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PUBLICLY AVAILABLE SPECIFICATION PRE-STANDARD



Maritime navigation and radiocommunication equipment and systems – Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results





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PRE-STANDARD



Maritime navigation and radiocommunication equipment and systems – Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results

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IEC PAS 61174-1 has been processed by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	Report on voting
80/978/DPAS	80/986/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

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INTRODUCTION

A route plan exchange format RTZ was published as Annex S of IEC 61174:2015.

This route plan exchange format is intended be used for many purposes. For example it can be used on board for route plan exchange between main and backup ECDIS, ECDIS and radar, ECDIS and optimization systems, etc.. Another example use is between ship and shore where it can be used to inform the shore about the plan of the vessel, the shore can recommend a route, the shore can optimize a route, etc.

This route plan exchange format is based on standardizing a single route plan. The application level of the sender and receiver is assumed to be able to handle multiple route plans for use cases which require availability of multiple routes, for example alternative route plans for the same voyage or route plans for different purposes.

Since publication of IEC 61174:2015, typographical errors have been identified in the original route plan exchange format. Issues relating to ambiguity in the underlying requirements have also been identified. Testing has uncovered further issues, including (among others) route import failures, highlighting a lack of robustness in the RTZ testing clauses specified in IEC 61174:2015.

During the implementation of route exchange as part of a collaborative industry project, the Sea Traffic Management (STM) Validation Project¹, an iteration of the RTZ XML schema, version 1.1, was developed in order to correct the errors that had been identified in version 1.0 and to expand the schema to accommodate the project's needs.

Further development has led to RTZ schema version 1.2 which incorporates schema version 1.1 and contains a further change by permitting extensions in the Leg element.

This PAS includes the following significant technical changes with respect to IEC 61174:2015:

- modifications to the body text of IEC 61174:2015 Annex S intended to correct typographical errors, properly align the text with the original RTZ schema, and to add clarification and remove ambiguity from the requirements;
- modifications to the testing clauses in IEC 61174:2015 6.9.2 to expand the existing tests for route plan exchange by introducing testing clauses covering the full range of requirements specified in IEC 61174:2015 Annex S;
- an updated RTZ schema to revised version 1.2 in order to expand the original schema and to correct errors and weaknesses in the original schema.

Details of the substantive changes between version 1.0 and version 1.2 of the schema are given in Annex D.

¹ https://www.seatrafficmanagement.info/projects/stm-validation/

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results

1 Scope

This PAS specifies requirements, methods of testing and required test results for route plan exchange format (RTZ).

This PAS has been developed to improve interoperability between equipment implementing route plan exchange format by addressing issues uncovered in the original RTZ specification (Annex S of IEC 61174:2015), and in recognition of the fact that some manufacturers have identified a pressing business need to implement an improved and expanded version of the RTZ format.

This PAS is intended to complement the original RTZ specification. This PAS provides a revised version 1.2 of the RTZ schema but retains the original version 1.0 of the schema unchanged. The intention is that compliance with this PAS can be achieved without compromising compliance with IEC 61174:2015.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61174:2015, Maritime navigation and radiocommunication equipment and systems – *Electronic chart display and information system (ECDIS)* – Operational and performance requirements, methods of testing and required test results

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this PAS.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Abbreviated terms

ECDIS Electronic chart display and information system

EUT Equipment under test

4 Requirements

4.1 General

A route plan consists of waypoints. Each waypoint, except the first, contains information related to the leg from the previous waypoint. Descriptions of route plans are shown in Figure 1 and Figure 2. The route exchange format is a file containing an XML encoded version of the route plan. The XML route exchange file shall use the extension .rtz. A description of the RTZ format is given in 4.5. Examples of RTZ format routes are given in 4.7 and 4.8.

XML schema is provided for validation of the structure and content of the RTZ format route files. Two versions of the RTZ schema are defined: version 1.0 (provided in Annex S of IEC 61174:2015) and 1.2 (provided in Annex A of this PAS). By default, equipment shall export routes using version 1.2 of the schema. Equipment shall allow the version 1.0 schema to be selected for export. Equipment shall support the import of both version 1.0 and version 1.2 schemas. Validation shall be mandatory for files using the version 1.2 schema and optional for files using the 1.0 schema. If an imported file fails to validate it shall not be used and an indication of the reason for validation failure shall be provided. The user manual shall specify the versions and optional attributes that are supported.

One of the differences between the version 1.0 and 1.2 schema is the renaming of the *SheduleElement* type to *ScheduleElement*. In textual references, other than xml examples, this PAS uses *ScheduleElement* to refer to both items.

NOTE 1 The requirements in this PAS can be applied not only to ECDIS, but also to software applications importing routes from ECDIS or exporting routes to ECDIS. In order to achieve interoperability, manufacturers of non-ECDIS software applications are strongly encouraged to apply the associated tests in this PAS.

NOTE 2 This route exchange format has some limitations for applicability due to the simple geometric mode used. Application for latitudes above 70° may cause significantly different paths over the earth surface between two systems. Application to long legs such as an ocean crossing is subject to differences in the exact path over the earth surface.

NOTE 3 It is recommended that the receiver of the route exchange always performs a check against the chart database and a geometry check before use for navigation purposes.

NOTE 4 Information in addition to the route exchange format will be necessary between third parties to assure the level of accuracy and repeatability required for Track Control System purposes.

NOTE 5 RTZ version 1.1 was used by the European Union's Sea Traffic Management project, but lacked the optional Extensions in the Leg element.



The distance between waypoints is from WOL to WOL with zero "advance and transfer" or "forwarding distance".

Figure 1 – Description of route plan – Distance between WP 2 and WP 3



Figure 2 – Description of route plan – Leg parameters belonging to WP 3

4.2 RTZP data container

RTZP data containers are standard ZIP archive files used to compress the size of the route exchange files.

The RTZP data container file .rtzp stores a single XML file .rtz, which conforms to the XML schema described in 4.6.

A single RTZP file shall be limited in compressed size to 10 MB.

Use of the RTZP data container is optional. When used without the RTZP data container the filename extension of the route exchange shall be **.rtz** and when used with the RTZP data container the extension shall be **.rtzp**. Within the RTZP data container the filename extension of the route exchange shall be **.rtz**. The user manual shall specify whether the RTZP data container is supported.

The filename of the RTZP data container shall be the same as the content of the attribute routeName described in 4.5.3.

In addition to the **.rtz** file a number of free-format files may be placed in the RTZP data container. The semantic data link between the XML nodes and files may be documented using a HTTP like scheme "rtz://<URI>", where "<URI>" identifies a file name inside the RTZP data container.

For example:

<extensions></extensions>
<pre><extension <="" manufacturer="Acme" pre="" version="2.1"></extension></pre>
<pre>name="AuxRouteInfo-9674F26E-EAFB-4319-AE24-08D5BA69D895"></pre>
<property <="" name="source" pre=""></property>
value="http://services.acme.com/auto_route/?id=3e891884e620970e5303fd2399427986"/>
<property name="attachment" value="rtz://assignement-13.04.2013.docx"></property>
<property name="attachment" value="rtz://MFD_original.rt3"></property>

4.3 High-level description of the RTZ format

The logical design of a route consists of three independent units:

- a block with general information about the route;
- a block with route geography (geometry) information which consists of blocks describing individual legs. Legs are listed in the order they appear on the route;
- a block that contains a set of route schedules. Each block can be extended by manufacturers to fit their needs.

Each block can be extended by manufacturers to fit their needs.

4.4 Adaption to third-party extensions and handling of optional data

4.4.1 Generic idea

Extended information in most cases refers to the geography (geometry) of a route.

It shall be possible to import and export RTZ files with extensions from different manufacturers.

4.4.2 Unique identification of a waypoint

Each waypoint in a route has a unique composite 'id'.

RTZ extensions shall use this composite identifier to link their data to the geography. This allows an application that does understand the extension to identify when third-party software has modified the related element (see 4.4.4).

