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Permanent Working Group 125

GUIDELINES AND RECOMMENDATIONS FOR RIVER INFORMATION SERVICES

Draft edition 4
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Draft version 0.7
(consistency and language check still to be done)

RIS GUIDELINES 2018

PIANC Permanent working group 125.

The RIS Guidelines 2018 have been produced in the meetings of the Working Group 125 in 2016 till 2018 in Brussels, Barcelona, Budapest, Pittsburgh, Szczecin, Rotterdam and the final meeting in Brussels. The contributors to the Guidelines 2018 are: Mr. Piotr Durajczyck (Poland), Mr. Jan Bukovsky (Czech Republic), Mr. Dierik Vermeir, Mr. Piet Creemers (Flanders), Mr. Alaric Blakeway (France), Mrs. Birgitta Schäfer (Germany), Mr. Robert Rafael, Mr. Mario Sattle, Mr. Juergen Trögl (all Austria) and Mr. Csaba Kovacs (Hungary), Mr. Giang Hoáng Hông (Vietnam) Mr. Pedro Vila (Spain), Mr. Peter Stuurman and Mr Jeffrey van Gils (both The Netherlands), Mr. Evgeny Brodsky (Russia), Mr. Richard Lockwood, Mr. Brian Tetreault, Mrs. Patricia Dijoseph (USA), and Mr. Cas Willems (The Netherlands and Chairman).

The PIANC RIS-Guidelines 2018 Edition 4 have been adopted by the PIANC Inland Navigation Committee in …….. 2018

CONTENT

1 INTRODUCTION

1.1 Historical development of River Information Services.

River Information Services is the concept for information services in inland navigation to support traffic and transport management in inland navigation, including interfaces to other transport modes.

The potential of RIS to put inland navigation in a better position in the transport chain was also recognized by international organisations like the United Nations Economic Commission for Europe (UNECE), several river Commissions like the Rhine and Danube Commissions and PIANC, the World Association for Waterborne Transport Infrastructure. PIANC established a working group that developed in 2002 the *Guidelines for River Information Services* which are still an important pillar in the implementation phase of River Information Services. In 2004 the first revision of these guidelines was drafted and published, another update followed in 2011.

In 2003 the worldwide Inland ENC Harmonization Group (IEHG) was formed by North America and Europe to come into close interaction with the International Hydrographic Organization (IHO) for a worldwide standard for Inland ENC. The harmonization group has in the mean time members in North and South America, Asia and Europe.

With the support of several EU Member States, the European Commission took the initiative of issuing a directive on RIS which came into force in 2005. The PIANC guidelines, revision 2004, are one of the basic regulations[1] of this Directive[2].

The RIS Directive put requirements to the EU Member States to implement several basic services and standardized key technologies in their parts of the waterway network. In the overall European context the development and formalization of RIS were seen as *the* example for other transport modes to move towards a successful implementation of traffic and transport information services. In the domain of inland navigation it was also recognized as an important step in cross border information exchange.

In the context of PIANC there has always been a good cooperation between Europe and USA on the development of RIS towards a worldwide concept. Since the introduction of River Information Services in Europe, the ongoing development and implementation of River Information Services are influencing inland navigation on a worldwide scale. Worldwide a significant number of RIS services and systems, dealing with vessel traffic and/or transport management, have been developed, implemented and put into operation.

1.2 The evolution of the PIANC RIS Guidelines

Since the first initiatives of the European Commission on River Information Services, this concept on information exchange to support traffic and transport management in inland navigation, has found its way throughout the world. River Information Services are in an implementation stage in North and South America, Africa, Europe and Asia.

[1] Commission Regulation (EC) No 414/2007 of 13 March 2007

[2] Directive 2005/44/EC of the European Parliament and of the Council of 7 September 2005 on harmonized river information services (RIS) on inland waterways in the Community

The PIANC RIS Guidelines are the basis for the RIS Guidelines as formally accepted by the CCNR and the European Commission. The RIS Guidelines edition 2 are published by the European Commission as regulation no 2007/414/EC directly connected to the EU RIS-Directive 2005/44/EC. The PIANC Guidelines also became a basis for UNECE Resolution No. 57 on Guidelines and Recommendations for River Information Services (TRANS/SC.3/165). CCNR has published the RIS Guidelines version 3 based om CCNR protocol 2003-I-22.

Since the last technical brief of PIANC on River Information Services (RIS) the development and especially the implementation of RIS has been considerable.
The first two editions of the RIS guidelines were published during and after the first research results in the development phase of River Information Services. The third edition of the RIS guidelines, published in 2011 was based on the experiences gained and lessons learned in the RIS implementation processes since 2004.

Now, in 2018, an update of the PIANC RIS guidelines is seen as necessary because of the following reasons:

- RIS is under (pilot)implementation throughout the world and requires RIS guidelines bringing added value to all authorities and organisations that plan to implement RIS in their domain. A conversion of the European oriented RIS guidelines into RIS guidelines that are for optimal use on a worldwide scale is needed.
- Since 2010 studies have been conducted on RIS enabled Corridor Management. The concept of Corridor Management can be recognised as the next step in the deployment of RIS supporting inland navigation as an important transport mode in the international multimodal logistic chain.
- Developments in the maritime world with respect to e-Navigation will influence River Information Services. The adaptation of the RIS guidelines towards multimodal use of information services is world-wide of utmost importance for all modes of transport.

PIANC Permanent Working Group 125 gathered in recent period the development and implementation experiences on RIS and based on that experience revised the guidelines.

1.3 The PIANC RIS guidelines 2018

The PIANC RIS Guidelines describe the principles and general requirements for planning and implementing RIS and related systems. More and more it becomes clear that operating of River Information Services requires international cooperation already in the initial phase of planning RIS services and systems. Only tuning and coordination as early as possible can guarantee harmonised and effective information services on international network or corridor level. International worldwide applicable guidelines on the planning and implementation of River Information Services are needed to guarantee the harmonised operation and use of these services and systems.

RIS is developing towards information services on transport corridor level or waterway network level that supports inland navigation as an important transport mode in the international oriented logistic chain. It is foreseen that RIS supports more and more logistic services in a multimodal transport domain, this development is reflected in the RIS guidelines 2018 as one of the upcoming developments.

Guidelines are equally applicable to traffic and transport on inland waterways by maritime and inland cargo vessels, passenger vessels, working vessels and pleasure craft. Multimodality and multimodal information services is becoming more and more a requirement in the RIS

domain. For this reason the PIANC RIS guidelines 2018 has taken the first steps to find the synergy as much as possible with the developments like e-Navigation in the maritime world.

These RIS Guidelines should be used in conjunction with international regulations, recommendations and guidelines, In annex 2 an overview is given of the international regulations that should be followed when a RIS is going to be implemented and/or operated. Vessels navigating in an area where RIS is in operation shall make use of mandatory services and are recommended to make use as far as possible of the information provided by RIS.

An important aspect of the implementation of RIS is that the national and local authorities have the responsibility and the possibility for issuing regulations on how to implement and use the systems. Special issues in this field are the rules and regulations with respect to the protection of the confidentiality of personal and commercial sensitive information[3] and creating awareness and take measures related to cyber risk management. In the occasion of cross-border data exchange, it is recognised that regulations should be issued that safe and secure data exchange is protected. Privacy aspects are becoming more and more an important issue in the exchange of RIS related data.

The rapid development of information and communication technology will pave the way to new applications for inland navigation and will make these RIS Guidelines a “living” document. For this reason a special chapter in the PIANC RIS Guidelines 2018 is devoted to upcoming and future development in or related to the RIS domain. This chapter can guide those who are responsible for the planning and implementation of RIS in their organisation towards sustainable RIS services, systems and application.

Most relevant updates in the RIS Guidelines 2018 are summarised:

- The RIS Guidelines 2018 are - where possible - converted from European oriented guidelines into worldwide applicable guidelines.
- The conditions and consequences of the planning and the first steps towards the implementation of RIS enabled Corridor Management are included
- Lessons learned from a PIANC study on e-Navigation with respect to the synergy with RIS and the possible strengthening of RIS are taken in account.
- The RIS Guidelines 2018 includes a basic vision on developments that are going to affect RIS in the future.

An essential change in relation to the e-Navigation developments is the alignment between RIS and e-Navigation, and consequently as a first step the use of the same terminology. For this reason in these guidelines the term “RIS key technologies” is replaced by “Technical Services” and “Services” are changed into “Operational Services” to be in line with the terms used in the domain of e-Navigation.

[3] Regulation (EU) 2016/679 (General Data Protection Regulation), the European Data Protection Regulation will be applicable as of May 25th, 2018 in all EU member states to harmonize data privacy laws across Europe.

1.4 Reading guide for this document.

The PIANC RIS guidelines document is reorganised rather drastically and in the opinion of the team that updated the guidelines made more logical in its sequence.
Chapter 2 is defining the objectives of RIS and the stakeholders as potential users of RIS with their information needs. The RIS guidelines 2018 provides in chapter 3 a decomposition of the basic RIS services and sub-services into RIS functions as support to those who are responsible to implement RIS in his/her organisation. RIS enabled corridor management as support to transport management by information services is becoming more and more an essential and explicit part of RIS and is defined in its basic elements in chapter 3.

The PIANC RIS guidelines 2018 and in special the guidance for implementing RIS services is depicted in chapter 4. RIS Technical Services - in previous version RIS key-technologies - like ENC, AIS, Electronic Reporting are described in chapter 5

Chapter 6 is describing the expected influence of e-Navigation on the RIS related services in inland navigation and depicts a set of recommendation how this development should be taken in account in the coming years.

Apart from e-Navigation several other developments related to RIS are already or on short notice on the agenda of those who are responsible for planning, implementing and operating RIS. Chapter 7 provides some considerations on these upcoming developments in relation to these RIS guidelines.

Successful implementation of RIS requires a structured approach as advised in chapter 8 starting with a mission statement on objectives that should be achieved by the implementation of RIS

Note: Related to these PIANC RIS guidelines a separate PIANC document is published with a list of RIS related definitions and abbreviations. The consistent use of the RIS related definition is necessary especially in the standardisation work and the related legislative activities in the RIS environment. In annex 1 of these guidelines a list of abbreviations as used in this document is included and explained.

2 RIVER INFORMATION SERVICES, OBJECTIVES, STAKEHOLDERS AND INFORMATION NEEDS

2.1 River Information Services and its objectives

River Information Services is formally defined as the concept for information services in inland navigation to support traffic and transport management, including the interfaces to other transport modes.[4]

River Information Services will contribute to the overall goal to make inland navigation a safe, efficient and environmental friendly link in the logistic chain[5].

RIS is not about dealing with internal commercial activities between one or more of the involved companies, but RIS is open for interfacing with commercial activities. RIS are provided by fairway authorities to

- Fairway Authorities
- Waterway users
- Related logistic partners.

According to the national allocation of responsibilities RIS are in the jurisdiction of local, regional or national authorities.

RIS and the RIS systems and applications collect, process, assess and disseminate in a harmonised way fairway, traffic and transport information. It is essential that this fairway, traffic and transport information is world-wide harmonised, this is made possible by using an internationally approved framework for RIS as depicted in these guidelines.

The principal objectives of River Information Services are providing information to:

(1) Contribute to safety of traffic and transport by:

- Reducing traffic and transport incidents and accidents;
- Reducing injuries;
- Reducing fatalities;
- Providing information for law enforcement and statistics.

(2) Contribute to *efficiency of traffic and* transport *by***:**

- Optimising the use of the capacity of waterways and prevention of traffic congestion;
- Optimising the carrying capacity of vessels;
- Enabling Just in Time transport by a better predictability of travel times ;
- Reduction of travel times and waiting times;

[4] Based on the definition in the RIS-directive 2005/44/EC

[5] In 2011 the European Commission adopted its White paper “Roadmap to a single European Transport Area – Towards a competitive and resource efficient transport system”. The White paper gives a vision for a competitive and resource efficient transport system and defines goals to be reached stepwise in the years 2030 and 2050. Regarding RIS the White Paper calls for the deployment of transport related information and communication technology to ensure improved and integrated traffic management and to simplify administrative procedures through improved freight logistics, cargo tracking and tracing, and optimized schedules and traffic flows.
With respect to the contribution to environmental friendliness it can be stated that RIS contributes to the United Nations Strategic Developments Goals on actions to combat climate change.

- Reducing the workload and increasing situational awareness of RIS users;
- Reducing transport costs;
- Reducing fuel consumption;
- Improving the efficiency of harbours and terminals.

(3) Contribute to *environmentally friendly* transport by**:**

- Reducing environmental hazards;
- Reducing/detecting polluting emissions (in particular CO2) and spills due to accidents, illegal actions or normal operations.

(4) Make inland navigation a reliable, plannable and transparent transport mode in the multimodal transport chain.

These objectives should be met under the constraints that RIS is supplied in a manner that is ***reliable, cost efficient and legally sound***.

This chapter will next to this paragraph draw up the potential stakeholders with their information needs as the basis for River Information Services.

