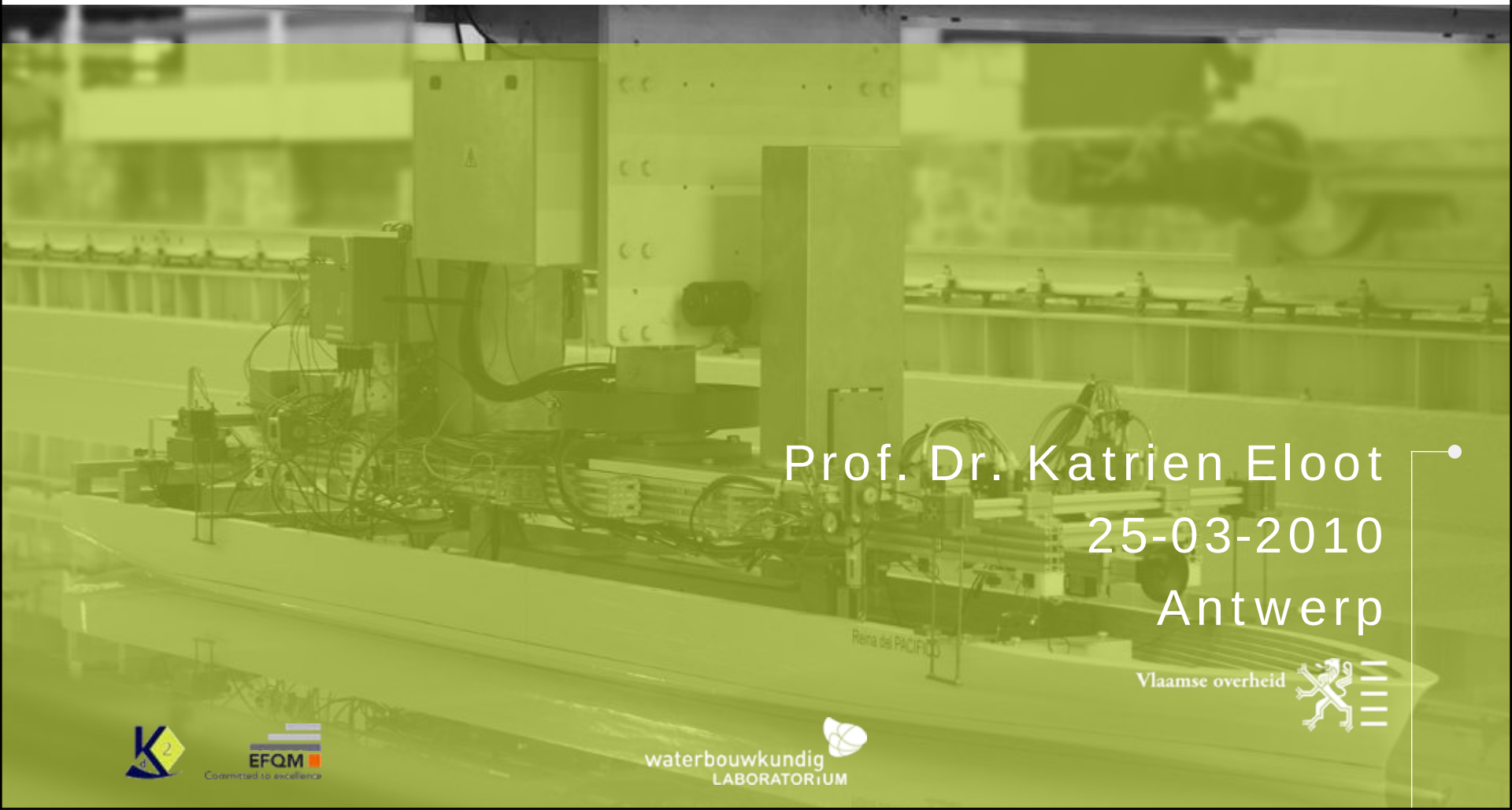
Ship Manoeuvring in Shallow and Confined Water



Prof. Dr. Katrien Eloot

25-03-2010

Antwerp

departement Mobiliteit en Openbare Werken

Vlaamse overheid

waterbouwkundig LABORATORIUM

EFQM Committed to excellence

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Summary

- Knowledge Centre Manoeuvring in Shallow and Confined Water
- History
- Purpose and objectives
- Recent and future projects
- Cooperation

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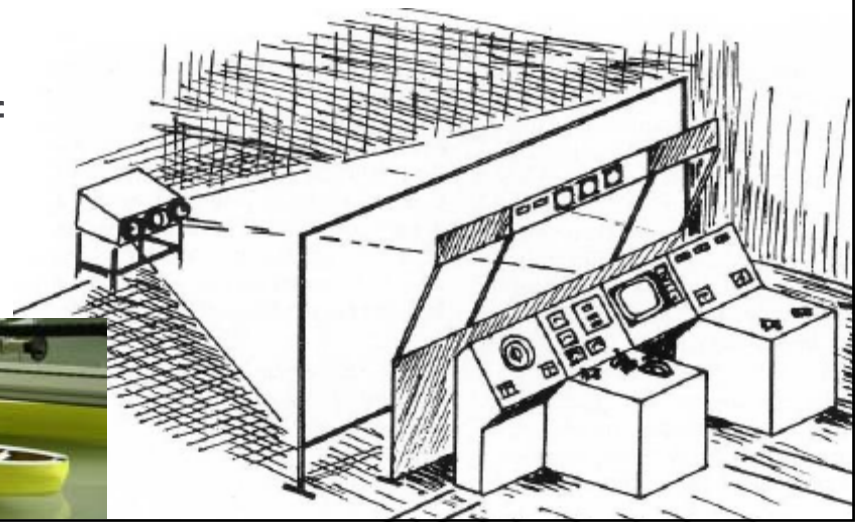
History

