Ship Manoeuvring in Shallow and Confined Water

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25-03-2010
Antwerp
Summary

• Knowledge Centre Manoeuvring in Shallow and Confined Water
• History
• Purpose and objectives
• Recent and future projects
• Cooperation
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
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.
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.
Objectives

• 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
Objectives

www.shallowwater.be

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 Schooobsouwknado Ghent University
- 1933 Foundation of Flanders Hydraulics Research
- 1964 Nautical research and Co-operation Maritime Technology
- 1986 First ship manoeuvring simulator
- 1987 Initial Development of the Towing Tank
- 2006 Knowledge Centre Manoeuvring in Shallow and Confined Water

www.shallowwater.be
latest newsletter

Newsletter 2010 01

The Knowledge Centre Manoeuvring in Shallow and Confined Water wishes you all the best for this 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 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 the 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 admission policy of the ( Fleming) hardware and the development of waterways for seagoing and inland shipping. Read more
Objectives

- 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.
Objectives

• 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.
Objectives

• 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)
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, without support from sponsors, without organisation, and without the support of the financial institution.
Objectives

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.
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
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
Ship to ship interaction

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

- Experimental program
- International collaboration
- Implementation in simulation database
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.
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
Shallow water manoeuvring

Fig. 3 Maneuvering basin main dimensions  Fig. 4 Maneuvering basin in shallow water condition
Shallow water manoeuvring
# Shallow Water Manoeuvring

## Table 8. Summary of Turning Circle Main Characteristics

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Nautical bottom

- Experimental program
- Simulation
- Validation at full scale in the port of Zeebrugge
### Full scale measurements

![Image of measurement equipment](image)

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Mobiliteit en Openbare Werken
Ship hydrodynamics in a lock
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
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)
Inland navigation
Recent and future projects

• Fundamental research
  • Ship to ship interaction
  • Bank effects
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  • 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
ProToel

- Probabilistic admittance policy for deep drafted ships
  - ProToel (versus Deterministic admittance policy)
- Port of Zeebrugge
- future Western Scheldt
Upstream and downstream regulation for ULCS

- Ultra Large Container Ships
  - Length 366 m to 400 m
  - Beam 48.4 m to 56.4 m
Upstream and downstream regulation for ULCS

- Encounters in this area have high chance of success
- Vessel sailing upstream has difficulty in keeping on the green buoy line
- A successful encounter (58) in the area between Buoy 70 and 72
- Bank effect never of any significance
- Only reason for the failure of voyages: MAXIMUM FLOOD CURRENT
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
Summary

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