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| IALA Guideline |

G1143

Unique Identifiers for Maritime Resources

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# INTRODUCTION

The use of unique identifiers is a necessary development of e-Navigation to maintain harmonization across domains and services. Navigationally unique objects such as Marine Aids to Navigation (AtoN), and Vessel Traffic Service (VTS) products and services and other maritime services require identification numbers to avoid duplication and misalignment of AtoN and Maritime Safety Information (MSI).

Worldwide harmonized identification of unique identifiers for maritime resources can:

* assist in the development and maintenance of enhanced data exchange applications for ship to ship, ship to shore, shore to ship and shore to shore in the context of e-Navigation;
* assist administrations in the efficient delivery of MSI; and
* reduce the administrative burden associated with the maintenance of international list of lights numbers and other navigation products.

This is not unique to the maritime domain, and this Guideline describes a syntax for Maritime Resource Names (MRN) based on proven methods from the internet domain, that will enable IALA members to issue unique identifiers for objects such as AtoN, VTS products and services, waterways, etc. in a format that is designed to be compatible with existing lists of lights, yet interoperable with usage in different domains such as Electronic Navigation Charts (ENC).

The MRN namespace defined by this Guideline is intended to be applied to MRN use within IALA, for those MRNs captured as “urn:mrn:iala:<type>:<namespace>”. Other maritime stakeholders who may seek to apply MRN in other areas of the maritime domain are invited to adopt syntax in accordance with IANA and IETF documentation that may be different from this Guideline.

## RELATED DOCUMENTS

ISO 3166-1 – The International Standard for country codes and codes for their subdivisions

RFC 2141 – URN Syntax (<https://www.ietf.org/rfc/rfc2141.txt>)

RFC 8141 – Uniform Resource Names (URN) (<https://tools.ietf.org/html/rfc8141>)

IALA’s MRN Request: (<https://www.iana.org/assignments/urn-formal/mrn>)

IHO S-100 version 4.0.0 – Universal Hydrographic Data model

# BACKGROUND

The International Hydrographic Organization (IHO) has noted in paper HSSC6-5.4B the problems Hydrographic Offices (HOs) may be confronted with if the existing light numbering schema is subject to changes by either the producing HO national light numbers or the UKHO international light number.

HSSC6-5.4B discussed the advantages of a Persistent Unique Identifier (PUI)[[1]](#footnote-1) for lights and its possible consequences. The support of the IMO e-Navigation solution S3 was highlighted. In addition, the possible effects on the workload for HOs which are deriving their products from a single database were mentioned. It was considered that some technical questions remain open for the time being. The paper proposed the establishment of a close IALA-IHO liaison on the light numbering development in particular and additionally, the harmonization of the light numbering systems between the IHO and the IALA to the widest extent.

# DISCUSSION

PUIs are needed in order to maintain data object identity as data objects pass through the data chain, are stored in different data stores, transformed to different formats and re-purposed for different domains. The same chunk of information may be present in different data stores in different formats (ISO 8211, XML, relational database record, etc.). Using a persistent identifier for the same chunk of data in all formats and stores will obviously help harmonization, validation, and tracking of data across multiple application domains and at different places in the data supply chain. Similarly, for data integration, especially references to features in a different data products and data-sets from the referring feature, require persistent identity.

Uniform Resource Names (URN) as defined by the IETF (Internet Engineering Task Force, which has standardized protocols like IP, http, FTP and other Internet protocols) are intended to serve as persistent, location-independent, resource identifiers and are designed to make it easy to map other namespaces (which share the properties of URNs) into URN-space. Therefore, the URN syntax provides a means to encode character data in a form that can be sent in existing protocols, transcribed on most keyboards, etc. The URN syntax provides a mechanism to ensure the uniqueness of the name of a resource.

This Guideline describes how the URN methodology is applied to identifying maritime resources within a MRN. This syntax allows decentralisation of the management of identities. It is envisaged that already existing numbering schemes can be fitted into this syntax relatively easily, providing backwards compatibility, while the syntax is extendable to new areas of application.

# REQUIREMENTS

Essential properties for a naming scheme are the following:

* Uniqueness:

An ID within the MRN namespace is never assigned to more than one resource and never reassigned to a different resource. Ensuring uniqueness within a namespace is the responsibility of the respective governing organization of the namespace.

* Decentralization:

It must be possible to create IDs without relying on a single global source that must be used every time an ID is created. A central source for creating specific types of ID, for example, route ID, may exist.

* Forward compatibility:

A global naming scheme must be designed for evolution enabling the addition of new naming schemes for new maritime domains in the future.

* Flexibility:

The naming scheme must be flexible and allow for identifying any type of resource such as documents, routes, equipment, ships and mariners, giving no preference to any specific type of IDs.