- 1904 Foundation of Maritime Technology at UGent
- 1933 Foundation of Flanders Hydraulics Research
- 1986 Exploration of the need for nautical research and Cooperation with the Maritime Technology Division of Ghent University
- 1986 – 1989 Installation of the ship manoeuvring simulator
- 1987 – 1992 Development of the Towing Tank for Manoeuvres in Shallow Water



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Purpose

- The Knowledge Centre was established in May 2008 to fix, extend and provide the scientific know-how on the behaviour of vessels in shallow or confined navigation areas. The Knowledge Centre supports the admission policy and the development of access channels to the Flemish harbours and inland navigation.
- Its organisation is a partnership between Flanders Hydraulics Research and the Maritime Technology Division of Ghent University.

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Purpose

- The Knowledge Centre will achieve these goals by consolidating and increasing the knowledge through:

- Objective A: documentation;
- Objective B: data management;
- Objective C: national and international collaboration.

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Objectives

Documentation

- A.1 Managing own literature (*Collecting and arranging*)

  Collecting and arranging of reports, publication and notes

- A.2 Managing external literature (*Acquisition*)

  Continuous literature study

- A.3 Distributing information (*Distribution*)

  Distributing information by a website and a periodical news letter. www.ondiepwater.be or www.shallowwater.be

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Knowledge Centre

History

The Knowledge Centre was established in May 2008 to fix, extend and provide the scientific know-how on the behaviour of vessels in shallow or confined navigation areas.

- 1904 *Scheepsbouwkunde* Ghent University
- 1933 Foundation of Flanders Hydraulics Research
- 1986 Nautical research and Co-operation Maritime Technology
- 1986 First ship manoeuvring simulator
- 1987 Initial Development of the Towing Tank
- 2008 Knowledge Centre Manoeuvring in Shallow and Confined Water

riodic newsletter

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Overview website

Knowledge Center	Research Topics	Facilities	Events
History Vision Structure	Ship to Ship Interaction Bank Effects Shallow Water Nautical Bottom Probabilistic Admittance Policy Inland Navigation Ship Hydrodynamics in a Lock	Towing Tank Lock Model Simulators Software	Ship to Ship 2011 Bank Effects 2009

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www.shallowwater.be

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latest newsletter

newsletter 2010 01

Latest newsletter

1 / 1 63.1% Zoeken

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The *Knowledge Centre Manoeuvring in Shallow and Confined Water* wishes you all the best for the year 2010.

New goals, wishes and intentions come with a new year. This is not different for our team and therefore we start with a periodical newsletter to inform you regularly on new developments and nautical research carried out at Flanders Hydraulics Research and Ghent University.

With the scientific support of the *Maritime Technology Division* of *Ghent University*, the *Knowledge Centre Manoeuvring in Shallow and Confined Water* has been created in May 2008. The goals of this Knowledge Centre are to consolidate, extend and disseminate the scientific and experience based knowledge on the behaviour of ships in shallow and confined water in order to support the admittance policy to the (Flemish) harbours and the development of waterways for seagoing and inland shipping. Read more

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Objectives

Data management

- B.1 Managing own data (*Collecting and arranging*)

  Easy access to data from the towing tank, mathematical models, etc.

- B.2 Deducing data from documents (*Distilling*)

  Collecting data from available literature and not based on a formal exchange with a research institute.

- B.3 Recommending future research (*Examining*)

  Based on the results of documentation management see (A) recommending future research as experimental research, theses, training, etc.

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Objectives

Collaboration

- C.1 Internal collaboration
  - ***C.1.1 Training***
  - ***C.1.2 Coordination* (formulating project plans and coordinating research projects).**
- C.2 Brainstorming group or sounding board ()

  The sounding board is an advisory group composed of all the important players of the internal maritime market.
- C.3 Advices for the Flemish Government, harbours, third parties (*Advising*)

  Giving limited advices to different (research) groups for new project plans.

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Objectives

Collaboration

- C.4 International collaboration
  - **C.4.1 *Temporary* (participation in international projects, organisation of training, workshops and conferences)**

    International Conference on Ship Manoeuvring in Shallow and Confined Water:

    May 2009: Bank Effects: Antwerp

    May 2011: Ship to Ship Interaction: Trondheim
  - **C.4.2 *Continuous* (a co-operation based on Memoranda of Understanding with foreign research institutes)**
  - **C.4.3 *Juridical framework* (co-operation based on contracts)**

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Bank Effects

International Conference on Ship Manoeuvring in Shallow and Confined Water: May, 2009, Antwerp, Belgium

The 1st Conference on Manoeuvring in Shallow and Confined Water has come to an end.

In partnership with the Royal Institution of Naval Architects, Flanders Hydraulics Research and Ghent University – Maritime Technology Division have taken the initiative for the organisation of this Conference with the purpose of making a modest contribution to a better understanding of the phenomena that dominate the behaviour of ships in restricted navigation areas. The organisers intended to create an additional forum for all parties involved in navigation in manoeuvring in shallow and confined waters, with a non-exclusive focus on ship-bank interaction effects or, in short, bank effects. The need for such an event has been proved by the attendance of about sixty delegates from fifteen countries, representing four continents. Although most of the sixteen speakers represented universities and research institutes active in the field of hydrodynamics and ship simulation, many participants had a strong relationship to the actual nautical practice. This diversity resulted in interesting interactions after the presentations and a fruitful group discussion. Finally, the delegates had the opportunity to become acquainted with the facilities of Flanders Hydraulics Research and the port of Antwerp during technical visits.

