Creation of S-101 Datasets and lessons learned

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Background

- **S-101 ENC Product Specification**
  - S-101 PT is developing the Product Specification, DCEG, Feature Catalogue, Portrayal Catalogue, Validation rules and Protection Scheme
  - S-57 to S-101 Converter and S-101 Simple Editor were developed
  - The production tool for S-101 ENC was released.
  - The team created a prototype of S-101 ENC in Busan Port area
  - to share the experience gained from it

Tool and procedure

- Two procedures

Procedure 1

Tools	S-57 ENC Editor		NOAA/ESRI S-101 Converter		S-101 Simple Editor
Step	Edit S-57 ENC	⇒	Convert S-101 ENC	⇒	Edit S-101 ENC
Note	Needs pre-work such as structuring		–		Edit S-101 features and attributes

Procedure 2

Tools	CARIS Composer 3.1		CARIS Composer 3.1		CARIS Composer 3.1
Step	Create S-101 cell base	⇒	Convert S-101 (import and copy S-57 ENC)	⇒	Edit S-101 ENC
Note	Create cell coverage and meta information		Edit the mapping table		Edit S-101 features and attributes

Overview of producing S-101 ENC datasets

- The planed procedure
  - Prepare S-57 ENCs in Port Busan
  - Edit and apply Feature Catalogue according to the latest S-101 ENC DCEG
  - Create new S-101 product profile
  - Edit converting rules related to Feature Catalogue
  - Import S-57 ENC data applied with converting rules
  - Edit additionally according to S-101 DCEG
  - Produce the S-101 ENC datasets

Overview of producing S-101 ENC datasets

- The testing area
  - 15 ENC cells (Band 6: 11 cells; Band 5: 2 cells; Band 4: 2 cells) at the Busan Port

Usage Band 6 – 11 Cells

Usage Band 4 – 2 Cells

Usage Band 5 – 2 Cells

Major issues with the creation of S-101 ENC

- ## Changing SOE (Skin Of Earth) features
  - ### changes to SOE features on S-101 ENC

S-57	Note	S-101	Note
Depth Area		Depth Area	
Dredged Area		Dredged Area	
Land Area		Land Area	
Unsurveyed Area		Unsurveyed Area	
Hulk	Group 1 → Group 2	Dock Area	Group 2 → Group 1
Floating dock	Group 1 → Group 2	Lock Basin	Group 2 → Group 1
Pontoon	Group 1 → Group 2		