2.2 RIS stakeholders

The inland navigation sector includes many parties such as national authorities, port authorities, vessel owners, skippers, providers of nautical services, customs etc. Achieving the objectives of RIS very much depends on the (information) needs of the stakeholders and interactions between these parties across national and organisational boarders, hence, the RIS Guidelines will describe generic solutions. The implementation guidelines will not consider how stakeholders are organised, as this may vary in different regions, countries and organisations. The RIS Guidelines focus on general recommendations for implementation of RIS taking in account international and national agreements and regulations.

The following categories of stakeholders can be differentiated:

- Services consumers – RIS users - in inland navigation operations
  Examples of this user group are; skippers, ship owners, lock operators, VTS operators, terminal operators and port operators, etc
- Authorities
  Examples of this stakeholder group are technical certification authorities, competent authority for traffic management, port authorities etc.
- Managers in inland navigation
  Examples of this stakeholder group are fleet managers, waterway managers and water manager.
- Information providers
  Fairway authorities (fairway surveillance, VTS operators, lock operators, …)
- Service providers
  Examples of this stakeholder group are RIS providers and rescue and emergency service providers.

The different stakeholder groups have their own *objectives* and requirements on the *services, systems and applications* to be provided or used based on their *information needs.*

2.3 RIS Information needs

In Table 2.1 the information categories are depicted that would benefit the potential stakeholders of River Information Services. In annex 3 a more extended table is given which provides support to the user of this RIS guideline. Based on amongst others technical services (former RIS key technologies) the information needs are met by RIS functions. Those RIS functions which form a thematic set are composed to a RIS service.

The Table 2.1 is organised in different information categories being:

- Infrastructure related information:
    - Waterway related information
    - Land related information
- Vessel related information:
    - Dynamic vessel data
    - Hull related data
- Voyage related information
    - Location related information
    - Vessel convoy information
    - Cargo related information
    - Persons on board related information
- Traffic related information
    - Object related information
    - Waterway section related information

Information Category		Information need
1st	2nd level	
Infrastructure related	Waterway related information	Navigation-based information on fairway and/or navigable water area
		Meteorological information
		Water level related information
		Information on obstructions and limitations
		Information on navigation rules and regulations
	Land related information	Information on land region
		Information on harbours
		Information on terminals
		Information on locks and ship lifts
		Information on bridges
		Information on cables/pipes overhead and other special constructions
		Information on waste reception facilities
Vessel related	Dynamic vessel data	Position information of vessels
		Information on vessel dynamics (i.e. RoT, velocity, CoG, SoG, ..)
		Event based triggers for vessel position
	Hull related information	Information on hull data
		Information on vessels certificates
Voyage and cargo related	Location related information	Information on origin of voyage
		Information on intermediate discharge locations
		Information on passage points
		Information on destination of voyage
		date/ time of arrivals
		date/ time of departures
		Predicted deviation of the original voyage plan (of skipper) at defined points on the route (locks, crossings, berths,) and terminals/ports
	Vessel - convoy related	Overall convoy information
	Cargo related data	Information on origin of cargo
		Information on destination of cargo
		Information on cargo details
		Loading unit related information
	Persons on board related information	Information on number of persons (crew, passengers, ...) on board
		Details on persons on board
Traffic related	Object related information	Berth/terminal information
		Information on operational status of locks and bridges
		Information on actual passage time/duration at locks and bridges
		Information on predicted passage time/duration at locks and bridges
		Information on average passage time/duration for certain categories / certain vessel types
	Waterway section related information	Information on traffic density on a certain stretch and/or corridor (for specific vessel classes)
		Informaiton on sailing time over a certain stretch for certain vessel classes per sailing direction

Table 2.1 Information needs grouped in information categories

3 RIS OPERATIONAL SERVICES AND FUNCTIONS;

3.1 Functional decomposition of the RIS concept

In the RIS arena the underneath defined decomposition is used to clarify the hierarchy of the RIS operational services, RIS functions and RIS information elements[6] and connected to that the RIS technical services – or as previously called RIS key technologies - used to produce, calculate, transport or compose the required RIS information elements and related functions and operational services. The RIS related information elements can be based on data from several sources and/or RIS technical services. These guidelines are restricted to the first three levels and will not further specify recommendations on data level.

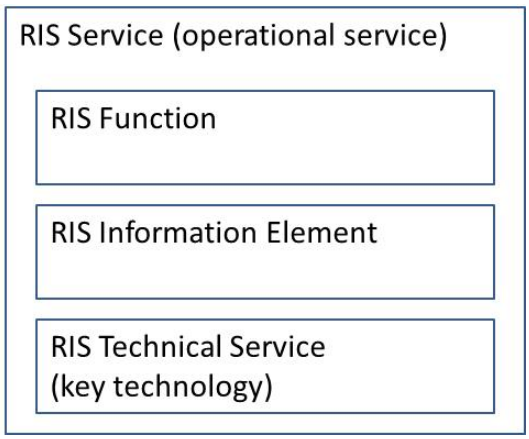

Figure 3.1 functional decomposition of RIS operational services

3.2 *RIS operational services*

A service provides and uses information. It supports the user in achieving an improvement in performance. Operational services support the user to achieve the objectives. The operational services defined in the context of RIS are given in Figure 3.1**Fout! Verwijzingsbron niet gevonden.** where:

Fairway information (FIS) contains geographical, hydrological, and administrative information regarding the waterway (fairway) in the RIS area that is required by the RIS users to plan, execute and monitor a voyage. Fairway information is one way information: shore to ship or shore to office (users' office).

Tactical traffic information **(TTI)** is the information service affecting the skipper's or the VTS operator's immediate decisions with respect to navigation in the actual traffic situation and the close geographic surroundings. Tactical traffic information contains position and specific vessel information of all targets detected by a radar and presented on an electronic navigational chart , and enhanced by external traffic information, such as the information provided by AIS. TTI may be provided on board of a vessel or on shore, e. g. in a VTS

Strategic traffic information (STI) *is the information service affecting the medium and long term decisions of RIS stakeholders.* Strategic traffic information contributes to the planning decision capabilities regarding a safe and efficient voyage or transport. A strategic traffic image

[6] The combination of a few information elements can lead to an information function, which is a digital or physical product that offers information to a user. A set of information elements belong to an information category.

contains all relevant vessels in the RIS area with their characteristics, cargoes and positions, stored in a database and presented in a table or on an electronic map.

Traffic Management Information (TM) is the (traffic) information service that supports traffic management processes in inland navigation being:

- *VTS – Vessel Traffic Services*.
  Where VTS is an information service implemented and provided in agreement with the IALA guidelines on Vessel Traffic Services for inland waterways. VTS is, implemented by a Competent Authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment.
- *Lock and Bridge management.*
  Lock and bridge management is the process of planning and operating bridge and lock management
- *Traffic Planning Services.*
  The information process for optimising the predictability and efficiency of the traffic flow on inland waterways

Calamity Abatement Support (CAS) is the information service that facilitate the supporting actions necessary to limit the consequences of a calamity (or accidents and incidents).

Transport logistics information (ITL) is the (transport) information service that supports transport logistic processes in inland navigation being:

- *Voyage planning.*
  Voyage planning is the process of developing a complete detailed description of the journey of a vessel, from start to finish.
- *Transport management.*
  Transport management is the process of planning, organising and executing of the efficient movement of goods from one location to another.
- *Port and terminal management*
  Port and terminal management is the process of planning, organising and executing the efficient ship and cargo handling in a port and terminal
- *Cargo and fleet management*
  Cargo and fleet management is the process of planning, organising and executing the efficient cargo and ships handling in an transport company

Law Compliance Information (ILC) is the information that facilitates legal compliance for the waterway users and facilitates the relevant agencies in inland navigation to support their tasks with respect to law enforcement.

Statistics Information (ST) is the information on traffic and transport in inland navigation that is required to support statistical processes

Waterway charges and port dues (WCD) is the information needed to facilitate the calculation and collection of waterway charges and port dues

Mainly traffic related

1 Fairway information Services (FIS)

2 Traffic information (TI)

a) Tactical traffic information (TTI)

b) Strategic traffic information (STI)

3 Traffic management information (TM)

a) Local traffic management (vessel traffic services - VTS)

b) Lock and bridge management (LBM)

c) Traffic Planning (TP)

4 Information to support calamity abatement (CAS)

Mainly transport related

5 Transport logistics Information (ITL)

a) Voyage planning (VP)

b) Transport management (TPM)

c) Port and terminal management (PTM)

d) Cargo and fleet management (CFM)

6 Information on Law ompliancy (ILC)

7 Statistics information (ST)

8 Information for waterway charges and harbour dues (CHD)

Table 3.2 River Information Services

3.3 RIS functions

Figure 3.1 shows the connections between operational services and functions and information elements. A set of information elements are combined into information categories. The information categories are presented in table 2.1 and gives an overview of the information needs of the stakeholders of RIS.

Based on the information needs the RIS functions and sub-functions are defined and presented in table 3.3. On function-level the RIS operational services are depicted, showing to which operational service the function could provide input. The table is intended to be used as a guide for those who have a responsibility to develop a RIS operational service.

Each function in the table provides a function number, the function number is related to the primary operational services. As an example: FIS 2 – provide meteorological information - has a primary relation to Fairway Information Services but is also a function in Traffic Information Services and Calamity Abatement Services.

Functions			RIS operational services			RIS operational services				
1st level	2nd level	Function Number	Fairway Information Services	Traffic Information	Traffic Management	Calamity Abatement Support	Information for Transport Logistics	Information for Law compliance	Statistics	Waterway charges and harbour dues
Provide navigation-based information on fairway and/or navigable water area		FIS 1	x	x	x	x	x			
	Provide information on bank of waterway, boundaries of the fairway, etc.									
	Provide information on depth profile of the fairway									
	Provide information on non-navigable or un-surveyed water area									
	Provide information on anchorage areas, mooring facilities and berths									
	Provide information on permanently moored vessel or facility in waterway									
Provide meteorological information		FIS 2	x	x		x				
	Provide continuous weather information									
	Provide weather warnings									
	Provide actual ice situation									
	Provide predicted ice situation									
Provide water level related information		FIS 3	x	x		x	x			
	Provide actual water levels									
	Provide predicted water levels									
	Provide actual discharge information									
	Provide predicted discharge information									
	Provide least sounded actual depths information (shallow sections)									
	Provide least sounded predicted depths information (shallow sections)									
	Provide barrage status									
	Provide regime status									
Provide information on obstructions and limitations		FIS 4	x	x			x			
	Provide information on long-time obstructions in the fairway									
	Provide information on temporary obstructions in the fairway									
	Provide information on ferries									
Provide information on navigation rules and regulations		FIS 5	x	x			x			x
	Provide information on official aids-to-navigation									
	Provide information on traffic signs									
	Provide information on traffic rules and regulation									
	Provide information on anchorage areas, mooring facilities and berths									
	Provide information on waterway charges, harbour dues and infrastructure charges									
	Provide actual status of light signals									
Provide information on land region		FIS 6	x				x			
Provide information on harbours		FIS 7	x	x			x			x
	Provide information on harbour area and basin									
	Provide information on category of harbour facility									
	Provide information on port schedule									
Provide information on terminals		FIS 8	x	x			x			
	Provide information on category of terminal									
	Provide information on cranes and boat ramps									
	Provide information on terminal schedule									
Provide information on locks and ship lifts		FIS 9	x	x			x			
	Provide information on construction and facility									
	Provide information on lock schedule									
	Provide operational status of locks									
Provide information on bridges		FIS 10	x	x			x			
	Provide information on construction									
	Provide information on openable bridge schedule									
	Provide operational status of openable bridges									
	Provide information on vertical clearance									
Provide information on cables/pipes overhead and other special constructions		FIS 11	x							
	Provide information on construction									
	Provide information on vertical clearance									
Provide information on waste reception facilities		FIS 12	x							

Functions			RIS operational services			RIS operational services				
1st level	2nd level	Function Number	Fairway Information Services	Traffic Information	Traffic Management	Calamity Abatement Support	Information for Transport Logistics	Information for Law compliance	Statistics	Waterway charges and harbour dues
Provide position information of vessels		TIS 1		x	x	x	x	x	x	
	Provide actual position information of vessels									
	Provide historic position information of vessels									
Provide vessel dynamics (i.e. RoT, velocity, CoG, SoG, ..)		TM 1			x		x	x	x	
	Provide actual vessel dynamics (i.e. RoT, velocity, CoG, SoG, ..)									
	Provide historic vessel dynamics (i.e. RoT, velocity, CoG, SoG, ..)									
Provide event based triggers for vessel position		TM 2			x		x	x		
	Provide notifications of arrivals at defined (passage) points of the waterway									
	Provide notifications of arrivals or departures at defined locations on the waterway									
Provide information on hull data		ILC 1				x		x	x	x
	Provide specific information on hull data									
	Provide data for the identification of vessels (minimum hull data set)									
	Provide full hull data									
Provide information on craft certificates		ILC 2				x		x		
	Provide community certificate									
	Provide ADN tank certificate									
	Provide ADN dry certificate									
	Provide measurement certificate									
	Provide other certificate									
Provide information on origin of voyage		VP 1					x	x	x	x
Provide information on intermediate discharge locations		VP 2					x	x	x	x
Provide information on passage points		VP 3					x	x	x	x
Provide information on destination of voyage		VP 3					x	x	x	x
Provide information on date/ time of arrivals		VP 4		x	x		x	x		
	Provide estimated date/ time of arrivals									
	Provide requested date/time of arrivals									
	Provide date/time of actual arrivals									
Provide information on estimated date/ time of departures		VP 5			x		x	x		
	Provide estimated date/ time of departures									
	Provide date/time of actual departures									
	Provide date/time of requested departures									
Predicted deviation of the original voyage plan (of skipper) at defined points on the route (locks, crossings, berths,) and terminals/ports		VP 6			x		x	x		
Provide overall convoy data		VP 7			x		x			
	Provide convoy type									
	Provide information on the hulls of a convoy									
	Provide information on the characteristics of a convoy									
Provide information on origin of cargo		CFM 1				x	x	x	x	
Provide information on destination of cargo		CFM 2				x	x	x	x	
Provide information on cargo details		CFM 3				x	x	x	x	
	Provide details of cargo sender									
	Provide details of cargo receiver									
	Provide details of non-dangerous cargo									
	Provide details of dangerous cargo									
	Provide port of loading									
	Provide estimated date/time of departure at loading place									
	Provide port of discharge									
	Provide estimated date/time of arrival at discharge place									
Provide loading unit related information		CFM 4				x	x	x	x	
	Provide number of containers on board									
	Provide information on type of containers on board									
Provide information on number of persons (crew, passengers, ...) on board		CAS 1				x				
Provide details on persons on board		CAS 2				x				

