



# dKart Office

Functional Overview

# Abstract

This paper describes the basic features of dKart™ Office, a complete solution for a Digital Hydrographic Office.

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## The Purpose

dKart Office is a software system designed for the production and maintenance of nautical charts and navigational publications including:

- Traditional paper charts and survey sheets;
- Electronic Charts (ENCs, AML, Inland ENC, etc.);
- Lists of Lights;
- Notices to Mariners;
- Sailing Directions, etc.

For the purpose of organizing and controlling of the production processes, dKart Office also includes powerful and configurable Workflow Management System (dKart ERMM).

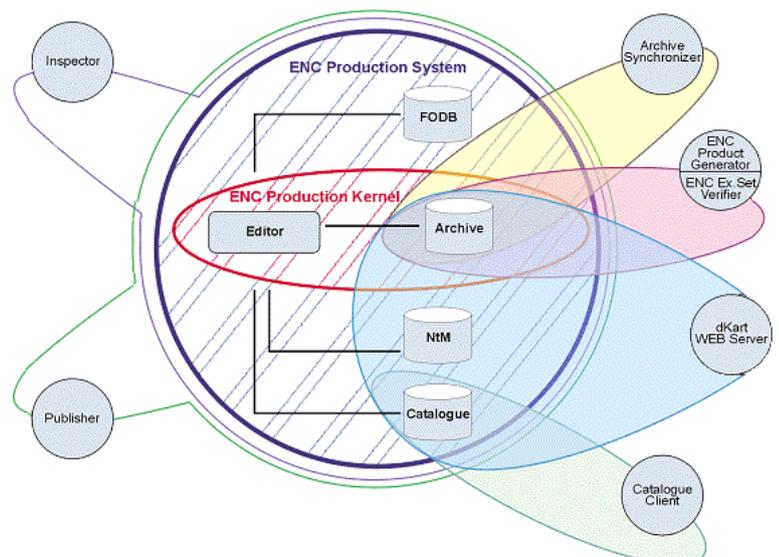
## Features

- dKart Office is based on the innovative Digital Hydrographic Office approach meeting the required specifications for the production of nautical publications as well as IHO S-57 philosophy.
- dKart Office hides all the complex techniques behind familiar procedures and terms, so there is no need for the operator to have in-depth knowledge of the standards.
- dKart Office has powerful tools for testing the manufactured products, ensuring their compliance with the required standards.
- The production process is organized as a 'conveyor line' to ensure maximum efficiency thereby saving time and costs.
- dKart Office has got a great kit of administrative functions designed for production process control.

## Components

dKart Office system has a modular structure, the configuration of which can be easily adapted for the specific needs of end users. By combining different modules/programs into a particular configuration it is possible to select the functionality to suite any specific need. At the same time the overall functionality can always be upgraded by adding new modules/components to the System as it becomes necessary.

For example an "ENC Production Kernel" configuration (dKart Editor + dKart Archive) facilitates the production and maintenance of electronic charts (S-57 ENC, AML, Inland ENC). The same system supplemented with dKart Publisher software additionally supports creation and maintenance of paper charts.



The system consists of specialized COTS (commercial off-the-shelf) programs and databases, combined into a joint system by means of electronic communications.

## PROGRAMS

**dKart Editor** - production, QC/validation and maintenance of ENC's (S57/3.x) and other chart products (AML, Inland ENC, etc.).

**dKart Publisher** - S57 (ENC) based production and maintenance of traditional paper charts.

**dKart WEB Server** - ENC, NtM and Catalogue online publishing.

**dKart Product Generator** - ENC packager for creating an exchange set of user-defined structure

**dKart Exchange Set Verifier** - S-57 Exchange set verifier that covers both un-encrypted and encrypted exchange sets (encryption based on IHO Data protection Scheme; S-63)

**dKart NtM Production System** - a complete and fully integrated Notices to Mariners production system customizable to the needs and specificity of end-user.

**dKart Converter** - a tool facilitating data exchange with third-party cartographic tools (i.e. import/export of various vector formats, including ESRI Shapefiles, Autocad DXF, GML 2.x/3.x, MicroStation DGN, XYZ/CSV, etc.).