* URN Compliance:

As MRN is a subset of URN, all active URN documentation must be followed in the creation of MRNs, regardless of OID ownership. OID Owners should specify and document additional parameters (such as those documented in *G1143*). Such documentation should be available to any users implementing MRN within the OID.

* Decentralization:

OID Owners may define further sub-namespaces inside of the Organization-specific namespace string (OSNSS) for representing further internal hierarchies and decentrally organize the assignment of MRN in these sub-spaces.

Within the IALA OSNSS, G1143 documents the use of MRN. Another example can be found in Maritime Connectivity Platform Identity Providers, see MCP MRN Specification: <https://maritimeconnectivity.net/docs/mcp-idsec-2-ID.docx>

* Forward compatibility:

OID namespaces shall be designed for evolution enabling the addition of new naming schemes for new resources in the future.

* Flexibility:

OID namespaces should be used with maximum capacity and flexibility; the schemes should allow for identification of many types of resources relevant to the OID. It is not necessary to request multiple OIDs in order to identify multiple resources.

There are also a few properties that are “nice to have” for an OID namespace scheme:

* Human readability:

A naming scheme should be readable by humans in such a way that identifiers can be entered in forms and documents. The human-readability aspect should not be read as a requirement to conform to specific language requirements. The human-readability aspect should not interfere with the uniqueness aspect of the identifier (see above). In cases where multiple languages may be used, it is not recommended to create an MRN in every language.

* Contextual:

A naming scheme should provide information on the type of resource that a particular identifier refers to, such as a vessel, mariner, AtoN, port or VTS centre.

* Backward compatibility:

Creation and implementation of new MRN schemes do not necessarily constitute a re-configuring of existing naming or numbering schemes. The MRN concept allows for the inclusion of a variety of schemes that already exist, and an OSNSS can allow integration with existing schemes so they can continue to be used. For instance, existing IALA guidance document numbers have been incorporated into MRN as follows:

IALA Guideline G1143 urn:mrn:iala:pub:g1143 :ed2.0

There are also a few properties that are “nice to have” for a global naming scheme:

* Human readability:

A naming scheme should be readable by humans in such a way that identifiers can be entered in forms and documents.

* Contextual:

A naming scheme should provide information on the type of resource that a particular identifier refers to such as, a vessel, mariner, AtoN, port or VTS centre.

* Backward compatibility:

Different maritime naming schemes already exist which include IMO numbers, MMSI numbers and various forms of AtoN identification. A naming scheme allows for integration with these existing schemes as they will continue to be used.

## NOTES

This section contains some clarifying notes on the requirements outlined above.

### MULTIPLE MRN IDENTIFIERS FOR A SINGLE ENTITY

It is possible to have more than one MRN assigned to a single resource, as outlined in RFC 8141:

“a single resource MAY have more than one URN assigned to it, either in the same URN namespace (if the URN namespace permits it) or in different URN namespaces, and for either similar purposes or different purposes.”

As an example of a different context, the same aid can be a buoy that is removed from the water at the end of each navigation season, where the buoy equipment has an MRN as a serial number and since there is different equipment used each navigation season these serial number MRN IDs can be viewed as different MRN IDs for the same aid in a different context.

As an example of a different domain, a given ship where there is one MRN for the ships IMO number, one MRN for the ships MMSI number and one MRN for the ship’s VTS track ID. The same ship has three IDs for different contexts; IMO number domain, MMSI number domain and VTS track domain.

### ATTRIBUTES WITHIN COMMON MARITIME DATA STRUCTURE (CMDS)

An attribute with the same name and definition should be used in data models to hold the MRN IDs to indicate that the identifiers are within the same context.

# MARITIME RESOURCE NAME SYNTAX

## MANAGEMENT OF MRN NAMESPACES

The MRN syntax is based on the URN as described in RFC 2141 published by the Internet Engineering Task Force (IETF).

All URNs have the following syntax. Phrases enclosed in quotes are REQUIRED:

<URN> ::= "urn:" <NID> ":" <NSS>

where <NID> is the Namespace Identifier; and <NSS> is the Namespace Specific String. The leading "urn:" sequence is case-insensitive but is conventionally written in lower case. The NID namespace for the maritime domain is MRN, therefore:

<URN> ::= "urn:mrn:" <NSS>

The namespace, “mrn” is case-insensitive in processing but is conventionally written in lower case.

### RULES THAT APPLY TO ALL MRN NAMESPACES

The urn:mrn namespace is fixed and is administered by IALA. The identifier has a hierarchical syntax. MRN defined using the Augmented Backus-Naur Form (ABNF), as specified in RFC 5234, is described below.