Functions			RIS operational services			RIS operational services				
1st level	2nd level	Function Number	Fairway Information Services	Traffic Information	Traffic Management	Calamity Abatement Support	Information for Transport Logistics	Information for Law compliance	Statistics	Waterway charges and harbour dues
Provide berth/terminal information		PTM 1			x		x			
	Number of vessels at berth									
	Percentage of occupied berth space									
	Exact location of vessel at berth									
	Predicted number of vessels at berth at a certain time / in a time period									
	Predicted percentage of occupied berth space at a certain time / in a time period									
	Reserved berth space (in percent or list of vessels) at a certain time / in a certain period									
Provide information on operational status of locks		LBM 1			x		x			
	Door status (open, closing, closed, opening, malfunction, unknown)									
	Chamber availability for navigation (Yes or No, if No then vessels entering, vessels leaving, locking in process, not in operation, unknown)									
	Water level at lock chamber (low, leveling up, high, leveling down, unknown)									
	Position of vessels in a lock chamber including number of blue cones or passenger vessel or certificate									
	Number of announced vessels approaching the lock per sailing direction (arriving on short term)									
	Number of vessels waiting for locking per sailing direction									
	The still available length and/or width									
Provide information on actual passage time/duration at locks and bridges		LBM 2			x		x			
	Actual passage duration									
	Actual waiting time									
	Actual locking duration									
	Sequence of entering the lock / passing bridge									
Provide information on predicted passage time/duration at locks and bridges		LBM 3			x		x			
	Predicted passage duration									
	Predicted waiting time									
	Predicted locking duration									
	Planned locking time									
Provide information on average passage time/duration for certain categories / certain vessel types		LBM 4			x		x			
	Average passage duration									
	Average waiting time									
	Average locking duration									
Provide information on traffic density on a certain stretch and/or corridor (for specific vessel classes)		TIS 1		x	x		x			
	Actual density									
	Predicted density									
	Average density									
Provide information on sailing time over a certain stretch for certain vessel classes per sailing direction		TIS 2		x	x		x			

Table 3.3 RIS functions and the relation to the RIS operational services

3.4 RIS enabled Corridor Management

In recent years several measures were studied to realize a future vision on vessel traffic management and transport management on inland waterway corridors to improve the position of inland navigation in the transport chain. Actions are needed on national and international level by public and private stakeholders to improve the position of inland navigation in the transport chain, optimal cooperation between stakeholders is required. Studies[7] made clear that transport over water should be planned on corridor level. Transport planning is an

[7] For example the VTMC project (Vessel Traffic Management Centre of the Future, Netherlands), the Netherlands – Germany electronic reporting pilot project and CoRISMa

important issue and requires cooperation, suitable information exchange and harmonised technology.
It is more and more evident that Traffic Management will shift from safety management to a service that supports the logistic transport chain in a more intensive way, however without compromising the safety.

Traffic management - including lock and bridge management – and transport management in a transport corridor requires an integrated network-approach where the operational information services to the users are an interactive part of voyage and traffic planning processes. In cases where many objects (locks, bridges, etc.) have to be passed, the diversity in object characteristics will make a corridor-based traffic management approach more useful. This requires the development of vessel traffic management strategies, designed to optimize transport capacities and offer ships reliable forecasts of their travel times and optimal use of the fairway, locks and bridges.

Corridor management as a concept aims at linking services together on a route or network in order to supply RIS not just locally, but regional, national and international in support of navigation on their voyages on the network. Corridor management will realise support for transport management. The supplied services in corridor management are all operational information services. In this respect the term management in corridor management may suggest an active approach of the information suppliers to actually 'manage' the corridor. This however is not intended here. As said, corridor management provides additional information services to the existing RIS in order to provide better service to the waterway users in support of their voyages. It is expected that corridor management services just by providing better information do improve the performance of inland navigation and the interaction with the logistic partners.
Consequently RIS enabled corridor management as support to transport management is becoming more and more an essential and explicit part of RIS Traffic Management.

The definition of RIS Enabled Corridor Management is:

> **"*Corridor Management is defined as information services among fairway authorities mutually and with waterway users and related logistic partners in order to optimise use of inland navigation corridors within a network of waterways*"**

Corridor Management requires sharing of information between authorities and the cooperation of public and private partners and is necessary to improve both the performance of inland navigation and the use of the existing infrastructure.

Corridor Management requires a structured cooperation among fairway authorities to provide a precisely defined set of harmonised operational services in the required quality.

The main beneficiaries of corridor management are the stakeholders in IWT (e.g. skippers, vessel operators, logistics operators) that benefit from better information presented in a homogenous way.

Corridor Management does not require new operational services[8], but is based upon existing River Information Services. The cooperating waterway authorities (respectively RIS

[8] In comparison to version 2 of the PIANC RIS guidelines of 2004 the function "Traffic Information Services " are added to the function list, other changes are only minor.

Authorities) in a specific corridor will have to agree mutually on the operational services and functions they are planning to provide in that corridor. Besides the technical and procedural harmonisation, this agreement among the fairway authorities is a key element of Corridor Management.

A corridor in the sense of Corridor Management is the “RIS Area”, being a formally described area where River Information Services are provided. A corridor is depending on the geographic region and the organisational diversity, where corridor management is applied.

There are three distinctive levels of corridor management. Although there are dependencies between the operational services in these levels, they are not built up in a strict hierarchical order.

Level 1: Corridor Management is a service to enable reliable route planning by supplying – dynamic and static – infrastructural information.

Level 2: Corridor Management is a service to enable reliable travelling times for voyage planning and for traffic management, by providing traffic information:

a) considering the actual use of the waterway network (e.g. actual waiting times)
b) also, considering predictions during a voyage (e.g. predicted waiting times on the corridor) where considered reasonable

Level 3: Corridor Management is a service to support transport management of the logistic partners (e.g. deviation management).

The following information categories are covered by the related level:

Corridor Management Level	Operational services on
Level 1	• Static Infrastructural information • Dynamic Infrastructural information • Prediction water levels and ice
Level 2a	• Vessel related information • Traffic related information • Voyage related information
Level 2b	• Traffic planning/prediction
Level 3	• Tracking information of specific vessels and/or cargo • Prediction of delays for specific vessels both made available only through RBAC (role based access control)

Table 3.4 Service-levels RIS enabled Corridor Management

3.5 Single point of access for the exchange of traffic and transport information.

For Corridor Management, the users – and providers of operational services and applications – would benefit from one single information entrance to get the information used during (international) voyages. Users would benefit from one "single point of access" to relevant RIS for planning and conducting a voyage.

The RIS service architecture should for public operational services compose local, regional or national RIS services, which either are based on public information or release public information, across borders, on a corridor or the entire network of inland waterways.

Users could access via a single point of access public information on:

- FIS: provision of Fairway information services of the entire network or corridor;
- TIS: provision of Traffic information services of the entire network or corridor;
- TM: provision of traffic management information of the entire network or corridor;
- ST: provision of statistical data services of the entire network or corridor.

Some operational services need input from privacy related information of specific vessels like:

- vessel position information;
- vessel hull information;
- vessel voyage information;
- vessel cargo information.

Exchange of privacy related or economic sensitive information with private parties requires strict authorisation rules and a legal basis. The information should be available for authorized users only from a single and controlled point of access. The provision of these information categories is a sub-service of the RIS service *Information to transport logistics*.

4 RECOMMENDATIONS FOR THE IMPLEMENTATION OF RIS OPERATIONAL SERVICES

4.1 Fairway information service

1. Fairway information contains static and dynamic as well as urgent information regarding the fairway. Static and dynamic fairway information should be communicated on a scheduled basis.
2. Fairway information should be provided at a national level or preferably at (International) fairway network level or corridor level by implementing and operating one single point of contact.
3. Safety related fairway information should be validated and approved by the competent authority.
4. Fairway Information Services should be given with an indication of the quality of the information. Depending on the type of information, this quality can be expressed in terms of accuracy, reliability, age, completeness, conformity to standards, etc. The user should be informed at least on:
    - Reliability of the information
    - Accuracy and age of the information
    - Completeness of the information
5. The *urgent* information needs to be updated very frequently and/or should be communicated on a real time basis by VHF radio or by other digital means like AIS or harmonised mobile communication services. Extended AIS functionalities, like ASM in AIS, could provide wider information content

4.2 Traffic information service

Information concerning the traffic situation may be provided in two ways:

a. As tactical traffic information (TTI) using radar overlaid in a viewer for Electronic Navigational Charts (ENC) and integrated with information from an AIS system
b. As strategic traffic information (STI) using an AIS network and/or electronic ship reporting.

4.2.1 Tactical traffic information service

1. For circumstances of poor visibility vessels should be equipped with radar to monitor all other ships in the close navigational area.
2. A tactical traffic image on board should be enhanced at least by displaying the radar information and AIS vessel information on an Electronic Navigational Chart (Inland) ENC.
3. The use of AIS on board a vessel as sensor for detection of surrounding vessels should be mandatory and fulfil the requirements of the relevant standard. The vessels identity information should be presented in the tactical traffic image and other additional information on these vessels should be available.

4. Tactical traffic information on shore should be used in local traffic management (e.g. VTS centres and lock operation centres).

In European inland waterways:

Using the Tactical Traffic Image in navigation mode requires that:

- The integrated display – inland ENC-viewer integrated with radar and AIS - is in accordance with the requirements for the navigation mode of the Inland ECDIS standard.
- The vessel's position is to be derived from a radar of which accuracy is consistent with the requirements of safe navigation.
- At least the safety relevant infrastructural objects should be included into the ENC. The competent authority should verify the safety relevant information in the ENC.

4.2.2 Strategic traffic information

1. Strategic traffic information should be implemented, when monitoring of the traffic situation in the RIS area is needed for medium term and long term decisions.
2. Strategic traffic information is helpful for the following operational services:
    - Lock and bridge management (calculation of estimated time of arrival - ETA - and required time of arrival - RTA);
    - Traffic Planning;
    - Calamity abatement support (vessel and cargo data);
    - Information for transport logistics in a multimodal environment like:
        - Voyage planning
        - Transport management
        - Intermodal port and terminal management
        - Cargo and fleet management.
3. For strategic traffic and transport management supporting services a ship reporting system should be established by the competent authority. The system has the task of collecting, processing, verifying and publication of the reported information on vessel position, voyage and cargo.

4.3 Traffic management

4.3.1 Vessel traffic services, (VTS)

1. A VTS should be planned, implemented and operated in accordance with the Inland VTS Guidelines of IALA and the CCNR guidelines on inland VTS.
2. RIS does not necessarily have to include a VTS.
3. The Tactical Traffic Image (TTI) to be used in an inland VTS is produced by combining shore based radar and AIS information and displaying the vessels and traffic information on an ENC.
4. AIS will enhance tactical and strategic traffic information in a VTS area and as such the VTS capabilities. AIS provides more vessel related information and improves an

overview on the traffic situation in a wider area than radar and can improve the communication with vessels in the VTS area.

4.3.2 Lock and bridge management

1. RIS should optimise the traffic flow by:
   - Support of the lock/bridge master in short term decisions for planning of the lock and bridge cycle by presentation of an electronic lock diary, by a database, and by registration and publication of waiting times and by presenting approaching vessels.
   - Support of the lock/bridge master in medium term decisions by data exchange with the neighbouring locks and on network level. Information from skippers to lock/bridge masters of a set of locks on a corridor or in a waterway network should only be collected and communicated once.
   - Support of the skipper by providing information on waiting times and/or expected time of passing.
   - Optimisation of lock cycles by the calculation of ETAs/RTAs for a chain of locks and providing information on RTAs to skippers.
2. Optimisation of lock and bridge management will lead to reduced waiting times at locks and bridges, increased utilisation of the capacity of locks and improved prediction of voyage-duration.
3. An electronic reporting system, an AIS network and appropriate means of communication are recommended to be implemented in order to enhance lock and bridge planning.

