Portrayal Concepts for
S-126 (Physical Environment) Data
- Status Report -

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Introduction

Nautical Information

❖ **Nautical Information**

Nautical charts, publications and their digital products

➢ **Nautical Chart**

Standardized format, contents / international rules

➢ **Nautical Publications**

Different format, contents and production method

→ Difficulty in intuitive awareness

➢ **Digital or electronic products beyond the NP1**

eg) PDF, PNG, JPEG, S-100 based output

❖ **S-126**

S-100 based product specification on physical environment in Sailing Directions

✓ **Physical Environment**

Land and sea descriptions (current, tide), atmospheric conditions (wind, visibility), man-made navigational aids, etc.

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As you well know,
Nautical information refers to nautical charts and publications and digital products
which are the outcome of hydrographic survey, oceanographic observation and fairway survey.

But they come in different forms
because they're created using different production methods and contain different contents for each country.

Therefore it's difficult for mariners to grasp necessary information intuitively.

Background – NIPWG5

KHOA's Proposal

- **Physical environment** is important and useful at planning stage
- **KHOA suggested** portraying and displaying the contents of SD on ECDIS for each phenomenon
  → For safe and economic navigation / To mariners around the world

Action Item for KHOA

- KHOA to be involved in the portrayal work of physical environment with NL and US and report at the NIPWG6
  ➤ **"Invest effort and capacity in the development of portrayal concepts for S-126 data"**

NIPWG Subcategory/CP HEADER	IHO Registry Name	ALPHA CODE	IHO product
Abnormal Falls			
Abnormal waves			
Aids to navigation			
Air temperature	AirTemperature	AIRTEM	S-412
Airport/AirportAirfield		AIRARE	S-126
Anchorages			
Anticyclones			
Arch			
Area			
Tidal stream-flood/ebb	TidalStreamFloodEbb	TS_FEB	S-111
Tides			S-112
Tides			
Tideway		TIDEWY	S-126
Visibility	SurfaceVisibility	SURVIS	S-412
Currents			

< Part of NIPWG5-21.2 Annex A >

"Tidal Stream, Sea Fog, Eddy"

