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Item 8 of the provisional agenda

Automation in inland navigation**Harmonization of the legal framework and policy areas for fostering innovations in inland navigation**

Transmitted by Belgium*

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 (ITC) at its eightieth session (20–23 February 2018) (ECE/TRANS/274, para. 123).
2. At its fifty-fifth session, the Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation (SC.3/WP.3) took note of the presentation by De Vlaamse Waterweg nv (Belgium) on policy areas for a common approach to foster innovations in inland navigation, and invited Belgium to prepare a document for the sixty-third session of the Working Party on Inland Water Transport (SC.3) (ECE/TRANS/SC.3/WP.3/110, paras. 29 and 72).
3. The proposal transmitted by Belgium, contained in this document, gives an overview of the policy areas relevant to the legal framework of the United Nations Economic Commission for Europe (UNECE) that require adaptation, as the first step towards the international regulatory basis for commercial use of smart vessels on inland waterways. This is not a final proposal, but a living document, and governments, international organizations and other stakeholders are invited to complement it from their expertise. Furthermore, it is suggested to work on temporary derogations or reservations from the existing regulations in order to enable testing of smart vessels and share the knowledge and best practices for creating a harmonized forward-looking approach.

* The present document was submitted after the deadline in order to reflect recent developments.

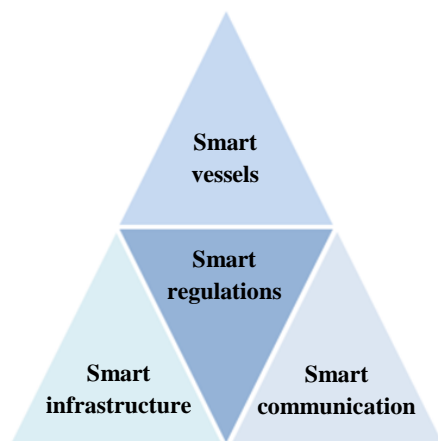


II. Proposal on policy areas where a harmonized approach is needed to foster innovations in inland navigation

A. Introduction and background

4. The future of mobility cannot be blind to the innovations in autonomous transportation. Autonomous driving and truck platooning are soon expected to reduce road transport costs and increase road transport flexibility, while rail corridors and the next generation of freight trains lower technical and organizational barriers for rail freight. Thus, inland water transport must start now to buffer its competitive advantage with Smart Shipping and other technological evolutions.

5. Smart Shipping can be defined as shown in the diagram below:



(a) “Smart vessels” have automated external data systems that optimize key functions of the vessel’s, e.g. navigation, fuel consumption, real-time planning, etc.;

(b) “Smart infrastructure” ensures two-way communication between smart vessels and their surrounding environment. The highly automated and organized corridors render efficient traffic management;

(c) “Smart communication” digitalizes the various forms of contact between vessels and third parties (government) in a smart, smooth and flexible process that meets the internationally standardized procedures;

(d) “Smart regulations” overarch the three areas of “smart + vessels – infrastructure – communication”.

6. The coming years will see an increased development of smart vessels, plus, technological solutions in the inland shipping sector. Technology today has enabled vessels to perform an ever-increasing number of tasks. Smart Shipping could fundamentally change the tasks of skippers, waterway authorities, shipping staff, etc. Totally autonomous vessels are yet to function on inland waterways, so discussion could be premature. But drones and small automated vessels are being tested – and some stakeholders plan to use automated inland cargo vessels as early as 2020. Waterway authorities in several countries can also attest to many requests for the certification of smart vessels. The entire inland navigation sector may be impacted by the recent and future developments in Smart Shipping.

7. Research and projects have been numerous and significant in Smart Shipping, and facilitated a rapid development requiring adjustments in the legal framework. These are all critical for further progress, though the practical implementation has not been sufficiently explored. Efforts must ensure that the legal framework evolves alongside any technological developments, and lack of efforts must certainly not hinder the use of new technologies. International coordination and agreement are particularly important for transboundary rivers and international waterways.

