(4)
Innovative Transportsysteme auf westdeutschen Wasserstraßen

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Challenges

- Skills shortage
- Low water
- Freight structure effect
- Competitive pressure
- Emission-free drives

Skills shortage

- Automation
- Reorganisation of work processes
- Increasing the attractiveness of
  - the education/training
  - the work

What is „automated“?

- Automated ↔ Autonomous
- Automated ↔ Unmanned
- Automated …
  - … Navigation
  - … Mooring
  - … Loading/Unloading
  - … Refuelling
  - … Inspection, Repair
  - … etc.

Levels of Automation

Level	Description	Ship's command	Monitoring	Fallback
0	No Automation			
1	Steering assistance			
2	Partial automation			
3	Limited Automation			
4	Extended Automation (with operation limitations)			
5	Full automation			

Source: CESNI

Automated Navigation

- Path control
  - The ship sails on a predefined or self-calculated course from the start to the end point.
- Environment recognition
  - The vessel recognises navigationally relevant environmental conditions and objects
- Driving strategy
  - The ship reacts to the environment and the behaviour of the surrounding objects

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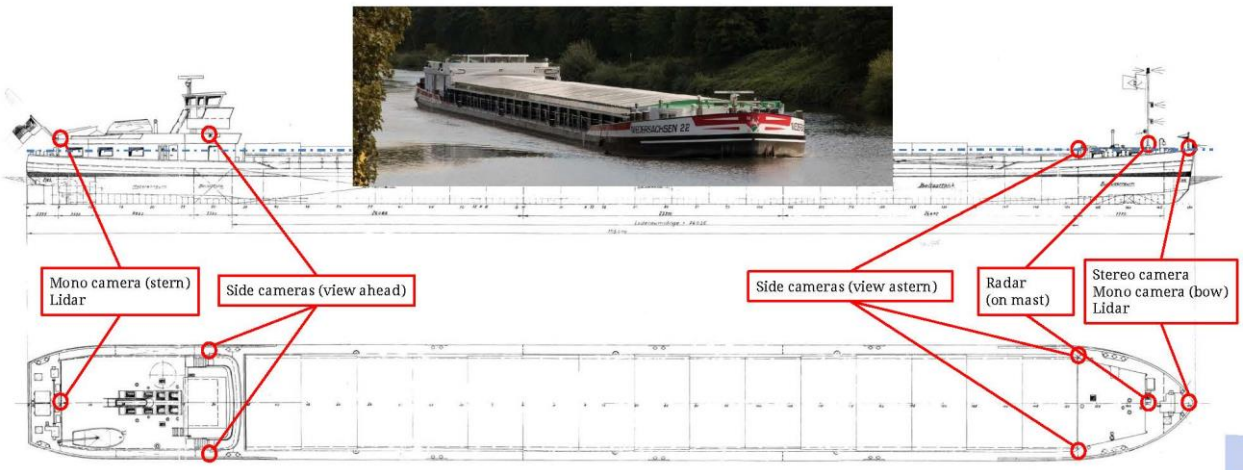
Sensors for automation



