Annex S
(normative)

Route plan format for export and import – RTZ

S.1 General

This route plan exchange format is intended be used for many purposes. It can be used for storing and transferring route data inside single program system from the same vendor (containing one or more ECDIS/Radar applications running on single or multiple workstations etc.) as well as for route data exchange between different program systems from different vendors (i.e. between ECDIS and route optimization systems or between on-board and shore systems).

RTZ 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.

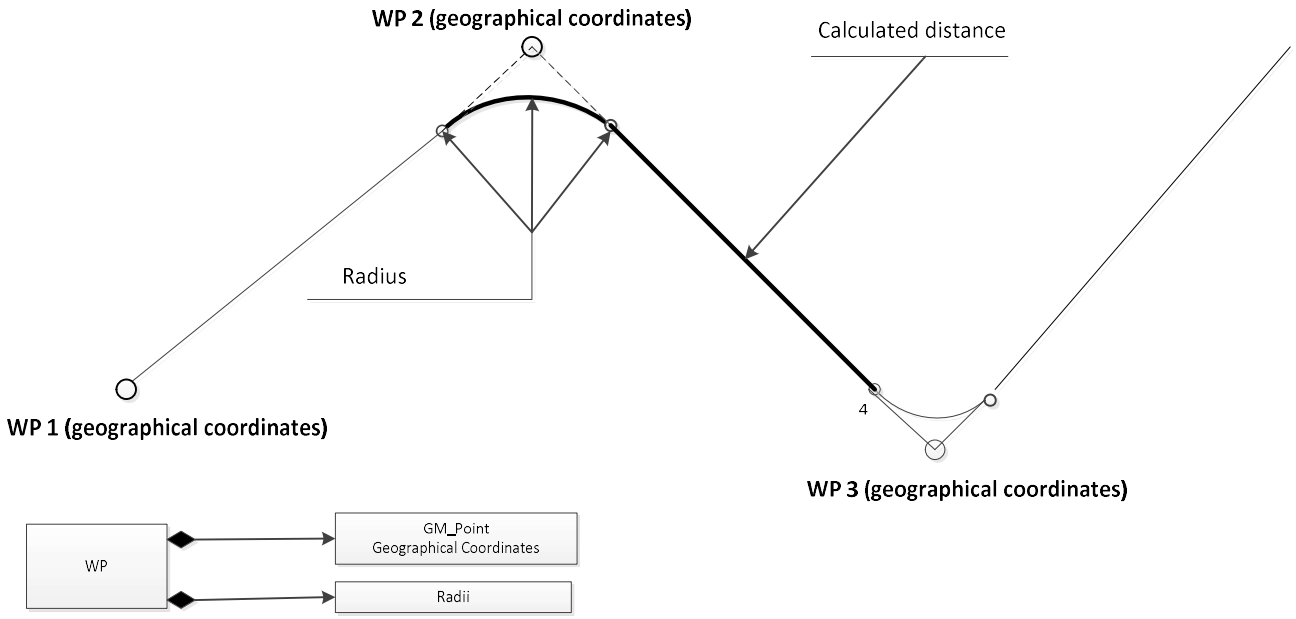
The RTZ format considers a route as a collection of waypoint elements. Single waypoint element contains both inherent waypoint data (i.e. coordinates, name etc.) as well as data related to the route leg directed to this waypoint (i.e. speed on the leg, cross-track deviation limits etc.). Description of route plans is shown in **Figure S.1**. The RTZ format is based on XML. The XML route exchange file uses the extension **.rtz**. A description of the RTZ format is given in Clause S.5. Examples of RTZ format routes are given in **Clauses S.7** and **S.9**.

Clause S.6 gives an XML schema to be met by RTZ route files so that their structure and content can be verified.

NOTE 1 This route exchange format has some limitations for applicability due to the simple geometric mode used. Application for latitudes above 70º 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 2 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 3 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.



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

Figure S.1 – Description of route plan – distance between WP 2 and WP 3

S.2 RTZP Data container

RTZP data containers are used as a means of reducing route data size as well as binding separate files together into a single unit. They are, actually, ZIP archives containing single RTZ file with some optional attachment files.

The container file **.rtzp** stores a XML file **.rtz**, which conforms to the XML schema described in Clause S.6.

Use of the data container is optional. In this case the route exchange may be used with or without the data container. When used without the data container the filename of the route exchange is **.rtz** instead of **.rtzp**.

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

For example:

```
  <extensions>
    <extension manufacturer="Acme" version="2.1"
      name="AuxRouteInfo-9674F26E-EAFB-4319-AE24-08D5BA69D895">
      <property name="source"

value="http://services.acme.com/auto route/?id=3e891884e620970e5303fd2399427986"/>
      <property name="attachment" value="rtz://assignement-13.04.2013.docx"/>
      <property name="attachment" value="rtz://MFD_original.rt3"/>
    </extension>
  </extensions>
  <extensions>
```

S.3 High-level description of the RTZ format

Logical design of a route consists of three independent units:

- block with general information about the route;
- block with route geography (geometry) information which consists of blocks describing individual legs. Legs are listed in the order they appear on the route;
- block that contains a set of route schedules.

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

S.4 Adaptation to the third-party extensions

S.4.1 General idea

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

There is a need to ensure that possibility to keep extensions from different manufacturers in a single file.

S.4.2 Unique identification of a waypoint

Each waypoint in a route has a unique composite ID.

It is assumed that all RTZ extensions use this identifier to link their data to geography.

The identifier consists of two parts:

- **id**, which allows to find a waypoint in the list;
- **revision**, which allows to determine modification of waypoint since the entry of the data into a file extension.

id is an integer

revision is a monotonically increasing integer.

S.4.3 Creation of new waypoints

After creation of the waypoint **revision** attribute gets the value of 0.

S.4.4 Change of geographic data for a waypoint

When the data of a waypoint changes, the software should increase revision number **revision**, so that third-party software that works with extension, is able to find out that the data to which it is associated is no longer valid.

S.4.5 Waypoints removal

When deleting a waypoint from a route, all the waypoint data including schedule data is deleted and the waypoint numbers within the route are updated.

Responsibility for extension's data modification is assigned to manufacturer’s code only.

The data that software is not able to recognize (e.g. extensions and options) are written back in the modified file without modification.

It is assumed that the receiver which understands extensions is able to filter out data when reading the route and be able to eliminate the data of extensions related to removed or related to non-existent waypoints.

S.5 Detailed RTZ format description

S.5.1 File components

The RTZ file consists of:

- mandatory XML processing instruction, which allows to specify the encoding of string data;
- root <route> element, which includes the URIs of the standard namespace http://www.w3.org/2001/XMLSchema-instance as well as RTZ namespace http://www.cirm.org/RTZ/1/1;
- version attribute of the format as **"Major.Minor"** (currently "1.1").

The preferred file encoding is UTF-8.

S.5.2 route element description

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

It has one mandatory attribute "version" that contains a version of the RTZ format used during file creation.

Version is specified as a combination of two numbers separated with dot. The first figure corresponds to the major version. It shall be changed in a case of significant modifications of document structure. Formats with different major-versions are incompatible.

