IALA

IALA GUIDELINE

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UNIQUE IDENTIFIERS FOR MARITIME RESOURCES

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1. 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.

1.1. 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

2. 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] 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.

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[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.

3. 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.

4. 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.

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.

4.1. NOTES

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

4.1.1. 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.

4.1.2. 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.

5. MARITIME RESOURCE NAME SYNTAX

5.1. 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.

5.1.1. 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.

5.1.2. 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.

5.1.3. 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.

5.2. MANAGEMENT OF THE "INT" AND "IALA" NAMESPACES

The MRN syntax for IALA namespaces are defined in the Namespace Specific String (NSS) section of the MRN identifier.

<NSS> is composed as follows:

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

Inserting 'iala' or 'int' as <governing-organization> will create namespaces where IALA can define unique type identifiers that must contain a minimum of 3 lower case alphanumeric characters:

urn:mrn:iala: '<type>':'<type-specific-part>'

Examples of 'types' include: aton (AtoN), wwy (Waterway), vts (VTS Name), etc.

The 'int' namespace is a wildcard that is reserved for use when it impractical to assign a governing organization, including for example 'iala', 'a country' or 'a service provider'. Use of the 'int' namespace is intended to be temporary and may, for example, be used while any competent organization is established, while assignment is pending, or for test purposes.

It is important to note that some data formats that use Uniform Resource Identifier (URI) namespaces (GML, XML, RDF, OWL) may give specific meaning to parts of the MRN ID, such as GML where the colon has special significance. MRNs therefore cannot be used verbatim for GML identifiers ("gml:id") or tags. Instead, for GML formats, either MRNs should be used as values for an attribute designed to carry identifiers, or translated into a format compatible with GML, or rules for mapping GML identifiers to MRNs should be defined.

Table 1   Examples of translating a URN identifier into a GML accepted identifier

URN ID Example	GML acceptable ID version
urn:mrn:iala:aton:us:1234.5	us-1234.5
urn:mrn:iala:aton:js:cg:54321678	js.cg.54321678

The ':' (colon) character has been translated into a '-' (dash) or a '.' (punctuation), and the urn:mrn:iala:aton: part has been omitted as this part would always be fixed in the product. Additional parts of the URN ID could be omitted, but the retained parts yield an ID that is still human readable as well as machine-processable in the same way as the original MRN.

5.2.1. NAMESPACE EXAMPLES
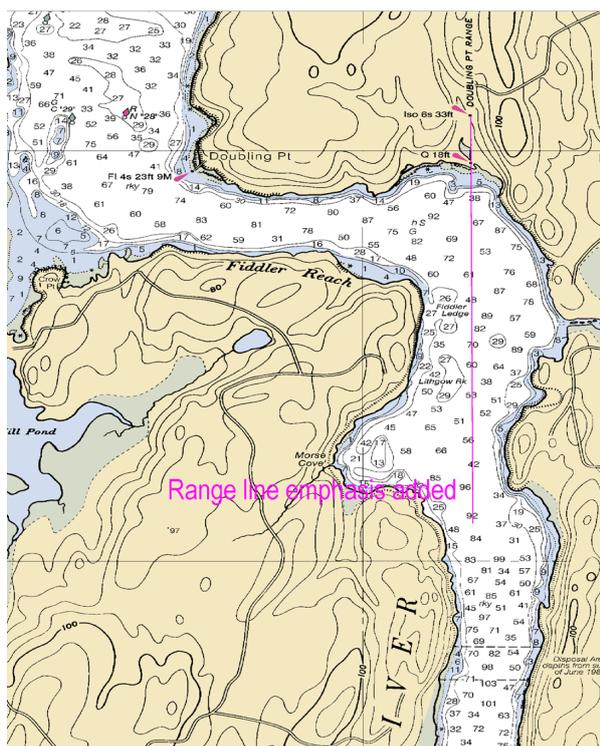
The identifiers related to AtoN use a schema allowing for decentralised management of their identifiers. This scheme includes <ISO 3166 Code>:<managed name spaces>, where <ISO 3166 Code> is the identifier defined by ISO 3166-1 alpha-2 codes for the representation of names of a country, territory, or area of geographical interest.

For example:

urn:mrn:iala:aton:us:1234.5

urn:mrn:iala:aton:gb:sco:1234.5

It is envisaged that for <managed name spaces> all existing naming/numbering schema within a country, territory, or area of geographical interest could be re used to a large degree. See Annexes for further detail.

