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WP1 Hydrodynamic modelling

Erland Wilske
SSPA Sweden AB

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Content

- Scope of work, aims and objective
- WP 1 members
- Groups of interest
- Brief introduction to azimuth propulsion
- Modelling and test methods
- Validation methods and available data
- Some conclusion and identification of gaps of knowledge

Aims and objectives

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- **Review**
  - Identify groups of interest
  - Collection and summary of existing hydrodynamic knowledge
  - Modelling and test methods
  - Validation methods and available data
- **Summarize and assimilate (on-going)**
- **Impact (partly on-going)**
  - Best practice for manoeuvring model test procedures
  - Compile engineering lectures
  - Map out the landscape for future R&D

The WP 1 team

- **School of Marine Science and Technology - Newcastle University (Michael Woodward)**
- Broström Aktiebolag
- Cons.a.r – Italian Ship Owners Research Consortium
- **CTO, Ship Design and Research Centre (Jan Kanar)**
- **Development Centre for Ship Technology and Transport Systems (Andrea Gronarz)**
- FORCE Technology
- Foundation for Safety of Navigation and Environment Protection
- **Mettle (Marielle Labrosse)**
- SOGREAH Consultants
- South Tyneside College
- **SSPA Sweden AB (Erland Wilske)**
- STC - Scheepvaart en Transport College
- Transas Limited
- United Kingdom Maritime Pilots Association

Groups of interest

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- Description of ACD Types (Azimuthing Control Devices)
- Ship Types
- Simulator Manufacturers
- Simulator Facilities
- Test Facilities
- Shipping Companies
- Pilot Organizations

Types of azimuth propulsion

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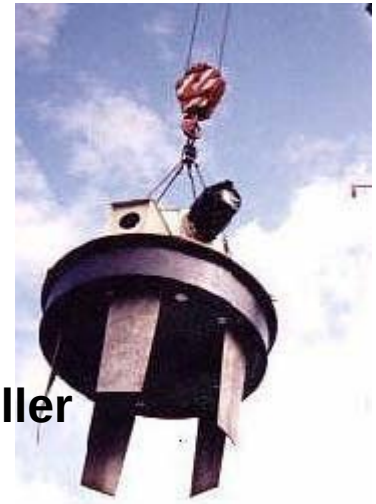
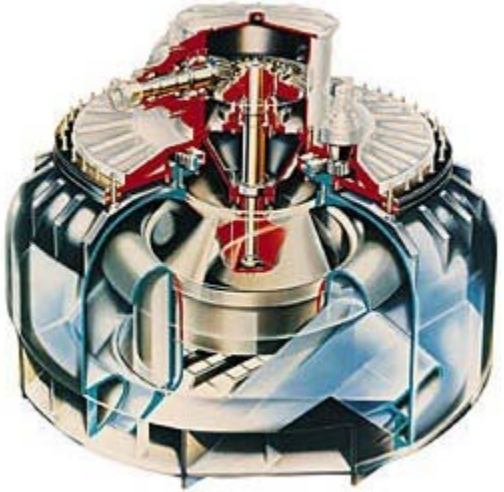
Steerable thruster



