**Paper for Consideration by S100WG5**

**S100 ECDIS' Performance Standard, Type Approval and Operational Expectations**

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| *Submitted by:* | Australian Hydrographic Office (AHO) |
| *Executive Summary:* | Based on a number of events that occurred in the last six months, this paper aims to: |
| | • foresee the most likely operational dates for type approved S100 navigation systems (ECDIS) |
| | • identify the steps required to capture and consolidate multi product performance requirements in preparation for S100 ECDIS type approval process. |
| *Related Documents:* | **IMO_MSC.232(82)** - Performance Standard for ECDIS |
| | **IEC 61174** – Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirement, methods of testing and required test result |
| | **S-52** – Chart content and display aspects of ECDIS |
| | **S-52, Annex A** – IHO presentation library for ECDIS |
| | **S-63** - IHO Data Protection Scheme |
| | **S-64** – IHO test data sets for ECDIS |
| | **S-100** – Universal Hydrographic Data Model |
| | **S-100** Product Specifications (various) |
| | **S-98** - Data Product Interoperability PS |
| | **NCSR 7-22-5** - Report on monitoring of ECDIS issues by IHO |
| | **NCSR 7/J/6** – Proposed Amendments to Resolution MSC.232(82) (as proposed by IHO (NCSR 7/22/5, paragraph 23.4) |
| | **TSM7_2019_7.1A**_S-100_and_the_IMO_PerformanceStandards_rev2 |
| | **TSM7_2019_7.1B**_SOLAS_Complience_S-100_Products |
| *Related Projects:* | |

**Introduction / Background**

1.  In September 2019, paper TSM7_20197.1B recommended amending IMO_MSC.232(82) 'performance Standard for ECDIS' to refer to S-100 and S-98. This recommendation aimed to broaden the definition of nautical chart from a single product (e.g. S-101) to a multiproduct approach (e.g. S-101+S-102). Under the 'front of bridge' concept, these amendments would allow a group of S-100 products, operating together under the rules of an Interoperability Catalogue, to be recognised as a 'nautical chart' under SOLAS and consequently be accepted as meeting IMO's chart carriage requirements.

2.  In October 2019, the IHO Council endorsed the concept of an implementation decade (2020-2030) which aims for the achievement of regular service provision of substantive geographic coverage of S-101 ENC in 2024.

3.  In November 2019, the IHO submitted the paper 'Report on monitoring of ECDIS issues by IHO' to IMO's NCSR 7 (Jan 2020). As a consequence, proposed amendments to Resolution MSC.232(82) 'Performance Standard for ECDIS' have been drafted (see NCSR 7/J/6) and, if endorsed by NCSR7, would be submitted to IMO's MSC102 (May 2020) for approval. The proposed changes seem to be S-101 specific and although MSC.232(82) draft does now mention S-100 in Appendix1, it does not mention S-98 (still to be published).

**Analysis/Discussion**

Despite the latest developments at NCSR7, a number of key milestones are still pending. At this point in time, the AHO believes the most likely scenario is that S100 ECDIS will require two approval stages; the first one in support of S-101 products only and the second one to fully implement the 'front of bridge' multiproduct concept.

Below is a list of events, in chronological order, which should occur before type approved S100 ECDIS can be used to fulfil IMO's chart carriage requirements. Some of these events are still to be coordinated by the corresponding IHO WG.  Red text has been used to indicate estimated dates and pending actions.

**A.   Limited S100 ECDIS (S-57, S-61 & S101)**

      i.   A new version of IMO_MSC.232(82) - Performance Standard for ECDIS  - expected to be adopted by IMO's MSC102 in May 2020.

      ii.   Pending - New versions of IEC 61174, IHO test datasets and standards to support the development and type approval of multi-fuel (S-57, S-61 & S-101) navigation systems (ECDIS) - should be published by mid-2022.

      iii.   Commence type approval of S101 ECDIS – from early 2023.

      iv.   OEMs to commence deployment of type approved multi-fuel navigation systems (ECDIS) capable of fulfilling IMO's chart carriage requirements under SOLAS - from 1 January 2024. Note: New systems only.