4.3.3 Traffic Planning.

1. Traffic planning should optimise the passage time on a fairway or transport corridor by providing information on the state of the fairway and passing times at locks and bridges on a fairway or corridor in an integrated approach.
2. Through electronic reporting and tactical and strategic traffic information waterway authorities can better anticipate to the demand for use of fariway infrastructure in the RIS area and provide enhanced Traffic Management Services.
3. Based on an ETA at the final destination, the fairway authority can advise a ship to adapt its ETA to optimize not only the resources but also the arrival time of the ship. This allows for better use of infrastructure and reduced waiting times leading to improved efficiency.

4.4 Information to support calamity abatement

1. Calamity Abatement Support is facilitated by reporting of the vessel's position, voyage and (dangerous) cargo and crew – persons on board - data at the beginning of a voyage. This information should be continuously updated during the voyage. In case of an accident, RIS centre should be able to deliver the information without delay to the emergency services.
2. In case of accidents responsible waterway authorities of a neighbouring RIS area should be informed on the type, status and possible consequences of an accident. Other vessels in the neighbourhood area of waterway should be informed without delays about

possible impact of an accident to restrict the possible negative consequences of an accident.

4.5 Information for transport logistics

1. Voyage planning is the task of the skipper and the vessel owner. Voyage planning comprises the planning of the loading and the draught and height of the vessel, as well as the planning of the ETA and of possible loadings or unloading during the voyage. RIS should support voyage planning by:
   - Fairway information service.
   - Strategic traffic information.
   - Traffic information and traffic planning.
   - Lock and bridge management.
2. RIS supports transport deviation management and as such can improve efficient transport logistics.
3. Transport management means the management of the transport chain driven by freight brokers and transport service quality managers. It is aimed at:
   - Controlling the overall performance of the contracted fleet managers/skippers and terminal operators.
   - Controlling the transport progress.
   - Monitoring unexpected events which might lead to a conflict with the transport preconditions.
   - Finalising the transport (delivery and invoice).
4. The competent authorities should develop their information systems in such a way that the information exchange between public and private partners is possible and privacy and security aspects are guaranteed.
5. The competent authorities should provide ample room for logistic services within the bounds of their possibilities, such as:
   - The exchange of information between users and customers relating to vessels and terminals.
   - Fleet and crew planning support.
   - ETA/RTA negotiations between vessels and terminals.
   - Vessel tracking and tracing.
   - Electronic market places.
6. Confidentiality of data exchange in a RIS needs to be ensured. In cases where logistic information is provided by systems operated by a competent authority, this authority should take the necessary steps to ensure the protection of confidentiality of commercial information. When confidential data is provided to third parties, privacy regulations have to be taken into account.

4.6 Information for law compliance

1. Safety and efficiency of navigation requires from the users that they comply with the law. RIS supports compliance with the law in inland navigation in the fields of:
   - Cross-border management (e.g. the movement of people controlled by the immigration service, customs).
   - Compliance with the requirements for traffic safety.
   - Compliance with environmental requirements.
2. Provision of documents and information in an electronic way to inspection and control authorities reduces administrative burden and enables inspection formalities more efficient and less time consuming.
3. Sharing of vessel, cargo and crew information between different law enforcement agencies in different countries will reduce the administrative burden and improves the efficiency of law enforcement.
4. Law enforcement agencies should use RIS with positive incentives for skippers e.g. by providing information on local, regional, national regulations and rules in an electronic way via FIS or ECDIS.

4.7 Information for statistics

1. The RIS operational services for Statistics is mainly based upon the other RIS operational services and in special Traffic Information and Traffic Management. By means of storing this information over a defined period, statistical analysis can be made. RIS information will result in a higher quality of transport statistics.
2. Using RIS information for statistical purposes will reduce:
   a. Costs on both authorities and logistic sector sides for provision, collection and evaluation of data;
   b. Double data input in different countries and for different purposes, which leads also to data inconsistency, wrong data and high costs;
   c. Administrative burden.

4.8 Information for waterway charges and port dues

1. The RIS operational services for waterway charges and port dues is mainly based on the RIS technical services like electronic reporting and AIS.
2. RIS could be used to provide information about waterway charges and port dues for all users, language independent and free of charge. User friendliness and right understanding is important.

5 RECOMMENDATIONS FOR THE IMPLEMENTATION OF RIS TECHNICAL SERVICES

5.1 General

1. RIS are based on technical services that facilitate the exchange of information related to :
   - Fairway and infrastructure information
     - Static fairway and infrastructural information is presented by means of Electronic Navigational Charts;
     - Dynamic fairway and infrastructural information is exchanged by means of Notices to Skippers, Notices to mariners or AIS.
   - Dynamic and static vessel information provided by Vessel Tracking and Tracing services;
   - Vessel voyages and loaded cargo by means of electronic reporting;
2. The RIS technical services have their origin in the maritime domain, where following technologies/services are used on a global level:
   - ECDIS (Electronic Chart Display and Information System) as standardised by the IHO (International Hydrographic Office);
   - The Automatic Identification System (AIS) as standardised by ITU (International Telecommunication Union) and IEC (International Electrotechnical Commission). The performance standard for AIS was defined by IMO (International Maritime Organisation) and developed by IALA (International Association of Lighthouse Authorities);
   - The EDIFACT standard as published UN-CEFACT incorporating IFTDGN message and partially complying IMO FAL forms
   - Notices to Mariners following IHO/IMO guidelines for navigational warnings.
3. In different regions of the world, slightly different regional versions of the RIS technical services are standardised and used
   - The European standards for technical services for RIS are Inland ECDIS, Electronic Reporting International (ERI), Inland AIS and Notices to Skippers (NtS).
   - The US RIS technical services are AIS and Inland ECDIS.
   - In Russia AIS and Inland ECDIS are in use.

Note: Apart from the RIS technical services, the basic technologies – like radar and radiotelephone services via VHF and mobile data connections like mobile (telephone) networks, satellite, WiFi, WiMax, and LoRa - are important supporting technologies for RIS. These basic technologies are not going to be described in these guidelines.

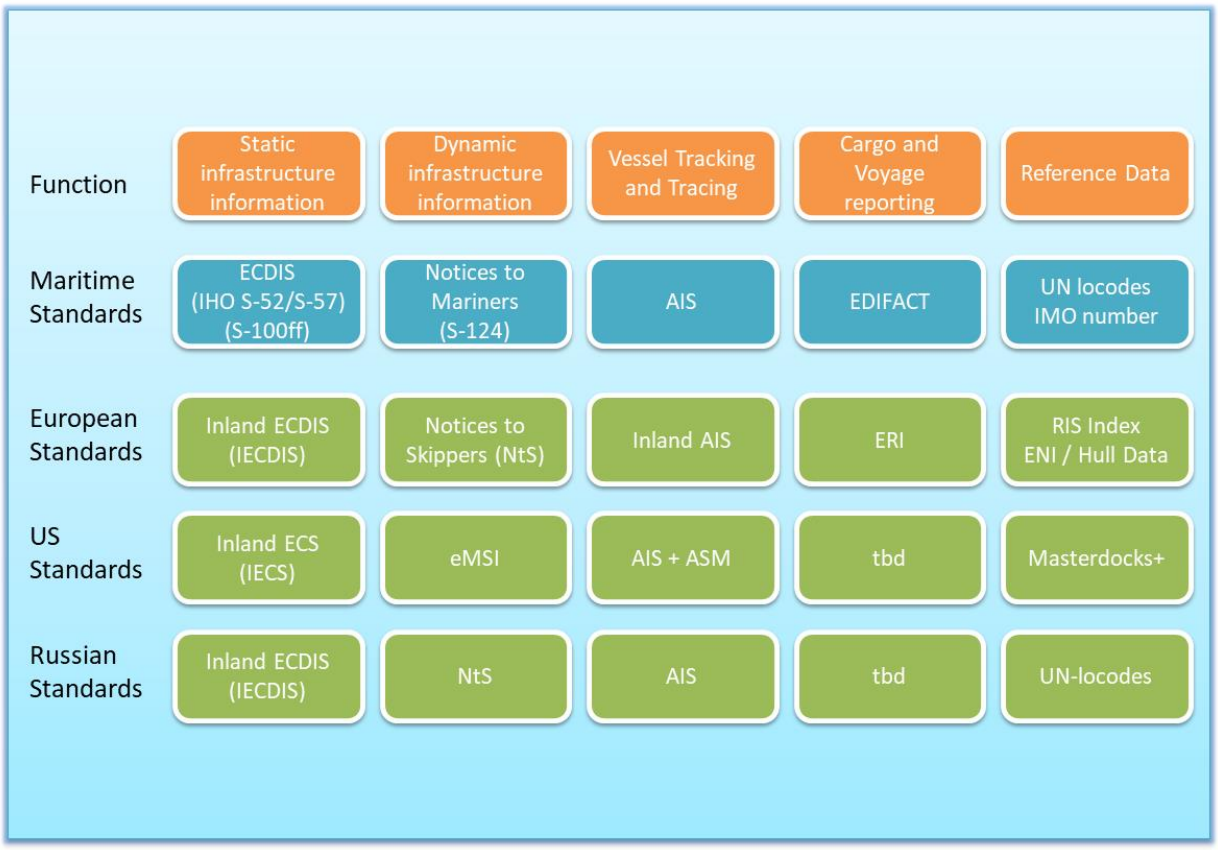

figure 5.1 RIS technical services world-wide

5.2 Exchange of Static Fairway Information; ENC and Inland ENC

1. An electronic navigational chart or ENC is an official database created by a national hydrographic office for use with an Electronic Chart Display and Information System (ECDIS). An electronic chart must conform to standards stated in the International Hydrographic Organization (IHO) Publication S-57 before it can be certified as an ENC.
2. ECDIS is a system for the display of electronic navigation charts and additional geographic related information, approved by IHO and IMO. ECDIS is displaying selected information from a System Electronic Navigational Chart (SENC) with positional information from navigation sensors and if required additional navigation-related information. Its purpose is to contribute to safety and efficiency of navigation and thus also to protection of the environment. Simultaneously ECDIS will reduce the workload when navigating the ship as compared to traditional navigation and information methods. ECDIS is complying with the conventional paper charts required by Regulation V/19 of the 1974 IMO SOLAS Convention. Only ENCs can be used within ECDIS to meet the International Maritime Organisation (IMO) performance standard for ECDIS.
3. ECDIS provides as one of the technical services the basis for other River Information Services, for the use of systems and applications like AIS
4. Inland ENC (IENC) are based on the standards for maritime ENC, supplemented with special information for the use on inland waterways. That means that currently:

a. Inland vessels sailing in maritime waters with IENC displays get all maritime ENC information.

b. Sea going vessels sailing in inland waters with maritime ENC display get all information being equal to marine information (e.g. river banks), but they do not get the additional inland information (e.g. inland notice marks).

Note: *The inland ENC Harmonization Group (IEHG) was formed in 2003 by North America and Europe to facilitate the development of international standards for Inland EDCIS. In the meantime Russia, and Brazil, China, South Korea, Venezuela and Peru joint the IEHG. The IEHG is comprised of representatives from government, industry and academia. Without restriction, it can be stated that the inland ECDIS standard as published by the IEHG can be seen as a worldwide standard for electronic navigation Charts for inland waterways.*

5. Inland ECDIS is a European standard for regulating IENC as well as the equipment for the display of IENC on board. Special attention is being given on the “Navigation” mode where an Inland ECDIS is being integrated into the radar display.

6. Sea-river vessels are recommended to use the additional IENC software libraries in order to obtain full Inland ENC information.

7. Inland ECDIS shall use chart information (iENC) as specified by the IHO S57 Standard (edition 3.0) with the additions published by the IEHG.

8. The presentation shall be in accordance with the IHO S52 Standard (edition 3.0) and with the amendments published by the IEHG.

9. It is recommended to include the water depths to the iENC (depths contours) for shallow river stretches that determine the draught of the vessels. The water depths may be related to a reference water level or to the actual water level.

5.2.1 Specific aspects and criteria for the use of iENC in inland waterways in Europe:

1. Inland ENC is the European IENC chart and equipment standard. Inland ENC charts are based on IEHG regulations.

2. Inland ECDIS displays may be used in navigation mode or in information mode.
   - Information Mode means the use of Inland ENC without traffic information by radar overlay.
   - In navigation mode, an Inland ENC (operating system software, application software and hardware) shall have a high level of reliability and availability at least of the same level as other means of navigation.

3. Inland ECDIS equipment for navigation mode shall be certified by the competent authority.

4. In navigation mode Electronic Navigational Charts (ENCs) shall be used which are certified by the waterway authorities.

