

Paper for Consideration by the S-100 Working Group**Proposed Alerts and Indications Model for S-100**

Submitted by:	SPAWAR Atlantic
Executive Summary:	A proposed model for S-100 alerts and indications is presented
Related Documents:	S-100 Part 9, TSMAD28_DIGWG6_12.4A, TSM3 5.3
Related Projects:	Development of S-100 and S-1XX product specifications

Introduction / Background

As presented by Hannu Peiponen / Furuno Finland at TSMAD28 and TSM3, there is a need for an alerts model defined within S-100 which will allow fielded ECDIS systems to conform to changing alerts requirements without software upgrades. Some examples include:

- New S-100 based product type
- New feature type added to an existing product where the new feature type should participate in alerts (feature catalog updated)
- Changes to the alert rules for an existing feature type and product type (new alerts catalog)

From the previously presented papers, it is noted that the alerts model can be based on the existing portrayal model, as many commonalities exist between detection of alerts and presentation of features. Whereas the portrayal catalog translates an XML representation of a dataset into draw instructions, the alerts catalog can translate the same XML representation of a dataset into alert instructions. Changes to the alerts catalog can be managed via a registry in the same manner as the portrayal catalog, allowing the ECDIS to update machine readable files in-lieu of software upgrades.

The recently published IEC 61174 ed4.0 provides some changes to previous requirements for alerts. In particular, the alert classification of Appendix 5 of IMO MSC.252(83) is used as summarized in Table D.1 of IEC 61174 ed4.0. The alerts model presented here is intended to support these new requirements.

Analysis / Discussion

The alert process is modeled on the portrayal process shown in Figure 1, with the portrayal functions replaced by alert functions, and the drawing instructions replaced by alert instructions.

The alert process can be summarized as follows:

1. Find the datasets which intersect the route plan / look-ahead area,
2. Encode each intersecting dataset into an alerts catalog input XML,
3. Use the alert functions (XSL transformations) published and encoded in the alerts catalog to produce alert instructions,
4. Determine the intersection of the route plan / look-ahead area and the spatial components contained within each alert instruction,
5. Use the intersecting spatial components and alert instructions to build an input XML for the portrayal catalog, where the feature type is set to generate the required highlight,
6. Use the portrayal functions to generate draw instructions,
7. Use the draw instructions to generate highlight regions. A notional highlight using the portrayal catalog `dnght_common.xsl` subTemplate is shown in Figure 2.