Voith Schneider Propeller

Podded propulsor



Schottel Pump Jet

Inside a pod

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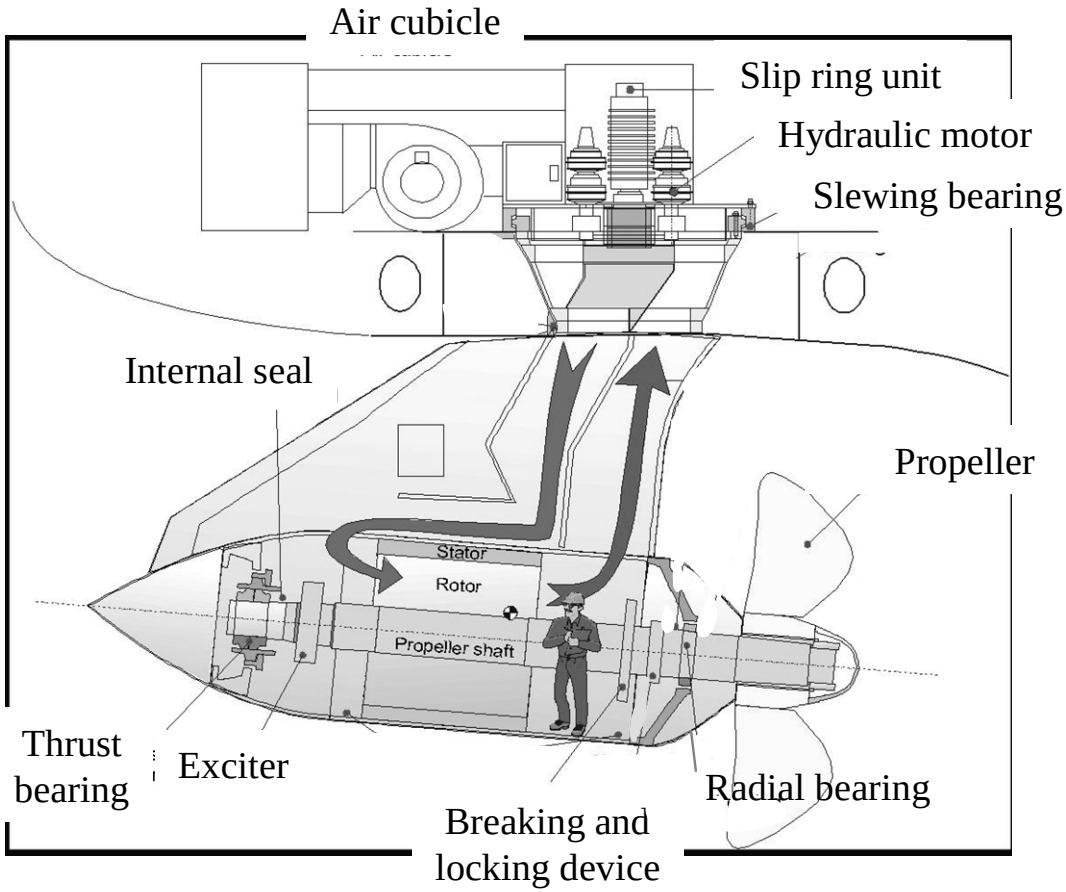

