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Tentative Plan to establish a Database Management System for Small Undersea Feature Names

(Draft by Lin Shaohua)

1. Objective

Collecting and processing all of the small undersea feature naming proposal data held by GEBCO，and establishing of Database Management System and Information System, to achieve releasing and managing of the data and information, to realize the data and information share in whole world.
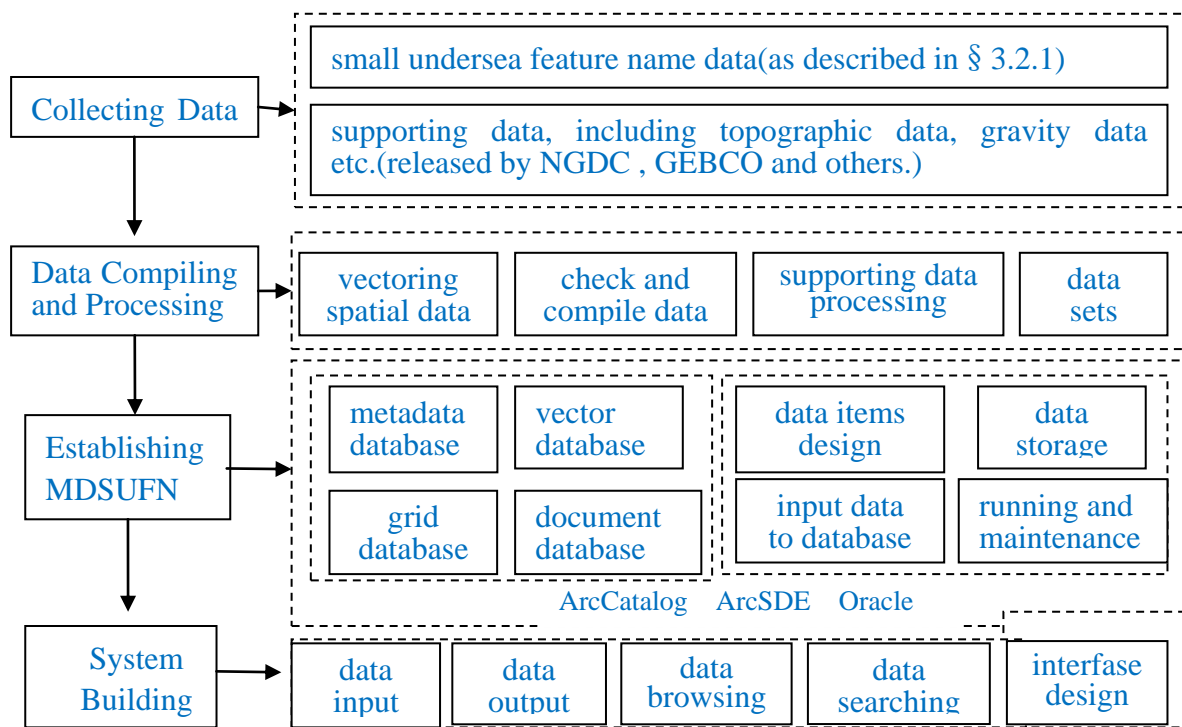
2. Tasks

To collect, compile and process all of small undersea feature naming proposal data and related supporting data held by GEBCO, to create vectoring spatial data layers and related supporting data sets; to establish the Management Database of the Small Undersea Feature Names（MDSUFN），and input the compiled and processed data into the database; to build the information management & service system, and to supply the system connection with the WEB Releasing System of GEBCO, and to realize data releasing and information share in network.

3. How to Establish MDSUFN

3.1 System Architecture of MDSUFN

Fig.1 is the architecture of database management system of the small undersea feature name.

| Collecting Data | small undersea feature name data(as described in § 3.2.1) |
| | supporting data, including topographic data, gravity data etc.(released by NGDC , GEBCO and others.) |

Data Compiling and Processing → vectoring spatial data | check and compile data | supporting data processing | data sets

Establishing MDSUFN → metadata database | vector database | data items design | data storage | grid database | document database | input data to database | running and maintenance — ArcCatalog ArcSDE Oracle

System Building → data input | data output | data browsing | data searching | interfase design

3.2 Collect, Compile and Process of the Data

3.2.1 Data Collecting

Collecting all of the small undersea feature naming proposal data from GEBCO and other related authorities; and collecting related supporting background data (such as topographic data , marine gravity data obtained by survey vessels, map and charts ,etc.) by internet or from documents. The content of the data collecting see table 1.

table1.content of the data collecting

Data type	Content of data
small undersea feature naming data	undersea feature naming database, related information （including all of information in the undersea feature name proposal）.
supporting data	background data reflecting topographic characteristics of the small undersea feature, including multi-beam bathymetric data, marine geophysical data and regional charts with difference scales.