**dKart OGC Server/Client** - Application, Server and client, used to utilize OGC services such as OGC WMS (Web Map Service) and OGC WFS (Web Feature Service). The Server is fully integrated with product databases and provides all means for secure and reliable publication of cartographic data on web, The Client is a stand a client tool used to connect, view and download misc. OGC data from any open servers.

## DATABASES

**dKart Archive** is a system of centralized cartographic data storage, where data is stored throughout all stages of production, maintenance and distribution.

**dKart FODB** is a hydrographic database used for centralized storage of scale-independent objects (enhanced "NavAids/Lights database").

**dKart Catalogue** is a host system of chart catalogues and nautical publications.

**dKart NtM DB** is a system for centralized storage of Notices to Mariners. The system comprises database and managing application. Depending upon the tasks and configuration of HO, can be delivered either as a stand-alone solution (e.g. automation of updating or web-server solution) or as a part of NtM Production System.

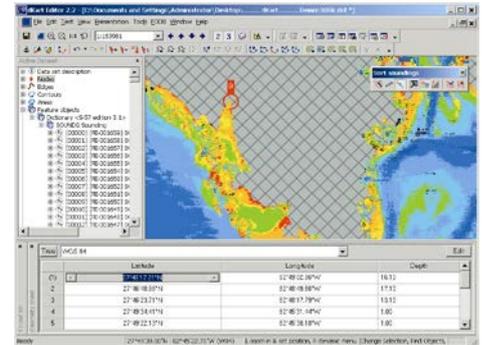
**dKart SMDB** is a system for centralized storage of source (NtM) messages. The system comprises database and managing application. Depending upon the tasks and configuration of HO, can be delivered either as a stand-alone solution (e.g. automation of updating) or as a part of NtM Production System.

## dKart Editor

The main objective of dKart Editor is to produce, validate and maintain vector Electronic Navigational Charts (ENCs), including:

- Displaying the vector and raster charts;
- Digitizing the paper charts and publications via semi-automated routines;
- Creating/compiling/editing vector charts;
- Vector chart validation and quality control, both visual checking and automatic testing;
- Vector chart updating and maintenance.

The program fully conforms to the latest editions of the S-57 standard including S-57 edition 3, S-57 edition 3.1 and edition 3.1.1/2.



IHO S-58 Edition 4.2 is also fully supported.

Dedicated modules of dKart Editor can be used to solve specific tasks, such as:

- AML Module - Production and maintenance of Additional Military Layers electronic charts (CLB, ESB, LBO, MFF, RAL, SBO product specifications ver. 1.0/2.1).
- Inland Module - Production and maintenance of Inland S57 electronic charts ("River ENCs").
- Sounding Selection module - cartographic sounding selection (automated/interactive thinning, rounding, etc.)

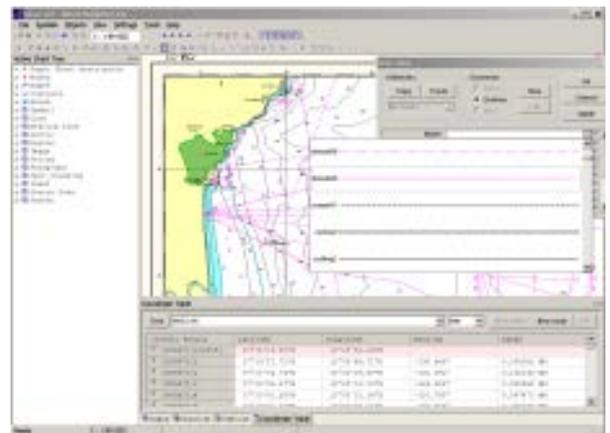
Powerful import/export tools supporting a wide range of well-known data formats to facilitate data exchange with 3rd party applications (DXF, DGN, SHP, CSV, XYZ, GeoTIFF, GML, etc.). dKart Editor is fully UNICODE-compatible, thus providing support of any national language used in an ENC. dKart Editor can also be integrated with all the other tools of dKart Office system providing a complete solution for a Digital Hydrographic Office.

dKart Editor 3.0 (and newer) is designed to run under Windows Vista and Windows 7 32/64 bit.

## dKart Publisher

dKart Publisher is a powerful tool for production and maintenance of traditional paper charts out of S-57 datasets (electronic charts).

