RISECDIS

Inland ECDIS

En route to autonomous sailing

A challenge for Inland ECDIS

Meeting October 2019

New Orleans, USA

En route to autonomous sailing

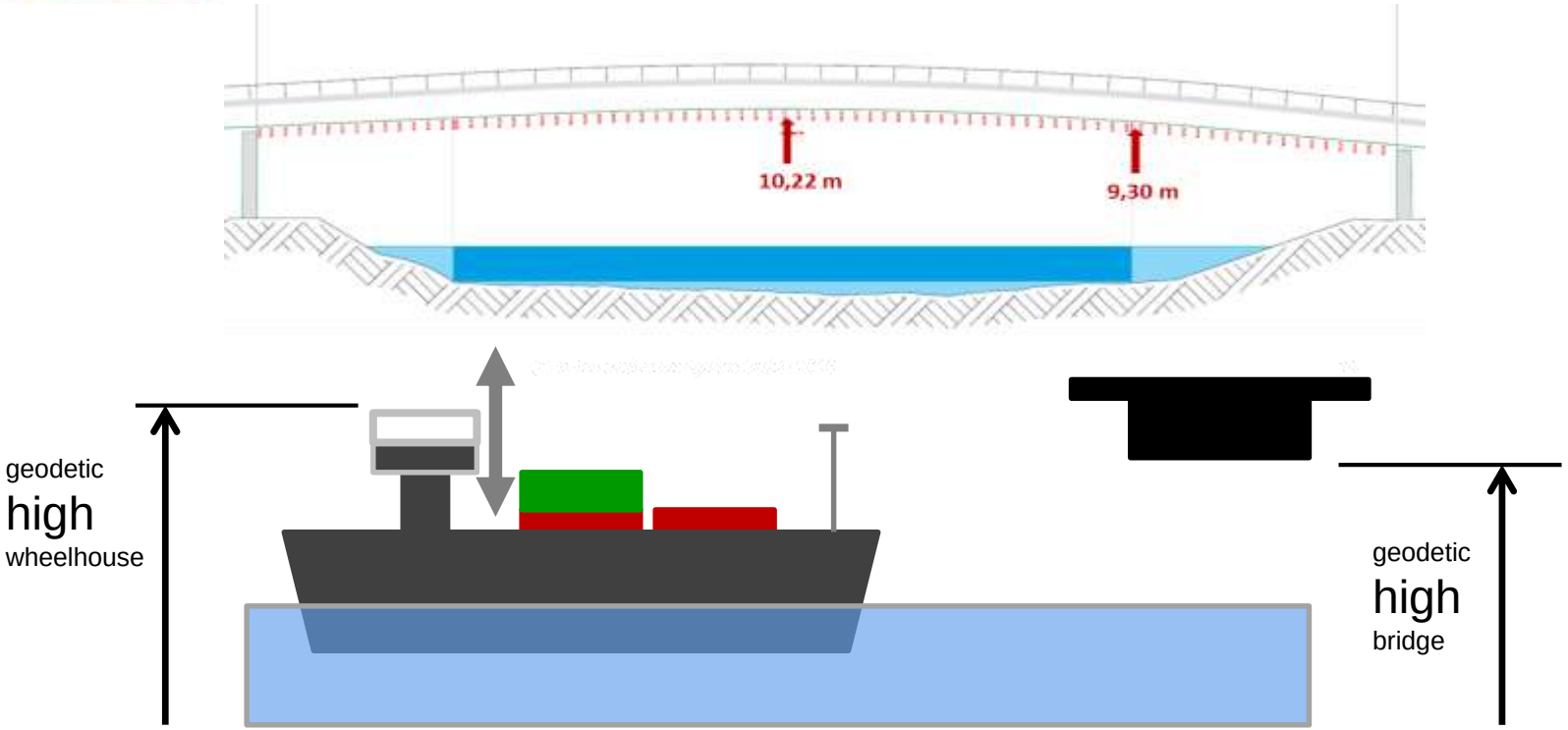
- Levels of automation in inland navigation
- Navigational assistance systems en route to…
  - Steering assistance systems (e.g. bridge collision warning)
  - Steering and propulsion assistance (docking assistant)
  - Collision avoidance assistance (on board or remote steering)
- Can Inland ECDIS also be a base standard for autonomous sailing?
  - System integration (ship cloud)
  - Combination of sensors, services and data exchange
  - Already known demands
- Conclusions