- Concept symbols were already made in 2017

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After the 8th HSSC meeting, S-126 Product specification was pushed back on the priority list so its development was discontinued.
But physical environment is very important and useful information at the voyage planning stage.
So KHOA proposed at the 5th NIPWG meeting that the major components of physical environment in nautical publications should be depicted and displayed on ECDIS to provide mariners with highly readable information.
The NIPWG tasked KHOA to invest effort and capacity in the development of portrayal concepts for S-126 data.
KHOA needed sample features of S-126 to perform action item.
So three features – tidal stream(especially fast & strong), sea fog and eddy – were chosen because they're similar to tidal stream, visibility and currents in Annex A, table on left and also considered to be of high importance.
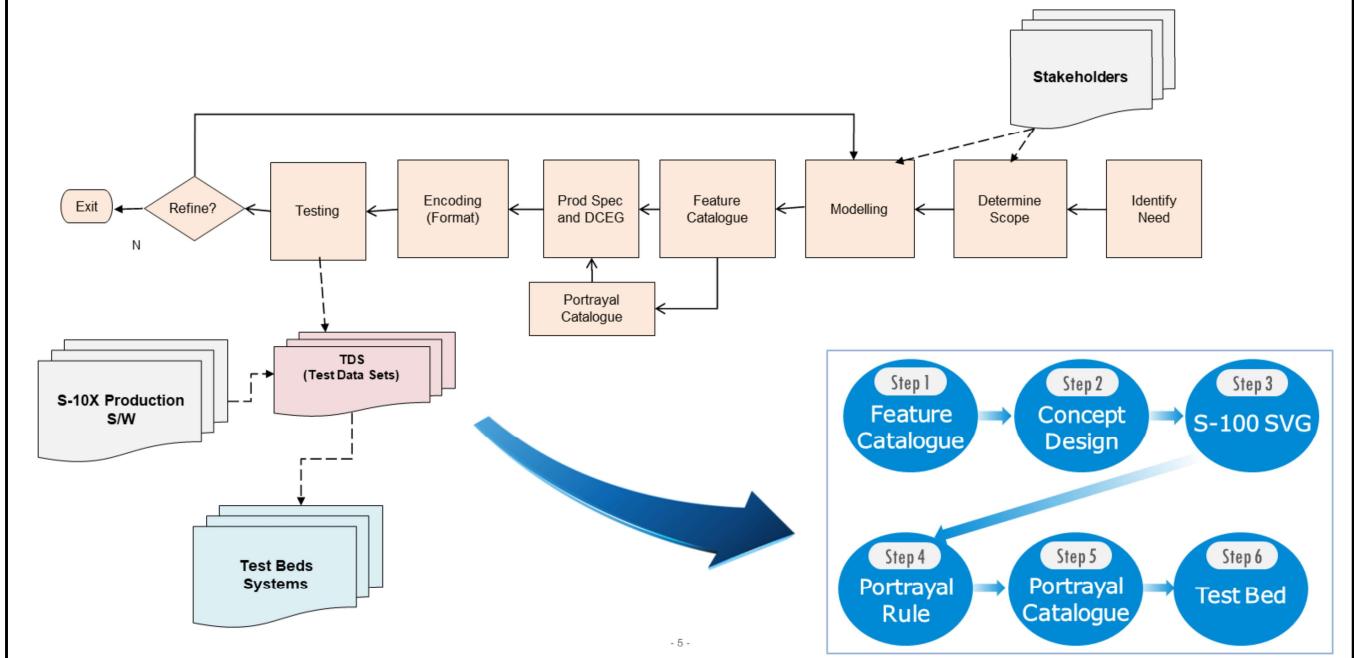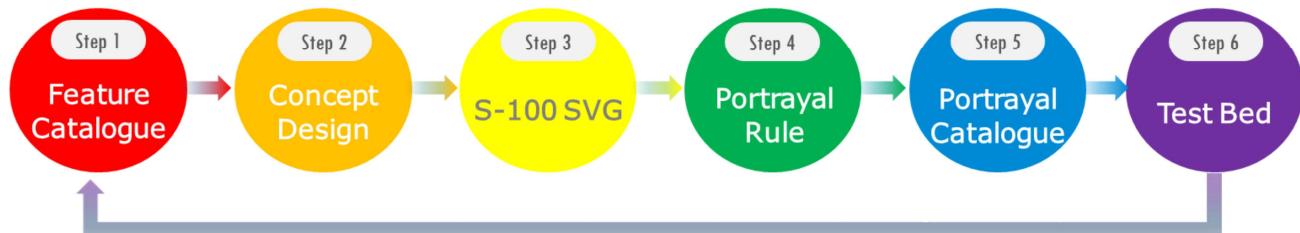
4

This is a flow chart of the development process for S-100 based Product specifications.
Following this process, KHOA carried out the six step process to express the symbol which was produced in 2017 on ECDIS.

Work Status – 2018 Work flow of KHOA

Step 1) Features, attributes, connectivity between features (simple / complex)

Step 2) Symbol (point / line / area / color / length / shape / …)

Step 3) S-100 SVG based symbol for display on ECDIS

Step 4) Decide the portrayal method for specific features and attributes

Step 5) Color profiles, rules, symbols, fonts, line styles, …

Step 6) Check the result by using S-100 Viewer and continuously modify

STEP 1. Feature Catalogue
If you want to display something on ECDIS, you first have to decide "what" is the something. It'll have many attributes (Integer, real, text, time), and it's simply or complicatedly linked to other related features. Feature Catalogue includes those things.

STEP 2. Concept Design
To portray a certain phenomenon, symbol and portrayal methods must be determined. When designing a symbol, generally use a program such as Adobe illustrator and KHOA also used it. Then you have to choose styles like, is point more appropriate to express feature's character? Or is line better? For example, usually an isobar is represented by lines and protected area is represented by polygon or circular lines or iterating pointwise pattern symbol.

