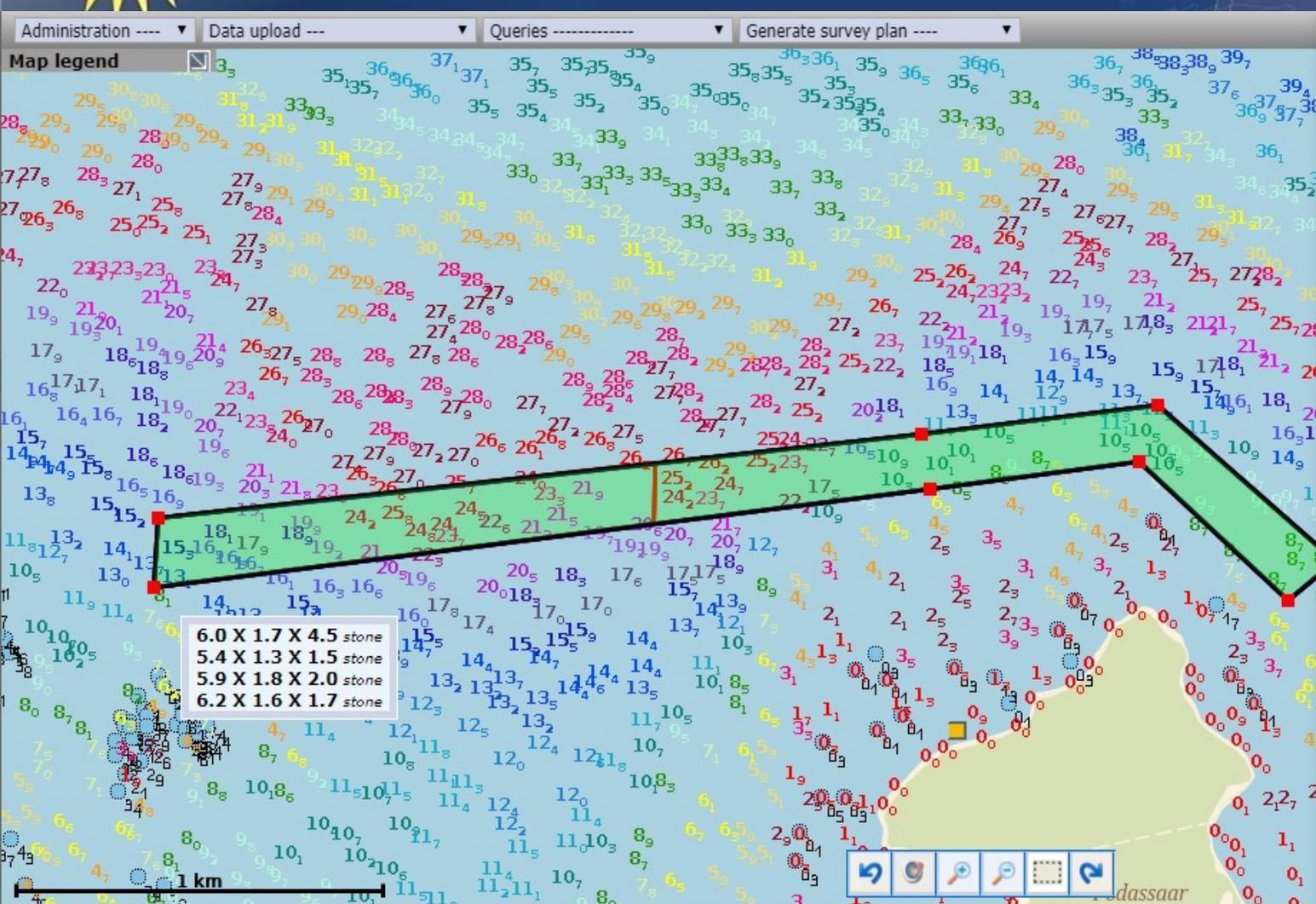




Hydrographical Data Management in WEB GIS



Area size 54 ha

To select area, drag on map with right mouse button, click right mouse button on the map, select file or insert up to four corners

Clean Done

Plan area

Name of Survey area	IHO cat	Scale	Area
rohusi_e	Ia	1:1000	0.2
sheet10_59_30	UNDEFINED	1:10000	0.3

Plan area size 54 ha

Use survey areas until scale 1:10000

Generate plan

Information wanted full plan

Output_format DAF

Scale to generate DAF

Soundings interval (m) vaha 2 - 4 m

Coordinate system BAG (S-102)

Height System S57

Min object height

Reduce depths frequency

Contour making max scale

Contour interval 1.0

2, 5, 10, 15, 20, 50, 100, 200

Choose file No file chosen



Hydrographical Data Management in WEB GIS

- **spatial database** for hydrographical data manageable in WEB.
Data is mainly updated automatically while uploading the survey data;
- complex **spatial queries** over WEB including 3D and bottom profiles to different outputs;
- automatic draft generation for **Electronic Navigation Charts**;
- different user profiles:
 - authenticated users (government)
 - public users;
- OpenGIS Web Map Service (WMS and WFS);
- based on open source software (Linux, Postgres, Apache).



Hydrographical Data Management in WEB GIS

Table of content



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The presentation is in 30 slides,
20 – main and 10 – accordingly labelled – more detailed



Hydrographical Data Management in WEB GIS

Estonian Maritime Administration

has developed
Hydrographic Information System (HIS),
which manages hydrographical data in web
since 1994 in cooperation with R-Systems Ltd.

