Paper for Consideration by ENCWG4

ENCs Containing Large Numbers of Spatial References

Submitted by:	IC-ENC
Executive Summary:	This paper presents a subject which has previously been discussed as part of S-58 discussions. It relates to ENC objects which reference large numbers of spatial components. IC-ENC would like to propose the inclusion of guidance in the UOC, an S-58 check and a test in S-64 to ensure ECDIS systems cater for this scenario.
Related Documents:	S-57 Edition 3.1
Related Projects:	S-58, S-64, S-101

Introduction / Background

1.   IC-ENC has received for validation a number of ENC cells with more than 12499 spatial components referenced by an object. As these cells do not load in some ECDIS systems IC-ENC currently has a policy to return these cells for improvement action. This issue has been discussed previously but this paper seeks to revisit it and proposes actions.

Analysis/Discussion

2.   The S-57 ENC Product Specification places no limit on the number of spatial references for an object. S-57 Part 3 notes (2.7) that the only size restriction is a maximum field length of 10^9-1 bytes which is defined by ISO/IEC 8211. Within the definition of the ISO 8211 encoding at Annex A of S-57 Part 3 the Record Length has a Length value of 5 which suggests a limit of 12,499 references. In reality, limits should be considered as follows; for sounding VRID records a limit of 8250 3D coordinates, 12375 2D coordinates for edge VRID records and 12375 for FRID records referencing edges. Record lengths can be "extended" using the DDR leader as detailed in S-57 Annex A.

3.   During the preparation of S-58 Edition 5.0.0 NOAA proposed an additional check for inclusion in S-58. The associated discussion is included at Annex A of this paper. Despite the outcome of this being to submit a paper to TSMAD it does not seem that this action was completed. dKart Inspector reports Warning GG2115 however this has no S-58 test number as no corresponding S-58 check exists. IC-ENC has only seen this message for 2D edges.

4.   Consequently IC-ENC would like to propose that guidance be issued for producers and then included in the UOC. Also an additional test should be included in S-64 to ensure that ECDIS software is tested to ensure that it supports objects with large numbers of references. In addition to ensure that ENC data does not exceed the maximum possible number of references IC-ENC recommend a new check is included within S-58 to detect records with more than 99,999 bytes.

5.   Primarily these changes will ensure that ECDIS systems install and display data as expected. Given the

development of ENCs containing high density depth contours often generated using semi-automated processes, IC-ENC sees the incidence of this issue as one which is likely to increase.

Recommendation

6. In order to ensure that ECDIS accepts ENCs containing a large number of references and to avoid the distribution of ENCs with an excessive number of references the IHO ENCWG should consider this paper and the proposal it makes.

Action Required of ENC WG

The ENC WG is invited to:

a. Publish an encoding bulletin making producers aware of this issue and include the relevant guidance in the Use of the Object Catalogue for ENC at the next opportunity

b. Consequently, add an additional test within S-64 and an additional check within S-58 with the category Critical. A draft S-58 check is included below to support further discussion;

Within…. **3.1 Checks Relating to S-57 Data Structure**

No	Check description	Check message	Check solution	Conformity to:	Cat
XXX	For each record check the DDR record length is not exceeded.	This record has more than the permitted number of references.	Reduce the number of references either through splitting the object or optimising the geometry.	Part 3 (2.7)	C

Annex A

NOAA : Just a heads up on a potential encoding bulletin and new S-58 check.   This would pertain to large area features that have an excessive amount of spatial edges.
Number of spatial references is not limited by S-57 but it could be limited by record length.

RP	Len	Entry name	Content
0	5	Record length	number of bytes in record

There is no specific wording in S-57 that would limit record length, but there is a limitation of record length in DDR. So record length written in DDR cannot exceed 99,999, consequently this is the maximum number of characters in one record. Considering that minimum length of one reference is 8 characters, one record can include maximum 12,5000 references. Based on this calculation we will change our software to accept maximum number of 12500 spatial references. We would need to determine the limit for the number of spatial edges for an area feature.
SHOM: Agree, but what is the reasonable limit?

UKHO: I agree with your question on the new test proposed by NOAA and wonder if this is linked to specific production software. Unsure what the reasonable limit should be. Suggest further investigation is required.
Jeppesen: If 8211 is already limited to 99999 records, why add another lesser limit?

AU: Suggest that wider discussion is required by full TSMAD on this issue before new encoding guidance is developed and a subsequent associated new S-58 test is created.
NOAA: This is linked to an issue that we had with an ECDIS, where they set a limit on the number of references. The production software was correct in this case, but we thought that it might be good to have an S-58 check also.
CA: Concur with Australia; these types of limits will require OEM input as well.
L-3 Nautronix (Frank Hippmann): The limit is not only applicable to edge references, but also applies to the number of vertices within an edge (SG2D). Normally this is not an issue if vertex density has been optimized for the intended display scale of a cell. The error is critical, as affected data sets will either fail to load or crash the target system. The same applies to SG3D references.
I agree with the check but there needs to be more investigation. Maybe it can be worded in more generic terms, Check that the maximum DDR Record Length is not surpassed.

SHOM (2nd round): As a first step, I propose adopting the above generic wording proposed by Frank.
Then I propose that NOAA set out this issue to the next TSMAD meeting in order to have a wider discuss with OEMs, and may be find a reasonable limit.

NOAA: After further reflection, this is perhaps a test that should go into S-64. The limit has been established by S-57. The issue was that the ECDIS was using a lower limit rather than the higher limit.
AU (2nd round): Tend to disagree. Clarifications to the Standard drive new/amended S-58 checks, not the other way around. The TSMAD discussion needs to occur first, and then a related S-58 test(s) developed as required. However, if it has been determined that exceeding the allowable DDR Record Length, which it appears to have been agreed is 99999, will cause issues with ENC loading in ECDIS, then have no problem with the suggested new test. Any further discussions regarding edge, SG2D and SG3D reference limit in FSPT should result in additional new tests in accordance to any future findings by TSMAD with cooperation from OEMs.
SHOM: According to the SHOM's expert in ISO 8211, the real limit is not 99,999 but 10^9-1 (see S57-part 3-clause 2.7 and ISO 8211 annex C-clause C.1.5.1). For records smaller than 99,999, the subfield Record length of the DDR must be set to 5, and for longer records it must be set to 0. Until further TSMAD discussions drive on changing the rule, the only tests we could write are:

Check where the subfield Record length of the Data Descriptive Record leader [DDR] is set to (5), that the maximum length (99,999 bytes) is not surpassed.
Check where the subfield Record length of the Data Descriptive Record leader [DDR] is set to (0), that the maximum length (10^9-1 bytes) is not surpassed.
AU: Still think this needs further input by OEMs and full discussion by TSMAD, so at this stage do not consider these tests should be added.

Conclusion: Deferred.
(Further discussion needed - NOAA to present a paper to TSMAD)