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Title	MEDIN data guideline for Bathymetry data
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Summary	This guideline is a data archive standard for bathymetry data. Used correctly the guideline facilitates easy use and reuse of the data. A template to record metadata is also provided if required.
Keywords	Hydrography, Geology, Bathymetry and Elevation, Seabed, Depth, Morphology, Sediment, Backscatter, Water Column

Change history		
Version	**Date**	**Change**
1.0	22/12/2011	First draft of document
1.1	23/01/2012	QC release
1.2	31/01/2012	INSPIRE assessment completed
1.3	06/02/2012	Adjusted following feedback from M. Charlesworth
1.4	07/02/2012	Changes incorporated following QC process; Draft for MEDIN review release
1.5	29/03/2012	Changes incorporated following review process; final release
1.6	24/6/13	Draft changes to structure and tables following discussion

		at workshop on 11th June 2013.
2.0	3/12/13	Changes to structure and obligations following discussion with UKHO and BGS

1 Introduction

1.1 What are MEDIN compliant data?

There are 3 requirements to ensure that your swath bathymetry data are MEDIN compliant:

1) **You supply General Metadata about your data –** *See Appendix A*
2) **You supply Detailed Metadata about your data –** *This may be included in a survey/cruise report or as additional metadata – See Appendix B*
3) **Your data are in a format that MEDIN accepts –** *See Appendix C*

Example of a MEDIN compliant bathymetry dataset:

A file containing General Metadata (Appendix A)

A Survey Report that contains Detailed Metadata (Appendix B)

Data from CARIS HIPS software submitted in a well organized folder structure (Appendix C)

1.2 Scope

This guideline is a data archive standard for bathymetry data. It covers seabed depth data and seabed characterisation data (backscatter) acquired using swath bathymetry techniques such as multibeam echo sounder (MBES), singlebeam echo sounder (SBES) and airborne acquisition such as LiDAR. It is also relevant for bathymetry data processed from seismic CUBE derived from 3D and 4D seismic data acquisition. It covers raw data, methods used and derived processed data. The guideline builds upon previous data management specification work undertaken by the British Geological Survey (BGS) in the Marine Survey Data Management Handbook (June 2009), the Maritime and Coastguard Agency (MCA) and UK Hydrographic Office (UKHO) in defining survey specifications for the Civil Hydrography Programme. The International Association of Oil and Gas Producers (OGP) Seabed Survey Data Model (SSDM) (see http://www.epsg.org/SSDM/ssdm.html) is also referred to with respect to provision of processed data.

1.3 Archiving Data

The UK Hydrographic Office (UKHO) is the MEDIN Data Archive Centre (DAC) responsible for archiving bathymetry data around the British Isles. In addition, the British Geological Survey (BGS), the MEDIN DAC responsible for geology and geophysics, manage MBES backscatter information in consultation with UKHO, as MBES backscatter and bathymetry data are interrelated. Contact details for both organisations are provided below.

Contact Details:

UK Hydrographic Office

Email: bathy.dac@ukho.gov.uk

Telephone: +44 (0)1823 337900

British Geological Survey

Email: offshoredata@bgs.ac.uk

Telephone: +44(0)131 6500275

1.4 Summary of the information required

A General Metadata:

This section lists the general metadata that should be provided with your data.

You can use the form here to record your General Metadata and can find additional information in Appendix A

The General Metadata fields are common throughout all MEDIN data guidelines and only need to be given once and referenced if your data set is composed of many data types and therefore conforms to a number of MEDIN Data Guidelines. If your collection of data forms part of a wider project or time series then the **Project Information** must be recorded but if the work is a small survey then project details may not be required.

What is a Survey/Project?

A **survey** is a uniquely identifiable programme of data collection such as a research cruise, moored instrument deployment or survey event. This information is likely to be the same for all sample events (e.g. stations) and subsamples in a given data set such as a cruise. Note that in the event that these are not common to all sample events then they should be specified for each one.

A **project** is a collection of surveys that have been completed for a common purpose. For example: an environmental impact assessment composed of a number of separate surveys; scientific research composed of a number of different research cruises; a legislative monitoring programme which is conducted each year over several years. A project is usually funded by the same organization(s) for its lifetime.