By 2016 the HIS was declared to be
fully competitive on international market.

www.hydrogis.online
(under construction)





Hydrographical Data Management in WEB GIS

INTERNATIONAL HYDROGRAPHIC REVIEW

NOVEMBER 2014

Notes

ESTONIAN HYDROGRAPHIC INFORMATION SYSTEM (HIS)

By Peeter VÄLING

(Head of Hydrographic Department - Estonian Maritime Administration)



„... The HIS is a very valuable tool for many different tasks starting from surveys management and ending with data viewing/extracting for very different purposes.“

„... Compilation of sea charts is much easier and less time consuming using HIS as there is no need for dealing with individual surveys. HIS creates a basic chart automatically. The cartographers need only to add additional data and do final compilation.“

[International Hydrographic review No 12](#)



Hydrographical Data Management in WEB GIS

HIS – survey management

Measuring | Coordinates | Map layers | Help | Log out

Generate survey plan ----

Map legend

Survey areas
Survey areas by Category

ERI	Ia	Ib	II
-----	----	----	----

UNDEFINED

Survey time

<1994	1994	1995	1996
1997	1998	1999	2000
2001	2002	2003	2004
2005	2006	2007	2008
2009	2010	2011	2012
2013	2014	2015	2016
2017	2018	2019	2020

Survey areas by status

Planned	Measured	Cleaned	Ready
---------	----------	---------	-------

dirh_b survey area 2019
sheet10_58_11 survey area UNDEFINED kat 1958
dirh_k survey area ERI kat 2018
Norrby fairway

(on mouseover)

Survey areas by survey time.



Hydrographical Data Management in WEB GIS

Survey Area is a folder with data from survey lines, files containing area borders, meta-data, defined underwater objects and all processed depths. All in simple ASCII format.

HIS is set to read these files and automatically fill/update database from them.

All survey data together with metadata can be uploaded to HIS and later downloaded for data cleaning or for using in other systems. Metadata can be edited and later exported.

The system tracks the status of survey areas, logs, who changed the data, what operation did he do and when was it carried out. When an area is processed, its status changes and the change is immediately visible to the other users of HIS.

Object data can be further managed in HIS, e.g. object type can be changed from obstruction to wreck, data added from other sources, etc.

Survey areas are spatially classified by

- IHO44 standard
- survey time
- survey stage.



Hydrographical Data Management in WEB GIS

List View data

Start Previous 5 6 7 8 9 10 11 12 13 Next End

id	Name	Status	IHO category	Area	Survey time	Insertion date	Cleaned by	Cleaning order	Ship
3451	roopa_j	under processing		14972.1	20.08.2019	09.08.2019	preedikh	N/A	
3452	roopa_k	surveyed		19925.4	20.08.2019	02.08.2019		N/A	
3457	roopa_p	final	SPECIAL	1424.43	27.08.2019	30.11.2019	Preedik	N/A	Jakob Prei
3459	roopa_s	final	SPECIAL	1437.6	27.08.2019	02.11.2019	Preedik	N/A	Jakob Prei
3499	ruilaid_sw2	surveyed		5946.4	20.11.2019	08.11.2019		N/A	
7731	rukki_020519	final	SPECIAL	16.2	09.05.2019	10.05.2019	Vladimir	N/A	KAJA
7776	rukki_110719	under survey			11.07.2019	11.07.2019		N/A	
7819	rukki_kan_251119	final	SPECIAL	45.88	25.11.2019	30.12.2019	Margus	N/A	EVA 320
7727	rukki_test_240419	under survey			24.04.2019	24.04.2019		N/A	
7754	s6rusad_m19027	final	SPECIAL	8.2	12.04.2019	26.05.2019		N/A	
7779	s6rusad_m19040	final	SPECIAL	8.3	06.07.2019	22.07.2019		N/A	
7777	saa_05_3objekti	under survey			23.05.2019	23.05.2019		N/A	
7778	saareotsa_2019	final	SPECIAL	71.1	17.07.2019	24.08.2019	Tonis	N/A	EVA 320
3558	sahmen_d	under survey		3999.9	20.09.2019	26.09.2019		N/A	
3560	sahmen_k	planned		598.5	10.07.2019	10.07.2019		N/A	
3561	sahmen_s	final	SPECIAL	379.6	11.07.2019	20.01.2020	Peeteri	N/A	EVA 301
7774	sahmen_s_vrk1	under survey		221.3	20.09.2019	26.09.2019		N/A	
7775	sahmen_s_vrk2	final	SPECIAL	15.38	18.09.2019	20.01.2020	Peeteri	N/A	EVA 301
3583	sandgr_ne	surveyed		4014.1	20.11.2019	22.11.2019		N/A	
3586	sandgr_sw	surveyed		6825.7	20.11.2019	22.11.2019		N/A	
3650	selglaid_nw3	surveyed		5943.4	20.11.2019	08.11.2019		N/A	
3651	selglaid_nw4	surveyed		6035.8	20.11.2019	08.11.2019		N/A	

Surveys made in 2019.





Hydrographical Data Management in WEB GIS

List
View data

	Save	Delete	Downloading	Statistic	Show on map	To planning
Name	rukki_kan_251119					
id	7819					
Insertion date	30.12.2019					
Status	3 - valmis					
Area	45.88					
Survey time	25.11.2019					
Surveillance time (h)	2.13					
Measured by	VA					
Ship	EVA 320					
Technique	IXSEA OCTANS gyro,Topcon NET-G3 RTK GPS,IXSEA OCTANS HRP,RESON T50R					
Km-s surveyed	29.4					
Min depth	1.64					
Max depth	9.32					
Lines	17					
Line distance	lausmoodistus					
Cleaning time	10.12.2019					
Cleaning time (h)	.00					
Cleaned by	Margus					
IHO category	ERI					
No of points initially	39246848					
No of points deleted	270340					
No of points changed	0					
No of points finally	38976508					
Un-cleaned lines	puudub					
Cleaning order						
Checked by						

his.vta.ee:8443/HIS/Show?REQUEST=QueryForm&TABLE=statistika&XS...

