INNOVATIVE TEACHING METHOD FOR SHIPHANDLING
– ELEMENT OF PROJECT “EURO ZA” BETWEEN SOUTH AFRICA AND EUROPE -

Knud Benedict[a] (Prof. Dr.-habil. Ing.), knud.benedict@hs-wismar.de
Michèle Schaub[a] (M.Sc.)
Michael Baldauf[a] (Dr.-Ing.)
Michael Gluch[a] (Dr.-Ing)
Matthias Kirchhoff[b] (Dipl.-Ing.)
Caspar Krüger[b] (M.Sc.)
[a] Department of Maritime Studies Warnemuende / Institute ISSIMS Hochschule Wismar, University of Applied Sciences - Technology, Business and Design, Rostock, 18119, Germany
[b] ISSIMS GmbH / Rostock, 18119, Germany

Abstract

Some years ago, the SAMMON software tool box was introduced for “Simulation Augmented Manoeuvring Design, Monitoring & Conning”. It is based on the innovative “Rapid Advanced Prediction & Interface Technology” (RAPIT) to simulate the ships motion by Fast Time Simulation (FTS) with complex dynamic math models and to display the ship’s track immediately in an Electronic Sea Chart for any rudder, thruster or engine manoeuvre planned by the navigator. Specifically, the SAMMON Planning Tool will be shown in its opportunities for achieving new knowledge for teaching of ship’s dynamic and training of ship handling elements. That system represents the full information from ship’s manoeuvring documentation and from additional trial results squeezed in a ship dynamic model, capable of simulating environmental effects by using the RAPIT technology. The paper introduces the variety of opportunities of the training tools by presenting use case studies, e.g. for drifting under wind. Additionally, two complex manoeuvring strategies for a port arrival scenario will be compared for a ship with azimuth propeller to find out potential alternatives with less fuel consumptions and emissions.

Keywords

Fast time manoeuvring simulation, voyage planning, dynamic prediction, simulator training

1. Introduction

According to the IMO standards for voyage planning from berth-to-berth there is a need to prepare harbour approaches in a new quality with complete berthing plans specifically in companies with high safety standards like cruise liners. These plans are helpful in briefing procedures to agree on a concept within the bridge team and also for the discussion and briefing with the pilot. But still the plan for the potential manoeuvres could be developed in a contemplative way, only by “thinking ahead”. With the unique SAMMON software an innovative electronic tool is now available to provide support for planning those manoeuvring concepts by Fast Time Simulation (FTS). It will improve also the ship handling simulator training which has proven high effect - However, it is based on Real-Time Simulation, and i.e. 1 sec calculation time by the computers represents one second manoeuvring time as in real world. This is a very time-consuming process. In the near future FTS will be used for increasing the effectiveness of training and also the safety and efficiency of manoeuvring real ships. That system represents the full information from ship’s manoeuvring documentation and additional trial measurements, which have been condensed in a complex ship dynamic simulation model, capable of simulating environmental effects by using the innovative “Rapid Advanced Prediction & Interface Technology” (RAPIT). Even with standard computers it simulates 1000 times faster than real time: in 1 second computing time it achieves simulates a manoeuvre lasting up to 20 minutes. This technology was initiated in research activities of the “Institute for Innovative Ship Simulation and Maritime Systems” ISSIMS at the Maritime Simulation Centre Warnemuende MSCW, which is a part of Hochschule Wismar, University of Applied Sciences - Technology, Business & Design in Germany, specifically in its Department of Maritime Studies. The technology has been further developed by the start-up company ISSIMS GmbH [6].

There are several modules of the FTS simulation system: In the centre stands SAMMON as the innovative system for “Simulation Augmented Manoeuvring – Design, Monitoring & Conning”. It comprises several software modules, the two most important are (a) the Manoeuvring Design & Planning Module and (b) the Manoeuvring Monitoring & Conning Module with Multiple Dynamic Manoeuvring Prediction. These modules are made for both for lecturing and simulator training for ship handling and also to assist manoeuvring of real ships on-board, e.g. to pre-pare manoeuvring plans for challenging harbour approaches / departures.

Important tools are made to support the SAMMON, e.g. the SIMOPT software for modifying ship math model parameters both for simulator ships in SHS and for on board application of the SAMMON System and the SIMDAT software module for analysing / displaying simulation results both from simulations in SHS or SIMOPT /SAMMON and from real ship trials. [6]

Also, in ongoing research projects the SAMMON tools are being used, e.g. in the ERASMUS+ project EURO-ZA. Several partner universities are working together - from Europe: HS Wismar /Germany, SOLENT Southampton /UK and SAMK Rauma, Finland) and from South Africa: DUT Durban, CPUT Cape Town and NMU Port Elizabeth as project co-ordinator.

The aim is a detailed analysis of the curriculums and facilities to evaluate similarities, differences and opportunities for improvement for all partners. The contribution of the ISSIMS institute of HS Wismar addresses the use of SAMMON FTS methods for ship handling training as one element of the potential improvement of training.

In this paper some findings from the use of the SAMMON Planning tool will be described, e.g. on how to discuss and calculate the drift of ships under wind. Also, the first estimations will be presented to use SAMMON to compare the fuel consumption for different manoeuvring strategies. Additionally, a lot of samples for using SAMMON to explain ship's dynamic were made to be seen on YouTube [**7**]. Other samples and details were presented at various conferences [**1**-4].

