



# PIANC

The World Association for Waterborne  
Transport Infrastructure

## SMART SHIPPING ON INLAND WATERWAYS



InCom Working Group Report N° 210 – 2022

# PIANC REPORT N° 210

INLAND NAVIGATION COMMISSION

## SMART SHIPPING ON INLAND WATERWAYS

March 2022

PIANC has Technical Commissions concerned with inland waterways and ports (InCom), coastal and ocean waterways (including ports and harbours) (MarCom), environmental aspects (EnviCom) and sport and pleasure navigation (RecCom).

This report has been produced by an international Working Group convened by the Inland Navigation Commission (InCom). Members of the Working Group represent several countries and are acknowledged experts in their profession.

The objective of this report is to provide information and recommendations on good practice. Conformity is not obligatory and engineering judgement should be used in its application, especially in special circumstances. This report should be seen as an expert guidance and state-of-the-art on this particular subject. PIANC disclaims all responsibility in the event that this report should be presented as an official standard.

**PIANC HQ**  
**Boulevard du Roi Albert II 20 B. 3**  
**1000 Brussels | Belgium**

<http://www.pianc.org>

VAT BE 408-287-945

ISBN 978-2-87223-015-0

© All rights reserved

# TABLE OF CONTENTS

TABLE OF CONTENTS.....	4
LIST OF FIGURES .....	6
LIST OF TABLES.....	6
<b>1 GENERAL ASPECTS.....</b>	<b>7</b>
1.1 SCOPE .....	7
1.2 INTRODUCTION .....	7
1.2.1 Terms of Reference .....	7
1.2.2 Structure of Report.....	8
1.2.3 Related PIANC Reports .....	8
1.2.4 Members of the Working Group .....	9
1.2.5 Meetings .....	9
<b>2 INVENTORY ANALYSIS .....</b>	<b>10</b>
2.1 INTRODUCTION .....	10
2.1.1 Objective.....	10
2.1.2 Approach.....	10
2.2 INVENTORY ANALYSIS PROJECTS .....	10
2.2.1 Overview of Projects .....	10
2.2.2 Project Scope.....	11
2.2.3 Interactions with Other Ships and Infrastructure During Testing .....	11
2.2.4 Fallback Scenarios.....	12
2.2.5 Levels of Automation.....	12
2.2.6 Data & Information .....	12
2.2.7 Technology .....	13
2.2.8 Partners and Stakeholders.....	13
2.2.9 Project Results.....	14
2.2.10 Impact and Influence.....	14
2.2.11 Regulations .....	14
2.3 CONCLUSIONS.....	14
<b>3 INTERNATIONAL REGULATIONS .....</b>	<b>16</b>
3.1 INTRODUCTION .....	16
3.2 EUROPE .....	17
3.2.1 Policy Area 1: Definitions .....	17
3.2.2 Policy Area 2: Competences and Crew Qualification.....	17
3.2.3 Policy Area 3: Technical Requirements for Inland Navigation Vessels .....	18
3.2.4 Policy Area 4: Presence of the Boatmaster and Crew Members on board .....	18
3.2.5 Policy Area 5: Responsibility and Liability .....	18
3.2.6 Policy Area 6: Communication between the Vessel and a Competent Authority and Vessel-to-Vessel Communication.....	18
3.2.7 Policy Area 7: Emergency Situations .....	19
3.2.8 Policy Area 8: Cybersecurity .....	19
3.2.9 Policy Area 9: Inland Waterway Infrastructure .....	19
3.3 CHINA .....	19
3.3.1 Policy Area 1: Definitions .....	19
3.3.2 Policy Area 2: Competences and Crew Qualification.....	21
3.3.3 Policy Area 3: Technical Requirements for Intelligent Navigation Vessels.....	21
3.3.4 Policy Area 4: Presence of the Boatmaster and Crew Members on Board.....	21
3.3.5 Policy Area 5: Responsibility and Liability .....	21
3.3.6 Policy Area 6: Communication between a Vessel and a Competent Authority, and Vessel-To-Vessel Communication.....	21
3.3.7 Policy Area 7: Emergency Situations .....	22
3.3.8 Policy Area 8: Cybersecurity .....	22
3.3.9 Policy Area 9: Inland Waterway Infrastructure .....	22
3.4 UNITED STATES OF AMERICA .....	23
3.4.1 Policy Area 1: Definitions .....	23
3.4.2 Policy Area 2: Competences and Crew Qualification.....	23
3.4.3 Policy Area 3: Technical Requirements for Intelligent Navigation Vessels.....	23
3.4.4 Policy Area 4: Presence of the Boatmaster and Crew Members on board .....	24
3.4.5 Policy Area 5: Policy area 5: Responsibility and Liability .....	24
3.4.6 Policy Area 6: Communication between a Vessel and a Competent Authority, and Vessel-to-Vessel Communication.....	24
3.4.7 Policy Area 7: Emergency Situations .....	24