B. Overview of the international policy framework in inland navigation

8. The development of Smart Shipping on inland waterways has been addressed in the international policy framework at different levels:

(a) The Ministerial declaration “Inland Navigation in a Global Setting”¹ adopted at the International Conference on Inland Water Transport in Wrocław, Poland, on 18 April 2018:

- Objective (c): To encourage investment in the sector aimed at building and modernizing the inland waterway infrastructure, the fleet and ports as well as fostering innovation and using alternative fuels, to increase the market share of inland water transport and ensuring that it is resilient to climate change;
- Strategic action 22: Ministers encourage measures aimed at promoting modern technologies, automation and innovations in the sector;

(b) UNECE:

- The programme of work for 2018–2019 adopted by ITC (23–25 February 2018), cluster 5: Inland Waterway Transport: Expected accomplishments: An improved and updated regulatory framework for inland water transport infrastructure and vessels in the ECE region
- Ministerial resolution on “Enhancing cooperation, harmonization and integration in the era of transport digitalization and automation”, endorsed at the eighty-first session of ITC
- ITC resolution No. 265 “Facilitating the Development of Inland Water Transport” adopted on 22 February 2019:
 - Invites member States, River Commissions, international and public organizations and other stakeholders to maintain policy dialogue on good practices and measures relevant to the implementation of the objectives taking advantage of the framework provided by UNECE
 - Requests SC.3, in line with its strategy for 2016–2021 and in close cooperation with member States, the European Commission, and River Commissions to proceed with the implementation of the objectives and strategic actions mentioned above, and to amend its programme of work accordingly;

(c) The European Union:

- Horizon-2020, the work programme for 2018–2020, section 11 “Smart, green and integrated transport”,² Call 2018–2020 “Mobility for Growth”, MG-3-2-2018 “The Autonomous Ship”
- The European Union macro-regional strategies (the North Sea region, the Baltic Sea region) and the projects related to automated waterborne transport;

(d) The Central Commission for the Navigation of the Rhine (CCNR):

- Under the Work Programme for 2018–2019 of the Police Regulations Committee (RP), task IV-18-6 “Monitoring developments in the field of automated navigation and investigating the extent to which regulations are necessary” has been given a high priority (I)
- The Ministerial declaration “150 years of the Mannheim Act – the driving force behind dynamic Rhine and inland navigation” adopted at the sixth congress of CCNR in Mannheim (Germany) on 17 October 2018, calls on CCNR “to press ahead with

¹ www.unece.org/fileadmin/DAM/trans/doc/2018/sc3/Ministerial-declaration_e.pdf.

² https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-transport_en.pdf.

development of digitalization, automation and other modern technologies, thereby contributing to the competitiveness, safety and sustainability of inland navigation”;³

(e) The European Committee for drawing up Standards in the field of Inland Navigation (CESNI):

The Work Programme for 2019–2021 states that CESNI shall prepare and adopt standards in the field of technical requirements for vessels, considering actively the digitalization of inland navigation, including automation of navigation. In close cooperation with other working groups, CESNI will collect experience gained with pilot projects for automation of inland navigation and evaluation of the regulatory needs;

(f) The World Association for Waterborne Transport Infrastructure (PIANC):

PIANC Working Group 210 “Smart Shipping on Inland Waterways” focuses on the impact of Smart Shipping on the infrastructure and waterway traffic managers. The Working Group was established in January 2019 and will run for two years. It will make a detailed overview of the existing initiatives on Smart Shipping, with the purpose to:

- create a common understanding of the terms and definitions;
- identify research gaps;
- identify the relevant future scenarios where smart ships will be used
- propose a follow-up where the identified needs for Smart Shipping will be further examined.

C. Overview of the UNECE legal framework in inland navigation

9. There are multiple legal instruments and resolutions that must be taken into account to make automated navigation possible. The following international conventions and agreements have been considered so far:

(a) International conventions and agreements under the ITC purview:

- European Agreement on Main Inland Waterways of International Importance (AGN)
- Convention relating to the Unification of Certain Rules concerning Collisions in Inland Navigation;

(b) Other international conventions and agreements relevant to inland shipping:

- Convention on the limitation of liability in inland navigation (CLNI).

10. The following UNECE resolutions have been analysed:

- Resolution No. 24, European Code for Inland waterways (CEVNI)
- Resolution No. 31, Recommendations on Minimum Requirements for the Issuance of Boatmaster’s certificates in Inland Navigation with a view to their Reciprocal Recognition for International Traffic
- Resolution No. 35, Standardized UNECE Vocabulary for Radio-Connections in Inland Navigation
- Resolution No. 48, Recommendation on electronic chart display and information system for inland navigation (Inland ECDIS)⁴
- Resolution No. 58, Guidelines and Criteria for Vessel Traffic Services on Inland Waterways
- Resolution No. 61, Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels

³ www.unece.org/fileadmin/DAM/trans/doc/2019/sc3/ECE-TRANS-SC.3-2019-05e.pdf.