2. Familiarisation with Fast-time simulation interface and example of wind drift

2.1. Interface of SAMMON Planning Tool

The interface of the SAMMON Manoeuvring Design & Planning tool combines the following three windows (see Figure 1):

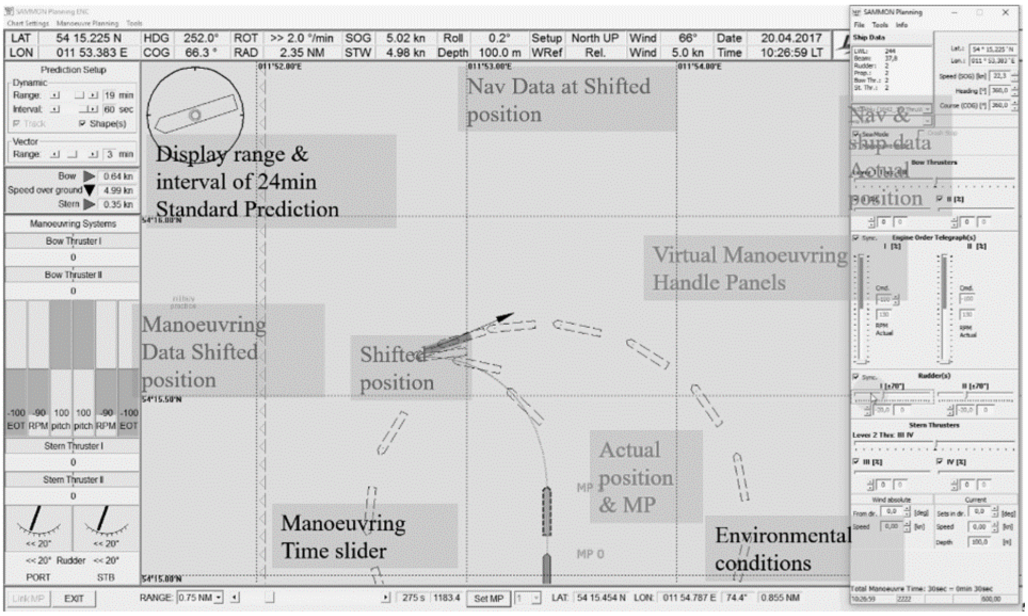


Figure 1: Interface elements of SAMMON Manoeuvring Design & Planning tool with additional comments (more information under YouTube [7])

- The right window represents the steering / control panel: this is for adjusting the controls for the selected actual Manoeuvring Point MP (actual position in red) or entering the environment conditions e.g. wind, current and water depths (bottom right),

- The centre window displays the electronic navigational chart (ENC) where the simulated ship's motion is visualised: the ships positions are shown as black contours indicating in time intervals for the display range. The reference position can be shifted by means of the time slider at the bottom to any position of the already predicted track. There a new MP can be set and controls may be changed there,

- The left and top window display the ship status at the reference ship position on the track, indicated as ship shape in blue colour in the ENC – this status is defined by e.g. the current navigation data and actual ship manoeuvring control data.

2.2. Simulation and Formulas for pure Wind Drift Motion

In the next figures the motion of a ship is discussed under wind speed 30kn from North 0°. The sample ship is a cruise liner of 253 m in length which is not using her propulsion. In Figure 2 the ship starts drifting from stop with zero speed.

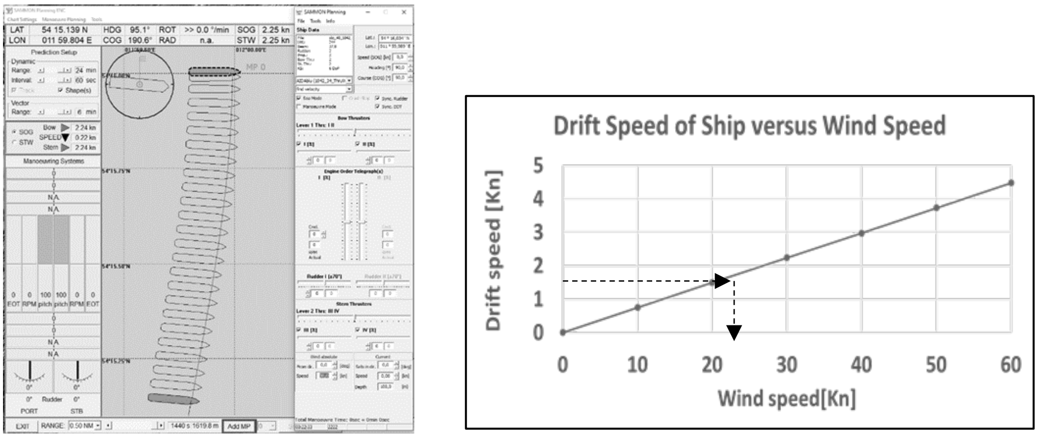
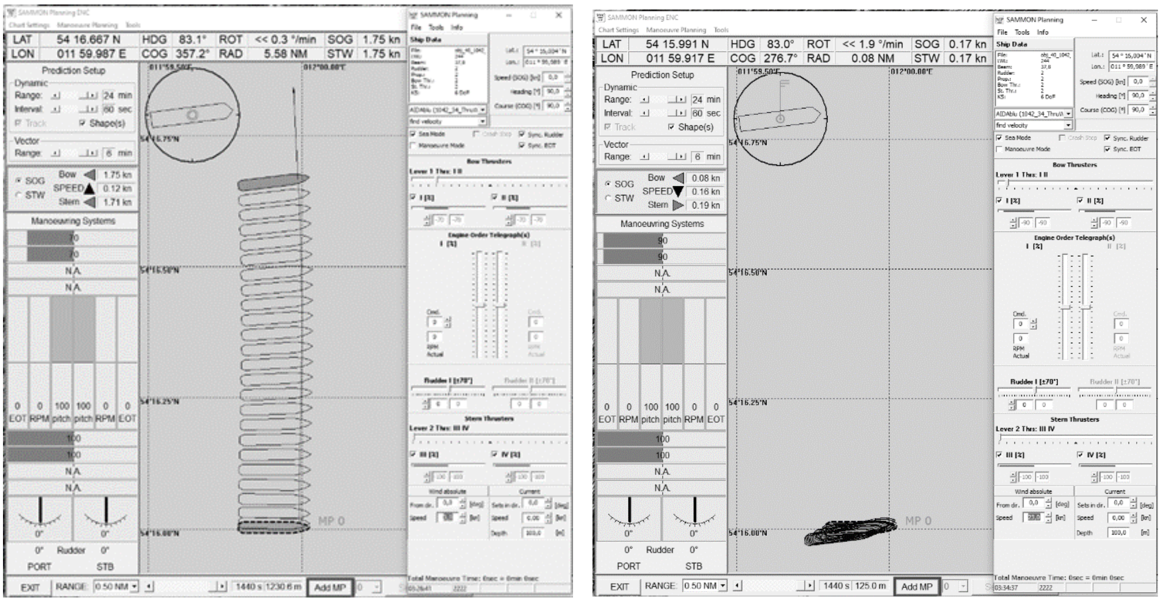


