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Automation in inland navigation

Automation in inland navigation and smart shipping in the activities of members States of the United Nations Economic Commission for Europe

Note by the secretariat*, **

Mandate

1. This document is submitted in line with the programme of work of the Transport subprogramme for 2020 (ECE/TRANS/2020/21, chapter IV, table, section A, para. 11) adopted by the Inland Transport Committee (ITC) at its eighty-second session (ECE/TRANS/294, para 136).

2. At its sixty-third session, the Working Party on Inland Water Transport (SC.3) confirmed the decision of the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (SC.3/WP.3) to continue exchanging information on automation in inland navigation and smart shipping by means of a questionnaire and asked the secretariat to collect information for the fifty-seventh session of SC.3/WP.3. Due to the COVID-19 outbreak, the fifty-seventh session of SC.3/WP.3 could not be held in Geneva according to the approved schedule, and the secretariat included this issue in the questionnaire for the sixty-fourth session of SC.3.

3. The answers to the questionnaire transmitted by member States to the secretariat are reproduced in the annex to this document. SC.3 may wish to take note of this information, complement this at its sixty-forth session, if necessary, and provide further guidance to the secretariat.

* The present document was submitted after the deadline in order to reflect the most recent information.
** The present document is being issued without formal editing.

Annex

Recent developments and the ongoing activities in the field of automation in inland navigation and smart shipping in Europe

A. UNECE questionnaire on automation in inland navigation

1. Governments were invited to provide information on the following issues:

- National programmes and/or strategies for inland water transport which include automation and smart shipping;
- The ongoing and forthcoming projects in the field of automation and smart shipping;
- The existing automated, autonomous and smart vessels, prototypes and models, test zones and areas and other achievements in this field;
- The legislative framework and standards for automated and smart shipping;
- The main challenges and critical issues identified in this work.

B. Austria

2. As a member of the European committee for drawing up standards in the field of inland navigation (CESNI), Austria takes part in the activities included in the CESNI 2019–2021 work programme on the automation of navigation. Furthermore, Austria is a member of the Small group on track keeping assistants of the Central Commission for the navigation of the Rhine (CCNR).

3. Currently, tests of autonomous and smart vessels may be conducted on the basis of special permissions. The legislative framework for autonomous and smart shipping will be developed by CESNI.

4. The main challenges and critical issues identified in this work include the following issues:

- Safety of vessels in case of a failure of the automated control system: on rivers, it is not sufficient to stop all systems of the vessel in case of a failure of the automated system. The backup system would have to be able to steer and safely stop a vessel on a free-flowing river.
- Replacing of the crew: most projects are focused on replacing the boatmaster with automated systems. Replacing the rest of the crew would either require very sophisticated and expensive automated mooring systems on board or a completely new infrastructure. The vessel maintenance and some particular systems on board vessels, for example, the fire-fighting system, would also need to be automated.
- Legal aspects, such as responsibility and liability, and the need for regulations for mixed traffic.

C. Belgium

Flemish Region

5. De Vlaamse Waterweg NV has a special programme dedicated to smart shipping. The programme is divided into three parts: smart vessels (including automated shipping), smart infrastructure and smart data. The programme aims to support innovation as much as possible and help to make the path for the commercialization of automated shipping. In relation to smart vessels, the purpose is to ensure the same safety level for automated vessels as for “regular” vessels. Together with partners from the AUTOSHIP project, De Vlaamse

Waterweg NV wants to deliver a hazard risk index, which will show the risks related to "regular" shipping and automated shipping and will compare the two cases. The expected timeframe is the end of 2020. Another ongoing project is a study of the economic aspects of smart shipping in the form of a business case. The expected timeframe is the end of 2021.

6. In relation to smart infrastructure, the current task is to get a better insight into the influence of automated shipping on the infrastructure. As a specific activity, De Vlaamse Waterweg NV is going to investigate the options that can be provided by the shore control centre, which could be also transformed in the future into the educational centre for shippers, so they can learn here how to control an automated ship. The timeframe for this activity would be the end of 2023. One more ongoing project aims to resolve the problem related to passing of automated vessels through locks (the details are given below).

7. Activities related to smart data focus on the adapting of agreements and standards to smart shipping. This is an ongoing project.

8. Next to these three pillars, De Vlaamse Waterweg NV also works on communication on a rolling basis, represents and promotes the smart shipping programme and the projects under its framework at national and international meetings.