The basic idea underlying the technology is fairly simple, which is that electronic charts and paper charts are two different ways to express the same hydrographic reality. Both should provide equally reliable and consistent information which inevitably requires *unification of production lines for paper and electronic charts, where S-57 electronic charts are used as a source for paper charts production and maintenance.*



dKart Publisher provides an efficient ENC-to-paper chart converter equipped with powerful cartographic editing and QC functions. Key features are:

- Support of multiple-presentation libraries (INT1, INT2, M4) which are easily customizable with national requirements
- Permanent consistency between ENCs and paper charts (use of unified information source)
- Ability to generate various paper products (chart series, albums, publications, etc.) from a single information source (ENCs)
- Ability to customize presentation rules and introduce new symbology in-house.
- "Print-on-demand" technology

In brief the process of a paper chart production with dKart Publisher comprises the following steps:

- Source ENC(s) are loaded into the program
- An “empty” paper chart of required datum, projection, scale and borders is created
- Automatic conversion begins guided by the Presentation Library. During the conversion, the software transforms objects of source electronic chart(s) to paper chart objects.
- Final “make-up” performed via a powerful cartographic editor includes refined positioning of texts and symbols, adding texts, pictures and tables from external sources, positioning insets, frames and other design elements.  
Editing operations are enriched with script-based tools that automate line masking, creation of flaps/continuations, frames and design elements.
- Resulting digital paper chart is saved in an electronic form and/or output to a printing format (e.g. Acrobat PDF, PostScript, GeoTIFF, Microstation DGN, BSB).

It worth mentioning that both the Presentation Library and the conversion script are “external” to the software, which means that they can be easily changed or substituted without having to re-design or even re-install dKart Publisher. The same scripting engine can be used to process data stored in external files or in a database. All the required customization can be done in-house by a trained operator (scripts and presentation libraries are plain text files).

Presentation Libraries and conversion scripts can be easily switched which allows production of different chart products from the same source data (e.g. charts of national and international series).

dKart Publisher can be used as a standalone tool or as an integral part of dKart Office system.

dKart Publisher is designed to run under Microsoft Windows 2000/XP/7 operating system.

## dKart Archive

Sharing data between users / workstations at an HO, dKart Archive fulfills the following tasks:

- Storage of the HO’s digital products - charts, data sets, updates, etc;
- Providing an interface to the database for dKart Office tools;
- Synchronization of database contents with other databases;
- Access control;
- Communication and data exchange;
- Data management services;
- Logging of user / workstation activity.

dKart Archive comprises:

- dKart Archive database built upon the Microsoft SQL Server 2005/2008 R2;
- dKart Archive Manager utility which allows for database management and performing administrative tasks;
- Interfaces to other dKart Office tools.

dKart Archive is designed to run under Microsoft Windows XP Prof/Windows 7 32/64 bit operating system; Microsoft SQL Server 2005/2008 R2.

## dKart FODB

dKart Feature Object DataBase (FODB) is intended for centralized storage of scale-independent objects (lights, aids to navigation, traffic separation schemes, pipelines, etc.).

The idea of such an enhanced “NavAids database” is fairly simple. If there is a scale-independent object (e.g. buoy) that should be plotted on several charts, it is sensible to create this object only once (i.e. centrally, in the database) and then distribute the information to all affected charts. The same applies to chart updating - it’s preferable to update information only once in

the database and then distribute the changes. This approach improves the information reliability and consistency (since there is a single information source) as well as saving on production and maintenance costs.

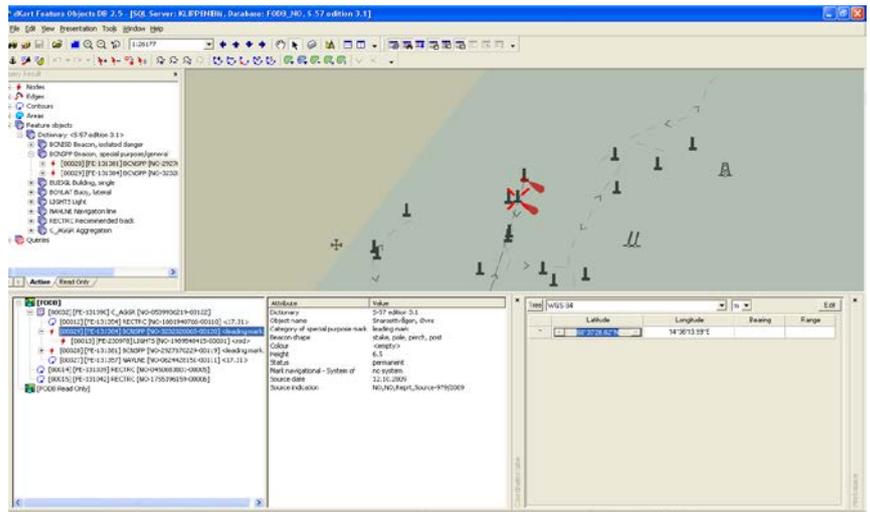
One of the system's advantages is that when working with dKart FODB, the operator deals with a "chart" representing information about stored objects in a most intuitive, visual way (table/numeric interface is also supported).

