R E P O R T

of the BSHC Working Group for the Harmonization of the Chart Datum of the Baltic Sea (CDWG)

Activities of the CDWG

The CDWG was established by the decision of the 11th BSHC Conference in 2005. The aim of the WG was to investigate the recent situation with vertical reference level and determination of the chart datum around the Baltic Sea. The Terms of Reference (Annex A) were adopted and the Chairman (V.Kraav) of the WG was elected by the 11th Conference in Jurmala. The members of the WG (at least one representative from each country) where named by every member state of the BSHC. According to the above-mentioned the final list of members of the CDWG is as follows:

Chairman: Dr Vaido Kraav (Estonia)
Members: Mr Klaus Smidt (Denmark)
Dr Tarmo Kouts (Estonia)
Dr Jaan Lutt (Estonia)
Mr Tonis Siilanarusk (Estonia)
Mr Jukka Varonen (Finland)
Dr Wilfried Ellmer (Germany)
Mr Jurijs Rizhovs (Latvia)
Mr Mindaugas Zakarauskas (Lithuania)
Mr Anžej Dolecki (Poland)
Mr Alexander Abramov (Russia)
Mr Lars Jakobsson (Sweden).

Exchanging information, opinions and ideas was carried out via the Internet, but also one Workshop of the CDWG during the period took place in January 2006.
The Workshop was targeted to discuss the following items:

a) the current situation with vertical reference sea levels and chart datum in the Baltic Sea area. Reports from all countries around the Baltic Sea were collected;
b) principles and ways for harmonization of the chart datum in the Baltic Sea;
c) possibilities for definition of unified and common chart datum for the Baltic Sea.

A summary about the workshop is given in Annex B.

In June 2006, during the visit of the representatives of IHB (Captain Gorziglia and Captain Bermejo), the problem with harmonization of the chart datum for the Baltic

Baltic Operative Oceanographic System (BOOS - Dr Erik Buch) to discuss the problem with common reference level and unification of the vertical chart datum, and about the importance of the problem and the need to cooperate in this field was fully understood. Hopefully successful cooperation between CDWG and BOOS in the future will develop.

A short overview of vertical reference levels in the Baltic Sea area

The Baltic Sea is non-tidal and sea level changes are induced mainly by wind activity and river inflow. The water exchange with the World Ocean and some other factors also influence the situation. Averaged long time series of sea level observations are free from seasonal variability and by using them the mean sea level could be calculated. This theoretical non-disturbed water surface is locally used as benchmark for estimation of the sea depths. Depending on historical developments and connections, different height systems are used by Baltic Sea countries based on their own sea level data and height systems. On the Eastern coast of the Baltic Sea (Russia, Estonia, Latvia, Lithuania, Poland and former East-Germany) the Baltic Height System (BHS) was used starting from the 1940s. It is based on the long-term sea level observations at the Kronstadt tide gauge (1825-1940) and is with minor corrections still in use as the chart datum. The height system was updated in 1977 and named Baltic Height System 1977 (BHS-77), also known as East European United Precise Levelling Network (UPLN). In the Southern part of the Baltic (former West-Germany, Denmark) the United European Levelling Network (UELN) based on the Normal Amsterdam Zero (according to Amsterdam tide gauge - NAZ) is in use. According to preliminary estimations the difference between the two above-mentioned systems is about 15 cm (the Kronstadt zero is higher). The Northern part of the Baltic Sea (Finland and Sweden) is covered by the Nordic Height System (NH-60). The difference in absolute height between the BHS-77 and NH-60 could also be about 15 cm. It means that at least three different reference levels are currently used in the Baltic Sea area. From the hydrographic point of view (S-44) the height system differences could be generally accepted in most cases. However, taking into account demands in the near future (e-navigation etc), also other purposes (coastal engineering, harbour constructions or spatial data infrastructure demands etc) the unification of vertical reference levels and chart datum for hydrographic information is essential and certainly needed.

Conclusions

WG generally fulfilled the tasks listed in the Terms of Reference of the 11th Conference of BSHC. In two years period the WG was able to clarify the situation with chart datum in the Baltic Sea area by collecting relevant information like definitions of chart datum, mean sea levels etc from all countries. The Workshop discussed differences in chart datum and mean sea level definitions of different countries, as well as perspectives of height systems development. Specifically, the IHO demand that chart datum should be related to land-based height system datum was pointed out and found to be of major importance. The existing material does not allow the definition of unified chart datum for the entire Baltic Sea, but regionally hydrographic data should still be rather well comparable inside the existing height systems: BHS-77 on the Eastern coast, NH-60 in the Western and Northern Baltic and NAZ in the Southern Baltic. Future actions that are needed for definition unified chart

Note BSHC12/E2/FIN). Hopefully the Conference will accept those.

