



# IHO S-64 Revision for S-100

## Phase 1 – Summary Report

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## 1 Introduction and Background

In order to produce a version of the IHO S-64 test datasets for ECDIS which will set out a baseline for testing S-100-capable ECDIS a progressive approach has been initiated. This is based on

1. An initial survey of the coverage of S-64
2. The requirements of the IMO Performance Standards for ECDIS
3. The capabilities of IHO S-100

A phased approach has been devised which will produce a complete test dataset and accompanying manual for testing of ECDIS in order to demonstrate conformance with a revised IEC testing standard. This short report details the progress of this effort in respect of Phase 1, its stated goal to accomplish “Setup and simple migration” – this goal covers:

1. Setup of an environment for conversion of existing test datasets into S-101 format and the ability to change manage, document and track issues on created data
2. An initial assessment of the data content contained within the converted datasets
3. Creation of simple “new” content (for S-101)
4. Documentation of issues where they arise.

Future phases will cover the introduction of new product specifications, more detailed/exhaustive co-existence testing, a broadening to general S-100 functionality and complete documentation production to support testing.

This document captures the results of testing so far and the content produced.

Conceptually, S-64 forms the link between the functionality specified in the IMO Performance Standard for ECDIS and the underlying IHO standards relating to ECDIS operation. IHO S-64 therefore draws from many components of the S-57 standards base in order to define the necessary datasets. To “move” to a position where S-100, its component product specifications and framework capabilities is a significant task for which the current standard provides only an initial framework. The object of Phase 1 has been to construct a conversion methodology using available tools and produce an initial set of data to act as a skeleton on which to build the eventual complete revision of S-64. Some thoughts on future phases is contained in the final section of this report.

## 2 Methodology and Tools

### 2.1 Tools used

The tools used to implement phase 1 of the S-64 test datasets are as follows:

1. Predominantly Caris was used as the dataset authoring tool due to the features offered and the existing skills the team has in using it. Theoretically there should be no barrier to use of another tool and future phases may well dictate a variety (and the test datasets may well be stronger for it).
2. GitHub is being used as the change control and management tool. This allows for:
  - a. Strict controls of file content and format
  - b. Capture and resolution of issues including linking to individual test datasets
  - c. Wiki style documentation of files/folders and easy update of non-normative documentation.

The following diagram illustrates the system used to create the initial phase 1 test datasets.