(a) Editing Pontoon from Group 1 to Group 2

(b) Editing Dock Area from Group 2 to Group 1
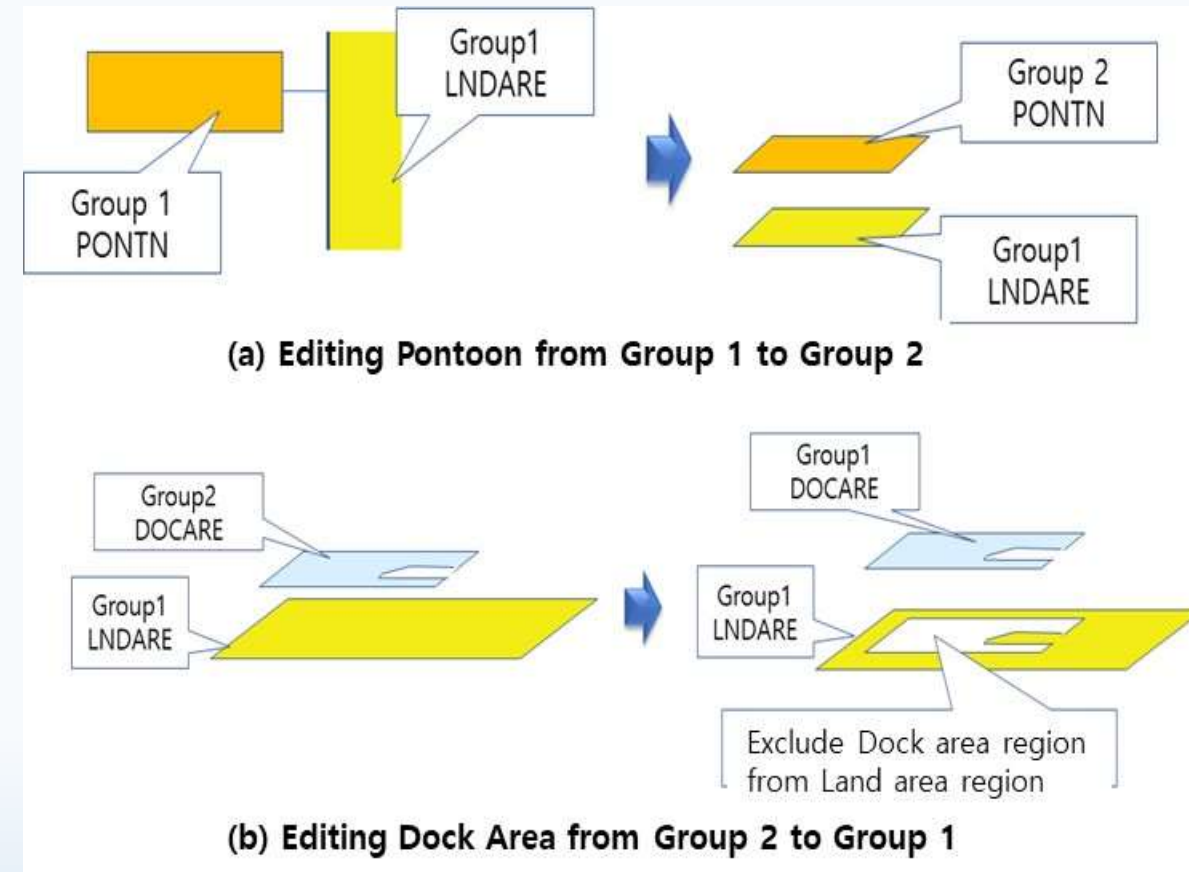
Major issues with the creation of S-101 ENC

- Data Coverage
  - M_COVR feature in S-57 shows the existence of data in cell area
  - S-57 uses M_CSCL (compilation scale of data) feature
  - M_CSCL feature is converted to data Coverage feature
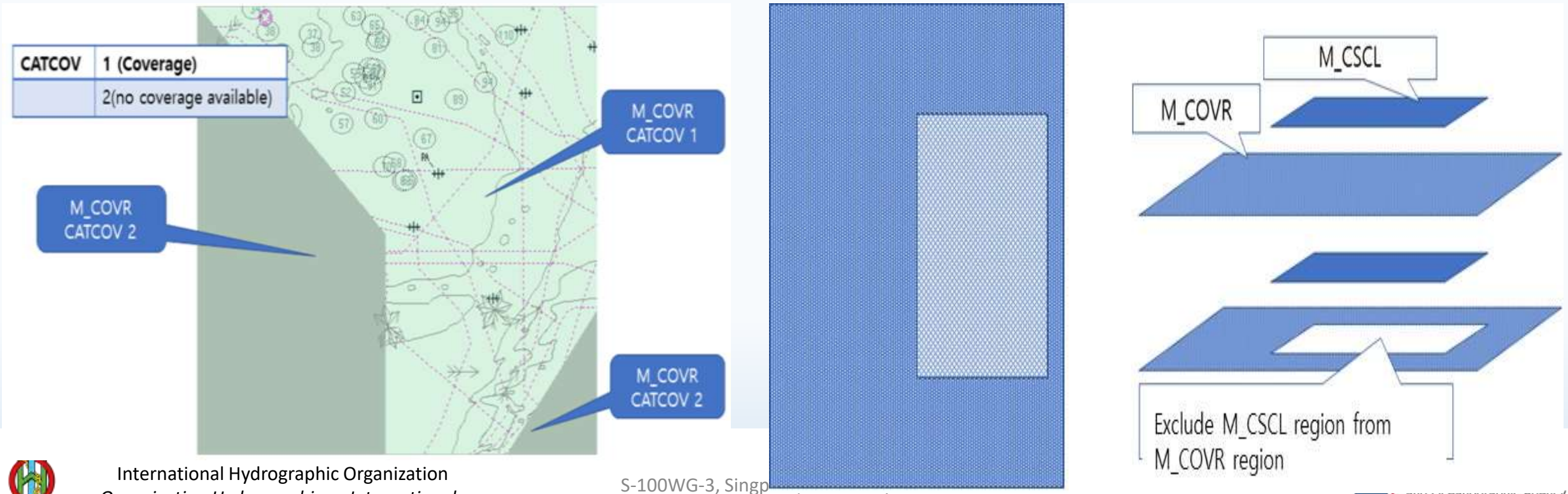
Major issues with the creation of S-101 ENC