Survey Information:
This information is mandatory and **must** be supplied with your data to ensure it can be reused:

1. surveyName
2. surveyType
3. surveyAbstract
4. surveyCode
5. originator
6. owner
7. surveyStartDate
8. surveyEndDate
9. timeZone
10. spatialCRS
11. positionFix
12. depthCRS

Additional items:
Please provide as much of the following information as possible to help others assess your data:

Survey Information:

1. originalCRS
2. transformation
3. horizontalAccuracy
4. verticalAccuracy
5. platformType
6. platformName
7. cruiseReportReference
8. confidentiality

Project Information:
Please provide as much of the following information as possible if your survey forms part of a wider project:

1. projectName
2. projectCode
3. projectStartDate
4. projectEndDate
5. projectWebsite

B Detailed Metadata:

This section lists the detailed metadata that should be collected with your data. You can use the form here to record your Detailed Metadata and can find additional information in Appendix B. This information can be supplied in a cruise or survey report.

The Detailed Metadata fields are specific to each data guideline and should be completed for each type of data. The information requested here may be supplied as additional metadata or may be supplied in a cruise or survey report.

Acquisition Method:

This information **should** be supplied with your data to ensure it complies with MEDIN standards and can be reused by others in the future. UKHO may still be able to use data without this information but it would not be considered MEDIN compliant:

1. methodID
2. systemDetails
3. processingOrganisation
4. acquisitionSoftware
5. acquisitionSoftwareVersion
6. processingSoftware
7. processingSoftwareVersion
8. systemFrequencyType
9. minMaxDepth
10. calibrationDate
11. acquiredData
12. processedData
13. coverage
14. interpolation
15. gridSize
16. storageFormat
17. proceduresUsed
18. qualityControlScheme

Additional Items:

Please provide as much of the following information as possible to help others assess your data:

1. systemMountingPoint
2. frequenciesUsed
3. calibrationDetails
4. storageMedium
5. surveyNotes
6. processingNotes
7. processingQCNotes
8. profiledOceanDataID
9. tideID
10. ancillaryID

C Data:

This section gives a summary of the required data content and format for multibeam echo sounder (MBES) and singlebeam echo sounder (SBES) data. It covers

Processed, full density, ungridded data

and

Processed, gridded/thinned data.

You can find additional information in Appendix C.

C.1 Format

The preferred format for MBES swath bathymetry data to be submitted to the Data Archive Centre is using CARIS HIPS or Fledermaus software or as ascii XYZ/XYA files. For SBES data the preferred format is as ascii XYZ/A files, CARIS HIPS or Generic Sensor Format (GSF). Survey acquisition software that routinely log the information listed below comply with MEDIN data guidelines. See Appendix C for further details.

C.2 Guidance

What is processed full density, ungridded data?

These are data that have been reduced to a vertical datum (e.g. chart datum, or mean sea level) and had any spurious depths removed (e.g. spikes, outliers). The dataset contains all the good data points from the survey and has not been thinned or gridded in any way.

What is processed gridded/thinned data?

These are data that have been reduced to a vertical datum (e.g. chart datum, or mean sea level) and had any spurious depths removed (e.g. spikes, outliers). The dataset has been thinned using a grid of a defined resolution and retains only 1 data point per grid cell. Depending on the gridding method used, the retained data point could be located at its true position or represented at the centre of the grid cell.

Processed, full density, ungridded data:

This information is mandatory and **must** be supplied as part of processed, full density ungridded data (survey acquisition software that routinely log this information comply with MEDIN standards):

1. dateAndTime
2. fixPing
3. xCoordinate
4. yCoordinate

5. depth[1]
6. meanAmplitude[1]

Additional Information:

Please supply as much of the following information as possible to help others assess your data (your survey acquisition software may already log this information):

1. rawDepth
2. tidalReduction
3. relativeAmplitude
4. KPDistanceAlong
5. pingMode
6. waveForm
7. roughness (E1)[2]
8. hardness (E2)[2]
9. Q1[2]
10. Q2[2]
11. Q3[2]
12. positionUncertainty
13. depthUncertainty (estimated depth error)
14. TPU (Total propagated uncertainty on position)
15. geometry

Processed, gridded/thinned data:

This information is mandatory and **must** be supplied as part of processed, gridded data (commonly used software routinely log this information):

1. xCoordinate
2. yCoordinate
3. depth[1]
4. amplitude[1]

Additional Information:

Please supply as much of the following information as possible to help others assess your data (your software may already log this information):

1. roughness (E1)[2]
2. hardness (E2)[2]
3. Q1[2]
4. Q2[2]
5. Q3[2]
6. gridSize[3]
7. gridUnits[3]
8. geometry