⁴ *Note by the secretariat:* the revised standard will be adopted by SC.3 at its sixty-third session.

- Resolution No. 63, International Standard for Tracking and Tracing on Inland Waterways (VTT)
- Resolution No. 79, International Standard for Electronic Ship Reporting in Inland Navigation
- Resolution No. 90, European Code for Signs and Signals on Inland Waterways (SIGNI).

D. The way forward

11. The proposal is to identify the gaps, challenges and bottlenecks in the existing legal UNECE framework that hamper the development of automated navigation. The exercise is focused on automation levels 1 to 5, according to the definitions adopted by CCNR,⁵ from a simple “steering assistance” to “full automation”. It is aimed to:

- Create the awareness of the work to be done
- Develop the necessary collaboration
- Bring together the existing expertise.

12. The exercise has identified gaps in the aforementioned UNECE legal instruments and resolutions mentioned above. Some other UNECE legal instruments and resolutions relevant to inland navigation have also been examined, but no gaps concerning technical evolution of Smart Shipping were found, as we know today. Furthermore, at this stage some other International Agreements and Conventions, including the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN), have not been examined in order to make the proposed approach feasible. It has been identified that several technical provisions were missing and should be developed prior to further elaboration of the regulatory framework. Next steps will therefore require the interaction in parallel between experts on both the technical and regulatory sides in order to reflect technical innovative developments and possibilities in the existing regulatory framework, with maintaining a high navigation safety and an efficient shipping traffic.

E. Policy areas to be addressed to create regulations for automated navigation and Smart Shipping

13. The present section contains references to and/or the text of International Conventions, Agreements and UNECE documents that are subject to evaluation in terms of implications they may have for Smart Shipping (highlighted in bold). They are grouped in thirteen policy areas. Evaluation shall be based on the following major assumptions:

- Automated vessels shall maximize safety of the inland waterway network
- Automated vessels shall support the market by bringing new cargo flows to inland shipping
- Automated vessels shall contribute to increasing the modal share of inland water transport.

Area 1. Definitions

14. The existing UNECE documents do not contain definitions of automation levels related to smart vessels. At its fifty-fifth session, SC.3/WP.3 considered the definitions introduced by CCNR, who will continue this work in 2020–2021 with a view to update them (ECE/TRANS/SC.3/WP.3/110, para. 70). UNECE could contribute to this work and provide its feedback to CCNR.

⁵ www.ccr-zkr.org/files/documents/resolutions/ccr2018-II.pdf, see also ECE/TRANS/SC.3/WP.3/2019/20.

15. The following definitions must be evaluated:

(a) CEVNI: Article 1.01, section 1 “Types of vessels”

(b) Resolution No. 79:

- Chapter 2 “Definitions”, the definition of shipmaster: “Shipmaster means **the person on board of the vessel** being responsible for the operation of the vessel and having the authority to take all decisions pertaining to navigation and vessel management (synonyms: captain, skipper).”

- Chapter 7 “Classifications and code lists”:

“(3) The following classifications shall be used in inland ship reporting:

...

4 **ERI ship identification number.”**

Currently, ERI ship identification numbers do not exist for any kind of smart ships;

(c) Resolution No. 63:⁶

- Annex A “Definitions”: the definition of navigational information:

“Navigational information is information provided to **the skipper on board to support in onboard decision-making**. (Source: IALA⁷ VTS⁸ guidelines).”

Furthermore, a gap analysis in the IALA VTS guidelines and other IALA guidelines could be useful for establishing an international framework for Smart Shipping;

(d) Resolution No. 58:

- Paragraph 2.1.9.2, the definition of navigational assistance service:

“A navigational assistance service is a **service to assist on-board navigational decision-making** and to monitor its effects”.