More information and pictures can be found on the website that was built for this conference.

The organisers would like to express their gratitude to all contributors to the success of this Conference. There would be no conference without delegates, without presenting authors

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Ship to Ship Interaction

2nd International Conference on Ship Manoeuvring in Shallow and Confined Water: May 18 - 20, 2011, Trondheim, Norway

Click here to download the first Call for abstracts

In many situations a reduced distance between two or more ships leads to hydrodynamic interactions. This is the case for waterways with dense shipping traffic, where meeting and overtaking manoeuvres are unavoidable and where moored ships are affected by passing ships. Ship-to-ship interactions also occur between tugs and vessels during escorting or manoeuvring and berthing assistance. Another type of operations dominated by hydrodynamic interaction concerns ship-to-ship operations for cargo transfer, as is more frequently performed in oil and gas transport.

Due to increasing ship dimensions, the effect of ship-to-ship interactions in channels and harbours become more and more important, since the dimensions of the navigation areas is not increasing at the same rate. Also applications of ship-to-ship cargo transfers are permanently developing, and are expected to take place in more severe environmental conditions.

After a successful conference on bank effects (Antwerp, May 2009), the Second Conference on Manoeuvring in Shallow and Confined Water will have a non-exclusive focus on Ship to Ship Interaction. This conference will be organised by the Royal Institution of Naval Architects, Flanders Hydraulics Research and Ghent University – Maritime Technology Division in association with the Norwegian University of Science and Technology and MARINTEK, who will host the event.

:ter

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Recent and future projects

New challenges

- Larger ships versus existing harbour infrastructure / fairway dimensions
- Actual ships versus new designed infrastructure
- Future design for future ships
- Etc.

Fundamental research

- Experimental Fluid Dynamics
- Computational Fluid Dynamics

Operational research

- Ship Manoeuvring simulator
- Desk study

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Recent and future projects

- Fundamental research
  - **Ship to ship interaction**
  - **Bank effects**
  - **Shallow water manoeuvring**
  - **Nautical bottom**
  - **Ship hydrodynamics in a lock**
  - **Inland navigation**
- Operational research
  - **Probabilistic admittance policy – ProToel**
  - **Upstream and downstream regulation for ULCS**
  - **Lock manoeuvres with ULCS**

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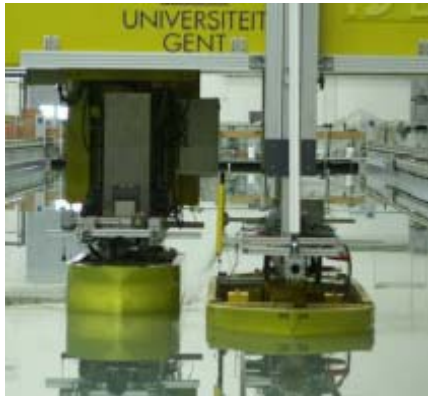
Ship to ship interaction

- Experimental program
  - **Encounters and overtaking manoeuvres**
  - **Lightering operations**
  - **Interaction tug – container ship**
  - **Interaction with moored ships (ROPES)**



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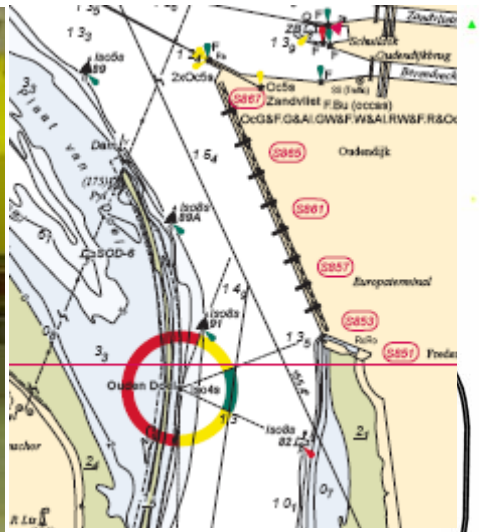
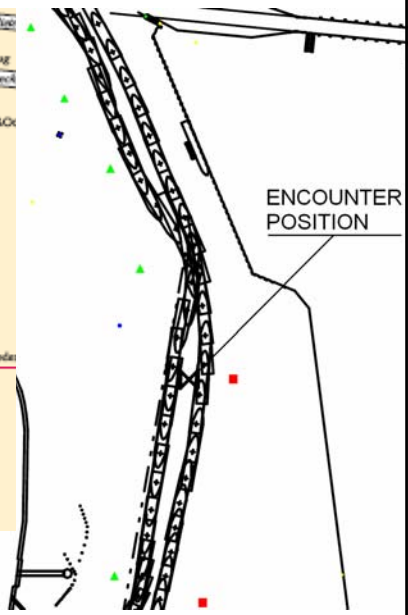
Bank effects

- Experimental program
- International collaboration
- Implementation in simulation database





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Bank effects

- Bank slopes (vertical wall, 1:5, 1:8, 1:1, 1:3, 1:4)
- Bank types: submerged and surface piercing
- Ship types
  - **Inland vessel class Va and estuary vessel**
  - **Container ships (8000 and 12000 TEU)**
  - **LNG carrier**
  - **VLCC**
  - **Theoretical Wigley hull**
- Operational parameters: bank distance, water depth, ship's speed, propeller rpm, rudder angle, etc.