Standard Deviation [m]	0.09
Arithmetical Mean [m]	0.0
Median [m]	0.01
rms [m]	0.09
Minimum difference [m]	-1.78
Maximum difference [m]	1.97
Difference of depths more than 10 cm [%]	7.5
Difference of depths more than 20 cm [%]	2.0
Difference of depths more than 50 cm [%]	0.2
Quantity of points	38976508
IHO S44 depth test resultat 0.95 probability (Accuracy Class)	IB
IHO S44 Special order depth %	92.4
IHO S44 Ia order depth %	93.3
IHO S44 Ib order depth %	93.3
IHO S44 II order depth %	99.6
IHO S44 Special order area %	100.0
IHO S44 Ia order area %	100.0
IHO S44 Ib order area %	100.0
IHO S44 II order area %	100.0
iho_eri_auk_prot	0.0
iho_1a_auk_prot	0.0
iho_1b_auk_prot	0.0
iho_2_auk_prot	0.0
Used cell size (m)	2.5
% of area with more than 2 points per m2	0.0
Min number of points per m2	0.0
Max number of points per m2	0.0
Average number of points per m2	0.0

Statistic parameters are found by comparing soundings of separate neighbor (located in the same cell) lines.

	Save	Delete	Downloading	Statistic	Show on map	To planning
--	------	--------	-------------	-----------	-------------	-------------

Detailed data and statistics of a chosen Survey.



Hydrographical Data Management in WEB GIS

28.01.2020 | TIIU REBANE | administraator

Administration --- Data upload --- Queries ----- Generate survey plan ----

Map legend

Name of Survey area	IHO cat	Scale	Area
rukki_kan_251119	ERI	1:1000	0.4

Plan area size 45 ha
Use survey areas until scale 1:1000

Generate plan

Information wanted full plan
Output_format DAF
Scale to generate 1:1000, punktide vahe 2 - 4 m
Soundings interval (m) 5
Coordinate system Geod. coord.
Height System EH2000
Min object height
Reduce depths frequency
Contour making max scale
Contour interval 1.0
2, 5, 10, 15, 20, 50, 100, 200
Choose file No file chosen

Generate plan

461902 Long: 23:20:20
6530072 Lati: 58:54:30

The chosen Survey on the map with orthophoto background, depths and objects layers selected and request to generate a plan from the Survey Area.



Hydrographical Data Management in WEB GIS

HIS – surveys management – detailed 1: work flow

Survey areas are loaded into HIS from packed files. HIS unpacks the file, then extracts information from included ASCII files and fills the relevant tables. The packed file will be automatically copied then into special folder for raw files.

STATUSES are defined by the stage of work-flow. Each stage means updating the tables and overwriting the packed raw data file.

When survey starts on a planned area its status changes to **under survey**, when survey is finished then the status changes to **surveyed**.

At the end of each week the survey areas are taken from ships and loaded into HIS.

For post-processing areas with statuses 'surveyed' (the packed raw data file) will be downloaded from HIS and the status changes to **under processing**.

After the processing the area will be loaded back to HIS and gets status '**processed**', the packed raw data file will be overwritten.

Then it will be downloaded for validation and gets status **under validation**.

Finally after validation the area will be loaded back to HIS and gets status **final**.

The packed raw data file will be overwritten again.

Remark : data files from Estonian survey and post-processing software hold all data – both processed and raw.



Hydrographical Data Management in WEB GIS

HIS – surveys management – detailed 2: automatic procedures

...

Areas with statuses 'final' are used for filling in the **depth cells**. This process occurs during night. After loading an area HIS sends an email to relevant persons about the updating.

Loading of areas triggers the following procedures depending on status:

Planned, under survey, surveyed – update or addition of new area into 'info' and 'survey area' table, display update.

Processed – update of the area in tables 'survey area', 'survey_area_hole' (if any holes occur), 'statistics', 'wreck', 'rock', 'sp_survey_area_name' (depths in 1m resolution), display update. For filling the depth table depths are generalized into 1m resolution first. The generalization is also part of HIS software.

Final – the same tables as above + filling the relevant cells with depths and contours, display update. Source for the cell filling are data from depth tables after **overlaps analysis**. **Generalization** is used for creating different resolutions of depths and for **contour making**. Contours are made using GMT (Generic Mapping Tools : triangulate, gridcontour, gmtsimpify). Contours are made first for area 1km wider of the cell to each side and then cut on exact cell border. This ensures that contours from different cells will match. Cutting process takes into account also land areas from table 'landareas'.



Hydrographical Data Management in WEB GIS

HIS – surveys management – detailed 3: comparison

One more important process is **COMPARING new underwater objects** (rocks, wrecks, obstructions) to those **already in database**. This is called **conflict resolving**.

For wrecks the conflicts are solved using special dialogue in HIS, for other objects automatic procedure takes place. The procedure marks old objects as 'not visible' if they overlap with new ones (in circle with 1m radius) or do not exist in new area. 'Not visible' means that these rocks cannot be accessed through HIS, but they are still kept in table. The aim of that is to allow access only to new and confirmed objects and get rid of duplicates.

