12th South West Pacific Hydrographic Commission Meeting
12th – 14th November 2013, Port Vila, Vanuatu

Information Paper

Establishing the DCDB as a Global Digital Bathymetry Reference Data Store

(Paper submitted to GEBCO/TSCOM, Venice, Italy, October 2013)

Submitted by:	IHB
Executive Summary:	The aim of this paper is to propose further development of the IHO DCDB to help address the significant lack of bathymetric data available globally by creating a web-based digital bathymetry reference data store into which trusted contributors may upload data and metadata covering all sea areas. The data and the metadata will thereby become a significant part of the Global Spatial Data Infrastructure.
Related Projects:	IHO-IOC GEBCO Project

Introduction / Background

1. A large percentage of the world's seas and oceans are still unsurveyed. Less than 10 percent of the world's sea areas are surveyed to modern standards. Where nautical charts and ocean maps do exist, they have limited utility because of the lack of reliable and detailed underlying information. Currently, there are higher resolution maps of the Moon and Mars than most of the world's sea and ocean areas. The grounding of vessels operating outside previously navigated routes is not uncommon.

2. There is no indication of any significant improvement in the level of hydrographic surveying being conducted around the world. At the XVIIIth International Hydrographic Conference (IHC-18) held in April 2012, the Member States of the IHO acknowledged that in the last three decades the numbers of surveying vessels operated by Member States has declined by 34% for offshore vessels and 35% for coastal vessels. Furthermore, it seems unlikely that this reduction in numbers has been matched by a corresponding increase in capacity through the use of more efficient technology, such as LiDAR or multibeam sonar sensors or through governments opting to use commercial surveying contractors.

3. Recognizing that much data gathering remains to be done, the IHO Member States at IHC-18 decided:

> " …. *to progress whatever actions are required to improve the collection, quality and availability of hydrographic data worldwide, monitor and rectify possible deficiencies and shortcomings, cooperate with other international organizations and stakeholders as necessary, and to keep Member States informed on progress on this issue. … ".*

4. The IHO Data Centre for Digital Bathymetry (DCDB) was established in 1990. It is hosted and managed at the National Geophysical Data Centre, Boulder USA, by the US National Oceanic and Atmospheric Administration (NOAA). The purpose of the DCDB is to provide a repository for oceanic soundings acquired by hydrographic, oceanographic and other vessels during surveys or while on passage. This data, collected by non-hydrographic personnel is, in effect, crowd-sourced data - albeit from trusted sources. Much of the data held at the DCDB is used as source data for the IHO-IOC GEBCO Project and for the world's nautical charts covering the oceans.

5. The extension of the scope of the DCDB to include shallow water areas was initiated in 2006 at the behest of TSCOM (then SCDB) when IHO Member States were invited to provide coastal soundings and contours harvested from their electronic navigational charts (ENCs).

Aim

6. The aim of this paper is to propose further development of the IHO DCDB to help address the significant lack of bathymetric data available globally by creating a web-based digital bathymetry reference data store into which trusted contributors may upload data and metadata covering all sea areas. The data and the metadata will thereby become a significant part of the Global Spatial Data Infrastructure.

Analysis/Discussion

7. It is proposed that the existing infrastructure of the DCDB be enhanced to enable it to become a global digital bathymetry data store. This would incorporate upload and download capabilities that are automated. In particular, it would enable pre-qualified data contributors to upload data and metadata at will. Similarly, it would be possible for data and metadata to be extracted from the data store automatically. This may be best achieved using Web Mapping technology. It is important that the data extraction capabilities are automated in order to minimise administrative and operational overheads and to reduce potential exposure to liability for any implied quality judgements about the data by the custodians (IHO). The contents of the data store would, in effect, be available to users on an "at own risk assessment" basis.

8. In addition to enabling the upload of data obtained from scientific and related cruises, as in the past, the new upload interface would accommodate the upload of so-called "crowd-sourced bathymetry" (CSB) obtained from merchant and other professionally manned vessels using data accumulation devices recognised by the IHO. The crowd-sourced bathymetry data would comprise simple sets of measurements (x,y,z,t) obtained directly from the NMEA 0183 (or equivalent) data outputs available in all modern commercial echo sounders and GNSS that are required to be fitted to vessels. The data would normally not be adjusted for tide. Such data would be accompanied by a minimum level of metadata that would allow it to be assessed and compared by users and in some cases, reprocessed or refined. The UKHO, other IHO Member States, and the IHB in cooperation with the Professional Yachting Association (PYA), have recently been engaged in various pilot CSB projects that have confirmed the feasibility of such an approach. There are also a number of commercially-based and volunteer based organisations using similar methodology.

9. Relatively inexpensive (<500USD), very small footprint data collection/recording devices exist. An example is shown in Annex A. These can be installed easily on almost any ship or craft with minimal impact on existing installations and virtually no requirement for maintenance or attention after initial installation. Connections to sensors can even be via wifi in cases where cabling presents problems. The cost impact on ships is minimal, while the benefits of contributing to a global, open, digital bathymetry data base are substantial.