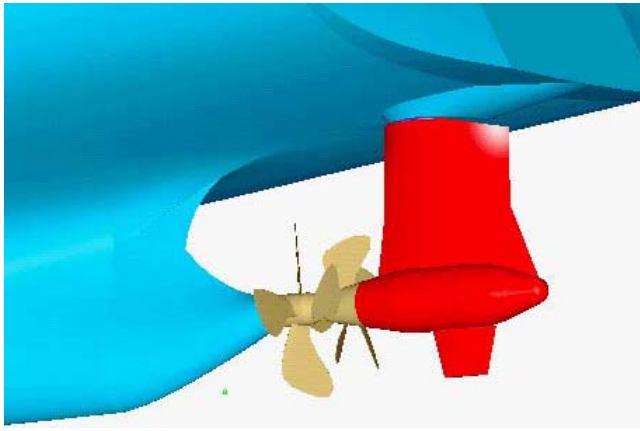

- Pulling or <u>pushing</u>
- Tandem propeller
- Contra rotating

Main POD manufactures

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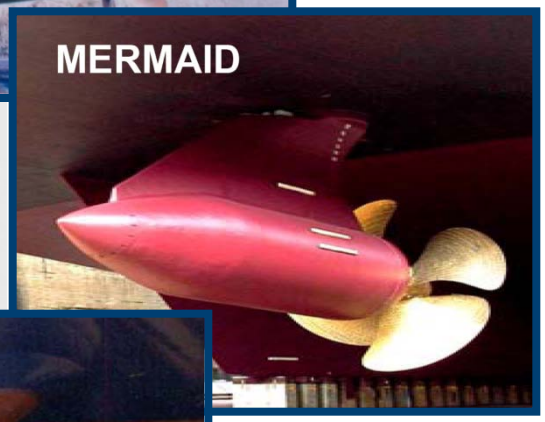
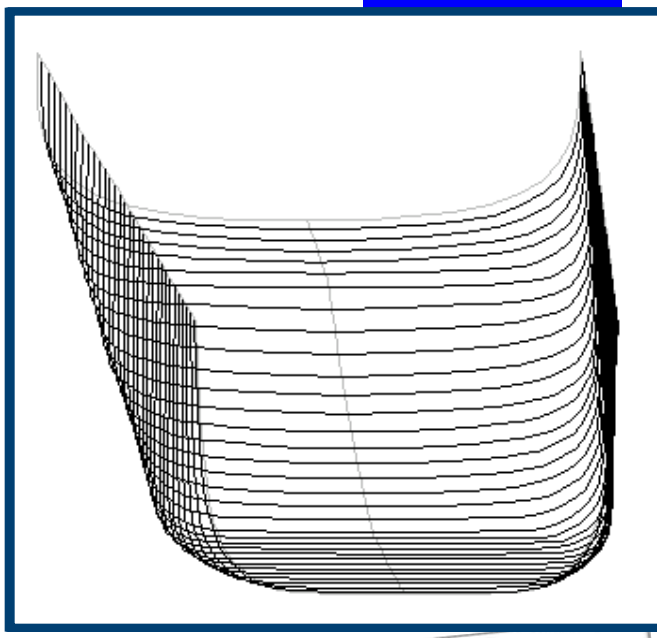


- **Azipod ABB Oy (AZIPOD)**
- **The consortium of a, Rolls Royce and ALSTOM (MERMAID)**
- **The consortium of SCHOTTEL GmbH & Co KG and Siemens SG Marine Solutions (SSP)**

Why pods?

- Improved speed-power efficiency
  - Better hull shape
  - Better alignment of propeller
  - Less resistance from appendage
- Improved manoeuvring performance



Queen Mary II - 4 x 21.5 MW Mermaid pods

Groups of interest – some statistics

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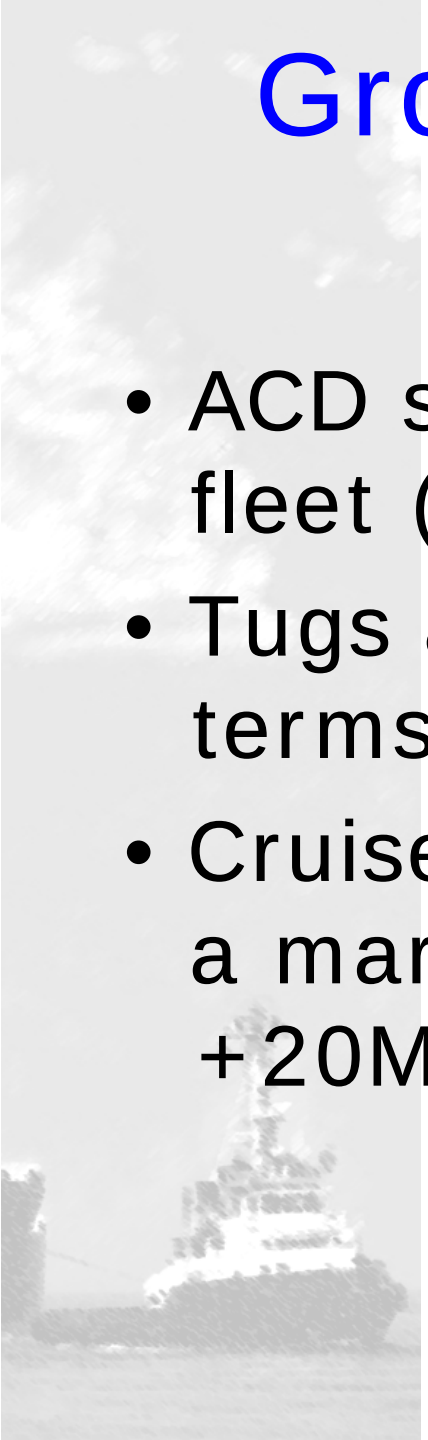
- ACD ship represent 7% of the world fleet (in number of ships)
- Tugs and off-shore dominates in terms of number
- Cruise ship and tankers have created a market for large ACD units (up to +20MW)