Area 2. Competences and crew qualifications

16. The following provisions related to competences and crew qualifications must be evaluated:

(a) CEVNI:

- Article 1.02, paragraph 1: “Every vessel or assembly of floating material, except vessels in a pushed convoy other than the pusher, shall be placed **under the authority of a person having the necessary qualifications**. This person is hereinafter referred to as **the boatmaster**. Boatmasters are considered to possess the necessary qualifications if they hold a valid boatmaster’s certificate.”
- Article 1.08, paragraph 2: “All vessels, except vessels in a pushed convoy other than the pusher, shall **have a crew sufficient in number and sufficiently skilled to ensure the safety of those on board** and safe navigation. However, non-motorized vessels in a side-by-side formation and some of the towed vessels in a rigid group are not required to have a crew if the vessel propelling the side-by-side formation or rigid group, or keeping it safely stopped, **has a crew sufficiently large and skilled to ensure the safety of those on board** and safe navigation.”
- Article 1.09, paragraph 1: “When under way, a vessel shall be steered by **at least one qualified person of not less than 16 years of age**.”
- Article 6.32, paragraph 2 (navigation by radar), the first sentence: “When a vessel is navigating by radar, there shall be **at all times in the wheelhouse a person holding a certificate required by the competent authorities** for that section of the inland

⁶ *Note by the secretariat:* to be revised in 2020, based on Commission Implementing Regulation (EU) 2019/838 of 20 February 2019.

⁷ International Association of Marine Aids to Navigation and Lighthouse Authorities.

⁸ Vessel Traffic Services.

waterway and for the type of vessel he navigates and the certificate referred to in article 4.06, paragraph 1 (b), and a second person sufficiently conversant with this method of navigation”;

(b) Resolution No. 31.

Area 3. Technical requirements for inland navigation vessels

17. The following technical requirements for vessels must be evaluated:

(a) CEVNI:

- Article 1.08, paragraph 1: “Vessels and assemblies of floating material shall be so constructed and rigged as to ensure the safety of those on board and safe navigation and **to be able to satisfy the requirements of these regulations.**”
- Article 1.08, paragraph 3: “The requirements set out in paragraphs 1 and 2 above are considered to be complied with when the ship has a ship’s certificate, issued in accordance with the Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels (resolution No. 61), or other recognized ship’s certificate, and when the construction and **the equipment of the vessel correspond to the content of the ship’s certificate**”;

(b) Resolution No. 48;

(c) Resolution No. 61.

Area 4. Presence of the boatmaster and crew members on board

18. The following provisions that require the presence of the boatmaster and crew members on board must be evaluated:

(a) CEVNI:

- Article 1.02, paragraph 3: “When a vessel is under way **the boatmaster shall be on board**; in addition, the boatmaster of floating equipment shall always be on board when the equipment is in operation.”
- Article 1.17, paragraph 1: “The boatmaster of a grounded or sunken vessel or of a grounded or broken assembly of floating material shall arrange for the nearest competent authority to be informed as soon as possible. In the case of a grounded or sunken vessel, **the boatmaster or a member of the crew shall remain on board or near the site of the accident** until the competent authority has authorized him to leave.”
- Article 7.08, paragraph 1: “An efficient watch shall be **kept continuously on board** of vessels lying in the fairway”;

(b) Resolution No. 63:

- Section 1.3 “Navigation”, the first sentence: “Vessel tracking and tracing can be used to support **the active navigation on board**”;

(c) Resolution No. 58:

- Paragraph 3.3.3, the first sentence: “When the VTS is authorized to issue instructions to vessels, these instructions should be result-oriented only, leaving the details of execution, such as course to be steered or engine manoeuvres to be executed, to **the boatmaster on board the vessel**”.

Area 5. Responsibility and liability

5.1 Responsibility

19. The responsibility must be evaluated in the following provisions of CEVNI, especially when the operation of a vessel is managed by a shore control centre or is fully automated:

- Article 1.02, paragraph 5: “Every floating establishment shall be placed under **the authority of a person**. This person shall be responsible for the observance of the provisions of these regulations on the floating establishment.”
- Article 1.02, paragraph 7: “In the case of a moored vessel or assembly of floating material having no boatmaster, the person responsible for ensuring compliance with the provisions of these regulations shall be:
 - (a) The person responsible for **keeping watch and surveillance under article 7.08**;
 - (b) The operator and owner of such vessel or assembly **if the person referred to in letter (a) is absent.**”
- Article 1.03, paragraph 1: “**Crew members shall carry out the orders given to them by the boatmaster in the performance of his duties**. They shall assist in complying with the requirements of these regulations and of any other provisions applicable.”
- Article 1.03, paragraph 2: “**All other persons on board** are required to comply with the orders given to them by the boatmaster in the interest of safe navigation or of good order on board.”
- Article 1.03, paragraph 3: “**Members of the crew and other persons on board** who temporarily determine the vessel’s course and speed themselves shall also be responsible in that respect for ensuring compliance with the requirements of these regulations”.