10. A particularly important aspect of establishing an IHO bathymetric data store is to ensure that data providers can see the results of their efforts in as close to real-time as possible. A regular criticism from potential data providers and from potential data users is that current arrangements in the DCDB and in other similar bathymetric data repositories often involve lengthy delays before the data can be viewed and used.

11. Mechanisms would be implemented to ensure that the identity of data providers is protected if they so wish. At the same time, many potential data providers will want their efforts to be recognised. Encouraging certain social-media type competitive behaviours to promote contributions to a CSB programme would also be an important component of the project.

12. A facility would be included in the upload service that enables data contributors to alert chart producers when the data contains information of immediate navigational significance. This could then be the 21st century equivalent of the *hydrographic note* and will not be difficult to implement by associating the geographic area of any uploaded data with the relevant INT chart producer nation.

13. A facility would be included that requires a minimum of metadata to be provided as part of the upload process. Metadata filters should be included to screen out inappropriate data. A proposed list is shown in Annex B.

14. It is envisaged that in order to qualify as a crowd-sourced bathymetry observer, vessels will purchase and install an IHO-approved collection device that will operate using pre-loaded software provided by the IHO (a pilot version already exists and is in use in the PYA trials). Observers would then register the device with the IHO. Thereafter observers would have access rights to the data store portal in order to upload data at their convenience.

15. Bathymetric data managers and data repositories already holding bathymetric data should also be encouraged to upload existing holdings. In cases where data owners require to restrict direct access to their data for commercial or other reasons, the nature, extent and ownership of the data should nevertheless be lodged in the data store as an aid to data discovery and to avoid, wherever possible the duplication of effort in resurveying areas for which data already exists.

Implementation

16. In order to implement the proposal described above, a number of preparations and extensions to existing capabilities are required.They include:

- defining minimum metadata parameters required to accompany uploaded data.

- defining minimum metadata parameters required for the notification of the existence of data that will not be made available directly through the data store.
- considering ways to enhance the quality and utility of duplicate or overlapping data in the data store through combinations of comparison, post-processing or crowd-sourced user commentary/evaluation;
- considering scalability for the database;
- enhancing and approving the software and parameters for the data acquisition/storage devices;
- ensuring all GEBCO project data is available through the data store;
- developing an upload portal based on the existing DCDB interface;
- developing a data download/ordering service using WMS.

Consultation

17. In developing this proposal, the IHB has had informal discussions with a range of stakeholders to gauge opinion and test the feasibility of the proposal, and in particular, the Manager of the DCDB, the national Hydrographers of Norway, UK and US, and the secretariats of a number of IHO Observer organisations: IMO, BIMCO, IAATO, IALA, ICS, and PYA. All have expressed enthusiastic support for the principles of the concept. None has identified any significant impediments to implementing the concept.

Timetable

18. Noting that much of the basic infrastructure is in place and the various enhancements and developments will build upon existing capabilities, and also noting the urgency to address the shortfall in available bathymetric data and the forthcoming 5th Extraordinary International Hydrographic Conference in October 2014, the following ambitious timetable of significant milestones is proposed:

late 2013	• finalise scope for upload and download portal with manager DCDB • conduct comparative trials of crowd-sourced data capture using PYA vessels
early 2014	• develop and implement upload and download portal
mid 2014	• commence operations with an accompanying publicity and education campaign
late 2014	• provide progress report to EIHC-5
2015 onwards	• continue to enhance and promote the programme

Benefits

19. Implementing an IHO digital bathymetry data store as described above would provide the following benefits:

- a dramatic increase in the availability and coverage of bathymetric data for all regions of the world, especially in coastal waters;
- the engagement of the professional maritime community in an attractive, low cost, high impact "self-help" programme;
- a significant increase in the profile of the IHO and the IHO-IOC GEBCO project; and
- a very significant contribution to the global spatial data infrastructure.

Action Required of TSCOM

20. TSCOM is invited to:

a. **consider** the proposal

b. **identify** activities where TSCOM and other GGC bodies can contribute to the implementation of the proposal

c. **provide comments** to the IHB

d. **make recommendations** as appropriate to the GGC.

Annex A

Typical Data Collection/Recording Device

Annex B

Minimum Metadata Parameters Required for Uploading Data

Vessel identity (via registration of UUID of data collection/recording device)
Vessel identity (plain language name)
Type of vessel
Draft of vessel
Tonnage
Length overall
Observer identity to be made public: Yes/No
Identity/model of echo sounder
Assumed velocity of sound in seawater
Transducer depth
Depths adjusted for transducer depth: Yes/No
Type of positioning system
Horizontal datum
Depths adjusted for tide: Yes/No
Start/end date of observations
Time Zone
Data format