Step 3. S-100 based SVG (Scalable Vector Graphics)
Then, you need to produce S-100 based symbols for display on ECDIS. Illustrator's digital file can be changed to SVG file but just on only circle, rectangle and line.

Step 4. Portrayal Rule
Now you have to decide appropriate portrayal methods by considering features and attributes at this step. Portrayal rule must be made by using XSLT, XML programming language, and symbols can be changed depending on time(day and night), area, and range.

Step 5. Portrayal Catalogue
Portrayal catalogue is an assembly of completed S-100 based SVGs and portrayal rule and it's kind of a mind map about how to display features on ECDIS.
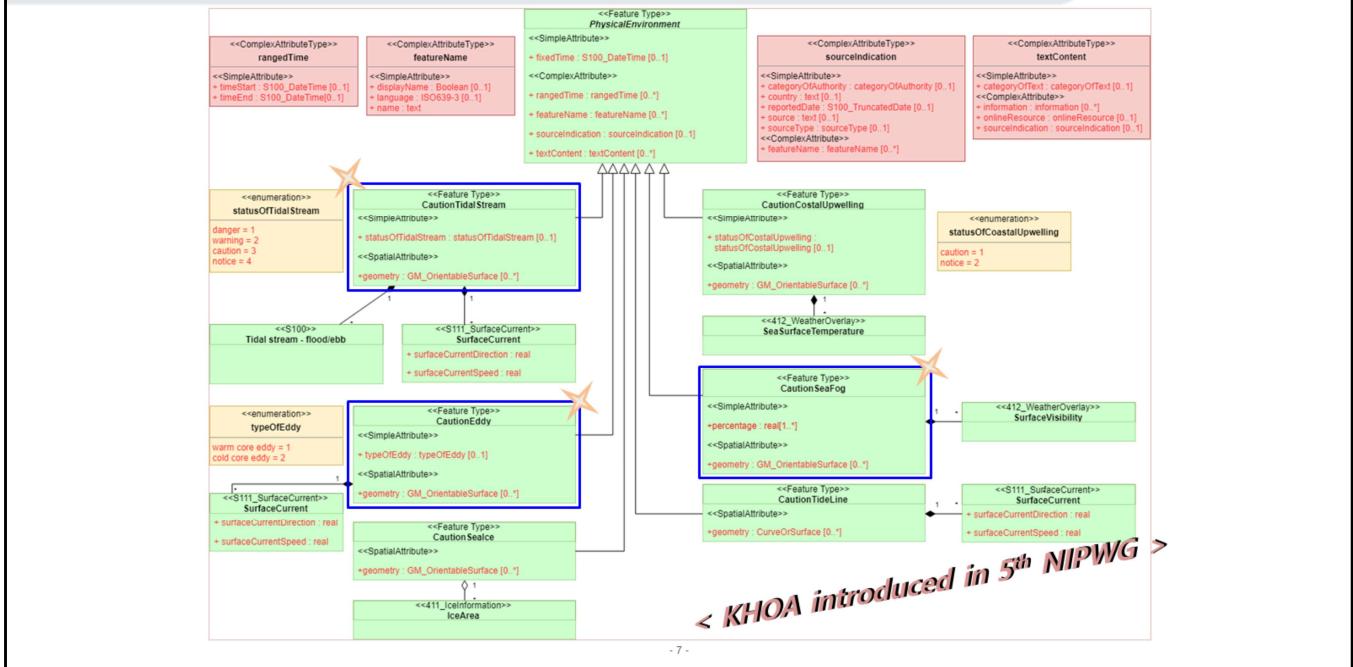
Step 6. Test bed
It's the final step of our work.
We constructed test data and verified that it appears proper on ECDIS. Through this test, KHOA checked whether other product specifications such as S-101 overlapped with colors or symbols. After that, if necessary, we returned to step 1 and repeated all steps.

The feature catalogue for the selected features is briefly introduced in the 5th NIPWG, as shown in the following figure.