Levels of automation in inland navigation

Level	Designation	Vessel command	Monitoring of and responding to	Fallback	Remote control
0	**No automation**				**No**
1	**Steering assistance**				
2	**Partial automation** (steering and propulsion)				**Possible** (impact on crew requirements)
3	**Conditional automation** (including collision avoidance)				
4	**High automation** (without lock passing)				
5	**Full automation**				

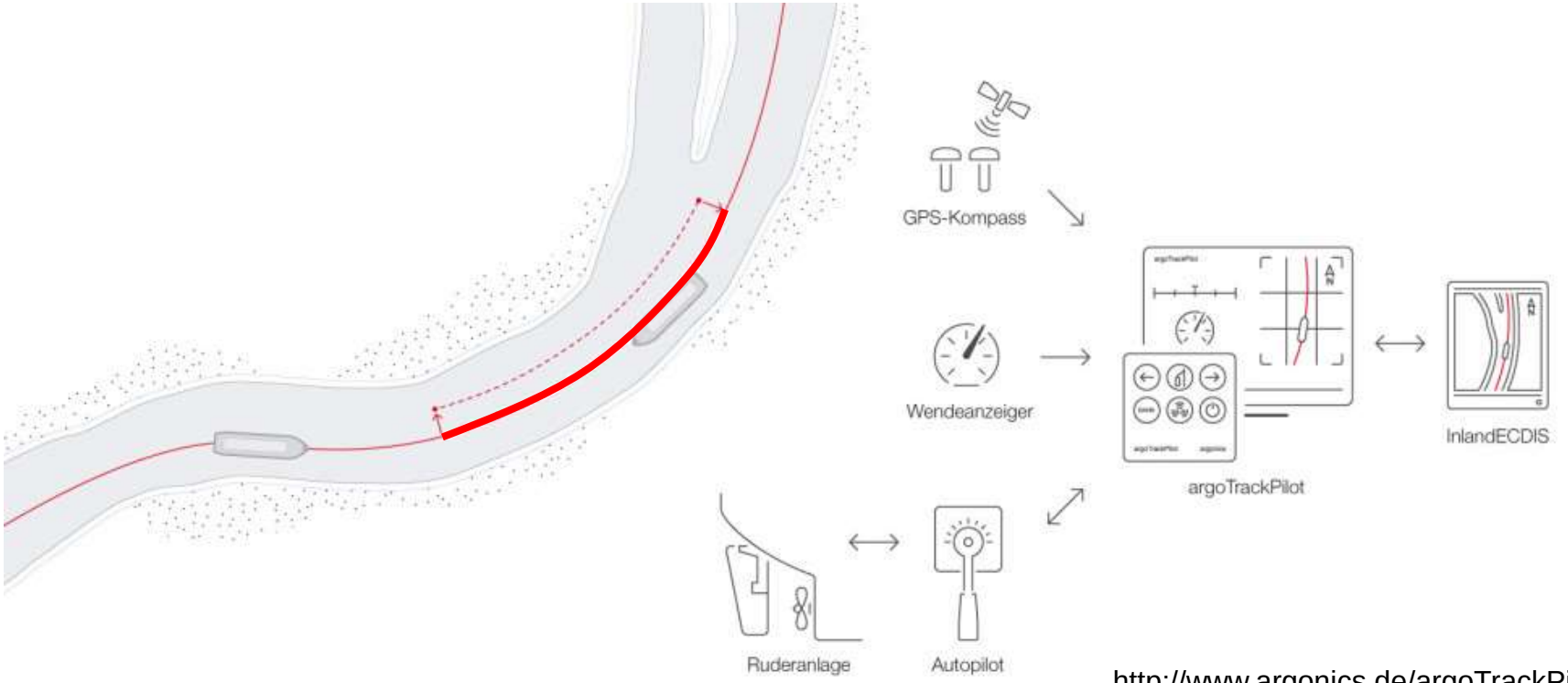
Navigational assistance systems en route…

