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Inland Transport Committee

Working Party on Inland Water Transport

Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation

Fifty-fifth session
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Item 5 of the provisional agenda
Automation in inland navigation and smart shipping

Automation levels in inland navigation

Note by the secretariat

I. Mandate

1. This document is submitted in line with cluster 5: Inland Waterway Transport, paragraph 5.1 of the programme of work 2018–2019 (ECE/TRANS/2018/21/Add.1) adopted by the Inland Transport Committee at its eightieth session (20–23 February 2018) (ECE/TRANS/274, para. 123).

2. At its fifty-fourth session, the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (SC.3/WP.3) noted the working document on automation in inland navigation submitted for the eighty-first session of the Inland Transport Committee (ECE/TRANS/2019/16) that contained the definition of automation levels in inland navigation adopted by the Central Commission for the Navigation of the Rhine (CCNR), and decided to include automation in the agenda of its fifty-fifth session (ECE/TRANS/SC.3/WP.3/108, para. 70).

3. The present document reproduces the annex to resolution 2018-II-16 adopted by CCNR at its plenary meeting in December 2018, transmitted to the secretariat, and contains proposals for follow-up actions that may be undertaken by the Working Party on Inland Water Transport (SC.3). SC.3/WP.3 may wish to continue discussion of the automation levels and provide recommendations for SC.3 on the follow-up activities.

II. International definition of automation levels in inland navigation adopted by the Central Commission for the Navigation of the Rhine

4. Automated navigation covers a wide range of technical solutions and addresses cases ranging from a simple navigation assistance to a fully automated navigation. Although technology synergies are expected with the maritime sector, CCNR has emphasized the specificities of inland water transport that should be taken into account, such as:

- The composition of crews
- Navigation in enclosed and restricted conditions
- The passage of locks
- The height of the water level and under bridges
- The manoeuvrability of vessels.

5. During its plenary meeting in December 2018, CCNR adopted a first international definition of levels of automation in inland navigation by its resolution 2018-II-16[1] in order to ensure a clear understanding of automated navigation as a whole and support further work, including the analysis of the regulatory needs. It was aimed at improving safety and functionality of navigation of the Rhine and European inland navigation in whole, promoting innovation and ensuring the uniformity and consistency of the legal framework and technical standards applicable on the Rhine. This definition is valid till 31 December 2020, given that it may be subject to modifications based on the experience and knowledge acquired.

6. CCNR invited the European Commission, the Economic Commission for Europe (ECE), the Danube Commission, the Mosel Commission, the International Sava River Basin Commission, CCNR observer States, the European Committee for the development of standards in the field of inland navigation (CESNI) and associations recognized by CCNR to apply this definition in the context of relevant initiatives or work, in particular, in the regulatory activities.

7. The definition of automation levels in inland navigation is given in the table below. For this purpose, the following terms and definitions are applied:

(a) “Dynamic navigation tasks”: the set of tactical vessel operations, such as operation of the rudder apparatus, propulsion, anchor winches or elevating wheelhouse. The complexity of these tasks depends upon the context considered (for example, the manipulation of anchor winches can be excluded, where the use of anchors is forbidden anyway).

(b) “Context-specific”: confined navigational conditions such as navigation on specific waterway sections or lock crossing, as well as vessel arrangements with convoys or platooning. The context includes the infrastructure relevant for automation, for example, the type and capacity of radio transmission networks.

(c) “Navigational environment”: fixed and dynamic conditions affecting navigation, such as the shape of a waterway, the water level, weather conditions, visibility, vessel crossing and other factors. The navigation automation system is able to use only a part of the available information (for example, under level 1, rate-of-turn indicators do not use information on vessel crossing). The response to the navigational environment includes the radiocommunication with boatmasters of other vessels.

(d) “Collision avoidance”: the critical task in responding to the environmental conditions (other vessels, bridges, etc.).

[1] www.ccr-zkr.org/files/documents/resolutions/ccr2018-IIf.pdf.