3.2.2 Data Compiling and Processing

After identifying the small undersea feature, to compile and process feature naming data that best defines the feature as well as related supporting data, including:

1. Vectoring spatial data

Processing collected spatial information of the small undersea feature naming proposal data, base on the spatial coordinates information, classifying them to point, line and polygon layers, processing and creating vectoring data in Shape file.

2. Checking and compiling of spatial data and attribute information

Base on collected the small undersea feature naming proposal data, to check and ratify spatial data and attribute information, including spatial position of the feature, submarine topographic information, feature description, reason for choice of name and so on.

Compiling attribute data in Shape file, including small undersea feature name, coordinates, feature description, reason for choice of name, discovery facts, supporting survey data and proposer etc.

3. Processing the supporting data

In order to reflect topographic characteristics of the feature very well, to process the collected background data, including marine topographic data (bathymetric data), gravity data obtained by survey vessels and regional charts, data processing including:

Checking and ratify integrity of the marine topographic data, standard format translation, filtering process, data extraction dilute, quality control, and eliminating the abnormal points.

Processing the gravity data obtained by survey vessels, including checking of integrity, standard format translation, the cross points alignment, test for gravity spatial anomaly correction and Bouguer anomaly correction.

Processing of the collected present and historical nautical charts, including image choose, image digitization, image correction, image mosaic format conversion, coordinate projection conversion and the datum conversion.

3.2.3 Setting Data Sets

Base on data compiling and processing result above mentioned, to create standard data sets and metadata sets in different category, and to create a unified metadata cataloging and spatial data index. Data sets products are as follows.

➢ Bathymetric (topographic) data sets and multi-resolution grid DEM (the space of grid depending on the data accuracy)

➢ Gravity data sets by survey line and Bouguer anomaly model.

➢ Digital chart data in different scales.

3.3 Building of MDSUFN

3.3.1 Content of Database Building

The building of the database contains mainly following content:

Base on data compiling and processing result, to make quality control on the data before input them into database, then to build the Management Database of the Small Undersea Feature Name. The Content of the database, as a comprehensive information database, consists of the small undersea feature information, supporting data sets, such as bathymetric (topographic) data sets, gravity data sets and digital chart data sets. According to type of the data, the database may be divided into metadata database, grid database, vector database and document database.

1. Metadata database

All of metadata information will be stored in this database. The relationships between vector databases and vector data, image databases and image data, document database and other databases will be set up.

2. Vector database

All of vector data will be stored in this database, including undersea feature naming information, bathymetric vector data, gravity data obtained by survey vessels. All of vector data are stored in spatial database（ArcSDE）。The related metadata information will be stored in metadata database.

3. Grid database

All of grid image data, including topographic DEM file and grid chart data file, will be stored in this database. The generated FootPrint file will be stored in the spatial database（ArcSDE）. The related metadata information will be stored in metadata database.

4. Data file database

The DEM entity data and chart entity data will be stored in this database. The related metadata information will be stored in metadata database.

3.3.2 Database items design

The data items may be divided into following three categories.

1. Geometric -type data items

Geometric data items will be used to display and to express the spatial position of the small undersea feature. The geometric data items may contains vector image data (points, lines, polygons) and grid image data. As shown in table 2, the items should be used to express naming information, spatial position and characteristics of the undersea features.

table 2 the content of geometric type data items

geometric type	covering naming information
vector image data in points	seamount, hill, water depth points and others.
vector image data in lines	sea ridges, submarine valley, bathymetric survey tracklines and so on.
vector image data in polygons	fracture zones, characteristics provinces, marine gravity data obtained by ship and so on.
grid image data	topographic grid data, map and charts data.