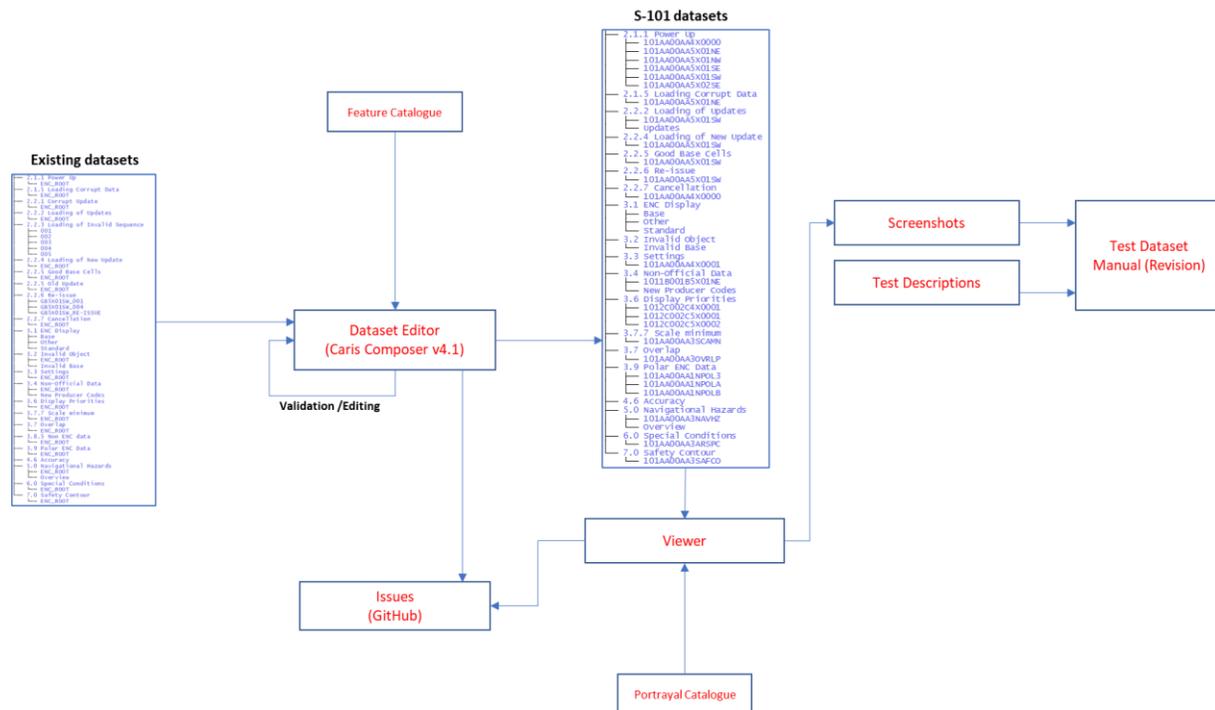


Figure 1: Creation of test datasets and documentation

As can be seen the source existing datasets (S-57 format) are converted using a dataset editor. In this phase Caris composer 4.0 (and later v4.1) was used to create the S-101 datasets. These are then saved into a folder structure resembling that of the current S-64 test datasets after any iterative validation and editing required.

The NIWC S-100 viewer was used as a validation tool as well as to visualise the datasets created. During this phase an attempt was made to replicate many of the screenshots/images used in the S-64 test dataset manual. A more detailed creation of such screenshots will be required and performed in later

phases – at this stage this is just a final validation phase of the layout, structure and content of the created dataset.

Captured issues, along with the final folder structure are all contained within the GitHub repository created for the project. A public copy of the folder structure is also created for more public dissemination and review and can be used to capture review issues and modifications in later phases.

A section of a revised test data manual has been prototyped which is auto-generated from screen captures and original text from the existing manual. The quantity of screen captures required makes the compilation of such a manual a time-consuming and error-prone process. It is hoped that a more change controlled approach can be adopted which is quicker and more reliable. This will be expanded on in subsequent phases – all necessary source documents and initial screenshots are within the phase 1 repository.

