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| IALA Guideline |

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Guideline on Digitalization of Waterways

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Revisions to this document are to be noted in the table prior to the issue of a revised document.

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# Introduction

This guideline intents to define what is meant by digitalisation of waterways and how digitalisation can benefit both the efficient maintenance of waterways and the safety of navigation.

Digitalisation of a waterway should be understood to include two partly separate themes:

* Creating digital model of the waterways, which may be further evolved to digital twin.
* Providing digital navigational services to vessels.

The baseline digital model of a waterway includes information about the basic characteristics and maintenance events of fairway/channel and the related marine aids to navigation (AtoN) in digital, reusable and preferably standardized format. It provides a virtual representation of a physical waterway. More developed digital model includes also real-time AtoN monitoring information, observations on environmental conditions and information on vessel traffic. When the digital model is used for providing future scenarios and initiating proactive corrective actions it can be called digital twin and used for supporting more optimized and predictive maintenance.

The other digitalisation process which affects waterways is e-Navigation, the overarching project for digitalisation of marine information and services led by IMO and enabling the provision of new digital services to vessels. Many of these new services are expected to enhance the safety and efficiency of navigation. Some of the services may require that there is a real-time digital model of the waterway already available.

Section 2 of this guideline will give guidance on how to identify the digital maturity of waterways. Section 3 will explain the concepts of digital model and digital twin and how these can be used to support the waterway maintenance. Section 4 discusses digital services which can be provided to vessels and suggests how waterways with different levels of services can be categorized.

[Objectives from task register:

* Define what is meant by digitalisation of waterways
* Review guidance on the use of simulation as a tool in waterway design and AtoN planning (IALA G1058 (and G1097, noting this has been superseded by G1058 Ed 3.0));]

# Digital Maturity

Reference material available from Project DIWA (<https://www.masterplandiwa.eu/>)

[Objectives from task register:

* Provide guidance on identifying digital maturity of waterways]

## Example of Sub-Section

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### Example of Sub-Section

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#### Example of Sub-Section

Some text here

##### Example of Sub-Section

# Digital model and Twin

[Objectives from task register:

* Identify best practice in development and use of digital twins;
* Provide guidance on the use of digital twins for fairways / aids to navigation provision;
* Identify uses of digital twins for planning, monitoring and maintenance
* Identify opportunities to enhance sustainability through the use of technology / digital twins for fairways and AtoNs.]

# Digital Services

[need to define terminology eg. digital vs. smart fairway (digital = broadcast services, smart = addressed services ?)

Initial ideas on categorization available from ENAV27-8.1.3 IALA MASS proposal\_02, and some material maybe available from “Harbour Approach Channels Design Guidelines” (PIANC).]

[Objectives from task register:

* Identify options to share information on the fairway infrastructure and services in a digital format with users
* Link with, for example, IMT-2030 and beyond for data exchange, AI/ML, S100,]

# DEFINITIONS

The definitions of terms used in this Guideline can be found in the *International Dictionary of Marine Aids to Navigation* (IALA dictionary) at <http://www.iala-aism.org/wiki/dictionary> and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

# abbreviations

TBA To Be Added

# references

1. TBD

# Further reading

1. TBD

# Index

**No index entries found.**

1. Example of appendix Title (Head 1) style

Appendices should be started on a separate page and contain information that is directly relevant to the main body of the text at a certain point, but that would be too large or distracting to include at that particular point. There are four levels of appendix heading styles available in the **Style Gallery.**

* 1. Example of Appendix Head 1 style
     1. Example of Appendix Head 2 Style

At the end of the **Appendix head 2** style text press carriage return, the following paragraph is **the Heading 1 separation line** style, press carriage return again, and the following line will be in **Body text** style.

* + - 1. Example of Appendix head 3 style

The same following formatting applies to the **Appendix Head 3** style i.e., press carriage return, the following paragraph is the **Heading 2 separation line** style, press carriage return again, and you will be back to body text.

* + - * 1. Example of Appendix Head 4 style

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1. Example of Annex title (Head 1) style

Annexes should include information that can exist in isolation e.g.

* a technical specification for a new piece of equipment;
* the content and structure of a new training module; or
* the detail associated with a new recommendation for an AIS.

Annexes can include appendices if required. There are also four levels of annex heading styles available in the **Style Gallery.** In addition to the **Annex title** (**Head 1)** style there is **Annexe Head 2**, **Annexe Head 3** and **Annexe Head 4**. These follow a similar format to the appendix heading styles. As many annexes can be included as needed and it is advisable to separate them with a page break. Only the level 1 **Annex title** style text will appear in the TOC.

* 1. Example of Annex Head 2 style
     1. Example of Annex Head 3 style
        1. Example of Annex Head 4 style

Annex figures and tables should be labelled with the **Annex Figure Caption** and **Annex Table Caption** styles respectively, rather than the main figure and table caption styles. This ensures the annex can be read logically in isolation and that annex figures and tables are not included in the List of Figures and Tables respectively on the main Guideline contents page.

1. Example of annex figure caption
   * + - 1. Example of Annex Head 5 style