

THE CHALLENGES FACING THE CONTRACTOR

Quality ENC Production for HOs

Hydrographic Offices (HOs) all over the world are going digital in their production environment. New shipboard equipment and improved display techniques embrace all the latest technologies in the interests of ensuring the Safety of Life at Sea (SOLAS). HOs increasingly seek to produce and distribute ENC datasets to standards specified in IHO Special Publication S57 (edition 3.1). The production and validation of ENC datasets to achieve these stringent quality requirements are outlined here.

The International Maritime Organization (IMO) has amended SOLAS articles relating to carriage requirements for the use of ECDIS in certain types of vessels. When production is outsourced manufacturers of ENC datasets must understand the requirements of HOs and provide qualitative and timely service. To enable this, complete understanding of the various processes involved in chart and ENC production is necessary for each ENC producer. HOs are using new data acquisition methods to collect large volumes of survey data to compile the latest, most accurate navigational charts for use by ships at sea. All these innovations have resulted in the acquisition of large datasets that need to be processed and presented to the mariner in a meaningful way to ensure a safe voyage. This is the nature of the challenge presently being faced by HOs around the world.

HO Contribution

Each HO has its own approach to the production of ENC datasets. However, they all follow the specifications laid down in IHO Publication Special Publication S57 edition 3.1. There may be differences in their production methodologies but they all seek to adhere to IHO specifications and standards. Each HO defines the requirements to suit their production environment and the source data used for the creation of the database. The inputs for ENC production may be any one of the following sources:

- a paper chart, used to create a digital file
- a raster image of the paper chart, used to create a digital file
- a registered tiff image provided by the HO, used to create a digital file
- a digital file of chart/source data
- film positives of the print production originals used by the HO, with all corrections updated for ENC, used to create a digital file.

HO-contracted ENC datasets

Exposure to a variety of approaches adopted by different HOs within the specifications of IHO, and understanding of the methodologies needed to meet clients'™ stringent specifications together make up the primary factor in creating qualitative ENC datasets. Proper selection of ENC production software brings us to the next significant factor. It is necessary to define the production processes for each client's™ specification and generate a document highlighting the workflow to meet the stringent specifications of the client. In addition, the personnel assigned to the specific project should undergo training in terms of the various tasks, and also in terms of the specifications and checklists to be used for compliance in the project. This training is project-specific and in addition to the general training undergone by personnel for production within a specific software environment.

Data Pre-processing

Identification of the requirements in terms of using raster files for registration, or scanning source data and registering the raster image, or checking the registered raster files should be performed. Sometimes the input may be a digital file provided by the client, which needs to be checked for proper coordinates and clarity of detail. In addition, any ambiguities in the input, as against the specifications, are to be resolved with the client. This ensures that there is no misinterpretation of the specifications or input material within the production environment. The technical co-ordinator for the project should ensure that operators fully understand the requirement, and should constantly monitor production flow. An EDC producer Development Group should evaluate the possibility of automating various tasks and implement any such by creating programmes or tools, testing these before they are introduced into the production environment.

Data Compatibility

In addition, the HO may specify particular requirements to be addressed in creation of the ENC dataset to suit their own internal database requirements; IHO S57 standard specifications are to be adhered to overall but within these each HO may have its own internal requirements for the dataset creation. For example, one HO may be issuing the ENC datasets as a geographical rectangular cell of uniform latitudinal and longitudinal extent; another HO may be using the chart limits as a cell boundary. In such cases the number of cells to be created for a single chart varies from HO to HO. The use of usage bands can also be interpreted by different HOs in differing ways but still remain within the scope of IHO Product Specifications.

Encoding of charted features into S57 objects and attributes is a manual process (Figure 1). Any misinterpretation of the charted features during encoding leads to the creation of incorrect data in an ENC. Each HO has its own way of interpreting the encoding of charted features as S57 attributes for feature objects. Some HOs use several attributes defined for each S57 object and some limited attributes for

each object. In some cases IHO S57 non-compliant features are used by HOs to suit their specific internal use; for example, US NOAA uses Imperial units in its ENC datasets, which is not compliant with IHO S57. All these aspects have to be taken care of by the contractor during the production of ENC datasets.