2. Attribute data items

Attribute data items should be used to store some description information of the object. They may include following items:

I) The data items from the undersea feature naming proposal: fields of records should be designed based on "the undersea feature name proposal form", including generic terms and specific terms，feature coordinate, feature description(maximum depth ,minimum depth, steepness, shape, dimension and total relief), reason for choice of name, No. of chart / map, supporting survey information and scale of chart.

II) The multimedia data and information: bathymetric map showing depth contours, track line map, 3D topographic map and others in " Naming Proposal" . Images data will be stored in binary numeration system.

III) Time status information: to express the time attribute information of the small undersea feature, such as name evolution ,former name, standard name, name approved by SCUFN, and time status related to geometric type items , which can best define the location of a feature, and other geographic element variations.

IV) Other data: The metadata of the supporting data and other related textbox information.

3. Relational data item

Taking a feature identifier"Feature ID"as a key field of a relational data. In order to ensure uniquely identification, Feature ID consists of 16-digit number, that is "data loading time(12digits-yyyymmddhhmm)＋Sequence number(4digits) , for instance 2012031622150001. Feature ID will be generated automatically by data loading system.

3.3.3 Data storage design

Taking unified modeling language（UML）to describe data storage Structure, choosing

Visio as the modeling tool in the data storage design.

Taking ESRI Geodatabase (ArcCatalog）as the spatial data model. In the unified spatial data model, it will be used to manage vectoring data and grid data. We choose FeatureClass and FeatureDataset of Geodatabase to manage vectoring data, and Using Mosaic Datset of Geodatabase to manage grid data. FOOTPRINT service will be generated in ArcSDE. For a large amount of data, the data will be stored in document cataloging. For a small amount of data with changes of low frequency and access of high frequency will be stored in form of ArcSDE. Using Oracle to store and manage the mass data, also including metadata and other related data.

3.3.4 Creation of database

Creation of database includes: generating table space, defining table structure, defining views, loading data into the database, building data index. The data loading into the database will be done by inserting file. Geometric data and attribute data, by relational data item, will be loaded into database simultaneously. The data of database will be managed through relational database and spatial data engine. The data index will be set up according to undersea feature name category code, reference chart/map number and undersea feature name serial number.

3.3.5 Database running and maintenance

After creation of database, the database will get into running and routine maintenance base on the scheme of database maintenance set up by us. The running and routine maintenance includes routine maintenance and monitoring, backup and restore, urgent processing and supervision. In this way, we may be able to protect data safety and portability. When there are new operations, such as to input a mess of data to the database, the following operation strategies should be considerable:

1) to run disk defragmenter regularly, in order to ensure efficient access of the memory;

2) best to make a plan before import a group of grid data into database, for example, if inputting data from upper left to lower right, the amount of Pyramid calculation will be reduced distinctly;

3) for processing of a group of data, to do pyramid calculation and statistics only when the last picture data imported, therefore we may avoid some unnecessary calculation, and improve grid data input speed;

4) before inputting a large amount of data into database, to make sure whether or not the

table space is good enough to store these data; if not, we should enlarge table space by manual work, because the enlarging table space dynamically will take much more time and lower data input speed seriously;

5) to eliminate or clear timely the redundant data and the rubbish data generated by dad operation of data inputting;

6) in order to reduce the burden of the database, to do backup processing to some data beyond a certain limitation and no longer commonly used, changing them into offline data;

7) according to the operating instructions, to make backups of both data and system regularly, against the occurrence of accident system and causing the loss of data and information;

8) when the system contingencies occur, to do data recovery operation according to the scheme of data recovery set in advance, such as the backup beforehand.