Figure 2: Transverse Drifting under Wind speed VA=30kn (Cruise ship AIDAblu). Left: situation with drift speed SOG=2.25kn, HDG 94°, COG 184°; right: diagram for drift speed versus wind speed with arrows indicating maximum drift balance by thrusters

Each shape represents her position after 1 minute, the full drifting speed is reached very fast to be SOG=2.25kn after 1 or 2 minutes (this is indicated by equal distances of the shapes). The bow falls slightly down with the wind because she has the centre of wind area ahead of midships position. The drifting speed can be reduced by the thrusters: the ship would drift only with SOG=1.51 kn if thrusters are used fully against the wind. It might be very helpful to estimate the drift speed: The drift speed is nearly linear increasing with the wind speed, as the lower diagram proves. As a consequence, only one result would be enough (maybe better two or more because of potential bias…) to estimate a constant factor to estimate the drift for other wind speeds. For instance, in this sample the linear drift speed factor C_D is about 0.075, i.e. the drift speed is 7.5% of the wind speed. As a conclusion this can be used a suitable “Rule of Thumb) to estimate the drift speed e.g. for cruise ships for a given wind speed! In which way the drift direction can be changed by using the thrusters was discussed already in [4].



SAMMON Planning ENC

LAT 54 16.667 N | HDG 83.1° | ROT << 0.3 °/min | SOG 1.75 kn
LON 011 59.987 E | COG 357.2° | RAD 5.58 NM | STW 1.75 kn

Prediction Setup: Dynamic Range: 24 min; Interval: 60 sec; ☑ Track; ☑ Shape(s); Vector Range: 6 min
● SOG ○ STW; Bow 1.75 kn; SPEED 0.12 kn; Stern 1.71 kn

SAMMON Planning ENC

LAT 54 15.991 N | HDG 83.0° | ROT << 1.9 °/min | SOG 0.17 kn
LON 011 59.917 E | COG 276.7° | RAD 0.08 NM | STW 0.17 kn

Prediction Setup: Dynamic Range: 24 min; Interval: 60 sec; ☑ Track; ☑ Shape(s); Vector Range: 6 min
● SOG ○ STW; Bow 0.08 kn; SPEED 0.16 kn; Stern 0.19 kn

SAMMON Planning: Lat.: 54 ° 16,004 ' N; Lon.: 011 ° 59,989 ' E; Speed (SOG) [kn] 0,0; Heading [°] 90,0; Course (COG) [°] 90,0; AIDAblu (1042_34_ThruW; find velocity; ☑ Sea Mode ☐ Crash Stop ☑ Sync. Rudder ☐ Manoeuvre Mode ☑ Sync. EOT

Figure 3: Experiment for Maximum Drift speed for full thruster with no wind: Result 1.75 kn (left) and test scenario to balance wind of 23kn by thruster (right)

It is also important to know the absolute limit wind speed V_{A_lim} which is possibly to be balanced by thrusters which can be estimated by measuring the Maximum Drift speed V_{D_max} for full thruster with no wind (see Figure 3). The result of 1.75 kn can be seen in the diagram as dotted horizontal line, as a result the Limit Wind speed can be seen as 23kn from the vertical arrow. Instead it is also possible to use a formula

$$V_{A\_lim}[kn] = \frac{V_{D\_max}}{C_D} = \frac{1.75}{0.075} = 23kn \qquad (1)$$

3. Planning and optimising manoeuvres for simulator training

3.1. Task Description for the exercise preparation – conventional briefing and NEW method

For preparing a simulator exercise e.g. for a port arrival, the trainee is commonly familiarised with the scenario, e.g. the port area, initial situation and environmental conditions. Normally this is done on a navigational chart, see e.g. Figure 4. In this sample exercise the ship should be brought through the fairway channel of Rostock Port from North, to be turned on the turning basin and then heading back through the channel to berth the ship with portside at the Passenger Pier. Manoeuvring sections would give a good overview on the different tasks / aims:

- 1st Section: the ship speed should slow down until around 3kn, so she is ready to be turned.
- 2nd Section: the ship starts and performs the turning manoeuvre to be adjusted ready to go back in the fairway on opposite course.
- 3rd Section: the ship slows down to be finally stopped and brought to the berth.

