OpenSeaMap – the Free Nautical Chart

The biggest worldwide geodatabase, made by the crowd

Nautical charts are expensive, and in many countries data are not always up to date. OpenSeaMap is an alternative solution which is free for anybody to use worldwide. Following the example of Wikipedia, the data are collected by volunteers and are visible on the chart within just a few minutes. OpenSeaMap involves experienced mariners, programmers and thousands of data collectors, all of whom are working to produce a nautical chart with comprehensive, relevant and up-to-date data for water sports which is open to everyone and free of charge.

Markus Bärlocher, initiator OpenSeaMap

OPENSEAMAP – THE FREE nautical chart – covers oceans and inland waterways worldwide. OpenSeaMap works like Wikipedia, the up-to-date, competent and most comprehensive encyclopaedia in the world. Thousands of skippers, divers, kayakers, and other water-sports enthusiasts compile information they consider important and useful for a nautical chart and save them in a spatial database.

Making use of crowdsourcing, OpenSeaMap is:

- Up to date – every change is visible online immediately
- Specialised – every user enters data that they consider important
- Precise and detailed – continuously optimised by thousands of people
- Comprehensive – information for everyone involved in water sports.

OpenSeaMap is the fastest chart in the world. Items such as buoys that have been moved, a new harbour or the harbour master's new telephone number can be found online within just a few minutes, instead of one year later in the next edition of a common harbour pilot book.

Oceans, rivers and topography

OpenSeaMap is versatile. It contains information on oceans, rivers and topography. The chart does not end at the coastline but instead also shows details of the harbour, the infrastructure of various places, traffic routes and much more. The river chart shows inland waters including inland waterways as well as wild-water stretches for kayakers.

OpenSeaMap is part of OpenStreetMap. The collection of free spatial data works just the same. There are three sources of data:

1. One million amateur cartographers collect spatial data using GPS devices, at home and abroad. They update the map with these data with a very keen eye for detail.
2. Authorities and organisations that are increasingly embracing the idea of OpenData provide data voluntarily.
3. Aerial photographs with partly excellent resolution obtained from Bing, Microsoft, local authorities and organisations are rendered manually into vector data of spatial information.

OpenData culture

OpenData means all databases that, in the interest of the public, can be freely accessed. OpenData is intended to initiate developments that are profitable for the overall economy: by giving everybody access, open data can be used to create synergies and thus innovative products and services. It is crucial that the information can be re-used, worked with and propagated freely by everyone. Spatial information is required to become OpenData as well.

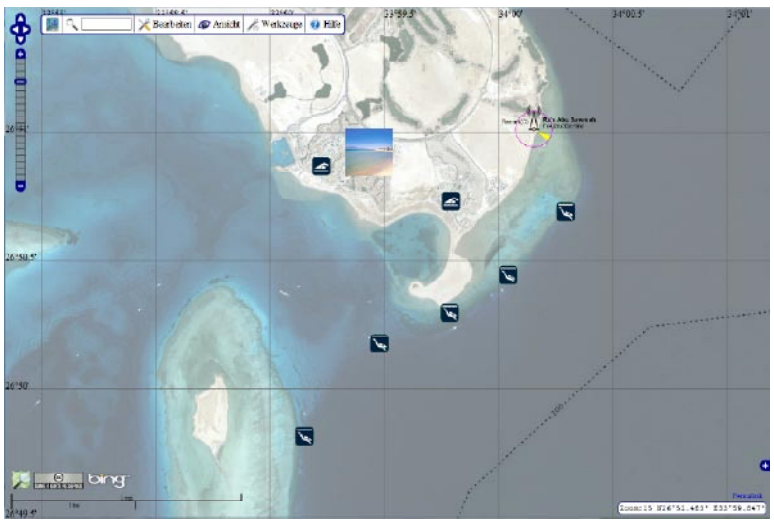

Figure 1: Diving spots.