5.3 Exchange of static and dynamic vessel information; AIS

1. The Automatic Identification System (AIS) is a ship borne radio data system, exchanging static, dynamic and voyage related vessel data between equipped vessels and between equipped vessels and shore stations. Ship borne AIS stations broadcast the vessel's identity, position and other data in regular intervals. By receiving these transmissions, ship borne or shore based AIS stations within the radio range can automatically locate, identify and track AIS equipped vessels on an appropriate display like radar or Inland ECDIS.
2. AIS is a cooperative device, therefore all those wishing to use and participate in the system must be equipped with an AIS device.
3. AIS is an additional source for navigation-related information but is not a navigation system. AIS does not replace navigation-related services such as tracking by radar, but in fact supports them. The strength of AIS lies in the detection and tracking of those craft fitted with it. AIS and radar complement one another due to their different characteristics.
4. The following operating modes can be distinguished for AIS
    a. Ship to ship: All vessels fitted with AIS are able to receive static and dynamic data from all other vessels and Aids-to-Navigation (AtoNs) equipped with AIS within the area of VHF coverage. Inland AIS may be used in combination with Inland ECDIS or radar to enhance a TTI and STI.
    b. Ship to shore: Data from vessels equipped with an AIS mobile station can also be picked up by AIS base stations and relayed to an RIS Centre where it can be used to display Tactical Traffic Information (TTI) and Strategic Traffic Information (STI).
    c. Shore to ship: Safety-related data can be transmitted to vessels by shore installations.
5. A peculiar trait of AIS is the autonomous mode which uses the SOTDMA (Self-Organised Time Division Multiple Access) procedure, thus dispensing with the need for a coordinating shore infrastructure consisting of base stations.
6. Various kinds of AIS device types or AIS stations may be distinguished:
    a. AIS mobile stations of Class A on all seagoing vessels subject to the requirements of the International Maritime Organisation (IMO) SOLAS Chapter V,
    b. AIS mobile stations of Class B CS/SO with restricted functionality, i.e. on seagoing leisure craft,
    c. Inland AIS mobile stations, derivatives of AIS mobile stations of Class A with full Class A functionality at VDL level plus additional inland navigation functions,
    d. AIS base stations, VDES stations including shore-based simplex repeater stations,
    e. AIS nautical signal stations for use on signalling devices such as beacons and buoys. ("Aids to Navigation" AtoN).
7. Inland AIS is the European standard for vessel tracking and tracing. It is fully based on maritime AIS but defines additional application-specific messages (ASM) for transmitting inland-waterway related information. Some messages need to be integrated in to the AIS unit, while others target for handling and display in connected Inland ECDIS displays. In view of their shared information content, Inland AIS and maritime AIS are compatible. All data transmitted can be received by both maritime and Inland AIS

devices to be visually displayed and analysed. However the specifically Inland AIS information is only transmitted and assessed by Inland AIS devices.

8. (Inland) AIS is an instrument for the tracking and tracing of navigation vessels with the goal to improve safety and efficiency of navigation supporting different RIS operational services as there are on-board decisions (TTI and STI), shore-based Traffic Management (TM) including Vessel Traffic Services (VTS, Lock and Bridge Management (LBM) and Traffic Planning (TP), Calamity Abatement Support (CAS), Information for Transport Logistics (ITL) and Information for Law Compliance (ILC).
9. For maritime AIS there is a carriage requirement according to the SOLAS convention.

5.3.1 Specific aspects and criteria for the use of inland AIS in European Waterways

1. On most European inland waterways a carriage requirement for Inland AIS is in force for vessels greater than 20m in length
2. The information transmitted by AIS can be divided into the following categories:
   a. Static information, such as vessel number, call-sign, vessel name, vessel type,
   b. Dynamic information, such as position of the ship with data on accuracy and integrity status,
   c. Voyage-related information, such as length and beam of combinations, dangerous cargo,
   d. Specific for inland AIS in Europe specific information is required like
      a. Standard European Vessel Number (ENI)[9],
      b. type of combination,
      c. number of blue cones/lights as per ADN,
      d. estimated time of arrival (ETA) at locks, bridges, terminals, borders.
3. For transmitting messages Inland AIS in Europe uses the same parameters and the same structure as AIS mobile stations of Class A, which the IMO prescribes for maritime navigation (IMO AIS). Fields with unused parameters are defined as “not available”. Elements marked with ‘*’ must be dealt with differently from seagoing vessels.
4. When using inland AIS In inland navigation the shipmaster should manually input the following data at the start of the voyage and whenever the data is amended:
   a. Correct navigation status,
   b. Type of combination,
   c. Length/beam of combination,
   d. Category of dangerous cargo,
   e. Draught of the ship,
   f. Loaded/unloaded,
   g. Port of destination and ETA.

[9] Seagoing vessels are permitted to use the IMO number but are obliged in Europe to have inland AIS implemented.on inland waterways.

The conning skipper must check data to ensure that the static ship data is correct and denotes the latest situation. This must be done at least once a month but preferably at the start of every voyage. At certain intervals the shipmaster must also check the dynamic data of his or her own AIS device.

5. A so called minimum keyboard and display (MKD) for Inland AIS devices serves to input voyage-related ship data and other vessel-specific data such as status indication and alarm messages. The MKD may also show AIS messages received, such as ship name, distance and heading of the reporting ship, alpha-numerically. Other ship data can be displayed by selecting a given ship. This form of displaying AIS data is not suited for navigational support and/or accident prevention. When using inland AIS data for navigation a graphical display similar to Inland ECDIS is essential.

5.4 Exchange of voyage and cargo information; Electronic reporting

Note: *In practice in 2018 only on some parts of the European waterways the use of electronic reporting is well developed, standardised, regulated and in operation. Some of the following statements may not be fully applicable in other areas.*

1. Electronic (Ship) reporting (ERI) is a RIS technical service that facilitates the RIS operational services like; Strategic Traffic Information (STI), Traffic Management (TM), Calamity Abatement Support (CAS), Statistics (ST), Law compliance (ILC), Waterway charges and harbour dues (CHD) as well as Transport Logistics (TL).
2. Electronic Reporting in Inland Navigation facilitates electronic data interchange (EDI) between partners in inland navigation as well as partners in the multi-modal transport chain involving inland navigation and avoids the reporting of the same information related to a voyage several times to different authorities and/or commercial parties.
3. Electronic reporting supports safety and calamity abatement and as such electronic reporting should be made mandatory.
4. Exchange of ETA/RTA data and other voyage data by electronic reporting reduces the need for voice communication via VHF and reduce the failures in (verbally) reported information.
5. Electronic reporting will not only reduce the administrative burden but electronic reporting should replace the need for carrying physical documents.
6. Electronic reporting includes the following messaging procedures
   a. Ship-to-authority messaging, dealing with:
      - Voyage notification message
      - Transport notification messages on the voyages of loaded or empty ships within the jurisdictional area of the authority where such is applicable.
      - Arrival notification and position reports at locks, bridges, reporting points of traffic centres.
   b. Authority-to-authority messaging dealing with transport notifications for ships, carrying cargo or being empty, travelling from one jurisdictional area to the other.
   c. Authority-to-ship messaging mainly consists of acknowledgements and responses to previously submitted notification messages and may also include the sending of dynamic fairway information, such as Notices to Skippers or may also include voyage notification updates.

7. Transport notifications are to inform the competent authorities of the intention to make a defined voyage with a designated ship, either carrying a specified cargo or being empty. The transport notification can either originate from the skipper of the ship or from the shipper of the cargo on behalf of the skipper.
8. Transport notifications shall be sent before the start of a voyage initially before entering the jurisdictional area of a competent authority and subsequently after every significant change of the voyage data, e.g. number of crew on board or number of barges in the convoy.
9. When a ship requires a permit for the voyage or part thereof, the competent waterway authority shall acknowledge the message after processing the contents of the notification. The acknowledgement will include the permission together with a reference or where applicable a refusal for such a permit together with further details upon the action to be taken.
10. Arrival notification and position reports are to inform the local waterway operators – such as lock masters, bridge operators, traffic centre operators, ports and docking crew – of the impending arrival of a ship. Position reports shall be sent at certain reporting points at the waterway. Arrival notifications and position reports can be obtained by AIS (preferably) or VHF radio.
11. The competent authorities shall be able, as far as ship reporting is required by national or international regulations, to receive electronic ship reports of the required data from ships.
12. In cross-border transport, electronic reports shall be transmitted to the competent authorities of the neighbouring jurisdictional area and any such transmission shall be completed before arrival of the vessels at the border.
13. The competent authorities shall take the necessary measures to ensure the confidentiality, integrity and security of information sent to them pursuant this standard. They must use such information only for the purposes of the intended operational services, for example calamity abatement, border control, customs.
14. A request to forward information contained in a ship-to-authority-message to any other involved party will not be executed without explicit approval from the owner of the information being the skipper of the vessel or the shipper of the cargo.
15. An agreement on the protection of privacy between all involved public and private parties shall be concluded, based on UNECE Recommendation 26 that contains a “Model Interchange Agreement”.

5.4.1 Specific aspects and criteria for the use of electronic reporting on European inland waterways.

1. The ERI (Electronic Reporting International) is the European standard for electronic reporting of voyage and cargo information in Europe.
2. Currently four messages are officially published
    a. ERINOT - Reporting of voyage related information and of in-formation on dangerous and non-dangerous cargo carried on-board vessels sailing on inland waterways.
    b. ERIRSP - Acknowledgement and optionally response from authority
    c. PAXLST - Transfer of passenger/crew data from authority to authority

d. BERMAN - Notification sent by vessels sailing on inland water-ways before arriving at or departing from a berth or a port

3. The ERIVOY message is not part of the official standard but important to report voyages which include multiple stops or changes of the convoy.

4. On the River Rhine it is obligatory to transmit electronic reports (ERINOT) for tanker and container

5.5 Exchange of dynamic fairway information

Note: *In practice in 2018 only on European waterways the use of standardized electronic fairway information is well developed, standardised, regulated and in operation. Some of the following statements may not be fully applicable in other areas.*

1. The means for the publication and exchange of the status of the navigation infrastructure in standard in uniform codification are the Notices to Mariners (NtM)or Notices to Skippers (NtS)
2. NtS typically cover the following types of information
   a. Fairway related information;
   b. Traffic related information;
   c. Information on Aids to Navigation (AtoN);
   d. Water level information;
   e. Ice information and
   f. Weather information
3. NtS shall be machine-readable
4. NtS shall be language independent
5. NtS shall use official location codes for referring to geographic objects
6. NtS shall follow a stringent encoding guide to ensure harmonized codification in different areas.

5.5.1 Specific aspects and criteria for the use of Notices to Skippers on European inland waterways.

1. Notices to Skippers (NtS) is a RIS technical service for RIS in European inland waterways that provides in a standardised manner and language independent:
   a. fairway and traffic related information, as well as
   b. hydrographical information such as weather information, water level information and ice information.

   Notices to Skippers is supporting Fairway Information Services (FIS) and transport planning as part of the Information for Transport Logistic (ITL).
2. A standardized Notices to Skippers in XML-format contains therefore 5 different sections:
   a. Identification,
   b. Fairway and traffic related messages,
   c. Water level related messages,

d. Ice messages,

e. Weather related messages.

3. The content of the messages is encoded in a machine-readable XML-file. This file can be used by software applications like voyage planning or Inland ECDIS on board of a vessel or by internet sites. The encoded information can be used directly for calculations, as for example in voyage planning, or be translated to the language of the user and displayed. The reference tables of the standard contain 21 languages of the member countries of the European Union, and additional 3 languages, namely the Croatian, Serbian, and Russian languages.

4. The standard for Notices to Skippers provides a standardized data format, which can be used for publishing Notices to Skippers on the internet (pull-services) or for distribution by e-mail (push services).

5. Fairway information should be provided at a national level or preferably on an (International) fairway network level by implementing one single dissemination point of contact.

6. A standardized method for exchanging Notices to Skippers by means of Web Service (WS) technology is currently in a trail phase. WS will enable an easier and more secure method for exchanging Notices to Skippers between authorities as well as private companies and/or operators.

5.5.2 Specific aspects and criteria for the use of Notices to Mariners on US inland waterways

1. Notices to Mariners in the US on inland waterways is provided by the U.S. Department of Homeland Security and especially by the U.S. Coastguard.

2. It allows to retrieve selected navigation regulations found in the Code of Federal Regulations, Navigation and Navigable Waterways.

3. Next to this there are local Notices to Mariners that can be downloaded in Adobe Reader pdf format.

4. Special notices will be send by AIS AtoN's displayed on ENC's, ECS, radar or PC. The intention is for the portrayal of this information to be compliant with forthcoming International Standards (i.e. IEC 62288 and IHO S-4)

5.6 Supporting technical services

5.6.1 General

1. The efficient and effective use of RIS technical services is based upon the specification and coding, formalisation and harmonised use of reference data.

2. RIS references and code tables are key elements in the RIS-standards and are an important link between the various RIS operational services. The exchange of computerized data without direct human interference between the RIS users and the RIS operational services is facilitated by the use of codes and references.

3. To ensure proper exchange of data there are a number of pre-conditions:

a. Reference and code tables are not static, they may change by international and or local rules and regulations. The need for harmonization and standardization however requires that the reference and codes tables are stable and consistent.

b. In order to ensure interoperability, throughout the whole transport and logistics chain, there is the general principle that the components of the RIS supporting technical services shall be kept in line with international standards such as the ISO, UNECE, ITU, IHO recommendations, and other relevant standards.

4. In order to guarantee a solid basis for the use of reference data and code tables, special attention is required for data maintenance, maintenance procedures and distribution of the reference data and code tables.