Required files: survey areas in packed format (tar.gz). Inside of these :

- plan file (contains area border before data processing and planned survey lines)
- border file (area border after processing)
- statistics file (metadata about survey area)
- objects file (defined objects like rocks, wrecks, obstructions)
- depths file (all processed depths in XYZ format)





Hydrographical Data Management in WEB GIS

HIS – database and queries

19.10.2020 | Tiiu Rebane | administraator

Administration ---- Data upload --- Queries ----- Generate survey plan ----

Map legend

13.4 X 0.5 X 1.5 stone

ROCK

NAV MARK

WRECK

Mapserver settings - Google Chrome

his.vta.ee:8443/HIS/Show?REQUEST=OptionsForm

Background map: orthophoto

Layer	Style
<input type="checkbox"/> Survey areas	choice 2
<input checked="" type="checkbox"/> Wrecks	choice 3
<input checked="" type="checkbox"/> Rocks	...
<input checked="" type="checkbox"/> Obstructions	S-57
<input checked="" type="checkbox"/> NAV marks	
<input checked="" type="checkbox"/> Harbours	
<input checked="" type="checkbox"/> Spot soundings	Main
<input type="checkbox"/> Depth contour	Main
<input type="checkbox"/> Depth 3D model	

Show cells

Show land

Show problems

Show fairways

Show profiles

Show ships

Depth in tooltip

Depth on a click

Apply changes

Create link



Hydrographical Data Management in WEB GIS

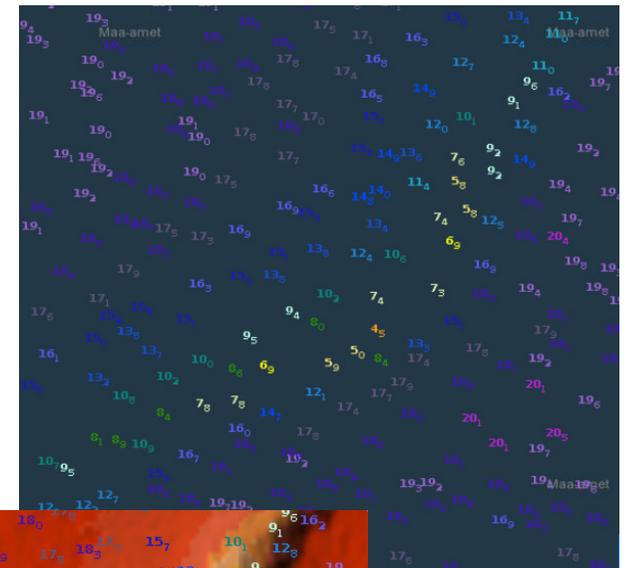
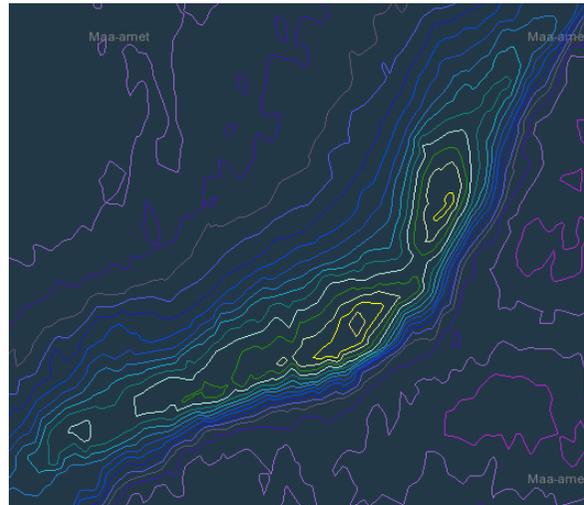
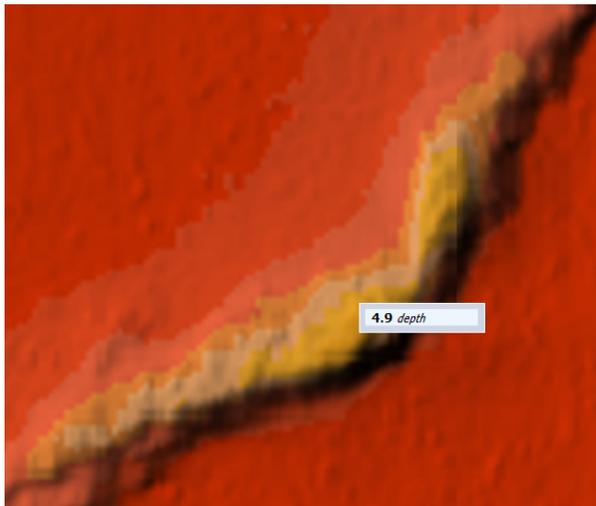
The database consists of two main parts: a seamless database of depths (soundings) and a database of objects. The objects for the system are collected from hydrographic surveys – survey areas, wrecks, rocks and obstructions. For every object extensive information can be stored in HIS, containing its location, classification and attributes, and also images.

The nav aids and harbours data are taken from other databases.

Queries can be textual, spatial and combined. Textual queries are performed using query builders for any data type in HIS. Spatial queries are performed by keying in coordinates or drawing polygons on a map. Such defined areas act as additional restriction to textual query if so desired. Outputs can be redirected to tables on screen or to different types of files.



Hydrographical Data Management in WEB GIS



Create a profile

Last segment length

Direction of last segment

Total length (m)

443754 6555008
443967 6554764

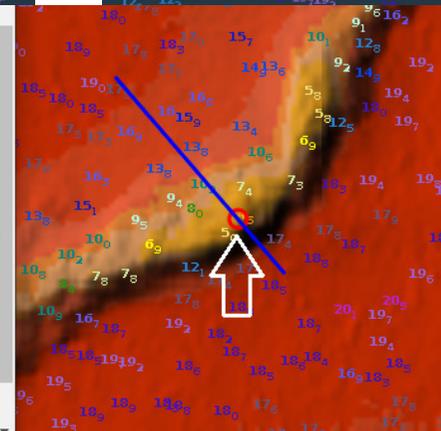
To start a profile draw a line on map using right mouse click

No file chosen

Choose the segment

Max depth of segment 19.3

Length of segment 323.9





Hydrographical Data Management in WEB GIS

HIS – database and queries – detailed 1

The HIS stores and displays the following data:

Survey areas – borders and meta-data: meta-data includes area status, area size, total survey line lengths, amount of survey lines, survey time, equipment, ship, surveyor, data cleaner, data validator, statistical data (min/max depths and coordinates, amount of points), quality estimators (standard deviation, mean, IHO S-44 order evaluations). Quality estimation is based on overlapping depths from different survey lines.

