Paper for Consideration by ENCWG3

Use of CSCL and M_CSCL

Submitted by:	Australian Hydrographic Office
Executive Summary:	AHO's current practices regarding the use of CSCL and M_CSCL
Related Documents:	S-57 Appendix B.1 Annex A (UOC) clause 2.2.6, S-57 Appendix B.1 – ENC Product Specification, clause 2.1, S-101 DCEG and PS.
Related Projects:	ENC display subWG

Introduction / Background

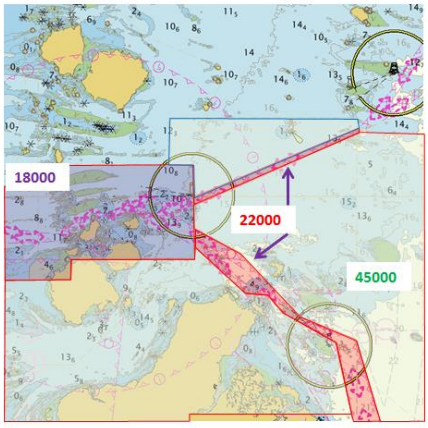
As part of the work carried out by the 'ENC display' subWG it was identified a need for further guidance on the use of CSCL and M_CSCL.
The intention of this paper is to share the current practices at the Australian Hydrographic Office and open the topic for discussion. The aim is also understand the use of the S-101 'DataCoverage' features and anticipate potential issues during S-57 to S-101 data migration.

The AHO is now adding new data into ENCs first and subsequently using them as source to derive paper charts later (ENC first policy).
As mariners become more and more familiar with ECDIS and its use, especially in restricted areas, it became clear that traditional bathymetric compilation practices, aimed to represent depths on a 'static' product like paper charts, are insufficient to support the full potential digital navigation brings to the bridge of modern vessels.
The AHO is now enlarging compilation scale in the Harbour usage, mainly in approaches to port and along the main traffic areas. The intention is to provide mariners with a smooth transition, from waiting (anchorage) areas to berth by connecting these ends by a series of M_CSCL areas with stepped compilation scales based on selectable radar ranges as recommended by the IHO.

Analysis/Discussion

Current chart compilation practices by an increasing number of HO's are supporting the 'ENC first' concept. This way of thinking means charts are compiled with the intention to serve the purpose and display characteristics of ENCs and not the paper charts'. Paper charts are now 'derived' from ENCs semi automatically using COTS software packages.
One of the benefits of electronic navigation is the interaction between ship's position (obtained from GNSS) and the information encoded in vector charts (e.g. ENCs). It's possible to set ECDIS to automatically 'zoom in' when larger compilation scale data is available. This can be the consequence of the existence of a larger scale product or a larger compilation scale area within the same product (M_CSCL).
At the AHO we have been using multiple compilation scales areas within the same product since a tiling product scheme was implemented for the NP 1 to 4 ENCs back in the early 2000's.
At that time ENCs were derived from the existing portfolio of paper charts and each ENC tile was made of the largest scale products available. For example AU411142 contains the data shown in 37500, 75000 and 150000 paper charts and its compilation scale (CSCL) was selected from the smallest scale paper chart included in the puzzle and based on the IHO recommended 'radar ranges' values (90000 for a 150k paper chart).