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

route element consists of a sequence of the following child elements:

- **routeInfo** element that contains basic information on the route;
- **waypoints** element that describes the geographical components of the route;
- **schedules** element that describes calculated schedule and timing defined by a user;
- **extensions** element that allows for extending the format to fit particular needs of a manufacturer.

S.5.3 routeInfo element description

routeInfo element provides a place to store information related to the whole route.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
routeName	name of the route	xsd:string	Mandatory	It cannot be empty
routeAuthor	Author of route	xsd:string	Option	
routeStatus	Status of route	xsd:string	Option	Free text description of the route status for the human reading
validityPeriodStart	Start of validity period	xsd:dateTime	Option	
validityPeriodStop	Stop of validity period	xsd:dateTime	Option	
vesselName	Ship's name	xsd:string	Option	
vesselMMSI	Ship's MMSI	xsd:nonNegativeInteger	Option	
vesselIMO	Ship's IMO number	xsd:nonNegativeInteger	Option	
vesselVoyage	Number of the voyage	xsd:string	Mandatory	Unique Voyage ID

Attribute	Description	Format	Status	Comment
vesselDisplacement	Ship's displacement	xsd:nonNegativeInteger	Option	Unit: tons
vesselCargo	Ship's cargo	xsd:nonNegativeInteger	Option	Unit: tons
vesselGM	Metacentric height	xsd:decimal	Option	Metacentric height of the ship for intended voyage. Unit: metres. Non-negative.
optimizationMethod	Route is optimized to meet KPI	xsd:string	Option	Could be Fix speed, Lowest Fuel Consumption, Fixed ETA
vesselMaxRoll	Ship's max roll angle allowed	xsd:nonNegativeInteger	Option	Unit: degrees
vesselMaxWave	Ship significant wave height limit	xsd:decimal	Option	Unit: metres. At least 1 digit after point. Non-negative.
vesselMaxWind	Ship's max wind speed limit	xsd:decimal	Option	Unit: in knots. At least 1 digit after point. Non-negative.
vesselSpeedMax	Ship's max speed	xsd:decimal	Option	Speed through water. Unit: knots. At least 1 digit after point. Non-negative.
vesselServiceMin	Ship's preferred service speed window_min	xsd:decimal	Option	Speed through water. Unit: knots. At least 1 digit after point. Non-negative.
vesselServiceMax	Ship's preferred service speed window_max	xsd:decimal	Option	Speed through water. Unit: knots. At least 1 digit after point. Non-negative.
routeChangesHistory	Cause of route change, Originator and Reason	xsd:string	Option	Free text description of the route changes for the human reading

For example:

```
<routeInfo routeName="AROUNDtheSKAGEN"
    routeAuthor="Simon Ross"
    routeStatus="Checked by Captain"
    validityPeriodStart="2016-10-20T03:15:00Z"
    validityPeriodStop="2016-10-22T10:15:00Z"
    vesselName="Pegasus"
    vesselMMSI="220348970"
    vesselIMO="3798347"
    vesselVoyage="urn:mrn:stm:voyage:id:acme:b6d7b492-ab3c-42f2-8afd-116c3d872f0c"
    vesselDisplacement="157"
    vesselCargo="14"
    vesselGM="2.16"
    vesselMaxRoll="17"
    vesselMaxWave="9.4"
    vesselMaxWind="55.3"
    vesselSpeedMax="23.8"
    vesselServiceMin="16.9"
    vesselServiceMax="21.4"
    routeChangesHistory="2016-10-20T11:14:41Z, Simon Ross, initial creation;
        2016-10-21T09:12:29Z, William Brown, corrections for reference points using"/>
```

Additionally, the element may contain child **extensions.**

S.5.3.1 routeInfo element STM extension

All STM extensions are put in RTZ extensions only.

routeInfoEx is an extension for **routeInfo** element.

Attribute	Description	Format	Status	Comment
routeStatusEnum	Route status number	xsd:integer	Mandatory	Route status should be a number (see S.5.3.2)
routeVersion	Version of the route	xsd:string	Option	Free route version number, GUID, etc
personsOnBoard	Ship's passengers including crew	xsd:nonNegativeInteger	Option	Number of passengers, including crew
routeChanges	Structured container of the route changes	RouteChanges type	Option	See S.5.3.3
depPort	Departure Port	xsd:string	Option	UN/LOCODE, 5 Characters without spacing
arrPort	Arrival Port	xsd:string	Option	UN/LOCODE 5 Characters without spacing
depPortCallId	Port Call Identifier for Departure Port	xsd:string	Option	Unique **Port Call Identifier** in departing port in MRN format
arrPortCallId	Port Call Identifier for Arrival Port	xsd:string	Option	Unique **Port Call Identifier** in arriving port in MRN format
startSeaPassage	WP and its type, where Sea passage starts	xsd:string	Option	The name of PortCDM LocationType and correlated waypoint representing start of sea passage
endSeaPassage	WP and its type, where Sea passage ends	xsd:string	Option	The name of PortCDM LocationType and correlated waypoint representing end of sea passage

- Description for the **depPortCallId** and **arrPortCallId**. These fields should correspond to the **Port Call Identifier (UPCID)** format (pattern) and do not exceed 120 symbols:

  <xs:pattern value="**urn:mrn:stm:portcdm:port_call:[A-Z]{5}:[A-Za-z0-9()+,\-.:=@;$_!*'%/?#]+**"/>

  Example of the **Port Call Identifier (UPCID): urn:mrn:stm:portcdm:port_call:SEGOT:C44928d8-0e93-46Be-baf9-b824e0fdbe90**

- Description for the **startSeaPassage** and **endSeaPassage**. These fields should correspond to the **Port Call Identifier (UPCID)** format according to **arrivalLocation** or **departureLocation** format. Where, **LogicalLocation** should be specified according to the PCM format, and additionally it is recommended to specify the WP ID for this LogicalLocation after the colon symbol. Examples:

  startSeaPassage="BERTH:WP2"/>
  endSeaPassage="LOC:WP311"/>
  endSeaPassage="PILOT_BOARDING_ AREA:WP56"/>

Logical Location LOC shall be used for the any specified Waypoint by default.

S.5.3.2 routeStatus description

The routeStatus field should be used to inform about the status of the route in order to support the various scenarios, e.g. route optimization and crosschecking. Note that there is no requirement to use these statuses during voyage planning, but as a rule, the route must have a status. The intention with status 8, inactive, is to be able to inform subscribers to a voyage plan that the voyage has been completed or cancelled, e.g. if a voyage is cancelled possible previous subscribers need to be made aware about this whether or not they are given access rights to the voyage that “replaces” cancelled one.