Steering Assistance (e.g. bridge collision warning)



Navigational assistance systems en route…

Steering Assistance (Track pilot)



http://www.argonics.de/argoTrackPilot

The preloaded track can be manipulated by the skipper to avoid collisions

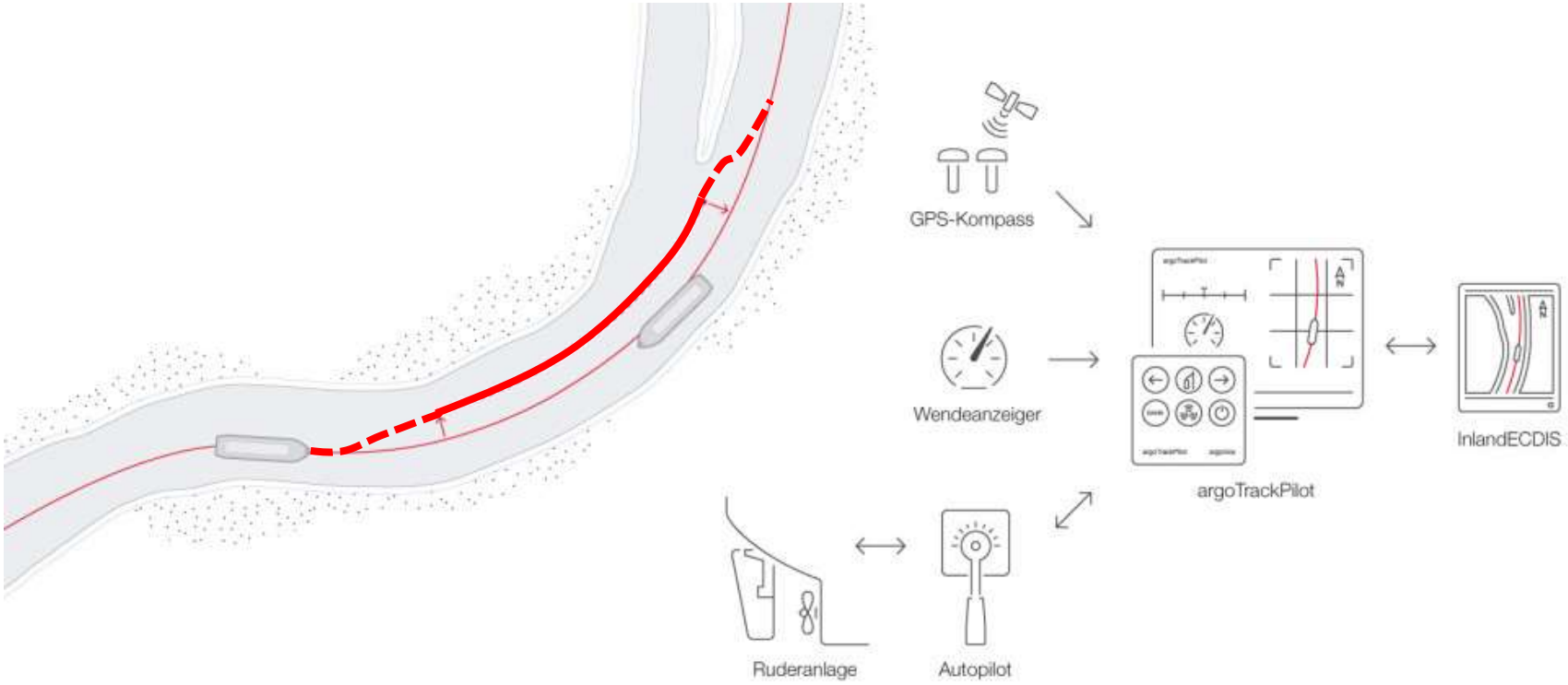
Navigational assistance systems en route…

Partial automation (steering and propulsion)