5.6.2 UN/Locode

1. The UN/LOCODE is a is a geographic coding scheme developed and maintained by United Nations Economic Commission for Europe
2. UN/LOCODE assigns codes to locations used in trade and transport with functions such as seaports, rail and road terminals, airports, Postal Exchange Office and border crossing points.
3. UN/LOCODEs have five characters.
   a. The first two letters code a country by the table defined in ISO 3166-1 alpha-2
   b. The three remaining characters code a location within that country. Letters are preferred, but if necessary digits 2 through 9 may be used, excluding "0" and "1" to avoid confusion with the letters "O" and "I" respectively.

5.6.3 IMO vessel number

1. The International Maritime Organization (IMO) number is a unique reference for ships and for registered ship owners and management companies.
2. IMO numbers were introduced under the SOLAS Convention to improve maritime safety and security and to reduce maritime fraud.
3. For ships, the IMO number remains linked to the hull for its lifetime, regardless of a change in name, flag, or owner.
4. The IMO ship identification number is made of the three letters "IMO" followed by the seven-digit number. This consists of a six-digit sequential unique number followed by a check digit. The integrity of an IMO number can be verified using its check digit.
5. IMO ship identification numbers are assigned by IHS Fairplay (previously Lloyd's Register-Fairplay)

5.6.4 HS code

1. The Harmonized Commodity Description and Coding System, also known as the Harmonized System (HS) of tariff nomenclature is an internationally standardized system of names and numbers to classify traded products. It has been developed and maintained by the World Customs Organization (WCO).
2. The HS code consists of 6-digits. The first two digits designate the HS Chapter. The second two digits designate the HS heading. The third two digits designate the HS

subheading. HS code 1006.30, for example indicates Chapter 10 (Cereals), Heading 06 (Rice), and Subheading 30 (Semi-milled or wholly milled rice, whether or not polished or glazed)

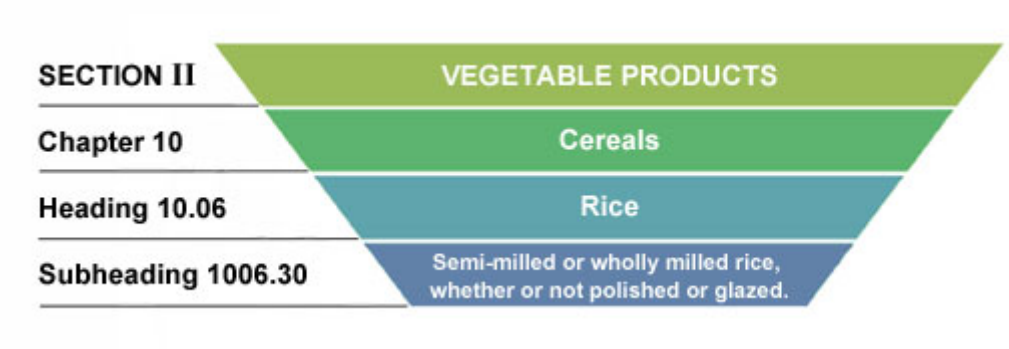

Figure 5.1 Example of the hierarchical structure of the Harmonized System

5.6.5 ENI Number in Europe

3. The ENI number (European Number of Identification or European Vessel Identification Number) is a registration for ships capable of navigating on European inland waters.
4. Like the IMO number, it is a unique, eight-digit identifier that is attached to a hull for its entire lifetime, independent of the vessel's current name or flag.
5. The ENI number consists of eight Arabic numerals. The first three digits identify the competent authority where the number is assigned (see "List of prefixes" below) and the last five digits are a serial number.
6. The ENI number is based on the Rhine Vessel certification system previously used for ships navigating the Rhine, and is comparable to the IMO ship identification number.
7. A vessel which has been issued an IMO number may only receive an ENI number if it has appropriate certifications for inland water travel. Its ENI will begin with "9" followed by its seven-digit IMO number.
8. The ENI number is issued by the national competent authority for vessel inspection.
9. In order to ensure the uniqueness of ENI numbers, the European Vessel Hull Database (EHDB) provides a central repository of all ENI numbers issued in Europe.

5.6.6 European RIS Index

1. A special group of reference data is covered by the RIS index. Inland ECDIS and Notices to Skippers in Europe require unambiguous coding of locations of geographic objects. The use of the RIS index/ISRS location code for geographic objects in Notices to Skippers and ECDIS facilitates the integration of Notices to Skippers in Inland ECDIS.
2. This is however also relevant for Electronic reporting and tracking and tracing activities.
3. A location code is the machine-readable link between Electronic Reporting, Inland ECDIS and Notices to Skippers. The location code is a unique ID for each piece of infrastructure, which is of importance for RIS.
4. The location code used in the RIS environment is a 20-digit alpha-numerical code – the ISRS location code - which consists of the following data elements:

a. UN Country code (2 letters).
b. UN Location code (3 letters).
c. Fairway section code (5 digits, alpha-numerical).
d. Object reference code (5 digits, alpha-numerical).
e. Fairway section hectometre (5 digits, numerical).

5. The RIS Index is a list of location ISRS location codes with additional information on the objects like their characteristics (name, fairway….), restrictions (available depth, clearance….), operating times etc.
6. In an international fairway network the introduction of a harmonized fairway ID is seen as a positive contribution to the need for linking the RIS index of different countries.
7. Each object in the RIS index shall have only one ISRS location code, even when those objects are located on common stretches of a waterway for two or more countries.

5.6.7 EU ECE ADN (dangerous goods) code

1. There is an European code for the Carriage of Dangerous Goods by Inland Waterways (AND) developed and formalised by the UNECE and the CCNR.

2. ADN contain provisions concerning dangerous substances and articles, provisions concerning their carriage in packages and bulk on board of inland navigation vessels or tank vessels, as well as provisions concerning the construction and operation of vessels carrying this type of cargo. ADN also addresses requirements and procedures for inspections, the issue of certificates of approval, recognition of classification societies, monitoring, and training and examination of experts.

6 RECOMENDATIONS ON INTEGRATION OF e-NAVIGATION IN THE RIS DOMAIN

In the maritime world ship and shore based stakeholders are more and more making use of information technology to improve the safety, security, reliability and efficiency of waterborne transport. It is seen as essential to develop in the implementation of these technologies a more integrated and coordinated approach to avoid that in the future the added value of these technologies will hamper.
The Maritime Safety Committee of IMO (International Maritime Organisation) initiated the development of a vision with respect to e-Navigation using existing and future supporting systems for navigation of vessels.
e-Navigation is defined as “the harmonised collection, integration, exchange, presentation and analysis of marine information onboard and ashore by electronic means to enhance berth to berth navigation and related operational services for safety and security at sea and protection of the marine environment”

The core objectives of the e-Navigation concept are to:

- Facilitate safe and secure navigation of vessels having regard to hydrographic, meteorological and navigational information and risks;
- Facilitate vessel traffic observation and management from shore/coastal facilities, where appropriate;
- Facilitate communications, including data exchange, among ship to ship, ship to shore, shore to ship, shore to shore and other users;
- Provide opportunities for improving the efficiency of transport and logistics;

PIANC saw the relevancy of the e-Navigation development for inland navigation and installed in 2011 a working group on e-Navigation with amongst others the task to determine whether inland navigation could benefit from the e-Navigation development and to identify the implications for River Information Services. The working group published in 2017 their findings in a report called “e-Navigation for Inland Waterways”

The current state of the development of e-Navigation in the Maritime World is still in a conceptual and/or pilot phase but is moving very fast to implementation. There are series of initiatives taken in the maritime world on e-Navigation that are of high interest and importance for the Inland Waterway Transport.
Harmonization between the inland and maritime world is very important, and further development of e-Navigation for Inland Waterways should be focused on interoperability with maritime e- Navigation wherever it is possible.

A first step in the implementation of e-Navigation for Inland Waterways should be the establishment of links between RIS and maritime e-Navigation by creating guidelines that take into account all stakeholder organizations and are based on common standards for data exchange.

In general, inland navigation and RIS could benefit from the e-Navigation development already in this conceptual phase and for this reason in these guidelines general recommendations on policy level and specific recommendations on technical level are given to be taken into account by those who are in the coming years planning and/implementation a RIS in their domain.

6.1 General policy recommendations to benefit of e-Navigation developments

1. Formal coordination between members of the RIS community and the maritime e-Navigation community should be established. The long-term goal of this coordination should be to broaden the scope to include wider intermodal interaction, while the short-term emphasis should focus on the interaction between IWT and maritime transportation.
2. In order to facilitate alignment between RIS and maritime e-Navigation, it is recommended to use the same terminology wherever possible or to identify commonalities if different terms are used. In these guidelines the first steps are taken, further alignment is however needed.
3. A communication strategy should be defined to create an awareness of and to promote e-Navigation for Inland Waterways to end-users and service and system providers.
4. RIS Flagship projects should take into consideration the state of play in maritime e-Navigation in order to pave the way for a coordinated implementation of e-Navigation for Inland Waterways.
5. Mixed traffic corridors (e.g., the Western Scheldt, Elbe channel) and hubs (e.g., sea-ports) should be identified where e-Navigation for Inland Waterways can reap the highest benefits and achieve first quick-wins
6. Priority areas of harmonization (organizational, legal, technical, geographical) between maritime e-Navigation and e-Navigation for Inland Waterways should be identified and addressed within appropriate flagship projects.
7. A holistic approach is necessary for the development of e-Navigation for Inland Waterways to ensure that the needs of all stakeholder groups are taken into account without emphasis on one or a few of the stakeholder groups. Governmental organisations can play a crucial role here as it is presumably the best party to play an independent role. There is a need for a win-win situation: e.g., a harmonized approach in service delivery and information exchange, between RIS authorities, logistics sector, skippers, ports, customs, etc. with the implementation of e-Navigation for Inland Waterways supporting transport management so inland navigation becomes a more efficient and cost-effective transport mode.

6.2 Specific recommendations to benefit of e-Navigation developments.

1. As e-Navigation for Inland Waterways is primarily about information sharing, the information barriers between maritime and inland waterway transport should be identified and information flows harmonized.
2. A RIS registry should be developed that goes beyond geo-spatial information. It should be aligned with the e-Navigation Maritime Service Portfolios.
3. Services of e-Navigation for Inland Waterways should be proposed and arranged on two registries:
    a. a generic registry containing specifications of particular functional services, which might be implemented by particular organizations in different areas, and
    b. a service registry containing a list of services practically implemented by different providers in different areas and operating according to the specifications contained in the generic registry.

4. The concept of the Maritime Connectivity Platform, which is based on service-oriented architecture (SOA), is very useful for the implementation of the RIS registry because the foundation of RIS is based on a set of operational services, realized through RIS technical services.
5. Standardization and harmonization by making use of S-100 and Common Maritime Data Structure (CMDS) are strongly recommended. The CMDS will be critical in the implementation of e-Navigation for Inland Waterways, as similar efforts in the inland world have been for the implementation of RIS. The CMDS is of interest for inland navigation primarily to ensure interoperability and clear communication of information between inland and coastal/maritime navigation stakeholders.
6. Harmonized electronic reporting formalities based on the single window(s) principle with seamless data exchange procedures between the involved stakeholders should be created in the inland environment to reduce administrative barriers when sailing through different countries. This approach can support the reduction of the time loss and the costs due to the administrative workload of the crew and thus can contribute to the increase of the competitiveness of IWT as an environmentally friendly mode of transport.
7. Whereas ship–ship, ship–shore and shore–ship information needs and messages are for the most part well defined, the communication protocols are in many cases ambiguous and not officially standardized on international level. e-Navigation for Inland Waterways shall specifically focus on the areas where interoperability is required.
8. The maritime e-Navigation overarching architecture may be used in the future development of RIS for finding communalities and differences between inland and maritime. These differences may indicate areas where there is incompatibility between the maritime and inland world. Where problems are identified, a cooperative effort between the appropriate inland and maritime bodies could be undertaken to address the problems.

7 CONSIDERATIONS ON MID TERM RIS RELATED DEVELOPMENTS

The development and deployment of River Information Services in the last decades have primarily been driven by transport policy related initiatives on regional, national and international scale. The main objectives of these initiatives have been the modernisation of the inland waterborne transport mode in order to make inland navigation more competitive with other land-based transport modes. This chapter reflects on upcoming policy and project initiatives that will have an impact on RIS, and how RIS might be perceived and utilised by these initiatives.

Considerations on RIS related developments in Europe

Since the beginning of the year 2000 inland navigation became more and more prominent on the European Transport Policy agenda. River Information Services have been included in the agenda as one essential measure for the modernisation of inland waterborne transport. Several national and international project initiatives have been successfully realised, on one hand enabling governmental authorities and agencies to deploy basic infrastructure for RIS on shore, on the other hand to create a market for RIS related on-board devices and applications.

Evaluation of the RIS Directive

More than ten years after the adoption and transposition of the RIS Directive, an important level of experience has been accumulated at EU, Member State and stakeholder's level. At the same time, important IT and technological developments took place. RIS has been recently included in the Digital Inland Waterway Area strategy (DINA), whose aim is to interconnect and unlock the potential of information systems on infrastructure, people, vessels, management and cargo components of inland waterway transport. Therefore the European Commission has decided that it is appropriate to examine whether the existing RIS framework is fit for purpose and delivers as intended/expected. Therefore the evaluation of the RIS Directive by the European Commission is foreseen for the year 2018.