Some ship types

Typical ASD tug
“Dunker” operating in the Sounds

Double Acting Tanker
“Tempera”

Twin pod Cruise vessel - Elation
8% increase in propulsion efficiency fuel savings of 40t per week compared to convensional CP prop configuration

Statistics – ship with ACD

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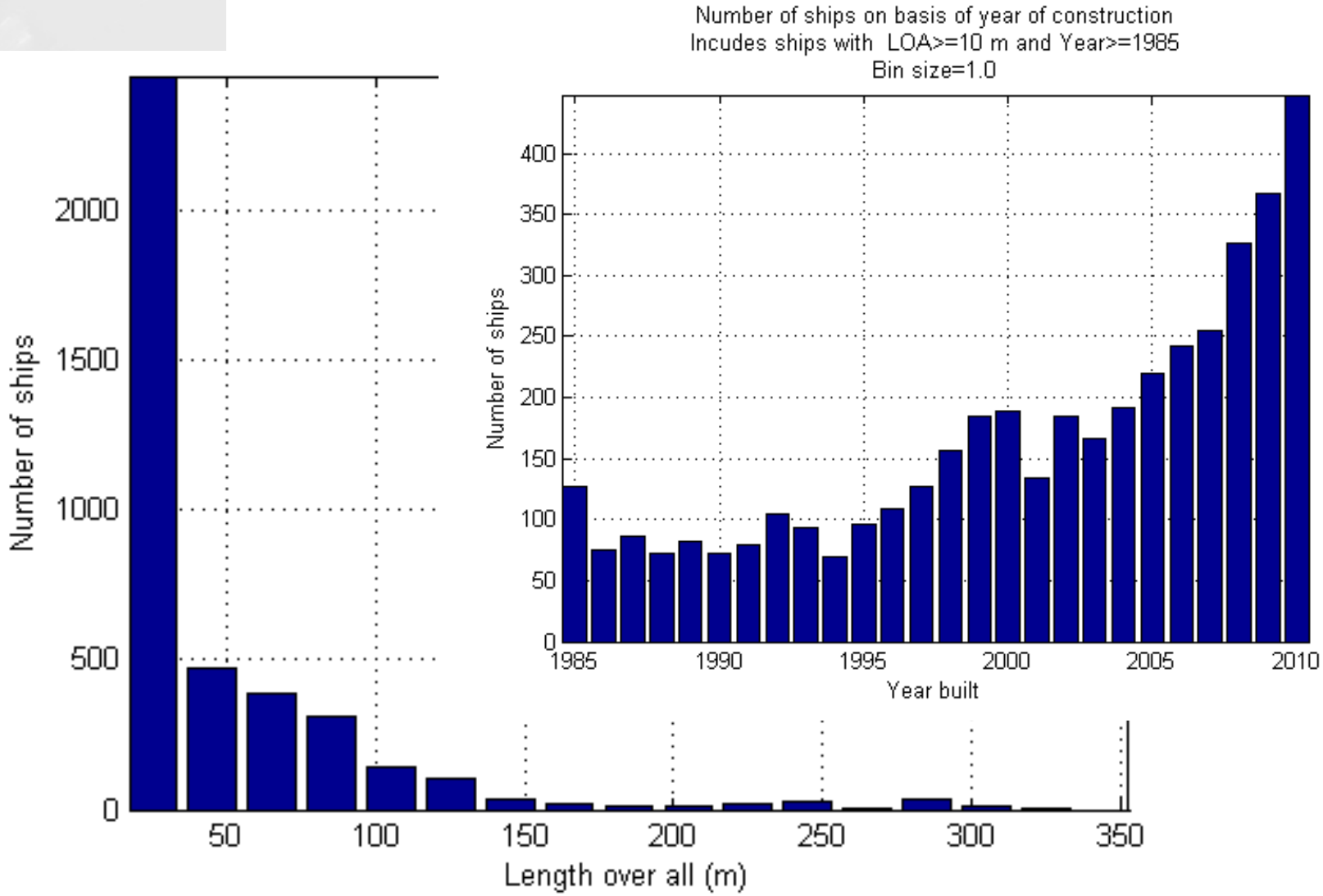
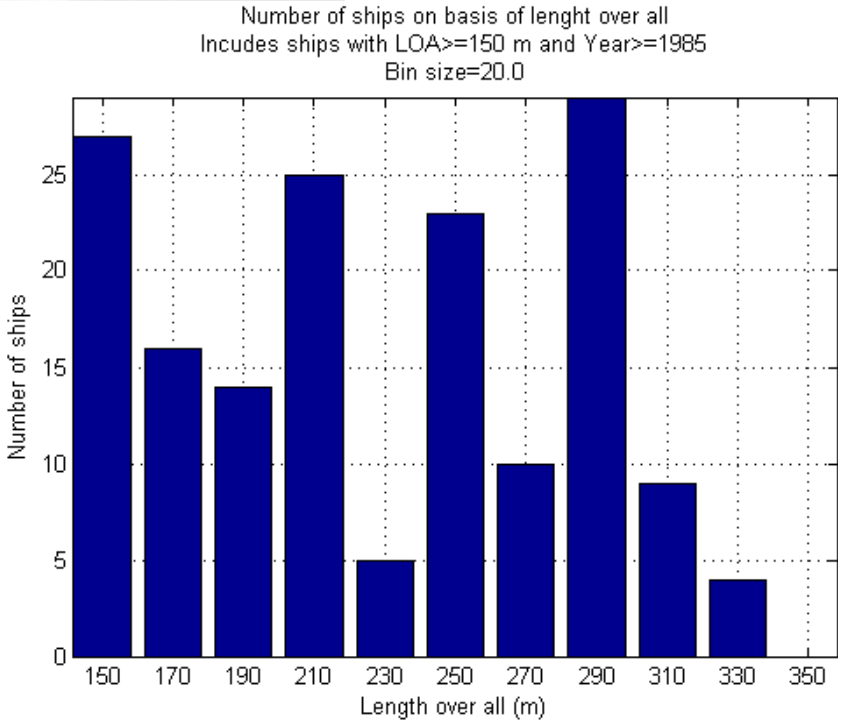
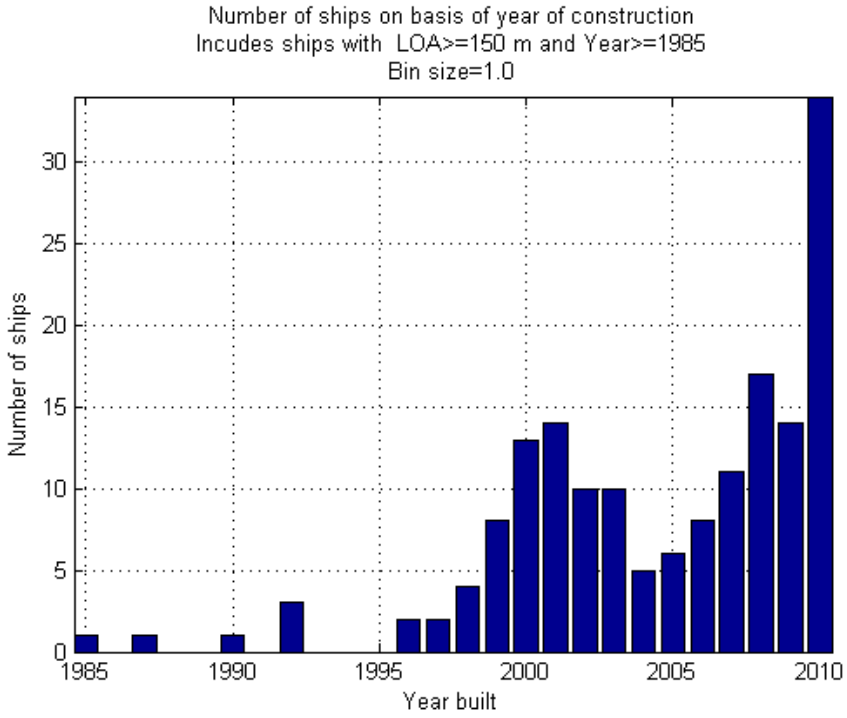