Research vessel: automatic docking

Navigational assistance systems en route…

Conditional automation (track pilot with collision avoidance assistant)



http://www.argonics.de/argoTrackPilot

Automated navigation, maybe no automated passing a lock

Navigational assistance systems en route…

Conditional Automation (“vessel train”)

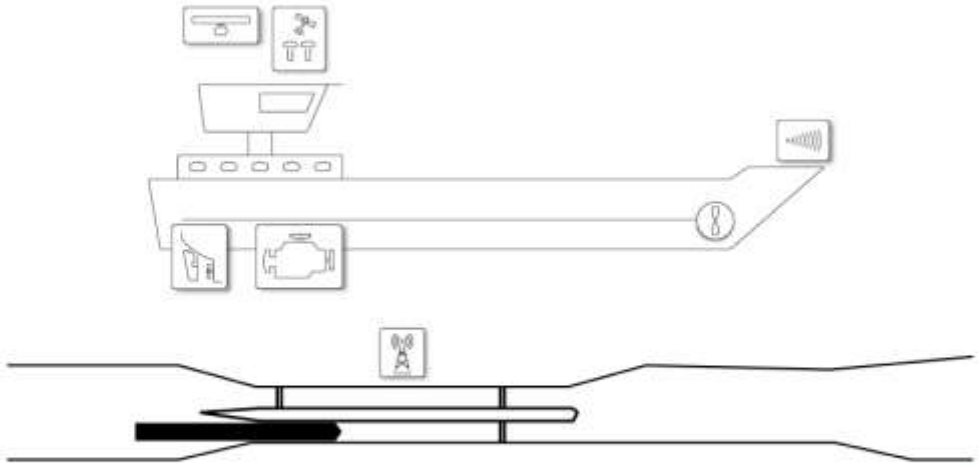
NOVIMAR
VESSELTRAIN

Navigational assistance systems en route…

High automation (lock passing assistant)

