### Contents

[Contents 1](#_Toc495498808)

[Introduction 2](#_Toc495498809)

[Future of shipping 2](#_Toc495498810)

[Automated 2](#_Toc495498811)

[Remote 2](#_Toc495498812)

[Autonomous 2](#_Toc495498813)

[Occurred accidents 2](#_Toc495498814)

[Computer science 3](#_Toc495498815)

[Situation Awareness 3](#_Toc495498816)

[Decision making 3](#_Toc495498817)

[Normal situation 3](#_Toc495498818)

[Under stress 3](#_Toc495498819)

[Mental models 3](#_Toc495498820)

[Theories 3](#_Toc495498821)

[Questions by the crew 3](#_Toc495498822)

[Crew behaviour 3](#_Toc495498823)

[Maritime technology 4](#_Toc495498824)

[Physical model 4](#_Toc495498825)

[Manoeuvrability 4](#_Toc495498826)

[Environmental forces 4](#_Toc495498827)

[Route-planning 4](#_Toc495498828)

[Cost function 4](#_Toc495498829)

[Data and visualisations 5](#_Toc495498830)

[Environment 5](#_Toc495498831)

[Ship 5](#_Toc495498832)

[Tool 6](#_Toc495498833)

[Bridge design 6](#_Toc495498834)

[User interface 6](#_Toc495498835)

[Amount of processable information 6](#_Toc495498836)

[Scope of my research 7](#_Toc495498837)

# Introduction

What is the purpose of my research

<https://www.maritiemland.nl/innovatie/projecten/tki-maritiem-innovatiethemas/slim-en-veilig-varen/>

NWA Vragen:  
• [Hoe krijgen we grip op de onvoorspelbaarheid van complexe netwerken en chaotische systemen?](https://vragen.wetenschapsagenda.nl/cluster/hoe-krijgen-we-grip-op-de-onvoorspelbaarheid-van-complexe-netwerken-en-chaotische-systemen)

## Future of shipping

What steps are we going to take in the coming years

### Automated

Take out manual steps and decision making

### Remote

Can we sail 5 ships

### Autonomous

The last step

## Occurred accidents

Why would we change the current situation?  
Investigation reports

# Computer science

Welke informatie moet waar zijn en is waar beschikbaar?

## Situation Awareness

What is needed to make someone aware of the situation including the three phases, see, interpret, do.

## Decision making

Welke keuzes worden gemaakt en waarom?

### Normal situation

What is a captain supposed to do, and why do they choose differently?

### Under stress

When do people do not choose logically?

## Mental models

Welke denkstappen worden gemaakt

### Theories

Welke modellen woren nu gebruikt

### Questions by the crew

Which questions do the crew try to answer continuously

## Crew behaviour

What does the crew do when and why

# Maritime technology

How are we going to model or simulate the ship

## Physical model

How can you model the behaviour

### Manoeuvrability

How does the inertia of ship work, and movements due to props and rudder

### Environmental forces

How are we going to model the wind, wave and current forces

## Route-planning

What are key issues in optimizing the route

## Cost function

What is a cost function, how to test and verify it,

# Data and visualisations

What is known, can be measured, and how can it be presented

## Environment

Can we look around to see other ships, environmental conditions, future predictions of environment, what are the regulations in this area

* We4Sea, focus op meten van fuel efficiency gekoppeld aan andere data
* Covadem, metingen diepte binnenwater. Met moderne hulpmiddelen en baanbrekende nieuwe inzichten willen wij de binnenvaart transformeren naar een meer winstgevende, schonere en efficiëntere vervoersmodaliteit.

## Ship

What is current state of the ship in availability of machinery, movements, status of tanks, etc.

# Tool

What kind of tools and knowledges exists in the real world

## Bridge design

What are factors during the design of the ship

### User interface

How would you design an user interface

### Amount of processable information

Which information, in what form, and what amount can be processed by crew members

# Scope of my research