Graduation project summary – Ingmar Wever

This document includes a short description of the graduation project for my double degree at the TU Delft. Combining both my maritime knowledge and computer science knowledge during a project at Damen Shipyards. The project is worth 60 ECTS, of which 30 ECTS is shared and 15 ECTS specifically per degree. The responsible supervisors at the TU Delft are:

Dr.ir. Robert Hekkenberg	Prof.Dr. Mark Neerincx	Toine Cleophas
Ship Design	Interactive Intelligence	Research & Development
Maritime Technology - DPO	Computer Science - DST	Damen Shipyards
TU Delft	TU Delft	

Every vessel has still a captain to control the vessel, certainly in case of complex manoeuvres. The captain is in this case always available and paying attention to its surroundings and the state of vessel. This could lead to loss of concentration due to fatigue and non-challenging jobs. Mostly caused by the fact that most of the time the operations of a ship are not very complex. In those cases no intervention and less attention is needed from the captain. However in specific situation where the risk increases attention or even intervention is desired from the captain. To determine when this situation occurs the probability of an event leading up to a failure should be determined. This probability depends on the time till an event occurs and the complexity of the solution which is needed to avoid an accident.

The time till the event occurs is mostly based on the possibility to look ahead. When there is enough time to make adaptions there is a low probability for the failure to occur. While a sudden change in the environment: another vessel, undetected rock, wind gust, etc. have a much bigger impact on the probability something goes wrong.

The key factor however is the complexity of the solution. This research will focus on developing a model for this complexity. An easy solution would be when not much has to change in throttle setting, speed, rudder angle and heading. While a complex solution would desire much changes in those variables, certainly when the vessel operates at its capability limits, a higher fuel consumption is often an indicator for this. Therefore inputs for the model are the inertia of the vessel, lay-out of the vessel, environmental conditions and the desired operation.

Different steps will be taken to validate and improve the model. First the model must be able to determine the complexity of a small segment straight and when steering. These can be validated with data available from tugs and fast crew suppliers on fuel consumption and 6 DOF movements. The second step is to do this for a planned route, without dynamic objects, showing critical moments. While the model is extended with more types of vessels. Taking into account if a vessel has to operate on its limits under certain environmental conditions. Finally the third step is a real-time simulation with dynamic objects.

The model will return the complexity of a specific situation. During the first step will be determined what interesting information for the captain could be in what situation. At the second step, it will be able to warn the crew on-shore and off-shore when more attention is needed, based on the planned route. Using a tool can be shown what solutions the captain has with the corresponding risks and costs. In the final stages this can be tested during operation of the vessel, helping the captain to make the right decision in high pressure situations. While enabling him to relax when the risks are low.