    Although the goal set in the IHO's 'implementation decade' is to achieve substantive S-101 ENC coverage (>= 50% of existing S-57 ENC coverage ??) by 2024, the AHO thinks this goal is too optimistic and it may take a few more years to hit that bar.

**B.   'Front of bridge' S100 ECDIS (S-57, S-61 & S101 + S102 + S104, etc)**

The AHO believes that the following actions should be encouraged and monitored by HSSC and the S100WG in order to achieve full S100 'front of bridge' functionality on board all SOLAS vessels by 2035:

      a.   Pending - **S-101PT5 (June 2020)** – In conjunction with IEC representative, come up with a plan to capture updated S100 ECDIS performance standards based on the requirements stablished in S-101PS and associated catalogues as well as improved in-built safety functions currently discussed by the DQWG. Once all requirements have been captured and crossed referenced with the corresponding source documents the S-101PT and IEC should document the way each of them is going to be handled (e.g. new test datasets and S-64 version to be prepared by the IHO; new test incorporated into a new version of IEC 611174, etc).

      b.   Pending – **S-100 PT responsible for other 'front of bridge' products** – Liaise with IEC to prepare S100 ECDIS performance requirements. Update IEC61174; create test datasets; coordinate the preparation of new versions of S-64 as required.

    **Note**: In order for S100 ECDIS' multi product display to be recognised as 'nautical charts' under SOLAS, new amendments to MSC.232(82) will be required. This relies on the publication of an operational version of S-98 and a 'front of bridge' interoperability catalogue.

      c.   Pending – S100 ECDIS test documents and test datasets to support full 'front of bridge' operational status should be ready by 2024. OEMs to commence deployment on new ships from 2025.

      d.   Pending – Achieve substantive S-100 'front of bridge' products coverage (focus on ports and restricted areas) by 2030.

      e.   Pending – Mandatory S100 ECDIS carriage requirement for existing ships to be implemented by the IMO using a similar timeline (10 years) than for S-57 ECDIS ??

      f.   All SOLAS ships to carry S100 with 'front of bridge' capacity and capable of fulfilling IMO's chart carriage requirements from 2035.

## Conclusions

1. The work required to finalise all the documentation and test datasets to support the type approval of S100 ECDIS requires a coordinated approach that includes internal and external IHO stakeholders.

2. In order to assure future S100 ECDIS perform as planned, it is paramount to prepare a detailed summary of requirements and thoroughly link them to specific test cases.

3. The proposed amendments to MSC.232(82) to be approved at the upcoming IMO's MSC102 wouldn't allow the simultaneous display of different S100 products be accepted as a 'nautical chart' and fulfil IMO's mandatory chart carriage requirements under SOLAS. This will require a new revision of MSC.232(82) and the corresponding approval by IMO's MSC.

4. No mandatory S100 ECDIS carriage requirements for existing vessels has been proposed to the IMO. At this point in time it seems that the IHO relies on a voluntary approach by ship owners. The AHO considers that this approach carries high risk and could negatively impact the IHO's 'implementation decade' strategic goal.

## Recommendations

1. Using the sequence of events and timeline presented in this document prepare a detailed roadmap with clear milestones in order to ensure fully operational S100 ECDIS are available in <u>all</u> SOLAS vessels not later than 2035.

2. Discuss the pros and cons of recommending the IMO a mandatory carriage requirement strategy (similar to the one implemented for S-57 ECDIS). If supported by the WG, escalate it to HSSC level.

3. Make sure S100 performance requirements are clearly identified and linked to test cases.
    a. Create a list of S100 ECDIS performance requirements by PS.
    b. Map S100 ECDIS performance requirements listed in different documents (MSC.232(82); S-52, etc) against the test (e.g. S-64 or IEC61174) or system files (e.g. S101 PC, AC) that demonstrate implementation. An example has been provided in Annex A.
        - Perform gap analysis and recommend action
    c. For S-101:
        - make sure requirements detailed in the current edition of S-52 are now fully covered by the corresponding portrayal or alerts catalogue.
        - Develop S101 version of S-64
        - Develop S101 version of ECDIS Chart1

## Justification and Impacts

Failing in identifying and mapping performance requirements against test cases to be used during the type approval of future S100 ECDIS can diminish the expected performance of the new systems and negatively impact in their standardisation and the training of mariners.

