AZIPILOT

WP3

MARITIME TRAINING
(22 person-months,
start: M0, end M36)

Jakob Pinkster
STC Group

Contents

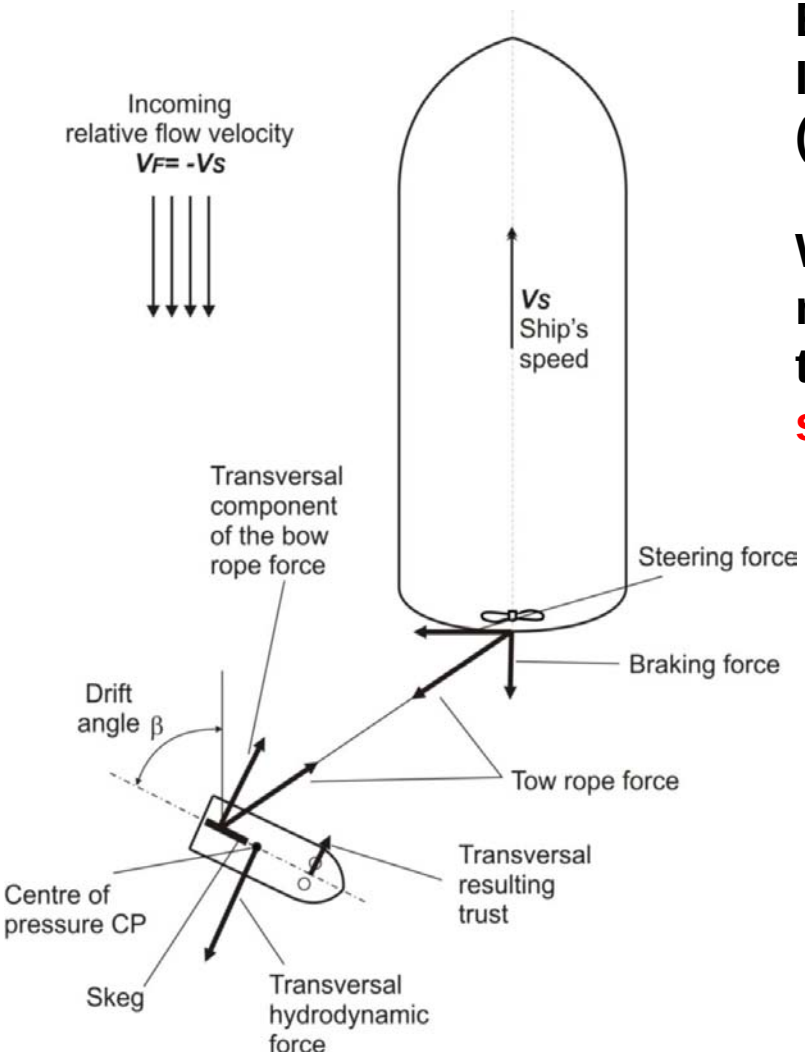
- Maritime Training ACD's
  - Who receives this?
  - What do we wish to be trained in?
  - condition ACD user (overloading?)
- Maritime Training how?
- Suggestions Maritime Training
- Conclusions/recommendations

How many people receive ACD Training?

AZIPILOT

- Approx. 7% vessels fitted with azimuting propulsion
- Largest groups being tugs, off-shore vessels and cruise liners.
- Rees (2010) reported
  - 8044 pilots questioned on ACD training 100%
  - 2334 responded (96% using azipods)
  - 736 (32%) received some ACD training 9%
  - few others received some instruction from manufacturers
  - others received no ACD training at all.
- ->1 in 11 pilots trained to pilot ACD vessel?

What do we wish to be trained in?



Example:
Indirect towing mode (distribution of forces)

What type of training do need to be able to do this type of difficult (highly stressful work)