Depths in up to 1m resolution: Cells store depths in 11 different resolutions from 4m to 200m. On a web map, depths are shown from cells, so starting from 4m resolution. Cells also store depth contours at 1m intervals.

Underwater objects: These include rocks, wrecks and obstructions. Wrecks can have a number of different information ranging from simple dimensions and coordinates through to lengthy records comprising ship's history and different pictures of the wreck and the ship.

The HIS is also linked to some **other databases** and this shows information about aids to navigation and harbours. This is useful for getting a complete overview of data in some regions.

The HIS also shows **WMS data** in the background - currently Estonian land maps, orthophotos and S-57 cells from PRIMAR.

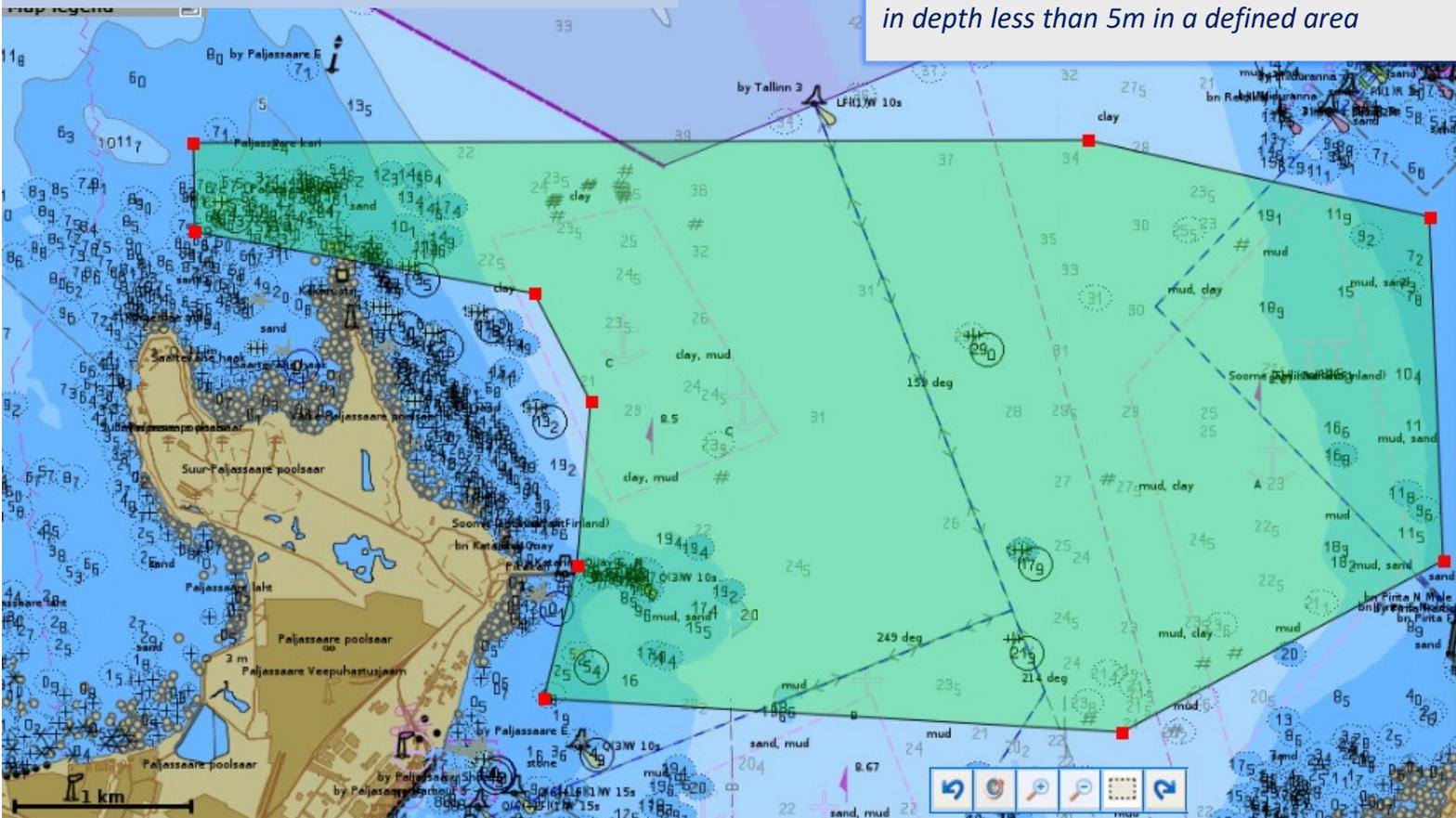


Hydrographical Data Management in WEB GIS

HIS – database and queries – detailed 2

Generate survey plan

Text query for wrecks higher than 1m or in depth less than 5m in a defined area



And Or

Query field:

Operator:

5

Search condition:

id

Full query

Wreck height (m) > 1
Or Wreck depth (m) < 5

Set search area

539197 6595455
544260 6595471
546197 6595041
546276 6593112
544455 6592151
541182 6592338

To select area, drag on map with right mouse button, click right mouse button on the map, select file or insert up to four corners