- Feature types which need editing after converting S-57 to S-101 ENC
  - the following feature types require additional editing with S-101 ENC editing tool after converting S-57 ENC to S-101 ENC

S-101 ENC Feature type	Relevant S-57 Object types
Data Coverage	M_COVR + M_CSCL
Deep Water Route	Deep water route and Deep water route part are separated
Fairway system	FAIRWY
Information Area	CTNARE, etc.
Island Group	LNDARE
Range system	RECTRC, NAVLNE
Span Fixed	BRIDGE
Nautical Information	-
Traffic Separation Scheme	TSSBND, TSSLPT, etc.
Two-way route	TWRTPT
Update Information	-
Vessel Traffic Service Area	ADMARE

Major issues with the creation of S-101 ENC

- Items requiring editing due to deleted features and attributes
  - pre-editing due to deleted feature and attribute types after converting S-57 ENC to S-101 ENC

S-57 Feature	Content	Deleted Attributes	Solutions
M_SREL	Name of fair sheets	Feature	Information Type
TESARE	Territorial sea of the ROK	INFORM NINFOM	Insert country acronym 'KR' in Nationality attribute of Territorial sea area feature
FOGSIG	Send a signal every 15 seconds (English & Korean)	INFORM NINFOM	Signal period, Signal sequence Can present as 'multiple attributes'
All of Geo Feature	Update information	SORIND SORDAT	Replace attribute information with 'Update Information' feature information
	Additional explanation	INFORM NINFOM	Replace attribute information with 'Natural Information' feature information
CTRPNT	Triangulation point and the height of mountain	CTRPNT feature	Replace with Land Elevation feature and input the height of mountain and name

Major issues with the creation of S-101 ENC

- Outcome of reviewing cautionary notes
  - Having surveyed the status of using CTNARE in Korean ENCs

Cautionary notes	Content	S-101 Feature type
Magnetic anomaly	Caution (around Musudan, irregular local magnetic anomaly at magnetic declination of 2° W appears sometimes)	Local Magnetic Anomaly + Nautical Information
Changes to tidal current	Tidal currents near A and B are high tide but after three hours they become low tide and flow to SE for three hours and to NW for the rest of hours.	Tidal stream panel data + Nautical Information
Prohibiting fishing activities	Mines were buried in No. 9 Russian sea area during the WWII thus anchoring and fishing activities are prohibited.	Information type
Traffic safety specific area	Traffic safety specific area	Information type
Changes to river and estuary bathymetry	Depth and sand bar near Nakdongpo can change due to earth and sand coming from Nakdong River.	Information type

Major issues with the creation of S-101 ENC

- Features requiring editing due to changes to collection features
  - C_AGGR and C_ASSO features

Relationships Features	Collection Features	ROK Status
Mooring trots	C_AGGR	X
Measured distances	C_AGGR	O
Traffic Separation Schemes systems	C_AGGR	O
Navigation lines and tracks	C_AGGR	O
Navigation lines, tracks and dangers	C_ASSO	X
Synchronised lights	C_ASSO	X
Airfield, airport, (runway, control, etc.)	C_ASSO	X
Tide, tidal stream (non-harmonic prediction – time series or harmonic prediction)	C_ASSO	X
Anchorage	C_ASSO	X
Fairway	C_ASSO /C_AGGR	X
Radar beacon	C_AGGR	X