The identifier consists of two parts:

- id, which allows the finding of a waypoint in the list; This 'id' is not intended to be a sequence number (i.e. does not need to relate to the position of the waypoint in the route);
- revision, which allows the determination of modifications of a waypoint since the entry of the data into a file extension.

id is an integer,

revision is a monotonically increasing integer.

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4.4.3 Creation of new waypoints

After creation of the waypoint the **revision** attribute shall have the value of 0.

4.4.4 Change of geographic data for a waypoint

When the data of a Waypoint or associated Leg changes, including the addition of a manufacturer extension, the software shall increase the revision number revision. This allows third-party software that works with the extension to find out that the data to which it is associated may no longer be valid.

4.4.5 Waypoint removal

When deleting a waypoint from a route, all the waypoint data including Leg and any Schedule data associated with the removed Waypoint shall be deleted and the ids of other waypoints within the route shall remain unchanged.

NOTE Deletion of the waypoint may result in schedules for other waypoints becoming invalid or being updated.

4.4.6 Waypoint modification

The data that software is not able to recognize (e.g. extensions and optional elements and optional attributes) shall be written back into the modified file without modification.

The data that software is able to recognize (e.g. extensions and optional elements and optional attributes known by the manufacturer) shall be handled as declared by the manufacturer. When importing a route, manufacturer extension data that is recognized shall be checked (e.g. by using the composite 'id' described in 4.4.2) and, where the application determines that modifications by an external 3rd party application may have invalidated the data, appropriate action shall be taken. The manufacturer shall declare the appropriate action to be taken which will depend on the nature of the extension, and may range from removal of the extension to maintaining it unchanged.

NOTE Modification of the waypoint can result in schedules becoming invalid or being updated.

4.5 Detailed RTZ format description

4.5.1 File components

The RTZ file consists of:

- the mandatory XML processing instruction, which allows the specification of the encoding of string data;
- a root <route> node, which includes the URIs of the namespaces used;

NOTE An example of a namespace is available in 4.6.

• the version attribute in the format "Major.Minor".

The file encoding shall be UTF-8.

A single RTZ file shall be limited in uncompressed size to 1 MB.

There shall be an indication to the user if file size constraint will be exceeded through modification to route plan.

4.5.2 Route node description

This is the only "root" element of the RTZ file.

It has one mandatory attribute "version" that contains the version of the RTZ schema.

Version is specified as a combination of two numbers separated with a dot. The first number corresponds to the major version. It is changed following significant modifications to the document structure.

The second number corresponds to the minor version and indicates format changes that do not affect compatibility.

The **Route** node consists of a sequence of the following child nodes:

- RouteInfo node that contains basic information on the route;
- Waypoints node that describes the geographical components of the route;
- Schedules node that describes calculated schedule and timing defined by a user;
- **Extensions** node that allows for extending the format to fit the particular needs of a manufacturer.

4.5.3 RouteInfo node description

The RouteInfo node provides a place to store information related to the whole route.

Attribute Description Format Status Comment routeName name of the route String Mandatory routeAuthor Author of route Option String routeStatus Status of route String Option Start of validity ISO 8601 Option validitvPeriodStart period Stop of validity ISO 8601 Option validityPeriodStop period vesselName Ship's name String Option vesselMMSI Ship's MMSI XXXXXXXXX Option vesselIMO Ship's IMO number XXXXXXX Option Number of the String Option vesselVoyage voyage vesselDisplacement Ship's displacement Integer Option Unit: tons Unit: tons vesselCargo Ship's cargo Integer Option XX.XX Option Metacentric height of the ship for intended voyage. vesselGM Metacentric height Unit: metres Could be fixed speed, Lowest Option String Route is optimized optimizationMethod Fuel Consumption, Fixed to meet KPI ETA ΧХ Unit: degrees Ship's max roll Option vesselMaxRoll angle allowed Ship significant Unit: metres хх х Option vesselMaxWave wave height limit Ship's max wind XX.X Option Unit: metres vesselMaxWind speed limit XX.X Option Unit: knots, Speed through vesselSpeedMax Ship's max speed water XX.X Option Unit: knots, Speed through Ship's preferred vesselServiceMin service speed water window min

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
vesselServiceMax	Ship's preferred service speed window_max	XX.X	Option	Unit: knots, Speed through water
routeChangesHistory	Cause of route change, Originator and Reason	String	Option	

For example:

<routeInfo routeName="AROUNDtheSKAGEN"

```
vesselName="ACME"
validityPeriodStart="2014-01-03T03:15:002"
validityPeriodStop="2014-01-06T10:15:002"
vesselMMSI="xxxxxxxx"
vesselVoyage ="xxxx"/>
```

Additionally, the node may contain child extensions.

4.5.4 Waypoints node description

The **Waypoints** node contains data related to the geometry of the route.

As minimum, it shall contain a sequence of Waypoint nodes that describe every leg of the route.

The order of the Waypoint nodes follows the order of the legs.

Before the sequence of **Waypoint** nodes it is possible to insert a **DefaultWaypoint** node, which may be used to define default values of attributes for newly created legs and for legs with attributes that have not been explicitly supplied except for the geometry data.

Additionally, the node may contain a child extensions node.

4.5.5 DefaultWaypoint node description

The **DefaultWaypoint** node allows the route file to provide a definition of default values of attributes for newly created waypoints and legs. Additionally, it allows the definition of default values of attributes for waypoints and legs where data has not been explicitly supplied. The user manual shall specify whether the equipment uses the default waypoint to set defaults and, if not, shall specify how defaults are set (e.g. using default settings set by the mariner on the ECDIS).

For example:

```
<waypoints>
        <defaultWaypoint revision="1" radius="1.4">
              <leg starboardXTD="0.5" portsideXTD="0.5" geometryType="Loxodrome"/>
              </defaultWaypoint>
```

If the **DefaultWaypoint** node is provided, then it may be used to provide values for attributes for newly created waypoints and legs and shall be used to provide values for attributes for waypoints and legs where data has not been explicitly supplied.

<waypoints></waypoints>	Defaults settings for all waypoints
<pre><defaultwaypoint radius="1.4" revision="1"></defaultwaypoint></pre>	
<leg <="" portsidextd="0.3" starboardxtd="0.3" th=""><th></th></leg>	
geometryType="Loxodrome"/>	
<waypoint id="33" revision="1"></waypoint>	For this waypoint default settings
<pre><position lat="53.0492" lon="8.87731"></position></pre>	applied
<waypoint id="17" radius="0.3" revision="3"></waypoint>	For this waypoint user settings applied:
<pre><position lat="53.0513" lon="8.87509"></position></pre>	Port XTD = 0,5 NM
<leg <="" portsidextd="0.5" starboardxtd="0.4" th=""><td>Starboard XTD = 0,4 NM</td></leg>	Starboard XTD = 0,4 NM
	Turn radius = 0,3 NM
geometryType="Orthodrome"/>	Geometry type is orthodrome

For example:

4.5.6 Waypoint node description

The **Waypoint** node contains the geographical description of a leg between waypoints.

Attribute	Description	Format	Status	Comment
id	Unique identifier	Integer	Mandatory	It does not have to be equal to the index of the waypoint
revision	Waypoint revision	Integer	Mandatory	Index of revision
name	Waypoint	String	Option	
radius	Turn radius	Real	Option	Unit: NM
position	Geographic point	GM_Point	Mandatory	Unit: degrees
leg	Leg attributes		Option	Not required for the first waypoint. Required for other waypoints.

Information is stored in the following attributes:

The **Position** node contains the latitude and longitude of the waypoint.

Attribute	Description	Format	Status	Comment
lat	Latitude	Real	Mandatory	Unit: degrees with decimal
lon	Longitude	Real	Mandatory	Unit: degrees with decimal

The **Leg** node contains attributes of the leg leading from the previous waypoint to the waypoint that contains the leg node (see Figure 2).