9. At the international level, De Vlaamse Waterweg NV takes part in the AUTOSHIP project. This project aims at giving two demonstrations with automated ships by the end of 2022: one of them will take place in Norway with a focus on short sea shipping and another will take place in Flanders with a focus on inland waterways. The use cases developed within the project will optimize efforts and investments in order to advance common standards and enable operations in a shorter timeframe than expected; this will allow commercial applications of the technology behind the next generation of autonomous ships by the end of 2023. Both use cases will be the first ones out of a series of vessels to be delivered shortly after the project ends and will be used to demonstrate a complete set of key-enabling technologies (KET) for autonomous operations to achieve level 5 (Automation Level 5 of the Society of Automotive Engineers). Together with the partners, De Vlaamse Waterweg NV will make sure that the remote control centre in Wintam (Belgium) is fully equipped to perform the demonstration.

10. A comprehensive impact analysis will link the KETs and the capabilities of new vessels to their interaction with the operations and logistics value chain. Their effects on operability, reliability and safety will be related to the complex scenarios addressing social and economic dimensions such as jobs, change management and logistics, security and cybersecurity, liability, international regulation and environment. Based on the newly identified crew and operators' skills requirements, best practices, methodologies, tools and training protocols will be defined.

11. In addition to the aspects mentioned above, AUTOSHIP covers the following aspects:

- Business case and models: through a thorough investigation of the proposed socio-economic framework for the adoption and acceptance of autonomous shipping, the project will eventually propose a comprehensive business case analysis with a focus on the two early-adopters use cases and how this knowledge can be transferred to other maritime transport segments
- Roadmap to intercontinental research and analysis navigation: preparation of a roadmap to generalize and apply results to other use-cases in view of scaling-up services for international and intercontinental navigation
- Communication acceptance and dissemination: to achieve the above objectives, the involvement of the necessary stakeholders will be assured, both with one-to-one interaction and by disseminating the results in the marine/maritime industry and forums.

12. At the national level, De Vlaamse Waterweg NV is supporting company Seafar which provides services to help operate unmanned and crew-reduced ships. They support and control automated ships through their control centre in Antwerp (Belgium). Seafar has already received two approvals:

- Since November 2019, they have been sailing on the IJzer and the Plassendale-Nieuwpoort canal with a vessel *Watertruck.*[1] Since April 2020, the company has received an additional permission to use two more *Watertrucks* on the same route
- Since April 2020, they have been allowed to sail with a *Watertruck* on the Leuven-Dijle Canal
- From 1 September 2020 on, Seafar will also test vessel *Gamma* on the channel Bocholt-Herentals and the sea channel Brussels-Scheldt. This ship is manned: the captain is permanently present on board, therefore the ship navigated according to the current laws and regulations. However, the vessel is controlled from Seafar's Shore Control Centre.

13. The test zone for automated and smart shipping covers all inland waterways in Flanders. The existing vessels in the Flemish region are:

- Project AUTOSHIP:
  - The inland waterway testing will concentrate on one catamaran, a Class 2 Pallet Shuttle Barge (PSB)
  - The short sea shipping testing will be performed on a vessel with a 1462 deadweight tons and 74.7 m length.
- Seafar:
  - *Watertrucks* – self-propelled, fully motorized barges of classes CEMT I and CEMT II.

14. Flanders has already implemented the legislation specifically for automated shipping. This legislation makes it possible for entrepreneurs to test their automated shipping technology on a test area which now covers the whole territory of the Flemish inland waterways. In order to get a permission for tests, a set of technical documents shall be submitted to De Vlaamse Waterweg NV. Now, a new legislation is under development in order to provide a general basis for extending the legislative framework for navigation of automated ships beyond testing purposes, thus making automated shipping more attractive from a commercial point of view.

15. Among the identified main challenges and critical issues were mentioned:

- The reluctance of the sector to the widespread introduction of automation in inland shipping related to safety of navigation, potential loss of jobs and other aspects
- Absence of the legal basis to allow the passage of automated vessels through locks, as the existing regulation prescribes that on a stationary vessel the engine must be stopped. De Vlaamse Waterweg NV is working on how to resolve this and organizes workshops and studies to achieve this goal.