Feature: Recommended Track
   Attribute: category of recommended track: Based on a system of fixed marks
   Attribute: orientation: 270 degrees
   Attribute: MRN: urn:mrn:iho:chart:js:ho:12345678
Feature: Navigational Line
   Attribute: category of navigation line: leading line bearing a recommended track
   Attribute: orientation: 270 degrees
   Attribute: MRN: urn:mrn:iho:chart:js:ho:87654321
Feature: Landmark
   Attribute: category of landmark: tower
   Attribute: function: light support
   Attribute: MRN: urn:mrn:iala:aton:js:cg:54321678
Feature: Light
   Attribute: category of light: leading light
   Attribute: colour: white
   Attribute: MRN: urn:mrn:iala:aton:js:cg:45678122
Feature: Landmark
   Attribute: category of landmark: tower
   Attribute: function: light support
   Attribute: MRN: urn:mrn:iala:aton:js:cg:54321679
Feature: Light
   Attribute: category of light: leading light
   Attribute: colour: white
   Attribute: MRN: urn:mrn:iala:aton:js:cg:45678123
Feature: Range System
   Attribute: name: Micklefirth approach range
   Attribute MRN: urn:mrn:iho:chart:js:ho:23456781
Aggregation: Range System Aggregation
   Consists of: MRN: urn:mrn:iho:chart:js:ho:12345678
   Consists of: MRN: urn:mrn:iho:chart:js:ho:87654321
   Consists of: MRN: urn:mrn:iala:aton:js:cg:54321679
   Consists of: MRN: urn:mrn:iala:aton:js:cg:45678123
   Consists of: MRN: urn:mrn:iala:aton:js:cg:54321678
   Consists of: MRN: urn:mrn:iala:aton:js:cg:45678122

Figure 1   Example of multiple Domain and Namespace use

5.3. EXTENDABILITY

The MRN is intended to be an extendable mechanism across the maritime domain.

5.3.1. EXTENDED APPLICATIONS WITHIN THE IALA NAMESPACE

IALA will extend the set of MRN type namespaces as appropriate. Definitions of new areas of application of the namespace within the specific domain will be published as additional or amended annexes to this Guideline.

6. AREAS OF APPLICATION

6.1. IALA NAMESPACE

This Guideline provides the following identifier <type> specific definitions of syntax constraint under the IALA namespace in Annex A, with the following Sections:

Table 2   Current Areas of application of MRN within IALA Namespace

ID types	Syntax constraint
Marine Aids to Navigation	ANNEX A, Section A1
VTS services	ANNEX A, Section A2
Waterways	ANNEX A, Section A3
Publications	ANNEX A, section A4
Object	ANNEX A, section A5

6.2. USE OF WILDCARD NAMESPACE ('INT' NAMESPACE)

This Guideline provides a description of the wildcard INT namespace in Annex B.

7. 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.

8. 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

ANNEX A   MRN FOR IALA NAMESPACE

A.1.   MRN FOR MARINE AIDS TO NAVIGATION

A unique identifier for an AtoN should be assigned by the responsible AtoN Authority.

When referenced outside the context of the national AtoN provider, the identifier should be prefixed using the MRN syntax, with the prefix:

urn:mrn:iala:aton:<ISO 3166 Code>:<managed name spaces>.

where <ISO 3166 Code> is the identifier defined by ISO 3166-1 alpha-2 codes for the representation of names of a country, territory, or area of geographical interest.

The MRN authority (e.g. National IALA member) must ensure, that the <managed name spaces> is unique within the domain, and that the syntax of the <managed name spaces> complies with the general MRN guidelines.

Examples:

urn:mrn:iala:aton:us:1234.5   [1]

In example [1] the AtoN with identifier 1234.5 defined by the US AtoN authority.

urn:mrn:iala:aton:gb:sco:6789.1   [2]

In example [2], the ISO 3166 code for the United Kingdom is 'gb'. Within the United Kingdom, AtoN are provided by 3 different AtoN authorities and so a further identifier is used: 'sco' for Scotland in this example where the Scottish asset identifier is 6789.1.

For AtoN Number:

urn:mrn:iala:aton:kr:A01010001   [3]

In example [3] Region(1) + Coast(2) + AtoN Type(2) + unique number(5): A01010001

Region Code

Region1	Region2	Region3	Region4	Region5	Region6	Region7
A	B	C	D	E	F	G

Coast Number

Coast1	Coast2	Coast3	Coast4
01	02	03	04

AtoN Type

Lighthouse	Light Buoy	Buoy	Light Beacon	Beacon	Bridge	Racon
01	02	03	04	05	06	07

For AtoN equipment and structure

urn:mrn:iala:aton:kr:light:17LLED0685   [4]

In example [4] Year + Type + unique number: 17 + LLED + 0685 → 17LLED0685

The equipment/structure type include the following:

Floating Structure, Fixed Structure, Light, Signal, Battery, Controller, Remote Telemetry Unit (RTU), Topmark, Other

A.2. MRN FOR VESSEL TRAFFIC SERVICES

A unique type namespace for VTS is assigned by the responsible MRN Authority. This Annex is reserved for description of VTS, bearing in mind that VTS could be described as a whole, or individual VTS components can be described separately.