	Level	*Designation*	*Vessel command (steering, propulsion, wheelhouse, etc.)*	*Monitoring of and responding to navigational environment*	*Fall-back performance of dynamic navigation tasks*	*Remote control*
Boatmaster performs part or all of the dynamic navigation tasks	0	**No automation** the full-time performance by the human boatmaster of all aspects of the dynamic navigation tasks, even when enhanced by warning or intervention systems *Example: navigation with the support of the radar installation*				
	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 human boatmaster performs all remaining aspects of the dynamic navigation tasks *Examples: rate-of-turn regulator; track pilot (track-keeping system for inland vessels along pre-defined guiding lines)*				No
	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 human 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 human boatmaster will be receptive to requests to intervene and to system failures and will respond appropriately				Subject to context specific execution, remote control is possible (vessel command, monitoring of and response to the environment or fall-back performance). It may have an influence on the number or qualification of crews
	4	**High automation** the sustained context-specific performance by a navigation automation system of all dynamic navigation tasks and fall-back operation, without expecting a human boatmaster responding to a request to intervene[2] *Example: vessel operating on a canal section between two successive locks (environment well known), but the automation system is not able to manage alone the passage through the lock (requiring human intervention)*				
	5	**Autonomous = Full automation** the sustained and unconditional performance by a navigation automation system of all dynamic navigation tasks and fall-back operation, without expecting a human boatmaster will respond to a request to intervene				

[2] This level introduces two different functionalities: the ability of "normal" operation without expecting human intervention and the exhaustive fall-back. Two sub-levels could be envisaged.

III. Proposed follow-up actions

8. At its sixty-second session, SC.3 agreed on the following steps:

- Consideration and acceptance by SC.3 of the definition of automation levels
- Analysis of bottlenecks
- Preparation of a road map for international cooperation for the promotion and development of autonomous shipping.

9. At its fifty-forth session, SC.3/WP.3 agreed with the definition proposed by CCNR (ECE/TRANS/SC.3/WP.3/108, para. 71). However, SC.3/WP.3 was invited to submit its feedback to CCNR.

10. Follow-up actions based on the decision of SC.3 may include:

(a) Collection of the feedback from member States

SC.3/WP.3 may wish to decide to collect the feedback from member States and other stakeholders by means of a questionnaire for the sixty-third session of SC.3;

(b) Acceptance by SC.3 of the definition of automation levels

SC.3/WP.3 may wish to consider preparing a SC.3 resolution to introduce the automation definitions at the pan-European level and encourage member States to implement them;

(c) Collection of the information about bottlenecks

Some findings on the bottlenecks and gaps in the existing legislation were presented at the workshop "Autonomous shipping and inland navigation" held at its fifty-second session (ECE/TRANS/SC.3/WP.3/104, paras. 9–30), the sixty-second session of SC.3 (ECE/TRANS/SC.3/207, para. 46) and the fifty-fourth session of SC.3/WP.3 (ECE/TRANS/SC.3/WP.3/108, para. 72). SC.3/WP.3 may wish to continue exchanging information on this issue;

(d) Preparation of a road map

SC.3/WP.3 may wish to decide to prepare a road map for international cooperation for the promotion and development of autonomous shipping. An example may be the ECE Road Map on Intelligent Transport Systems (ITS).[3] Given the efforts by member States, the European Commission, CCNR, IMO, the Marine Autonomous Systems Regulatory Working Group (the United Kingdom of Great Britain and Northern Ireland) and other stakeholders as well as the progress reached in other inland transport modes, the purpose could be the integration of automation in inland navigation in the activities of ITC. The proposed actions should build on the coordination and close cooperation with key players. They could be:

- Acceptance of a common definition that is used by all stakeholders
- Harmonizing policies for the deployment of automation in inland navigation at the pan-European level
- Forging international cooperation and exchanging best practice in ensuring data security, addressing the liability concerns and other relevant issues
- Integration of this topic in the work of ITC as part of ITS and reaching synergy with other Working Parties
- Assisting governments, contributing to capacity building and awareness raising, organizing workshops and round tables on automation and smart shipping.

[3] www.unece.org/fileadmin/DAM/trans/publications/Intelligent_Transport_Systems_for_Sustainable_Mobility.PDF.