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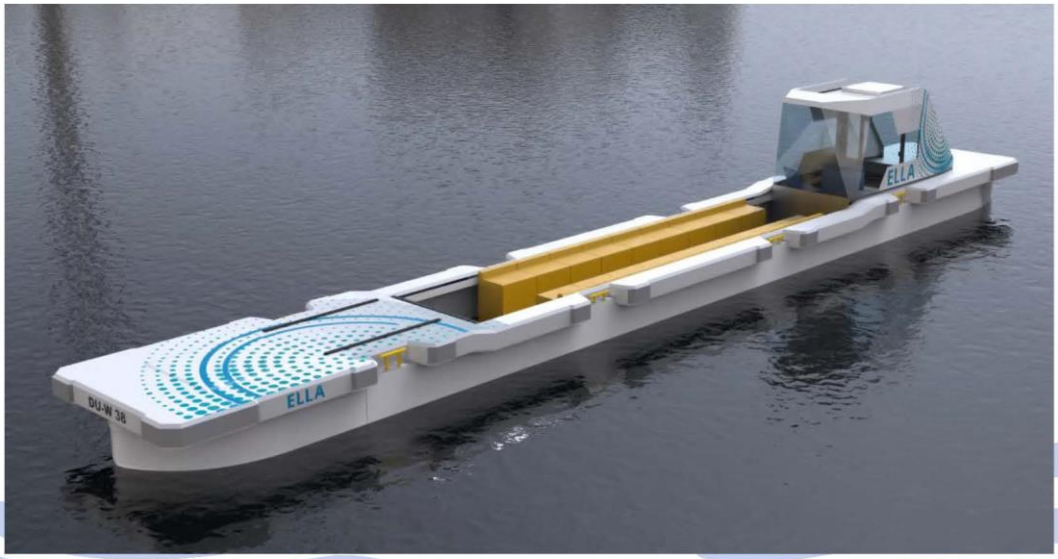

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Smart & Green Ship

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Increasing the attractiveness

Training and
Examination
on the simulator

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Increasing the attractiveness

- Project „Fernbin“
  Remote control of an inland vessel with the aid of assistance systems and a control centre
- Office workplace
- Partial automation (Level 3)
- Mobile network coverage

Low water

- Transport volumes/speeds

$$\nabla = C_B \times L \times B \times T$$

$$Fr_h = \frac{V}{\sqrt{gh}} \leq 0{,}75$$

- Reliability of the transport mode

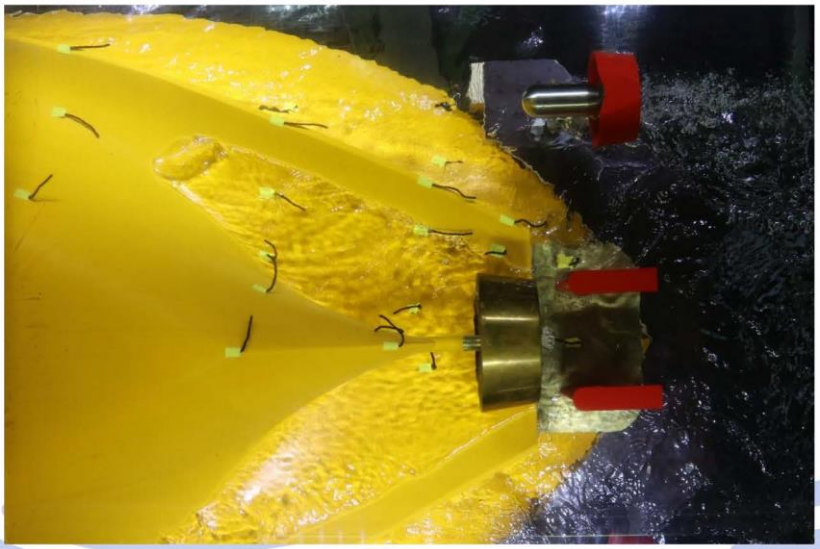
Low water

- Reserve vessels + reserve crew
- Auxiliary drives for existing ships
- Technical adaptation for new builds: Aft body shape and propulsors
- Lower draft → increasing length and breaths, lightweight structure
- Extended storage at the customer

Low water

- Project „FlaBi“
  - Adapted aft body shape
  - Alternative propulsors (paddle wheel, paddle chain drive, auxiliary drives for existing vessels)
  - Structural lightweight construction