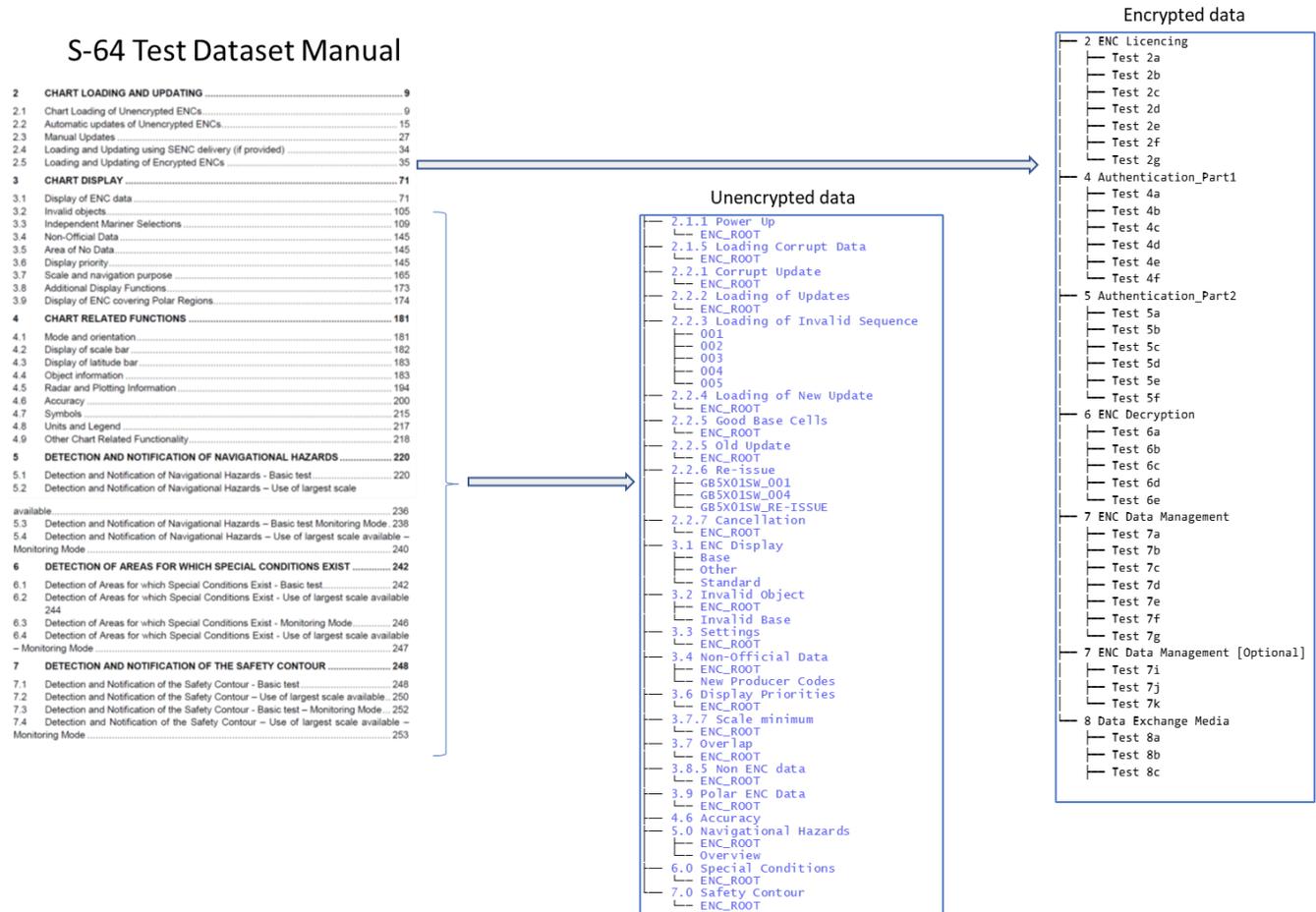
## **2.2 Existing Test datasets**

The existing test datasets in S-57 format are grouped into a file structure resembling the tests as documented in the S-64 manual. In the original S-64 scoping study it was decided that the underlying structure of the test datasets reflects well the structure of the IMO Performance Standard and it should be used as a template for the revised S-64.

What is not covered in the existing S-64 standard is a mapping of the “intent” of the test to the data which is included in each of the dataset folders. For instance a test of Base Display should include ALL features to be included in the base display – this isn’t documented in the S-64 test datasets (i.e S-64 doesn’t list out which features constitute “Base Display”) and will need to be created as the phases continue. Although in some cases this is simple, in others (e.g. safety contour generation) it is more complex. This is discussed in more detail in the conclusions and way forward at the end of this document.

The existing S-64 test datasets are designed to be used in conjunction with the Test Dataset Manual (TDS). This manual contains the actual tests performed by the tester in order to demonstrate compliance with IEC61174. The S-64 tests are split into the following major categories:

- Unencrypted
- Encrypted



**Figure 2: S-64 Manual and Dataset Folder Structures**

It is likely that future phases will add to these major sections (e.g. new product specifications, co-existence testing (S-57/S-101 for dual fuel operation) and further subdivide them based on the areas within the Performance Specification (so, for instance, data loading and viewing will be dealt with in the S-57/S-101 co-existence tests).

Each major section is split into a number of numbered tests testing areas of functionality covered by IEC61174 (and mapping back to the original IMO PS). The numbering is not absolute but there are cross-references in the text which will need to be preserved.

For Phase 1 it was decided to retain the existing folder structure as no new datasets are being created. Future phases should commence with a proposed folder structure able to accommodate the expanded scope and possibilities of S-100 and other product specifications.

## 2.3 Conversion Process.

The conversion process uses the out-of-the-box Caris mappings from S-57 objects/attributes to S-101 features/attributes and relationships to information types. This has not been analysed in detail nor is it intended to be defined as “the” formula to convert from S-57 to S-101.

Some aspects of the conversion were further refined during the validation/editing phase including the following:

1. Removal of any attributes not matching the feature catalogue bindings
2. Insertion of mandatory metadata
3. Change of names for auxiliary files and their mappings within features

## 2.4 Outcomes

The output cells are listed in the table below:

. /2.1.1 Power Up/101AA00AA4X0000/101AA00AA4X0000/101AA00AA4X0000.000
. /2.1.1 Power Up/101AA00AA5X01NE/101AA00AA5X01NE/101AA00AA5X01NE.000
. /2.1.1 Power Up/101AA00AA5X01NW/101AA00AA5X01NW/101AA00AA5X01NW.000
. /2.1.1 Power Up/101AA00AA5X01SE/101AA00AA5X01SE/101AA00AA5X01SE.000
. /2.1.1 Power Up/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.000
. /2.1.1 Power Up/101AA00AA5X02SE/101AA00AA5X02SE/101AA00AA5X02SE.000
. /2.1.5 Loading Corrupt Data/101AA00AA5X01NE/101AA00AA5X01NE/101AA00AA5X01NE.000
. /2.2.2 Loading of Updates/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.000
. /2.2.2 Loading of Updates/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.001
. /2.2.2 Loading of Updates/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.002
. /2.2.2 Loading of Updates/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.003
. /2.2.2 Loading of Updates/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.004
. /2.2.2 Loading of Updates/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.005
. /2.2.2 Loading of Updates/Updates/001/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.001
. /2.2.2 Loading of Updates/Updates/002/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.002
. /2.2.2 Loading of Updates/Updates/003/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.003
. /2.2.2 Loading of Updates/Updates/004/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.004
. /2.2.2 Loading of Updates/Updates/005/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.005
. /2.2.4 Loading of New Update/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.000
. /2.2.4 Loading of New Update/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.001
. /2.2.5 Good Base Cells/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.000
. /2.2.6 Re-issue/101AA00AA5X01SW/101AA00AA5X01SW/101AA00AA5X01SW.000
. /2.2.7 Cancellation/101AA00AA4X0000/101AA00AA4X0000/101AA00AA4X0000.000
. /2.2.7 Cancellation/101AA00AA4X0000/101AA00AA4X0000/101AA00AA4X0000.001
. /3.1 ENC Display/Base/101AA00AA5DBASE/101AA00AA5DBASE/101AA00AA5DBASE.000
. /3.1 ENC Display/Other/101AA00AA5OTHER/101AA00AA5OTHER/101AA00AA5OTHER.000
. /3.1 ENC Display/Standard/101AA00AA5STNDR/101AA00AA5STNDR/101AA00AA5STNDR.000
. /3.2 Invalid Object/Invalid Base/101AA00AA5X01NE/101AA00AA5X01NE/101AA00AA5X01NE.000
. /3.3 Settings/101AA00AA4X0001/101AA00AA4X0001/101AA00AA4X0001.000
. /3.4 Non-Official Data/1011B001B5X01NE/1011B001B5X01NE/1011B001B5X01NE.000
. /3.4 Non-Official Data/New Producer Codes/1012C002C3NEWCC/1012C002C3NEWCC/1012C002C3NEWCC.000
. /3.4 Non-Official Data/New Producer Codes/1012C002C3NEWPC/1012C002C3NEWPC/1012C002C3NEWPC.000
. /3.6 Display Priorities/1012C002C4X0001/1012C002C4X0001/1012C002C4X0001.000
. /3.6 Display Priorities/1012C002C5X0001/1012C002C5X0001/1012C002C5X0001.000
. /3.6 Display Priorities/1012C002C5X0002/1012C002C5X0002/1012C002C5X0002.000
. /3.7 Overlap/101AA00AA3OVRLP/101AA00AA3OVRLP/101AA00AA3OVRLP.000
. /3.7.7 Scale minimum/101AA00AA3SCAMN/101AA00AA3SCAMN/101AA00AA3SCAMN.000
. /3.9 Polar ENC Data/101AA00AA1NPOL3/101AA00AA1NPOL3/101AA00AA1NPOL3.000
. /3.9 Polar ENC Data/101AA00AA1NPOLA/101AA00AA1NPOLA/101AA00AA1NPOLA.000
. /3.9 Polar ENC Data/101AA00AA1NPOLB/101AA00AA1NPOLB/101AA00AA1NPOLB.000
. /5.0 Navigational Hazards/101AA00AA3NAVHZ/101AA00AA3NAVHZ/101AA00AA3NAVHZ.000
. /5.0 Navigational Hazards/Overview/101AA00AA2OVRVU/101AA00AA2OVRVU/101AA00AA2OVRVU.000
. /6.0 Special Conditions/101AA00AA3ARSPC/101AA00AA3ARSPC/101AA00AA3ARSPC.000
. /7.0 Safety Contour/101AA00AA3SAFCO/101AA00AA3SAFCO/101AA00AA3SAFCO.000

Figure 3: List of initial S-101 cells output from Phase 1

These constitute the complete unencrypted test datasets in the current S-64 tests. Exchange sets with default CATALOG.XML have been created alongside these cells and reference implementations for the Part 15 encryption are able to digitally sign and encrypt them as well.