Walloon Region

16. In the end of June 2019, the Walloon Region launched a call for expressions of interest and applications for a research and development partnership in order to enable a real automated navigation on the Haute Sambre. This involves real automated navigation tests on the Charleroi-Maubeuge link on the Haute Sambre, based on the definitions of CCNR resolution 2018-II-1. The aim is to analyse the technical feasibility of autonomous navigation adapted to a river. At the end of this test period, the partner company will submit a final report containing a technical action plan to ensure partial automation of navigation on this waterway section. This project is a part of a research and development logic referred to in Article 32 of the Public Procurement Act of 17 June 2016. The final report will provide a detailed description of the general experience that has been developed around the partial autonomous navigation of a boat. The themes to be developed in the report are:

1. Safety;

[1] Type of barge developed under the project Watertruck.

2. The composition of the crew;

3. Passage through locks, the infrastructure, and

4. Communication.

The existing vessel in the Walloon region is motorized barge *Watertruck 1*.

17. A draft decree of the Walloon government on authorizing automated navigation tests was submitted in February 2020 to the Minister responsible for transport and is waiting for the approval. However, there is a need for the development of the legislative basis for automated shipping.

Brussels Capital Region

18. For the time being, there are no special projects in this field under way in the port of Brussels, but the port is monitoring the work and tests carried out in the Flemish and Walloon Regions.

D. Croatia

19. The focus is currently made on modernizing the obsolete inland waterway fleet. In the forthcoming period, it is planned to include automated and smart navigation terminology in national strategies and programmes.

20. Croatia is currently not involved in automation and smart navigation projects, but is looking forward towards starting projects related to automation and smart shipping hopefully in the near future, including the work on developing international legislation in this field. The main objectives of this type of projects would be:

- The development of the regulatory basis
- Cybersecurity issues
- The establishment and operation of test zones and areas on inland waterways, conducting tests and trials.

21. Among the main challenges in this work are basically special conditions of each section of the waterway that generate daily changes of the navigation conditions along the river. Therefore, it is not possible to apply the established solutions when navigating the river, and there is a need for immediate decisions based on the realistic real time parameters.

E. Germany

22. In Germany, the Funding Guidelines for Investments for the Development of Digital Test Fields on Federal Waterways came into force on 1 August 2020 (duration until 31.12.2022). The deadline for applications for funding is 30 September 2020. Detailed information can be provided on the requested projects at a later stage.

23. The ongoing projects are part of the project RIS COMEX funded by the European Union (Application Specific Messages (ASM), pilot application of Aids to Navigation on the Elbe).[2] A full list of the ongoing pilot and research projects in the field of automation in inland navigation of the CCNR member States is available on the CCNR website at https://automation.ccr-zkr.org/1000-en.html.

24. The ongoing projects in Germany are:

- Design study of ferries from under the framework of the project CAPTin Kiel (Clean Autonomous Public Transport in Kiel)
- New test and management centre for autonomous inland waterway transport (VeLaBi) in Duisburg.

[2] Detailed information is available in Informal document SC.3/WP.3 No. 4 (2017).

25. It is planned to establish test areas for automated vessels on the following waterways: the Kieler Förde, the Dortmund-Ems Canal, the Spree-Oder waterway, the Elbe, the Elbe-Lübeck Canal and the Hildesheim branch canal. The technical prescriptions and cybersecurity issues are addressed by CCNR and CESNI as a part of the work programmes of CESNI and the CCNR Police Committee, and the corresponding standards will be developed by the CESNI Working Group on Information Technology (CESNI/TI).

26. The existing vessels, prototypes and models are (a) a remote-controlled motorboat with collision sensors which is being tested in the Baltic Sea by OFFIS (Institute for Information Technology, Oldenburg (Germany)) and (b) push boat *ELEKTRA*, the first purely electric push boat with batteries and fuel cells to be deployed between Berlin and Hamburg in the end of 2020. It is expected than more "floating test vehicles" will be built within the framework of the above-mentioned Funding Directive.

27. Among the existing challenges is a lack of cooperation between numerous projects and project ideas. Therefore, it is intended to set up a mixed committee consisting of industry and authorities to provide support and advice in this field, in parallel with the CCNR Small Committee on Shipping which will be established in the near future.