The IHO should learn from the mistakes made with S-57 ECDIS where loose ends between requirements and test cases generated differences between what was written in S-52 and what OEMs implemented. Systems that were technically non conformant were anyway type approved simply because test cases were missing or incomplete.

## Action Required of S100 WG

The S100 WG is invited to:
    a. note this paper
    b. endorse the recommendations

# Limited S100 ECDIS (S-57, S-61 & S-101) - Performance Requirements

**MSC.232(82)**

| Req. # | Section | Description | Test case | | Comments |
|---|---|---|---|---|---|
| | | | Document | Test No | |
| 1 | 4.9 | ECDIS should be capable of accepting both non-encrypted ENCs and ENCs encrypted in accordance with the IHO Data Protection Scheme3. | S-64 Ed 3.0.2 | 2.1.1 | Needs S-101 ENC test dataset |
| 2 | 5.7 | It should be possible to change the display scale by appropriate steps e.g. by means of either chart scale values or ranges in nautical miles. | S-64 Ed 3.0.2 | 3.7.6 | In order to achieve a better correlation between the scale a product is compiled at and the scale mariners view them, the S101PT expects S100 ECDIS to only (?) offer for selection the display scales mandated by S-101 DCEG section 2.5.5. This specific requirement is not documented anywhere although it is expected to be implemented !? |
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| 4 | | | | | |
| 5 | | | | | |

**S-52 to S-101 PC**    PC = Portrayal Catalogue        AC = Alerts Catalogue

| Req. # | S-52 Section | Description | Migrated to S-101 ? | Test case | | Comments |
|---|---|---|---|---|---|---|
| | | | | Document | Test No | |
| 1 | 2.3.1c 2 | If the manufacturer should add non-HO (non- ENC) chart information to the SENC it should be symbolised in the same way as HO chart information and distinguished from HO chart information as described for the various cases below: | // | // | // | // |
| 1a | 2.3.1c 2(i) | Limited non-HO data is added to existing HO data to augment the chart information. Each object should be marked by the special identifiers described in the Presentation Library, Part I, section 10.7.3. | PC | ? | ? | Point and Line symbology CHCRID01 exists in S101 PC. No test found in S-64. Included in IEC 61174 ?? |
| 1b | 2.3.1c 2(ii) | An area of non-HO data is located in waters for which HO chart data exists; it is superimposed on the HO data. In some cases the non-HO data may be more appropriate for the intended purpose, for example it may be more detailed.

In this situation it is at the mariner's discretion whether to use the HO or the non-HO data.

If the mariner selects the non-HO data, the boundary of this data should be identified on the ECDIS display by the line LC(NONHODAT) and the warning "Unofficial data displayed; refer to official RNC or paper chart" should be displayed.

Note that the LC(NONHODAT) is a "one-sided line", and the boundary of the area of non-HO data must be drawn according to S-57 rules to ensure that the diagonal stroke of the line is on the non-HO data side of the line. More details are given in the Presentation Library, Part I, section 10.1.7 and in section 2 of the Addendum to Part I | PC | S-64 | 3.4 | Line symbology NONHODAT exists in S101 PC. |
| 1c | 2.3.1c 2(iii) | An area of non-HO data is located wholly outside the area covered by HO data (although it may share a boundary with the HO data) but is shown on the same display as HO data. The non-HO data should be bounded by the line LC(NONHODAT) and the warning "Unofficial data displayed; refer to official RNC or paper chart." should be displayed. | PC | ? | ? | Line symbology NONHODAT exists in S101 PC. No test found in S-64. Included in IEC 61174 ?? |
| 1d | 2.3.1c 2(iv) | The entire display contains nothing but non-HO data. The warning "No official data available; refer to official RNC or paper chart." should be displayed. In this case, special identifiers need not be used." | N/A | ? | ? | No test found in S-64. Included in IEC 61174 ?? |
| 2 | | | | | | |
| 3 | | | | | | |
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