The cells have been validated within the editing tool (Caris composer) as far as it allows (in the absence of a formal S-58 equivalent) and all have been loaded within the viewer to sanity test the content.

This set of data can be cloned from the output GitHub repository and tests made against them – if necessary issues can be raised within the repository for resolution.

## **2.5 Gaps for later phases.**

A number of items have been covered in less detail and will be fleshed out in future phases of the S-64 test datasets.

1. CATALOG.XML files have been populated with default values which will need documenting, agreeing and specifying as part of a future phase. The baseline in the CATALOG.XML is conformant with the XML schema and produced by the COTS dataset editing tool.
2. Full encrypted test datasets from multiple providers have not been produced yet. The S-100 Part 15 implementation is complete in respect of tools and digital signature reference functionality but a more detailed set of test cases need to be defined based on the loading/unloading and service provision parameters of the S-100 ECDIS. As the dual-fuel ECDIS and its operating modes become clearer these test cases can be fully defined. For instance cases involving large media support, PRODUCTS.TXT and ECDIS status report need to be re-defined in terms of their equivalent structures (or lack thereof!) in S-100.
3. Full validation of datasets in line with a revised S-58 will need to be done as the new S-58 evolves. All aspects such as geometry, ISO8211 encoding, attribute value validation etc will all need to be revised continuously.
4. External files may require update, date stamps in tests etc will all need to be revised as the different phases are implemented. The data has been converted “as is” for this phase, the emphasis being on producing a platform and scheme which can be used to grow the end goal of a complete and comprehensive revision of S-64.
5. Mapping to original test “intentions” in respect of the IMO Performance Standard will need to be done as a priority in the next phase. This will establish which tests require “exhaustive” feature content and which cells have content which is contextual only. The S-101 feature catalogue and DCEG is reasonably complete and should be sufficient to be used as a normative guide to what should be included in cells. Where possible new features have been included, many have been defined by the editing tool (Caris) default mappings but there is no firm evaluation of whether this is complete as yet.

## **3 Conversion results**

A small number of inconsistencies have been noted in the IHO feature catalogue for S-101 current at the time of dataset creation. These are just mismatches between the DCEG definitions of relationships between features/information types and the XML encoding within the feature catalogue. These have been raised with the S-101PT chair and will be more formally discussed at the next meeting of that group.

The Phase 1 sets up a system where data is viewed on the NIWC S-100 viewer according to the portrayal catalogue with its current portrayal catalogue. A number of obstacles, mostly relating to either feature catalogue or ISO8211 encoding were noted and discussed with both NIWC and Caris and progressed during phase 1. The tools now are currently stable and perform well for this phase of the data creation process. Some representative screenshots suitable for inclusion in the test dataset manual were produced from the viewer – these are including in the repository for phase 1. The 8211 inconsistencies are reflective of a lack of rigorous tests for the S-100 Part 10a encoding (along the lines of S-58) and some areas where Part 10a could more thoroughly describe the encoding and its parameters. Again, these will be discussed at the next meeting of the relevant groups.