The scope of the evaluation will focus on the lessons learned from the process by which the technical guidelines and specifications were delivered.
The aim of the envisaged consultations is to seek information and feedback from the relevant stakeholders and wider public in relation to the effects of the RIS Directive with regards the provision of harmonised River Information Services in the EU. The consultation activities will target the following main categories of stakeholders: national administrations, barge owners/operators, skippers, inland port and terminal operators, inland waterway and freight European associations, shippers and logistics service providers, companies that produce/make use of RIS technologies, international organisations such as the United Nations Economic Commission for Europe (UN-ECE), as well as river commissions.

Summarizing the roadmap for the RIS Directive, its evaluation is performed in the year 2018, followed by an impact assessment in 2019 and eventually leading to a revision of the RIS Directive in the year 2020.

The Digital Inland Waterway Area (DINA)

Transport and logistics are considered to be key sectors in the Digital Single Market strategy of the European Union[10]. In many ways new digital technologies such as the internet-of-things, data sharing technologies and big data analytics enable increases in efficiency and reliability. Some examples include:

- New manufacturing technologies and e-commerce processes change the supply chain of businesses and require new transport services
- New logistics paradigms such as 'synchro modality' and the 'Physical Internet' all rely on new underlying data-infrastructures to bring together the supply and demand of transport services:

  Synchro modality relates to the strategic, tactic and operational planning of shipments and transport operations based on real-time availability of available logistics services, data on the transport means (e.g. the location of trucks or barges and their available capacities) and data on the infrastructure (e.g. expected delays). By sharing this data stakeholders can optimize their transport operations.

  The *Physical Internet* is a new paradigm based on intelligent cargo technology. Cargo is routed through a self-organizing multi-modal transport network. Intelligent hubs or nodes ensure that cargo is routed to its destination allowing for optimizing cargo flows between these hubs.
- In many modes Intelligent Transport Systems and (semi-) autonomous vehicles make transport more efficient, reduce emissions and enhance the capacity of Europe's infrastructure;
- Electronic data exchange between businesses and government can assist in reducing the administrative burden.

In 2016 the European Commission has commissioned a study for investigating the potential for digitalisation in the Inland Waterborne Transport sector and to define a concept for the Digital Inland Waterway Area - DINA. The study has been published at the end of 2017 and can be downloaded from the inland waterways section of the website of the European Commission[11].

In the DINA study it has been concluded that it is essential for the future competitiveness of inland waterway transport to follow the trends in digitalisation: in some cases, inland waterway transport (IWT) competes with other modes of transport whilst in other cases IWT is part of a larger multi-modal chain making collaboration an essential prerequisite. The study has identified three areas where digitalization is critically important for IWT:

1. The improvement of navigation and management of traffic: this is necessary to make more efficient use of the capacity of the infrastructure and to reduce fuel costs for vessel operators.
2. The integration with other modes of transport, especially in multimodal hubs: this is necessary to optimize processes in terminals and to allow for an improved integration of IWT in supply chains and multi-modal logistics operations, thereby potentially attracting additional customers.

[10] European Commission (2015), A Digital Single Market Strategy for Europe – Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions
[11] https://ec.europa.eu/transport/modes/inland/studies/inland_waterways_en

3. A reduction of the administrative burden: reducing the number of business-to-government declarations (thereby saving costs and improving efficiency) and making law-enforcement more efficient and effective.

Several underlying issues have been identified. These range from the lack of data sharing capabilities to the limited size of the IWT market in comparison to other modes of transport.

The proposed Digital Inland Waterway Area (DINA) is a concept to interconnect information on infrastructure, people, operations, fleet and cargo in the inland waterway transport sector and to connect this information with other transport modes. An architecture is proposed that allows for the controlled sharing of this information which can serve as platform for future developments.

- DINA builds on existing investments and developments such as existing components of River Information Services. Extensions are proposed to enable real-time data exchange and the improved integration of other actors such as shippers, logistics service providers and inland ports.
- Furthermore, a digital environment ('data platform') for barge operators is needed to allow them to control data on their vessel, voyages, cargo and crew. They can use this data for their own purposes such as smart navigation but also share it in a controlled way with others actors, e.g. for reporting purposes.
- It is envisioned that a new on-board toolkit (e-IWT) will be needed to connect barges with this digital environment and provide functionality for skippers as one of the end-user categories.

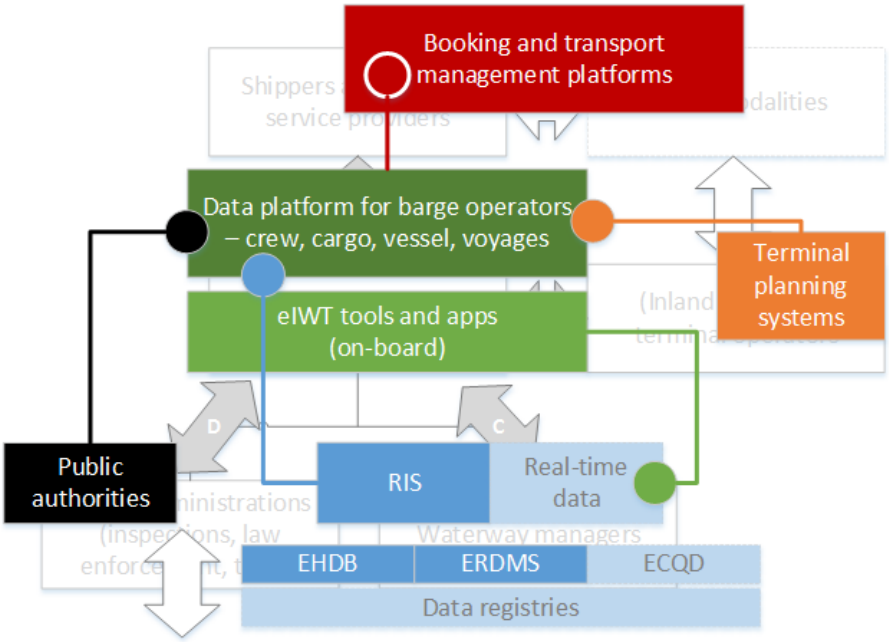

Figure 7.1: Conceptual DINA architecture

The study recommends focusing on two aspects as part of the implementation roadmap for DINA:

- Standardization and governance: providing adequate governance mechanisms to develop and maintain the standards used in DINA. This can provide the necessary

economies of scale. In addition, this is needed to align with developments in other modalities.
- Public-private collaboration and shared innovation programmes to develop the various components of DINA and to encourage the development of new digital operational services as part of it.

In order to support the European Commission in the development of the DINA policy initiative, a dedicated Expert Group has been established. The group has its first meeting in February 2018.

The RIS COMEX project

As it is expected that the RIS COMEX project will have a major impact on the concept, architecture and definition of River Information Services on a global scale, it has been included in this section of the PIANC WG125 RIS Guidelines.

RIS Corridor Management Execution - RIS COMEX - is a CEF funded multi-Beneficiary project aiming at the definition, specification, implementation and sustainable operation of Corridor RIS Operational services. RIS COMEX started in 2016 and will last until the end of 2020. The project area covers altogether 13 different European countries having 15 partners joined their forces to realise Corridor RIS Operational services.

The RIS COMEX project aims for implementation and operation of cross-border River Information Services based on operational exchange of RIS data. These RIS-based Corridor operational services shall allow for traffic management by the authorities and transport management by the logistics sector. They make use of available national infrastructure and services.

The main objectives of the project are:

- Development of an overall Corridor RIS Management concept in dialogue between RIS providers and logistics users to ensure the relevance of the implemented services.
- Implementation and permanent operation of selected parts of the overall concept providing increased quality and availability of Fairway-, Traffic- and Transport Information Services.
- Defined and agreed operational arrangements (legal, organisational, financial, technical, quality) to ensure sustainable further development, implementation and operation of infrastructure and operational services for harmonised RIS enabled Corridor Management beyond the lifetime of the project.
- Harmonisation of data exchange concepts for RIS data through the cooperative development and specification of RIS enabled Corridor Services avoiding the rise of different data exchange concepts.
- RIS COMEX will develop harmonized River Information Services for inclusion in the DINA initiative and will bring RIS one step further to integration with other transport modes.

Until April 2018 the operational services and the architecture are being defined, followed by the elaboration of technical specifications and the implementation of the RIS COMEX system for the provision of RIS enabled Corridor Management Services in Europe.

8 STRUCTURE APPROACH ON THE IMPLEMENTATION OF RIS

8.1 General

The need for RIS should be carefully assessed, based on a benefit/cost analysis and a consultation of the user groups.

In those cases where RIS are deemed to be necessary for the safety of traffic flow, the protection of the environment, the efficiency of transport and to augment the traffic on the waterways while keeping the safety at least on the same level, the competent authority should provide the necessary expertise and arrange funding to provide the desired levels of technology and expertise to meet the objectives.

The RIS operational services, as defined in Chapter 3 and their relationship with the RIS technical services, can be seen as a layered model similar to that presented in figure 8.1 The implementation of RIS should contain a least Fairway Information Services and in the next step it can be extended with traffic information, then with traffic management information as the primary operational services. Based on these three primary operational services the other operational services can be implemented.

Figure 8.1 RIS Operational services implementation sequence

8.2 Mission Statement

The first step in the approach for a structured approach for the implementation of RIS is the definition of a mission statement.

A mission statement is a formal, written statement of the organisation or RIS authority on objectives that should be achieved by the implementation of River Information Services. The mission statement should guide the actions of the organisation, spell out its overall goal, provide a sense of direction, and guide decision-making. It provides "the framework or context within which the company's strategies are formulated."

8.3 Steps of a structured approach for the implementation of RIS

The mission statement has to be translated into a Vision Statement, i.e. define what the organisation wants to realise without specifying how it will be done. Before the Vision Statement can be defined training is necessary for the involved partners in existing directives and the technical specifications on RIS and other relevant documents.

8.3.1 Vision Statement

A Structured Approach for the content of the ***Vision Statement*** contains at least the following items:

1. *Definition of the Primary Stakeholders.* They have the capabilities, funding and authority (legal basis) to make decisions for the realisation of RIS. They contain at least the authorities that will be responsible for the RIS centre(s) and the organisation of it. To get a clear view on this it is important to define the working area for which RIS operational services will provided.
2. *Definition of Secondary Stakeholders*. These stakeholders are involved in the realization for RIS but don't have the authority to take decisions, e.g. the skippers, providers of hydrographical, hydrological and meteorological data.
3. *RIS key Actors.* The Primary and Secondary Stakeholders should form the RIS Key Actors.
4. *Definition of the RIS Operational services*. Figure 8.1 gives an overview of the stack of the RIS operational services which are described in more detail in Chapter 4. Chapter 5 gives an overview of the recommendations on the RIS technical services. The Primary Stakeholders will have to decide which RIS operational services they need and to what level of detail each service will be provided. It is recommended to implement at least FIS, TI and TM. The Primary Stakeholders should also decide which organisation will implement a certain service.
5. *The RIS technical services.* The type of RIS operational services define which RIS technical services are necessary to be implemented.
6. *Definition of the RIS Index.* In Europe the RIS technical services heavily depend upon the RIS Index. The realisation of the RIS Index is necessary and experience shows that this is not an easy task to create and to keep it updated. Special attention should be given to objects in a cross-border situation where the entries in the RIS Index should be aligned with the neighbouring countries.
7. *Evaluation existing systems.* The Primary Stakeholders should decide if they want to realise RIS on the basis of new systems or existing systems. The decision to use new systems or existing systems should be evaluated on basis of cost, availability, reliability and training of personnel.
8. Demands on the level of availability and reliability (down time) and other requirements with respect to the *Quality of Information Services.* The availability of each RIS service has to be defined, will it be available between office hours or does it need to be 24/7/365 availability. The reliability (redundancy) of the used system for the implementation of the RIS operational services has to be defined.

9. *Definition of data exchange.* The definition of data exchange can be defined on two levels:
    a. Internal: This contains the data exchange with organisations that feed the different systems used for the implementation of RIS, e.g. hydro-meteo organisations that provide water levels for NtS.
    b. External: What information, and how, will be exchanged with neighbouring RIS organisations. A lot of effort on this level has already been done and defined by the IRIS Europe I and II projects. There can be also other organisations that need information e.g. the government in case of CAS.
10. *Training of the personnel.* The selection of RIS operational services that will be implemented procedures has to be defined by how these RIS operational services will be used and maintained. A function of these procedures is the knowledge (capacity) of the RIS operators that has to be defined together with the necessary training.
11. *General Planning.* For the implementation of the RIS operational services a time schedule should be made on the basis of the operational services that will be implemented taking into account the layered structure, as shown in. It is important to take into account that different partners, organisations and international regulations can be involved in the realization of RIS. This can be a very important factor for the definition of the critical path within any planning framework. `
12. *Estimation of Cost.* The estimation of the cost should contain different items:
    a. A calculation of the total cost for the implementation of the RIS operational services;
    b. The cost for the management and maintenance of the systems and infrastructure e.g. FIS portal, Inland AIS network,
    c. Estimation of costs for updates like Inland ENC's,
    d. Estimation of costs due to updates and amendments of regulations, software…
    e. Costs for initial training of the personnel and update of the training depending on the adjustments in the procedures of the use of the RIS operational services.

