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

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Item 4 of the provisional agenda
Workshop "Autonomous shipping in inland navigation"

Autonomous shipping in inland navigation: Concepts, opportunities and challenges

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/SC.3/2017/24) to be adopted by the Inland Transport Committee at its eightieth session (20-23 February 2018).

2. The strategy of the Working Party on Inland Water Transport (SC.3) for 2016-2021, adopted by SC.3 on 4 November 2016, envisaged activities aimed at fostering innovations in inland water transport. Autonomous shipping principles applied on inland waterways can significantly contribute to the development of intelligent transport systems in the sector and, as such, to the implementation of the Sustainable Development Goals.

3. At its sixty-first session, SC.3 decided to organize a workshop on autonomous vessels at the fifty-second session of Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (ECE/TRANS/SC.3/205, para. 95). The workshop will be organized jointly by De Vlaamse Waterweg NV and ECE on 14 February 2018.

4. The present document, prepared jointly by De Vlaamse Waterweg NV and the secretariat, gives a brief overview of the autonomous shipping concept, addresses its practical value, possible advantages and challenges for the inland water transport sector and proposes issues for discussion during the workshop.

II. Background

5. The past few years have been characterized by the rise of innovations such as automated vehicles, intelligent transport systems and advanced systems for freight transport and logistics. The concept of autonomous vehicles has been developed for different transport modes, such as unmanned airplanes, self-driving cars, ‘smart train’ and ‘unmanned’ automated systems for railway transport, smart, unmanned and autonomous ships in the maritime sector.

6. Intelligent transport systems and automated driving are rapidly moving towards widespread commercialization and market acceptance. High levels of automation are expected to improve road safety, reduce congestion and emissions, and increase the personal mobility of the elderly and persons with disabilities. A major regulatory milestone towards the deployment of automated vehicle technologies was attained on 23 March 2016 with the entry into force of amendments to the 1968 Vienna Convention on Road Traffic.

7. The shipping industry moves ahead with the development of smart and autonomous shipping. A number of projects are under development or being tested, and different aspects are currently under discussion, such as: technical issues, safety and security, possible social implications, the applicable regulatory framework, etc.

III. Overview

8. Inland shipping is a transport mode with several assets that make it green and sustainable. It can transport large amounts of cargo and is not subject to congestion problems. Nowadays, when transport volumes are being increased worldwide and different transport modes are looking for innovative developments to optimize the cargo flow and reduce the transportation expenses as much as possible, inland water transport should be the background for innovation and adaptation to further develop its competitive advantage as a safe, relatively cheap and punctual mode of transport. Enabling autonomous shipping on inland waterways can help the sector to retain this advantage.

9. There are different levels of autonomy in shipping, and not all of them preclude the presence of a crew on a vessel, as it is presumed on fully unmanned vessels:[1]

- Smart vessels – manned vessels with a higher level of automation;
- Hybrid solutions with remotely operated vessels and/or unmanned vessels in a convoy guided by a manned vessel;
- Short-manned vessels, where 12 hours of manned watch followed by 12 hours of control from an onshore control centre;
- Unmanned vessels that are remotely operated from an onshore control centre;
- Fully autonomous vessels.

[1] Autonomous safety on vessels. An international overview and trends within the transport sector. Robert Rylander, Yemao Man. www.lighthouse.nu/sites/www.lighthouse.nu/files/attachments/autonomous_safety_on_vessels_-_webb.pdf.

10. The Conferences on Smart Ship Technology held in London on 26-27 January 2016 and 24-25 January 2017, organized by the Royal Institution of Naval Architects, addressed different aspects of smart shipping.[2] Based on the principle that a smart ship integrates data from a wide variety of sources for improving its operational efficiency and performing its function in a safe and cost-effective manner, the participants discussed:

- The concept of smart ships covering predictive maintenance, performance optimization, decision support tools, increased automation and robotics, unmanned operation, etc.;
- The potential of smart and autonomous vessels, and benefits for the shipping industry;
- Handling big data in ship performance and navigation monitoring;
- Safety and cyber security;
- Regulatory framework;
- Liability and other issues.

11. Autonomous ships are the next generation of vessels that are essentially an extension of remotely operated vessels. Navigation and performance of such vessels will be controlled from an onshore operating centre, by means of detectors, sensors, cameras, satellite communication systems etc. However, people will still need to monitor the vessel from the shore or to perform maintenance operations on a vessel. It is expected that crew members will not entirely disappear, but their profile and task will certainly change. This approach, on the one hand, will give the sector a chance to attract specialists with new qualifications and, on the other hand, will help to cope with the shortage of crew members.

12. The benefits of autonomous shipping are obviously a reduction in crew-related operational costs and safety. On an inland waterway vessel, the crew costs amount to one-third of the total operational costs. On unmanned vessels, energy-consuming crew facilities, such as heating and sanitary facilities, may be dispensed with. Reducing the crew can thus significantly reduce the total operational costs of a vessel.

13. Autonomous shipping might also reduce the human-related errors, as the influence of the human factor will be minimized or excluded. Furthermore, an autonomous vessel can navigate full-time, as there is no crew that needs to rest. This will economize the travel time and allow cargo to arrive faster at the destination.

14. Autonomous shipping could pave the way for new business models, such as smaller inland waterways that today are not in use. This will, furthermore, support the modal shift from road to water transport.