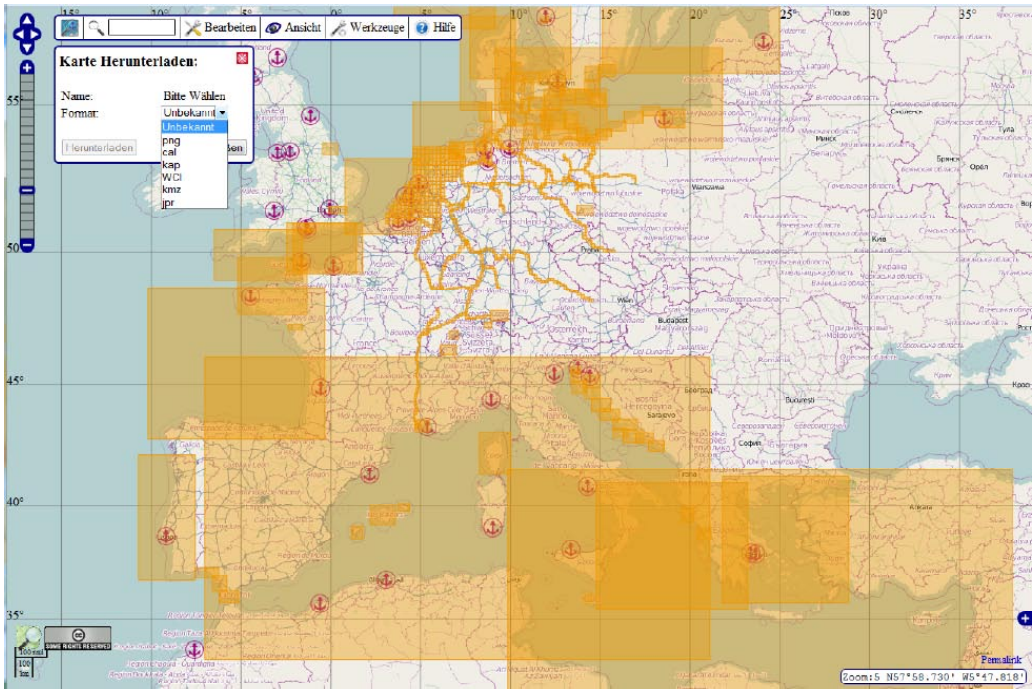

Figure 2: Offline charts in various formats.

The spatial data relevant for OpenSeaMap are virtual data such as details of protection zones, data relating to what lies beneath the water's surface or concerning objects far out at sea. Capturing these data is not as easy as collecting data about the countryside. The information is already there but most nations treat it rather proprietarily. The OpenData community hopes that the OpenData culture will increasingly spread amongst marine authorities. For example, OpenSeaMap is allowed to use water level information and tidal information from Germany, Austria, and Switzerland. Germany in particular shares quite a lot of country-specific data, and the German Bundesamt für Seeschifffahrt und Hydrographie (BSH) has also offered to share quite significant data.

Collecting data

Anyone can collect spatial data: amateur cartographers and water -sports enthusiasts as well as nautical and bathymetry specialists, geographers and hydraulic engineers. All objects relevant for nautical purposes that are described in the international IHO standards INT-1, S-57 and S-100 can be entered. There is simply no limit to the variety of objects. OpenSeaMap shows anything from complex sector lights and traffic separation areas to shops for yachting equipment and bakeries. The exact forms, positions and descriptions of these objects are fine-tuned iteratively using nautical know-how and local knowledge.

A user-friendly graphical editor can be used to enter more detailed descriptions. It was specially developed for nautical data so that water-sports objects can be depicted that are not usually included on traditional nautical charts. The editor translates the collected object details into a data schema according to IHO S-57 and S-100. The data are then saved in a central spatial database.

Finally, the chart is rendered from the entered data and made available both through the web browser and as an offline chart.

Offline charts

Offline charts are available for use en route. They can currently be loaded onto iPad or Garmin Plotter. As yet, there is no application for Android and OpenSeaMap is still looking for Android developers. OpenSeaMap offers hundreds of offline charts for download from the website.

Vector charts are the future because they support head-up and true motion view. OpenSeaMap already provides vector charts for use on Garmin devices. However, most of the navigational software programs still work with raster charts, meaning that it is necessary to modify these navigation programs so that they can handle vector charts instead.

All-in-one workplace

Leisure-sailing skippers need a modern, integrated system; instead of using dozens of charts and manuals, the information must be contained in one single chart. This has already been realised on the web-based full-screen chart.