Information storage in the database is fully S-57 compliant, which includes information encoding and object identification.

The operator makes use of the powerful dKart Inspector engine for formal validation of stored information as well as visual validation tools similar to those provided by dKart Editor.

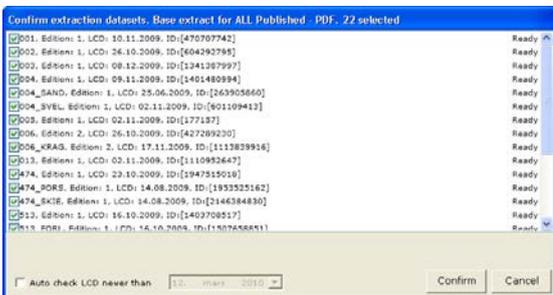
dKart FODB is designed to work with other components of dKart Office family, in particular dKart Editor and dKart Archive.

dKart FODB is designed to run under Microsoft Windows XP Prof/Windows 7 32/64 bit (PENDING Mid 2012) operating system; Microsoft SQL Server 2005/2008 R2.



## dKart Paper Chart Product Generator (Print on Demand)

dKart Paper Chart Product Generator is a system to automatically extract paper chart products to misc. puposes and to several (graphical) formats.



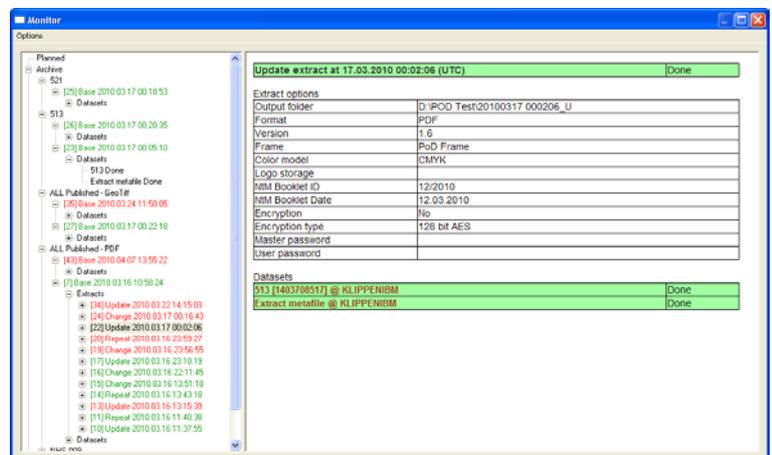
The system will automatically extract products defined by the export parameters for each "Product Line", store extract history for each product line, multiple product format extract (PDF, GeoTIFF and GML), support for product dependant Standard or PoD frame/No frames etc.

The system is configurable to support multiple processors and/or network processing (multiple workstations) allowing for an effective processing.

The system is also configurable to support product dependant settings, such as multiple product presentations, PDF Encryption, PDF version, frame types (PoD Frame, Standard frame, No frame), GeoTiff resolution (DPI/Colors) etc.

Re-use of "Product line" allow for Update/Change extracts, where only changed products are extracted (changes since last Base or Update extract).

dKart Paper Chart Product Generator is designed to run under Microsoft Windows 2000/XP/7 operating system; Microsoft SQL Server 7.0/2000/2005 is used for database services.