AU411142 – CSCL = 90000



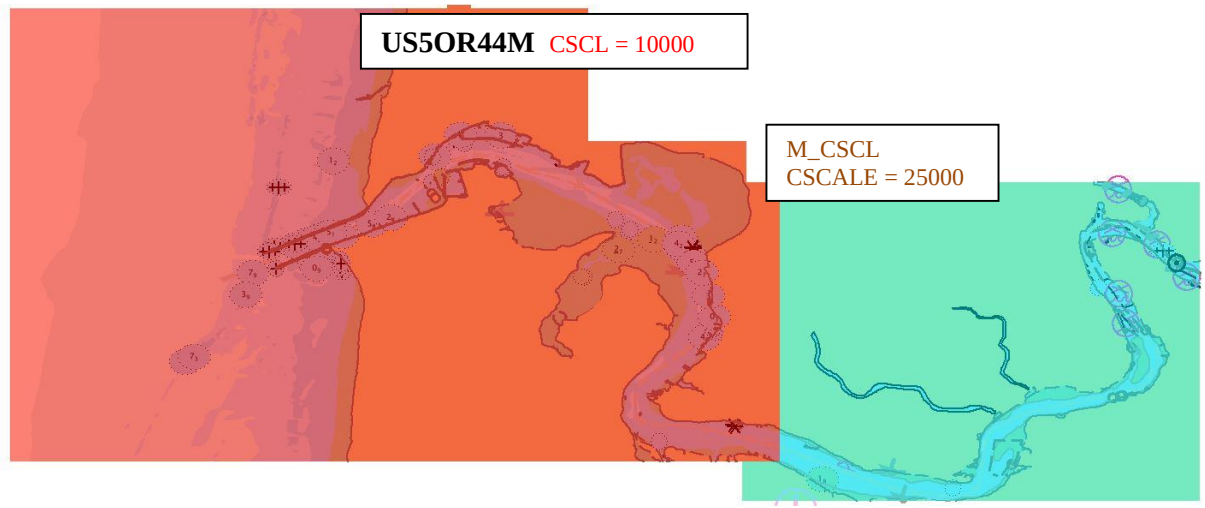
In the last 5 years or so the AHO started to include larger compilation scale areas in ENCs (AU5 first) to improve electronic navigation using ECDIS without any direct impact on paper charts. An example of this can be seen in the image above where a 1:22000 M_CSCL was created along the TWR up in Torres Strait (Great Barrier Reef). This area includes more soundings and detailed standard contours and gives more room for ships to visualize crossings, etc.

The current UOC guidance (2.2.6 Compilation scale) states as follows:

' …… The default value for the entire data set must be given in the "Compilation Scale of Data" [CSCL] subfield of the "Data Set Parameter" [DSPM] field. The default value should be the compilation scale appropriate to the greater part of the data in the cell.'

Please note that the statement above is open to interpretation and it may imply that CSCL should be the one corresponding to the largest area encoded at the same scale. In AU411142's case this would be 45000.
In order to encode this properly then we should delete the M_CSCL feature with CSCALE=45000 and create a new one covering the northern part of the cell with CSCALE=90000. This 'different' interpretation of clause 2.2.6 above would 'produce an ENC containing an M_CSCL object with a CSCALE attribute value smaller than the compilation scale (CSCL) of the cell.

Other countries such as the US (NOAA) have encoded some ENCs with M_CSCL features at a smaller scale than the CSCL value of the ENC.



M_CSCL display on ECDIS

AS part of the investigation conducted by the AHO to prepare this paper it was noticed that the "Conditional Symbology Procedure (CSP)" **DATCVR02** is not defined in S-52 PresLib Ed 4.0.2 Part I (13.1.4).
It seems that the way S-52 PL describes the way overscale pattern, overscale indication and larger scale boundary symbology **[LC(**SCLBDY51**)]** should be managed by ECDIS is only described in plain text in sections 10.1.10..2 and 10.1.10.3 of S-52 PresLib Ed 4.0.2 Part I. This is despite having 'DATCVR02' as the CSP to be executed when displaying M_CSCL features on ECDIS (see 'Look-up tables for Areas' in Annex A).

S-101 and 'DataCoverage':

The way 'DataCoverage' objects in S-101 (DCEG 3.4) function would appear to improve and standardise the way different compilation scales are used in the same ENC product.
The attributes 'minimumDisplayScale' (minDS) and 'maximumDisplayScale' (maxDS) are mandatory and 'minimumDisplayScale' must be the same for the whole ENC product.

While using the S-57 to S-101 converter (available to S-100WG members in Basecamp), the AHO noticed that M_COVR is converted into a 'DataCoverage' feature and minDS is set to one scale range smaller than CSCL and maxDS to CSCL. Similarly M_CSCL features are converted to the same S-101 object with minDS equal to the one set for the Data Coverage feature based on M_COVR and maxDS is set to the value of the corresponding CSCALE attribute.

The methodology currently used by the converter presents some problems:

- The 'DataCoverage''feature corresponding to M_COVR always overlaps the ones derived from M_CSCL objects.
- If a country has an M_CSCL with a CSCALE value smaller than CSCL (e.g. NOAA) the maxDS of this features is set to a value which is smaller than minDS
- If CSCL or CSCALE values do not correspond to one of the IHO's accepted scale ranges, the software automatically 'rounds them down' to match one.

Another topic the AHO would like to be discussed is the current guidance in S-101 PS (0.0.2) regarding the maximum number of 'DataCoverage' areas (see below).