Route Status	Name	Description
1	Original	Template or basic voyage planned and received from shore
2	Planned for voyage	Route and schedule prepared by crew
3	Optimized	Route and schedule optimized by 3rd party service provider
4	Cross Checked	Route verified by 3rd party
5	Safety Checked	Safety check by ECDIS/crew
6	Approved	Approved by master
7	Used for monitoring	Loaded in ECDIS for monitoring
8	Inactive	Voyage completed or cancelled

S.5.3.3 routeChanges description

routeChanges element is a container of **historyItem** elements, every one of which contains the following attributes:

Attribute	Description	Format	Status	Comment
dateTime	Date and time of the change.	xsd:dateTime	Mandatory	
author	The author of the change.	xsd:string	Mandatory	It cannot be empty.
reason	The reason of change.	xsd:string	Option	

For example:

```
    <routeInfo routeName="AROUNDtheSKAGEN"
        routeAuthor="Simon Ross"
        routeStatus="7"
        validityPeriodStart="2016-10-20T03:15:00Z"
        validityPeriodStop="2016-10-22T10:15:00Z"
        vesselName="Pegasus"
        vesselMMSI="220348970"
        vesselIMO="3798347"
        vesselVoyage="urn:mrn:stm:voyage:id:acme:b6d7b492-ab3c-42f2-8afd-116c3d872f0c"
        vesselDisplacement="157"
        vesselCargo="14"
        vesselGM="2.16"
        vesselMaxRoll="17"
        vesselMaxWave="9.4"
        vesselMaxWind="55.3"
        vesselSpeedMax="23.8"
        vesselServiceMin="16.9"
        vesselServiceMax="21.4"
        routeChangesHistory="2016-10-20T11:14:41Z, Simon Ross, initial creation;
            2016-10-21T09:12:29Z, William Brown,
            corrections for reference points using">
        <extensions>
            <extension xsi:type="stm:RouteInfoExtension" manufacturer="STM" version="1.0.0"
                name="RouteInfoEx"
                routeStatusEnum="7"
                routeVersion="7D1DFAEC-3521-49D1-9EB1-E81805C43CFE"
                personsOnBoard="28"
                depPort="RULED"
                arrPort="SEGOT"
                depPortCallId="urn:mrn:stm:portcdm:port_call:RULED:C44928d8-0e93-46Be-
                    baf9-b824e0fdbe90"
                arrPortCallId="urn:mrn:stm:portcdm:port_call:SEGOT:D44928d8-0e93-46Be-
                    baf9-b824e0fdbe80"
                startSeaPassage="PILOT_BOARDING_AREA:WP3"
                endSeaPassage="BERTH:WP209">
                <stm:routeChanges>
                    <stm:historyItem dateTime="2016-10-20T11:14:41Z" author="Simon Ross"
                        reason="initial creation"/>
                    <stm:historyItem dateTime="2016-10-21T09:12:29Z" author="William Brown"
                        reason="corrections for reference points using"/>
                </stm:routeChanges>
            </extension>
        </extensions>
    </routeInfo>
```

S.5.4 waypoints element description

The **waypoints** element contains data related to geometry of the route.

It consists of **waypoint** elements (not less than two) that describe every leg of the route.

The order of **waypoint** elements follows the order of legs.

Before the sequence of **waypoint** elements, it is possible to insert **defaultWaypoint** element, which defines default values of attributes for newly created legs except geometry data.

For example:

```
<waypoints>
    <defaultWaypoint radius="0.25">
        <leg geometryType="Orthodrome"/>
    </defaultWaypoint>
    <waypoint id="4">
        <position lat="53.01323" lon="8.92837"/>
    </waypoint>
    <waypoint id="5">
        <position lat="53.05134" lon="8.87509"/>
        <leg starboardXTD="0.22" portsideXTD="0.10"/>
    </waypoint>
    <waypoint id="6">
```

```
        <position lat="53.14133" lon="8.80325"/>
        <leg starboardXTD="0.25" portsideXTD="0.40"/>
    </waypoint>
</waypoints>
```

Additionally, the element may contain child **extensions** element that allow extending the format to fit particular needs of a manufacturer.

S.5.5 defaultWaypoint element description

defaultWaypoint element allows the definition of default values of attributes for newly created waypoints.

For example:

```
<waypoints>
    <defaultWaypoint radius="0.25">
        <leg starboardXTD="0.31"
            portsideXTD="0.17"
            safetyContour="9.1"
            safetyDepth="9.1"
            geometryType="Orthodrome"
            speedMin="22.3"
            speedMax="25.8"
            draughtForward="8.9"
            draughtAft="9.1"
            staticUKC="0.9"
            dynamicUKC="0.6"
            masthead="21.3"/>
    </defaultWaypoint>
```

If the **defaultWaypoint** element is provided, it shall contain values for some attributes in those waypoints where these attributes are not given.

For example:

`<waypoints>`
`  <defaultWaypoint radius="1.40">`
`  <leg starboardXTD="0.30" portsideXTD="0.30"`
`  geometryType="Loxodrome"/>`
`  </defaultWaypoint>`
	Defaults settings for all waypoints

`  <waypoint id="3" rev="1"/>`
`  <position lat="53.04921" lon="8.87731"/>`
`  </waypoint>`
	For this waypoint default settings applied

`  <waypoint id="5" rev="3" radius="0.30">`
`  <position lat="53.05130" lon="8.87509"/>`
`  <leg starboardXTD="0.40" portsideXTD="0.50"`
`  geometryType="Orthodrome"/>`
`  </waypoint>`
	For this waypoint user settings applied:
	Port XTD = 0.50 NM
	Starboard XTD = 0.40 NM
	Turn radius = 0.30 NM
	Geometry type is orthodrome

S.5.6 waypoint element description

waypoint element contains the geographical description of a leg between waypoints.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
id	Unique identifier	xsd:nonNegativeInteger	Mandatory	

Attribute	Description	Format	Status	Comment
revision	Waypoint revision	xsd:nonNegativeInteger	Option	Index of revision
name	Waypoint	xsd:string	Option	
radius	Turn radius	xsd:decimal	Option	Unit: NM. At least 2 digits after point. 0 ≤ r ≤ 5.
position	Geographic point	GM_Point	Mandatory	Unit: degrees
leg	Leg attributes	Leg	Option	

position element contains the latitude and longitude of waypoint.

Attribute	Description	Format	Status	Comment
lat	Latitude	xsd:decimal	Mandatory	Unit: degrees with decimal. At least 5 digits after point. -90 ≤ lat ≤ 90.
lon	Longitude	xsd:decimal	Mandatory	Unit: degrees with decimal. At least 5 digits after point. -180 ≤ lon < 180.

leg element contains attributes of the leg associated with the waypoint (see Figure S.1).

