Understanding Operation of Automated Inland Vessels using Process Diagrams

Thomas Kerkmann
kerkmann@dst-org.de

DST
www.dst-org.de

Development Centre for
Ship Technology and
Transport Systems

ICMASS 2024 Conference | 29-30 October 2024

Research at the DST

ELLA

SANDRA II

VeLABi

Agenda

1. Motivation
2. Methodology
3. Process Diagrams
4. Conclusion

Agenda

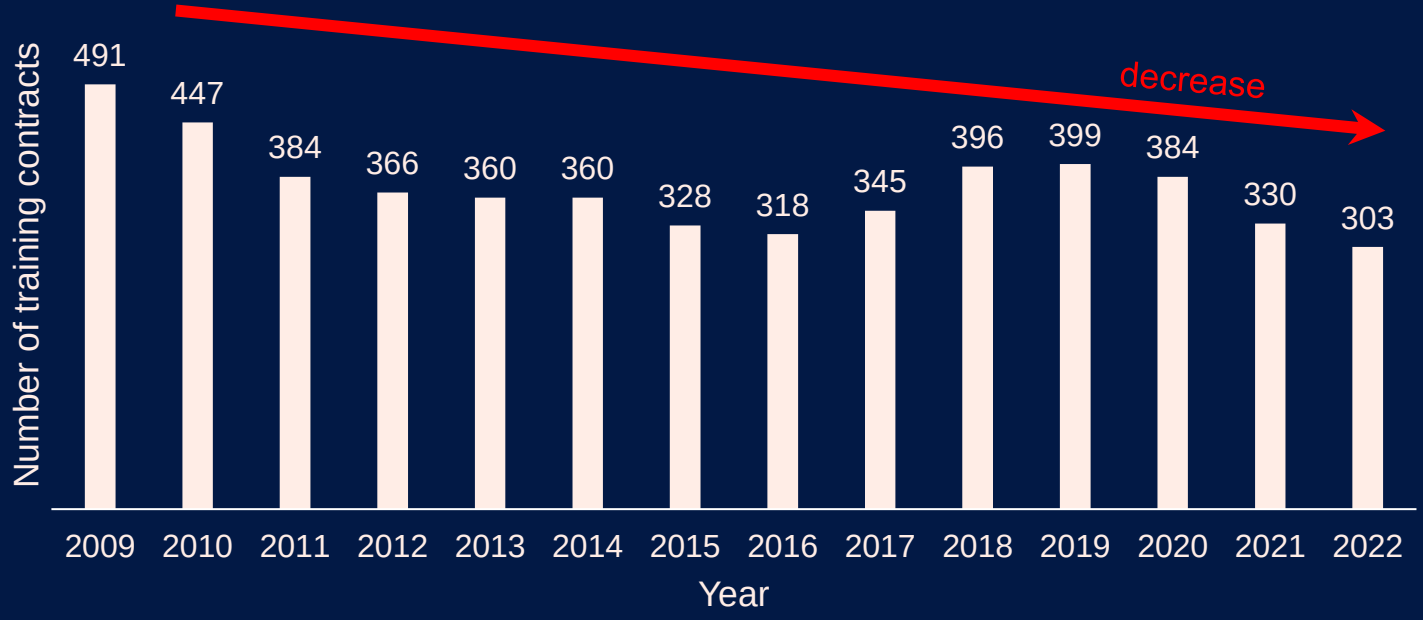