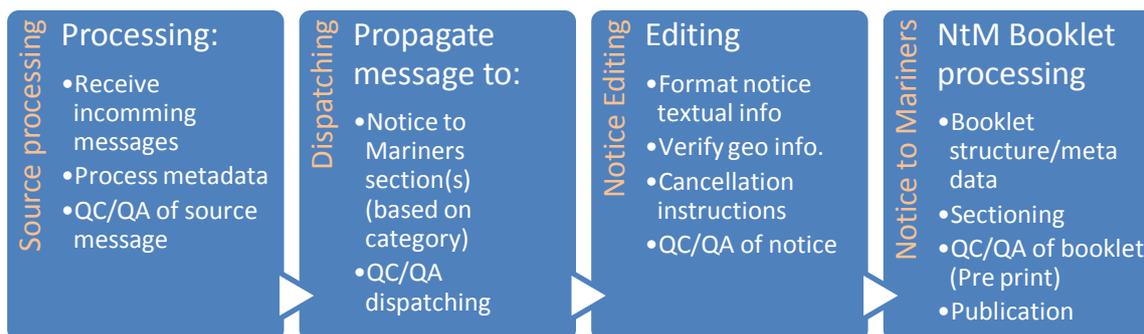
## dKart NtM Production System

dKart NtM Production System - is a complete and fully integrated Notices to Mariners production system.

The system provides a comprehensive technological solution for producing Notices to Mariners, both paper and electronic.

There are three basic stages outlining the NtM production process:

- Source messages are received, assessed and dispatched for further processing
- Draft notices are prepared and QCed
- NtM booklets are compiled and published.



dKart NtM PS offers a specialized program for each stage; they are dKart SMDB Dispatcher, NtM Editor and NtM Publisher. Based on a single platform, the programs inherited many common features from it, including user's interface.

The system as a whole operates as follows. dKart SMDB Dispatcher receives source messages via various communications, identifies and registers them, thus populating the Source Message Database. The messages are then assessed and dispatched to the processing department, where draft notices are prepared according to the identified message type. The NtM Editor workstation operator processes the message and prepares a new notice or decides that "no action required" (NAR), or asks the source for more information. In all cases, he reports his decision to the Dispatcher, and puts the draft notice into the Draft Notice database. The Publisher workstation operator retrieves the draft notice, and carries out pre-print procedures using dKart Publisher. The operator then publishes an issue of NtM and sends copies to the NtM Booklet database.

The system may be easily integrated with dKart Editor and dKart FODB systems thus providing high-level automation of chart updating (i.e. the programs use Notices information to detect affected chart and particular object(s)/location(s), automatically feed in coordinates, etc.).

Been supplemented with dKart Publisher software (ENC-based paper chart compilation platform) the NtM Production system also facilitates creation of tracings (the presentation library for the tracings visualization is a subject of bespoke customization).

dKart NtM Production System is designed to run under Microsoft Windows XP Prof/Windows 7 32/64 bit operating system; Microsoft SQL Server 2005/2008 R2.

## dKart Catalogue

dKart Catalogue has been designed to be installed in maritime agencies and Hydrographic Offices. The system presents an electronic catalogue, which gives a detailed description of an agency's products.

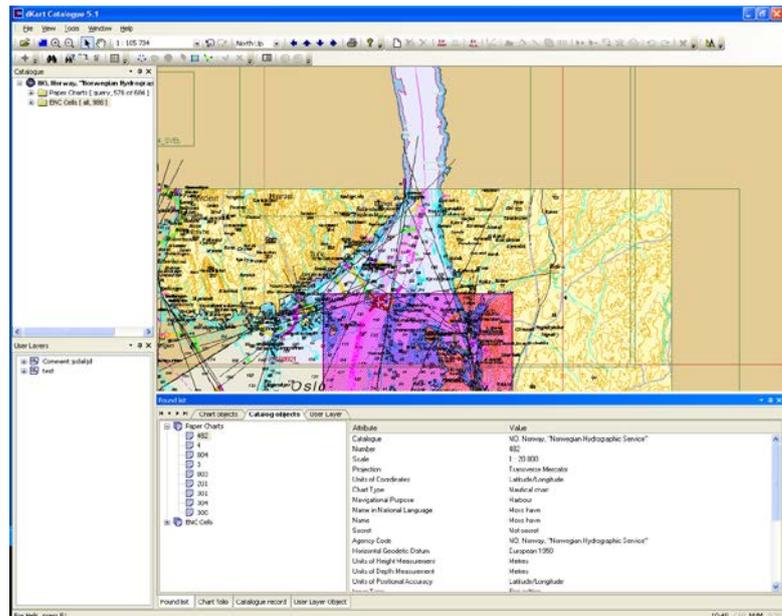
By default, the program supports the following types of nautical products:

- Paper charts
- Electronic charts
- Survey sheets

This list can easily be extended if required.

dKart Catalogue system consists of a Server, which holds catalogue information, and Clients (e.g. NtM Updater module of dKart Editor which acts as Catalogue client in order to simplify NtM-based updating of electronic charts).