ACD ships with LOA > 150 m





Sources for ACD hydrodynamic modelling knowledge

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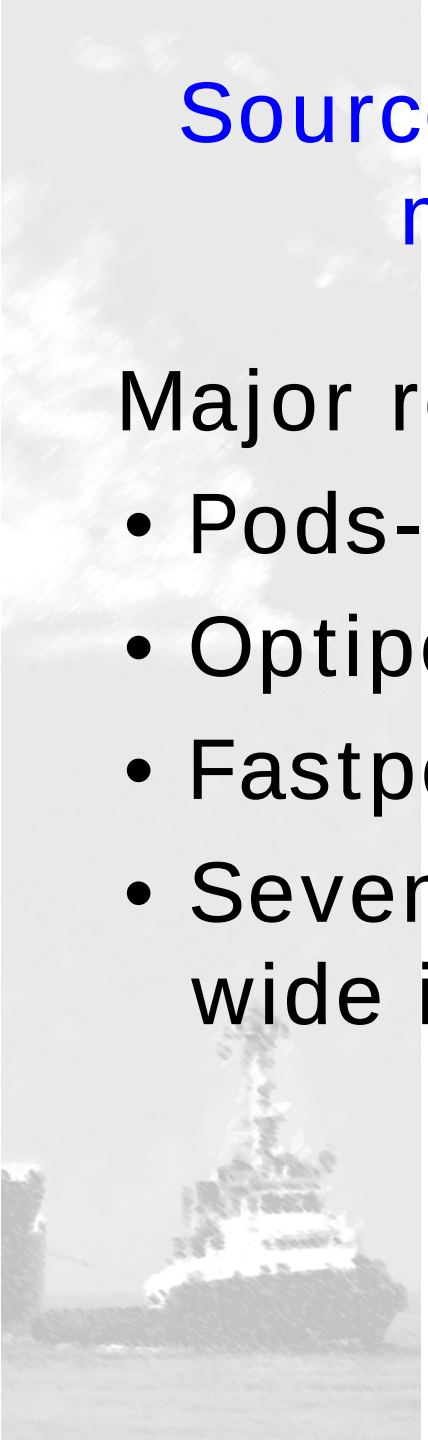
Major research projects

- Pods-in-service (2000-2003)
- Optipod (2000-2003)
- Fastpod (2002-2005)
- Seven other larger ACD project world wide identified



Sources for ACD hydrodynamic modelling knowledge

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Published knowledge

- ITTC - The Specialist Committee on Azimuthing Podded Propulsion
- Conference series – some important
  - T-Pod
  - MARSIM
  - Dynamic Positioning conferences
- Overview of literature comprising 90 paper (manoeuvring, Propulsive, operational and marine engineering)

Hydrodynamic issues

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- Speed-power prediction
- Prediction of structural load
- Manoeuvring prediction

Some preliminary conclusion Speed power prediction

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- Some difference among the test institutes for procedure
- Some concerns about precision in speed-power prediction
- Gap-effects
- Harmonisation to ITTC test procedure