Selecting the menu option 'View' provides access to a wealth of information depicted in layers on the base map. The 'navigational aids' layer contains typical features of a nautical chart. It has 18 zoom levels that range from a view of the world to detailed harbour plans in 1:2000 scale. The most advantageous combinations of objects are depicted for each particular zoom level. The 'harbour' layer shows 6,000 harbours, thousands of marinas, and anchorages. Clicking on the symbol opens the harbour pilot which can be updated by users with detailed descriptions and images of the harbours. The 'weather' layer comprises weather maps of the world including parameters such as wind direction and wind force, air pressure, temperature, precipitation and the height of waves. Also included is a three-day weather forecast. The 'water depth' layer shows the deep-water bathymetry by GEBCO. The

'ship tracking' layer shows the AIS positions in real time. The 'water gauge' layer shows dynamic water levels of coasts and rivers. The 'aerial photograph' layer was provided by Bing. The aerial photographs can be used to receive spatial data by digitising them. The 'Wikipedia' layer has direct links to 2.5 million Wikipedia articles. This co-operation between OpenSeaMap and Wikipedia is aimed at benefiting from synergy effects and hence making a cultural contribution.

Of course, it is intended that all these layers will soon be available on offline charts too, so that skippers can check and monitor all nautical data and the onboard instruments via their smartphone or tablet computer from anywhere on the ship.

Chart for water-sports enthusiasts

OpenSeaMap is interested in everything that is 'blue' in the world – from oceans to rivers and streams; after all, 70% of our planet's surface is covered in water. Until now, users of the navigational charts have usually been skippers and motorboat operators. However, growing numbers of divers, surfers, kayakers, anglers and other water-sports enthusiasts are keen to benefit from OpenSeaMap too, and they are catered for by the 'sports' layer. Among other things, this shows great diving spots, diving schools and places for filling up or renting scuba tanks. Kayaking routes are marked with different colours depending on their degree of difficulty, and entry and exit points plus obstacles and spots where kayaks need to be carried are clearly indicated.

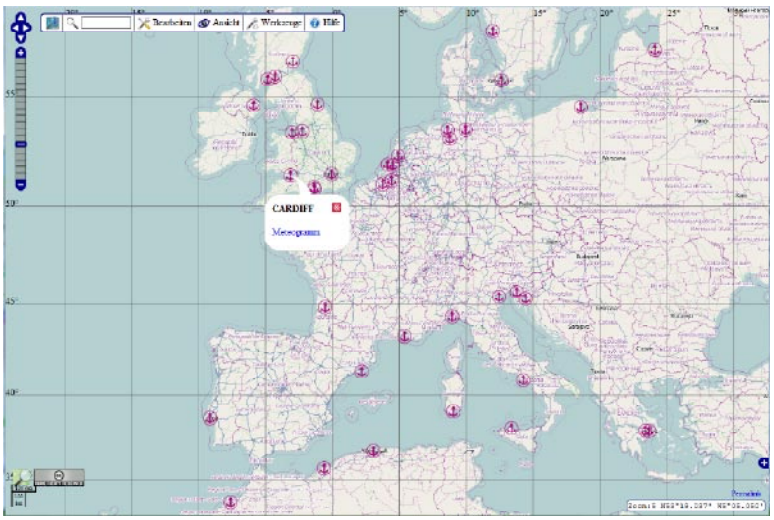

Figure 3: European harbours.

Added value for organisations

In addition to skippers and water sports enthusiasts, OpenSeaMap is increasingly being used by communities and tourist organisations that want to offer a great service to guests and tourists. Thanks to the free license, any organisations can easily integrate OpenSeaMap into their website free of charge.

The same goes for commercial use for ship owners, charter companies, organisations for the protection of the environment, oceanologists, schools and universities. Furthermore, users can add layers of their own such as images of protection zones, construction projects, wind turbines, distribution of fish species or other information.

Shallow water depths

A chart without water depths is rather useless, but unfortunately depth information is difficult to obtain from countries. That is why OpenSeaMap wants to measure the seacoasts worldwide using crowdsourcing. In this way, everybody can contribute and collect depth data. Most ships are equipped with GPS and sonar systems, which makes data collection easy. The devices can write the data via an NMEA string format. An NMEA data logger, which was developed specifically for OpenSeaMap, then stores the data on a USB stick. Contributors can transfer the collected data from any computer with internet access to the central server. The raw data can be corrected (fed with heel and tide data) and calculated to create a terrain model. From this, depth contours will be derived and shown in the chart.

TeamSurv and ARGUS recently explained in HYDRO INTERNATIONAL that finding contributors for crowdsourcing is quite a challenge. The OpenSeaMap community is large and spread all over the world, so the chances of this ambitious project succeeding are rather good. However, there are other challenges such as feeding the system with tide and wave information data. It is therefore important to have bathymetry specialists contributing to OpenSeaMap. And of course it would be especially valuable to benefit from the experience of TeamSurv and ARGUS.