3.4.8	Policy Area 8: Cybersecurity .....	24
	Policy Area 9: Inland Waterway Infrastructure .....	24
3.4.9	24	
3.5	ANALYSIS OF THE EUROPEAN, CHINESE AND U.S. FRAMEWORKS .....	25
3.6	CONCLUSION .....	26
<b>4</b>	<b>USE CASES SMART SHIPPING.....</b>	<b>27</b>
4.1	INTRODUCTION .....	27
4.2	SMART SHIPPING EVOLUTIONS.....	27
4.3	DEFINITION OF THE USE CASES .....	27
4.4	APPROACH .....	28
4.5	DETAILED DESCRIPTION OF THE USE CASES .....	28
4.5.1	Remote Controlled Shipping .....	28
4.5.2	Fully Autonomous Shipping .....	29
4.6	QUALITY OF DATA.....	30
4.7	DATA GATHERING/DATA SOURCES.....	30
4.7.1	Information Provided by the Authority .....	31
4.8	DATA EXCHANGE AND FORMAT .....	31
4.9	ATTENTION POINTS.....	32
4.9.1	Transition Period and Roadmap towards Unmanned Vessels.....	32
4.9.2	Communication between Ships and between Ship and Shore.....	32
4.9.3	Privacy and Cybersecurity .....	32
<b>5</b>	<b>FUNCTIONAL AREA ANALYSIS.....</b>	<b>33</b>
5.1	INTRODUCTION .....	33
5.1.1	Objective.....	33
5.1.2	Approach.....	33
5.2	FUNCTIONAL NEEDS ANALYSIS.....	34
5.2.1	Why is Automated Shipping Important? .....	34
5.2.2	Why is it Impossible to Meet the Objectives Today, What Is Holding Us Back? .....	35
5.2.3	What is the impact if those objectives are not met? .....	37
5.3	FUNCTIONAL SOLUTIONS ANALYSIS .....	38
5.3.1	Information Exchange .....	38
5.3.2	Maturity of Technology.....	39
5.3.3	Lack of Suitable Rules .....	39
5.3.4	Political Importance or Awareness.....	39
5.3.5	Not a Lot of Ongoing Smart Shipping Developments.....	39
<b>6</b>	<b>RECOMMENDATIONS FOR THE FUTURE.....</b>	<b>41</b>
6.1	INTRODUCTION .....	41
6.2	SWITCH FROM HUMAN TO MACHINE.....	41
6.2.1	Priority.....	41
6.2.2	Responsibility.....	42
6.2.3	Effort .....	42
6.2.4	Cost.....	42
6.2.5	External Stakeholder Involvement .....	42
6.2.6	Next Steps .....	42
6.3	TESTING .....	43
6.3.1	Priority.....	43
6.3.2	Responsibility.....	43
6.3.3	Effort .....	43
6.3.4	Cost.....	43
6.3.5	External Stakeholder Involvement .....	44
6.3.6	Next Steps .....	44
6.4	CREATE AWARENESS.....	44
6.4.1	Priority.....	44
6.4.2	Responsibility.....	44
6.4.3	Effort .....	44
6.4.4	Cost.....	44
6.4.5	External Stakeholder Involvement .....	44
6.4.6	Next Steps .....	45
6.5	LEARN FROM OTHER SECTORS.....	45
6.5.1	Priority.....	45
6.5.2	Responsibility.....	45
6.5.3	Effort .....	45
6.5.4	Cost.....	45

6.5.5	External Stakeholder Involvement .....	45
6.5.6	Next Steps .....	46
6.6	COLLABORATE WITH PRIVATE PARTIES .....	46
6.6.1	Priority.....	46
6.6.2	Responsibility.....	46
6.6.3	Effort.....	46
6.6.4	Cost.....	47
6.6.5	External Stakeholder Involvement .....	47
6.6.6	Next Steps .....	47
6.7	COLLABORATE WITH KNOWLEDGE INSTITUTES AND STANDARDISATION ORGANISATIONS .....	47
6.7.1	Priority.....	47
6.7.2	Responsibility.....	47
6.7.3	Effort .....	47
6.7.4	Cost.....	47
6.7.5	External Stakeholder Involvement .....	47
6.7.6	Next Steps .....	48
6.8	DEVELOP SAILING SIMULATORS .....	48
6.8.1	Priority.....	48
6.8.2	Responsibility.....	48
6.8.3	Effort .....	48
6.8.4	Cost.....	48
6.8.5	External Stakeholder Involvement .....	48
6.8.6	Next Steps .....	48
6.9	SUMMARY.....	48
<b>7</b>	<b>REFERENCES.....</b>	<b>50</b>
	<b>APPENDIX A: TERMS OF REFERENCE.....</b>	<b>51</b>
A.1	INTRODUCTION .....	51
A.1.1	What is Meant by Smart Shipping?.....	51
A.1.2	Why is there the Need for Establishing a PIANC Working Group on this Topic at this Specific Moment?.....	51
A.2	THE EXPECTED IMPACT OF SMART SHIPPING.....	52
A.3	TASK OF THE WORKING GROUP .....	52
A.3.1	Scope.....	52
A.3.2	Tasks .....	53
A.3.3	Suggested Final Products.....	53
A.4	RECOMMENDED MEMBERS .....	53
A.5	RELEVANCE FOR COUNTRIES IN TRANSITION .....	54
A.6	WORKING WITH NATURE.....	54
	<b>APPENDIX B: GLOSSARY, ABBREVIATIONS AND SYMBOLS .....</b>	<b>55</b>
B.1	GLOSSARY.....	55
B.2	ABBREVIATIONS.....	56
	<b>APPENDIX C INVENTORY ANALYSIS: CONSIDERED PROJECTS .....</b>	<b>59</b>

## LIST OF FIGURES

Figure 1: Overview of the levels of automation as envisaged by the investigated projects .....	12
--	----

## LIST OF TABLES

Table 1: Smart Shipping Projects reviewed by WG 210.....	12
Table 2: Overview with summarising properties of the recommendations for the future .....	52