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Attribute	Description	Format	Status	Comment
starboardXTD	Starboard XTD	Real	Option	Unit: NM with decimal
portsideXTD	Portside XTD	Real	Option	Unit: NM with decimal
safetyContour	Planned Safety contour	Real	Option	Unit: metres
safetyDepth	Planned Safety depth	Real	Option	Unit: metres
goomotryTypo	Geometry type of	Enumeration	Ontion	loxodrome (= rhumb line) or
geometryType	leg	Enumeration	Option	orthodrome (= great circle)
speedMin	Lowest cruising speed	Real	Option	Unit: knots, Speed over ground
speedMax	Highest allowed speed	Real	Option	Unit: knots, Speed over ground
draughtForward	Static Draught Forward	Real	Option	Unit: metres
draughtAft	Static Draught Aft	Real	Option	Unit: metres
staticUKC	Minimum UKC on the leg	Real	Option	Unit: metres
dynamicUKC	Minimum Dynamic UKC on the leg	Real	Option	Unit: metres
maathaad	Height of masthead	Real	Ontion	Unit: metres
masmead			Option	Calculated from keel
legReport	Reporting information	String	Option	Part of annotated route plan
la slafa	Nice to know	String	Ontion	e.g. telephone / web / service point
leginio			Option	Could be relevant in approach to harbour or VTS
legNote1	Notes regarding the ETD/ETA	String	Option	
legNote2	Local remarks	String	Option	

If an optional attribute is absent the appropriate parameter may be taken from the element **DefaultWaypoint**.

For the case when geometryType is absent, this attribute should be considered as "Loxodrome".

Additionally, the node may contain a child **extensions** node.

4.5.7 Storing date and time for legs

Date and time parameters that are associated with the corresponding legs are stored as strings of calendar date and UTC in extended format according to ISO 8601.

For example:

```
<schedule id="2" name="Schedule2">
  <manual>
    <scheduleElement id="100" etd="2002-11-17T15:25:00Z"/>
    <scheduleElement id="105" eta="2002-11-17T15:25:00Z"/>
    </manual>
```

</schedule>

4.5.8 Schedules node description

The **Schedules** node contains data on the schedules associated with the route.

Children schedule nodes describe the specific schedule.

Additionally, the node may contain a child **extensions** node.

4.5.9 Schedule node description

4.5.9.1 Components

The **Schedule** node consists of a sequence of the following child nodes:

- Manual node that describes user's preferences for the schedule;
- **Calculated** node that describes schedule calculation results according to user's preferences.

Additionally, the node may contain a child extensions node.

The manufacturer shall declare which types of schedules are supported (Manual, Calculated or none) and whether multiple schedules are supported when exchanging routes. This information shall also be available in the user manual.

4.5.9.2 Manual node description

The **Manual** node contains a sequence of **ScheduleElement** nodes that describe time preferences and calculation restrictions for selected legs of the route. A waypoint should not have more than one associated ScheduleElement within a Manual node.

Additionally, the node may contain a child **extensions** node.

4.5.9.3 Calculated node description

The **Calculated** node contains a sequence of **ScheduleElement nodes** that store calculations results according to user's preferences. A waypoint should not have more than one associated ScheduleElement within a Calculated node.

Additionally, the node may contain a child **extensions** node.

4.5.9.4 ScheduleElement (manual/calculated) node description

The **ScheduleElement** node stores a number of time oriented values related to the route leg (N-1, N), where N is a zero-based index of the leg in the list.

Attribute	Description	Format	Status	Comment
waypointId	Identifier of waypoint	Integer	Mandatory	
etd	Departure time	ISO 8601	Option	
etdWindowBefore	Describes the uncertainty of the predicted etd after optimization	± HH:MM (RTZ v1.0) xsd:duration (RTZ v1.2)	Option	Time window as hours (HH) and minutes (MM) before the etd. Both + and – HH:MM mean before the etd,
				(RTZ v1.0)
etdWindowAfter	Describes the uncertainty of the predicted etd after optimization	<u>+</u> HH:MM (RTZ v1.0) xsd:duration (RTZ v1.2)	Option	Time window as hours (HH) and minutes (MM) after the etd. Both + and – HH:MM mean after the etd,
				(RTZ v1.0)
eta	Arrival time	ISO 8601	Option	
etaWindowBefore	Describes the uncertainty of the predicted eta after optimization	<u>+</u> HH:MM (RTZ v1.0) xsd:duration (RTZ v1.2)	Option	Time window as hours (HH) and minutes (MM) before the eta. Both + and – HH:MM mean before the eta.
				(RTZ v1.0)
etaWindowAfter	Describes the uncertainty of the predicted eta after optimization	± HH:MM (RTZ v1.0) xsd:duration (RTZ v1.2)	Option	Time window as hours (HH) and minutes (MM) after the etd. Both + and – HH:MM mean after the eta.
				(RTZ v1.0)
stay	Stay time on WP	dd.hh.mm (RTZ v1.0) xsd:duration (RTZ v1.2)	Option	Length of stop on WP as days (dd), hours (hh) and minutes (mm)
		, , ,		(RTZ v1.0)
speed	Ground speed	Real	Option	Unit: knots
speedWindow	Describes the uncertainty of the predicted speed after optimization	x.xx	Option	Unit: knots from -x.xx knots to + x.xx knots
windSpeed	True wind speed	Real	Option	Unit: knots
windDirection	True wind direction	Real	Option	Unit: degrees
currentSpeed	Current speed	Real	Option	Unit: knots
currentDirection	Current direction	Real	Option	Unit: degrees
	Speed loss squard			Unit: knots
windLoss	by wind	Real	Option	Calculated during optimization
	Speed loss caused			Unit: knots
waveLoss	by wave	Real	Option	Calculated during optimization
	-			Unit: knots
totalLoss	Total speed loss	Real	Option	Calculated during optimization
rpm	Advised Engine RPM	Integer	Option	Unit: RPM Calculated during optimization

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
				Unit: %
pitch	Advised propeller pitch	Integer	Option	Calculated during optimization
	Predicted fuel			Unit: kg
fuel	consumption on leg	Real	Option	Calculated during optimization
	Relative fuel saving after optimization	Real	Option	Unit: kg
relFuelSave				Calculated during optimization
	Absolute fuel soving			Unit: kg
absFuelSave	after optimization	Real	Option	Calculated during optimization
Note		String	Option	

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NOTE For details of the format of xs:duration see: https://www.w3schools.com/xml/schema_dtypes_date.asp

For example:

```
<schedule id="2" name="Schedule2">
<manual>
   <sheduleElement id="100" etd="2002-11-17T15:25:002" />
   <sheduleElement id="105" eta="2002-12-17T15:25:002" />
   </manual>
   <calculated>
        <sheduleElement id="100" etd="2002-11-17T15:25:002" speed="11.00000000"/>
        <sheduleElement id="105" eta="2002-12-17T15:25:002" speed="12.23242000"/>
        </calculated>
        <calculated>
        <calculated>
        </calculated>
        </calculat
```

Additionally, the node may contain a child extensions node.

4.5.10 Extensions node description

The **Extensions** node contains a set of child **extension** nodes, each of which specify additional information that may be associated with:

- whole route;
- whole geographical data;
- certain waypoint;
- whole schedules block;
- certain schedule;
- certain schedule element.

4.5.11 Extension node description

The **Extension** node contains a set of mandatory attributes that identify the extension and a number of child nodes that may contain arbitrary information. Format of these nodes is beyond the scope of this document.

If provided, the manufacturer shall include the specification of his extension nodes in the user manual.

The following attributes are used:

Attribute	Description	Format	Status	Comment
manufacturer	Unique vendor identifier	String	Mandatory	
name	Extension name	String	Mandatory	
version	Extension version	String	Option	

An example that illustrates one of the Acme extensions for GMDSS areas is:

```
<extensions>
<extension manufacturer="acme" name="GMDSS-96CF94DF-6ADB-4B08-B43F-355F939AF5F8"
        version="1.3">
        <point id="77" class="A1" range="20.0"/>
        <point id="79" class="A1" range="22.0"/>
        <point id="79" class="A1" range="121.2"/>
        <point id="80" class="A2" range="121.2"/>
        </extension>
</extensions>
```

4.6 XML schema to be met by RTZ route files

4.6.1 RTZ schema version 1.0

The RTZ Schema version 1.0 is defined in Annex S of IEC 61174:2015.