Our practical tests so far have proved quite successful. Extensive data collection will be starting in the sailing season 2013; however, any bathymetry already collected can be submitted to OpenSeaMap immediately.

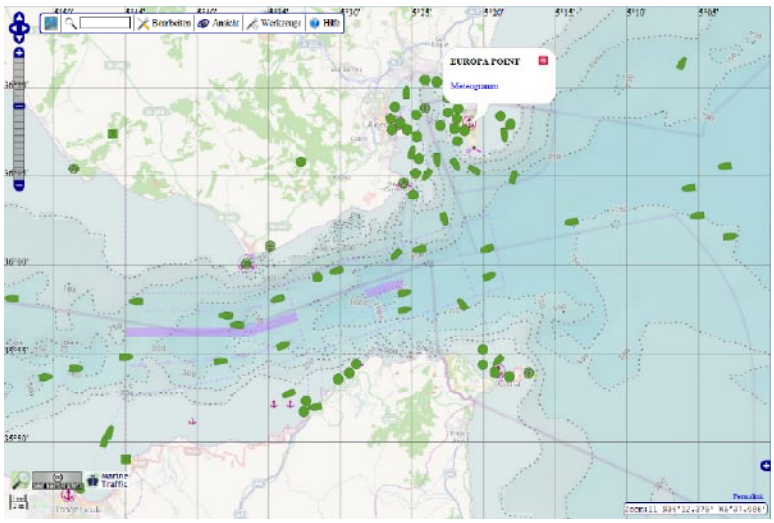

Figure 4: GEBCO water depths in the Street of Gibraltar.

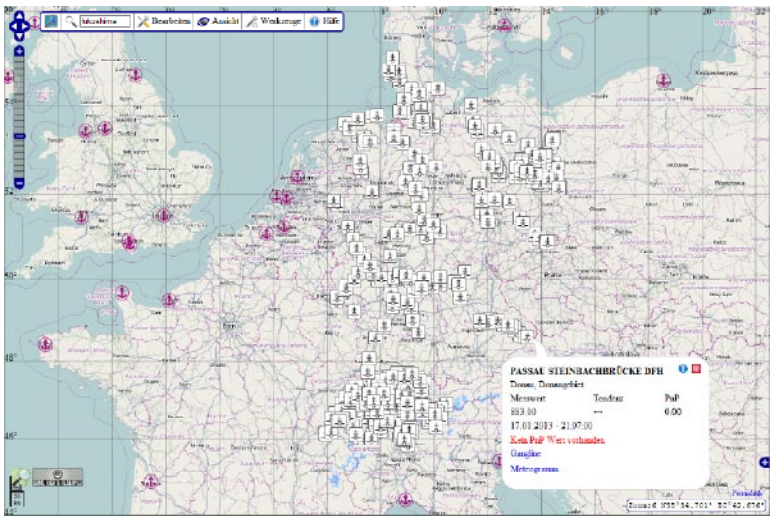

Figure 5: Gauges in real time.

Current challenge

You can help us by telling people about this project and asking your friends to update the chart with spatial information about their place of residence or home country. Tell the people at your sailing club about OpenSeaMap. Ask skippers to record water depths and upload them. Researchers and scientists can help OpenSeaMap feed the system with depth data. We are looking for tide models, waves, wave travel times, ship movements, etc. Professors and students alike can find exciting topics for diploma theses or internship reports.

There are many more ideas for OpenSeaMap and together we can accomplish them. If you are a developer, you are welcome to join OpenSeaMap – we could use your experience in various fields such as servers, databases, rendering, hardware, microcontroller, web programming, app programming, graphics, web design, data transformation, statistics, geodesy, bathymetry, cartography, translations and more. Let's build the chart together!

Acknowledgements

Many thanks to all our diligent amateur cartographers and of course our programmers. Together, they all help to create OpenSeaMap.

The Authors

Markus Bärlocher is an experienced skipper and sailing instructor. He is the initiator of OpenSeaMap. He sails worldwide and crossed the Atlantic Ocean W-E. Professionally he is an organisation developer. For OpenSeaMap, he had to learn a lot about bathymetry, cartography and computing, and he is grateful to all the experts involved for their helpful conversations.

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