5.2 Liability

20. The following provisions related to liability must be evaluated:

- (a) CLNI: provisions for liability of vessel owners, as defined in Article 1, paragraph 2 of the Convention;⁹
- (b) Convention relating to the Unification of Certain Rules concerning Collisions in Inland Navigation:
 - Article 3: “If the damage is caused by the fault of one vessel only, **liability to compensate for the damage shall attach to that vessel**”.

Therefore, the absence of persons on board does not affect the correct implementation of the Convention. Often, the liability shall be related to the specific vessel. However, in case of smart ships, the liable person shall be clearly identified: the shipowner, the skipper, the remote control centre, the software provider or other persons engaged.

Area 6. Technical solutions

21. The following provisions of CEVNI are relevant to the technical solutions used in current pilot projects and must be evaluated. These technical solutions can contribute to the development of adjusted goal-based regulations.

- Article 1.07, paragraph 2: “The load or the list of the vessel shall not **restrict the direct view at a distance of more than 350 m in front of the vessel**. If direct visibility astern and aside is restricted during the voyage, this lack of visibility may be **compensated for by the use of radar apparatus**.”
- Article 1.09, paragraph 3: “In order to ensure proper control of the vessel, the helmsman shall be able to receive and give all information and all orders **reaching or proceeding from the wheelhouse**. In particular, he shall be able **to hear sound signals and have a sufficiently clear view in all directions**.”
- Chapter 3, “Visual signals (marking) on vessels”
- Chapter 4, “Sound signals; Radiotelephony; Navigation devices”

⁹ www.ccr-zkr.org/files/clni/clni_2012_en.pdf.

- Article 4.01, paragraph 2: “**The sound signals given by motorized vessels shall be accompanied by light signals synchronized with them**, such light signals shall be yellow, bright and visible from all directions. This provision shall not apply to small craft or to the signal prescribed in article 6.32, paragraph 4 (a), to be given by vessels proceeding downstream and navigating by radar, or to be ringing or pealing of a bell.”
- Other relevant articles
- Chapter 5, “Waterway signs and marking”
- Article 6.03, paragraph 1: “Meeting or overtaking is permitted only when the fairway is unquestionably wide enough for simultaneous passage, taking all the local circumstances and movements of other vessels into account.”
- Article 6.20, paragraph 1: “**Vessels shall regulate their speed** to avoid creating excessive wash or suction likely to cause damage to stationary or moving vessels or structures. In particular, they shall reduce speed in good time, but not to below the speed required to steer safely: (...)”
- Article 6.28, paragraph 7:
“In locks:

...

(b) While the lock is being filled or emptied and until they are allowed to leave, vessels shall be made fast and the mooring ropes shall be so handled as to prevent bumping against the walls, gates or protective devices or against other vessels or assemblies of floating material;”
- Article 6.28, paragraph 8, the first sentence: “In locks and lock basins it is obligatory to keep a minimum lateral distance of 10 m from the vessels or convoys **carrying the marking referred to in article 3.14, paragraph 1**”.

Area 7. Communication between a vessel and the competent authority

22. The following provisions related to the communication between a vessel and the competent authority must be evaluated:

- (a) CEVNI:
 - Article 1.12, paragraph 4: “When a vessel encounters an unknown obstacle on a waterway, **the boatmaster shall at once inform the nearest competent authority**, specifying as accurately as possible the place where the obstacle was encountered.”
 - Article 1.14: “When a vessel or assembly of floating material has damaged a permanent structure (lock, bridge, groyne, etc.), **the boatmaster shall at once inform the nearest competent authority**.”
 - Article 1.19, the first sentence: “**Boatmasters and persons in charge of floating establishments** shall comply with any special instructions given to them by officials of the competent authorities in order to ensure safe and orderly navigation.”
 - Article 6.26, paragraph 1: “Without prejudice to the other provisions of these regulations and to any other provisions applicable, **boatmasters shall**, on approaching and passing through movable bridges, **obey any instructions given to them** by the bridge staff to ensure safe and orderly navigation or quick passage. **The boatmaster of a vessel shall announce his intention** to navigate through the bridge to the bridge operators **by means of a long blast or radiotelephone**.”
 - Article 6.26, paragraph 3: “Overtaking when approaching movable bridges is prohibited unless special instructions are given by the bridge staff.”
 - Article 6.26, paragraph 6: “The bridge operator is obliged to have on or near the bridge a radiotelephone device corresponding to the provisions of Article 4.05. For the entire duration of the navigation through the bridge, the radiotelephone device must remain switched on.”