4.6.2 RTZ schema version 1.2

The RTZ Schema version 1.2 is defined in Annex A.

4.7 Basic RTZ v1.0 route example

```
</defaultWaypoint>
    <waypoint id="15" revision="1">
       <position lat="53.0492" lon="8.87731"/>
    </waypoint>
   <waypoint id="52" revision="3">
        <position lat="53.0513" lon="8.87509"/>
        <leg portsideXTD="0.3" starboardXTD="0.3"
           safetyContour="11.20000000" safetyDepth="22.20000000"
           geometryType="Orthodrome"/>
   </waypoint>
   <waypoint id="1" revision ="1" name="To the pier">
        <position lat="53.5123" lon="8.11998"/>
        <leg portsideXTD="0.1" starboardXTD="0.1"/>
   </waypoint>
    <waypoint id="5" revision ="3" name="To the pier">
        <position lat="53.0492" lon="8.87731"/>
        <leg portsideXTD ="0.1" starboardXTD ="0.1"
           safetyContour ="11.20000000" safetyDepth ="22.20000000"
           geometryType="Orthodrome"/>
   </waypoint>
</waypoints>
<schedules>
   <schedule id="1" name="Schedule1">
        <manual>
           <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z" />
           <sheduleElement waypointId="15" eta="2002-11-17T15:25:00Z" />
        </manual>
        <calculated/>
   </schedule>
    <schedule id="2" name="Schedule2">
        <manual>
           <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z" />
           <sheduleElement waypointId="15" eta="2002-12-17T15:25:00Z" />
        </manual>
```

<calculated>

<pre><sheduleelement <="" etd="2002-11-17T15:25:00Z" pre="" waypointid="15"></sheduleelement></pre>
speed="11.34520000"/>
<pre><sheduleelement <="" eta="2002-12-17T15:25:00Z" pre="" waypointid="15"></sheduleelement></pre>
speed="12.66635112"/>
<extensions></extensions>

4.8 RTZ v1.2 test files

Information about the RTZ v1.2 test dataset is provided in Annex B.

5 Methods of testing and required test results

5.1 General

The following tests are written so that, in addition to applying to ECDIS and ECDIS backup, they can also be performed on non-ECDIS equipment that participates in route exchange with ECDIS. To promote interoperability, it is strongly recommended that these tests are performed on such equipment, as far as practical.

Perform the following tests using the test data set described in Annex B.

5.2 User manual

Confirm by inspection of the documented evidence that the user manual specifies:

- a) The versions of the RTZ schema supported (4.1)
- b) The optional attributes of the RTZ schema supported (4.1)
- c) Whether the RTZP container is supported (4.2)
- d) The types of schedules supported (4.5.9.1)
- e) The manufacturer extensions supported (4.5.11)

5.3 Schema compliance

NOTE See 4.1.

The tests for schema compliance are as follows.

- a) Do not select the version of the schema for export (i.e. leave it as the default for the EUT) and export a route. Confirm by observation that the content is compliant with schema version 1.2. Confirm by observation that all parts of the schema identified in the user manual as supported have correct values.
- b) If supported, export a route using RTZ schema version 1.0 and confirm by observation that the content is compliant with schema version 1.0, as far as practical.
- c) Import a route conforming to the minimum mandatory elements of RTZ schema version 1.0. Confirm by observation that the file imports without error and that all parts of the route are correctly presented. (Test file: "RTZ1.0MandatoryElementsAndAttributes.rtz")

- d) Import a route conforming to the minimum mandatory elements of RTZ schema version 1.2. Confirm by observation that the file imports without error and that all parts of the route are correctly presented. (Test file: "BasicRoute.rtz")
- e) Import a route conforming to RTZ schema version 1.2 containing all optional elements. Confirm by observation that the file imports without error and that all parts of the schema identified in the user manual as supported have correct values. (Test file: "RTZ1.2AllOptionalElementsAndAttributes.rtz")
- f) Attempt to import a file using RTZ schema version 1.2 that does not fully conform to the schema. Confirm by observation that it does not successfully import and that an indication of the reason for validation failure is provided (e.g. line number where validation failed). Repeat for all test cases provided by the test data set. (Test files: "RouteNameDoesNotMatchFilenameError.rtz", "DuplicateWaypointIdError.rtz", "MissingWaypointIdError.rtz", "NonsenseGeometryTypeError.rtz", "ScheduleError.rtz", "EsotericRouteInfoError.rtz")
- g) Export route plans in all supported formats of RTZ and confirm by observation that the extension is .rtz or .rtzp as appropriate (4.1 and 4.2). Repeat for all supported RTZ schema versions.

5.4 RTZP data container

NOTE See 4.2.

The tests for RTZP data container are as follows.

- a) If the RTZP data container is supported, export a route using RTZP and confirm by observation that the rtzp file contains a single rtz file and the rtzp filename is the same as the content of the routeName attribute.
- b) If the RTZP data container is supported, import a RTZP data container containing both a valid route plan and free-format files and confirm by observation that it imports without error. (Test files "defaultwaypoint.rtzp" & "rtzp_with_attachments.rtzp")

5.5 Revision attribute

NOTE See 4.4.3, 4.4.4.

The tests for revision attribute are as follows.

- a) Add a new waypoint to a route and export the file. Confirm by observation that the revision attribute has the value of 0.
- b) Create or import a route. Modify data for one Waypoint and modify Leg data for a different waypoint on the same route and export the route. Confirm by observation that the Waypoint revision counter has been incremented for both Waypoints. (4.4.4; Test file for import: "RevisionAttribute.rtz")
- c) Create or import a route with manufacturer extensions. Modify data for one Waypoint and modify Leg data for a different waypoint on the same route and export the route. Confirm by observation that the revision attribute has been incremented for the modified waypoint and modified leg. (Test file for import: "ManufacturerExtensions.rtz")

5.6 Schedules

NOTE See 4.4.5.

If the schedule feature is supported, create a route and add a schedule for the route. Delete a waypoint from the route and export the route. Confirm by observation that all the waypoint data including Leg and, if previously present, individual Schedule data associated with the deleted Waypoint has been removed. Confirm by observation that the ids of the remaining waypoints have remained unchanged.

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5.7 Manufacturer extensions and handling of optional data

NOTE See 4.4, 4.5.10, 4.5.11.

The tests for extensions and handling of optional data are as follows.

- a) If applicable, import a route file containing optional elements and optional attributes that are not supported by the equipment and confirm by observation that the file imports without error. Modify the route by deleting a waypoint, adding a waypoint and modifying a waypoint and then re-export the route. Confirm by observation that the re-exported file maintains the unsupported optional elements and attributes for the waypoints that remain. (Test file: "RTZ1.2AllOptionalElementsAndAttributes.rtz")
- b) If manufacturer extensions are supported, export a route file containing extensions. Use external arrangements to modify a waypoint with an extension in the exported route, updating the revision attribute, and then re-import the route. Confirm by observation that the file imports without error. Confirm by analytical evaluation that appropriate action is taken for extensions associated with the modified waypoint in accordance with the user manual.
- c) Import a route file containing extensions from a different manufacturer (i.e. a 3rd party) to the EUT. Confirm by observation that the file imports without error. Modify the route by deleting a waypoint, adding a waypoint and modifying a waypoint, and then re-export the route. Confirm by observation that the re-exported file maintains the 3rd-party extensions for the original waypoints that remain in the route and that any added waypoints do not include any 3rd-party extensions. (Test file: "ManufacturerExtensions.rtz")

5.8 Default data

NOTE See 4.5.5, 4.5.6.

The tests for default data are as follows.

- a) If applicable, create a route that contains default waypoint and leg data. Ensure the route has at least one Waypoint and Leg without values set for the attributes where default data is available. Import the route. Confirm by observation that the waypoints and legs without data supplied explicitly are populated in accordance with the guidance given in the user manual (i.e. either from the default waypoint or by another specified method). Confirm by observation that the default data is not applied to attributes with data explicitly provided.
- b) Import a route that contains default waypoint and leg data. Add a new leg to the route. Confirm by observation that the default data is applied or not applied to the new waypoint and leg in accordance with the guidance given in the user manual. (Test file: "DefaultWaypoint.rtz")

5.9 Application of leg element values

NOTE See 4.1, 4.5.6.