Next slides show a schematic presentation of different arrest modes

Different manoeuvres tug boat

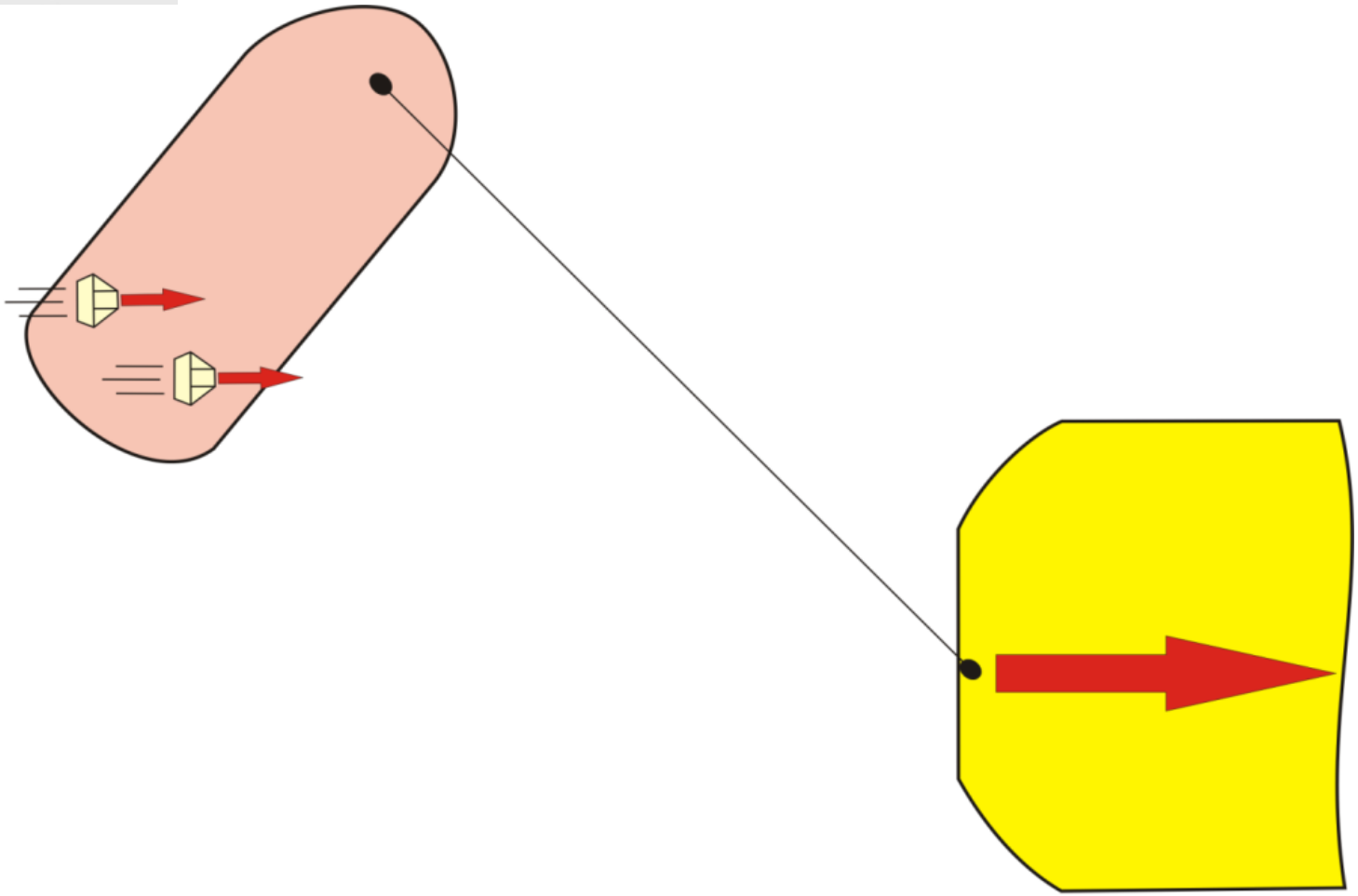
AZIPILOT

Direct Arrest Mode: *Reverse Arrest*

Direct Arrest Mode: *Transverse Arrest*

Different manoeuvres tug boat

AZIPILOT