E-navigation systems need real time data on environmental conditions at sea First of all the sea level, to which depths are related to, must be available. Cooperation with BOOS seems to be essential in the future, as this community develops operational products broadcasting sea levels and other oceanographic parameters for the entire Baltic Sea area for mariners and other users (see: http://servlet.dmi.dk/vandstand/servlet/boos). Some other regional scale pilot products of real-time information systems are under development, as for example one by the Marine Systems Institute, Tallinn University of Technology (see: http://online.msi.ttu.ee/?jaam=parnu&periood=518400), broadcasting from January 2007 to users real time sea levels together with 24-hour forecast, operating at 7 stations on the Estonian coast. All these tools transmitting data into VTS and AIS systems help mariners to navigate safer in quite shallow Baltic waters. The amount of such information is constantly growing, as well as the need for the establishment of a common Baltic reference level.

I want to take this opportunity and thank all the members of the WG and especially Mr Jukka Varonen for their good cooperation and contribution to the CDWG.

ANNEX A

Baltic Sea Hydrographic Commission 11th Conference
Jurmala, 14-17 June 2005

BSHC Working Group for the Harmonization of the Chart Datums of the Baltic Sea

Terms of Reference

To find out the existing situation of the Mean Sea Level and chart datums used in the Baltic Sea area and make proposals for harmonizing the practices used.

Especially the Working Group should:

- to prepare an introductive presentation of existing geodetic height datums which cover several countries around the Baltic Sea
- to prepare a presentation of the future international height datum and estimation when it will be implemented
- to clarify the role of other international bodies on this subject and contacts to them
- to specify the existing differences of chart datums used in the Baltic Sea area by making a questionnaire for members states at least on the following issues:
    - mareographs (tide gauges) in use
    - for each mareograph the connections to height datum, description of that datum and also connections to the GRS80 ellipsoid
    - methods and equipment for distributing real time sea level data for mariners and VTS-organisations
    - points of contacts in other organisations involved to this subject in each country.

Proposals for harmonisation should include:

- proposals of information to be printed on charts and other navigational publications
- proposals to use AIS and VTS systems by harmonised way to broadcast real time sea level data and predictions of sea level state for the following hours
- proposals to harmonize the chart datums in relation to a widely adopted European or world wide height datum.

The working Group should report to the BSHC 12th Conference.

Chart Datum Working Group of the BSHC

Workshop

25 January 2006, Tallinn

S U M M A R Y

Participants - Participants List: Annex 1
Chaired by Vaido Kraav
Minutes by Krista Rohtmaa.

On the workshop the following items were under the discussion:

- The current situation with vertical reference level and chart datum in the Baltic Sea area.
- Possible principles and ways for harmonization of the chart datum for the Baltic Sea area.
- Approval of the working plan of CDWG for the period 2006-2007.

Under item 1 all the CDWG participant countries gave an overview about the current situation with vertical refernce level in their country (overviews were submitted in written form prior to the workshop as well). It was acknowledged that the vertical reference level is different in various areas of the Baltic Sea.

Also Mean Sea Level (MSL) and Geoid Models (GM) were thoroughly discussed by participants of the workshop.

The following was found to be important:

- Vertical datum for hydrographical applications – the Chart Datum (CD) of navigation charts - should be connected to land vertical datum.

- Number of GM-s exists in different countries and many hydrographical offices use GPS technology and GM in their everyday surveys in order to estimate heights. However, this method should be a working tool and not a way to define MSL.

- GM for the entire Baltic Sea could be probably the standard height system for all countries in the future. There are already now existing a lot of gravity measurement data for that purpose.

satisfied with the situation but some are not and are going to change this in the future (Finland, Sweden).

- Harmonisation of the CD in the Baltic Sea needs more joint efforts. It is not needed only for Hydrographical Offices but also for other users (for example BOOS – Baltic Operative Oceanographic System). Definitely more research is needed on the subject. It was agreed that WG will produce joint report about MSL used now by different countries around the Baltic Sea (on the bases of the reports of all Baltic Sea countries).

Information was given that some projects deliver real time sea level information for the entire Baltic Sea (BOOS) and Swedish coastal waters (VIVA). At present the entire Baltic unified reference level is not existing. Nevertheless water level information is important and usable for operative purposes. The future vision will be the creation of the unified reference level for all purposes.

Problems with "guaranteed depths" was discussed. Countries use different values of depths deducted from actual measurement data if charts are produced. Participants of the seminar however didn't find overall principle and procedure how guaranteed depths could be presented in the same way in all countries.

Hydrographic survey methods used by different countries were discussed and especially how water level reduction is obtained. In many cases the local GM and GPS RTK technology is used to estimate absolute heights in WGS-84. Preciseness class of survey depends on depths.

It was agreed that the next CDWG meeting will take place in 18 October 2006 in Rostock.

Annex 1

LIST OF THE PARTICIPANTS

WORKSHOP of the Chart Datum Working Group of the BSHC
24-25 January 2006, Tallinn

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