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Shallow water manoeuvring

- Free-sailing model tests (based on standard full scale trials) in deep and shallow water
  - **Manoeuvring basin in BSHC in Varna**
    - Container ships, RoRo vessel, Car carrier, LNG carrier
  - **Towing tank in FHR in Antwerp**

    used for validation of mathematical models
- Captive model tests
  - **Towing tank in FHR in Antwerp**

    used for determination of mathematical models

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Shallow water manoeuvring

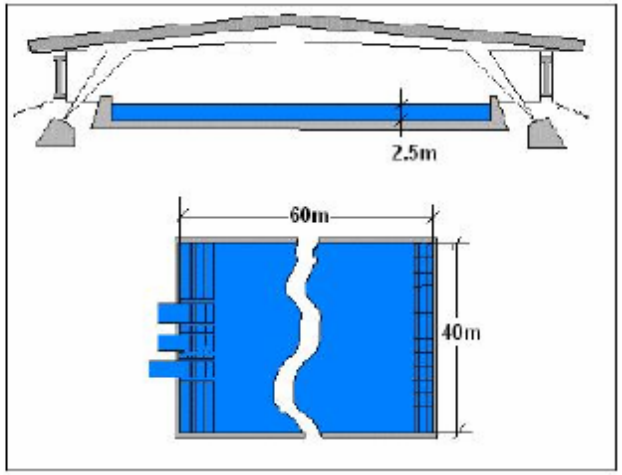

Fig. 3 Maneuvering basin main dimensions

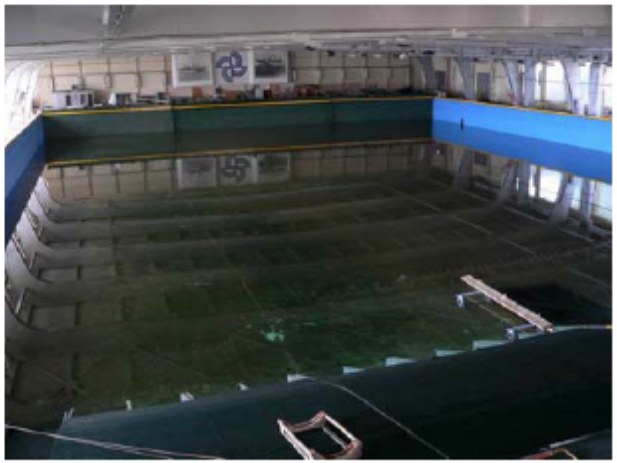

Fig.4 Maneuvering basin in shallow water condition

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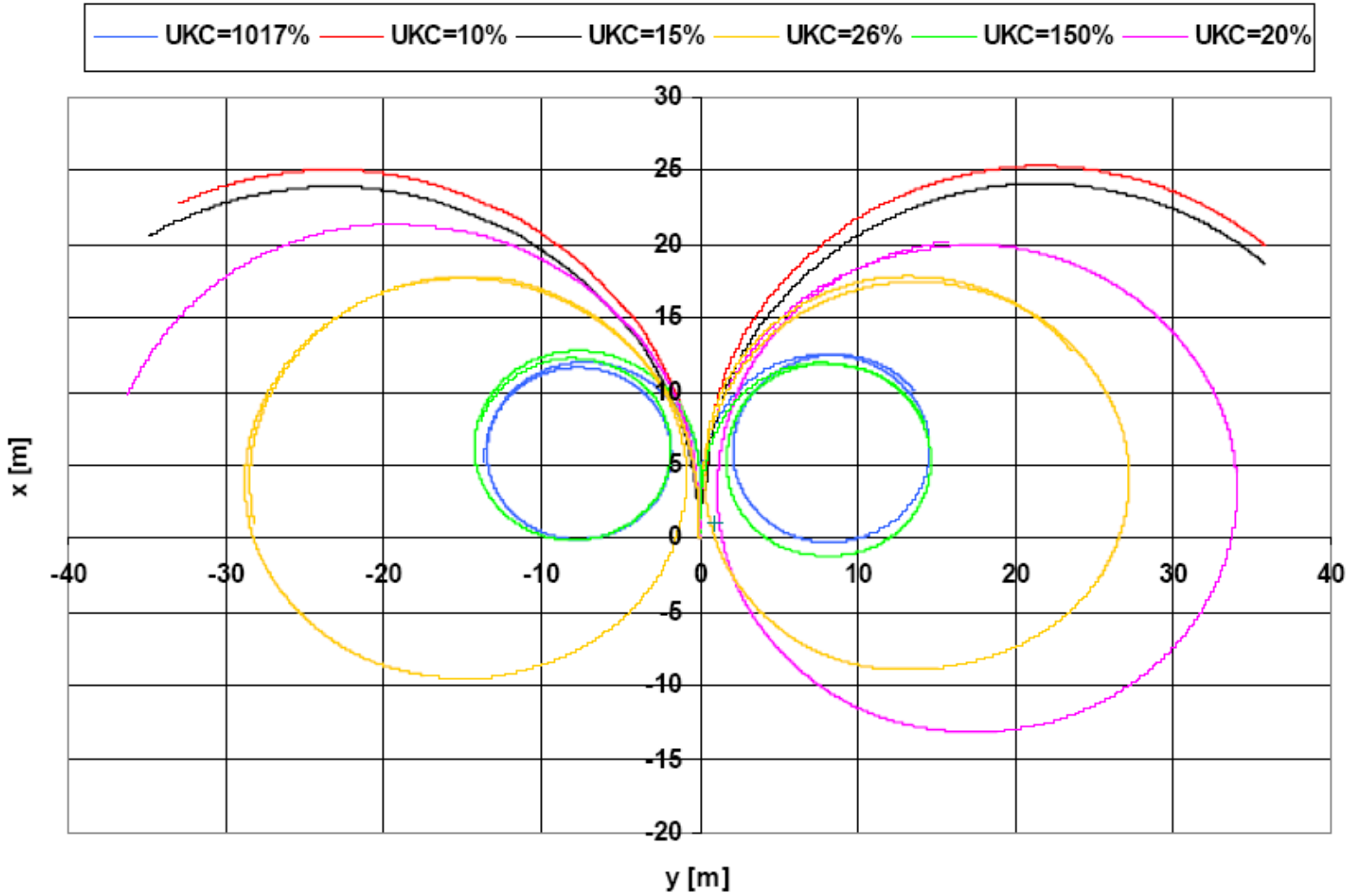
Shallow water manoeuvring