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[1] Interchangeable depending on whether XYZ or XYA is supplied

[2] SBES data only

[3] MBES data only

2 Guidance

2.1 Background to Data Guidelines

The Marine Environmental Data and Information Network (MEDIN) is working towards creating a framework of consistent standards covering the major types of data collection undertaken in the marine environment around the UK. The principle benefits of this suite of standards are:

- Allows contracting organisation to easily specify a format that data should be returned in that can be readily used and includes all relevant attributes
- Provides a consistent format for contractors to work to (rather than a different format for each contract)
- Data can be readily exported to Data Archiving Centres and other users
- Instils good practice amongst users

Each standard defines the data and information that must be stored with a particular data type to ensure it can be readily used and reused. As this type of information is specific for different data types, guidelines are developed for each type. This document describes one such format. Other standards can be accessed through www.oceannet.org.

2.2 Using this Data Guideline

The data guideline is split into sections that refer to information that should be collated at different levels as shown below:

A General Metadata
B Detailed Metadata
C Data

A General Metadata

The General Metadata tables are common to all Data Guidelines and so only need to be completed once for a survey even if a number of different techniques and data guidelines are used.

Survey - a uniquely identifiable programme of data collection such as a research cruise, moored instrument deployment or survey event

Project - a collection of surveys that have been completed for a common purpose

B Detailed Metadata

The detailed metadata are specific to a technique of data collection (e.g. trawl, grab etc) and are subsequently specific to each Data Guideline.

Acquisition Method (Data Production Tools) – Details of any method or instruments used to collect the data

C Data

The tables in the Appendices outline the data fields, a description and, where available, a controlled vocabulary and/or format which should be used to store the data. Each field is either mandatory, conditional or optional as indicated by M, C, or O respectively. Conditional means that the field must be completed if a value is known.

In the event that historical data which does not have all the necessary mandatory fields is being configured into this guideline, then it is permissible to use the following entry terms:

Term	Description
unknown	The correct value is not known to and not computable by the creator of this information. However a correct value probably exists.
inapplicable	There is no appropriate value. To be used in cases where metadata elements cannot be set null due to schema constraints.

In some cases it may be necessary to extend this guideline for a specific purpose such as a specific exchange of data between applications or to fulfil the needs of a specific project. This is permissible, however we advise that the broad structure and format is maintained and that where possible controlled vocabularies are used. As any extension to the structure and format may be useful for other organisations please inform MEDIN of further agreements.

2.3 Controlled Vocabularies

MEDIN makes use of controlled vocabularies (sometimes called "Term Lists") to ensure that information provided alongside data is unambiguous. The available catalogues of controlled vocabularies used for this MEDIN data guideline are provided primarily by SeaDataNet, the International Council for the Sea (ICES) and EPSG. If a term is not available in a recommended list then please contact MEDIN to arrange for the term to be added.

The SeaDataNet list may be viewed at http://seadatanet.maris2.nl/v_bodc_vocab_v2/welcome.asp. By clicking on the list any term may be searched for by using the drop-down menus or all terms viewed by clicking search. The terms may be viewed in groups of 15 or may be downloaded into an excel file.

The ICES term lists are available at http://vocab.ices.dk/
Use the search box to find term lists, you can also select the theme you require to filter your search. The results are shown for the selected list and may be downloaded into MS Excel by selecting the Excel symbol at the top right of the list.

The EPSG database of coordinate reference systems (http://www.epsg-registry.org/) provides a dictionary of reference systems with a code for each entry. In brief, to find a code, enter the title (e.g. WGS84) into the 'Name' field and click search. The name, code and further information is displayed. If you are looking for a specific type of reference system such as 'vertical' then click in the 'Type' box, hover over coordinate reference system and click on vertical and then click the search button and all recorded vertical reference systems are shown. If you want to search for a reference system in a particular part of the world (e.g. Northern Ireland Grid) the you may do so by submitting a term to the 'Area' box or fill out the lat and longs then click search. The website also provides a database of the reference systems and web services to access the information.