'*Producing Authorities are to note, however, that excessive use of multiple Data Coverage features having different values of maximum display scale within a single dataset must be avoided, with a maximum number of* ***3*** *Data Coverage features being permitted.*'

The AHO would like to see this statement amended to '4 Data Coverage features' or treat the statement as guidance only (should instead of must). As an example the AHS uses CSCALE=22000 in NP4 and 5 depending on the area charted (e.g. **AU5** 4000, 8000, 12000, 22000 // **AU4** 22000, 45000, 90000, 180000).

Conclusions

a) The way M_CSCL objects are used by different countries is not consistent and this could impact on the way ECDIS presents the 'overscale pattern', 'overscale indication' and/or the 'larger scale boundary'.

b) It has been noted that the '*S-52 Presentation Library Edition 4.0(.2), Part I, Appendix C Look-up Table for Areas with Symbolized Boundaries*' refers to a conditional symbology procedure (DATCVR02) not referenced in the main document. The way ECDIS use M_CSCL features in an ENC to manage the use of 'overscale pattern', 'overscale indication' and 'larger scale boundary' symbology relies on the interpretation of sections 10.1.10.2 and 10.1.10.3 S-52 PresLib Ed 4.0.2 Part I.

c) A CSP is referred to in the S-52 ''Look-up table for areas with symbolised boundaries' M_CSCL entry but it is not defined/described anywhere in the standard.

d) The S-57 to S101 converter creates overlapping 'DataCoverage' features when at least one M_CSCL object exists in an ENC.

e) The AHO would like to see the maximum allowed number of S-101 'DataCoverage' features increased by one (unless there's evidence of a negative impact on ECDIS performance).

Recommendations

Discuss the way areas of different compilation scales should be encoded in ENCs and managed by ECDIS and the other points listed in the 'conclusions' above.

Justification and Impacts

This activity intends to come up with better guidance on the encoding of M_CSCL areas and facilitate their migration to S-101.

It may be also necessary to investigate if the existing guidance in the S-52 PL is clear/strong enough as to avoid discrepancies in the way overscale alarms, warnings and areas containing data at larger compilation scales are managed by different ECDIS models.

Action Required

The ENCWG is invited to:

a. discuss the content of this paper,
b. recommend actions and potential changes to the existing specifications and
c. share this paper and recommendations with the S-101 PT

Annex A

"FORSTC","CONVIS1","AC(CHBRN);LS(SOLD,1,CHBLK)","4","S","STANDARD","22220"
"FRPARE","","LS(DASH,2,CHGRF)","2","S","OTHER","36020"
"FSHFAC","","AP(FSHHAV02);LS(DASH,1,CHGRD)","4","S","STANDARD","26210"
"FSHFAC","CATFIF1","AP(FSHFAC03);LS(DASH,1,CHGRD)","4","S","STANDARD","26210"
"FSHFAC","CATFIF2","AP(FSHFAC04);LS(DASH,1,CHGRD)","4","S","STANDARD","26210"
"FSHFAC","CATFIF3","AP(FSHFAC04);LS(DASH,1,CHGRD)","4","S","STANDARD","26210"
"FSHFAC","CATFIF4","AP(FSHFAC04);LS(DASH,1,CHGRD)","4","S","STANDARD","26210"
"FSHGRD","","SY(FSHGRD01);LS(DASH,2,CHGRF)","3","S","STANDARD","26210"
"FSHZNE","","LS(DASH,2,CHGRF)","2","S","OTHER","36040"
"GATCON","","AC(CHBRN);LS(SOLD,2,CSTLN)","8","S","DISPLAYBASE","12410"
"GRIDRN","","LS(DASH,1,CHGRD)","5","S","STANDARD","27060"
"HRBARE","","LS(DASH,2,CHGRD)","2","S","OTHER","36020"
"HRBFAC","","SY(CHINFO07)","4","S","OTHER","32410"
"HRBFAC","CATHAF1","SY(ROLROL01)","4","S","OTHER","32410"
"HRBFAC","CATHAF4","SY(HRBFAC09)","4","S","OTHER","32410"
"HRBFAC","CATHAF5","SY(SMCFAC02)","4","S","OTHER","32410"
"HULKES","","AC(CHBRN);LS(SOLD,2,CSTLN)","2","S","DISPLAYBASE","12410"
"ICEARE","","AC(NODTA);AP(ICEARE04);LS(DASH,1,CHGRD)","3","S","DISPLAYBASE","12410"
"ICNARE","","SY(INFARE51);LS(DASH,1,CHMGF);CS(RESTRN01)","3","S","STANDARD","26250"
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