Recent Developments – Control System for SCIPPER

Lock maneuvering assistance system based on PPP and VDES for inland navigation



Alberding

weather dock AG

DLR

in innovative navigation

argonics GmbH

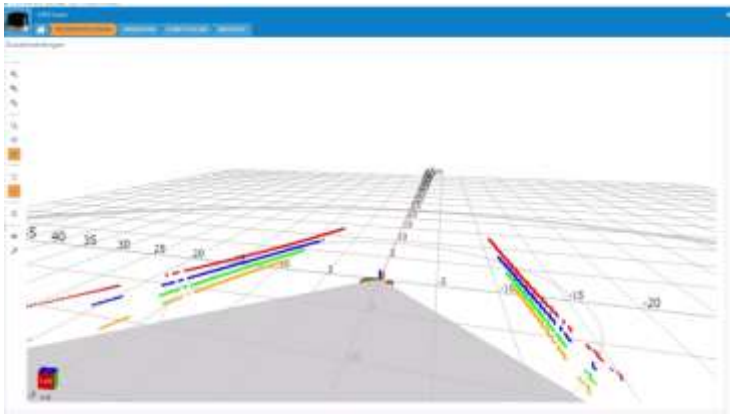
BAW Bundesanstalt für Wasserbau

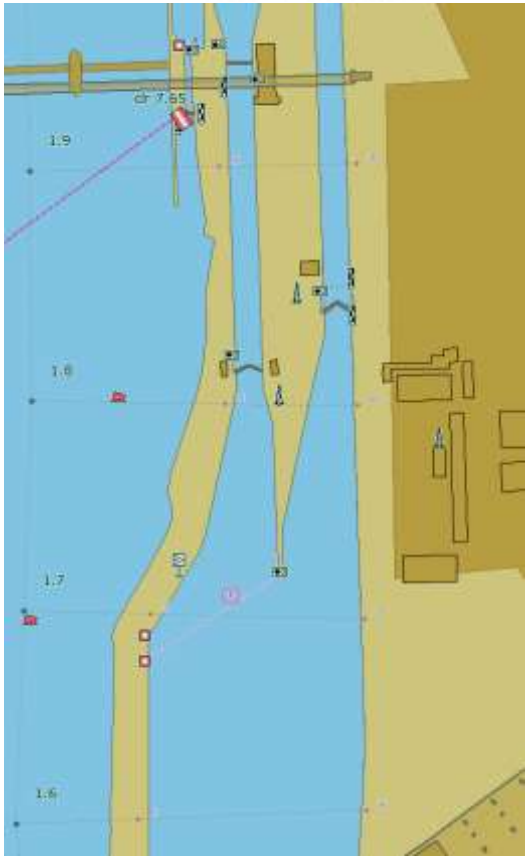
WSV.de

Navigational assistance systems en route…

High automation (lock passing assistant)

SCIPPER





Can Inland ECDIS also be a base standard for autonomous sailing?

Status quo: Inland ECDIS is ready for **visual Navigation**

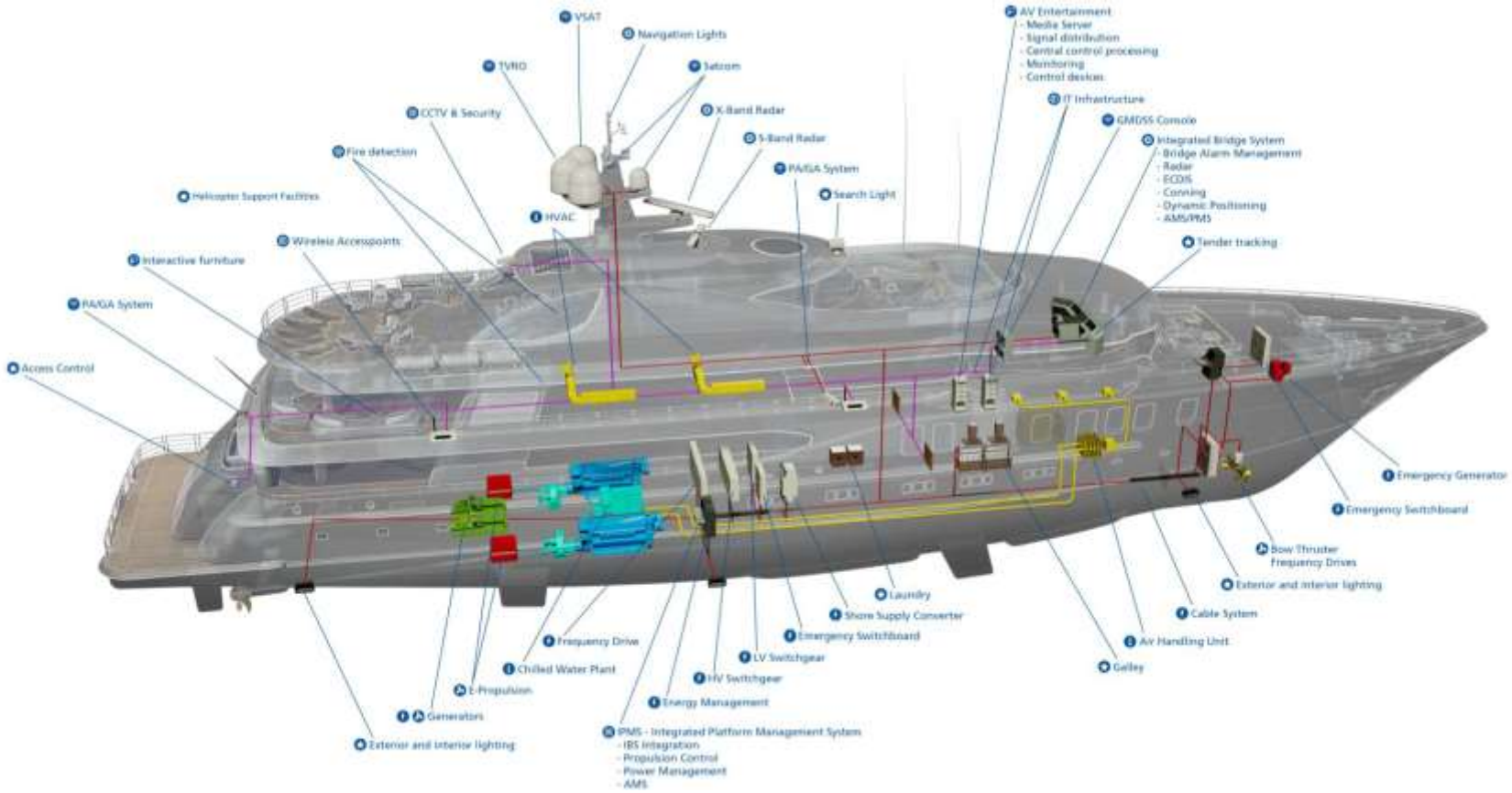
The Inland ECDIS system on board provides the skipper all the necessary information for navigation on inland waterways