F. Russian Federation

28. The concept for the development of automated and smart shipping in the Russian Federation is set out by the Transport Strategy of the Russian Federation for the period up to 2030. The expected results are:

- Stimulating the upgrading of the transport fleet, based on the implementation of the legal acts aimed at supporting the Russian shipping and ship construction, ensuring the competitive lending schemes for ship construction
- The construction of river cargo vessels and auxiliary vessels
- The creation of electronic navigation charts on the entire range of waterways of the Russian Federation
- The development of navigation on inland waterways of the Russian Federation.

29. Furthermore, a pilot project on autonomous navigation of commercial vessels is being realized under the framework of the Working group on the implementation of the National Technological Initiative "Marinet" with the support of the Ministry of Industry and Trade of the Russian Federation and with the participation of the Ministry of Transport of the Russian Federation. The strategic goal of the project is to establish the technical and legal background for the widespread operation of maritime autonomous surface ships (MASS) by no later than January 2021.

30. The Transport Strategy of the Russian Federation for the period up to 2030 has set out the following goals:

- The establishment of operational telecommunications aimed to ensure safety of navigation in the fifteen inland water transport basins
- The installation of monitoring and correcting stations in order to establish a single navigation field on inland waterways
- Setting up and modernization of ship traffic management systems in seaports and on inland waterways
- Fitting inland waterway vessels with automatic identification systems, electronic cartographic systems and GLONASS receivers.

31. An example of the implementation of autonomous navigation on newly designed ships and ships under construction is research vessel *Pioneer-M* of project 25700 (shipyard "JSC Sredne-Nevskiy sudostroitelnyy zavod" (Middle Neva Shipyard), designed by JSC "OSK-teckhnologii"). The development of a remote control centre is under way, including interfaces for all onboard systems, a joystick control system and communication systems, in particular, video communication with the crew.

32. In 2016–2019, the test area “Hermitage” was established for testing e-Navigation technologies under the framework of Federal targeted programme “Maintaining, developing and using the GLONASS system for 2012–2020”. The river and lake segments of the test area are located on the waterways under the authority of the Basin Administration of the Volga-Baltic Waterway and include the Neva, the Ladoga and the mouth of the Svir. The installation of innovative equipment on waterways allows to fully exploit their potential for solving the foremost tasks of the transport system of the Russian Federation and, in particular, the implementation of unmanned technologies in the transport sector. On the basis of the river and lake segments of test area “Hermitage”, the Basin Administration of the Volga-Baltic Waterway has established a dedicated area for full-scale tests called “Bespilotnik” in order to ensure safety of navigation during tests. Currently, preparations for testing autonomous vessels are ongoing and the issue of developing a regulatory framework for the use of autonomous vessels on inland waterways is under consideration.

33. Alongside with the development and testing of ships and equipment, the work is ongoing on introducing changes to the Russian legislation, aimed to enable the operation of maritime autonomous ships and MASS flying the flag of the Russian Federation within the framework of the existing international regulatory framework:

- Introducing the conceptual framework and the fundamental provisions in the Merchant Shipping Code and federal laws, these also cover the legal relationship arising from the use of autonomous vessels
- Enabling the operation of MASS flying the Russian flag for a “transitional” period till 2025, and defining the requirements of the flag administration for managing their operation
- Developing recommendations for the unified practical application of individual regulatory requirements for the operation of MASS.

34. On 26 June 2020, the Russian Maritime Register of Shipping issued the Guidelines on the classification of MASS which contain requirements for the design and construction of autonomous ships.

35. In its activities in the field of the classification and surveys of vessels, the Russian River Register is guided by provisions of the applicable international treaties of the Russian Federation, the Regulations for the Classification and Surveys of Ships, as well as the regulations referred to in paragraph 2 of Article 35 of the Inland Water Transport Code of the Russian Federation which contain requirements for vessels and their components at the stages of design, construction, modernization, re-equipment and repair as well as requirements for materials and products to be used on board vessels.

36. The Russian Federation supports UNECE resolutions in the field of River Information Services maintained by SC.3. Traffic-related services are implemented and supported by governmental agencies – Inland Waterway Administrations. Other available services outside the RIS concept are “Information for Law Enforcement Purposes”, “Statistics” and “Charges for the use of waterways and ports”. Such key RIS technologies as Inland ECDIS and Automatic Identification Systems on inland waterways are at the stage of implementation, while the Notices to Skippers and the Electronic Ship Reporting are currently under study and testing.