A dedicated Catalogue Client application may be used to distribute catalogue information to customers and authorities (on-line and off-line). The Client application also provides the means for remote updating of Catalogue information via the Internet.



dKart Catalogue provides a convenient way for information search and retrieval. It is possible to search for a record by coordinates or attributes. A coordinate search can be performed either on-chart or using precise numeric inputs (the program supports search by point, area or route methods). Located records can be compiled into a report and output to a printer or saved to a file.

Catalogue information can be entered into the system manually or automatically from dKart Archive database (additionally, the scripting technology used in the program helps importing any structured information should it be stored in a file or in a database).

The scripting technology also allows easy in-house customization with no need to upgrade or re-install the main application.

dKart Catalogue is designed to run under Microsoft Windows XP Prof/Windows 7 32/64 bit operating system; Microsoft SQL Server 2005/2008 R2.

## dKart ENC Product Generator

dKart Product Generator - ENC packager into an exchange set of user-defined structure.

A manual creation of end products, is relatively slow and, which is of great importance also, is subjected to human errors especially when large amounts of data are involved. The purpose of dKart Product Generator is to automatically produce end products (S57 exchange sets) from the data sets stored in the database (dKart Archive) on a periodical basis, i.e. "time-slice" of data.

The result is a set of files, produced as an S57/3.x exchange set, ready for publishing on CD. The following type of extracts are supported:

- Base - extract the latest version of the latest edition of the EN file for every ENC within the database, together with associated ER files and text and picture files relevant to that latest edition.
- Update ("cumulative change") - extract all datasets that were changed since the latest Base extract.
- Change ("delta change") - extract all datasets that were changed since the previous (Change or Base) extract.

dKart Product Generator supports creation and automatic maintenance of multiple "production lines" (extraction histories assigned to a particular customer) thus facilitating data exchange with different recipients/authorities.

When creating an extract the program can automatically merge update files into a single update file or apply ER-files directly to the base cell (i.e. making a re-issue). All information about merging and re-issuing is stored in the production history in order to support correct production line.

By default, the program supports two different directory structures - flat and hierarchical (S63). However due to scripting technology used, necessary modifications can be easily done in-house.

dKart Product Generator is designed to run under Microsoft Windows XP Prof/Windows 7 32/64 bit operating system; Microsoft SQL Server 2005/2008 R2.

## dKart Exchange Set Verifier

dKart Exchange Set Verifier - is a complete set of tools facilitating validation of S-57 exchange sets.

The main purpose of the validation is to confirm the integrity of exchange sets (i.e. data is free from loader errors and conforms to S57 and S63 requirements). dKart ExS Verifier provides detailed testing of exchange set structure, encoding and integrity of files.

Two types of exchange sets can be verified using the dKart Exchange Set Verifier:

- *Unencrypted* exchange sets; these are "pure" S-57/3.x exchange sets, uncompressed, unencrypted and unsigned.
- *Encrypted* exchange sets created for distribution; these are compressed and digitally signed S-57/3.x exchange sets encrypted according to IHO Data protection Scheme; S-63 standard (also known as PRIMAR Security Standard)

Both incoming and outgoing exchange sets may be delivered to the system either on a CD (multiple-volume sets are also supported) or as a hard drive folder.

The main capabilities of dKart Exchange Set Verifier are:

- to confirm file names and paths - that all (and only those) files named in the Catalogue file are present
- to confirm that all (and only those) text and/or image files referenced in the data files (via TXTDSC and PICREP attributes) are present and correct
- to check CRC of all data files
- to perform loader tests (extended set based on checks from dKart Inspector) for all data files
- to confirm that any added data files (e.g. digital signatures, etc.) are accurate and complete

The main feature of the program is "hiding" the complexity of heterogeneous checks and operations thus providing an almost "one-button-click" solution.