2.4 Relationship between MEDIN data guidelines and MEDIN discovery metadata

The MEDIN discovery metadata format is aimed at allowing the non-informed user to discover data sets and it is likely that one 'discovery' data set record will contain a large range of data types that are in turn covered by a range of data guidelines. To enable individuals to reuse data of a specific nature (e.g. benthic invertebrate data) then related information must be collected (e.g. data owner, reference systems used etc). Some of the information which is collected in the General Metadata in a data guideline is also required to create a discovery metadata record. Who creates the MEDIN discovery record for a dataset is case specific and dependant on the organisation, and the relationship it has with a Data Archive Centre. However it is intended that the information collected at the 'Survey Information' level is reused for creating a MEDIN discovery metadata record. Further details are available on the MEDIN website which demonstrate clearly which fields in the MEDIN Data Guidelines can be reused for which elements in the MEDIN Discovery Metadata Standard.

2.5 Updates and Feedback

If you have any comments or feedback on these guidelines please contact enquiries@oceannet.org . Standards develop over time and it is likely that this standard will change in the future. We advise that you return to the MEDIN website to identify new versions and that you sign up to the MEDIN Standards e-mail listing (e-mail enquiries@oceannet.org) and Marine Data News to be kept informed of developments.

Appendix A

General Metadata:

This section describes the general metadata that should be provided with your data.

You can use the form here to record your General Metadata

The General Metadata fields are common throughout all MEDIN data guidelines and only need to be given once and referenced if your data set is composed of many data types and therefore conforms to a number of MEDIN Data Guidelines. If your collection of data forms part of a wider project or time series then the **Project Information** must be recorded but if the work is a small survey then project details may not be required.

A.1 Guidance:

Detailed descriptions and examples are given below to help you create General Metadata to accompany your data.

This information **must** be supplied with your data to ensure it can be reused:

Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
surveyName	M	Title of the survey	Free text;	2004 CCW Menai Strait benthic monitoring survey
surveyType	M	Category of survey for use in subsequent searching for certain types of surveys.	Controlled Vocabulary; OGP SSDM WORK_CATEGORY Domain;	Geophysical and Hi-Res Seismic (Analogue and Digital Survey) **Or** Free text; Oceanographic; benthic biology; fish stock

	surveyAbstract	M	Brief description of the purpose of the survey and other types of measurements that were made for the survey.	Free text;	Survey was the first in a series of 3 in 2010 whose specific aim was to identify sites suitable for further monitoring. Geophysical techniques were used in combination with grabs and cores to assess seabed type.
	surveyCode	M	A unique code for the survey to allow links to be built between this and sample event data, (the cruise identifier code could be used). To ensure uniqueness, it is recommended that the website of the organization responsible for the work is used followed by a unique code designated by the responsible organization.	Free text;	http://www.noc.ac.uk/JCR3022; http://www.bennett.ac.uk/RIBJULY_03_01
	originator	M	The organization who has created the data set. If the organization is not in EDMO please contact enquiries@oceannet.org to add it. If a person who is not associated with any organization generated the data then please provide the name in the sample event table.	Controlled vocabulary: **European Directory of Marine Organizations** at http://seadatanet.maris2.nl/v_edmo/welcome.asp;	28: Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory 2588: ABP Marine Environmental Services Ltd
	owner	M	Organization that owns the data set. If the organization is not in EDMO please contact enquiries@oceannet.org to add it.	Controlled vocabulary: **European Directory of Marine Organizations** at http://seadatanet.maris2.nl/edmo/;	78: Department of Environment Fisheries and Rural Affairs 53: BP Exploration and Production

	surveyStartDate	M	The date and time that the survey started.	Date or DateTime; yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2009-01-24 12:33:00
	surveyEndDate	M	The date and time that the survey ended. May be left null if the survey is ongoing.	Date or DateTime; yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2009-02-16 16:33:00
	timeZone	M	Give the time zone in which the date and time of the data acquisition is made (preferably Coordinated Universal Time (UTC))	Free text;	UTC
	spatialCRS	M	Spatial coordinate reference system. Describes the system of spatial referencing. i.e. the datum used to supply the decimal latitudes and longitudes. There are additional fields to indicate the datum of the original data if the coordinates have been transformed.	Controlled vocabulary: **EPSG Geodetic Parameter Dataset** at http://www.epsg-registry.org/	**WGS84** code: EPSG::7030; **British National Grid** (projected) code: EPSG::27700; **ETRS89 / UTM zone 28N** code: EPSG::25828; **ETRS89 / UTM zone 29N** code: EPSG::25829; **ED50** code: EPSG::4230; **UTM31N** code: EPSG::23031
	positionFix	M	Position fix method and source. Give the method and source of the position fix instrument.	Free text;	Differential GPS taken from the ships navigation equipment. 4 point satellite fix achieved

	depthCRS	M	Depth coordinate reference system. Give the reference to which the depth has been calculated e.g. Ordnance Datum Newlyn; Highest Astronomical Tide. Mandatory if seabed depths are given for each sample. See controlled vocabulary lists.	Controlled vocabulary: **EPSG Geodetic Parameter Dataset** at http://www.epsg-registry.org/	**Ordnance Datum Newlyn** code: EPSG::5701 **Malin Head height** code: EPSG::5731