1. Motivation

2. Methodology

3. Process Diagrams

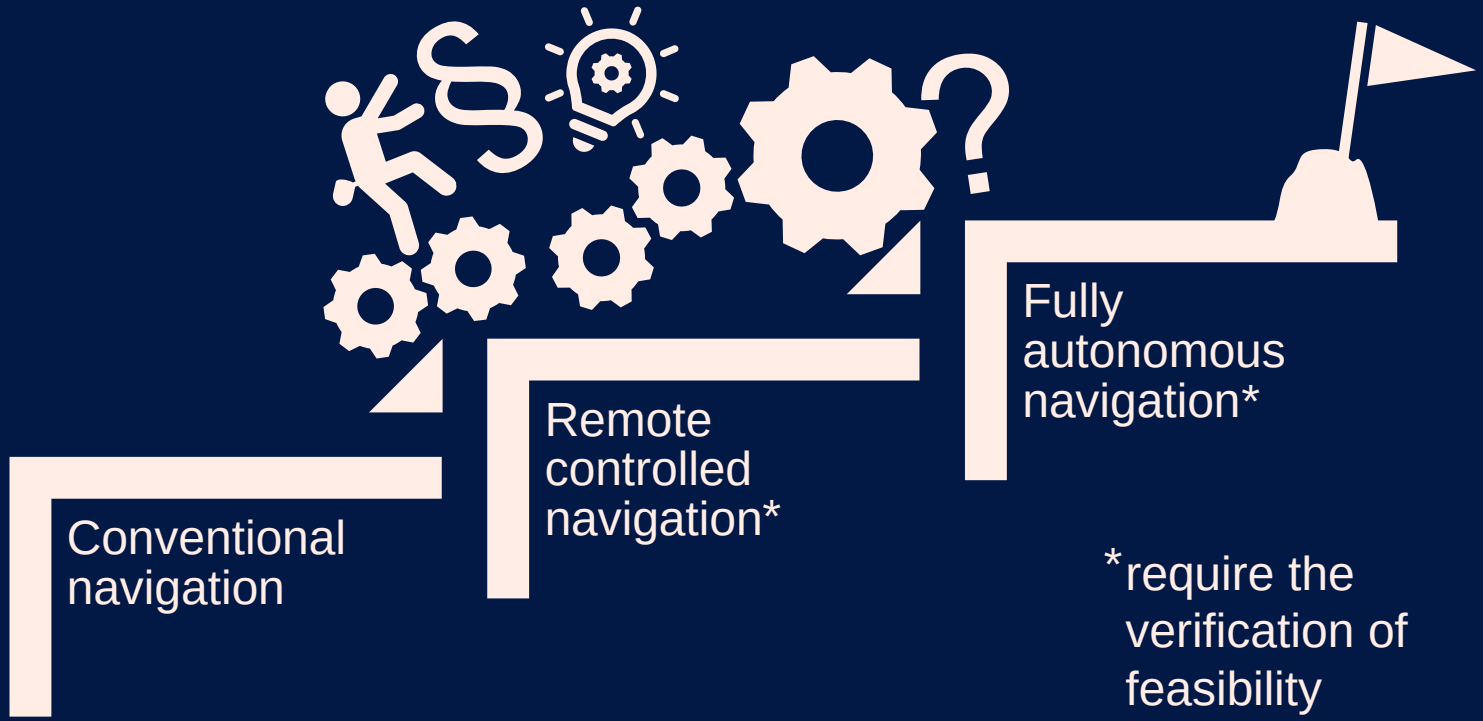
4. Conclusion

Number of existing training contracts for inland navigation operators in Germany

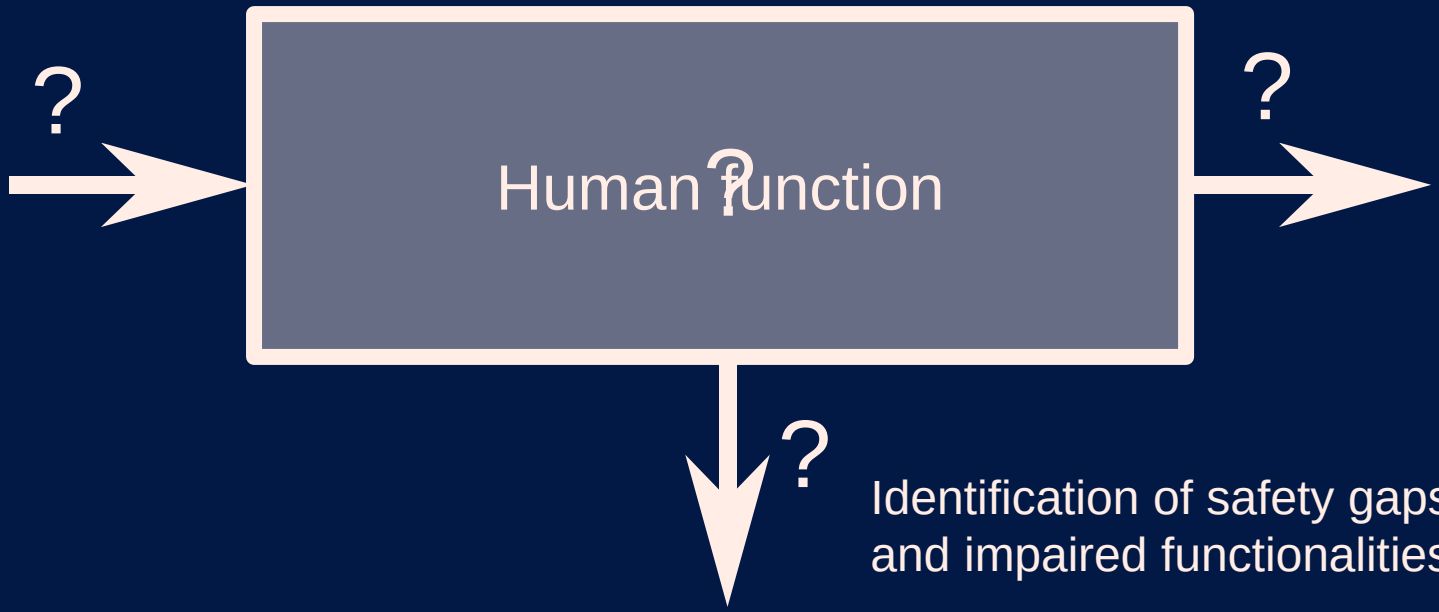


Source: https://de.statista.com/statistik/daten/studie/203022/umfrage/anzahl-der-ausbildungsvertraege-von-binnenschiffer-in-deutschland/