15. However, there are still many questions concerning autonomous shipping on the inland waterways that need further clarification:

- Possible social impact: could this imply actual job losses in the sector;
- Qualification and certification for new jobs;
- Interaction between autonomous and manned vessels and between autonomous vessels;
- Applicable technical and safety requirements and the legislative base;
- Ensuring cyber security;
- Safe and correct data exchange and other issues.

[2] www.rina.org.uk/Smart_Ships.html; www.rina.org.uk/Smart_Ships2017.html.

IV. Current progress and projects

16. This issue has been addressed by major international organizations in maritime safety, such as:

(a) The International Maritime Organization (IMO), who has included autonomous shipping in its agenda: this issue was addressed at the ninety-eighth session of the Maritime Safety Committee (MSC) held on 7-16 June 2017 in London, and it will be discussed in the agenda of the ninety-ninth session of MSC to be held on 16-25 May 2018;[3]

(b). The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), who considers the concept of autonomous vessels to be one of the future milestones for the shipping industry. Possibilities offered to the sector by the development of digital technologies and data exchange will contribute to better connections and coverage, bring benefits and opportunities in terms of the efficiency, safety and security of navigation by developing new technologies, minimize navigation errors and reduce costs for shipowners and authorities.

17. For inland waterways, Flanders (Belgium) and the Netherlands are working on establishing a common test area for autonomous vessels with the same safety requirements. The goal is to adapt the national legislation in the future in an appropriate way; efforts are being made to establish a community to work on social acceptance of autonomous vessels. In Germany, local administrations investigate how automatization of vessels can boost the use of the Elbe and other rivers.

18. The Central Commission for the Navigation of the Rhine (CCNR) plans to address the development of automation in inland navigation in the years to come, to evaluate the possible legal consequences of automation on the Rhine regime and to develop an international definition of various levels of automation. The CCNR secretariat also actively supports the work on cyber security in inland navigation conducted under the aegis of Task Group 204 of the World Association for Waterborne Transport Infrastructure (PIANC).

19. Several cooperation initiatives and projects were organized at the international, national and/or regional levels:

(a) The Marine Autonomous Systems Regulatory Working Group (MASRWG) established in 2014 under the auspices of the Government of the United Kingdom of Great Britain and Northern Ireland,[4] who published an Industry Code of Practice for Maritime Autonomous Surface Ships (MASS) up to 24 metres in length in November 2017;[5]

(b) The Norwegian Forum for Autonomous Ship (NFAS);

(c) A research project on autonomous ships “Advanced Autonomous Waterborne Applications Initiative” (AAWA) launched in Finland in 2015;

(d) A project on creating an ecosystem for autonomous marine transport in the Baltic Sea “One Sea Autonomous Maritime Ecosystem” founded in Finland in 2016;

(e) Projects “Maritime Unmanned Navigation through Intelligence in Networks” (MUNIN)[6] of the European Commission and “Safety and Regulations for European Unmanned Maritime Systems” (SARUMS) by the European Defence Agency;

[3] MSC 99/1.
[4] MSC 95/INF.20.
[5] www.ukmarinealliance.co.uk/content/masrwg-code-practice.
[6] www.unmanned-ship.org/munin/.

(f) The International Network for Autonomous Ships (INAS), an informal group of national or regional interest organisations worldwide on unmanned, autonomous and smart ships established on 30 October 2017.

V. The workshop: Purpose, topics and the desired outcome

20. Autonomous shipping is a recent innovation that may have implications on all aspects of inland waterway navigation and, therefore, SC.3/WP.3 is invited to consider the current status and progress already reached by member States, international organizations and other key players in this field. Governments and administrations, international organizations, River Commissions, representatives of the shipping industry, classification societies and academia are invited to take part in the workshop. Participants are invited to focus on the aspects of automatization that can give this transport mode an economical boost and appropriate policy tools to reduce the negative impact as much as possible.

21. The following topics are proposed for the workshop:

- Smart and autonomous shipping as a part of intelligent transport systems;
- The maritime experience, recent developments and lessons learned;
- Autonomous vessels in inland navigation: added value, opportunities and challenges;
- The regulatory framework;
- Autonomous inland vessels: existing vessels for inland waterways, urban lines and projects under development;
- Data exchange, cyber security and related issues;
- Social aspects related to autonomous shipping and possible solutions.

22. The desired outcome of the workshop would be a selection of items for further consideration and possibly recommendations on specific relevant actions for SC.3 and SC.3/WP.3, to improve the role of inland water transport in intermodal transport chains and to create added value at the pan-European level. The following issues could be relevant for the future activities of SC.3:

- Certification for the new qualifications of the crew members;
- Safety issues and requirements;
- Acceptance criteria;
- Terms of data exchange, the standardization and harmonization of requirements and documents in terms of interoperability;
- Relevance to international conventions, existing barriers and challenges.

23. SC.3/WP.3 may wish to propose issues for further consideration with a view to supporting member States that intend to guide the inland waterway sector towards more automatization. SC.3/WP.3 may also wish to provide recommendations to SC.3 and possible activities toward the sound legislation and regulation in support of innovative transport such as autonomous shipping and building a framework which enables the commercial use of autonomous ships in a safe way.