3.4 Construction of data management and service system

3.4.1 Overall construction of the system

It is necessary to build data management and service system as a supporting system to implement application service of the database. The system self consists of four layers of software system, that is, data acquisition and processing system, data supporting system, fundamental function and application software system. In addition, there are two supporting systems, that is the network support environment and the relevant standard specification system. See Fig.2.
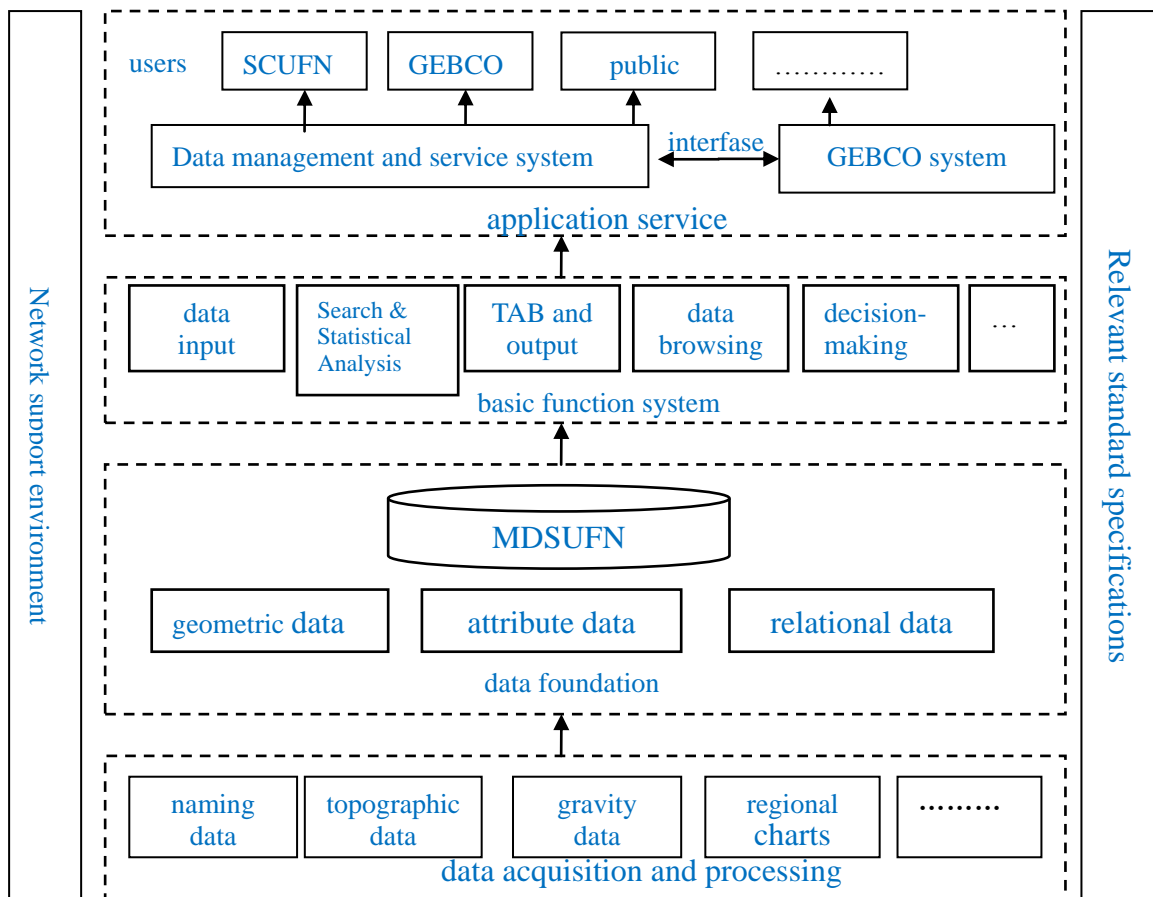
Fig.2 Overall construction of Data management and service system

Considering difference application service, the system will adopt the mixed pattern of B/S and B/S. C/S mode is placed an emphasis on data management, naming data input, information sharing services, data analysis and decision-making. B/S mode is deployed on the Internet. Its major function is implementation of interfase interconnection between MDSUFN system and GEBCO existing system, supplying information releasing service and dynamic information tracing service.

3.4.2 System Function Module Design

The system function module is divided into two parts. One is basic information service function and another is application service function.