Auxiliary drives for existing ships



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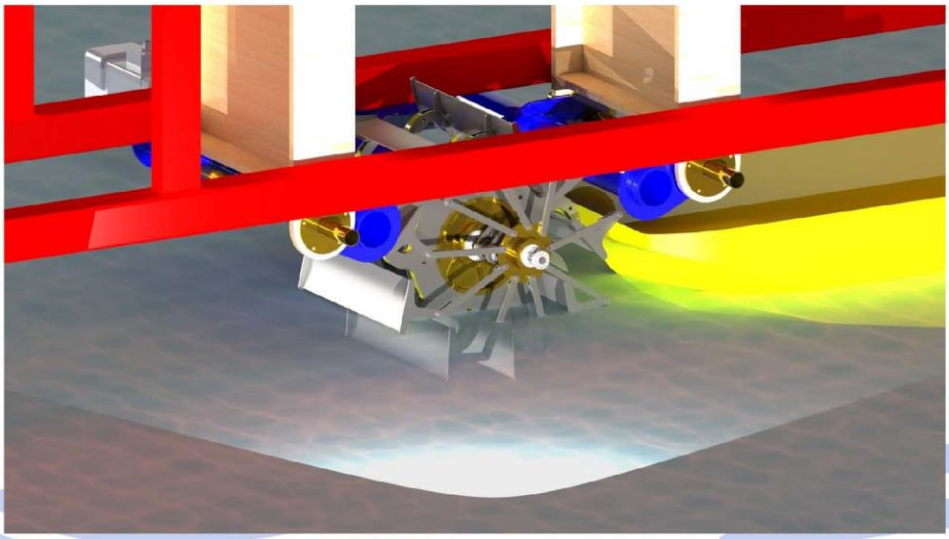
Paddle wheel



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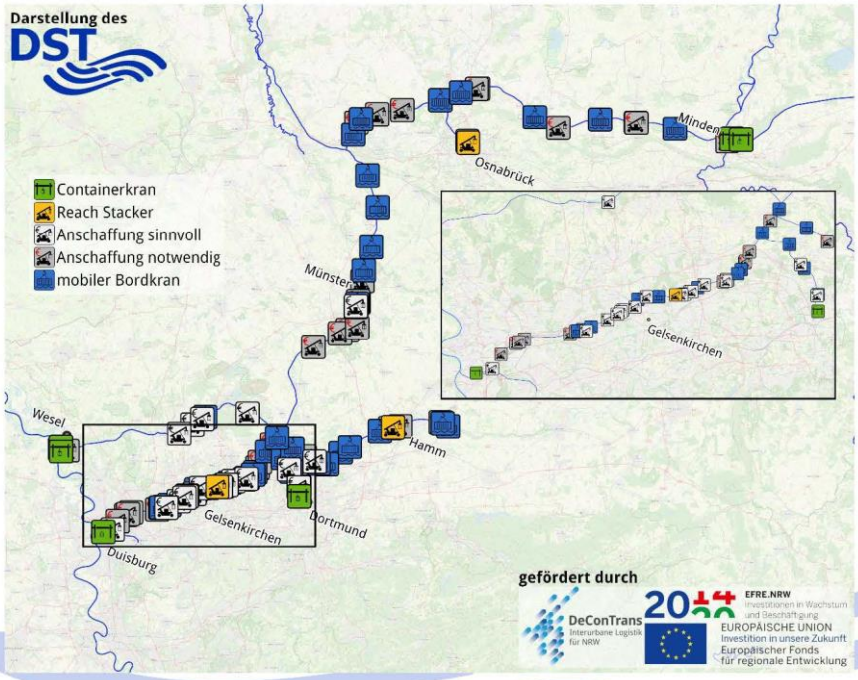
Freight structure effect

- Bulk goods become significantly less
- Smaller cargo units
  - Project cargo
  - Container
  - Paletts, bigbags



Project "DeConTrans"

Decentralised Container Transport

Competitive pressure

- Automation on road and railway
- Multimodal transports
  - Think in system terms
  - shift to the waterway, if possible
- Costs of cargo handling kills multimodal transports

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Automated harbour operations

HaFoLa
Versuchszentrum für innovative Hafen- und Umschlagtechnologien

gefördert vom
Ministerium für Verkehr
des Landes Nordrhein-Westfalen

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HaFoLa

- Simulation
- Model tests
- Automation
  - Mooring
  - Container handling
  - Handling of liquid goods
  - Interface to road/railway

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Conclusions

- Technical solutions (at least approaches) for inland vessels available.
- Not only inland vessels have to be adapted.