- **Static information**: from the IENC, stored in the SENC (the on board database)
- **Dynamic information** (current restrictions): from AIS, Internet, sensors on board, but

only visualized on the chart

Can Inland ECDIS also be a base standard for autonomous sailing?

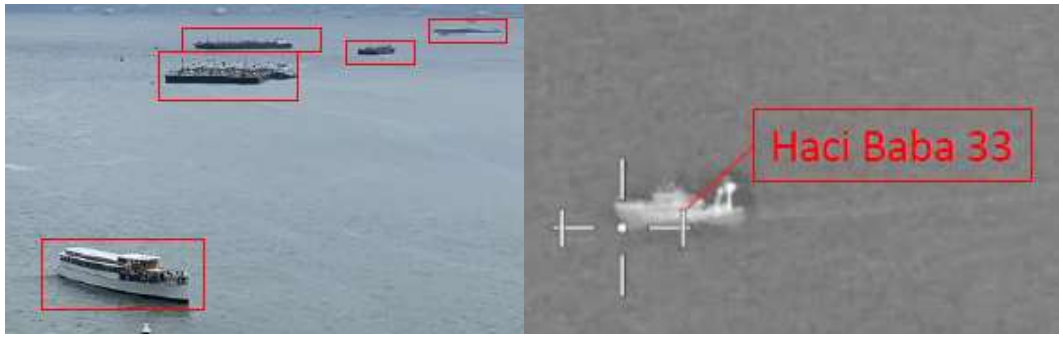
System integration (shipcloud)



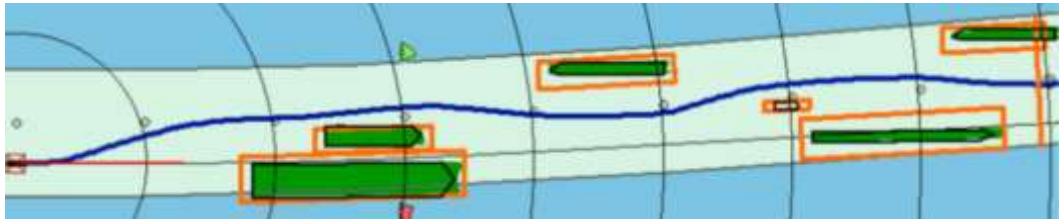
Can Inland ECDIS also be a base standard for autonomous sailing?

Combination of sensor data, data and data exchange

- Video processing, radar processing, target detection (matching)



- Predicting of meeting point to avoid collisions



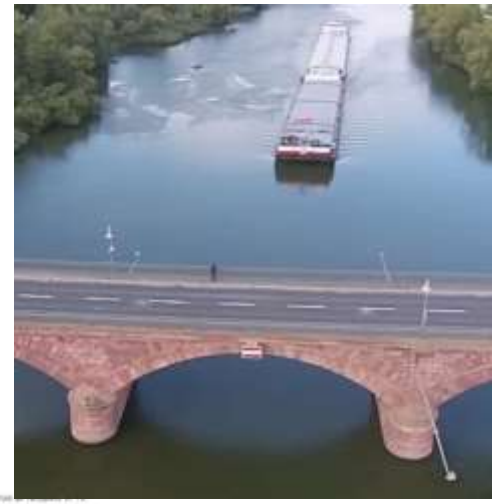
Can Inland ECDIS also be a base standard for autonomous sailing?