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Shallow water manoeuvring

Table 8. Summary of turning circle main characteristics

35_SB	UKC %	ADV	ADV/Lpp	TR	TR/Lpp	TD	TD/Lpp
	[%]	[m]	[-]	[m]	[-]	[m]	[-]
	1017	12.33	3.19	6.4	1.66	14.48	3.75
	150	11.88	3.07	6.8	1.76	14.66	3.79
	26	17.4	4.5	12.45	3.22	27.18	7.03
	20	19.89	5.15	15.94	4.13	33.99	8.8
	15	24.15	6.25	21.05	5.45		
	10	25.33	6.56	21.69	5.61		
35_Port	UKC %	ADV	ADV/Lpp	TR	TR/Lpp	TD	TD/Lpp
	[%]	[m]	[-]	[m]	[-]	[m]	[-]
	1017	11.81	3.06	-5.7	-1.48	-13.33	3.45
	150	12.66	3.28	-6.5	-1.68	-14.24	3.68
	26	17.64	4.56	-16.11	-4.17	-28.45	7.36
	20	21.36	5.53	-19.27	-4.99		
	15	23.89	6.18	-24.5	-6.34		
	10	25.08	6.49	-23.93	-6.19		

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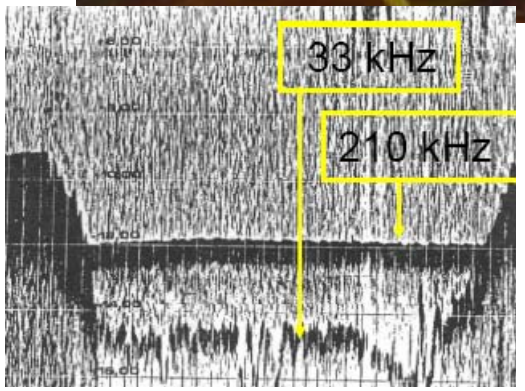
Nautical bottom

- Experimental program
- Simulation
- Validation at full scale

  in the port of
  Zeebrugge



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Full scale measurements

Read Only Connection to F180 Series

File View Calibration Logging Help

Source : Ethernet Log Mod

Real-Time Data: IMU Motion

Pitch	Roll
-0.11 °	-0.52
Heading	**On-line Heave**
87.12 °	0.02 m
Latitude	**Longitude**
51°12.2070' N	4°26.8544' E
UTC Time	**Speed**
10:24:10.3 31/08/2009	0.0 kn

Correction : RTK (2 cm)-Not received Power/Comms : Data On COM1

Message Log

31/08/2009 10:20:57(U): Warning: Heading lock has been lost.
31/08/2009 10:20:57(U): Info: Calibration status: Unknown
31/08/2009 10:20:58(U): Info: Heading lock has been acquired instantly.
31/08/2009 10:20:58(U): Info: Calibration status: In Progress
31/08/2009 10:20:59(U): Warning: Heading lock has been lost.
31/08/2009 10:20:59(U): Info: Calibration status: Unknown
31/08/2009 10:21:00(U): Info: Heading search in progress.
31/08/2009 10:21:10(U): Warning: No heading search in progress.
31/08/2009 10:21:11(U): Info: Heading search in progress.

Data not being logged

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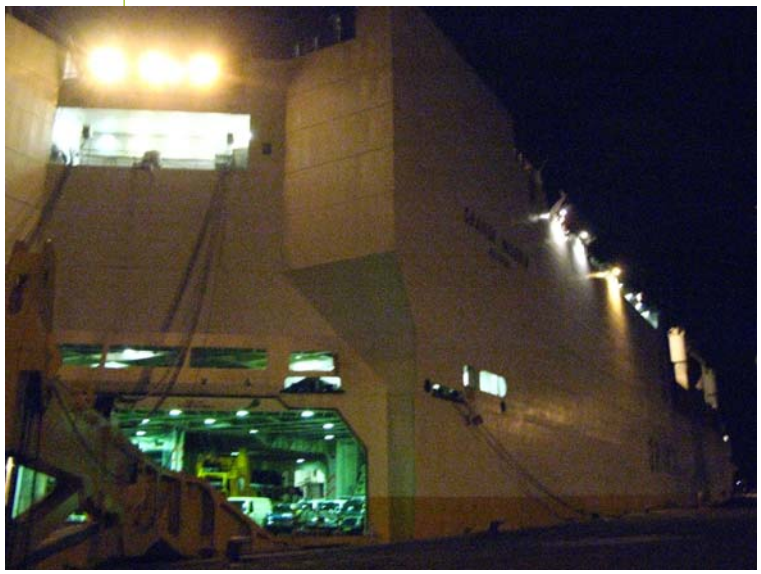