Work Status – Step 2. Concept Design

- Tidal Stream (Tidal Current)
  - (NIPWG5) Consisting of undulating lines to indicate a strong water flow
  - (NIPWG6) Reproduce as intuitively recognizing symbol
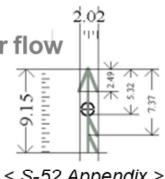
Tidal Stream (NIPWG5) / Tidal Stream (2018 New)

< S-52 Appendix >

- Sea Fog
  - (WMO) Using just lines
  - (KHOA) Lines + horizon (one more line) + cloud (two types)

Sea Fog (Lv1) / Sea Fog (Lv2)

Fog / Mist < WMO Symbol >
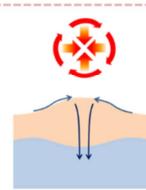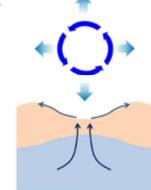
- Eddy
  - Separate colors of eddy by water temperature
  - Warm eddy – Clockwise
  - Cold eddy – Counterclockwise

Warm Eddy / Cold Eddy

< Clockwise > < Counterclockwise >

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This is the concept design for target features.
We made symbols by considering the characters of each physical phenomenon.

First, Tidal stream.
Last year, we made tidal stream symbol by using three undulating lines to indicate tidal current
but KHOA thought it also can remind of wave or severe depth changes area.
So KHOA reproduced with flood and ebb current symbols used in other standards, S-101 and S-57.

next, Sea fog.
The fog symbol used in the WMO expresses the range of fog according to the number of parallel lines.
One is not used often, two are mist, three are dense fog.
However, KHOA added a horizontal line to express the occurred

fog on the sea
and put a cloud shape to display that sea fog occurs at the boundary between sea and atmosphere.

KHOA has used artificial neural networks to predict sea fog since 2017.
Based on this data, KHOA made two types of symbols.
Level 1 is less then 50% chance of occurrence possibility, level 2 is more than 50%.
So if these are selected as sea fog symbols in S-126, thin fogs can be portrayed using level 1 and thick fogs using level 2.

Finally, Eddy.
KHOA separated the colors of eddy symbols using water temperature.
And in the case of eddy, since the rotation direction exists, KHOA expressed it by using wing shape to reflect their characteristics.

Work Status – Step 3. S-100 SVG

S-100 SVG

❖ The subset of SVG elements that have been used in the creation of **S-100 SVG** symbols

➢ **"Adobe illustrator.svg"**
  ▪ Possible to depict **arc, curve and ellipse**
  ▪ Expressing **a great number of colors**

➢ **"S-100 based.svg"**
  ▪ Can only depict **circle, quadrangle and line**
  ▪ Expressing **limited colors**