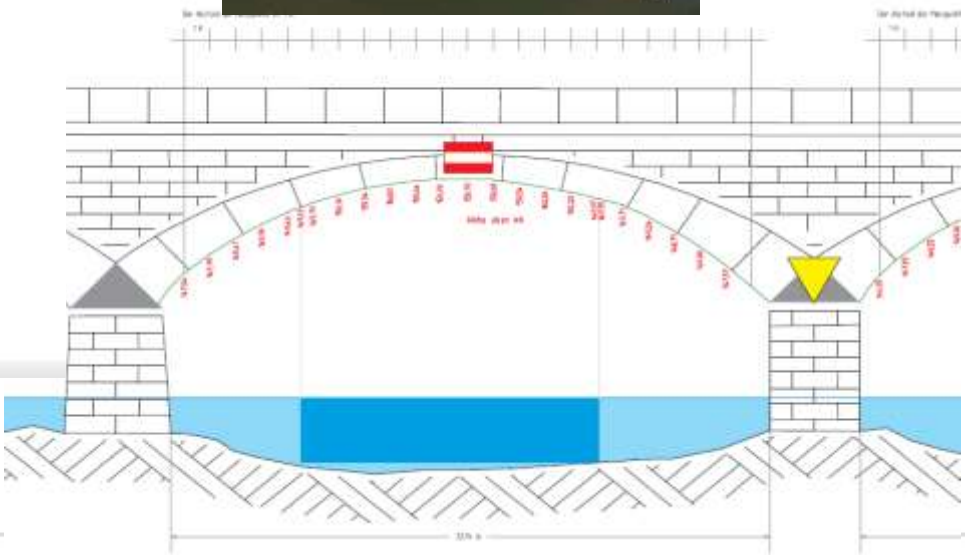
Already known demands (bridge profile)

Bridge heights in Inland-ECDIS charts

Object **wtwprf** (waterway profile), relevant attributes:

hunits	
wtwdis	
HEIGHT	Height, the value of the vertical distance to the highest point of the object, measured from a specified vertical datum.
reflev	Reference gravitational level
verdat	Vertical datum
OBJNAM, NOBJNM	
INFORM, NINFOM	
SCAMIN	
PICREP, TXTDSC	
DATSTA, DATEND	
PERSTA , PEREND	
SORDAT, SORIND	
NTXTDS	





Can Inland ECDIS also be a base standard for autonomous sailing?

Already known demands (Signals/symbols with “direction of impact”)

- **Proposal 1:** orientation of the symbol, plus text

- **Proposal 2:** Combination of two symbols

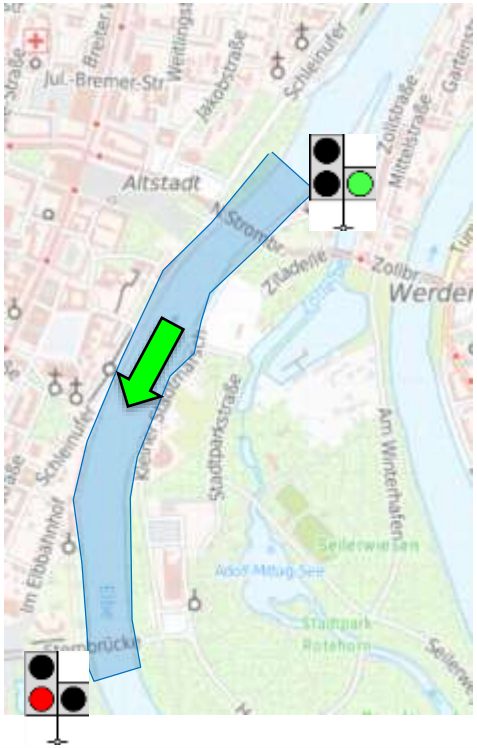
- **Proposal 3:** Direction of visibility of the signal