- Article 8.02, paragraphs 1 and 3:

“1. **Boatmasters of the following vessels and convoys shall**, prior to entering the sectors, traffic control posts, traffic centres and locks indicated by the competent authority, eventually by B.11 sign (annex 7), **report their** presence on the indicated radiotelephone channel: (...).

3. The data given in paragraph 2 above, except those in (c) and (h), may be communicated **by other services or persons** to the competent authority **either in writing, or by telephone or if possible, electronically**”;

(b) Resolution No. 79:

Chapter 4, “Messaging Procedures”, 4.1 Ship-to-authority messaging:

“(2) Ship-to-authority messaging is not confined to messages sent from a ship directly to the authority. All messages concerning the ship, sent by or on behalf of the ship, count as ship-to-authority messaging even if sent by shippers ashore”.¹⁰

Area 8. Ship-to-ship communication

23. The following provisions related to the communication between ships and other users of the waterway must be evaluated:

(a) CEVNI:

- Article 1.17, paragraph 2: “When a vessel is grounded or sunk, or an assembly of floating material is grounded, in or near the fairway, **its boatmaster shall**, unless it is obviously unnecessary, as soon as possible and without prejudice to the obligation to display the marking referred to in article 3.25, **give warning to approaching vessels and assemblies of floating material** at suitable points far enough from the site of the accident to enable them to take the necessary action in good time.”
- Chapter 3, “Visual signals (marking) on vessels”
- Article 4.05, paragraph 2, the first sentence: “Motorized vessels, excluding small craft **may navigate only if they are equipped with a radiotelephone installation** in proper working order for ship-to-ship, nautical information and ship-to-port-authority networks”;

(b) Resolution No. 35: the applicability of the standardized vocabulary to the automated reception, acknowledgement and processing of ship-to-ship messages;

(c) Resolution No. 48;

(d) Resolution No. 61.

Area 9. Digital documents / documents to be available on board

24. The availability of documents on board is required by legal instruments and resolutions. However, in case of digital documents, their paper copies may not be kept on board in certain cases. Therefore, the following provisions must be evaluated:

(a) CEVNI:

- The list of documents available on board required by Articles 1.10 and 9.02
- Article 1.11: A copy of the navigation regulations on board (except for unmanned vessels) required by Article 1.11;
- (b) the certificates required by resolution No. 61.

Area 10. Recreational navigation

25. CEVNI provisions related to the interaction between Smart Shipping and recreational navigation must be evaluated, without any prejudice to navigation safety.

¹⁰ This is an example of a definition that can also be applied to unmanned vessels.

Area 11. Emergency situations

26. The following provisions establishing responsibilities in case of emergency situations must be evaluated:

(a) CEVNI:

- Article 1.16, paragraphs 1 and 2

“1. In the event of an accident endangering persons on board, **the boatmaster** shall use every means at his disposal to save them.

2. **Every boatmaster** who is close to a vessel or assembly of floating material which has suffered an accident endangering persons or threatening to obstruct the fairway **is required to give immediate assistance** insofar as is consistent with the safety of his own vessel”;

(b) Resolution No. 63.

Area 12. Cybersecurity

27. Legal instruments and resolutions must be evaluated to ensure the appropriate level of cybersecurity for Smart Shipping and possibly complemented with the relevant provisions.

Area 13. Inland waterway infrastructure

28. The following provisions related to the inland waterway infrastructure must be evaluated with respect to their applicability for Smart Shipping:

(a) AGN: the existing classification and parameters of inland waterways may require additional clauses to ensure the accommodation of smart vessels and the necessary infrastructure;

(b) SIGNI: the applicability of provisions related to the development of standardized signs and signals, visualization of aids to navigation on electronic charts to the automated acknowledgment of the information related to navigation safety;

(c) Resolution No. 48: the applicability of the existing Inland ECDIS charts for autonomous ships and possible adaptation to needs and opportunities of Smart Shipping.