Data Capture

The data capture process is the main task wherein the utmost care is to be taken to translate correctly the charted features into digital form. The correct interpretation and translation of charted details from the source data to digital format is very crucial, as the subsequent process to generate final deliverables depends on this task. Quality control mechanisms should address this aspect closely and ensure that the data conversion process is carried out without any errors. Any errors in the process are to be identified and fixed before moving to the next task. The data capture process differs with the requirements of the client and these are to be well documented in a document specific to the particular project (HO) for compliance of specifications.

ENC Dataset Creation

ENC dataset creation largely depends upon the ability to understand the concept of the IHO S57 data model and GIS concepts defining spatial relations specified in the model. Once the cartographer has fully grasped the chart content, linking the charted details to appropriate S57 objects becomes a more straightforward task. However, reference to the IHO Use of Object Catalogue and client specifications for coding the charted features into S57 objects and attributes is essential for appropriate coding of features. A very detailed knowledge and understanding of the IHO S57

data model and its relationship to charted features is essential if cartographers and production team are to render a qualitative ENC dataset. ENC producers must have trained personnel involved in encoding charted features into S57 objects and their attributes. All coded features have to be subjected to thorough scrutiny before these are used in the creation of ENC datasets. Handling charts of different regions with typical chart presentation provides production personnel with great insight into the S57 data model and encoding of charted features.

ENC producers have to evolve a process of automating the majority of the encoding of charted features by appropriately assigning to graphic/symbols/text entities feature codes as per the software used for data capture. This results in significant time-saving in the process of encoding charted features into the S57 data model by the Quality Assurance testing of any ENC production software (Figure 2). A “Look-up” table can be customised for conversion of captured features into S57 objects and attributes within the specific software platform used for production. Building topology for spatial objects can be carried out in semi-automatic mode using software tools for creating topology and checking the topology using tools for clean topology. Creation of the S57 data model is to be carried out using tools and appropriate software with in-built tools to check the various aspects of the S57 data model and ensure its IHO S57 compliance. In addition, the dataset should be subjected to validation in viewing software for display compatibility in an ECDIS system. ENC data is also subjected to third-party validation software to check its content and quality (Figure 3).

Validating Datasets

Production of the digital files is but one aspect; validation and updating of these files for compliance with IHO and HO specifications is another. Some HOs prefer to produce these digital files in-house and have them independently validated. ENC producers have to provide this digital file-validation service to HOs in ENC production. This is a time-consuming process requiring high-level skills “base to understand the HO’s own internal production procedures and adopt the required validation procedures to meet the clients’ specifications for quality control mechanisms. Part of the process involves production by ENC producers of well-documented QC reports for the user, to accompany updated digital files.

Manpower Strength

People with considerable experience of working in a national hydrographic office dealing with various aspects of hydrography and nautical cartography must be available to supervise nautical chart and ENC production. Further, these experienced specialists can over a period build up the necessary workforce to meet the demands of production. Nautical chart and ENC production expertise cannot be acquired without sufficient training and appropriate background knowledge. The strength of any ENC producer should reflect its trained workforce, which must possess thorough background knowledge of navigation charts and IHO specifications. The people working on these projects need to be rigorously trained in interpretation of navigation chart content of various countries and in IHO standards for the production of paper charts and ENCs. The ENC production team should be well trained for executing tasks using differing production software platforms. And all personnel should be given training on dummy projects in the software suite used before they are assigned to any task within the production environment.

Client Interaction

Constant interaction with clients in the course of any project affords increasing insight into the working methods adopted by each client within their own production environment. ENC producers should endeavour to meet client requirements by understanding the methodology used by them. This constant client interaction and feedback provides guidelines for the interpretation of specific features in subsequent charts. In this way ENC producers gain wide exposure to the charts of different countries and the differing presentation options available within the scope of IHO specifications (Figure 4).

Summary

Constant fine-tuning of the skills of production personnel will provide the best platform for any ENC producer to compete globally in providing services to HOs. In addition, ENC producers must be aware of changes in the specifications, standards and regulations promulgated by international bodies such as IHO, IMO and other agencies involved in marine and hydrographic activities. Organisations such as IHO and IMO constantly strive to keep pace with ever-increasing marine environment technological changes aimed at safety of life and material at sea. All these changes must be known to ENC producers in order for them to provide HOs with qualitative and timely services in nautical chart and ENC production.