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<svg id="Emphasis" xmlns="http://www.w3.org/2000/svg" viewBox="0 0 150
150"><defs><style>.cls-1{fill:#fff;}.cls-2{fill:none;stroke:#6f7072;stroke-
width:10px;}.cls-2,.cls-3{stroke-miterlimit:10;}.cls-
3{fill:#d0d2d3;stroke:#595a5b;stroke-width:4px;}.cls-
4{fill:#595a5b;}</style></defs><title>highTidalcu_danger</title><circle class="cls-1"
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7.51,9.53,7.51,17.35,7.51,9.54-7.51,17.37-7.51,12.25,7.51,12.25,7.51"
transform="translate(-5.1 -4.86)"/><path class="cls-2" d="M33.14,86.57s4.41-
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7.52,17.37-7.52,12.25,7.52,12.25,7.52" transform="translate(-5.1 -4.86)"/><path
class="cls-2" d="M33.14,123.28s4.41-7.51,12.23-7.51,9.53,7.51,17.36,7.51,9.53-
7.51,17.36-7.51,9.53,7.51,17.35,7.51,9.54-7.51,17.37-7.51,12.25,7.51,12.25,7.51"
transform="translate(-5.1 -4.86)"/><path class="cls-3"
d="M76.68,54.8,50.09,100.86a4,4,0,0,0,3.42,5.92h53.18a4,4,0,0,0,3.42-
5.92L83.52,54.8A4,4,0,0,0,76.68,54.8Z" transform="translate(-5.1 -4.86)"/><polygon
class="cls-4" points="78.02 84.5 71.98 84.5 70.94 75.55 70.36 66.02 79.64 66.02 79.06
75.55 78.02 84.5"/><rect class="cls-4" x="71.56" y="88.56" width="6.88"
height="5.11"/></svg>
```

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?><?xml-stylesheet
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baseProfile="tiny" xml:space="preserve"  style="shape-rendering:geometricPrecision; fill-
rule:evenodd;" width="10mm" height="10mm"  viewBox="-5 -5 10
10">  <title>SEAFOG02</title>  <desc>must be defined</desc>  <metadata>  <S100SVG
xmlns:iho="http://www.iho.int/SVGMetadata">  <Description iho:publisher="KHOA"
iho:creationDate="11/06/2018" iho:format="S100SVG" iho:version="0.1"/>  </S100SVG>
</metadata>  <rect class="symbolBox layout" fill="none" x="-5" y="-5" height="10" width="10"
/>  <rect class="svgBox layout" fill="none" x="-5" y="-5" height="10" width="10" />
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```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?><?xml-stylesheet
href="SVGStyle.css" type="text/css"?><svg xmlns="http://www.w3.org/2000/svg" version="1.2"
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rule:evenodd;" width="10mm" height="10mm" viewBox="-5 -5 10 10"><title>CAUTID02</title>
<desc>caution of strong tidal current</desc><metadata> <S100SVG
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iho:version="0.1"/> </S100SVG></metadata>  <rect class="symbolBox layout" fill="none" x="-5"
y="-5" height="10" width="10" /><rect class="svgBox layout" fill="none" x="-5" y="-5" height="10"
width="10" /><path d="M -4.00,2.76 L 0.00,-4.17 L 4.00,2.76 L -4.00,2.76" class="fCHWHT"
```

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S-100 based SVG, Scalable vector graphics, is the subset of SVG elements that have been used in the creation of S-100 based symbols and covers the set of SVG elements and associated attributes and properties.

And it's possible to change the filename extension as ".svg" in the Adobe illustrator.
This Adobe "svg" file has almost every option to use web pages so it can perfectly depict arc, curve, ellipse and all colors used in Adobe illustrator can be expressed.

However, portraying current Adobe svg files on ECDIS isn't possible.
ECDIS can display symbols composed of only circle, rectangle and line, and it rejects Adobe svg files.
Therefore, it's necessary to reconstruct the Adobe svg files as S-100 based SVG files.

This is S-100 based SVG file of Sea fog level 2.
The SVG file consists of metadata and numerical files that express symbols as vector data.
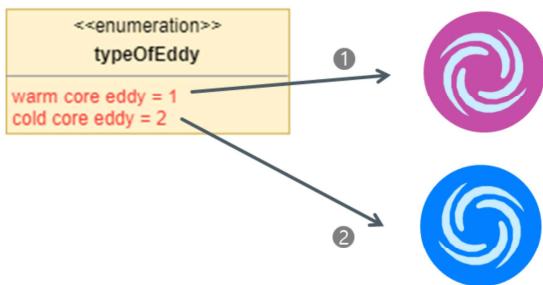
'rect' means rectangle, in this example files, It actually means the transparence background of symbol.

And you can set the attribute such as color and line thickness using class and style.

< XSL format portrayal rule on eddy >

Then you need to make a portrayal rule to display the features on ECDIS.
Portrayal rule is a specification on how to display features according to their attributes.

This is an example about portrayal rule, Eddy.

"typeOfEddy" defines whether it's a warm or a cold eddy.
One is clockwise warm eddy in red series and two is counterclockwise cold eddy in blue series.