Climbing the challenges of automation



Verification of feasibilities by using process diagrams



Agenda

1. Motivation

2. Methodology

3. Process Diagrams

4. Conclusion

Blocks and connections

German standard: VDI 2206

The four phases of a process

Inland Vessel System

2. Processing

3. Decision

Environment

1. Information acquisition

4. Action

Agenda

1. Motivation

2. Methodology

3. Process Diagrams

4. Conclusion

Diagram for a conventional inland vessel

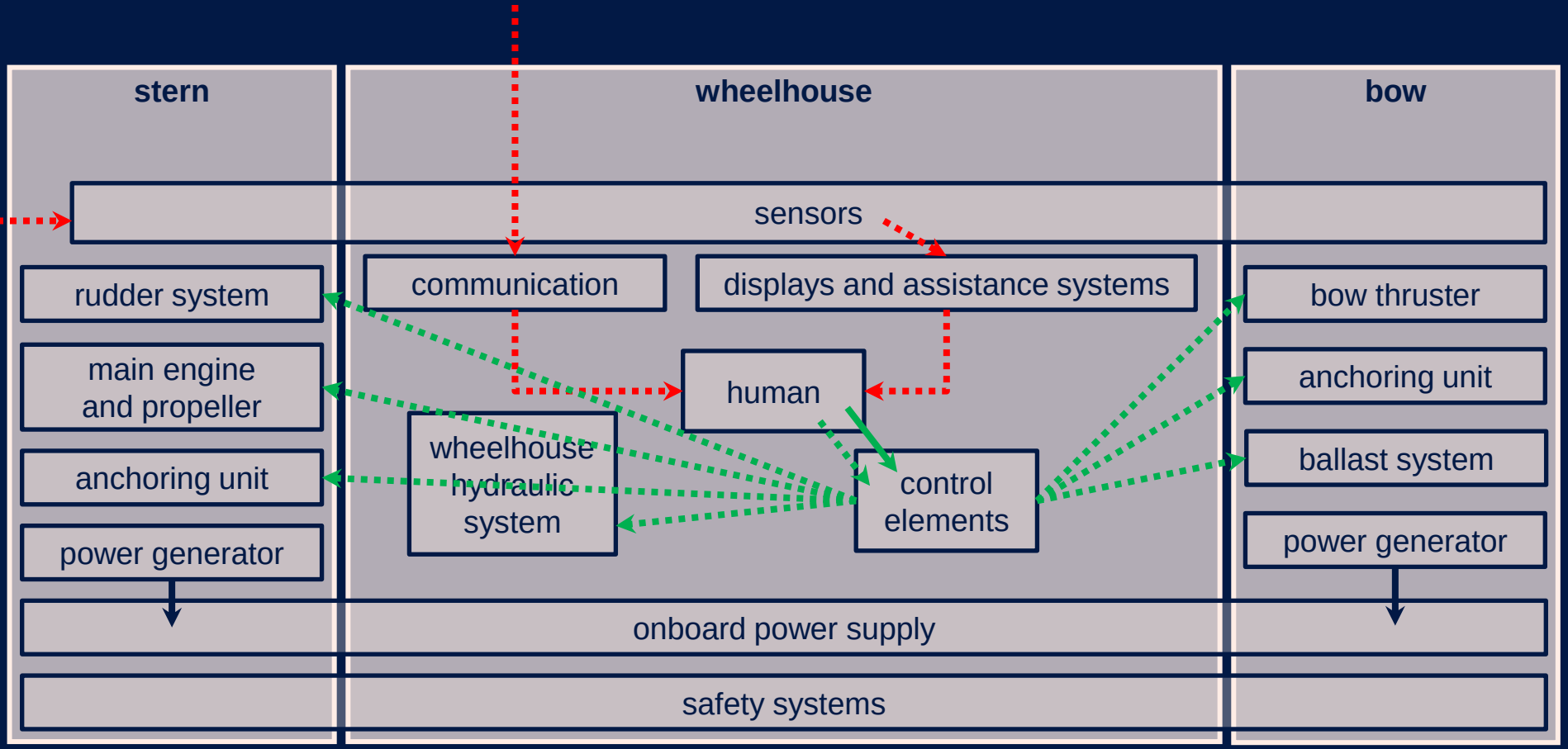


Diagram for a remotely controlled inland vessel

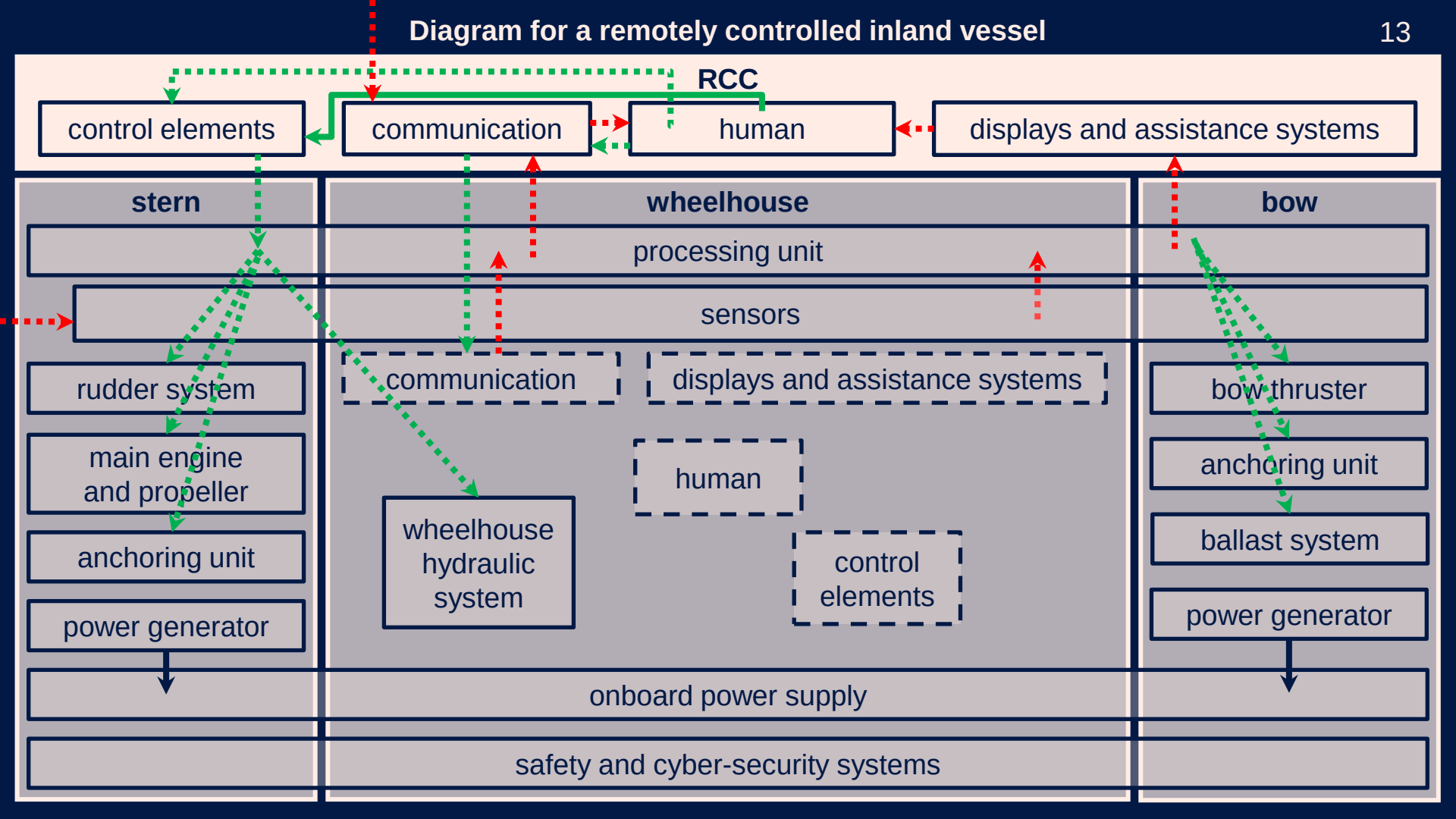
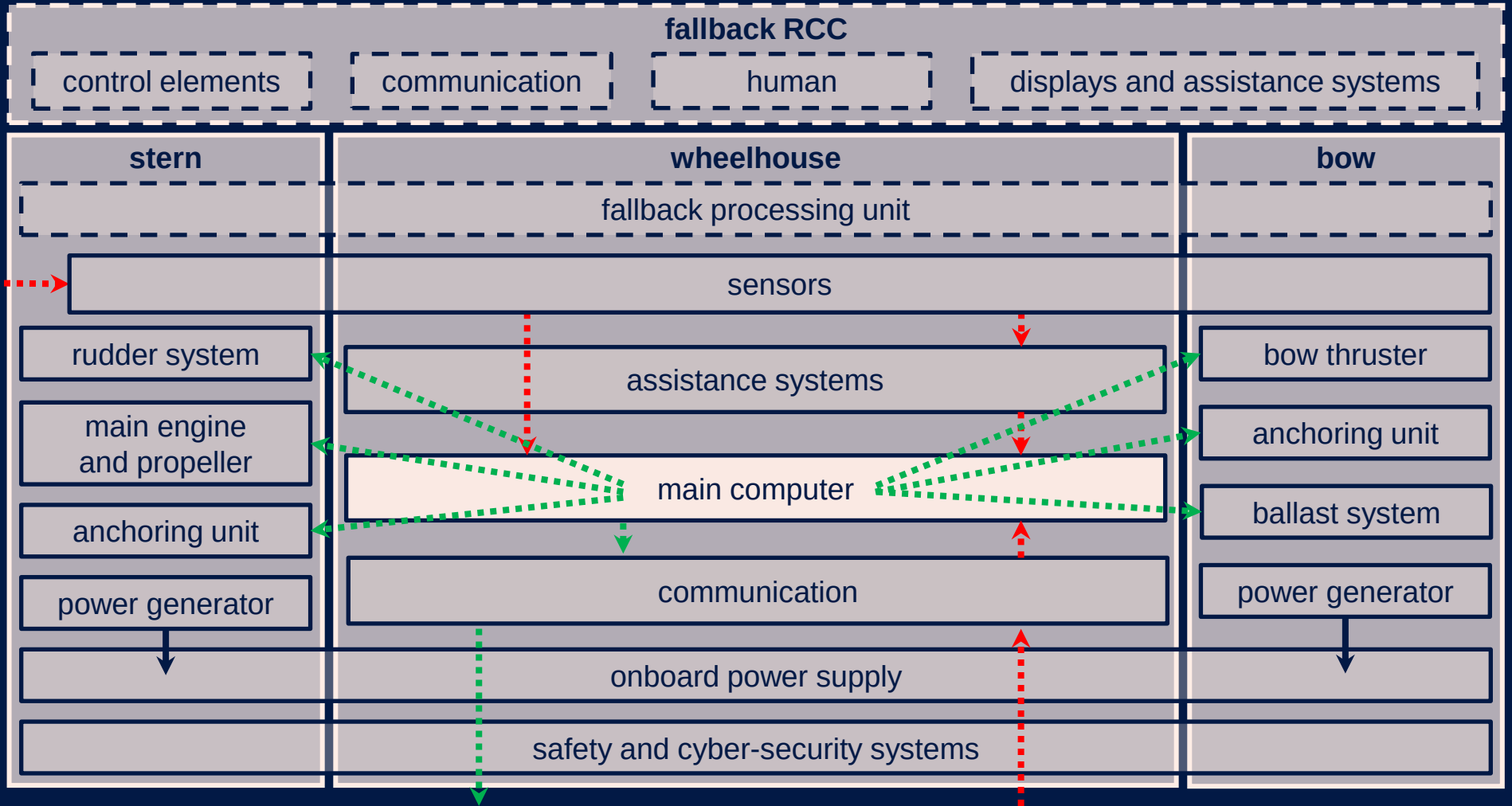


