Report of the IHO Data Centre for Digital Bathymetry

Submitted by:	Director of the DCDB
Related documents:	IHO CL23-1990 on Establishment of the DCDB 2023 MOU between NOAA & the IHO To Cooperate on the Data Centre for Digital Bathymetry
Related Projects	IHO CSB Initiative, GEBCO, Nippon Foundation-GEBCO Seabed 2030 Project

1. Meetings Held During Reporting Period

N/A

2. Work Programme

The IHO Data Centre for Digital Bathymetry was established in 1990 to steward the worldwide collection of bathymetric data. The Centre archives and shares, freely and without restrictions, depth data contributed by mariners. The IHO DCDB is hosted by the U.S. National Oceanic and Atmospheric Administration (NOAA) on behalf of the IHO Member States.

Please note the IHO DCDB has a new url: *ncei.noaa.gov/iho-data-centre-digital-bathymetry*

2.1 DCDB Data Holdings

DCDB data holdings are routinely used for the production of improved and more comprehensive bathymetric maps and grids, particularly in support of the GEBCO Ocean Mapping Programme and the Nippon Foundation-GEBCO Seabed 2030 project. The Seabed 2030 project has created a global drive to search out new datasets to be added to the currently available bathymetry and the IHO DCDB has been identified as the preferred archive.

Multibeam

Since establishment, the quantity of data archived in the DCDB has grown considerably both in area coverage and data volume, particularly in the last decade with the addition of multibeam echo sounder (MBES) data. Today, the DCDB archives over 70 terabytes (TB) of uncompressed oceanic soundings acquired by hydrographic, oceanographic and other vessels during surveys or while on passage. The archive includes raw and processed multibeam bathymetry data, survey metadata, and in some cases ancillary data and products from over 3,800 multibeam surveys spanning 44 years contributed by 60 different data sources.

Since June 2023, 93 new multibeam bathymetry surveys have been archived. The largest data providers to the DCDB continue to be the U.S. Academic Research Fleet (ARF) with 55 surveys archived in the last year. Additional significant data contributions to the DCDB in the last year also include:

- NOAA - 32 surveys
- Inkfish - 2 surveys
- DIHIDRONAV - 1 survey
- GEOMAR- 1 survey
- Maine Coastal Mapping Initiative - 1 survey
- Northwestern Michigan College - 1 survey

Singlebeam

The DCDB also archives singlebeam bathymetry data collected from nearly 6000 surveys by over 200 different institutions. 34 new surveys have been added to the archive since June 2023.

Crowdsourced Bathymetry

Over the last year, the DCDB continued to bring in crowdsourced bathymetry (CSB) data from Rosepoint Navigation System, FarSounder Inc, PGS, MacGregor Germany, M2Ocean, Great Lakes Observing System (GLOS), Orange Force Marine and GEC Aqua Map.

New CSB data ingest pipelines were finalized with the Interdisciplinary Center for Development in Ocean Mapping (CIDCO), Seabed 2030, International Seakeepers Society, and the Center for Ocean Mapping and Innovative Technologies (COMIT).

We are currently in the process of onboarding Alcatel Submarine Network and Docktech.

31.5 GB of CSB data, contributed from 369 vessels, are publicly accessible. In April the DCDB exceeded 1 billion data points (1,008,164,463).

2.2 DCDB Infrastructure Updates

DCDB Map Viewer
Bathymetric data contributed to the DCDB are made discoverable and accessible through the DCDB web map viewer (*ncei.noaa.gov/maps/iho_dcdb/*).

Recent improvements and updates to the viewer include:

- Updates:
  - Simplified and revised AusSeabed and EMODnet layers
    - AusSeabed: only footprints for bathymetry acquisitions and compilations are displayed.
    - EMODnet: multibeam and singlebeam now combined; issue addressed with identify popup
  - Updated UKHO web services
  - Updated to ArcGIS jsapi 3.45
- Additions:
  - Added Cape Verde grids
  - Added Seabed 2030 Regional Centers layer (under "Options")
  - Added new ETOPO Hillshade basemap

In the next year, our intent is to finally modernize the DCDB Map Viewer. Motivation for this multi-month level of effort include: increasing maintainability, transitioning to a modern UI design, and increasing accessibility and 508 compliance.

Multibeam Ingest Pipeline (MABLE)

In response to the growing data demands from the Seabed 2030 project and IHO CSB initiative, and the acknowledgement of our very dated systems, the DCDB commenced an effort several years ago to rebuild its entire infrastructure to enhance its ability to ingest and archive data and also to improve its ability to provide better discovery, display and retrieval of global bathymetric data.

The new ingest-to-archive data pipelines will allow for improved reliability, increased automation, greater ease in ingesting new data, greater flexibility in allowed data formats for evolving bathymetric technology, provide error handling & notification, better handling of complex datasets and large volumes of data and allow us to be cloud ready.