Where possible the base datasets have also been dumped to text files to make subsequent validation and inspection of their contents possible. This is still a work in progress but a sample of the text dump of a cell is shown in the following table:

```
FR 100/85 Obstruction Obstruction:{ waterLevelEffect=7, },
FR 100/86 Coastline
FR 100/87 ShorelineConstruction ShorelineConstruction:{ scaleMinimum=200000, },
FR 100/88 Pontoon Pontoon:{ scaleMinimum=200000, },
FR 100/89 PipelineOverhead PipelineOverhead:{ radarConspicuous=1, scaleMinimum=200000, },
FR 100/90 PipelineOverhead PipelineOverhead:{ radarConspicuous=1, scaleMinimum=200000, },
FR 100/91 PipelineOverhead PipelineOverhead:{ scaleMinimum=200000, },
FR 100/92 Obstruction Obstruction:{ categoryOfObstruction=8, scaleMinimum=200000, },
FR 100/93 MooringWarpingFacility MooringWarpingFacility:{ categoryOfMooringWarpingFacility=6, scaleMinimum=200000, },
FR 100/94 MooringWarpingFacility MooringWarpingFacility:{ categoryOfMooringWarpingFacility=4, scaleMinimum=200000, },
FR 100/95 Gate Gate:{ categoryOfGate=5, horizontalClearanceOpen:{ horizontalClearanceValue=15, }, scaleMinimum=200000, },
FR 100/96 Gate Gate:{ categoryOfGate=4, horizontalClearanceOpen:{ horizontalClearanceValue=15, }, scaleMinimum=200000, },
FR 100/97 Landmark Landmark:{ categoryOfLandmark, scaleMinimum=200000, },
FR 100/98 Hulk Hulk:{ scaleMinimum=200000, },
FR 100/99 LandArea LandArea:{ scaleMinimum=200000, },
FR 100/100 PylonBridgeSupport PylonBridgeSupport:{ categoryOfPylon, scaleMinimum=200000, },
FR 100/101 Pile Pile:{ scaleMinimum=200000, },
FR 100/102 OffshorePlatform OffshorePlatform:{ scaleMinimum=200000, },
FR 100/103 UnderwaterAwashRock UnderwaterAwashRock:{ valueOfSounding, waterLevelEffect=2, scaleMinimum=200000, },
FR 100/104 Obstruction Obstruction:{ valueOfSounding=10, waterLevelEffect=1, scaleMinimum=200000, },
FR 100/105 ShorelineConstruction ShorelineConstruction:{ scaleMinimum=200000, },
FR 100/106 MooringWarpingFacility MooringWarpingFacility:{ categoryOfMooringWarpingFacility=5, scaleMinimum=200000, },
FR 100/107 MooringWarpingFacility MooringWarpingFacility:{ categoryOfMooringWarpingFacility=2, scaleMinimum=200000, },
FR 100/108 MooringWarpingFacility MooringWarpingFacility:{ categoryOfMooringWarpingFacility=1, scaleMinimum=200000, },
FR 100/109 MooringWarpingFacility MooringWarpingFacility:{ categoryOfMooringWarpingFacility, scaleMinimum=200000, },
FR 100/110 Wreck Wreck:{ categoryOfWreck=2, waterLevelEffect=2, scaleMinimum=200000, },
FR 100/111 Wreck Wreck:{ valueOfSounding=10, waterLevelEffect=3, scaleMinimum=200000, },
FR 100/112 UnderwaterAwashRock UnderwaterAwashRock:{ valueOfSounding=10, waterLevelEffect=3, scaleMinimum=200000, },
FR 100/113 Obstruction Obstruction:{ waterLevelEffect=7, scaleMinimum=200000, },
FR 100/114 LandArea LandArea:{ scaleMinimum=200000, },
FR 100/115 DepthArea DepthArea:{ depthRangeMinimumValue=0, depthRangeMaximumValue=10, },
FR 100/116 DepthContour DepthContour:{ valueOfDepthContour=10, },
FR 100/117 LandArea LandArea:{ scaleMinimum=200000, },
FR 100/118 DepthArea DepthArea:{ depthRangeMinimumValue=0, depthRangeMaximumValue=10, },
FR 100/119 UnsurveyedArea
FR 100/120 Coastline
```

Figure 4: Text dump of test dataset

This allows for inspection of dataset values for completeness, creation of new feature/attributes and their bindings.

### 3.1 Test Dataset Manual.

The accompanying test dataset manual is, in the repository, constructed using the “asciidoc” tool from a set of text files and screen captures. This allows each test to be self-contained in a separate text file and a single aggregation process to produce an output PDF file.

The process is a modular one which can be expanded to compile the large manual required for ECDIS testing. This avoids the need to compile large documents manually and imposes a rigorous change management process on edits to the manual as it develops over time.

An example of an asciidoc text “test” specification is shown below:

```

==== Loading a Corrupted update
==== Corrupted update load.

[width="95%",caption="",stripes="odd"]
|=====
|Test Reference | 2.2.1 | IHO Reference | IEC61174 / 4.4.1
|=====
[width="95%",caption="",stripes="odd"]
|=====
|Test Description
|Loading of initial datasets and indication of own ship stationary position.
|Setup
|a) Load cells:
|
|* 2.1.1 Power Up\ENC_ROOT\GB4X0000.000
|* 2.1.1 Power Up\ENC_ROOT\GB5X01NW.000 with the following settings:
|* Select Display Category Other
|* Set the Safety Contour value to 8 m
|* Set the Safety Depth value to 8 m
|* Select Symbolized Boundaries
|* Select Paper chart symbols
|* Select all Text groups
|* Select Accuracy
|* Select Highlight info
|* Select Highlight date dependent
|* Ship position 32°29.66'S, 060°55.86'E
|* Heading 234.0 degrees
|
|Action
|Load cells and view the chart display.
|Results
|a) With the charts displayed the own ship shall be placed at the jetty in Micklefirth.
|
|.GB4X0000.000
image::images/demotest1.png[scaledwidth=100%,align="center"]

_After loading of GB4X0000.000, displayed scale 1:50 000 Note: Screen plot above is based on the full text NATSUR
attribute. To reduce undue clutter in the ECDIS chart display, the use of the abbreviations of the NATSUR attribute is
recommended (see screen plot on next page). Note: Within this test dataset there are two omni directional lights co-
located at 32°34.68S, 060°54.95E, this case is not a real-world example, as such the ECDIS may show a red-light
sector.
|=====

