Inland navigation - setting up the regulatory framework of autonomous vessels

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A key player for automation : the CCNR

- The CCNR (Commission centrale pour la navigation du Rhin) is an international body regulating navigation on the Rhine.

- It provides the secretariat of CESNI (*), the committee for technical standards for vessels, crews and information technology in inland waterways.
- Beyond regulation, the remit of CCNR covers any and all questions related to the development of navigation on the Rhine.

(*Comité Européen pour l'Élaboration de Standards dans le Domaine de Navigation Intérieure)

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Strategic context of the CCNR work on automation

The CCNR mandate for work on automation stems from the Mannheim Declaration (2018) :

“ We call on the CCNR to promote the development of digitalisation, automation and other modern technologies in order to contribute to the competitiveness, safety and sustainable development of inland navigation. “

Three targets :

- safety
- sustainability
- competitiveness

This was translated into a detailed **Vision for automation 2022–2028**

https://www.ccr-zkr.org/files/documents/AutomatisationNav/Vision_detaillee_fr.pdf (FR, DE, NL only)

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The CCNR work program on automation 2022-2028

«VISION FOR AUTOMATION – 2022-2028»

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The challenges of inland waterways

Automation of vessels on inland waterways has its own unique challenges, different from other land-base modes of transport or from maritime transport.

These were identified as :

- the composition of the crews,
- navigation in a closed environment, with limitations related to the restricted dimensions of the waterway,
- passage through locks,
- water and bridge heights,
- maneuverability of the vessels.

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The RN committee : a structure to manage automation

In 2020, the CCNR reestablished RN committee to :

- Examine requests for experimentations of automated navigation.
- Prepare decisions authorizing the necessary temporary exemptions from navigation rules.
- More generally, to steer, prioritize and coordinate all work on automated navigation.

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CCNR tools to build a common understanding

Knowledge-sharing tools produced by CCNR include :

- A census of past and current **automation projects** :

  https://automation.ccr-zkr.org/

- A multilingual **glossary of terms** relating to automated navigation and remotely operated craft.
- A common definition of 5 **levels of automation** (LoA) in inland waterways

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	Level of automation[1]	Designation	Craft command (steering, propulsion, wheelhouse, etc.)	Monitoring of and responding to navigational environment	Fallback performance of dynamic navigation tasks
BOATMASTER PERFORMS PART OR ALL OF THE DYNAMIC NAVIGATION TASKS	0	**NO AUTOMATION** the full-time performance by the boatmaster of all aspects of the dynamic navigation tasks, even when supported by warning or intervention systems			
	1	**STEERING ASSISTANCE** the context-specific performance by a steering automation system using certain information about the navigational environment and with the expectation that the boatmaster performs all remaining aspects of the dynamic navigation tasks			
	2	**PARTIAL AUTOMATION** the context-specific performance by a navigation automation system of both steering and propulsion using certain information about the navigational environment and with the expectation that the boatmaster performs all remaining aspects of the dynamic navigation tasks			
SYSTEM PERFORMS THE ENTIRE DYNAMIC NAVIGATION TASKS (WHEN ENGAGED)	3	**CONDITIONAL AUTOMATION** the sustained context-specific performance by a navigation automation system of all dynamic navigation tasks, including collision avoidance, with the expectation that the boatmaster will be receptive to requests to intervene and to system failures and will respond appropriately			
	4	**HIGH AUTOMATION** the sustained context-specific performance and fallback performance by a navigation automation system of all dynamic navigation tasks, without expecting a boatmaster responding to a request to intervene[2]			
	5	**AUTONOMOUS = FULL AUTOMATION** the sustained and unconditional performance and fallback performance by a navigation automation system of all dynamic navigation tasks, without expecting a boatmaster responding to a request to intervene			

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A CCNR process for allowing autonomous experimentations

A CCNR process for allowing temporary exemptions from regular rules has been implemented, beginning in 2022.

This has allowed several remote operations to be approved, beginning with the remotely operated *Perseverance* and *Privilège* in 2023.

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And at a national level ?

- Almost countries have adopted a framework for approving experimental vessels, but the approval processes differ from one country to the next.
- The national processes have been applied to autonomous vessels, allowing experimentation of remotely operated boats, with regular, reduced or no crews.
- Adoption has been variable, with Belgium and the Netherlands leading the way
- SEAMLESS aims to demonstrate the operation of a vessel across national borders

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Conclusion and key challenges

In 2026, the “experience-building phase” for automated inland navigation is well underway, with a growing number of test deployments.

Remotely operated boats, rather than “self-driving” boats appear to be the most popular form of automation. The next stage for these will be to test the reduction in the onboard crew.

For inland waterways, there are still many challenges beyond mastering navigation :

- Traffic rules adaptation
- Human–machine interaction
- Crew requirements
- Cybersecurity
- Liability

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Thank you

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