Import a route and confirm by observation that the values in the leg elements are applied to the leg leading from the previous waypoint to the waypoint that contains the leg element. (Test file: "BasicRouteWithOptionalAttributes.rtz")

Annex A

(normative)

RTZ schema version 1.2

```
<?xml version="1.0" encoding="utf-8"?>
```

<!--

Route Exchange Format (RTZ)

XML schema

Revision 1.2

Source: IEC PAS 61174-1

-->

<xsd:schema

xmlns:xsd="http://www.w3.org/2001/XMLSchema"

xmlns="http://www.cirm.org/RTZ/1/2"

targetNamespace="http://www.cirm.org/RTZ/1/2"

elementFormDefault="qualified"

attributeFormDefault="unqualified">

<xsd:annotation>

<xsd:documentation>

RTZ schema version 1.2. For more information on RTZ and this schema,

visit http://www.cirm.org/RTZ.

RTZ uses the following conventions: all coordinates are relative to the WGS84 datum.

All measurements are in nautical miles unless otherwise specified.

</xsd:documentation>

</xsd:annotation>

<!--

<!-- Root element -->

<!-->

<xsd:element name="route" type="Route">

-->

<xsd:annotation>

<xsd:documentation>

Route is the root element in the XML RTZ file.

</xsd:documentation> </xsd:annotation> </xsd:element> <!----> <!-- Root element type definition --> <!----> <xsd:complexType name="Route"> <xsd:annotation> <xsd:documentation> RTZ files contain a number of waypoints, followed with auxiliary schedules. You can add your own elements to the extension section of the RTZ document. </xsd:documentation> </xsd:annotation> <xsd:sequence> <xsd:element name="routeInfo" type="RouteInfo" minOccurs="1" maxOccurs="1"> <xsd:annotation> <xsd:documentation> Generic route information. </xsd:documentation> </xsd:annotation> </xsd:element> <rpre><xsd:element name="waypoints" type="Waypoints" minOccurs="1" maxOccurs="1"> <xsd:annotation> <xsd:documentation> A list of waypoints. </xsd:documentation> </xsd:annotation> </xsd:element> <xsd:element name="schedules" type="Schedules" minOccurs="0" maxOccurs="1"> <xsd:annotation> <xsd:documentation> Optional list of schedules.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

<xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">

```
<xsd:annotation>
```

<xsd:documentation>

You can add extend RTZ by adding your own elements from another schema

here.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

</xsd:sequence>

<xsd:attribute name="version" type="xsd:string" use="required" fixed="1.2">

<xsd:annotation>

<xsd:documentation>

Format version (currently "1.2").

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

</xsd:complexType>

</th <th></th> <th></th> <th></th> <th></th> <th>></th>					>
</th <th>"RouteInfo"</th> <th>element</th> <th>type</th> <th>definition</th> <th>></th>	"RouteInfo"	element	type	definition	>

±±

<!--

<xsd:complexType name="RouteInfo">

<xsd:sequence>

<xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">

-->

<xsd:annotation>

<xsd:documentation>

You can add extend RTZ by adding your own elements from another schema

here.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

</xsd:sequence>

<rpre><xsd:attribute name="routeName" type="xsd:string" use="required">

<xsd:annotation>

<xsd:documentation>The name of the route.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="routeAuthor" type="xsd:string">

<xsd:annotation>

<xsd:documentation>The author of route.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="routeStatus" type="xsd:string">

<xsd:annotation>

<xsd:documentation>Status of route.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="validityPeriodStart" type="xsd:dateTime">

<xsd:annotation>

<xsd:documentation>

Start of validity period in ISO 8601 format.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="validityPeriodStop" type="xsd:dateTime">

<xsd:annotation>

<xsd:documentation>

Stop of validity period in ISO 8601 format.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselName" type="xsd:string">

<xsd:annotation>

<xsd:documentation>The name of ship.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselMMSI" type="xsd:nonNegativeInteger">

<xsd:annotation>

<xsd:documentation>MMSI of ship.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselIMO" type="xsd:nonNegativeInteger">

<xsd:annotation>

<xsd:documentation>IMO number of ship.</xsd:documentation>

</xsd:annotation>

```
</xsd:attribute>
```

<xsd:attribute name="vesselVoyage" type="xsd:string">

<xsd:annotation>

<xsd:documentation>Number of the voyage.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselDisplacement" type="xsd:nonNegativeInteger">

<xsd:annotation>

<xsd:documentation>Displacement of ship in tons.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<re><xsd:attribute name="vesselCargo" type="xsd:nonNegativeInteger">

<xsd:annotation>

<xsd:documentation>Cargo of ship in tons.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<rpre><xsd:attribute name="vesselGM" type="LengthType">

<xsd:annotation>

<xsd:documentation>Metacentric height in metres.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="optimizationMethod" type="xsd:string">

<xsd:annotation>

<xsd:documentation>Route is optimized to meet KPI.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<rpre><xsd:attribute name="vesselMaxRoll" type="xsd:nonNegativeInteger">

<xsd:annotation>

<xsd:documentation>

Max roll angle of ship allowed in degrees.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselMaxWave" type="LengthType">

<xsd:annotation>

<xsd:documentation>

Ship significant wave height limit in metres.

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</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselMaxWind" type="SpeedType">

<xsd:annotation>

<xsd:documentation>

Max wind speed limit of ship in knots.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselSpeedMax" type="SpeedType">

<xsd:annotation>

<xsd:documentation>Max speed of ship in knots.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselServiceMin" type="SpeedType">

<xsd:annotation>

<xsd:documentation>

Preferred service speed window minimum in knots.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="vesselServiceMax" type="SpeedType">

<xsd:annotation>

<xsd:documentation>

Preferred service speed window maximum in knots.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="routeChangesHistory" type="xsd:string">

<xsd:annotation>

<xsd:documentation>Route changes history.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

</xsd:complexType>

<!--

```
<!-- "LengthType" element type definition -->
<!--
                                          -->
<xsd:simpleType name="LengthType">
 <xsd:annotation>
   <xsd:documentation>Length type.</xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:decimal">
   <xsd:minInclusive value="0.0"/>
 </xsd:restriction>
</xsd:simpleType>
<!--
                                         -->
<!-- "SpeedType" element type definition -->
<!--
                                         -->
<xsd:simpleType name="SpeedType">
 <xsd:annotation>
   <xsd:documentation>Speed type.</xsd:documentation>
 </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
   <xsd:minInclusive value="0.0"/>
 </xsd:restriction>
</xsd:simpleType>
<!--
                               -->
<!-- Extension type definition -->
<!--
                               -->
<re><xsd:complexType name="Extension">
 <xsd:annotation>
   <xsd:documentation>
     You can add extend RTZ by adding your own elements from another schema here.
   </xsd:documentation>
  </xsd:annotation>
 <xsd:sequence>
    <xsd:any namespace="##any" processContents="lax" minOccurs="0" maxOccurs="unbounded">
     <xsd:annotation>
       <xsd:documentation>
```