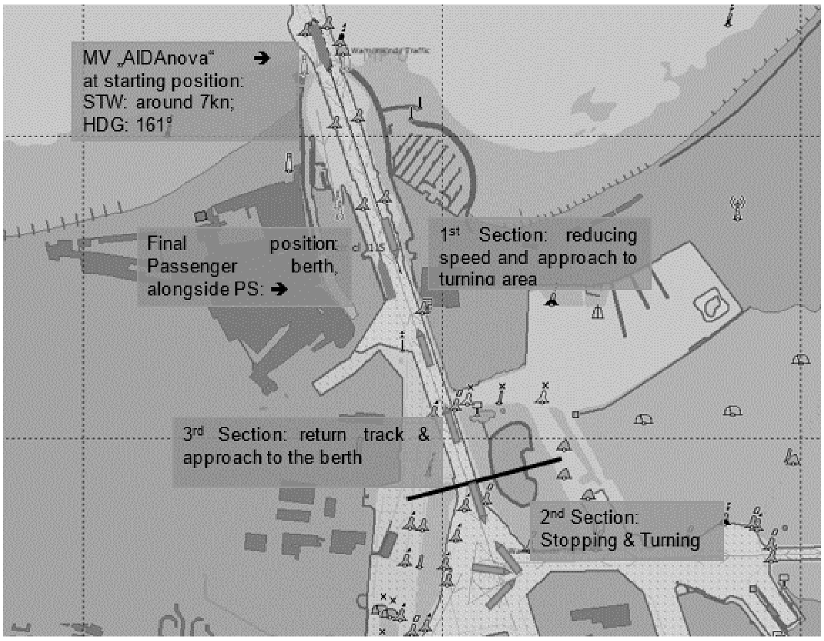


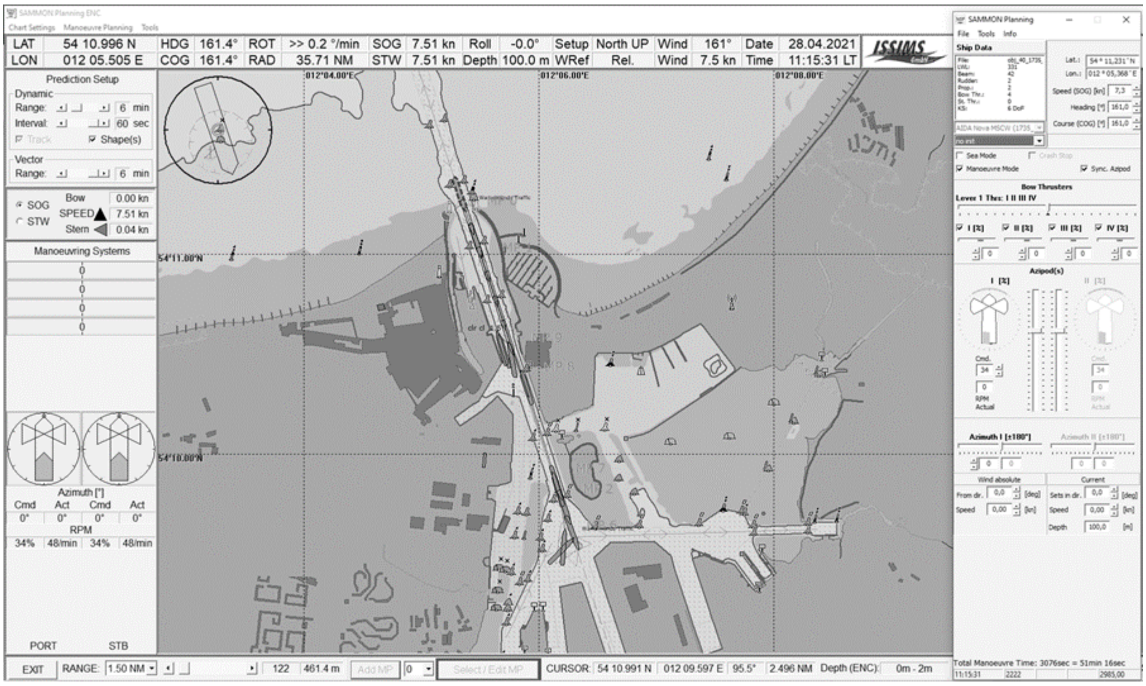
Figure 4: Sample for conventional briefing for a berthing scenario in the Port of Rostock

In the conventional briefing and exercise preparation, only guessing and these rough indications of manoeuvring conditions can be used to develop a “manoeuvring plan” - specific manoeuvres and settings controls cannot be discussed in detail. By means of the RAPIT Fast Time Simulation an individual exercise preparation with self-developed manoeuvring concepts would be possible:

- With the SAMMON Manoeuvre Planning Tool it would be easy and quick to develop a detailed Manoeuvring Plan and moreover, even the
- Improvement of the concept by several attempts or even “What-if” trials with that tool, e.g. for considering fuel consumptions and emissions is possible.

In the following section a sample will be given to develop a manoeuvring plan for a ship with azimuth propellers according to the scenario above with two different strategies to use the PODs. The topic of this investigation was to find out the most effective manoeuvre with respect to energy / consumption and emissions for Port approaches. Two different strategies were used:

1. Conventional POD strategy, similar to twin propeller / rudder configuration, i.e. speed changes by changing POD revolutions and rudder angles
2. New POD strategy, with IN-OUT configuration, i.e. speed changes by turning both PODs inward or outward, or as tandem configuration



LAT	54 10.996 N	HDG	161.4°	ROT	>> 0.2 °/min	SOG	7.51 kn	Roll	-0.0°	Setup	North UP	Wind	161°	Date	28.04.2021
LON	012 05.505 E	COG	161.4°	RAD	35.71 NM	STW	7.51 kn	Depth	100.0 m	WRef	Rel.	Wind	7.5 kn	Time	11:15:31 LT

Dynamic
Range: 6 min
Interval: 60 sec
☑ Track ☑ Shape(s)

Vector
Range: 6 min

● SOG ○ STW
Bow 0.00 kn
SPEED 7.51 kn
Stern 0.04 kn

Azimuth [°]

Cmd	Act	Cmd	Act
0°	0°	0°	0°

RPM

34%	48/min	34%	48/min

RANGE: 1.50 NM | 122 | 461.4 m | 0 | CURSOR: 54 10.991 N | 012 09.597 E | 95.5° | 2.496 NM | Depth (ENC): 0m - 2m

Total Manoeuvre Time: 3076sec = 51min 16sec
11:15:31 2222 2985,00

Lat.: 54 ° 11,231 ' N
Lon.: 012 ° 05,368 ' E
Speed (SOG) [kn] 7,3
Heading [°] 161,0
Course (COG) [°] 161,0

AIDA Nova MSCW (1735_
no init

☐ Sea Mode ☐ Crash Stop
☑ Manoeuvre Mode ☑ Sync. Azipod

Lever 1 Thrs: I II III IV
☑ I [%] 0 ☑ II [%] 0 ☑ III [%] 0 ☑ IV [%] 0

I [%] Cmd. 34 RPM Actual 0
II [%] Cmd. 34 RPM Actual 0

Azimuth I [±180°] 0 0
Azimuth II [±180°] 0 0

From dr. 0,0 [deg]
Speed 0,00 [kn]

Sets in dr. 0,0 [deg]
Speed 0,00 [kn]
Depth 100,0 [m]