< Portrayal Catalogue XSL >

< Directory Tree >

Portrayal Catalogue is the wholeness of S-100 based SVG symbols and portrayal rules.
These are some contents of portrayal catalogue and its directory tree.
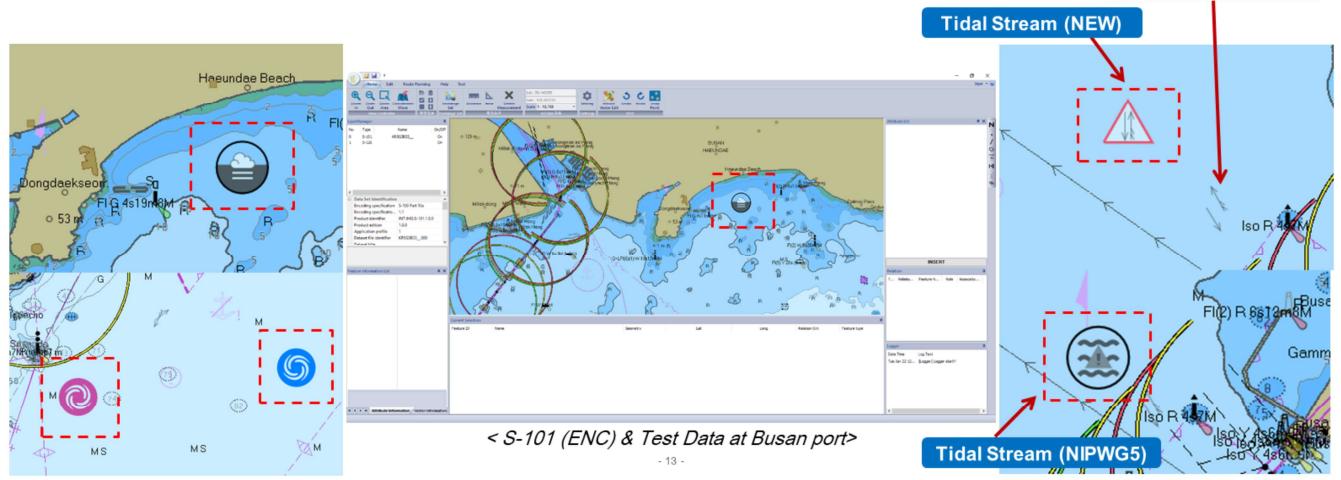
The portrayal catalogue made by KHOA has a simple structure that includes just three features, tidal stream, sea fog, eddy.

< S-101 (ENC) & Test Data at Busan port >

Here is the final step.
KHOA constructed test data of three features for Busan Port and tested whether it's displayed on ECDIS well or not.

And it's the result of KHOA's work in 2018 since the 5th NIPWG meeting.

Moving on, it's KHOA's challenges and plans.
In terms of the Development of the concepts for S-126 data,
Fisrt of all, KHOA confirmed that feature catalogue, symbol, S-100 based SVG,
Portrayal rule and catalogue need to portray physical environment elements.

Then, KHOA developed the technology to properly display tidal stream, sea fog, and eddy on ECDIS
and confirmed the results by S-100 viewer test.

This year, we'll analyze our coast pilots to determine which marine phenomenon should be standardized
and what symbols are used by other countries or internationally based on S-100.

In conclusion, KHOA proposes to further review and add the curved functions such as curve, quadratic curve to depict symbols more effectively on ECDIS.

That symbol, BUIREL15, consists of circles, line and lines to make curve on top. In addition, there are many symbols that express curves as a set of several straight lines.

Second, since there are a few types of color palettes available and there are many colors overlapping of each symbol, it's necessary to vary the color palettes.

Lastly, symbol size is currently specified in mm only. However, in order to set the symbol size according to the resolution or the aspect ratio of the screen, it's preferable to define the pixel or the ratio.

For the "discussion", KHOA wondered if there is any plan in the NIPWG to promote S-126, physical environment portrayal. If there's a plan, KHOA is willing to continue to make standardized symbols or develop portrayal skills on S-126 by

way of showing an example but this requires that the completion of features' selection be prioritized. And a consensus of NIPWG is also important.

Thank you for your attention!

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