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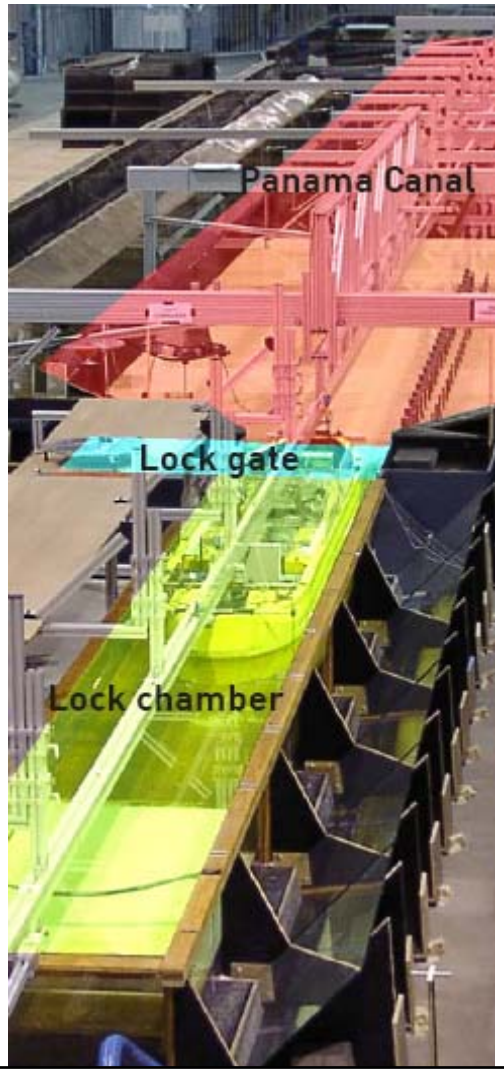
Ship hydrodynamics in a lock



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Ship hydrodynamics in a lock

- Kamsarmax bulk carrier
  in West lock Terneuzen
- Ship: 230 m, 37 m, 12.5 m
- Lock: eff. width 38 m

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Ship hydrodynamics in a lock

- Experimental research at model scale
- Hydrodynamics in a lock (blockage, ship's speed, wave profile, return flow, etc.)
- Mathematical modelling
- Simulation (research and training)

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Inland navigation

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Recent and future projects

- Fundamental research
  - **Ship to ship interaction**
  - **Bank effects**
  - **Shallow water manoeuvring**
  - **Nautical bottom**
  - **Ship hydrodynamics in a lock**
  - **Inland navigation**
- Operational research
  - **Probabilistic admittance policy – ProToel**
  - **Upstream and downstream regulation for ULCS**
  - **Lock manoeuvres with ULCS**

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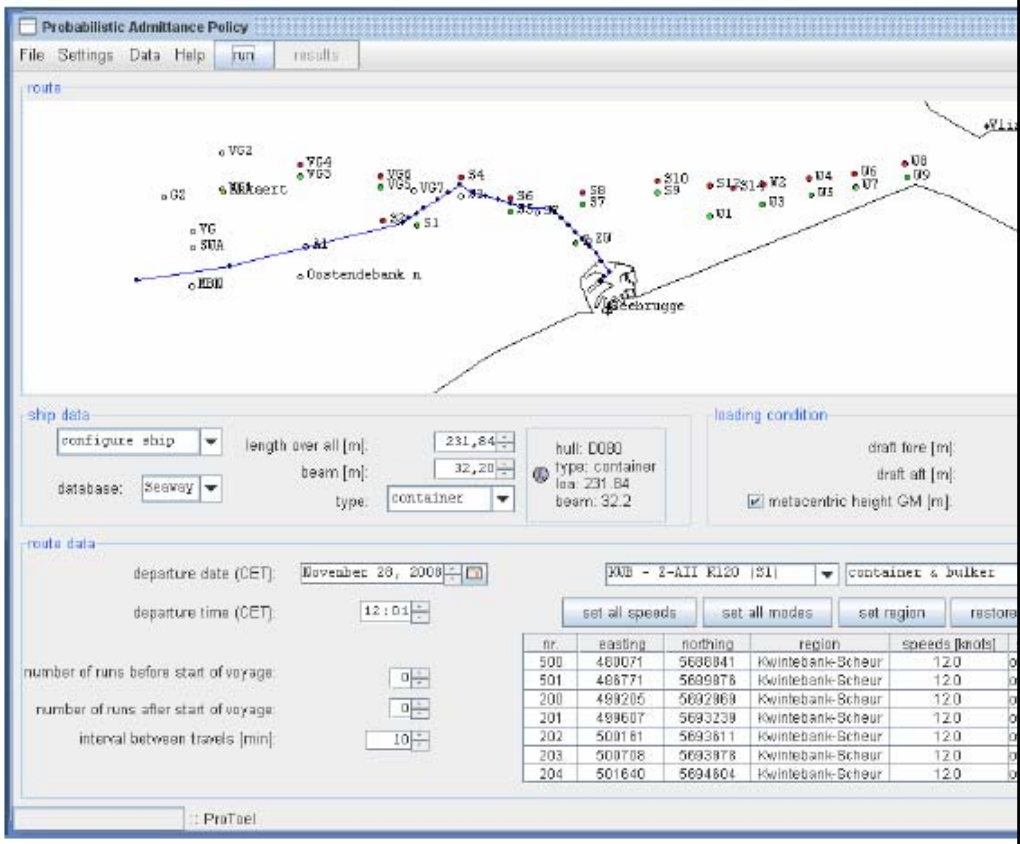
ProToel