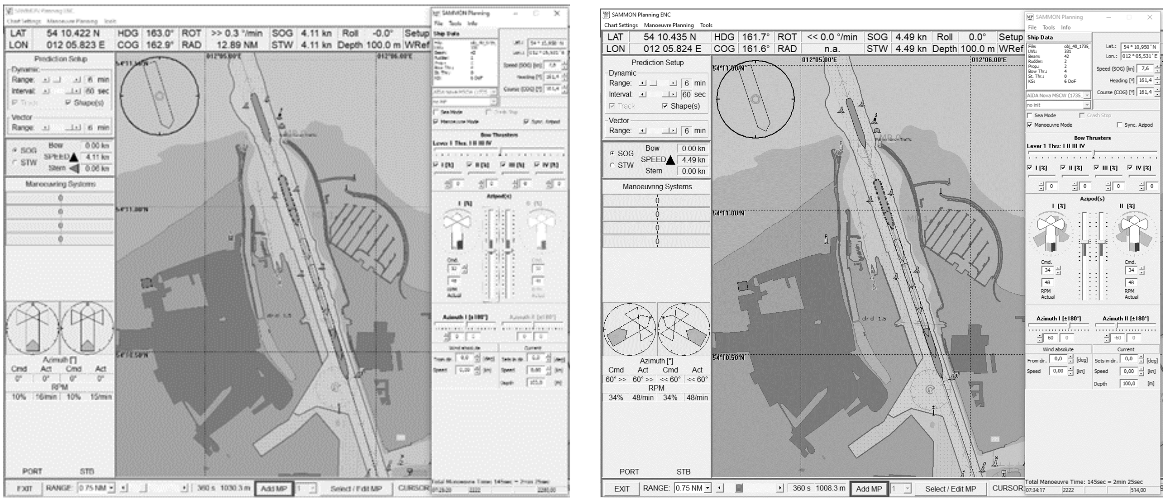
Figure 5: Sample with SAMMON Planning tool for arrival planning for Rostock port: Using new POD strategy with IN-OUT configuration, e.g. speed changes by turning PODs inward

In Figure 5 the plan for the 2nd new POD strategy is shown. It looks nearly the same as the other variant 1 (therefore not extra shown here); the difference is in the details which will be discussed separately soon. The two manoeuvres with different strategies were initially simulated with SAMMON Planning tool, resulting in two respective Manoeuvring Planning Files. Afterwards these files were taken as input to the SIMOPT/ SIMDAT tool to be analysed in detail with respect to assess the fuel consumption for further optimisation, if needed.

3.2. Planning by means of Fast-time simulation for two strategies

With the new SAMMON Planning tool there is the chance for designing a Manoeuvre Plan with the specific control settings at distinguished positions called Manoeuvring Points MP. The following sample demonstrates how to make a full manoeuvring plan by means of the suitable control actions at the MPs.

In Figure 6 the initial position MP0 is to be seen where the ship was set in the centre of the fairway before entering the moles, the speed rate is initially EOT=32%, revealing a speed of 7.2kn. The ship has already been moved by the time slider at the ENC bottom to set the next manoeuvring point MP1. There, the speed reduction manoeuvre is started:



LAT 54 10.422 N HDG 163.0° ROT >> 0.3 °/min SOG 4.11 kn Roll -0.0°
LON 012 05.823 E COG 162.9° RAD 12.89 NM STW 4.11 kn Depth 100.0 m

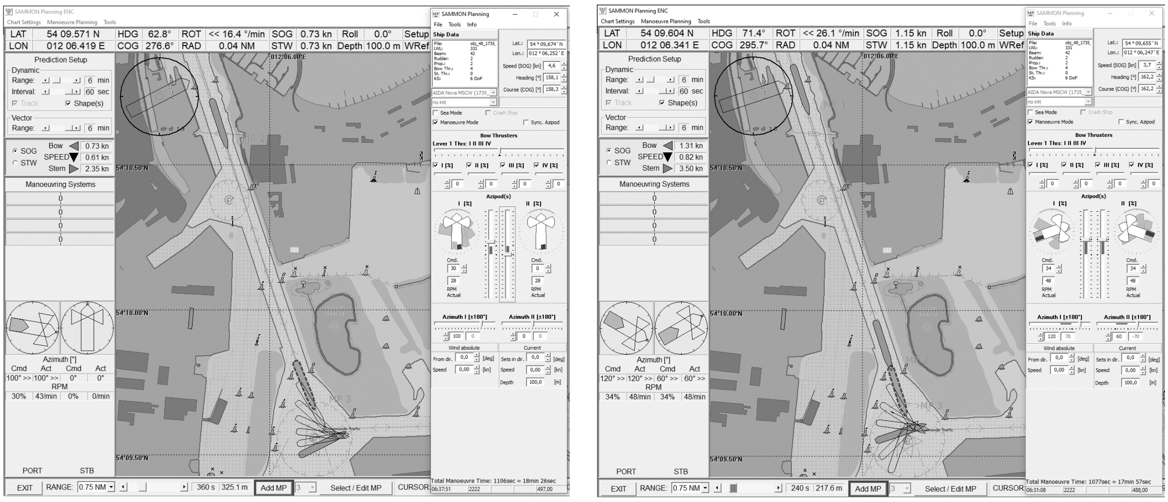
LAT 54 10.435 N HDG 161.7° ROT << 0.0 °/min SOG 4.49 kn Roll 0.0°
LON 012 05.824 E COG 161.6° RAD n.a. STW 4.49 kn Depth 100.0 m

Figure 6: SAMMON planning interface: Starting position at MP0 and predicted shapes for the following slow down manoeuvre beginning at MP1: Left:: in conventional way with reducing EOT to 10%; right: turning both pods inward IN 30°

- In the left figure it is done with reducing EOT to 10%. The ship shapes of the predicted track ahead of the MP0 already show continuously reduced distances, i.e. the speed drops according to the new handle positions. And by moving the blue reference shape by means of the time slider to the new position at 360 sec, the speed there is only SOG 4.11 kn, to be seen in the top row. This is the same manoeuvre which typically would be done with a conventional twin screw vessel.
- In the right figure it is done with a typical POD manoeuvre by turning both pods inward to IN 30°. Now the thrust of the pods is not fully directed forward anymore, therefore the speed is dropping to 4.49 kn after 360 sec.