Dynamic Arrest Mode: *Indirect Arrest Mode*

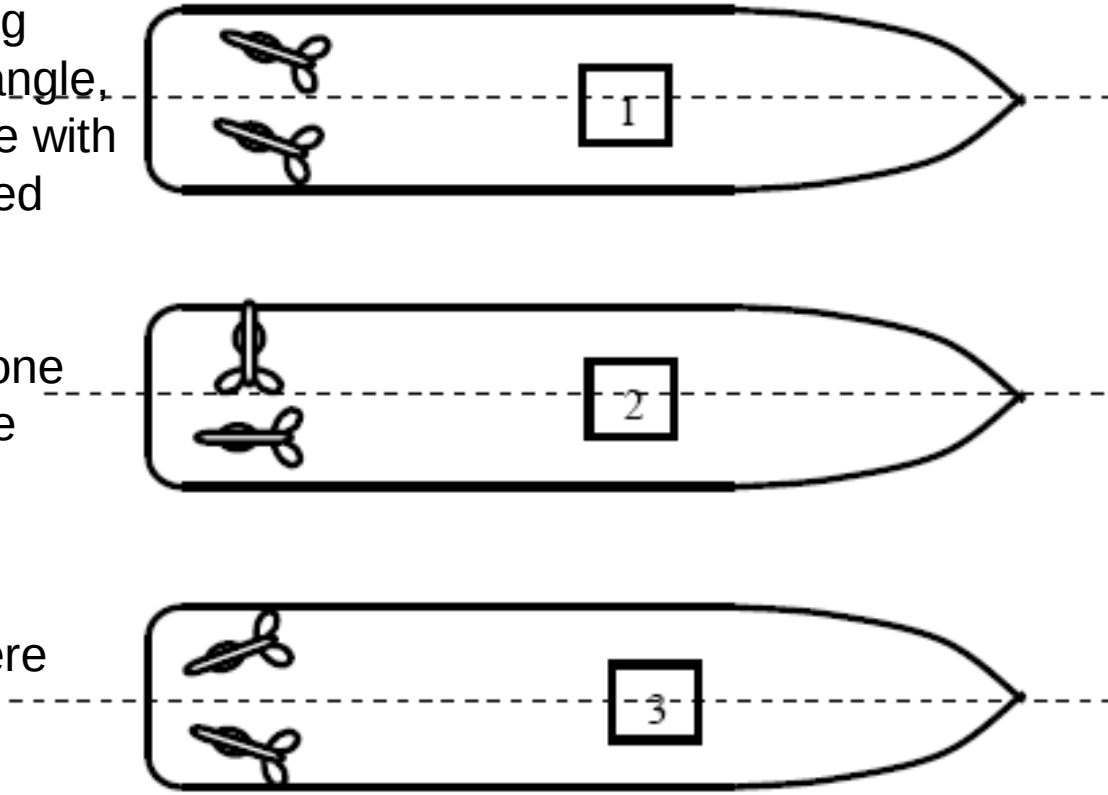
3 control modes for ACD's

AZIPILOT

1. Cruise manoeuvring mode, using both PODs deflected to the same angle, in a similar way as it is usually done with two rudders in twin-screw ships fitted with conventional propellers