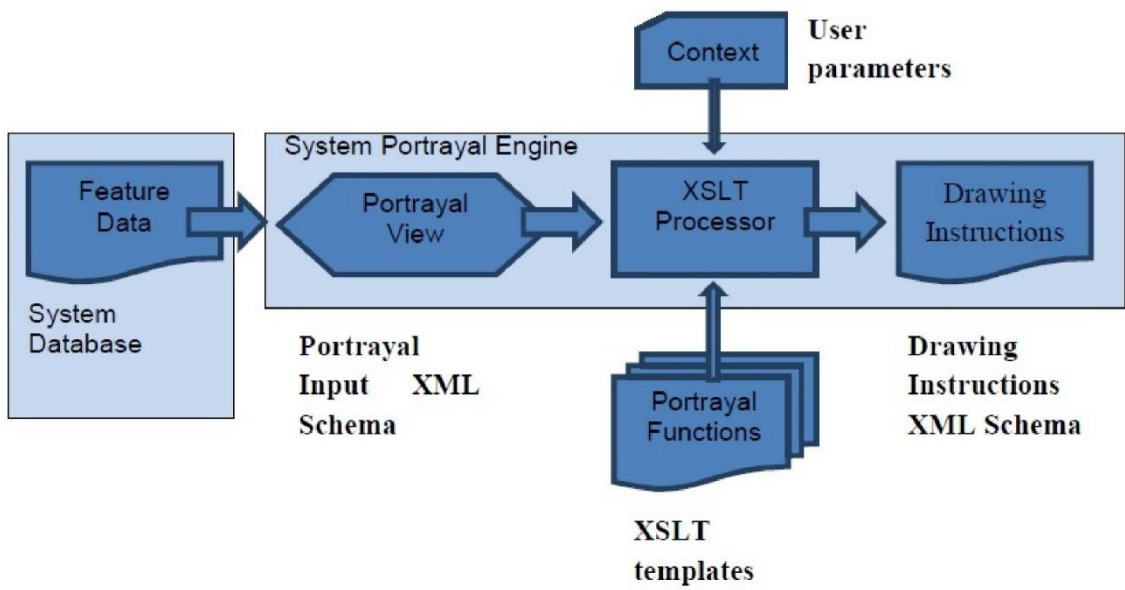


Figure 1 Portrayal process

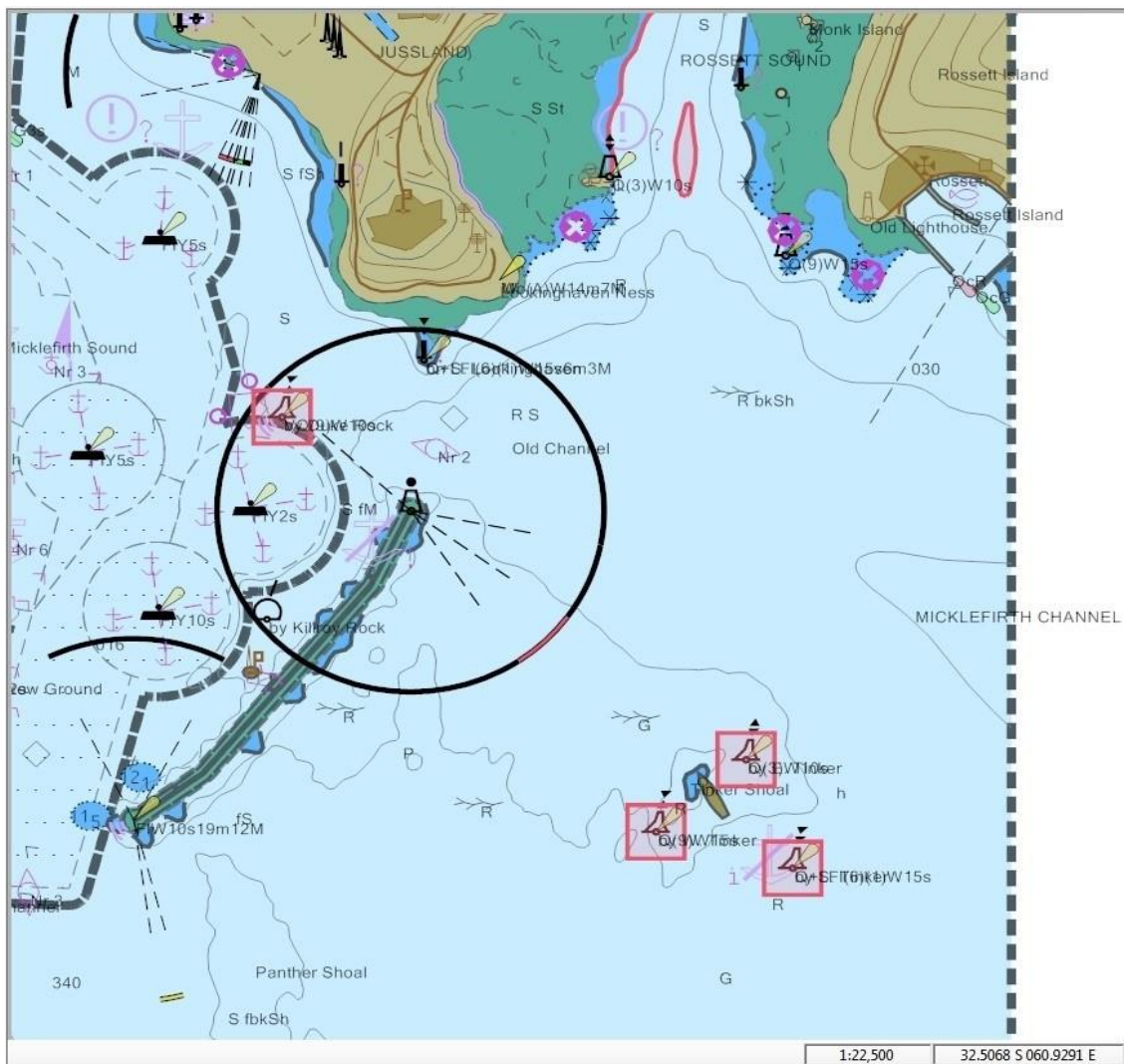


Figure 2 Notional highlight

Package Overview

The portrayal provides packages which describe the InputSchema, PortrayalCatalog, DrawingInstructions, and SymbolDefinitions. Alerts will use the portrayals InputSchema (or a copy of it), will have an AlertsCatalog as described below, will replace the DrawingInstructions with AlertInstructions as described below, and has no equivalent for the SymbolDefinitions package.

Data Input Schema

The alerts data input schema will be the same as the portrayal input schema. This allows the ECDIS to use the same code to generate both portrayal catalog input XML and alerts catalog input XML. It also allows the portrayal functions and alert functions (XSLT) to share much of the same processing. An issue that will have to be addressed is whether the alerts catalog should depend on the portrayal catalog for the input schema, or if the input schema should be delivered as part of the alerts catalog. The first option could pose an issue if there is ever a product type that is not intended to have a portrayal, or if there is a desire in the future to have different input schemas for the two catalogs. The second option could introduce synchronization issues as the portrayal catalog and alerts catalog are updated independently of each other from the registry.

Alerts Catalog

The AlertsCatalog is based on a simplification / restriction of the PortrayalCatalog, as shown in Figure 3. The items in the red boxes are not needed by the AlertsCatalog, nor are the enumerated values which have been struck through. The content of the alerts catalog will include alert functions and alert context; these are analogous to the similarly named items in the portrayal catalog.