Sort by:

Output format:



Hydrographical Data Management in WEB GIS

HIS – database and queries – detailed 3

Start Previous 1 Next End

id	Ship name	Ship type	Time of shipwrec	Wreck dept	Wreck height (m)	Ship leng
39	T-1	Pukser	10.10.1944	29.01	2.3	16.6
210	DERBY	Kaubaaurik	13.04.1876	17.91	7.54	77.3
237	NIMETU-80		01.01.1970	4.31	4.7	
755	NIMETU-350		01.01.1970	3.59	2.86	

*Query results
in a list, and for a selected object:
✓ detailed information
✓ images
✓ position on map.
With proper user rights information
can be altered right here.*

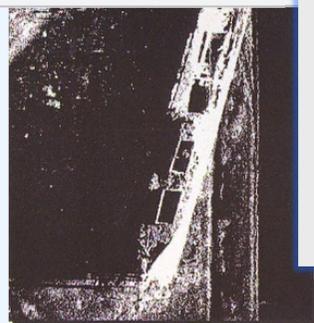
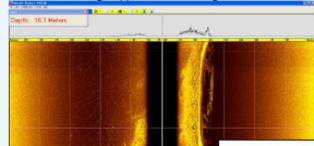


Image type: Wreck image sss



Click on image to

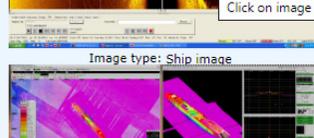
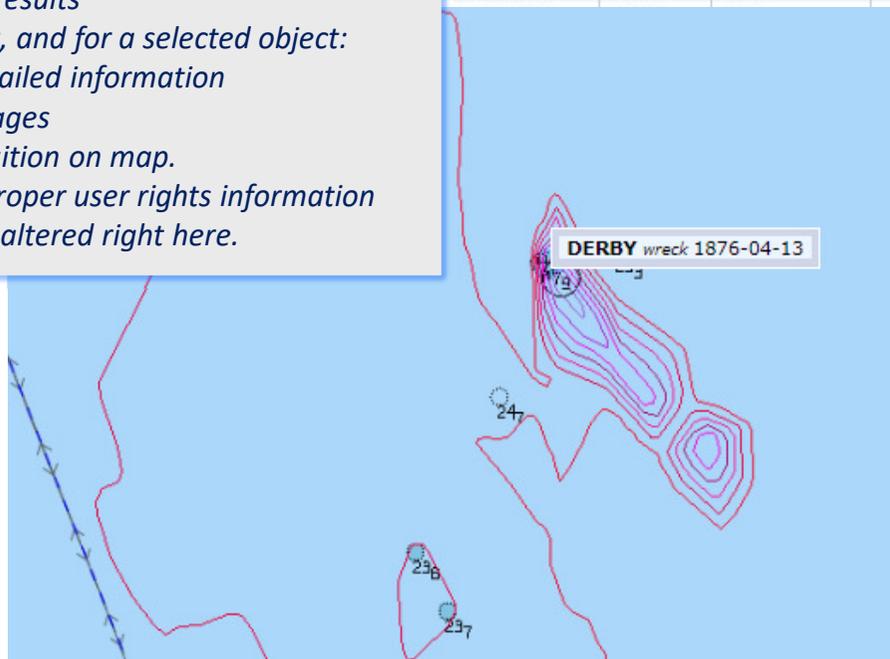