2. Soft manoeuvring mode, when one POD (left or right, depending on the direction of turn) is used to perform maneuvers

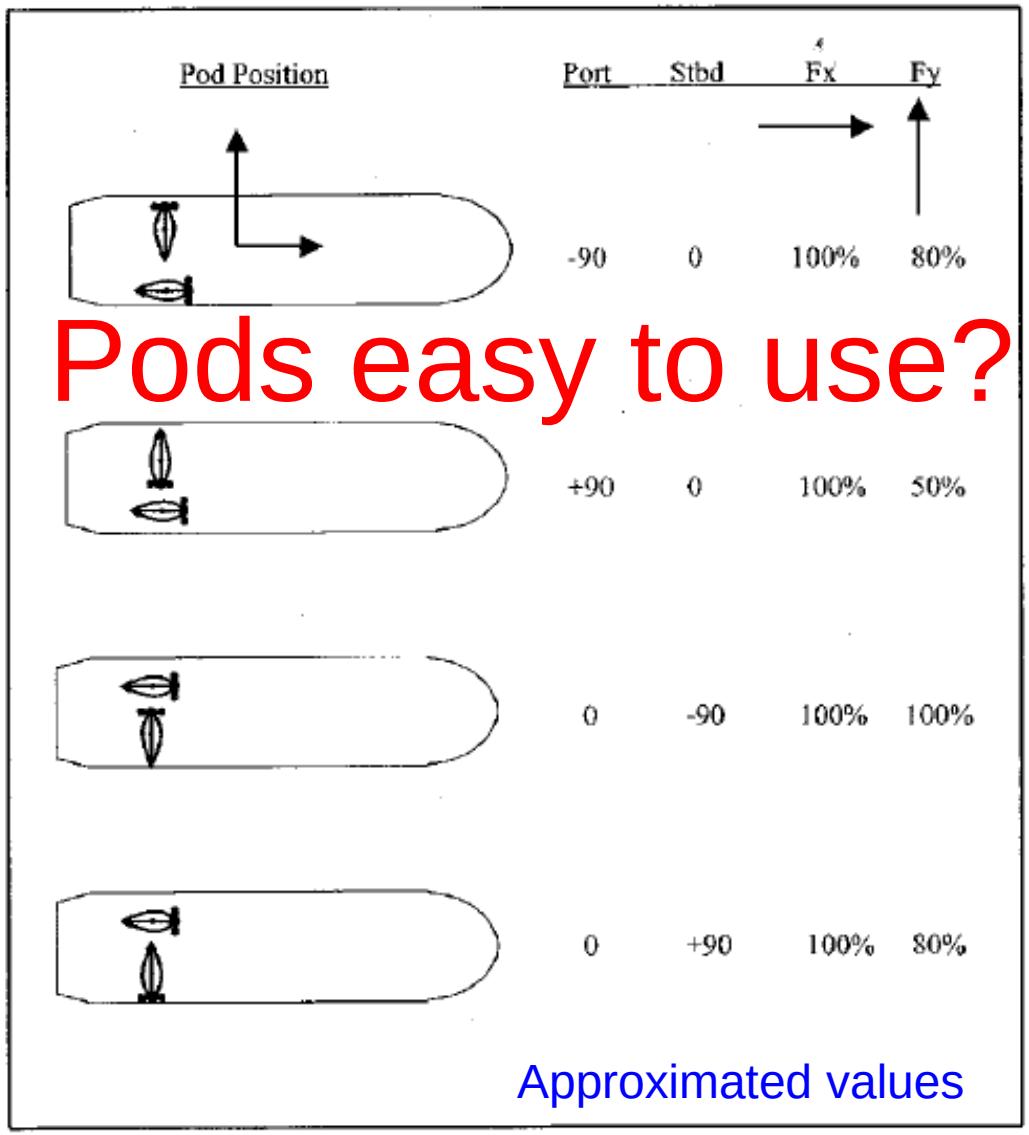
3. Strong manoeuvring mode, where both PODs are used to perform maneuvers



AZIPILOT

- Strong interaction may be expected when one POD is working in the propeller slipstream of the other one and this is affecting considerably thrust and torque.

Pod efficiencies



Pods easy to use?

Task analysis of ACD's

For various ship handling situations during voyage phases & review of over/under loaded working conditions.

- -open sea
- -anchor area approach
- -narrow channel/rivers
- -port basin and terminal approach
- -maneuvers with tug assistance

Practical experience with ACD's

AZIPILOT

Investigation (carried out via interviews and questionnaires) concerning:

-steering and course alterations

-crash stop

-steering with low speed

-maneuvering

-mooring

-side stepping

-ship handling in ice

-reverse rpm´s

Results from these investigations (1)

AZIPILOT

- Usual human factor methods prove useful to obtain data of task, environments and users on ASD tugs and in an ASD tug state-of-the-art simulator
- ASD tug work can be defined as an over-load environment
- Over-load and under-load environments bring different challenges to the human processing system.
- ASD tug maneuvering goes to the limit of human capability

Results from these investigations (2)

AZIPILOT

- Maritime training is needed for the experienced as well as the inexperienced navigator
- Training, education and experience optimizes decision making in complex dynamic situations
- Optimized decision making leads to optimized and safer tug work

Results from these investigations (3)

AZIPILOT

- Questionnaire proved useful as quantitative data source.
- Interview proved useful as qualitative data source.
- Controls are not optimally designed
- Degree of replication of bridge and equipment depend partially on purpose.
- Choosing “perfect” level of difficulty and complexity in ASD tug courses

Maritime Training

AZIPILOT

- For ACD vessels, MT faces more than enough challenges!

Maritime Training ACD's how?

AZIPILOT

- Via Simulators
- Via Manned models

Type of simulators

AZIPILOT

- Within the bridge-related simulator systems many types and levels of sophistication exist.