Attribute	Description	Format	Status	Comment
starboardXTD	Starboard side XTD	xsd:decimal	Option	Unit: NM. At least 2 digits after point. 0 ≤ xtd < 10.0
portsideXTD	Portside XTD	xsd:decimal	Option	Unit: NM. At least 2 digits after point. 0 ≤ xtd < 10.0
safetyContour	Planned Safety contour	xsd:decimal	Option	Unit: metres. At least 1 digit after point. Non-negative.
safetyDepth	Planned Safety depth	xsd:decimal	Option	Unit: metres. At least 1 digit after point. Non-negative.
geometryType	Geometry type of leg	xsd:enumeration	Option	“Loxodrome” (= rhumb line) or “Orthodrome” (= great circle)
speedMin	Lowest cruising speed	xsd:decimal	Option	Speed over ground. Unit: knots. At least 1 digit after point. Non-negative.
speedMax	Highest allowed speed	xsd:decimal	Option	Speed over ground. Unit: knots. At least 1 digit after point. Non-negative.
draughtForward	Static Draught Forward	xsd:decimal	Option	Unit: metres. At least 1 digit after point. Non-negative.
draughtAft	Static Draught Aft	xsd:decimal	Option	Unit: metres. At least 1 digit after point. Non-negative.
staticUKC	Minimum UKC on the leg	xsd:decimal	Option	Unit: metres. At least 1 digit after point.
dynamicUKC	Minimum Dynamic UKC on the leg	xsd:decimal	Option	Unit: metres. At least 1 digit after point.
masthead	Height of masthead	xsd:decimal	Option	Calculated from keel. Unit: metres. At least 1 digit after point. Non-negative.

Attribute	Description	Format	Status	Comment
legReport	Reporting information	xsd:string	Option	Part of annotated route plan
legInfo	Nice to know	xsd:string	Option	E.g., telephone / web / service point. Could be relevant in approach to harbour or VTS.
legNote1	Notes regarding the ETD/ETA	xsd:string	Option	
legNote2	Local remarks	xsd:string	Option	

If an optional attribute is absent the appropriate parameter will be taken from the element **defaultWaypoint** element. If this parameter is absent in the **defaultWaypoint** element, then its value is set to "zero" or "empty", depending on the type of the parameter. For the case when geometryType is absent, this attribute should be considered as “Loxodrome”.

Additionally, the element may contain child **extensions** element.

S.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 waypointId="100" etd="2002-11-17T15:25:00Z"/>
    <scheduleElement waypointId="105" eta="2002-11-17T15:25:00Z"/>
  </manual>
</schedule>
```

S.5.8 schedules element description

The **schedules** element contains data on the schedules associated with the route.

Children **schedule** elements describe the specific schedule.

Additionally, the element may contain child **extensions** element.

S.5.9 schedule element description

S.5.9.1 Components

schedule element consists of a sequence of the following child elements:

- **manual** element that describes user's preferences for the schedule;
- **calculated** element that describes schedule calculation results according to user's preferences.

Additionally, the element may contain child **extensions** element.

S.5.9.2 manual element description

manual element contains a sequence of **scheduleElement** elements that describe time preferences and calculation restrictions for each leg of the route. A waypoint should not have more than one associated **scheduleElement** within a **manual** element.

Additionally, the element may contain child **extensions** element.

S.5.9.3 calculated element description

calculated element contains a sequence of **scheduleElement** elements that store calculations results according to user's preferences. A waypoint should not have more than one associated **scheduleElement** within a **calculated** element. All schedule data from **manual** element for a waypoint should be duplicated in the correspondent **calculated** element. If a datum in **manual** element contradicts the same in **calculated** element, the latter should be considered as valid.

Additionally, the element may contain child **extensions** element.

S.5.9.4 scheduleElement (manual/calculated) element description

scheduleElement element 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.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
waypointId	Identifier of waypoint	xsd:nonNegativeInteger	Mandatory	
etd	Departure time	xsd:dateTime	Option	
etdWindowBefore	The maximum value of time interval prior to the ETD used to adjust the ETD to get the earliest probable date/time.	xsd:duration	Option	Time to ETD, it might be more than 24 hrs
etdWindowAfter	The maximum value of time interval after the ETD used to adjust the ETD to get the latest probable date/time.	xsd:duration	Option	Time after ETD, it might be more than 24 hrs
eta	Arrival time	xsd:dateTime	Option	
etaWindowBefore	The maximum value of time interval prior to the ETA used to adjust the ETA to get the earliest probable date/time.	xsd:duration	Option	Time to ETA, it might be more than 24 hrs
etaWindowAfter	The maximum value of time interval after the ETA used to adjust the ETA to get the latest probable date/time.	xsd:duration	Option	Time after ETA, it might be more than 24 hrs
stay	Stay time on WP	xsd:duration	Option	Length of stop on WP, it might be more than 24 hrs
speed	Ground speed	xsd:decimal	Option	Unit: knots. Non-negative.
speedWindow	Describes the uncertainty of the predicted speed after optimization	xsd:decimal	Option	Speed delta by modulus. Unit: knots.
windSpeed	True wind speed	xsd:decimal	Option	Unit: knots. At least 1 digit after point. Non-negative.
windDirection	True wind direction	xsd:decimal	Option	Unit: degrees. At least 1 digit after point. $0 \leq dir < 360$.
currentSpeed	Current speed	xsd:decimal	Option	Unit: knots. At least 1 digit after point. Non-negative.

Attribute	Description	Format	Status	Comment
currentDirection	Current direction	xsd:decimal	Option	Unit: degrees. At least 1 digit after point. 0 ≤ dir < 360.
windLoss	Speed loss caused by wind	xsd:decimal	Option	Calculated during optimization. Unit: knots. At least 1 digit after point.
waveLoss	Speed loss caused by wave	xsd:decimal	Option	Calculated during optimization. Unit: knots. At least 1 digit after point. Non-negative.
totalLoss	Total speed loss	xsd:decimal	Option	Calculated during optimization. Unit: knots. At least 1 digit after point.
rpm	Advised Engine RPM	xsd:nonNegativeInteger	Option	Calculated during optimization. Unit: RPM
pitch	Advised propeller pitch	xsd:integer	Option	Calculated during optimization. Unit: %
fuel	Predicted fuel consumption on leg	xsd:decimal	Option	Calculated during optimization Unit: kg. Non-negative.
relFuelSave	Relative fuel saving after optimization	xsd:decimal	Option	Calculated during optimization. Unit: %.
absFuelSave	Absolute fuel saving after optimization	xsd:decimal	Option	Calculated during optimization. Unit: kg.
Note		xsd:string	Option	

For example:

```
<schedule id="2" name="Schedule2">
  <manual>
    <scheduleElement waypointId="100" etd="2002-11-17T15:25:00Z" />
    <scheduleElement waypointId="105" eta="2002-12-17T15:25:00Z" />
  </manual>
  <calculated>
    <scheduleElement waypointId="100" etd="2002-11-17T15:25:00Z" speed="11.0"/>
    <scheduleElement waypointId="105" eta="2002-12-17T15:25:00Z" speed="12.2"/>
  </calculated>
  <extensions>
  </extensions>
</schedule>
```

Additionally, the element may contain child **extensions** element.

S.5.9.5 scheduleElement STM extension

All STM extensions are put in RTZ extensions only.

scheduleElementEx is an extension for **scheduleElement** element.

Attribute	Description	Format	Status	Comment
waveHeight	Height of waves	xsd:decimal	Option	Unit: metres. Non-negative.
waveDirection	Wave direction	xsd:decimal	Option	Unit: degrees. 0 ≤ dir < 360.

For example:

```
        <schedule id="2" name="Schedule2">
            <manual>
                <scheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"/>
                <scheduleElement waypointId="52" eta="2002-12-17T15:25:00Z"/>
            </manual>
            <calculated>
                <scheduleElement waypointId="15"
                    etd="2002-11-17T15:25:00Z" speed="11.3">
                    <extensions>
                        <extension xsi:type="stm:ScheduleElementExtension" manufacturer="STM"
                            version="1.0.0"
                            name="scheduleElementEx"
                            waveHeight="1.3" waveDirection="53"/>
                    </extensions>
                </scheduleElement>
                <scheduleElement waypointId="52"
                    eta="2002-12-17T15:25:00Z" speed="12.7">
                    <extensions>
                        <extension xsi:type="stm:ScheduleElementExtension" manufacturer="STM"
                            version="1.0.0"
                            name="scheduleElementEx"
                            waveHeight="2.2" waveDirection="334"/>
                    </extensions>
                </scheduleElement>
            </calculated>
            <extensions/>
        </schedule>
```

S.5.10 extensions element description

extensions element contains a set of child **extension** elements, each of which specifying additional information that may be associated with:

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

S.5.11 extension element description

extension element contains a set of mandatory attributes that identify the extension and number of child elements that may contain arbitrary information. Format of these elements is beyond the scope of this standard.

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

The following attributes are used:

Attribute	Description	Format	Status	Comment
manufacturer	Unique vendor identifier	xsd:string	Mandatory	It cannot be empty.
name	Extension name	xsd:string	Mandatory	It cannot be empty.
version	Extension version	xsd: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="80" class="A2" range="121.2"/>
  </extension>
</extensions>
```

S.6 XML-schema to be met by RTZ route files

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

  Route Exchange Format (RTZ)

  XML schema

  Revision 1.1

  Source: IEC 61174
-->
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns="http://www.cirm.org/RTZ/1/1"
targetNamespace="http://www.cirm.org/RTZ/1/1" elementFormDefault="qualified"
attributeFormDefault="unqualified">
    <xsd:annotation>
        <xsd:documentation>
      RTZ schema version 1.1. 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>
            <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="1.1">
            <xsd:annotation>
                <xsd:documentation>
                    Format version (currently "1.1").
                </xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
    </xsd:complexType>
    <!--                                      -->
    <!-- "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>
        <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>
        <xsd:attribute name="vesselCargo" type="xsd:nonNegativeInteger">
            <xsd:annotation>
                <xsd:documentation>Cargo of ship in tons.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <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>
        <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.
                </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 -->
<!--                              -->
<xsd:complexType name="Extension">
    <xsd:annotation>
        <xsd:documentation>
            You can add extend GPX 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 GPX 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>
    <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 GPX 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>
                    <xsd:documentation>Waypoint defaults.</xsd:documentation>
                </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.
                    </xsd:documentation>
                </xsd:annotation>
            </xsd:element>
        </xsd:sequence>
    </xsd:complexType>
    <!--                                          -->
    <!-- "DefaultWaypoint" element type definition -->
    <!--                                          -->
    <xsd:complexType name="DefaultWaypoint">
        <xsd:sequence>
            <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>
                <xsd:documentation>Geographic point.</xsd:documentation>
            </xsd:annotation>
        </xsd:element>
        <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="id" type="xsd:nonNegativeInteger" use="required">
        <xsd:annotation>
            <xsd:documentation>
                Unique waypoint identifier.
            </xsd:documentation>
        </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="revision" type="xsd:nonNegativeInteger">
        <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: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>
        <xsd:attribute name="draughtForward" type="LengthType">
            <xsd:annotation>
                <xsd:documentation>Static draught forward in metres.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <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>
        <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>
        <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"/>
            <xsd:maxExclusive value="10.0"/>
        </xsd:restriction>
    </xsd:simpleType>
    <!--                                          -->
    <!-- "geometry/geopoint" element type definition -->
    <!--                                          -->
    <xsd:complexType name="GM_Point">
        <xsd:attribute name="lat" type="LatitudeType" use="required">
            <xsd:annotation>
                <xsd:documentation>Latitude in degrees.</xsd:documentation>
            </xsd:annotation>
        </xsd:attribute>
        <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 -->
    <!--                                       -->
    <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"/>
            <xsd:maxInclusive value="90.0"/>
        </xsd:restriction>
    </xsd:simpleType>
    <!--                                        -->
    <!-- Geographical longitude type definition -->
    <!--                                        -->
    <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 -->
    <!--                                                -->
    <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>
        <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>
        <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 -->
<!--                                          -->
<xsd:complexType name="ScheduleElement">
    <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>
    <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>
                <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>
        <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>
        <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>
        <xsd:attribute name="pitch" type="xsd:integer">
            <xsd:annotation>
                <xsd:documentation>Advised Engine Pitch.</xsd:documentation>
            </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>
        <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 -->
    <!--                          -->
    <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>
```

S.7 Basic RTZ route example

```
<?xml version="1.0" encoding="UTF-8"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns="http://www.cirm.org/RTZ/1/1" version="1.1"
       xsi:schemaLocation="http://www.cirm.org/RTZ/RTZ Schema version 1_1.xsd">
<routeInfo routeName="AROUNDtheSKAGEN"
    routeAuthor="Simon Ross"
    routeStatus="Checked by Captain"
    validityPeriodStart="2016-10-20T03:15:00Z"
    validityPeriodStop="2016-10-22T10:15:00Z"
    vesselName="Pegasus"
    vesselMMSI="220348970"
    vesselIMO="3798347"
    vesselVoyage="urn:mrn:stm:voyage:id:acme:b6d7b492-ab3c-42f2-8afd-116c3d872f0c"
    vesselDisplacement="157"
    vesselCargo="14"
    vesselGM="2.16"
    vesselMaxRoll="17"
    vesselMaxWave="9.4"
    vesselMaxWind="55.3"
    vesselSpeedMax="23.8"
    vesselServiceMin="16.9"
    vesselServiceMax="21.4">
</routeInfo>
<waypoints>
    <defaultWaypoint radius="0.20">
       <leg starboardXTD="0.31"
            portsideXTD="0.17"
            safetyContour="9.1"
```