1、Basic information service function: to supply commonly used basic GIS functions, including data loading, data searching, data statistical analysis, 3D visualization, TAB output and others. The function module is mainly used for data management system, and the operation mode is on individual computer. Fig.3 is the interface of system.
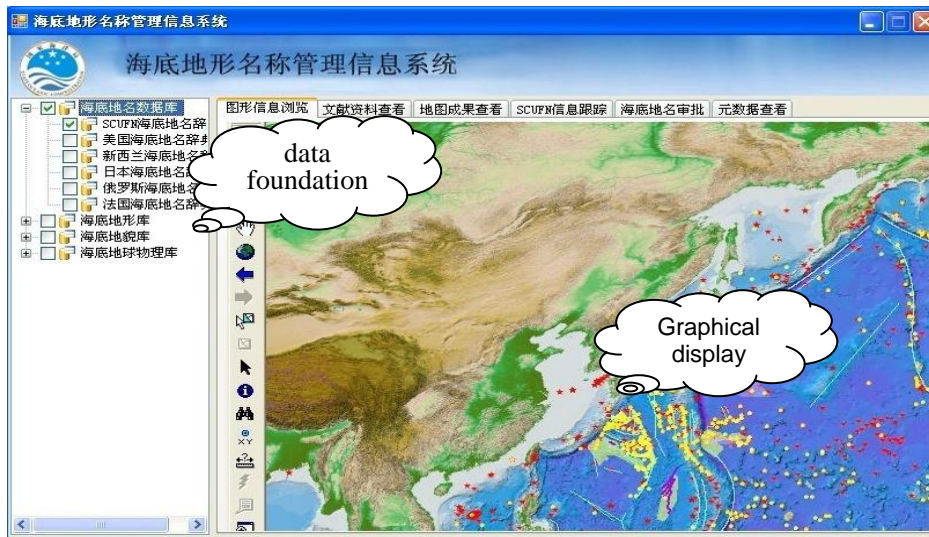
Fig.3 the operation interface of MDSUFN on individual computer

2、Application service function: to implement information sharing services, spatial decision-making of the small undersea feature naming and others. This function module is mainly used for data service system, and the operation mode is on WEB. Fig.4 is the interface of the system.
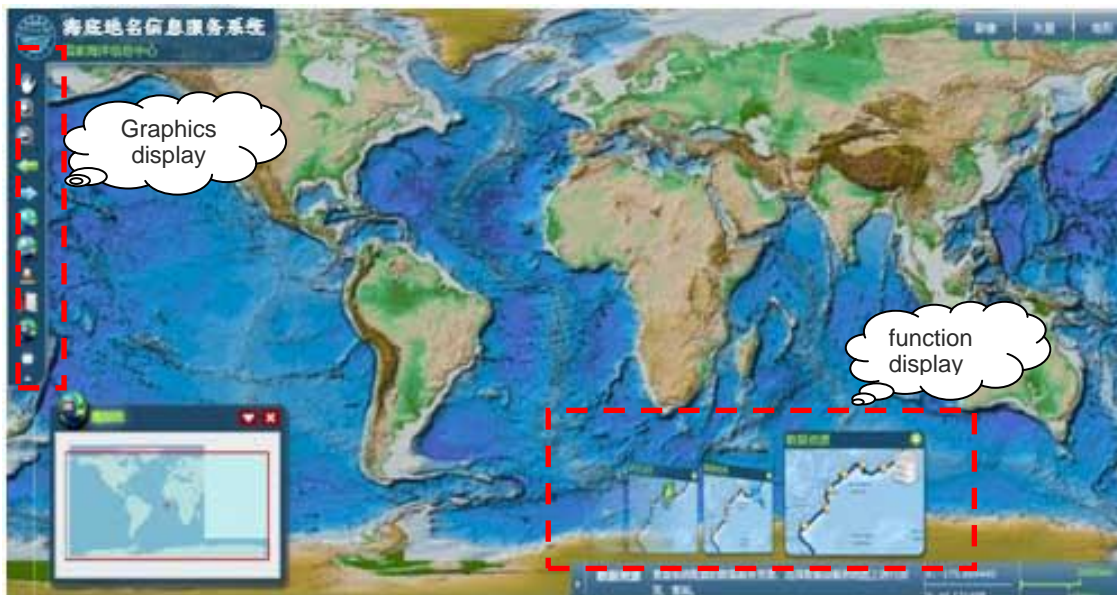

Fig.4 the operation interface of MDSUFN on WEB

3.4.3 System interfase design

The system interfase design is to implement data transmission and access each other between MDSUFN system and GEBCO existing naming system.

Achievement of the metadata transmission between the two systems is by mean of XML exchange file format. We will take ArcGIS Server as the platform of spatial data releasing, and to achieve sharing service of the data. External users can query, browse the data using WEB browser. The users may call GEBCO existing service websit to query, browse and download data.