Diagram for a fully autonomous inland vessel



Agenda

1. Motivation

2. Methodology

3. Process Diagrams

4. Conclusion

What has been presented?

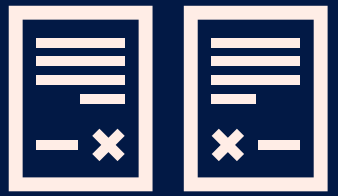
Process diagrams describing the navigation process in inland waterways

- Three operation modes
  - Conventional navigation
  - Remote controlled navigation
  - Autonomous navigation
- Analyzing main components and interconnections
- Fallback options

How do we benefit from it?

Relevance assessment of individual functionalities

Reveal impaired functionalities by system damage or failure



Comparison and risk analysis for different operation modes

What can be researched in the future?

More specific scenarios, systems and processes

Deeper analysis of degree of interconnection, e.g. by counting weighted connections

Thank you for your attention!

Co-authors from the DST

- Mohan Sai Krishna Illuri
- Igor Bačkalov
- Frédéric Etienne Kracht

Co-authors from the University of Duisburg-Essen

- Eva Spachtholz
- Marvin Glomsda

Funded by:

Federal Ministry for Digital and Transport

on the basis of a decision by the German Bundestag

The presented research is part of the SAFEBin project funded by the German Federal Ministry for Digital and Transport under grant agreement 45DTW2V05B.

Thomas Kerkmann
kerkmann@dst-org.de

Detailed diagrams

DST

SmartShipping website
www.smartshipping.info

SmartShipping