Category	Class	Function
1 Full Mission	Class A.	Bridge Operation
2 Multi Task	Class B.	Machinery Operation
3 Limited Task	Class C.	Radio Communication
4 Single Task	Class X.	Cargo handling

- Class A FMB necessary for ACD training

For ACD training

AZIPILOT

FMB simulators should reproduce properly the main manoeuvring characteristics:

- Turning characteristics
- Yaw control characteristics
- Course keeping characteristics
- Stopping characteristics

AND

be capable of simulating different factors influencing ship behaviour, at least:

- ☐ Shallow water effect
- ☐ Bank effect
- ☐ Effect of proximity of quay or pier
- ☐ Effect of limitation of dimensions of harbour basin
- ☐ Surface and submerged channel effect
- ☐ Ship-to-ship interaction
- ☐ Effect of current
- ☐ Effect of special rudder installations, including thrusters
- ☐ Effect of soft bottom and mud
- ☐ Ship-tug cooperation in harbour (low speed towing)
- ☐ Escorting operations using tugs
- ☐ Anchoring operations.

Full Mission Bridges?

AZIPILOT

•There are 14 simulated navigational bridges (and growing!) capable of being used together or individually. All bridges have a visual display with high quality day/night photo textured scenes.

• FMB's are controlled by computers programmed to simulate ship motion

- work in the real time
- controlled by rudder/engine/ACD
-in different environmental conditions

Models are made of ships and environment.

Operational scenario's developed and run with the human element at the vessel's controls!

Simulation run

AZIPILOT

Simulator manufacturers

Company	Address 1	Address 2	Address 3	Address 4	Tel	Fax	E Mail
Kongsberg Maritime	Bekkajordet 6	NO-3194	Horten	Norway	+47 81 57 37 00		km.simulation.sales @ koongsberg.com
Kongsberg Maritime	Bekkajordet 8A	N-3189	Horten	Norway	+47 33 03 23 14	+47 85 028 028	Solvi.opthun@ kongsberg.com
Transas Mediterranean SAS	Les 2 Arcs	1800 Route des Cretes	06560 Valbonne	France	+33 (0) 4 89 86 41 00	+33 (0) 4 89 86 41 29	med-sales @transas.com paul.dollery @ transas.com
Applied Research International	B-1, Hauz Khas	New Delhi - 110016		India	+91-11-4165512 3-28	+91-11-2685833 1	info @ariworld.com
FORCE Technology	Maritime Division: Hjorteka ersvej 99	2800 Lyngby		Denmark	+45 72 15 77 96		info @ forcetechnology.com (Cathrine M. Steenberg)
L-3 Maritime Product and Service	2961 West California Avenue	Salt Lake City	Utah 84104	USA	888-259-4746	801-983-9900	
L-3 Marine Systems UK	Innovation Drive	Burgess Hill	West Sussex, UK	RH15 9TW	(44) 0-1444-247535		burgess.hill-office @L-3com.com
BMT SeaTech	Grove House	7 Ocean Way Ocean Village	Southampton	SO14 3TJ	+44 (0)23 8063 5122	+44 (0)23 8063 5144	enquiry @ bmtseatech.co.uk
MARIN, Wageningen (main office)	P.O. Box 28	6700 AA Wageningen		The Netherlands	+31 317 49 39 11	+31 317 49 32 45	info @marin.nl

Manned models

Model of POD driven 140000 m3 gas carrier in SHRTC

AZIPILOT

Model length 11.5 m

(Manned model centres:
-Port Revel Shiphandling
- Shiphandling Research and Training Centre, Ilawa, Poland)

Model of Azipod tractor tug used in SHRTC

AZIPILOT

The tug models are used in escorting operations.

Manned models working together

AZIPILOT

Examples of some present ACD training courses

AZIPILOT

STC B.V. Centre for Simulator Maritime Research & Training owned by STC Group, Rotterdam, The Netherlands	Ship Handling course (with or without Azimuthing drives)	3-5	Basic and advanced ship handling courses are given by STC. Depending on the wishes of the clients these courses can be given for ships with/without azimuthing drives.
STC B.V. Centre for Simulator Maritime Research & Training owned by STC Group, Rotterdam, The Netherlands	Tug Handling course (with or without Azimuthing drives)	3-5	Basic and advanced ship handling courses are given by STC. Depending on the wishes of the clients these courses can be given for ships with/without azimuthing drives.
FORCE Technology DENMARK	Tug Handling Course	Variable	During theoretical lessons and practical simulator exercises, the participants shall: • Enhance their knowledge of, and skills in – ASD tug manoeuvring. • Enhance their knowledge of Human Factor Issues and skills in the use of Human Factor Issues, such as communication, planning, briefing and situational awareness. • Enhance safety by applying the proper procedures for conducting safe tug operations.