```
            safetyDepth="9.1"
            geometryType="Orthodrome"
            speedMin="22.3"
            speedMax="25.8"
            draughtForward="8.9"
            draughtAft="9.1"
            staticUKC="0.9"
            dynamicUKC="0.6"
            masthead="21.3"/>
    </defaultWaypoint>
    <waypoint id="3">
        <position lat="53.01323" lon="8.92837"/>
    </waypoint>
    <waypoint id="45">
        <position lat="53.05134" lon="8.85097"/>
        <leg starboardXTD="0.20"
            portsideXTD="0.10"
            legReport="Prevailing Currents: NE"
            legInfo="Skagen port phone: +4598443787, fax: +4598450029,
                email: saga@saga-shipping.dk, web: www.saga-shipping.dk"
            legNote1="ETD and ETA should be during daylight"
            legNote2="Cruise Season: April-September"/>
    </waypoint>
    <waypoint id="25">
        <position lat="53.14133" lon="8.80325"/>
        <leg starboardXTD="0.25" portsideXTD="0.40"/>
    </waypoint>
</waypoints>
    <schedules>
        <schedule id="1" name="Schedule1">
            <manual>
                <scheduleElement waypointId="3"
                    etd="2016-09-25T08:25:00Z"
                    etdWindowBefore="PT5H37M"
                    etdWindowAfter="PT2H54M"/>
                <scheduleElement waypointId="25"
                    eta="2002-11-17T08:25:00Z"
                    />
                <scheduleElement waypointId="45"
                    eta="2016-09-25T16:07:00Z"
                    etaWindowBefore="PT3H14M"
                    etaWindowAfter="PT1H48M"
                    stay="PT1H30M"
                    Note="We should stay here exactly one and a half hour"/>
            </manual>
            <calculated>
                <scheduleElement waypointId="3"
                    etd="2016-09-25T08:25:00Z"
                    etdWindowBefore="PT5H37M"
                    etdWindowAfter="PT2H54M"/>
                <scheduleElement waypointId="25"
                    eta="2016-09-25T11:13:00Z"
                    etaWindowBefore="PT2H27M"
                    etaWindowAfter="PT4H12M"
                    stay="PT1H30M"
                    etd="2016-09-25T12:43:00Z"
                    etdWindowBefore="PT4H6M"
                    etdWindowAfter="PT3H11M"
                    speed="18.9"
                    speedWindow="3.6"
                    windSpeed="6.7"
                    windDirection="189.4"
                    currentSpeed="0.2"
                    currentDirection="218.9"
                    windLoss="0.9"
                    waveLoss="0.4"
                    totalLoss="1.3"
                    rpm="65"
                    pitch="85"
                    fuel="231.7"
                    relFuelSave="2.2"
                    absFuelSave="5.1"/>
                <scheduleElement waypointId="45"
                    eta="2016-09-25T16:07:00Z"
                    etaWindowBefore="PT3H14M"
                    etaWindowAfter="PT1H48M"
                    speed="21.3"
```

```
                    speedWindow="2.7"
                    windSpeed="7.8"
                    windDirection="135.2"
                    currentSpeed="0.4"
                    currentDirection="224.9"
                    windLoss="1.2"
                    waveLoss="0.6"
                    totalLoss="1.8"
                    rpm="70"
                    pitch="87"
                    fuel="243.2"
                    relFuelSave="2.9"
                    absFuelSave="7.1"
                    Note="We should stay here exactly one and a half hour"/>
            </calculated>
        </schedule>
        <schedule id="2" name="Schedule2">
            <manual>
                <scheduleElement waypointId="3"
                    etd="2016-09-29T08:17:00Z"
                    etdWindowBefore="PT1H58M"
                    etdWindowAfter="PT3H9M"/>
                <scheduleElement waypointId="25"
                    speed="24.2"
                    speedWindow="1.6"/>
                <scheduleElement waypointId="45"
                    speed="23.7"
                    speedWindow="1.7"/>
            </manual>
            <calculated>
                <scheduleElement waypointId="3"
                    etd="2016-09-29T08:17:00Z"
                    etdWindowBefore="PT1H58M"
                    etdWindowAfter="PT3H9M"/>
                <scheduleElement waypointId="25"
                    eta="2016-09-29T11:26:00Z"
                    etaWindowBefore="PT2H27M"
                    etaWindowAfter="PT4H12M"
                    stay="PT1H30M"
                    etd="2016-09-25T19:43:00Z"
                    etdWindowBefore="PT4H6M"
                    etdWindowAfter="PT3H11M"
                    speed="24.2"
                    speedWindow="1.6"
                    windSpeed="6.7"
                    windDirection="189.4"
                    currentSpeed="0.2"
                    currentDirection="218.9"
                    windLoss="0.9"
                    waveLoss="0.4"
                    totalLoss="1.3"
                    rpm="65"
                    pitch="85"
                    fuel="231.7"
                    relFuelSave="2.2"
                    absFuelSave="5.1"/>
                <scheduleElement waypointId="45"
                    eta="2016-09-29T19:15:00Z"
                    etaWindowBefore="PT3H14M"
                    etaWindowAfter="PT1H48M"
                    speed="23.7"
                    speedWindow="1.7"
                    windSpeed="7.8"
                    windDirection="135.2"
                    currentSpeed="0.4"
                    currentDirection="224.9"
                    windLoss="1.2"
                    waveLoss="0.6"
                    totalLoss="1.8"
                    rpm="70"
                    pitch="87"
                    fuel="243.2"
                    relFuelSave="2.9"
                    absFuelSave="7.1"/>
            </calculated>
        </schedule>
    </schedules>
```