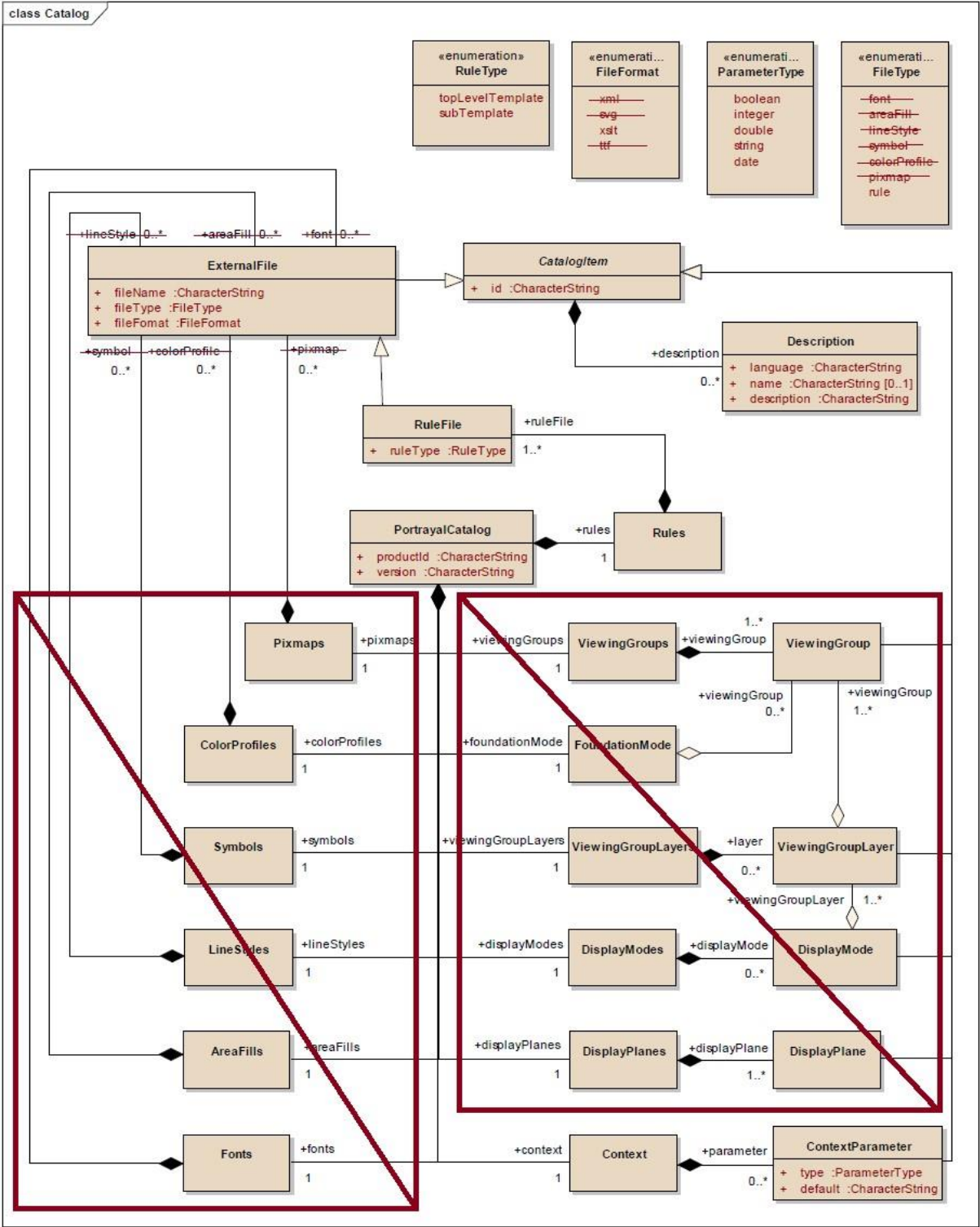


Figure 3 Portrayal / Alerts Catalog Model

Model of the Alerts Catalog

The following elements from the PortrayalCatalog defined in S-100 9-14.3.1 are replicated in the AlertsCatalog: productId, version, context, and rules. A single extension is added as highlighted in the table below; a featuresUsed element which specifies the feature types used by the XSLT. This element allows the ECDIS to build an input XML based on a subset of the feature instances contained within a dataset, and should serve to improve performance and reduce memory usage.

Role Name	Name	Description	Mult.	Type
Class	AlertsCatalog	A container of all the Catalog items	-	-
Attribute	productId	The ID of the product for which the Catalog is intended	1	string
Attribute	version	The version of the product the Catalog is defined for.	1	string
Role	context	Container of context parameter definitions	1	Context (same as portrayal)
Role	rules	Container of XSLT rule file references	1	Rules (same as portrayal)
Role	featuresUsed	Container of feature type references	1	FeaturesUsed

Role Name	Name	Description	Mult.	Type
Class	FeaturesUsed	A container of features	-	-
Role	alertFeature	Container of alert features	1..*	AlertFeature

Role Name	Name	Description	Mult.	Type
Class	AlertFeature	A feature code and primitive type	-	-
Attribute	code	S-100 feature type identifier	1	S-100:StringCode
Attribute	primitiveType	The spatial primitive type	1	S100_FC_SpatialPrimitive

Note that since many of the context elements are duplicated in the portrayal catalog, and since each context element must be associated with a selector by the ECDIS, it would be desirable to define these elements in one place where the portrayal and alerts catalog can share them. This would help prevent two different context elements being defined for the same selector (e.g. SAFETY_DEPTH vs. SafetyDepth), which would result in duplicate selectors within the ECDIS. The duplicate selectors within the ECDIS could then be set to conflicting values by the mariner. It is outside the scope of this paper to recommend how the definition of the context elements can be shared between the portrayal and alerts, but if it is decided that they will not be shared the developers of each catalog should ensure a strict naming convention is adhered to, and that the context element names are equivalent for each selector.

Some context elements used by the alerts catalog which are not present in the portrayal:

Context Parameter	Type	Description
ROUTE_PLANNING	boolean	Selects between route planning and route monitoring
WARNING_ON_SPECIAL_CONDITIONS	boolean	Selects between warning or caution for areas with special conditions
WARNING_ON_HAZARDS	boolean	Selects between warning or caution for hazards
TBD	TBD	More parameters will likely be added as development progresses

Model of the Alert Instructions

The output of the alert process is AlertInstructions. These are analogous to the DrawingInstructions output from the portrayal process. The AlertInstructions attempt to model the behavior required by IEC 61174 ed4.0, as summarized in Table D.1. Currently, S-100 and S-101 requirements do not conform to this model. It is presumed that S-100 and S-101 will be updated to harmonize with IEC 61174 ed4.0.