Manouvering issues

- Course stability
  - Needs to be carefully stuied in the design
  - How should IMO manoeuvring criteria apply to ACD ships?
- Large heel angle
- Modelling of confined water effects
- Stopping procedure
  - Many options
  - Restriction due to structural loads

Model testing of roll angle

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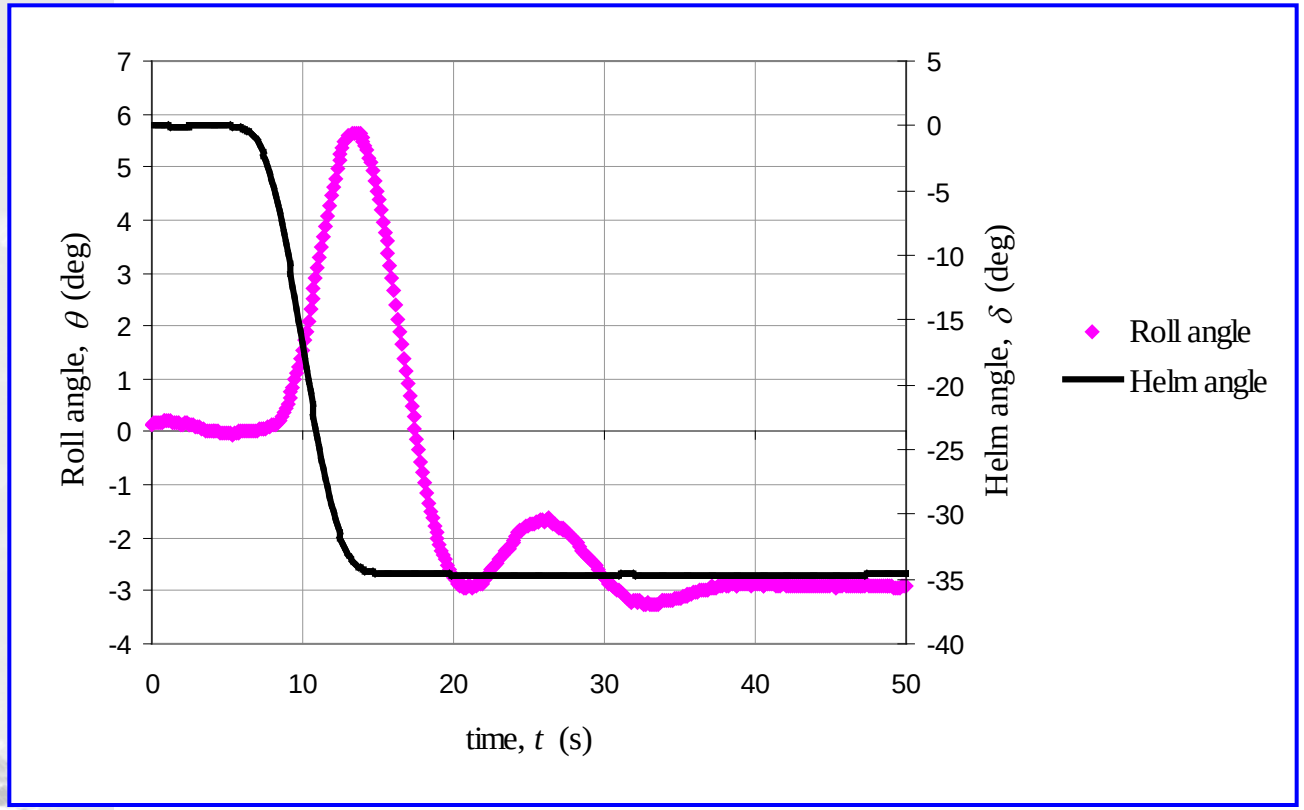

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Some preliminary conclusion Structural loads

- Indication that structural load is problems
- Spike load when turning
- Gyroscopic effect can be double the torque on the propeller axis.
- Slamming on the stern

Spike load during steering

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