The work can be simplified into 6 projects:

1. Develop a new database schema to store metadata - *Completed*
2. Build a new application pipeline - *Completed*
3. Provision and configure pipeline hosts, deploy pipeline applications - *Completed*
4. Migrate over 40 years of metadata to the new schema - *Completed*
5. Reingest all 3800 multibeam surveys through new pipeline - *Work to begin Fall 2024*
6. Update map services and data access (NEXT) dependencies - *Work to begin Fall 2024*

The Crowdsourced Bathymetry Coastal State Review Application

Last year, software developers focused most of their CSB-allocated time on finalizing and testing the Crowdsourced Bathymetry Coastal State Review Application (CSB CSRA). The intent of the CSB CSRA is to provide a process for coastal States who have requested, via IHO CL 21/2020 or IRCC CL 1/2020, the pre-approval of CSB data collected within waters of their national jurisdiction before the public distribution from the DCDB. The application was tested by colleagues at the Danish and French Hydrographic Offices in late 2023 and has been undergoing the software deployment process for the last several months. The intent is that it will be fully operational very soon.

Over the next year, the DCDB will reach out to all coastal States who requested pre-approval of CSB data and provide them training and access to the CSB CSRA. The DCDB will seek and gather feedback and recommendations for future enhancements.

Crowdsourced Bathymetry Pipeline (Crowbar)

The DCDB receives most suggested enhancements for the CSB data pipeline (referred to as Crowbar), from the IHO Crowdsourced Bathymetry Working Group (CSBWG). Much of the current suggestions involve improving the discovery and access of CSB data through programmatic methods with our point cloud API.

The following requests will be reviewed and prioritized in Summer 2024, with work taking place throughout the remainder of the year:

- Increase searchability of cloud copies of CSB files, including filtering by date, provider, and geographic region. Add common queries to public documentation.
- Improve translation of files between ArcGIS MapService API and S3 bucket.
- Ensure full metadata is accessible alongside CSV in cloud buckets.
- Review options to improve efficiency of CSV files in cloud buckets.
- Ensure pipeline is compatible with GeoJSON schema updates.
- Add ability to create a custom URL for map viewers, allowing users to specify all files from a particular provider or platform within the URL.

AutoGrid

The current version of AutoGrid (ncei.noaa.gov/maps/autogrid/) is a web application which accepts the user's area of interest, cell size, and grid format and then asynchronously produces a custom data grid from the multibeam archive.

For the last two years, we have tasked a part-time developer to build AutoGrid 2.0. The updated application will run in the cloud (AWS) and integrate both multibeam and CSB. While progress has been made on this work, we are held up by the required re-ingestion of multibeam data through MABLE (explained above).

GEBCO Gazetteer

The DCDB developed and hosts, on behalf of the IHO, the GEBCO Gazetteer, a web tool that allows the public to search for, view, and download information (eg: geographic location, feature dimensions, the discoverer, and the origin of the name) on more than 3800 undersea features. Gazetteer v4.3.7 is live at *ngdc.noaa.gov/gazetteer*. The GEBCO Subcommittee on Undersea Feature Names (SCUFN) is the primary stakeholder for the Gazetteer.

The DCDB software development team continues to make enhancements to Gazetteer 5 based on feedback from SCUFN members and internal testing. Since SCUFN 36 (November 2023), 17 enhancements and fixes have been made. This work included (1) resolving reported issues or enhancement requests, (2) providing maintenance releases and (3) continuing development on Gazetteer v5.0.4 which will provide interoperability with the Beta-Gazetteer developed by the Korean Hydrographic and Oceanographic Agency.

Continued improvements and enhancements of the Gazetteer will remain incremental and will focus next year on:

- Maintenance and upgrades (when necessary)
- Implementation of SCUFN-requested enhancements
- Continued progress on the development of the GEBCO Gazetteer and KHOA OWS interoperation

3. Progress on IRCC Action Items

No actions from IRCC15.

4. Problems Encountered

The DCDB has recently lost two (out of three) data managers. This will obviously impact almost every item listed above, along with our ability to work with the community on documenting, contributing, searching for and accessing data in a timely manner. Our intent is to advertise for these two positions this summer.

5. Any Other Items of Note

While the DCDB has been provided the opportunity to virtually present regional breakdowns of data holdings at several RHC meetings in 2023-2024, ideally this would become a standard agenda item for all RHCs moving forward. The DCDB also continues to be willing to provide these data breakdowns for RHC SPI reporting if requested.

6. Conclusions and Recommended Actions

It is highlighted that the DCDB is an IHO Member States' resource that requires additional data to increase the coverage and move towards a comprehensive global bathymetric dataset. Therefore IHO Member States and stakeholders are invited to contribute and encourage the provision of bathymetric data regardless of its origin or reason for gathering.

7. Justification and Impacts

It should be noted that any data contributed to the DCDB will be reviewed for inclusion into the GEBCO grid.

8. Actions Required of IRCC

The IRCC is invited to:

A. Note the contents of this report;

B. Encourage Member State and community bathymetric data contributions to the DCDB, regardless of origin, resolution or quality;

C. Encourage RHC Chairs to collaborate with the DCDB on developing and highlighting annual regional breakdowns of data holdings as part of SPI reporting.

D. Take any other action it considers appropriate.