You can add extend RTZ by adding your own elements from another schema

```
here.
       </xsd:documentation>
     </xsd:annotation>
   </xsd:any>
 </xsd:sequence>
 <xsd:attribute name="manufacturer" type="NonEmptyString" use="required">
   <xsd:annotation>
     <xsd:documentation>Unique vendor identifier.</xsd:documentation>
   </xsd:annotation>
 </xsd:attribute>
 <xsd:attribute name="name" type="NonEmptyString" use="required">
   <xsd:annotation>
     <xsd:documentation>Extension name.</xsd:documentation>
   </xsd:annotation>
 </xsd:attribute>
 <xsd:attribute name="version" type="NonEmptyString">
   <xsd:annotation>
     <xsd:documentation>Extension version.</xsd:documentation>
   </xsd:annotation>
 </xsd:attribute>
 <re><xsd:anyAttribute processContents="skip"/>
</xsd:complexType>
<!--
                                    -->
<!-- NonEmptyString type definition -->
<!--
                                    -->
<xsd:simpleType name="NonEmptyString">
 <xsd:annotation>
   <xsd:documentation>Non-empty string.</xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:string">
   <xsd:minLength value="1"/>
   <xsd:pattern value=".*[0-9a-zA-Z].*"/>
 </xsd:restriction>
</xsd:simpleType>
<!--
                                     -->
```

```
<!-- Extensions type definition -->
<!--
                                   -->
<xsd:complexType name="Extensions">
 <xsd:annotation>
   <xsd:documentation>
     You can add extend RTZ by adding your own elements from another schema here.
   </xsd:documentation>
 </xsd:annotation>
 <xsd:sequence>
   <xsd:element name="extension" type="Extension" minOccurs="0" maxOccurs="unbounded">
     <xsd:annotation>
       <xsd:documentation>Extension.</xsd:documentation>
     </xsd:annotation>
   </xsd:element>
 </xsd:sequence>
</xsd:complexType>
<!--
                                         -->
<!-- "Waypoints" element type definition -->
< ! - -
                                         -->
<xsd:complexType name="Waypoints">
 <xsd:sequence>
   <xsd:element name="defaultWaypoint" type="DefaultWaypoint" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <re><xsd:documentation>Waypoint defaults.</re>
     </xsd:annotation>
   </xsd:element>
   <xsd:element name="waypoint" type="Waypoint" minOccurs="2" maxOccurs="unbounded">
     <xsd:annotation>
       <xsd:documentation>Waypoint details.</xsd:documentation>
     </xsd:annotation>
    </xsd:element>
   <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <xsd:documentation>
         You can add extend RTZ by adding your own elements from another schema
```

here.

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```
</xsd:documentation>
     </xsd:annotation>
   </xsd:element>
  </xsd:sequence>
</xsd:complexType>
<!--
                                               -->
<!-- "DefaultWaypoint" element type definition -->
<!--
                                               -->
<xsd:complexType name="DefaultWaypoint">
 <xsd:sequence>
   <rpre><xsd:element name="leg" type="Leg" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <xsd:documentation>Leg attributes.</xsd:documentation>
     </xsd:annotation>
   </xsd:element>
   <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <xsd:documentation>
         You can add extend RTZ by adding your own elements from another schema
         here.
       </xsd:documentation>
     </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
 <xsd:attribute name="radius" type="RadiusType">
   <xsd:annotation>
     <xsd:documentation>Turn radius in NM.</xsd:documentation>
    </xsd:annotation>
 </xsd:attribute>
</xsd:complexType>
<!--
                                          -->
<!-- "RadiusType" element type definition -->
<!--
                                         -->
<xsd:simpleType name="RadiusType">
 <xsd:annotation>
```

```
<xsd:documentation>Radius type.</xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:decimal">
   <xsd:minInclusive value="0.0"/>
   <xsd:maxInclusive value="5.0"/>
 </xsd:restriction>
</xsd:simpleType>
<!--
                                        -->
<!-- "Waypoint" element type definition -->
<!--
                                        -->
<xsd:complexType name="Waypoint">
 <xsd:sequence>
   <xsd:element name="position" type="GM Point" minOccurs="1" maxOccurs="1">
     <xsd:annotation>
       <re><xsd:documentation>Geographic point.</rest:documentation>
     </xsd:annotation>
   </xsd:element>
    <rpre><xsd:element name="leg" type="Leg" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <re><xsd:documentation>Leg attributes.</re>
     </xsd:annotation>
   </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <xsd:documentation>
         You can add extend RTZ by adding your own elements from another schema
         here.
        </xsd:documentation>
     </xsd:annotation>
    </xsd:element>
 </xsd:sequence>
 <xsd:attribute name="id" type="xsd:nonNegativeInteger" use="required">
    <xsd:annotation>
     <xsd:documentation>
       Unique waypoint identifier.
```

</xsd:documentation>

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```
</xsd:annotation>
  </xsd:attribute>
 <xsd:attribute name="revision" type="xsd:nonNegativeInteger" use="required">
   <xsd:annotation>
     <xsd:documentation>
       Waypoint revision. Increased on every change.
     </xsd:documentation>
   </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="name" type="xsd:string">
   <xsd:annotation>
     <xsd:documentation>
      Waypoint name.
     </xsd:documentation>
   </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="radius" type="RadiusType">
   <xsd:annotation>
     <xsd:documentation>
      Turn radius in NM.
     </xsd:documentation>
   </xsd:annotation>
 </xsd:attribute>
</xsd:complexType>
<!--
                                   -->
<!-- "Leg" element type definition -->
<!--
                                  -->
<xsd:complexType name="Leg">
 <xsd:sequence>
   <rpre><xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <xsd:documentation>
         You can add extend RTZ by adding your own elements from another schema
         here.
       </xsd:documentation>
```

</xsd:annotation>

```
</xsd:element>
```

- </xsd:sequence>
- <xsd:attribute name="starboardXTD" type="XtdType">
 - <xsd:annotation>
 - <xsd:documentation>Starboard XTD in NM.</xsd:documentation>
 - </xsd:annotation>
- </xsd:attribute>
- <xsd:attribute name="portsideXTD" type="XtdType">
 - <xsd:annotation>
 - <xsd:documentation>Port XTD in NM.</xsd:documentation>
 - </xsd:annotation>
- </xsd:attribute>

<xsd:attribute name="safetyContour" type="LengthType">

- <xsd:annotation>
 - <xsd:documentation>Safety contour in metres.</xsd:documentation>
- </xsd:annotation>
- </xsd:attribute>
- <xsd:attribute name="safetyDepth" type="LengthType">
 - <xsd:annotation>
 - <xsd:documentation>Safety depth in metres.</xsd:documentation>
 - </xsd:annotation>
- </xsd:attribute>
- <xsd:attribute name="geometryType" type="GeometryType">
 - <xsd:annotation>
 - <xsd:documentation>Geometry type of leg.</xsd:documentation>
 - </xsd:annotation>
- </xsd:attribute>
- <xsd:attribute name="speedMin" type="SpeedType">
 - <xsd:annotation>
 - <xsd:documentation>Lowest cruising speed in knots.</xsd:documentation>
 - </xsd:annotation>
- </xsd:attribute>
- <xsd:attribute name="speedMax" type="SpeedType">
 - <xsd:annotation>
 - <xsd:documentation>Highest allowed speed in knots.</xsd:documentation>
 - </xsd:annotation>
- </xsd:attribute>

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```
<xsd:attribute name="draughtForward" type="LengthType">
 <xsd:annotation>
   <xsd:documentation>Static draught forward in metres.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<re><xsd:attribute name="draughtAft" type="LengthType">
 <xsd:annotation>
   <xsd:documentation>Static draught aft in metres.</xsd:documentation>
 </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="staticUKC" type="LengthType">
 <xsd:annotation>
   <xsd:documentation>Minimum UKC on the leg.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="dynamicUKC" type="LengthType">
 <xsd:annotation>
   <xsd:documentation>Minimum dynamic UKC on the leg.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<rpre><xsd:attribute name="masthead" type="LengthType">
 <xsd:annotation>
   <xsd:documentation>Height of masthead.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="legReport" type="xsd:string">
 <xsd:annotation>
   <xsd:documentation>Reporting information.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<xsd:attribute name="legInfo" type="xsd:string">
 <xsd:annotation>
   <xsd:documentation>Nice to know.</xsd:documentation>
  </xsd:annotation>
</xsd:attribute>
<rpre><xsd:attribute name="legNote1" type="xsd:string">
 <xsd:annotation>
```

<xsd:documentation>Notes regarding the ETD/ETA.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="legNote2" type="xsd:string">

-->

<xsd:annotation>

<xsd:documentation>Local remarks.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

</xsd:complexType>

<!--

<!-- XTD type definition -->

<!--->

<xsd:simpleType name="XtdType">

<xsd:annotation>

<xsd:documentation>

XTD of the point. Nautical miles.

</xsd:documentation>

</xsd:annotation>