```

Figure 5: Example asciidoc text file

An example of a test as converted to PDF is shown in the screen capture below. This shows the tabular format, embedded screen image and formatting.

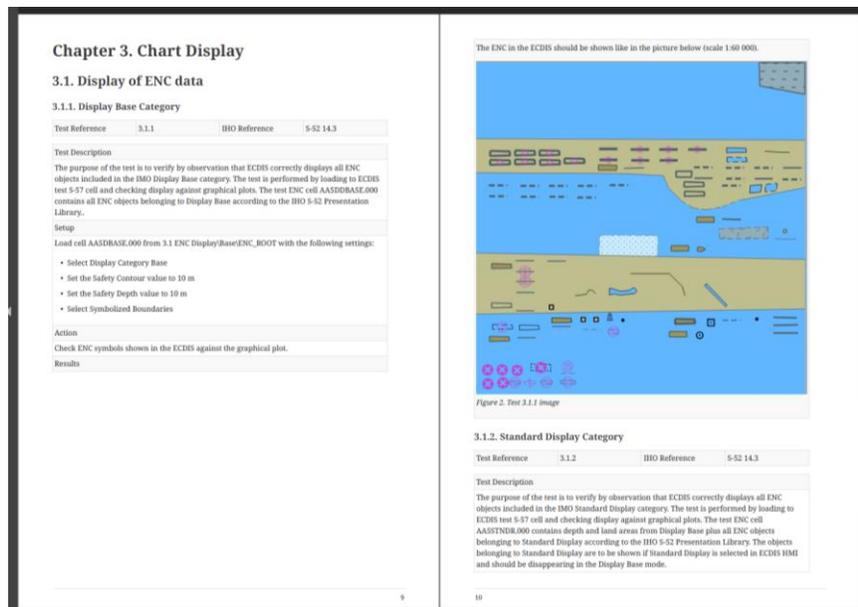


Figure 6: Auto-generated PDF of test dataset manual test 3.1.1

## 4 Way Forward

The initial phase 1 has set out what it tried to achieve, namely an initial platform, tools, methodology and datasets representing the current S-64. Some suggestions for approaching the remaining phases are set out in the following list:

1. Some S-64 test datasets contain data which is incidental to the test content. Some tests have a definite purpose and certain data which tests that purpose. For instance a test of an unknown feature or attribute contains many other features in the dataset which are contextual. From the point of view of a conversion to S-101 the exact data content of such a test is not significant and any mapping from S-57 to S-101 can be used. For other tests, particularly ones where an exhaustive set of features/attributes are defined (such as, for example, safety contour or viewing group tests) the exact content is much more important and will require review, checking and testing against the S-101 feature catalogue and DCEG documentation. Future phases will approach this methodically, therefore with reference back to the feature catalogue and DCEG to ensure tests are correct.
2. Choice of suitable metadata and parameters will be defined in later phases. Initial versions have been created and can be edited as this area is considered separately. Datums, display scales, mandatory features/attribution will all be considered as the datasets are refined. The existing S-57 test datasets contain ENC-specific metadata and parameters and the aim will be to replicate these alongside any new items required for the revised datasets.
3. The existing structure in the repository will be enhanced to add sections for new functionality (e.g. S-57/S-101 dual fuel operation, co-existence testing) and new data (other ECDIS related S-100 product specifications and arbitrary S-100 data alongside interoperability specifications and associated datasets).
4. The textual representation of datasets and conformance to feature catalogues has been a step forward in Phase 1, particularly where comparisons with the original S-57 data are concerned. These text dumps of datasets will be maintained as the data is validated, edited and changed according to the content of the S-64 specification.