This comparison of the speed drop after 360 sec was only to show the effect of the two manoeuvres. The reference position may be moved further along the fairway to a suitable position where the next manoeuvre is necessary. A new Manoeuvring Point MP 2 can be set by pressing the button “Add MP” and then the focus is on the new MP 2 and so forth. In the next Figure 7 two different manoeuvres are shown to discuss the different turning strategies starting at position MP3:

- In the left figure it is done in conventional way by stopping the port engine and turning the ship with the SB POD IN100° with transverse thrust like a rudder.
- In the right figure the pods are used in a tandem position: PT POD IN120° and SB pod OUT60°



LAT 54 09.571 N | HDG 62.8° | ROT << 16.4 °/min | SOG 0.73 kn | Roll 0.0°
LON 012 06.419 E | COG 276.6° | RAD 0.04 NM | STW 0.73 kn | Depth 100.0 m

Lat.: 54 ° 09,674 ' N
Lon.: 012 ° 06,252 ' E
Speed (SOG) [kn] 4,6
Heading [°] 158,1
Course (COG) [°] 158,3

LAT 54 09.604 N | HDG 71.4° | ROT << 26.1 °/min | SOG 1.15 kn | Roll 0.0°
LON 012 06.341 E | COG 295.7° | RAD 0.04 NM | STW 1.15 kn | Depth 100.0 m

Lat.: 54 ° 09,655 ' N
Lon.: 012 ° 06,247 ' E
Speed (SOG) [kn] 3,7
Heading [°] 162,2
Course (COG) [°] 162,2

Figure 7: Two manoeuvres for different turning strategies starting at position MP3: left: conventional way by stopping the port engine PT POD EOT 0% and turning the ship with the SB POD to IN100° with EOT 30%; right: the pods are used in a tandem position: PT POD to IN120° and SB POD to OUT60°, both with EOT 34%

In the final phase of the manoeuvring plan the ship will be stopped short before the berth: also here the pods can be used in conventional way of stopping by reversing the pods to direct the thrust in astern direction or to be used inward to create maximum resistance and on the same time adjusting the EOTs so that the ship is moving in the direction of the berth, together with the bow thrusters.

3.3. Analysis of fuel consumption

The question is now to decide which of the two strategies are better? For this reason, the fuel consumption was estimated for both versions by means of the SIMOPT [6] / SIMDAT software programs. In Figure 9 a comparison of controls for both manoeuvring strategies is made, it can be seen that the conventional strategy is using much lower revolutions but achieving nearly the same speed history.

The benefit is shown in Figure 10 comparing the consumption for both manoeuvring strategies for each manoeuvre separate (left) and as a cumulative sum of all the manoeuvres (right). It can be analysed with respect to consumption:

a) Conventional POD- strategy: consumption ca. 3x106 g, i.e. ca 3 t

b) New POD-Inward strategy: ca. 9x106 g consumption, i.e. ca 9 t

Therefore, the following conclusion can be made:

- The conventional operation of PODs like for a normal Twin Screw ship has only 30% fuel consumption (and in analogy about 30% emission of CO2), compared to the New operation: Operating the PODs against each other is a waste of energy and damage to the environment!

- It is without any doubt that the Inward strategy has a lot of advantages because the ship is much easier to control due to the immediately available steering forces when turning the pods for higher revolutions. But this should only be used if these high forces are really needed, e.g. for challenging external forces or complicated manoeuvres.