Major issues with the creation of S-101 ENC

- S-101 Collection features to be edited

S-101 Collection Feature type	Content	Editing or not
Additional Information	Connect geographical feature with information feature	O
Aids To Navigation Association	Connect navigational aids such as lighthouses	O
ASL Aggregation	Connect islands fairways and the features among them	X
Bridge Aggregation	Connect bridges and the features among them	O
Caution Area Association	Connect navigation systems applied with cautionary information	X
Deep Water Route Aggregation	Connect deep fairways and the features in the areas among them	O
Fairway Aggregation	Combine fairways which consist navigation systems	O
Fairway Auxiliary	Combine fairways and their preliminary fairways	X
Island Aggregation	Connect islands in a group of islands given one name	X
Pilotage District Association	Combine pilotage areas with their pilot boarding points	X
Range System Aggregation	Connect navigational lines and their aids to navigation	O
Spatial Association	Connect spatial types and spatial quality information features	X
Structure/Equipment	Connect structures and navigational auxiliary equipment features	X
Text Association	Connect geographical features and the position of texts on maps	X
Traffic Separation Scheme Aggregation	Connect traffic separation schemes or their features	O

Major issues with the creation of S-101 ENC

- Other editing items
  - Aids to navigation
  - Notices to mariners
  - Bridge
  - Cautionary notes
  - Recommended fairway
  - VTS line
  - Speed measuring area
  - Traffic Separation Scheme
  - Aids to Navigation Association
  - Two-way Route
  - Change to the naming standard for external reference files

Major issues with the creation of S-101 ENC

- Other editing items
  - Aids to navigation : Structure/Equipment association, light number in NOBJNM, OBJNAM, INFORM, NINFOM