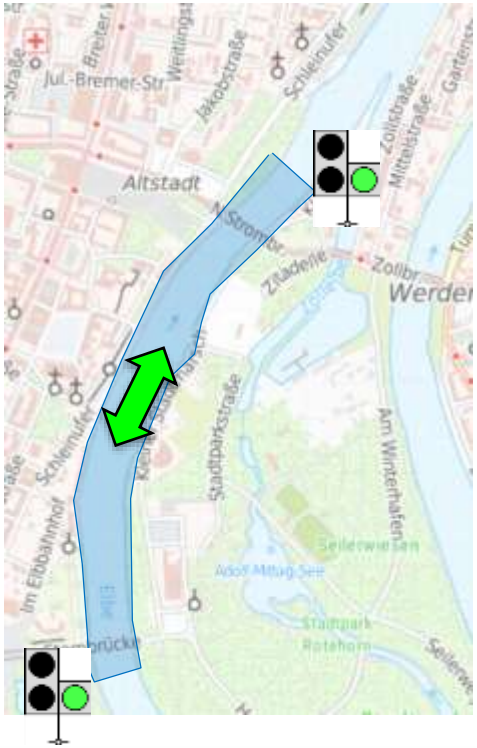
Can Inland ECDIS also be a base standard for autonomous sailing?

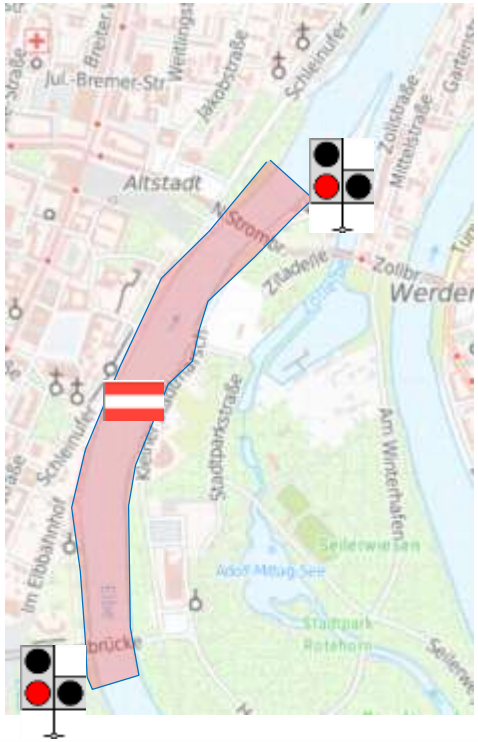
Already known demands (Direction of impact: temporarily one way)

Signals/symbols with “direction of impact” refer to a specific area:

- **Proposed solution:** to show the impact at this area:







Can Inland ECDIS also be a base standard for autonomous sailing?

Conclusions (general)

- **Static information**: The IENC is an important source to provide data about the general navigational conditions of the waterways. This can be used by human navigators (visualized to the skippers) as well as by machines (data import by assistance systems)

- **Dynamic information**: Provided by the “sensory organs” of the navigational assistance systems:
  - Sensors on board
  - Services (AIS, Web services)
  - Other vessels

- At the end the **“full autonomous”** navigation needs full autonomous decisions on board based on a reliable, complete and up to date data bank (on board) which represents the reality
- “Autonomous sailing” is much more complicate on Inland waterways than in maritime area

Can Inland ECDIS also be a base standard for autonomous sailing?

Conclusions (regarding the Inland ECDIS Standard)?

- Standardisation is at the end of technical development, but the process “En route to autonomous sailing” should be closely accompanied by the Inland ECDIS standardisation groups with the aim:
  - to detect the best practice results early and to standardize it in time

- **Inland ECDIS (SENC) and the IENC** could be in future the basic database for navigational systems as it is now for human skippers. In this case we miss:
  - Data fields for “dynamic information” in our data model
  - An general defined interface for the on board access to the SENC

Thank you for your attention!

Drafts by industrial designers of the Muthesius University of Fine Art and Design Kiel, AG Prof. Detlef Rhein, and ship drafts/technical concepts FH Kiel, AG Prof. Dr. Meyer-Bohe