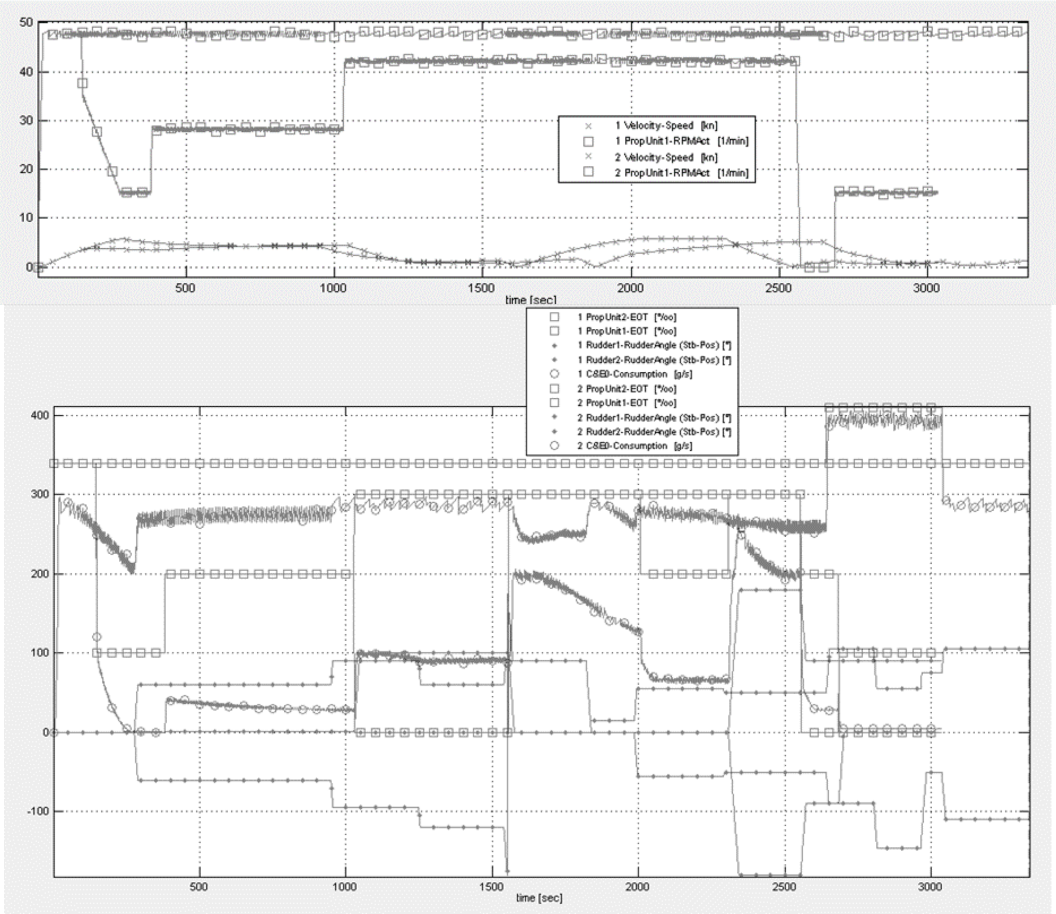


Figure 8: Comparison of controls for both manoeuvring strategies: Top: Time history of speed and engine revolutions; Bottom: pod angles together with EOT and revolutions (Blue: Conventional POD strategy, speed changes by reducing POD revolutions - Red: New POD strategy, speed changes by turning both PODs inward, shown as rudder units)

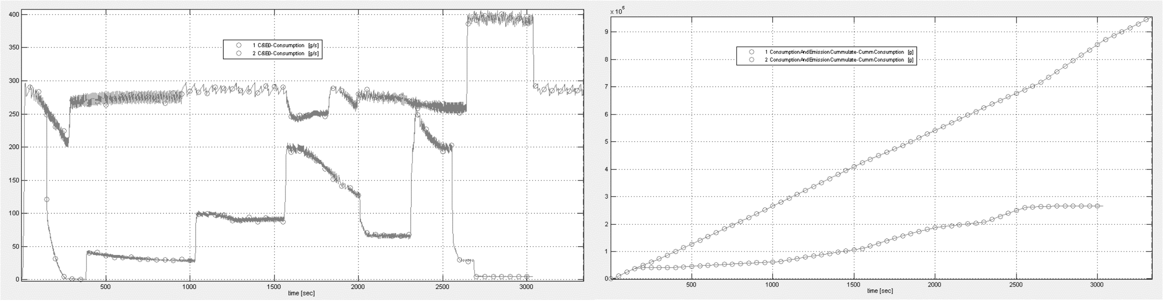


Figure 9: Comparison of consumption for both manoeuvring strategies: Left: Plot of consumption of separate manoeuvres; right: Plot of cumulative consumption (Blue: Conventional POD strategy, speed changes by reducing POD revolutions - Red: New POD strategy, speed changes by turning both PODs inward)

It should be mentioned that the models for fuel consumptions and emission used here are still simple and not precise enough the really calculate reliable results for the total values. However, they are a good estimation when comparing the relative data of consumption and emissions for two different manoeuvring strategies. For the time being the models are based on quasi-linear, steady state models, calculating of the fuel consumption is based on its calorific value, the propeller torque and its speed during the manoeuvres. New models for transient engine operation in non-steady operation are already under development, but needs much higher efforts for engine data and additional simulation parameters [3, 5].

4. Methods for calculating Fuel Consumption and Emissions during Manoeuvres

4.1. Simulation of Consumption

While the previously presented consumption calculation is derived from the delivered propeller torque and the propeller revolutions, an engine model is presented below, which calculates the consumption $\dot{m}_B$ via a PID controller algorithm [8]:

$$\dot{m}_B(t) = K_P e(t) + K_I \int_0^t e(\tau) d\tau + K_D \dot{e}(t)$$

The PID controller reacts to the deviation $e(t)$ between the current engine speed n_{act} and its commanded speed n_{cmd} , the K represent the parameters of the PID controller. The available drive power is calculated via a speed- and power-dependent efficiency and by including the fuel calorific value. The engine torque is obtained by dividing the drive power by the engine's angular frequency. Based on a system of differential equations for the engine dynamics, the difference between the propeller torque, which corresponds to the counter-torque of the engine, and the engine torque is formed and then related to the moment of inertia of the drive train. The speed acceleration calculated in the differential equation is added to the current speed.

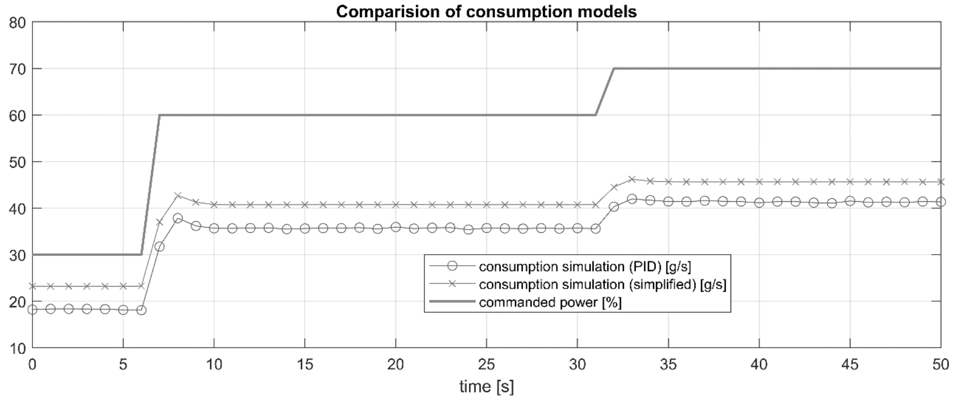


Figure 10: Comparison between the consumption calculation

Figure 11 shows a comparison between the consumption calculation using the above described PID controller algorithm (circles) and the simplified calculation (crosses). The latter method calculates slightly more consumption. Besides this deviation, the accuracy depends in particular on the propeller torque determined via a lookup table.