The model of the AlertInstruction package is:

Role Name	Name	Description	Mult.	Type
Class	AlertList	An ordered set of Alert Instructions	-	-
Role	alertInstruction	An instruction of this list	0..*	AlertInstruction

Role Name	Name	Description	Mult.	Type
Class	AlertInstruction	A container for an alert instruction	-	-
Role	featureReference	The reference to the feature type that caused the alert	1	FeatureReference
Role	spatialReference	The reference(s) to the spatial components associated with the feature that should be acted on as defined by the spatial instruction. Not used when the entire geometry of the feature should be acted on.	0..*	SpatialReference
Role	spatialInstruction	Describes how the features spatial components should be evaluated.	0..1	SpatialInstruction
Role	priority		1	AlertPriority
Role	category		0..1	AlertCategory

Role Name	Name	Description	Mult.	Type
Class	FeatureReference	A reference to a feature type	-	-
Attribute	reference	The identifier of the feature type	1	string

Role Name	Name	Description	Mult.	Type
Class	SpatialReference	A reference to a spatial type	-	-
Attribute	reference	The identifier of the spatial type	1	string

Role Name	Name	Description
Type	SpatialInstruction	Defines the mode for checking the spatial
Enumeration	checkIntersection	Check for intersection with route plan / look-ahead area
Enumeration	checkDistance	Check for less than user-specified distance from route plan / look-ahead

Role Name	Name	Description
Type	AlertPriority	Defines the possible priorities for an alert
Enumeration	Alarm	Indicates conditions requiring immediate attention and action by the bridge team. (MSC.252(83) 19.1.2)
Enumeration	Warning	Indicates changed conditions and should be presented for precautionary reasons which are not immediately hazardous but which may become so, if no action is taken. (MSC.252(83) 19.1.3)
Enumeration	Caution	Indicates a condition which does not warrant an alarm or warning condition, but still requires attention and out of the ordinary consideration of the situation or of given information. (MSC.252(83) 19.1.4)
Enumeration	PermanentIndication	Indication that is displayed visually and continuously and cannot be removed from the display other than by eliminating the cause of the indication (IEC 61174 ed4 3.1.27)
Enumeration	Indication	Display of regular information and conditions. (MSC.252(83) appendix 1)

Role Name	Name	Description
Type	AlertCategory	Defines the possible categories for an alert
Enumeration	A	Danger of collision / grounding. Graphical information is necessary as decision support. (MSC.252(83) 19.3.1.1)
Enumeration	B	All non-A. No additional information is necessary for decision support. (MSC.252(83) 19.3.1.2)

Sample output of the AlertInstruction package:

```

<alertList>
  <alertInstruction>
    <featureReference reference="4"/>
    <spatialInstruction>checkDistance</spatialInstruction>
    <priority>Indication</priority>
  </alertInstruction>
  <alertInstruction>
    <featureReference reference="23"/>
    <spatialReference reference="5"/>
    <spatialReference reference="17"/>
    <spatialInstruction>checkDistance</spatialInstruction>
    <priority>Alarm</priority>
    <category>A</category>
  </alertInstruction>
</alertList>

```

A preliminary (incomplete) implementation of the alerts catalog and alerts functions will be made available on the S-100 Test Bed site on basecamp.com. The implementation is only intended to provide a representative sample. It is based on the current contents of S-101 C2.10.7 and C2.10.9, which still contain vestiges of S-57.

Recommendations

1. Endorse continued development of the alerts process.
2. Come to agreement on whether the alerts process and portrayal should share common schema elements. If so, create a plan to determine how the common elements should be shared.
3. Create a plan for harmonizing S-101 alerts requirements with IEC 61174 ed4.0 requirements.
4. Update S-101 C2.10.7 and C2.10.9 to provide authoritative feature list and conditions for implementation of alert functions.

Action Required of S-100WG

The S-100 working group is invited to:

- a. note the paper
- b. discuss the recommendations
- c. provide further direction