```
<xsd:restriction base="xsd:decimal">
```

<xsd:minInclusive value="0.0"/>

<re><xsd:maxExclusive value="10.0"/>

</xsd:restriction>

</xsd:simpleType>

<!-- -->
<!-- -->
<!-- "geometry/geopoint" element type definition --->
<!-- -->
<xsd:complexType name="GM_Point">
<xsd:complexType name="GM_Point">
<xsd:attribute name="lat" type="LatitudeType" use="required">
<xsd:attribute name="lat" type="LatitudeType" use="required">
<xsd:annotation>
</xsd:annotation>
</xsd:annotation>
</xsd:attribute name="lon" type="LongitudeType" use="required">
<xsd:annotation>
</xsd:attribute name="lon" type="LongitudeType" use="required">
</xsd:annotation>

<xsd:documentation>Longitude in degrees.</xsd:documentation>

</xsd:annotation>

```
</xsd:attribute>
</xsd:complexType>
< ! --
                                     -->
<!-- RL/GC indicator type definition -->
<!--
                                     -->
<xsd:simpleType name="GeometryType">
 <xsd:annotation>
   <xsd:documentation>RL/GC indicator.</xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:string">
   <xsd:enumeration value="Loxodrome"/>
   <xsd:enumeration value="Orthodrome"/>
 </xsd:restriction>
</xsd:simpleType>
<!--
                                            -->
<!-- Geographical latitude type definition -->
< ! - -
                                           -->
<re><xsd:simpleType name="LatitudeType">
 <xsd:annotation>
   <xsd:documentation>
     The latitude of the point. Decimal degrees, WGS84 datum.
   </xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:decimal">
   <xsd:minInclusive value="-90.0"/>
   <re><xsd:maxInclusive value="90.0"/>
 </xsd:restriction>
</xsd:simpleType>
<!--
                                             -->
<!-- Geographical longitude type definition -->
<!--
                                            -->
<re><xsd:simpleType name="LongitudeType">
 <xsd:annotation>
```

```
<xsd:documentation>
      The longitude of the point. Decimal degrees, WGS84 datum.
   </xsd:documentation>
  </xsd:annotation>
 <xsd:restriction base="xsd:decimal">
   <xsd:minInclusive value="-180.0"/>
   <xsd:maxExclusive value="180.0"/>
 </xsd:restriction>
</xsd:simpleType>
< ! --
                                         -->
<!-- "Schedules" element type definition -->
<!--
                                         -->
<xsd:complexType name="Schedules">
 <xsd:sequence>
   <xsd:element name="schedule" type="Schedule" minOccurs="0" maxOccurs="unbounded">
     <xsd:annotation>
       <xsd:documentation>Schedule definition.</xsd:documentation>
     </xsd:annotation>
   </xsd:element>
   <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
     <xsd:annotation>
       <xsd:documentation>
         You can add extend RTZ by adding your own elements from another schema
         here.
       </xsd:documentation>
     </xsd:annotation>
   </xsd:element>
  </xsd:sequence>
</xsd:complexType>
<!--
                                                  -->
<!-- "schedules/schedule" element type definition -->
<!--
                                                  -->
<re><xsd:complexType name="Schedule">
 <xsd:annotation>
   <xsd:documentation>
```

Schedule definition.

</xsd:documentation>

</xsd:annotation>

<xsd:sequence>

<xsd:element name="manual" type="Manual" minOccurs="0" maxOccurs="1">

<xsd:annotation>

<xsd:documentation>

Manual schedule values definition.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

<xsd:element name="calculated" type="Calculated" minOccurs="0" maxOccurs="1">

<xsd:annotation>

<xsd:documentation>

Calculated schedules.

</xsd:documentation>

</xsd:annotation>

```
</xsd:element>
```

<xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">

<xsd:annotation>

<xsd:documentation>

You can add extend RTZ by adding your own elements from another schema

here.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

</xsd:sequence>

<xsd:attribute name="id" type="xsd:nonNegativeInteger" use="required">

<xsd:annotation>

<xsd:documentation>

Schedule name.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<re><xsd:attribute name="name" type="xsd:string">

<xsd:annotation>

<xsd:documentation>

Schedule name.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

</xsd:complexType>

<!--

<!-- "Manual" element type definition -->

<!--

<xsd:complexType name="Manual">

<xsd:annotation>

<xsd:documentation>User defined schedule parameters.</xsd:documentation>

-->

-->

</xsd:annotation>

<xsd:sequence>

<xsd:element name="scheduleElement" type="ScheduleElement" minOccurs="1"
maxOccurs="unbounded">

<xsd:annotation>

<xsd:documentation>

Manual schedule leg definition.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

<xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">

-->

<xsd:annotation>

<xsd:documentation>

You can add extend RTZ by adding your own elements

from another schema here.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

</xsd:sequence>

</xsd:complexType>

<!-- "Calculated" element type definition -->

<xsd:complexType name="Calculated">

<xsd:annotation>

<!--

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```
<xsd:documentation>
```

Calculated schedule parameters.

</xsd:documentation>

</xsd:annotation>

<xsd:sequence>

<xsd:element name="scheduleElement" type="ScheduleElement" minOccurs="0"
maxOccurs="unbounded">

<xsd:annotation>

<xsd:documentation>

Calculated schedule waypoint parameters.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

<xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">

<xsd:annotation>

<xsd:documentation>

You can add extend RTZ by adding your own elements

from another schema here.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

</xsd:sequence>

</xsd:complexType>

<!--

<!-- "ScheduleElement" element type definition -->

<!--

<re><xsd:complexType name="ScheduleElement">

<xsd:sequence>

<rpre><xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">

-->

-->

<xsd:annotation>

<xsd:documentation>

You can add extend RTZ by adding your own elements from another schema

here.

</xsd:documentation>

</xsd:annotation>

</xsd:element>

</xsd:sequence>

<xsd:attribute name="waypointId" type="xsd:nonNegativeInteger" use="required">

<xsd:annotation>

<xsd:documentation>Unique waypoint identifier.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="etd" type="xsd:dateTime">

<xsd:annotation>

<xsd:documentation>

UTC estimated departure time in ISO 8601 format.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="etdWindowBefore" type="xsd:duration">

<xsd:annotation>

<xsd:documentation>

The maximum value of time interval prior to the ETD used to adjust the ETD to get

the earliest probable date/time.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="etdWindowAfter" type="xsd:duration">

<xsd:annotation>

<xsd:documentation>

The maximum value of time interval after the ETD used to adjust the ETD to get the

latest probable date/time.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="eta" type="xsd:dateTime">

<xsd:annotation>

<xsd:documentation>

UTC estimated arrival time in ISO 8601 format.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="etaWindowBefore" type="xsd:duration">

<xsd:annotation>

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<xsd:documentation>

The maximum value of time interval prior to the ETA used to adjust the ETA to get the earliest probable date/time.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="etaWindowAfter" type="xsd:duration">

<xsd:annotation>

<xsd:documentation>

The maximum value of time interval after the ETA used to adjust the ETA to get the Latest probable date/time.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="stay" type="xsd:duration">

<xsd:annotation>

<xsd:documentation>Stay time on WP.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="speed" type="SpeedType">

<xsd:annotation>

<xsd:documentation>True speed in knots.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<rpre><xsd:attribute name="speedWindow" type="SpeedType">

<xsd:annotation>

<xsd:documentation>

Describes the uncertainty of the predicted speed after optimization in knots.