```
    <extensions/>
</route>
```

S.8 XML-schema for STM Extensions

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

  STM Extension RouteInfo for Route Exchange Format (RTZ)

  XML schema

  Revision 1.0.0

  Source: STM Developer Forum
-->
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:stm="http://stmvalidation.eu/STM/1/0/0"
    targetNamespace="http://stmvalidation.eu/STM/1/0/0"
    xmlns:rtz="http://www.cirm.org/RTZ/1/1" elementFormDefault="qualified">
    <xsd:import namespace="http://www.cirm.org/RTZ/1/1" schemaLocation="rtz.xsd"/>
    <!--                                                -->
    <!-- STM routeInfo extension type definition -->
    <!--                                                -->
    <xsd:complexType name="RouteInfoExtension">
        <xsd:complexContent>
            <xsd:extension base="stm:RouteInfoExtensionAbstract">
                <xsd:sequence>
                    <xsd:element name="routeChanges" type="stm:RouteChanges"
                        minOccurs="0" maxOccurs="1">
                        <xsd:annotation>
                            <xsd:documentation>Route changes history.</xsd:documentation>
                        </xsd:annotation>
                    </xsd:element>
                </xsd:sequence>
                <xsd:attribute name="routeStatusEnum" type="stm:RouteStatusType">
                    <xsd:annotation>
                        <xsd:documentation>Route status number.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="routeVersion" type="xsd:string">
                    <xsd:annotation>
                        <xsd:documentation>Version of the route.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="personsOnBoard" type="xsd:nonNegativeInteger">
                    <xsd:annotation>
                        <xsd:documentation>
                            Ship's passengers including crew.
                        </xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="depPort" type="stm:UNLOCODE">
                    <xsd:annotation>
                        <xsd:documentation>Departure port.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="arrPort" type="stm:UNLOCODE">
                    <xsd:annotation>
                        <xsd:documentation>Arrival port.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="depPortCallId" type="stm:PortCallIdentifier">
                    <xsd:annotation>
                        <xsd:documentation>
                            Port call identifier for departure port.
                        </xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="arrPortCallId" type="stm:PortCallIdentifier">
                    <xsd:annotation>
                        <xsd:documentation>
                            Port call identifier for arrival port.
                        </xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
```

```
                <xsd:attribute name="startSeaPassage" type="xsd:string">
                    <xsd:annotation>
                        <xsd:documentation>
                            WP and its type, where sea passage starts.
                        </xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="endSeaPassage" type="xsd:string">
                    <xsd:annotation>
                        <xsd:documentation>
                            WP and its type, where sea passage ends.
                        </xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
            </xsd:extension>
        </xsd:complexContent>
    </xsd:complexType>
```

```
    <xsd:complexType name="RouteInfoExtensionAbstract"  abstract="true">
        <xsd:complexContent>
            <xsd:restriction base="rtz:Extension">
                <xsd:attribute name="manufacturer" type="rtz:NonEmptyString"
                    use="required" fixed="STM">
                    <xsd:annotation>
                        <xsd:documentation>Unique vendor identifier.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="name" type="rtz:NonEmptyString"
                    use="required" fixed="routeInfoEx">
                    <xsd:annotation>
                        <xsd:documentation>Name of the extension.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="version" type="rtz:NonEmptyString"
                    use="required" fixed="1.0.0">
                    <xsd:annotation>
                        <xsd:documentation>Version of the extension.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
            </xsd:restriction>
        </xsd:complexContent>
    </xsd:complexType>
    <!--                                  -->
    <!--"RouteStatus" type definition -->
    <!--                                  -->
    <xsd:simpleType name="RouteStatusType">
        <xsd:annotation>
            <xsd:documentation>Route status value.</xsd:documentation>
        </xsd:annotation>
        <xsd:restriction base="xsd:integer">
            <xsd:minInclusive value="1"/>
        </xsd:restriction>
    </xsd:simpleType>
    <!--                                       -->
    <!-- RouteChangeHistory type definition -->
    <!--                                       -->
    <xsd:complexType name="RouteChanges">
        <xsd:annotation>
            <xsd:documentation>
                Data for route changes history.
            </xsd:documentation>
        </xsd:annotation>
        <xsd:sequence>
            <xsd:element name="historyItem" type="stm:HistoryItem"
                minOccurs="0" maxOccurs="unbounded">
                <xsd:annotation>
                    <xsd:documentation>History item details.</xsd:documentation>
                </xsd:annotation>
            </xsd:element>
        </xsd:sequence>
    </xsd:complexType>
    <!--                                  -->
    <!-- HistoryItem type definition -->
    <!--                                  -->
    <xsd:complexType name="HistoryItem">
        <xsd:annotation>
            <xsd:documentation>
```

```
            Route change history item.
        </xsd:documentation>
    </xsd:annotation>
    <xsd:attribute name="dateTime" type="stm:DateTimeUTC" use="required">
        <xsd:annotation>
            <xsd:documentation>Date and time of change.</xsd:documentation>
        </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="author" type="rtz:NonEmptyString" use="required">
        <xsd:annotation>
            <xsd:documentation>Author of change.</xsd:documentation>
        </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="reason" type="rtz:NonEmptyString" use="required">
        <xsd:annotation>
            <xsd:documentation>Reason of change.</xsd:documentation>
        </xsd:annotation>
    </xsd:attribute>
</xsd:complexType>
<!--                                      -->
<!-- PortCallIdentifier type definition -->
<!--                                      -->
<xsd:simpleType name="PortCallIdentifier">
    <xsd:annotation>
        <xsd:documentation>
            Port call identifier, based on MRN.
            First element of the NSS should be the UN/LOCODE of the port.
        </xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
        <xsd:maxLength value="120"/>
        <xsd:pattern value=
            "urn:mrn:stm:portcdm:port_call:[A-Za-z]{5}:[A-Za-z0-9()+,\-.:=@;$_!*'%/?#]+"/>
    </xsd:restriction>
</xsd:simpleType>
<!--                           -->
<!-- UNLOCODE type definition -->
<!--                           -->
<xsd:simpleType name="UNLOCODE">
    <xsd:annotation>
        <xsd:documentation>UN/LOCODE</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
        <xsd:maxLength value="5"/>
        <xsd:pattern value="[A-Z]{5}"/>
    </xsd:restriction>
</xsd:simpleType>
<!--                                       -->
<!-- DateTimeUTC element type definition -->
<!--                                       -->
<xsd:simpleType name="DateTimeUTC">
    <xsd:annotation>
        <xsd:documentation>Length type.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:dateTime">
        <xsd:pattern value=".*Z"/>
    </xsd:restriction>
</xsd:simpleType>
<!--                                                  -->
<!-- STM scheduleElement extension type definition -->
<!--                                                  -->
<xsd:complexType name="ScheduleElementExtension">
    <xsd:complexContent>
        <xsd:extension base="stm:ScheduleElementExtensionAbstract">
            <xsd:attribute name="waveHeight">
                <xsd:annotation>
                    <xsd:documentation>Height of waves in metres.</xsd:documentation>
                </xsd:annotation>
                <xsd:simpleType>
                    <xsd:restriction base="xsd:decimal">
                        <xsd:minInclusive value="0.0"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
            <xsd:attribute name="waveDirection">
                <xsd:annotation>
                    <xsd:documentation>Wave direction in degrees.</xsd:documentation>
```

```
                    </xsd:annotation>
                    <xsd:simpleType>
                        <xsd:restriction base="xsd:decimal">
                            <xsd:minInclusive value="0.0"/>
                            <xsd:maxExclusive value="360.0"/>
                        </xsd:restriction>
                    </xsd:simpleType>
                </xsd:attribute>
            </xsd:extension>
        </xsd:complexContent>
    </xsd:complexType>

    <xsd:complexType name="ScheduleElementExtensionAbstract" abstract="true">
        <xsd:complexContent>
            <xsd:restriction base="rtz:Extension">
                <xsd:attribute name="manufacturer" type="rtz:NonEmptyString"
                    use="required" fixed="STM">
                    <xsd:annotation>
                        <xsd:documentation>Unique vendor identifier.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="name" type="rtz:NonEmptyString"
                    use="required" fixed="ScheduleElementEx">
                    <xsd:annotation>
                        <xsd:documentation>Name of the extension.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
                <xsd:attribute name="version" type="rtz:NonEmptyString"
                    use="required" fixed="1.0.0">
                    <xsd:annotation>
                        <xsd:documentation>Extension version.</xsd:documentation>
                    </xsd:annotation>
                </xsd:attribute>
            </xsd:restriction>
        </xsd:complexContent>
    </xsd:complexType>
</xsd:schema>
```