- Probabilistic admittance policy for deep drafted ships
  - ProToel (versus Deterministic admittance policy)
    - **Port of Zeebrugge**
    - **future**

      Western Scheldt



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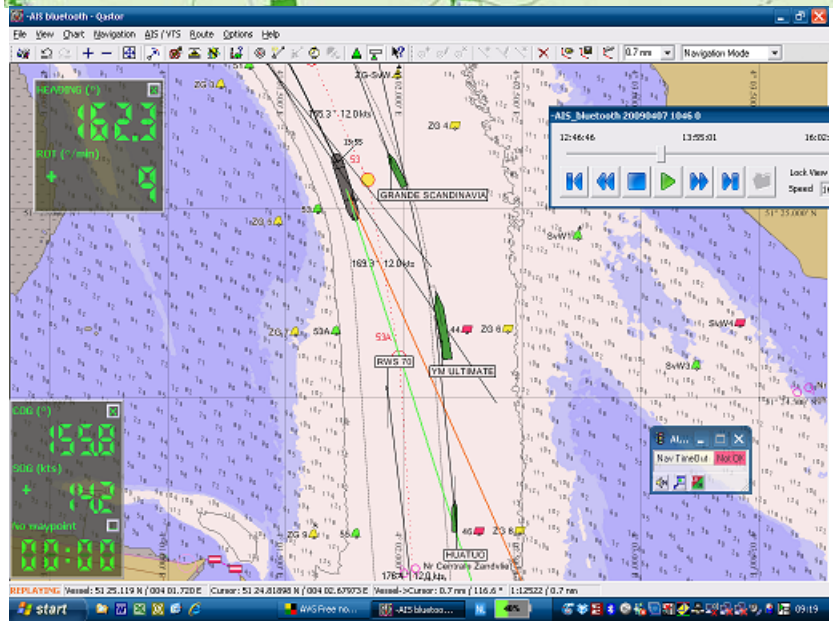
Upstream and downstream regulation for ULCS

- Ultra Large Container Ships

  Length 366 m to 400 m

  Beam 48.4 m to 56.4 m



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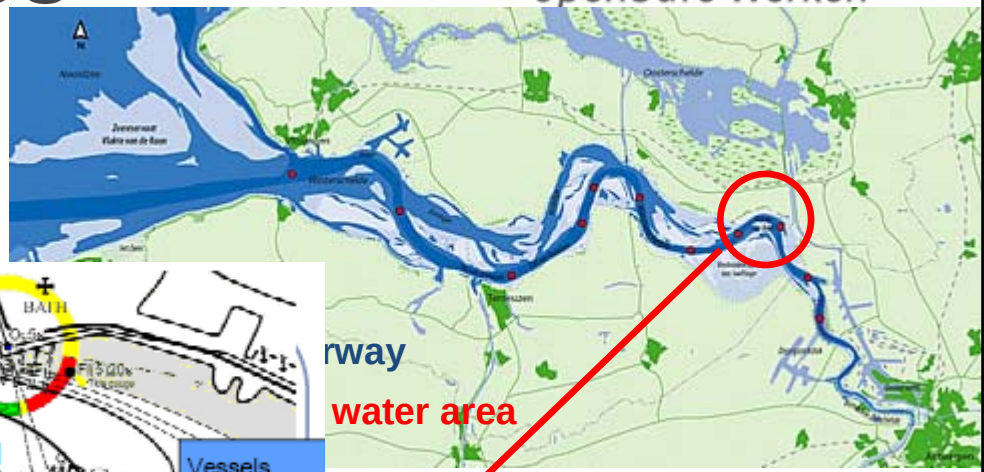
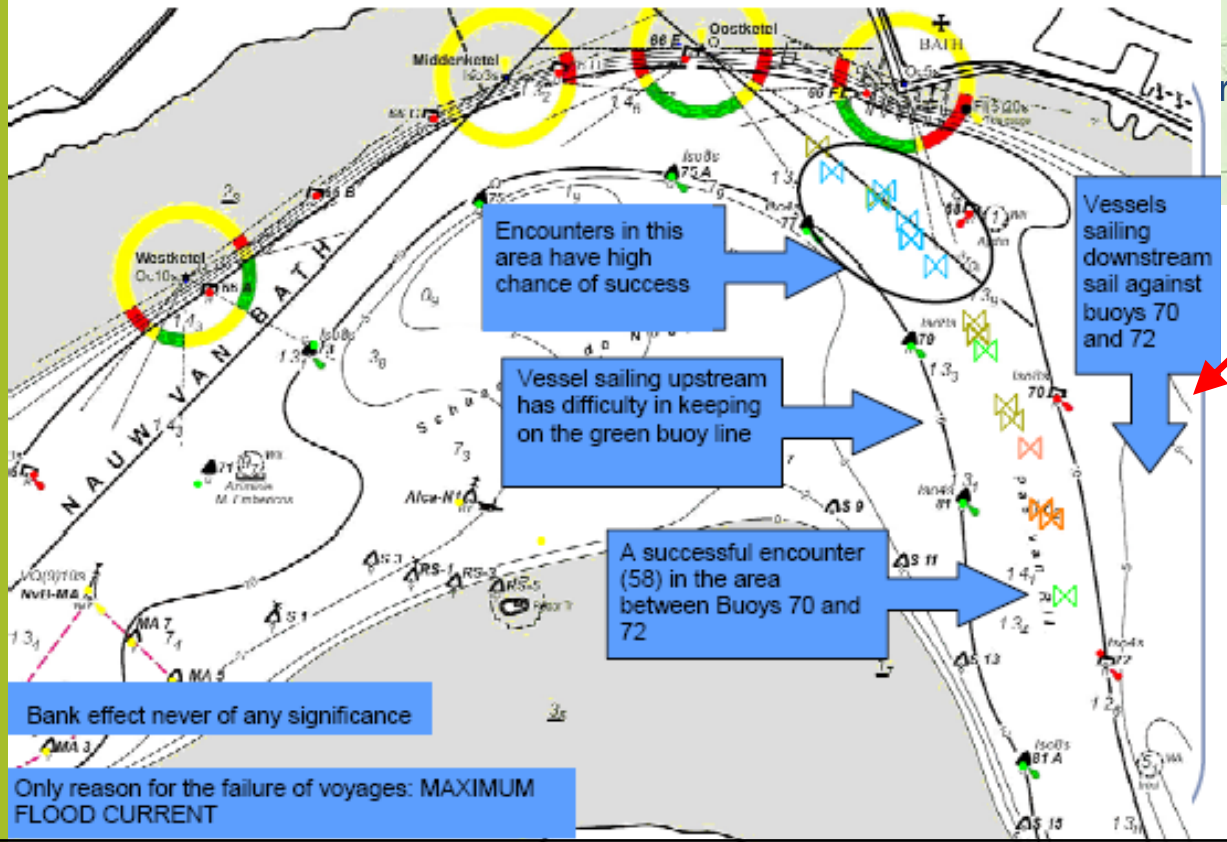
Upstream and downstream regulation for ULCS