</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="windSpeed" type="SpeedType">

<xsd:annotation>

<xsd:documentation>True wind speed in knots.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="windDirection" type="CourseType">

```
<xsd:annotation>
```

<xsd:documentation>True wind direction in degrees.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="currentSpeed" type="SpeedType">

<xsd:annotation>

<xsd:documentation>Current speed in knots.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="currentDirection" type="CourseType">

<xsd:annotation>

<xsd:documentation>Current direction in degrees.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="windLoss" type="SpeedType">

<xsd:annotation>

<xsd:documentation>Speed loss caused by wind in knots.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="waveLoss" type="SpeedType">

<xsd:annotation>

<xsd:documentation>Speed loss caused by wave.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<re><xsd:attribute name="totalLoss" type="SpeedType">

<xsd:annotation>

<xsd:documentation>Total speed loss.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<xsd:attribute name="rpm" type="xsd:nonNegativeInteger">

<xsd:annotation>

<xsd:documentation>Advised Engine RPM.</xsd:documentation>

</xsd:annotation>

</xsd:attribute>

<re><xsd:attribute name="pitch" type="xsd:integer">

<xsd:annotation>

<xsd:documentation>Advised Engine Pitch.</xsd:documentation>

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```
</xsd:annotation>
  </xsd:attribute>
 <xsd:attribute name="fuel" type="xsd:decimal">
   <xsd:annotation>
     <xsd:documentation>Predicted fuel consumption on leg.</xsd:documentation>
   </xsd:annotation>
 </xsd:attribute>
 <xsd:attribute name="relFuelSave" type="xsd:decimal">
   <xsd:annotation>
     <xsd:documentation>
       Relative fuel saving after optimization in percent.
     </xsd:documentation>
   </xsd:annotation>
  </xsd:attribute>
 <rpre><xsd:attribute name="absFuelSave" type="xsd:decimal">
   <xsd:annotation>
     <xsd:documentation>
      Absolute fuel saving after optimization.
     </xsd:documentation>
   </xsd:annotation>
  </xsd:attribute>
 <xsd:attribute name="Note" type="xsd:string"/>
</xsd:complexType>
< ! - -
                           -->
<!-- Course type definition -->
<!--
                           -->
<rpre><xsd:simpleType name="CourseType">
 <xsd:annotation>
   <xsd:documentation>Course type in degrees.</xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:decimal">
  <xsd:minInclusive value="0.0"/>
   <xsd:maxExclusive value="360.0"/>
 </xsd:restriction>
</xsd:simpleType>
```

</xsd:schema>

Annex B

(normative)

RTZ v1.2 test files

The full test dataset is made available on the CIRM² website at: http://cirm.org/rtz.

B.1 RTZ v1.2 with minimum mandatory elements

| File name | Description |
|----------------|--|
| BasicRoute.rtz | Includes only mandatory attributes in the RouteInfo and Waypoint nodes |

B.2 RTZ v1.2 with leg elements

| File name | Description |
|--------------------------------------|---|
| BasicRouteWithOptionalAttributes.rtz | Includes optional leg attributes in the Waypoint node |

B.3 RTZ v1.2 with all optional elements and attributes

| File name | Description |
|--|--|
| RTZ1.2AllOptionalElementsAndAttributes.rtz | Includes all optional elements and attributes in all nodes |

B.4 RTZ v1.2 not fully conforming to schema (errors)

| File name | Description |
|--|--|
| RouteNameDoesNotMatchFilenameError.rtz | routeName attribute does not match the filename |
| DuplicateWaypointIdError.rtz | First two waypoints have the same id (11 in both cases) |
| MissingWaypointIdError.rtz | First waypoint does not have an id |
| NegativeRevisionError.rtz | First waypoint has the revision value -1 |
| GeometryTypeError.rtz | Contains a leg geometry type of "GreatCircle" |
| NonsenseGeometryTypeError.rtz | Contains a leg geometry type of "Nonsense" |
| ScheduleError.rtz | Contains numerous errors in the schedule node |
| EsotericRouteInfoError.rtz | ValidityPeriodStart is after validityPeriodStop; extension element
in routeInfo is not wrapped in an extensions element (and
extending of routeInfo is not mentioned in std) |
| EsotericScheduleError.rtz | Second schedule contains wind and current directions of 370 and negative speeds; defaultWaypoint leg safetyContour is zero |

² Comité International Radio-Maritime, The International Association for Marine Electronics Companies, www.cirm.org.

B.5 RTZ v1.2 in RTZP data container

| File name | Description |
|----------------------------|--|
| defaultwaypoint.rtzp | RTZP (zip archive with extension .rtzp) containing the mandatory one RTZ file |
| rtzp_with_attachments.rtzp | RTZP (zip archive with extension .rtzp) containing attached files that are referred to in extension elements within the RTZ file |

B.6 RTZ v1.2 with extensions from 3rd party manufacturer

| File name | Description |
|----------------------------|--|
| ManufacturerExtensions.rtz | Includes 3rd party manufacturer extensions in the different Route
Element sections; Check Route has been performed; Voyage
Plan has been created |

B.7 RTZ v1.2 using revision attribute

| File name | Description |
|-----------------------|--|
| RevisionAttribute.rtz | Based on the DefaultWaypoint.rtz test file but every waypoint has a revision attribute starting at waypoint id plus 10 |

B.8 RTZ 1.2 with default waypoint

| File name | Description |
|---------------------|------------------------------------|
| DefaultWaypoint.rtz | Includes full defaultWaypoint node |

Annex C (informative)

UML model of the route plan exchange format (RTZ v.1.2)



IEC

Annex D

(informative)

Comparison of schema versions

Table D.1 contains a list of the substantive changes between version 1.0 and version 1.2 of the schema.

| Change | Impact |
|--|---|
| Schema definition
"attributeFormDefault" changed from
"qualified" to "unqualified" | Elements from the target namespace no longer need to be qualified with the namespace prefix |
| Units of "Max wind speed limit of ship"
changed from "decimal" to
"SpeedType" | This change was for consistency with other speeds in the schema, but
has the effect of changing the units from m/s to knots. It only impacts
systems that define the maximum wind speed limit of a ship (likely to
be a very small number). Such equipment will need to be able to
support both versions of schema. |
| Type of "routeChangesHistory"
attribute corrected from "SpeedType"
to "string" | The original schema definition erroneously defined the change history
to be a value in knots. This meant that a compliant implementation of
routeChangesHistory was impossible. New version makes it possible
to document changes to the route within the RTZ file. Previously, RTZ
files containing a change history would likely fail schema validation
and be rejected or need to be validated against a non-conformant
schema, or not validated at all. |
| "Extensions" type name corrected to
"Extension" | Corrects a typographical error in the original schema which made it
impossible to define manufacturers' extensions that were also
conformant to the schema, hence RTZ files with extensions would
either fail schema validation and be rejected, or need to be validated
against a non-conformant schema, or not validated at all. |
| "processContents" = "skip" changed to
"lax" | Improves validation of RTZ files by ensuring that recognised
extensions are validated but unrecognised extensions don't cause an
error. Previously, extensions were not validated at all, potentially a
cyber vulnerability. |
| Adds "manufacturer", "name" and "version" attributes | These attributes, defined in the IEC 61174:2015 Figure S.3 (UML diagram), were erroneously omitted from the v1.0 schema, meaning that there was no documented method to identify what manufacturers' extensions existed in the route file. |
| Add "Extensions" element | The complete absence of the "Extensions" element from the 1.0 schema (in conflict with the IEC 61174:2015 Figure S.3 UML diagram) made it challenging to implement compliant manufacturers' extensions. |
| "RadiusType" max value reduced from 10 to 5 NM | Max turn radius is now lower, based on the experience of the STM project |
| "sheduleElement" changed to
"scheduleElement" | Corrects a typographical error in the original schema, which was in conflict with the IEC 61174:2015 Figure S.3 UML diagram. |
| Type of "etdWindowBefore",
"etaWindowAfter" and "stay" changed
from "time" to "duration" | Original schema was inconsistently interpreted – some implementers interpreted these as time durations (based on +/- in front of time) and others interpreted as times of day (based on hhmmss), so standardised use of these fields across 3 rd parties was impossible. |
| Type of "speedWindow" changed from
"decimal" to "SpeedType" | More formal definition of the field |
| "absFuelSace" changed to
"absFuelSave" | Typo in attribute name corrected |
| "Extensions" added to "Leg" element | This was missing from the original schema, which was in conflict with the IEC 61174:2015 Figure S.3 UML diagram. |

Table D.1 – Schema changes

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Bibliography

ISO 8601, Data elements and interchange formats – Information interchange – Representation of dates and times

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