Image type: Ship image



Save Create new Delete Show on map

Name of Survey area tall_laht2

Wreck depth (m) 17.91

Wreck length (m) 79.65

Wreck width (m) 9.0

Wreck height (m) 7.54

Ship length (m) 77.3

Ship width (m) 9.1

Ship name DERBY

Tonnage (brt) 1299 brt

Ship type Kaubaaurik

Owner at the time of shipwreck W. Bailey & Leatham

Time of shipwreck (format : 23.01.2000 or 2000) 13.04.1876

WATLEV always under water/submerged

CATWRK dangerous wreck

Other names

Building time ehitusaeg_help 1871

Building place Suurbritannia,Hull, Humpry Pearson

Flag state at the time of shipwreck GBR

Captain at the time of shipwreck

Number of victims

Cause of shipwreck jääpress

Depth of surrounding area (m) 25-26

Wreck condition Hästi säilinud

Wreck direction 137-317





Hydrographical Data Management in WEB GIS

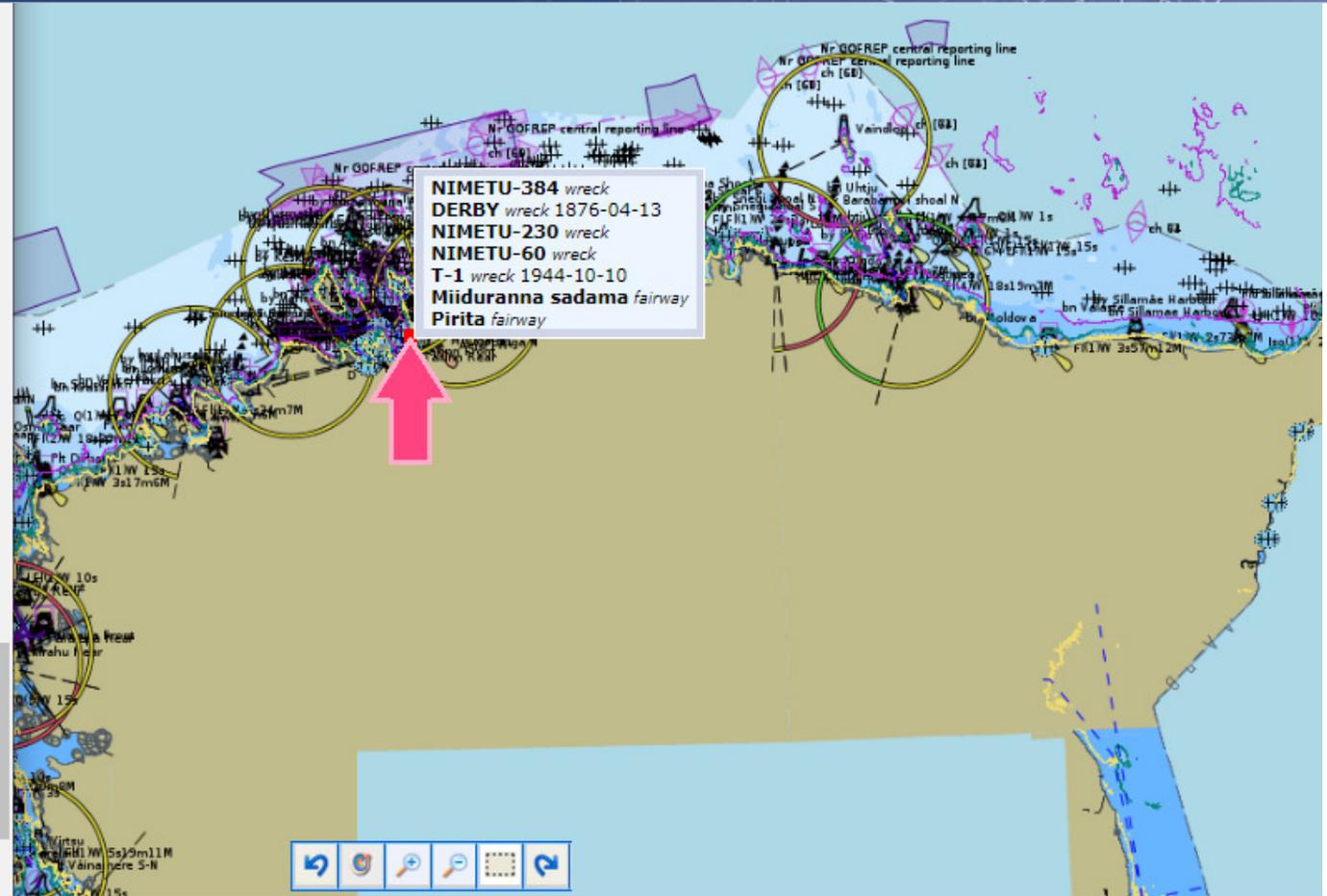
HIS – database and queries – detailed 4

Other names	ex LOOTS
Building time	01.01.1931
Building place	Tallinn, Riigi Sadamatehas
Flag state at the time of shipwreck	SU
Captain at the time of shipwreck	Kõmmus
Number of victims	4
Cause of shipwreck	Põhjamiin
Depth of surrounding area (m)	
Wreck condition	Stabiilne
Wreck direction	42-222
History	1931 LOOTS EST, omanik Mere Piirivalvevalitsus, 1941 mobiliseeriti, jäi Tallinnasse, saksa okupatsioonivõimude teenistuses, 1944 T-1 SU, hukkus miinil 2005 juuli vraki mõõdistas AHERO 7-kanalilise ridasonariga EVA-320 2017 märtsis mõõdistas vraki üle Jakob Prei
Comments	Identifitseeritud, V. Mäss 25.07.2005;raudlaev;14.5;7.5;2;543603.29 6594370.01
Coordinates LEst	543613.82 6594375.45
Geod. coord.	59:29.090130 24:46.179923

Images ...

Fairway

id	130
Name	Miiduranna sadama
Width	0
Depth	0.0



On mouseover all objects under the cursor are listed. Click will result in next list of detail data of objects.



Hydrographical Data Management in WEB GIS

HIS – ENC compilation

extracting area to DAF, DXF, XYZ, KML, BAG or S57 format

Administration --- Data upload --- Queries ----- Generate survey plan ----

Map legend

6.0 X 1.7 X 4.5 stone
5.4 X 1.3 X 1.5 stone
5.9 X 1.8 X 2.0 stone
6.2 X 1.6 X 1.7 stone

1 km

dassaar

575180 6599285

575168 6599098

Area size 54 ha

To select area, drag on map with right mouse button, click right mouse button on the map, select file or insert up to four corners

Clean

Done

Plan area

Name of Survey area	IHO cat	Scale	Area
rohusi_e	Ia	1:1000	0.2
sheet10_59_30	UNDEFINED	1:10000	0.3

Plan area size

54 ha

Use survey areas until scale

1:10000

Generate plan

Information wanted

full plan

Output_format

DAF

Scale to generate

DAF vahe 2 - 4 m

Soundings

interval (m)

Coordinate system

Height System

Min object height

Reduce depths frequency

Contour making

Contour interval

max scale

1.0

2, 5, 10, 15, 20, 50, 100, 200

Choose file No file chosen



Hydrographical Data Management in WEB GIS

To obtain data for ENC first defining the required area (by coordinates or interactively from map), scale and contour intervals are necessary. The HIS then finds survey areas inside the defined area, analyses **overlaps**, extracts depths, objects and contours, performs sounding generalization into the desired scale, creates necessary meta-objects from survey areas and saves all data into required format (DAF by default). DXF and ESRI Shape formats are available but they do not represent S-57 objects, and also do not include meta- objects. Depths and contour output depends on the desired scale or output resolution. Starting from a scale of 1:5000 or depth resolution of 4m, the data are taken from **cells** instead of depth tables of survey areas. This significantly decreases depth extraction time as data in cells are already prepared into the desired scale. It also makes possible depth extraction from very large areas, for example from all Estonia (total area of larger water bodies is around 36,000 km²).