FMB simulator

Examples of some present ACD training courses

AZIPILOT

- Port Revel (France)

Offers a 5-day course on azipod driven ships since 2006.

- At SHRTC 3 day and 5 day course designed for masters, chief officers from ships equipped with podded propulsion units and pilots from harbours operating such ships is offered.

MODEL TRAINING PROGRAMME ON AZIPODS DRIVEN SHIP FOR MASTERS OR PILOTS FOR FULL MISSION BRIDGE SIMULATORS

AZIPILOT

Objectives of training

- Improve safety at sea by providing participants with knowledge and skill about methods of safe operation of ships driven with azimuthing propulsion devices in different situations, including harbour approaches, berthing and unberthing, docking, negotiating narrow passages, in wind and current conditions.
- Help participants to understand interaction effects, such as effect of shallow water and canal effect, bank effect, interaction between two ships when passing or meeting.
- Counteract complacency by exposing participants to unique and unusual situations relevant to marine environment.
- Provide experience in full bridge team participation using procedures for error management combined with safe and efficient communication.
- Conduct training during critical stage of transferring controls from the centre console to the bridge wings.

MODEL TRAINING PROGRAMME ON AZIPODS DRIVEN SHIP FOR MASTERS OR PILOTS FOR FULL MISSION BRIDGE SIMULATORS

AZIPILOT

Lectures

•General information on the simulator facility. Principles of work and operation of azimuthing propulsion devices. Types of ships with azimuthing propulsion devices and types of azimuthing propulsion.

•Manoeuvring characteristics of ships equipped with azimuting propulsion devices. Pivot point. Basic manoeuvres. IMO requirements related to manoeuvrability. Forces acting on the manoeuvring ship.

•Human factor issues. Effect of human factor on failure probability. Communication, planning, briefing and situation awareness. Bridge team work.

•Operation modes of azipod driven ships. Various modes of stopping. Slow speed manoeuvring. Harbour manoeuvres. Tugs assisted manoeuvres.

•Effect of wind, current, shallow water, canal effect, and bank effects and ship/ship interaction effect.

•Operational recommendations and limitations for ships driven by azimuthing propulsion devices,

•Principles of risk analysis and planning to avoid risks to occur and to handle cases of failures on board.

MODEL TRAINING PROGRAMME ON AZIPODS DRIVEN SHIP FOR MASTERS OR PILOTS FOR FULL MISSION BRIDGE SIMULATORS

AZIPILOT

Pratical exercises

- Familiarization with the simulator. Procedures for start-up and stop. Familiarization with controls and equipment. Unberthing and berthing; crabbing towards the jetty or away from the jetty without or with bow thruster used.
- Navigating in different modes: cruise, soft and strong. Turning ahead, astern, and when stopped using one or both pods, different modes.
- Stopping in different modes Negotiating narrow passages and entering lock, bow first or stern first. Manoeuvring feeling interaction effects - shallow water, bank effect and canal effect. Manoeuvring in current, from different directions.
- Emergency manoeuvres involving engine failure forcing to steer with one pod only, the other blocked in different position.
- Exercise the critical stage of transferring controls from the centre console to the bridge wings

Conclusions (1)

AZIPILOT

- Usual human factor methods prove useful to obtain data of task, environments and users on ACD tugs and in an ACD tug state-of-the-art simulator
- ACD tug work can be defined as an over-load environment
- Over-load and under-load environments bring different challenges to the human processing system.
- ACD tug maneuvering goes to the limit of human capability
- ACD training a must for proper and safe usage of this type of propulsion system

Conclusions (2)

AZIPILOT

- Maritime Training can be done via FMB simulators or Manned Models specialized in ACD simulations
- ACD courses should consist of a basic course including introduction into an over-load and under-load environment
- For more challenging use of ACD installations, an advanced course should be developed that is customised to suite the individual ship types involved.
- Mathematical models and manned models need to be further developed in order to replicate real life as well as reasonably possible

Recommendations

- ACD training be further implemented and attended by more pilots and other bridge personnel
- More work be done to develop better ACD models for both FMB simulators and Manned models
- FMB simulators and Manned models centres work together to develop better ACD models and ACD training courses

AZIPILOT

- Thank you for your attention
- Questions/Comments?