Major issues with the creation of S-101 ENC

- ## Other editing items
  - ## Notices to mariners

- Create notices to mariners for each feature as 'Update Information' feature according to S-101 ENC production standard and set the relationship between the feature and Update Information Aggregation'.
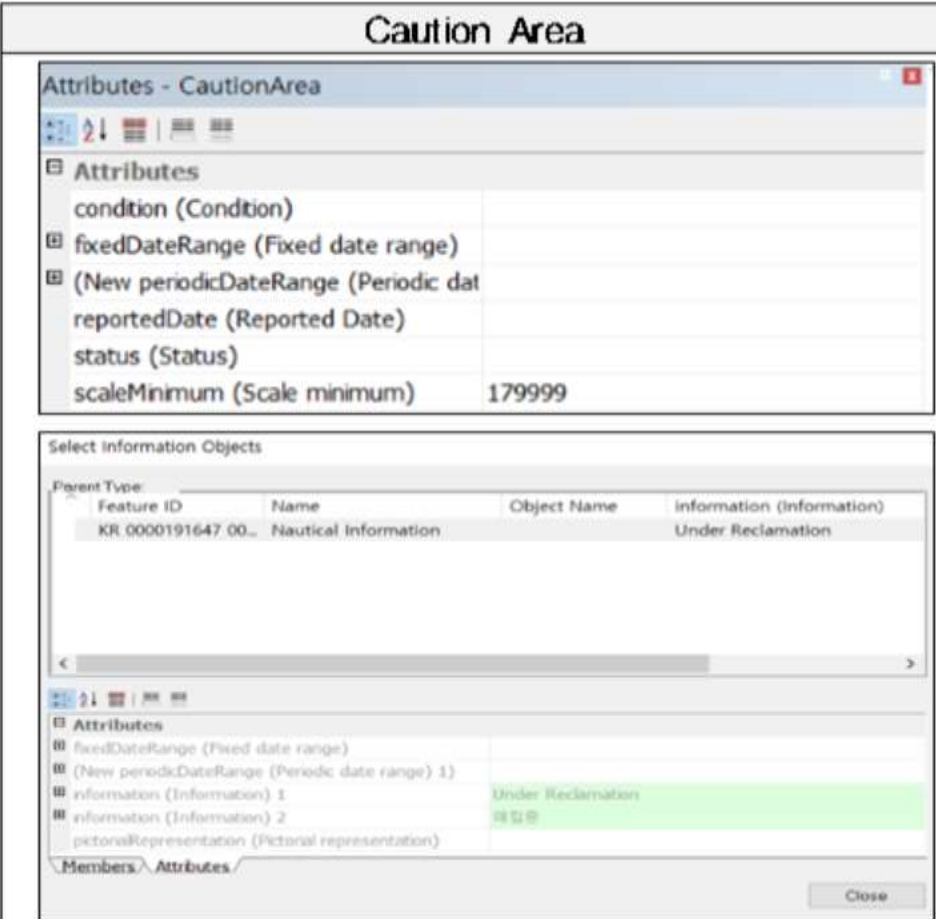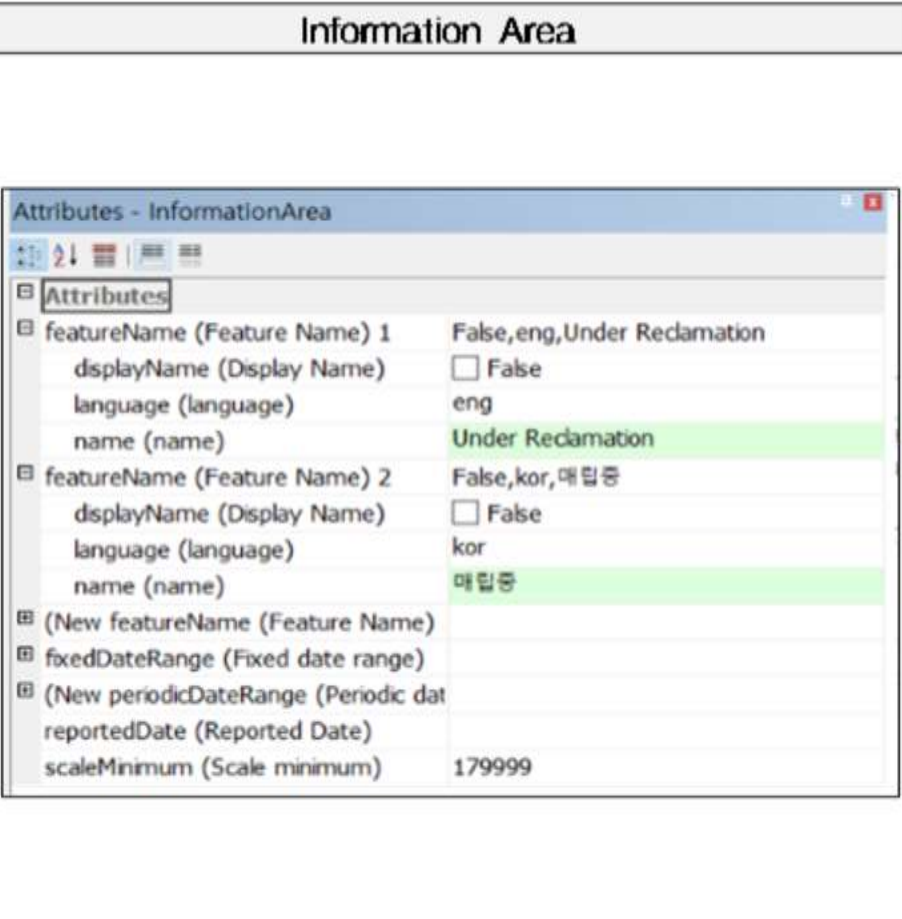
Major issues with the creation of S-101 ENC