When referenced outside the context of the VTS provider, the identifier should be prefixed using the MRN syntax, with the prefix:

urn:mrn:iala:vts:<ISO 3166 Code>:<managed name spaces>.

where <ISO 3166 Code> is the identifier defined by ISO 3166-1 alpha-2 codes for the representation of names of a country, territory, or area of geographical interest.

The MRN authority (e.g., National IALA member) must ensure, that the <managed name spaces> is unique within the domain, and that the syntax of the <managed name spaces> complies with the general MRN guidelines.

Examples:

    urn:mrn:iala:vts:ca:ecareg   [1]

In example [1] the VTS zone identifier for Eastern Canada VTS zone as defined by the Canadian Coast Guard.

    urn:mrn:iala:vts:nl:rtd:me   [2]

In example [2], the VTS zone identifier for 'rtd' for Port of Rotterdam and 'me' for the Maas entrance to the port.

A.3. MRN FOR WATERWAYS

A unique type namespace for waterways (wwy) is assigned by the responsible MRN Authority. This Annex is reserved for description of waterways, bearing in mind that waterway could be described as a whole, or individual waterway segments can be described separately.

When referenced outside the context of the waterway, the identifier should be prefixed using the MRN syntax, with the prefix:

urn:mrn:iala:wwy:<ISO 3166 Code>:<managed name spaces>.

where <ISO 3166 Code> is the identifier defined by ISO 3166-1 alpha-2 codes for the representation of names of a country, territory, or area of geographical interest.

Example:

    urn:mrn:iala:wwy:us:atl:chba:potri   [1]

In example the identifier to the Potomac River waterway using a scalable approach showing the relationships between waterways from national to regional to local level. The name spaces are atl for Atlantic, chba for Chesapeake Bay, and potri for Potomac River.

A.4. MRN FOR PUBLICATIONS

A unique type namespace for publications (pub) is assigned by the responsible MRN Authority. This Annex is reserved for description of publications.

When referenced outside the context of the publication author, the identifier should be prefixed using the MRN syntax, with the prefix:

urn:mrn:iala:pub:<managed name spaces>

or

urn:mrn:iala:pub:<ISO 3166 Code>:<managed name spaces>

where <ISO 3166 Code> is the identifier defined by ISO 3166-1 alpha-2 codes for the representation of names of a country, territory, or area of geographical interest.

Examples:

urn:mrn:iala:pub:g1143 [1]

In example [1] the publication with identifier g1143 defined by IALA.

urn:mrn:iala:pub:ca:cg:ramn:2018 [2]

In example [2], the ISO 3166 code for the Canada is 'ca'. The code for the Canadian Coast Guard within Canada is 'cg' and they have issued the Radio Aids to Marine Navigation publication with the code 'ramn'. The year of issue is 2018.

A.5.   MRN FOR OBJECTS AS A WILDCARD

A unique type namespace for objects (obj) is assigned by the responsible authorities. Object (obj) is a reserved wildcard for use where it is unknown or impractical to assign another type, the identifier should be prefixed using the MRN syntax, with the prefix:

urn:mrn:iala:obj:<ISO 3166 Code>:<managed name spaces>.

where <ISO 3166 Code> is the identifier defined by ISO 3166-1 alpha-2 codes for the representation of names of a country, territory, or area of geographical interest.

The MRN authority (e.g. National IALA member) must ensure, that the <managed name spaces> is unique within the domain, and that the syntax of the <managed name spaces> complies with the general MRN guidelines.

Examples:

urn:mrn:iala:obj:us:nm:42.42 [1]

In example [1] the flying saucer with identifier 42.42 defined by the US flying saucer authority in New Mexico.

urn:mrn:iala:obj:gb:sco:swan52 [2]

In example [2], the ISO 3166 code for the United Kingdom is gb. Within the United Kingdom, mute swans are tracked by 3 different mute swan authorities and so a further identifier is used: sco for Scotland in this example where the Scottish mute swan identifier is swan52.

ANNEX B   MRN FOR INT NAMESPACE

IALA recognises that a multitude of different naming schemes exist today, and that various countries have their own usage rules. It is not feasible to create a naming schema that encompasses all possibilities, or force countries to adapt to a rigid system. Therefore, IALA recognises the possibility that "wildcard" characters be identified and used in the MRN namespace, to allow for situations that cannot be foreseen or for those objects that do not correspond exactly with the structure. For this reason, IALA has reserved the "int" namespace to act as a wildcard for use where it is unknown or impractical to assign another namespace as an Organization ID <OID>.

No provision is made for avoiding collision of MRNs within the "int" namespace, but measures should be taken to ensure uniqueness. It is not recommended that implementers use the "int" namespace for any purposes other than documentation, private testing, and experimental contexts.

ANNEX C   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.