4.2. Data-based models for Prediction of Emissions

For seagoing vessels, CO_2, SO_X, NO_X and PM emissions are of particular interest when it comes to protecting the environment. While CO_2 and SO_X are almost proportional to consumption, NO_X and PM depend on the combustion air ratio and thus on the inertia of the system. This means that the engine model would either have to be more detailed than the one described in 3.1 [9], or that these emissions would have to be calculated via a data-based model [10]. To comply with the speed requirements of FTS, a data-based, empirical model seems appropriate. For this purpose, two approaches were investigated, both of which referring to artificial neural networks (ANN) in the form of feedforward multi-layer perceptron networks: One with external dynamics (where the engine dynamics are calculated by differential equations,), the other with internal dynamics (where the engine dynamics is calculated within the ANN). While the former is easier to program and train, the latter in general yields more reliable results. Figure 12 shows a comparison between the two approaches.

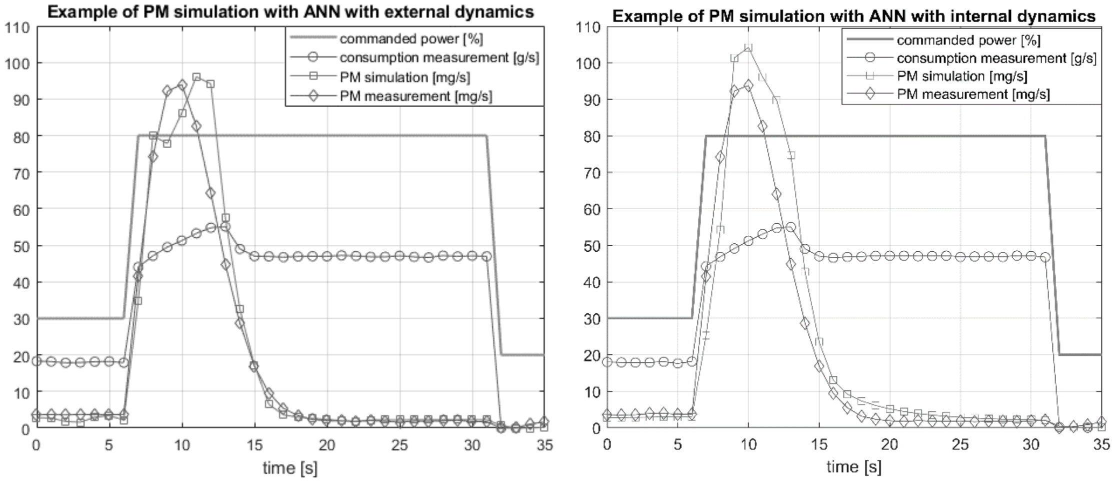


Figure 11: Comparison of two Artificial Neural Network approaches: Left: ANN with external dynamics, right: ANN with internal dynamics.

Both approaches are possible for supplementing the existing prediction software with fast-calculating emission models, provided that sufficient corresponding measurement data are available.

5. Conclusion

The examples have shown the benefits of using SAMMON Planning tool: For lecturing it is much better to use samples by Fast-Time Manoeuvring Simulation instead of theoretical explanations; they are self-explaining for specific ship behaviour and for the sample of wind drift two simple formulas could be developed to calculate the drift speed. SAMMON allows even for preparing complete manoeuvring plans very fast – same trials in a full mission SHS which would take hours. It will be a great benefit to implement fuel consumption and emissions into the simulation: For the time being simple models were used to estimate and compare the fuel consumption for different manoeuvring strategies with each other. As a result, it could be shown that conventional operation of PODs for changing speed by changing revolution like for a normal Twin Screw ship has only 30% fuel consumption compared to the alternative new operation to control the speed by turning the PODs inward for speed reduction: Operating the PODs against each other is a waste of energy and damage to the environment! SAMMON has proven already its benefits for lecturing and training and will have a great potential to increase efficiency and sustainability of manoeuvring also on-board. A comparison of simple models for engine operation and fuel consumption shows that also simple models allow for a reliable analysis of different manoeuvring strategies.

Acknowledgments

Research results presented in this paper were partly achieved in “Euro-ZA Capacity building in the field of maritime education” a project funded by European Commission. The start-up company “Innovative Ship Simulation and Maritime Systems GmbH” (ISSIMS GmbH; www.issims-gmbh.com) is developing and maintaining the professional version of the SAMMON software tool.

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Cover Letter for Paper at IAMUC 21

Paper Title:

INNOVATIVE TEACHING METHOD FOR SHIPHANDLING – ELEMENT OF PROJECT "EURO ZA" BETWEEN SOUTH AFRICA AND EUROPE -

Knud Benedict[a] (Prof. Dr.-habil. Ing.), knud.benedict@hs-wismar.de
Michèle Schaub[a] (M.Sc.)
Michael Baldauf[a] (Dr.-Ing.)
Michael Gluch[a] (Dr.-Ing)
Matthias Kirchhoff[b] (Dipl.-Ing.)
Caspar Krüger[b] (M.Sc.)
[a] Department of Maritime Studies Warnemuende / Institute ISSIMS Hochschule Wismar, University of Applied Sciences - Technology, Business and Design, Rostock, 18119, Germany
[b] ISSIMS GmbH / Rostock, 18119, Germany

Declaration:

Herewith the authors of this paper declare explicitly that the manuscript is being submitted for publication in the Conference proceedings of the **IAMUC AGA21.**

The corresponding author Prof. Dr. Knud Benedict declares that there would be no objection if the manuscript is to be formally refereed.

Biography of the presenting author Prof. Dr. Knud Benedict:

Knud Benedict, was graduated at the Faculty of Naval Architecture of the Rostock University in 1972. He achieved Doctoral degrees in Ship Hydrodynamics / Manoeuvrability (1978) and on Ship Operation Technology / Advisory Systems (1990). Since 1992 he has been Professor for Ship's Theory at Hochschule Wismar (HSW), University of Applied Sciences /Germany. Furthermore, he has been Visiting Professor at WMU Malmoe and expert consultant to the IALA World Wide Academy. From 1998-2013 he was the Head of Maritime Simulation Centre Warnemuende MSCW. Now he is the Head of the Institute for Innovative Ship Simulation and Maritime Systems ISSIMS at HSW. From 2012-2018 he was the Chairman of INSLC and member of the Steering Committee of IMLA.