- Other editing items
  - Cautionary notes : As for cautionary notes which do not need warnings to mariners, change Caution Area to Information Area feature
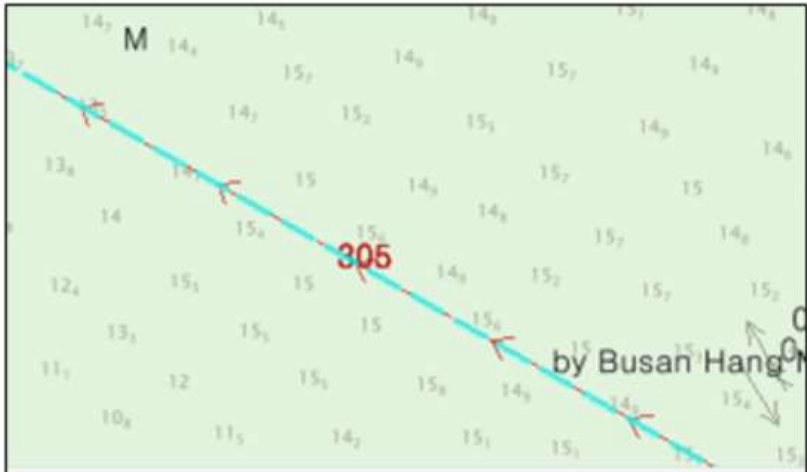
Major issues with the creation of S-101 ENC

- Other editing items
  - Recommended fairway When Navigation Line and Recommended Track show recommended fairways, create Range System which is a new feature of S-101 ENC and set Range system Aggregation relationship

Major issues with the creation of S-101 ENC

- Other editing items
  - VTS line

Major issues with the creation of S-101 ENC

- Other editing items
  - Navigation line : Create new feature type Range system and set the Range System Aggregation between Navigation line and relevant beacons

Considerations for production consistency in S-101

- KHOA identified consistency issues for ROK ENC
  - CATLIT attribute of Lights type : LIGHTS used as aircraft warning lights, no CATLIT attribute value
  - Entering light numbers : Light numbers add international or domestic numbers to INFORM and NINFOM but there is no consistency
  - Pilot boarding area : Pilot boarding areas or points need to be entered as PILBOP but as for the Masan Port, they are entered as ADMARE
  - Varying cautionary notes : Inconsistency between CTNARE INFORM and support file
  - Fair sheets : Fair sheet information is occasionally entered in both M_SREL and M_QUAL depending on the editor, resulting in unnecessary duplication

Considerations for production consistency in S-101

- KHOA identified consistency issues for ROK ENC
  - Buildings : When entering building names, some are entered with function which shows rough type of buildings and which does not. Symbols are presented differently depending on function of BUISGL
  - RESARE : The name of restricted area should be changed to OBJNAM. Current INFORM is additional information so it is entered as Additional Information in S-101
  - RADAR information : The signal interval of radar information is entered as attribute in SIGSEQ but is also duplicated in INFORM attribute
  - Seabed : WATLEV attribute for point type seabed was unnecessary
  - M_NPUB : Delete unnecessary chartlet/chart information or M_CSCL

Conclusions

- KHOA produced the prototype of S-101 ENC in the Busan Port area as part of the S-100 Testbed project.

- We believe considerations identified such as editing SOE feature could be solved if improvements were made to S-57 to S-101 Converter and editing tools.

- When we convert the S-57 ENC to S-101 ENC according to certain mapping rule, it's required to maintain consistency in the S-57 ENC production

Conclusions

- Lessons learnt from the creation of S-101 ENC datasets

  - After Final feature catalogue according to DCEG, proper mapping rules, if the convertor and editor tool is updated, the problems identified will be solved like the feature type association and SOE feature issues.

  - In order to apply the mapping rules via convertor, Consistency of S-57 is required