8.3.2 Implementation of the Vision

The vision statement is the basis for the realisation of the RIS implementation. It creates the blue print of the project which should contain at least the following steps:

1. *Definition of the functional and operational requirements (FOR).* This is the translation of the objectives, defined in the vision statement, into requirements that can be implemented. This should be user driven. It defines what should be realised without being concerned on how the solution should be made. An important task in this phase is also the definition of the non-functional requirements like for example availability of the solution, does it need for example 24/7/365 availability, scalability of the solution;
2. *Prototyping*: a prototype should be developed and evaluated by the users. Mostly this will result in an update/change of the FOR. It is very important that the users get a feeling of the functionality that will be provided before the developments starts;
3. *Technical design:* This will translate the FOR in the description on how the system has to be developed. The FOR will be extended with a number of technical issues and an important driving force will be the non-functional requirements;

4. *Implementation:* on the basis of the FOR and technical design the solution will be developed;
5. *FAT:* factory acceptance test, the implementer proves in a simulated environment that the implementation fulfils the FOR;
6. *SAT:* site acceptance test - the implementer shows that the implementation fulfils the FOR and non-FOR in the real environment;
7. *Training:* the users get training in the use of the implemented systems;
8. *System test:* the implementer proves that the implementation works without any problems during a number of days when it is used in a real time situation;
9. *Documentation:* is provided on how the implementation is build. A user guide is provided. The necessary information to maintain the installed equipment and systems is set out and planned.

The above is a minimum list of the steps that are necessary for the planning and realisation of the implementation of a RIS project. There are different methods to define the execution of the project, for example the waterfall or Agile methodology. The chosen methodology will depend on the implementer, the type of the project, the way an organisation works, etc. But it should be taken into account that the FOR and prototyping can take an essential and significant part of the total time foreseen for the project. Experience shows that these are the basis for a successful project.

8.4 Legal considerations

The liability element of compliance with RIS guidance is an important consideration which can only be decided on a case-by-case basis in accordance with national law. Consequently, a RIS authority should take into account the legal implications in the event of a shipping accident, where RIS operators may have failed to carry out their duty competently.

Other legal considerations should include at least the following aspects:

- Definition of the tasks and the responsibilities of the responsible RIS authority.
- Provisions for regulating data exchange at national and (if applicable) at international level.
- Rules and regulation for the data storage, especially taking into account data privacy regulations.

The legal considerations should be outlined upfront to be able to identify the relevant actions (e.g. amendment of the inland shipping legislation, preparation and conclusion of administrative agreements).

8.5 Training

The successful delivery of RIS depends upon competent and experienced personnel to fulfil the responsibilities of a RIS authority. The recruitment, selection and training of suitable personnel are a pre-requisite to the provision of professionally qualified personnel capable of contributing to safe and efficient vessel operations. Such personnel will help to ensure that full regard is given to the diverse tasks inherent in RIS activities.

Training will depend on the RIS operational services that the organisation wants to implement, the existing organisation (is it starting with a green field situation or will RIS be integrated in already existing situation like a VTS centre), is there already trained VTS personnel, are there operational procedures in the organisation.

The following recommendations on training can be defined:

1. First the organisation, responsible for the implementation of RIS, has to define the capabilities that are needed from the personnel, depending on the RIS operational services that shall be implemented. This should answer the question ***"What to train";***
2. Then the organisation should make a matrix based on the needed capabilities and the capabilities of the available personnel that could be taken into account to fulfil the required needs after the necessary training. This should answer the question ***"Who to train",*** i.e. if the organisation can fulfil the implementation of RIS with the existing personnel or if there is a need for new personnel;
3. The result of the above steps result in a schema that defines ***"Who has to be trained in what***" ;
4. Training means that there is a training environment. This is a very important element during the definition of the functional and operational requirements. The implementation of RIS should make it possible that the provided solution can work in a simulated mode and that previously situations can be replayed for purpose of training;
5. The above steps define the need of a separate environment for training. This solves the answer to the question ***"Where to train";***
6. Due to the evolution in the RIS environment a continuously update program of training has to be foreseen and implemented.

ANNEX 1: ABBREVATIONS

ADN	Accord Européen relatif au transport international des marchandises dangereuses, European Agreement concerning the International Carriage of Dangerous Goods
AIS	Automatic Identification System
ASM	Application Specific Message
AtoN	Aids to Navigation
BERMAN	ERI Berth Management (Message)
CAS	Calamity Abatement Support
CCNR	Central Commission for the Navigation on the Rhine
CEF	Connecting European Facility for Transport (European Commission)
CFM	Cargo and Fleet Management
CMDS	Common Maritime Data Structure
CoG	Course over Ground
COMEX	Project COrridor Management EXecution
CoRISMa	Project RIS enabled Corridor Management
DINA	Digital Inland Waterway Area
EC	European Commission
ECDIS	Electronic Chart Display and Information System
EDIFACT	Electronic Data Interchange For Administration, Commerce and Transport (UNECE Standard)
ENC	Electronic Navigational Chart
ENI	European Number of Identification or European Vessel Identification Number
ERI	Electronic Reporting International
ERINOT	ERI Notification (Message)
ERIVOY	ERI Voyage plan (Message)
ETA	Estimated Time of Arrival
FAT	Factory Acceptance Test
FIS	Fairway Information Services
FOR	Functional and Operational Requirements
GPS	Global Positioning System
HS code	Harmonized Commodity Description and Coding System
IALA	International Organisation of Marine Aids to Navigation and Lighthouse Authorities
IEC	International Electrotechnical Commission
IEHG	Inland ENC Harmonisation Group
IENC	Inland Electronic Navigational Chart
IECS	Inland navigation nautical system charts
IFDTGN	International Forwarding and Transport Dangerous Goods Notification (Message)
IHO	International Hydrographic Organisation
ILC	Information for Law Compliance
IMO	International Maritime Organisation
IMO FAL	Convention on the Facilitation of International Maritime Traffic
ISO	International Standardisation Organisation
ISRS	International Ship Reporting Standard
ITL	Information for Transport Logistics

ITS	Intelligent Transport Systems
ITU	International Telecommunication Union
IWT	Inland Waterway Transport
LBM	Lock and Bridge Management
LoRa	Low Power wireless communication technology
MKD	Minimum Keyboard Display
NtS	Notices to Skippers
PAXLIST	Passenger List (Message)
PC	Personal Computer
PIANC	International Navigation Association
PTM	Port and Terminal Management
RIS	River Information Services
RoT	Rate of Turn
RTA	Requested Time of Arrival
SAT	Site Acceptance Test
SENC	System Electronic ChartS100
SOA	Service-Oriented Architecture
SoG	Speed over Ground
SOLAS	IMO Convention Safety of Life at Sea
SOTDMA	Self-Organised Time Division Multiple Access
STI	Strategic Traffic Information (Image)
ST	Statistics
S-100	Universal Hyrdrographic datamodel -IHO
TI	Traffic Information
TIS	Traffic Information Services
TM	Traffic Management
TP	Traffic Planning
TPM	Transport Management
TTI	Tactical Traffic Information
UN CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UNECE	United Nations Economic Commission for Europe
UN/LOCODE	United Nations/Location Code
VDL	VHF Data Link
VDES	VHF Data Exchange System
VHF	Very High Frequency
VP	Voyage Planning
VTS	Vessel Traffic Services
XML	XML is a simplified subset of the Standard Generalized Mark-up Language (SGML)
WCO	World Customs Organisation
WCD	Waterway Charges and Harbour Dues
WiMax	Worldwide Interoperability for Microwave Access

ANNEX 2: OVERVIEW OF INTERNATIONAL REGULATIONS

In this annex an overview – not exhaustive – is given on international rules and regulations that should be followed in case of the implementation and operation of River Information Services

- European Commission, Directive 2006/87/EC Technical requirements for inland waterway vessels, 2006
- Harmonised Commodity Description and Coding System of the WCO (world-wide)
- UN Code for Trade and Transport Locations UN/LOCODE (world-wide)
- EDIFACT Standard of the UN (world-wide)
- …
- …

To be completed

Legal basis for Inland ECDIS standard in Europe is:

1. EC Regulation defining the technical specifications for the electronic chart display and information system for inland navigation (Inland ECDIS) in accordance with Directive 2005/44/EC of the European Parliament and the Council, and will be published in the fourth quarter of 2011.
2. Resolutions of the Central Commission for the Navigation of the Rhine of 2001 and 2006 for Inland ECDIS Edition 2.1 (protocol 2001-I-16 and protocol 2006-II-22).
3. Recommendation of the Danube Commission of 2008 for Inland ECDIS Edition 2.1, (DK 201/VII-2001).
4. Resolution No. 48 of the UNECE on Recommendation on electronic chart display and information system for inland navigation (Inland ECDIS) (ECE/TRANS/SC.3/156/Rev.1).

The Inland ECDIS standard has six sections corresponding to the maritime ECDIS Standard:

- Performance standard (according to IMO A.817(19)).
- Data standard (additions to IHO S57).
- Codes for producers and waterways" – complements IHO Standard S-62.
- Presentation standard (additions to IHO S52).
- Operational and performance requirements, methods of testing and required test results (according to IEC-1174).
- Glossary of terms.

International regulations for maritime AIS are:

1. IMO Resolution MSC.74(69) annex 3: Recommendation on performance standards for AIS
2. ITU Recommendation ITU-R M1371: Technical characteristics for an universal ship borne automatic identification system, using time division multiple access in the VHF maritime mobile band
3. ITU Recommendation ITU-R M 585 Assignment and use of identities in the maritime mobile service

4. ITU Recommendation ITU-R M.1842 Characteristics of VHF radio systems and equipment for the exchange of data and electronic mail in the maritime mobile service RR Appendix 18 channels
5. IALA Recommendation A-124 on the AIS Service
6. IALA Technical clarifications on recommendation ITU-R M.1371-1
7. IEC 61993-2 Automatic identification systems (AIS) part 2: class A ship borne equipment of the universal ship borne automatic identification system (AIS)
8. IALA Guidelines on the automatic identification system (AIS) IALA Guideline No. 1028 on The Automatic Identification System (AIS) Volume 1, Part I Operational Issues
9. IALA Guideline No. 1029 on The Automatic Identification System (AIS) Volume 1, Part II – Technical Issues
10. IALA Guideline No. 1081 on provision of virtual Aids to Navigation
11. IALA Recommendation O – 143 On Provision of Virtual Aids to Navigation

The legal basis for Inland AIS in Europe is:

1. Resolution of the Central Commission for Navigation on the Rhine (CCNR) of 2006: (Protocol 2006-I-21);
2. EC Regulation No 415/2007 of 2007 concerning the technical specifications for vessel tracking and tracing systems referred to in Article 5 of Directive 2005/44/EC of the European Parliament and of the Council on harmonised River Information Services (RIS) on inland waterways;
3. Resolutions of the Central Commission for Navigation on the Rhine (CCNR) of 2007: “Vessel Tracking and Tracing Standard for Inland Navigation – Type approval, installation and operation of Inland AIS devices on inland navigation vessels “ (Protocol 2007-I-15 and 2007-II-24);
4. UNECE Resolution No.63 on International Standard for Tracking and Tracing on Inland Waterways (VTT) (ECE/TRANS/SC.3/176/Rev.1, as amended).

The Inland AIS Standard defines:

- Functional requirements for Inland AIS devices,
- Technical requirements for Inland AIS devices,
- Specification of AIS messages for the exchange of messages between Inland AIS devices via radio,
- Specification of AIS data sets for data exchange between Inland AIS devices and connected applications.

The legal basis for electronic reporting in inland waterways in Europe is:

1. EC Regulation No 164/2010 of 2010 on the technical specifications for electronic ship reporting in inland navigation referred to in article 5 of Directive 2005/44/EC of The European Parliament and of the Council of 2005 on harmonised River Information Services (RIS);

2. Resolution of the Central Commission for Navigation on the Rhine (CCNR) of 2003: (Resolution 2003-I-23);
3. United Nations recommendations regarding the interchange of trade data (UN CEFACT recommendation 25, 31 and 32, EDI and E-Commerce agreements);
4. UNECE Resolution No.79 on International Standards for Electronic Ship Reporting in Inland Navigation (ECE/TRANS/SC.3/198, as amended).

The legal basis for Notices to Skippers is:

8. EC Regulation 416/2007 concerning the technical specifications for Notices to Skippers as referred to in Article 5 of Directive 2005/44/EC of the European Parliament and of the Council on harmonised river information services (RIS);
9. Resolution of the Central Commission for the Navigation on the Rhine of 2004: (Resolution 2004-I-17);
10. UNECE Resolution No.60 on International Standards for Notices to Skippers and for Electronic Ship Reporting in Inland Navigation (ECE/TRANS/SC.3/175, as amended);
11. UNECE Resolution No.80 on International Standard for Notices to Skippers in Inland Navigation (ECE/TRANS/SC.3/199, as amended).