S.9 Example of the RTZ route with STM extensions

```
<?xml version="1.0" encoding="UTF-8"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns="http://www.cirm.org/RTZ/1/1" version="1.1"
    xmlns:stm="http://stmvalidation.eu/STM/1/0/0"
    xsi:schemaLocation="http://stmvalidation.eu/STM/1/0/0 stm_extensions.xsd">
    <routeInfo routeName="AROUNDtheSKAGEN"
        routeAuthor="Simon Ross"
        routeStatus="7"
        validityPeriodStart="2016-10-20T03:15:00Z"
        validityPeriodStop="2016-10-22T10:15:00Z"
        vesselName="Pegasus"
        vesselMMSI="220348970"
        vesselIMO="3798347"
        vesselVoyage="urn:mrn:stm:voyage:acme:b6d7b492-ab3c-42f2-8afd-116c3d872f0c"
        vesselDisplacement="157"
        vesselCargo="14"
        vesselGM="2.16"
        vesselMaxRoll="17"
        vesselMaxWave="9.4"
        vesselMaxWind="55.3"
        vesselSpeedMax="23.8"
        vesselServiceMin="16.9"
        vesselServiceMax="21.4">
        <extensions>
            <extension xsi:type="stm:RouteInfoExtension"
                manufacturer="STM" name="routeInfoEx" version="1.0.0"
                routeStatusEnum="7"
                routeVersion="BCF8ABB2-4BE2-4082-8718-E3594734A5F6"
                personsOnBoard="67">
                <stm:routeChanges>
                    <stm:historyItem dateTime="2016-10-20T11:14:41Z" author="Simon Ross"
                        reason="initial creation"/>
                    <stm:historyItem dateTime="2016-10-21T09:12:29Z" author="William Brown"
                        reason="corrections for reference points using"/>
```

```
            </stm:routeChanges>
        </extension>
    </extensions>
</routeInfo>
<waypoints>
    <defaultWaypoint radius="0.20">
        <leg starboardXTD="0.31"
            portsideXTD="0.17"
            safetyContour="9.1"
            safetyDepth="9.1"
            geometryType="Orthodrome"
            speedMin="22.3"
            speedMax="25.8"
            draughtForward="8.9"
            draughtAft="9.1"
            staticUKC="0.9"
            dynamicUKC="0.6"
            masthead="21.3"/>
    </defaultWaypoint>
    <waypoint id="3">
        <position lat="53.01323" lon="8.92837"/>
    </waypoint>
    <waypoint id="45">
        <position lat="53.05134" lon="8.85097"/>
        <leg starboardXTD="0.20"
            portsideXTD="0.10"
            legReport="Prevailing Currents: NE"
            legInfo="Skagen port phone: +4598443787, fax: +4598450029,
                email: saga@saga-shipping.dk, web: www.saga-shipping.dk"
            legNote1="etd and eta should be during daylight"
            legNote2="Cruise Season: April-September"/>
    </waypoint>
    <waypoint id="25">
        <position lat="53.14133" lon="8.80325"/>
        <leg starboardXTD="0.25" portsideXTD="0.40"/>
    </waypoint>
</waypoints>
<schedules>
    <schedule id="1" name="Schedule1">
        <manual>
            <scheduleElement waypointId="3"
                etd="2016-09-25T08:25:00Z"
                etdWindowBefore="PT5H37M"
                etdWindowAfter="PT2H54M"/>
            <scheduleElement waypointId="25" eta="2002-11-17T08:25:00Z"/>
            <scheduleElement waypointId="45"
                eta="2016-09-25T16:07:00Z"
                etaWindowBefore="PT3H14M"
                etaWindowAfter="PT1H48M"
                stay="PT1H30M"
                Note="We should stay here exactly one and a half hour"/>
        </manual>
        <calculated>
            <scheduleElement waypointId="3"
                etd="2016-09-25T08:25:00Z"
                etdWindowBefore="PT5H37M"
                etdWindowAfter="PT2H54M"/>
            <scheduleElement waypointId="25"
                eta="2016-09-25T11:13:00Z"
                etaWindowBefore="PT2H27M"
                etaWindowAfter="PT4H12M"
                stay="PT1H30M"
                etd="2016-09-25T12:43:00Z"
                etdWindowBefore="PT4H6M"
                etdWindowAfter="PT3H11M"
                speed="18.9"
                speedWindow="3.6"
                windSpeed="6.7"
                windDirection="189.4"
                currentSpeed="0.2"
                currentDirection="218.9"
                windLoss="0.9"
                waveLoss="0.4"
                totalLoss="1.3"
                rpm="65"
                pitch="85"
                fuel="231.7"
```

```
                relFuelSave="2.2"
                absFuelSave="5.1"/>
            <scheduleElement waypointId="45"
                eta="2016-09-25T16:07:00Z"
                etaWindowBefore="PT3H14M"
                etaWindowAfter="PT1H48M"
                speed="21.3"
                speedWindow="2.7"
                windSpeed="7.8"
                windDirection="135.2"
                currentSpeed="0.4"
                currentDirection="224.9"
                windLoss="1.2"
                waveLoss="0.6"
                totalLoss="1.8"
                rpm="70"
                pitch="87"
                fuel="243.2"
                relFuelSave="2.9"
                absFuelSave="7.1"
                Note="We should stay here exactly one and a half hour"/>
        </calculated>
    </schedule>
    <schedule id="2" name="Schedule2">
        <manual>
            <scheduleElement waypointId="3"
                etd="2016-09-29T08:17:00Z"
                etdWindowBefore="PT1H58M"
                etdWindowAfter="PT3H9M"/>
            <scheduleElement waypointId="25"
                speed="24.2"
                speedWindow="1.6">
                <extensions>
                    <extension xsi:type="stm:ScheduleElementExtension"
                        manufacturer="STM" name="ScheduleElementEx"  version="1.0.0"
                        waveHeight="3.4" waveDirection="148"/>
                </extensions>
            </scheduleElement>
            <scheduleElement waypointId="45"
                speed="23.7"
                speedWindow="1.7">
                <extensions>
                    <extension xsi:type="stm:ScheduleElementExtension"
                        manufacturer="STM" name="ScheduleElementEx"  version="1.0.0"
                        waveHeight="3.4" waveDirection="148"/>
                </extensions>
            </scheduleElement>
        </manual>
        <calculated>
            <scheduleElement waypointId="3"
                etd="2016-09-29T08:17:00Z"
                etdWindowBefore="PT1H58M"
                etdWindowAfter="PT3H9M"/>
            <scheduleElement waypointId="25"
                eta="2016-09-29T11:26:00Z"
                etaWindowBefore="PT2H27M"
                etaWindowAfter="PT4H12M"
                stay="PT1H30M"
                etd="2016-09-25T19:43:00Z"
                etdWindowBefore="PT4H6M"
                etdWindowAfter="PT3H11M"
                speed="24.2"
                speedWindow="1.6"
                windSpeed="6.7"
                windDirection="189.4"
                currentSpeed="0.2"
                currentDirection="218.9"
                windLoss="0.9"
                waveLoss="0.4"
                totalLoss="1.3"
                rpm="65"
                pitch="85"
                fuel="231.7"
                relFuelSave="2.2"
                absFuelSave="5.1"/>
            <scheduleElement waypointId="45"
                eta="2016-09-29T19:15:00Z"
```

```
                    etaWindowBefore="PT3H14M"
                    etaWindowAfter="PT1H48M"
                    speed="23.7"
                    speedWindow="1.7"
                    windSpeed="7.8"
                    windDirection="135.2"
                    currentSpeed="0.4"
                    currentDirection="224.9"
                    windLoss="1.2"
                    waveLoss="0.6"
                    totalLoss="1.8"
                    rpm="70"
                    pitch="87"
                    fuel="243.2"
                    relFuelSave="2.9"
                    absFuelSave="7.1"/>
            </calculated>
        </schedule>
    </schedules>
    <extensions/>
</route>
```

S.10 UML model of the Route exchange format