  - The way of how to encode in some parts can be different, The interface to adjust the mapping rules is highly required.
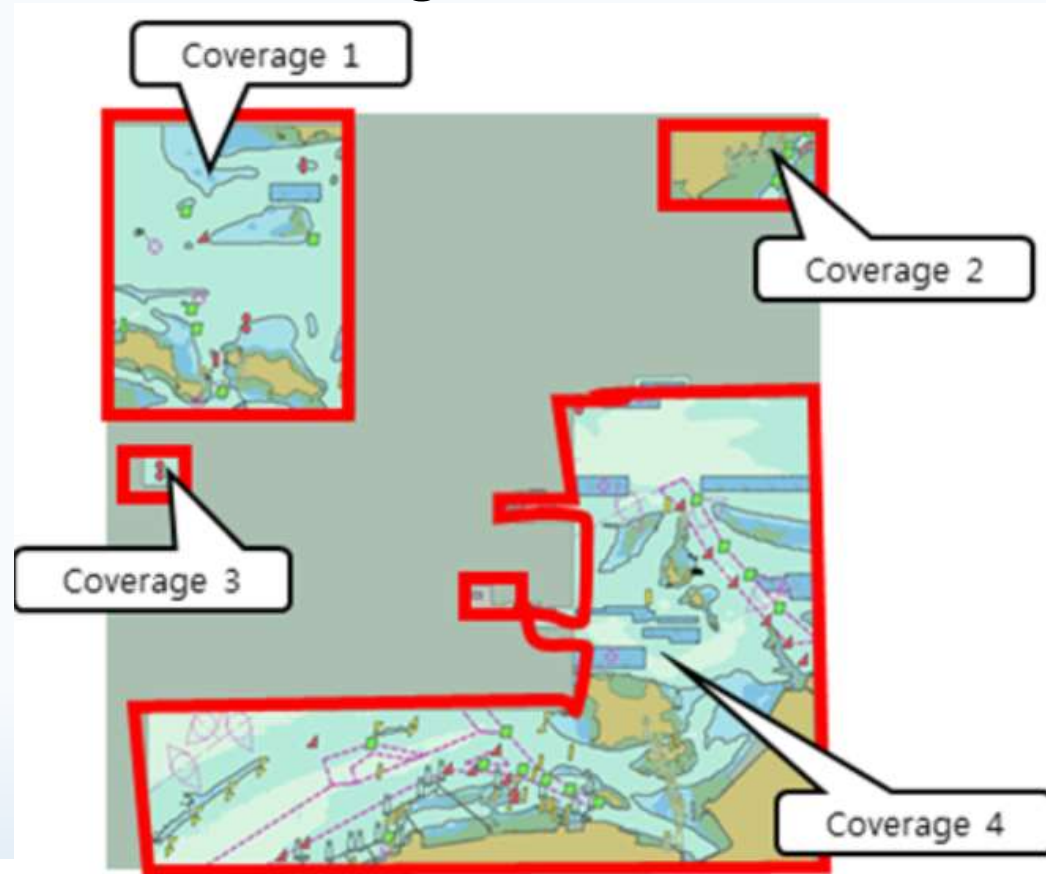
Recommendations

- It is regulated that there should be less than three data coverage in one S-101 ENC cell,

- while M_COVR and M_CSCL in S-57 is changed to data coverage in S-101 at the same time.

- Since S-57 ENC of the ROK includes many of M_COVR and M_CSCL,

- it makes it very difficult to comply with the requirements on data coverage in S-101.

- It is recommended to discuss the requirement of having three data coverage in S-101.

Recommendations

- Data Coverage Feature type

Data Coverages in KR5F2K34

M_CSCL in KR4F2O30

Recommendations

- S101_DatasetDiscoveryMetadata

Name	Multiplity	Value	Type	Remarks
horizontalDatumReference	1	EPSG	CharacterString	
horizontalDatumValue	1	4326	Integer	WGS84
verticalDatum	1	{1} to {30}	S100_VerticalAndSoundingDatum	
soundingDatum	1	{1} to {30}	S100_VerticalAndSoundingDatum	
dataType	1	ISO 8211 BINARY	S100_DataFormat	
otherDataTypeDescription	0..1		CharacterString	
dataCoverage	1..3		S101_DataCoverage	Provides information about data coverages within the dataset
comment	0..1		CharacterString	

Invite S-100WG to discuss why S-101 restrict the number of data coverage to three.

Recommendations

- S-101 Project Specification development team and the S-100 Testbed project team are invited to review the outcome from creating the S-101 ENC datasets stated in this document.