The OID and OSS namespaces are equivalent to the NSS namespace in RFC 2141, therefore:

"urn:mrn:"<NSS> is equivalent to “urn:mrn:” <OID> : <OSS> where NSS is the Namespace Specific String composed as follows:

<NSS>::=<governing-organization>":"<type>":"<type-specific-part>

<MRN> ::= "urn" ":" "mrn" ":" <OID> ":" <OSS>

[ rq-components ]

[ "#" f-component ]

where:

<OID> ::= (alphanum) 0\*32(alphanum / "-") (alphanum) ; Organization ID

<OSS> ::= <OSNID> ":" <OSNS> ; Organization-specific string

<OSNID> ::= (alphanum) 0\*32(alphanum / "-") (alphanum) ; Organization-specific namespace ID

<OSNS> ::= pchar \*(pchar / "/") ; Organization-specific namespace string

Rules not defined here:

\_alphanum and pchar as defined in RFC 3986.

rq-components and f-component as defined in RFC 8141. q-component, f-component and r-component are not generally defined by this specification. Organization specific namespace strings might choose to make use of them where applicable.

### CHARACTER SET AVAILABLE

<NSS> ::= 1\*<URN chars>

<URN chars> ::= <trans> | "%" <hex> <hex>

<trans> ::= <upper> | <lower> | <number> | <other> | <reserved>

<hex> ::= <number> | "A" | "B" | "C" | "D" | "E" | "F" | "a" | "b" | "c" | "d" | "e" | "f"

<other> ::= "(" | ")" | "+" | "," | "-" | "." | ":" | "=" | "@" | ";" | "$" |"\_" | "!" | "\*" | "'"

<upper> ::= "A" | "B" | "C" | "D" | "E" | "F" | "G" | "H" | "I" | "J" | "K" | "L" | "M" | "N" | "O" | "P"

|"Q" | "R" | "S" | "T" | "U" | "V" | "W" | "X" |"Y" | "Z"

<lower> ::= "a" | "b" | "c" | "d" | "e" | "f" | "g" | "h" | "i" | "j" | "k" | "l" | "m" | "n" | "o" | "p" |

"q" | "r" | "s" | "t" | "u" | "v" | "w" | "x" | "y" | "z"

<number> ::= "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

<reserved> ::= '%" | "/" | "?" | "#"

The <reserved> set is reserved from normal use as specified in RFC 2141. The ‘%’ character is used for encoding the escape sequence of an octet. If a reserved character is used in an MRN, it must be encoded using the appropriate %-encoding. While permitted, the use of a character from the <reserved> set in MRNs is discouraged, except that they may be used with r-, q-, or f-components as specified in RFC 8141.

### ENCODING AND CASE-INSENSITIVITY

The entire MRN is case-insensitive.

An ID of urn:mrn:iala:aton:ca:001.3 could be understood as being different from URN:MRN:IALA:ATON:CA:001.3. However, since MRN processing is case-insensitive the two are not different in the context of MRN. Similarly, both variations can be expressed in %-encoding and thus be unique but in the context of MRN be identical. E.g. urn:mrn:iala:aton:ca:001.3 is the same as urn%3Amrn%3Aiala%3Aaton%3Aca%3A001.3 in the context of URI (and by inheritance MRN), but they may otherwise be understood as being different and unique.

*Note post ARM21: Chapter 5 should be amended with more guidance and examples. The guideline produced by the Canadian Coast Guard (ARM20-8.4.1.1) may provide good inspiration.*







# 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

ABNF Augmented Backus-Naur Form

AtoN Marine Aid(s) to Navigation

CMDS Common Maritime Data Structure

HO Hydrographic Office

IALA International Association of Marine Aids to Navigation and Lighthouse Authorities

IANA Internet Assigned Numbers Authority

ID Identification / Identity / Identifier

IETF Internet Engineering Task Force

IHO International Hydrographic Organization

IMO International Maritime Organization (UN)

IP Internet Protocol

ISO International Organization for Standardisation

MMSI Maritime Mobile Service Identity

MRN Maritime Resource Names

MSI Marine Safety Information

NID Namespace Identifier

NSS Namespace Specific String

PUI Persistent Unique Identifier

RFC Request for comments (IETF)

UKHO United Kingdom Hydrographic Office

URN Uniform Resource Name(s)

VTS Vessel Traffic Service

XML eXtensible Markup Language











1. Country Codes within IALA MRN Namespace

The country code follows the ISO 3166-1 alpha-2 list. Implementation of the country codes is at the discretion of the individual nations to coordinate.

1. IALA chooses the term Maritime Resource Names of the concept of a Persistent Unique Identifier in order to expand it into VTS and waterway management and other areas of maritime activity. [↑](#footnote-ref-1)