rway

water area



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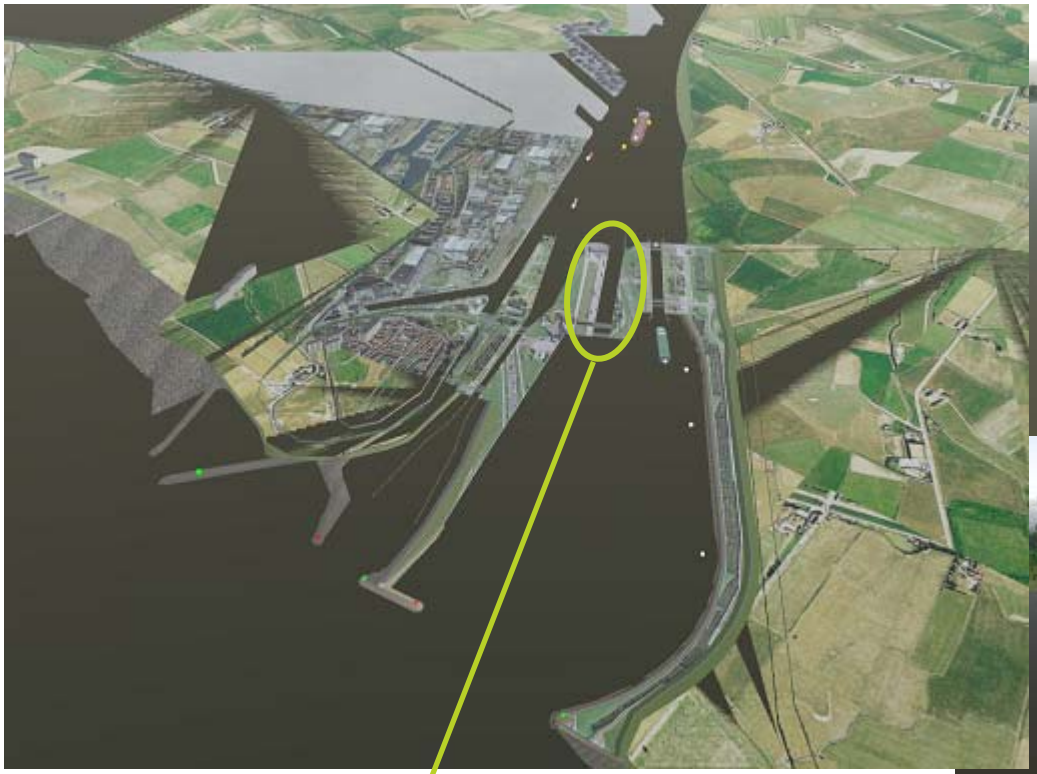
Lock manoeuvres with ULCS and bulk carriers



Accessibility study for a new lock in Terneuzen: lock 427 m x 55 m, design ship 366 m x 48.8 m x 14.5 m

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Summary

- Knowledge Centre Manoeuvring in Shallow and Confined Water
- History
- Purpose and objectives
- Recent and future projects
- Cooperation

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Cooperation

- These projects have been realized in close cooperation with all involved parties of the Flemish Government and private maritime companies: Flemish and Dutch Pilotage, Brabo pilots, Shipping Assistance Division, Agency for Maritime and Coastal Services, port authorities, tug companies, etc.
- A good cooperation is necessary to prepare, develop, execute, evaluate and validate these researches. Working together is the best way for tackling the problems and challenges related to ship manoeuvring in shallow and confined water.