Structurally the application is built from two COTS modules:

- dKart Exchange Set Verifier - Standard module used for checking of unencrypted S-37/3.1 exchange sets;
- dKart Exchange Set Verifier - S-63 module used for specific validation of encrypted exchange sets.

dKart Exchange Set Verifier is designed to run under Microsoft Windows XP Prof/Windows 7 32/64 bit operating system; Microsoft SQL Server 2005/2008 R2.

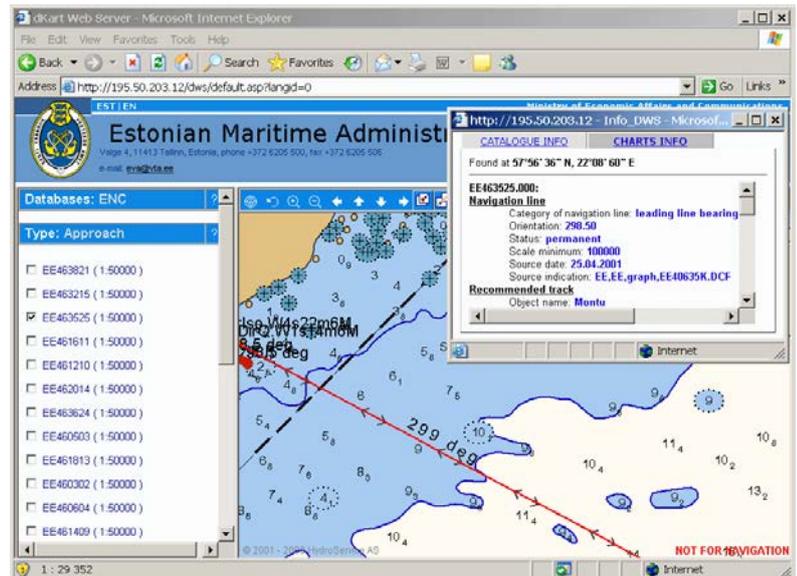
## dKart WEB Server

dKart WEB Server - ENC, NtM and Catalogue online publishing.

The purpose of dKart WEB Server is to publish products of an HO on the Internet, these include electronic charts, Catalogues. An end-user may browse published information using an ordinary Internet browser

The System makes it possible to execute the following major tasks:

- Display Catalogues published by a HO.
- Display borders/coverage of charts in the Catalogues.
- Provide information on charts in the Catalogues
- Display electronic charts on-line (OGC WMS service).
- Provide information about objects on electronic charts.



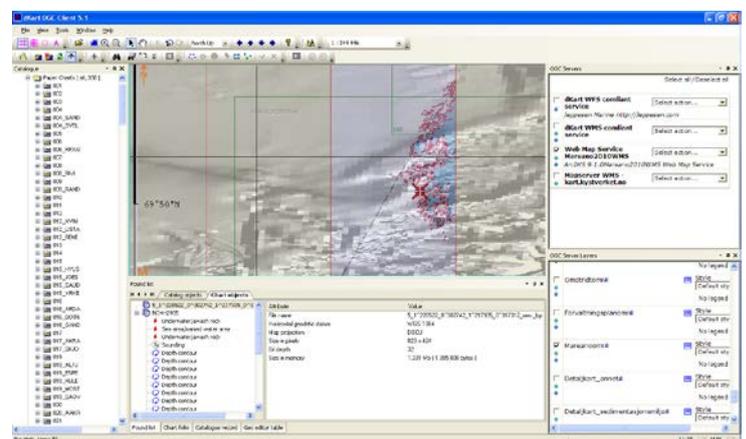
dKart WEB Server should be integrated with other software components of a dKart Office system thus providing a high level of automation of data publishing.

dKart WEB Server is designed to run under Microsoft Internet Information Server (IIS) 5.0 or higher; Microsoft SQL Server 2005/2008 R2.

## dKart OGC Service (Server)

The OGC Server provide integrated connection to defined database repositories and serve all OGC Server requirements for OGC WMS and OGC WFS calls, displaying and security handling.

An OGC Client, through dKart Look (FREEWARE), provide means for connection to any open OGC server providing WMS and WFS services. The Client tool may also be setup to read internal dKart databases, such as Archive, Catalogue and provide ability to load and view ENC, Paper charts and raster files



## dKart Converter

The newly released dKart Converter provides import/export capabilities from misc. formats. Geographical formats may be converted to GIS formats and visa versa. A variety of datum and projections along with a wide range of supported formats makes this tool a valuable link in the production and quality control chain.

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