Hydrographical Data Management in WEB GIS

Overlaps.

In order to query depths or objects from overlapped survey areas some automatic procedures have to be performed. First topological analysis of area borders gives exact areas where overlapping occurs, second procedure analysis relevant survey areas and finds which ones have better quality and/or newer data. These data will have precedence over others, so querying depths from HIS gives from overlapping survey areas only newest and better quality data.

Cells.

For seamless depth and contours database HIS is using cells. Depths are stored in cells in 11 different resolution from 4 to 500 m. Contours are created and stored in 1m interval. Viewing and querying the depth data means getting data from relevant cells in resolution needed. That makes possible to see data in web mapping services quickly. Same is true about depth contours. The cells are filled automatically from survey areas when new validated data are available.



Definitions :

- 1) Defining area of interest (the same way as spatial query)
- 2) Defining required information type : only depths, only objects or full data (depths,objects,contours)
- 3) Defining wanted output format : available formats are S-57, DAF (Dkart ASCII format), DXF, Shape, XYZ, KML.
Output format depends on previous selection – for example only depths are allowed only into XYZ format.
- 4) Defining output scale or depth resolution (if only depths selected) from predefined list.
- 5) Defining contour interval : 3 possible ways – one interval, predefined 'cartographic' intervals or intervals from text file.
- 6) Defining output coordinate system : currently EPSG:3301 and EPSG:4326 (WGS84 lat/long). Other possibilities are available.



Processing :

1) After definitions the process first analyses defined area – if the area is less than 50 km² then the depth data will be taken from depth tables for each survey area and contours will be created based on these depths .

Generalization of depths will be done according to defined scale/depth resolution. If bigger than 50 km² then depths and contours are taken from cells. As depths in cells are already stored in different resolutions then no further generalization is needed – depths are selected in defined resolution. If area is bigger than 8000 km² then only allowed information type is only depths .

Such approach makes data access **very quick** – compiling basic map in S-57 format in scale 1:100000 from 6000 km² area from hundreds different survey areas takes just some minutes.

The area sizes are definable in configuration file.



2) First case also triggers analyses of overlaps: depths are taken from overlapping survey areas taking into account survey time and quality (IHO_S44 class). Second case does not need such analysis as the cells are already filled in this way.

S-57 and DAF formats will need analysis of overlapping survey areas anyway as the required meta-objects (like MQUAL) need this.

c. Next process selects depths from tables or cells according to defined area and generalizes them into output scale if needed.

3) Then contours will be generated or selected if it was wanted.

4) Selection of underwater objects if wanted.

5) Finally all these data will be written into selected output data format and download link will be sent to user.

The whole process is logged, temporary files and log files are stored in special folder. This folder is cleaned once a week.

Brief log about user activities is also kept in database (tables 'stat user', 'stat user info', 'stat user plan')



Hydrographical Data Management in WEB GIS

HIS – Administration and technology

The system can be **administered** remotely.

The main activities are **logged**
both for system and each user separately.

Any change in main database is
automatically reflected in **backup** database.
In addition, raw data and system are backed
up daily.

Application

is written in Java.
Frontend is HTML generated by XSL conversion
and JavaScript.

Base software

- Fedora core 64-bit Linux
- PostgreSQL and PostGIS
- F-Open mapserver (serves WMS/WFS)
- Apache Tomcat
- GMT
- JTS (Jump Topological Suite)

In Estonia the main server requires
5 TB of disk space and
70 GB RAM with two CPU-s.



Hydrographical Data Management in WEB GIS

R-Systems Ltd. (R-Süsteemid OÜ)

is an Estonian **Hi-Tech** software development company with **spatial data** processing expertise dating back to 1989.

since 1991 – software development for air surveillance systems

since 1994 – hydrographic survey and data management systems

since 1994 – development of the basic means for geo- information systems

since 2000 – web-based information systems

since 2002 – minehunting operations and information system

since 2002 – browser-based geo-information systems (WEB GIS)

since 2006 – modernisation of naval navigation systems

since 2010 – tactical data links

since 2012 – land planning

since 2013 – isobath technology for hydrographical data presentation

since 2017 – AI for hydrographical survey data processing

since 2020 – 3D and bottom profile for hydrographical data presentation

R-Süsteemid OÜ

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Tallinn, Estonia



Hydrographical Data Management in WEB GIS

R-Systems develops for EMA also

Survey Software

to collect, store, analyse and present bathymetric data

- Planning of survey jobs (graphical editing of the survey plan).
- Reading data from sonar, GPS-receiver, (gyro) compass and motion sensor.
- Presenting the collected data recalculated into soundings both on the background of the chart and as a three-dimensional bottom relief.
- Storing collected data.
- Presenting the information necessary for navigation to the helmsman on a separate screen.
- Checking the sounding coverage of the survey area.
- Water column and snippet data
- Autopilot mode
- Different modes for sounding visualization



Hydrographical Data Management in WEB GIS

Post-processing Software

to check and filter out erroneous bathymetric data.

- Searching and removing the occasional errors in the collected data.
- Interactive editors and automatic filters.
- Visualising and analysing the bottom profile.
- Special echo selecting techniques for multiecho sonars, large volume handling (hundreds of millions soundings)
- Searching and marking the discovered underwater objects on the chart.
- Analysing the quality of survey- both the area coverage and accuracy of measurement.
- Exporting checked soundings to cartographic GIS or other analysing systems.
- 3D modelling of the sea floor.
- Smile (specific error in data caused by wrong sound velocity) optimization.
- AI (Artificial Intelligence) for detecting survey errors (pikes) and objects (currently under development).