Additional Items:
Please provide as much of the following information as possible to help others assess you data:

Survey Information:

	Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
	originalCRS	C	Datum of original coordinate if different from the one used to supply data.	Controlled vocabulary: EPSG Geodetic Parameter Dataset at http://www.epsg-registry.org/ or other defined coordinate reference system register;	
	transformation	C	Transformation used to create decimal degrees if transformation undertaken.	Free text;	Data was converted from OSGB to WGS84 in ArcGIS using the petroleum transformation.
	horizontal Accuracy	C	Horizontal positional accuracy. How accurate the spatial positions are likely to be.	Decimal; units = metres	15.2
	verticalAccuracy	C	Vertical positional accuracy. How accurate the vertical resolution is. Must be provided if seabed depths are given.	Decimal; units = metres	0.5

	platformType	O	The platform type (e.g. Research Vessel) from which the sampling device was deployed.	Controlled vocabulary: SeadataNet Platform Classes, **Table L06** at http://seadatanet.maris2.nl/v_bodc_vocab_v2/welcome.asp;	31: Research Vessel; 13: beach/intertidal zone structure; 48: mooring; 71: human
	platformName	C	Mandatory if a vessel was used for the survey. The name of the platform from which the sampling device was deployed. If your platform is not on the list please contact accessions@ices.dk	Controlled vocabulary: ICES Reference Codes, **Table SHIPC** at http://vocab.ices.dk/	74LG: Lough Foyle AA30: Unspecified Ship 74E9: Cefas Endeavour AA36: Unspecified Fishing Vessel AA33: Unspecified Self-Propelled Small Boat
	cruiseReport Reference	O	Cruise report or boat log reference if applicable.	Free text; in reference format.	Litt, E.J. 2009. PHiXT 4. 30 July to 2 August 2009 RV Prince Madog POL Coastal Observatory Liverpool Bay Cruise Report. POL Coastal Observatory, Liverpool.
	confidentiality	O	Note if the survey is confidential	Free text;	Restricted access; Public;

Project Information:
Please provide as much of the following information as possible if your survey forms part of a wider project

	Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
	projectName	M	The nationally/internationally accepted version of the project name.	Free text; Programme 1989-2010 ;	North Hoyle Windfarm EIA; Rapid Climate Change; Dogger Bank pSAC Monitoring Programme; EA Bathing Water Monitoring
	projectCode	M	Provide a code to uniquely identify the project and allow links to be made between the tables. To ensure uniqueness, it is recommended that the website of the data owner is used, followed by a unique code which should reflect the code used by the funding organization where possible. e.g. contract code.	Free text;	http://www.dassh.ac.uk/; http://www.bodc.ac.uk/
	projectStartDate	M	The date that the project started which is from when the funding was in place to start. Use the 1st of the month if the exact date is not known.	Date; yyyy-mm-dd;	2001-01-24; 1973-01-01
	projectEndDate	C	The date that the project finished or is due to finish. Use the 1st of the month if the exact date is not known.	Date; yyyy-mm-dd;	2007-01-24; 1976-01-01
	projectWebsite	C	If a project website exists give the address. This should be the web address of the environmental survey and not, in the case of environmental impact assessments, the engineering development.	URL;	http://www.southampton.ac.uk/oes/research/projects/rapid_meridional_overturning_circulation_moc.page

Appendix B

Detailed Metadata:

This section describes the detailed metadata that should be collected with your data. It contains specific information about the methods used, the organisations that carried out the work and any calibrations that have been applied to the data.

You can use the form here to record your Detailed Metadata or it may be supplied in a cruise or survey report.

The Detailed Metadata fields are specific to each data guideline and should be completed for each type of data. The information requested here may be supplied as additional metadata or may be supplied in a cruise or survey report.

B.1 Guidance:

Detailed descriptions and examples are given below to help you create Detailed Metadata to accompany your data.

Acquisition Method:

This information **should** be supplied with your data to ensure it complies with MEDIN standards and can be reused by others in the future. UKHO may still be able to use data without this information but it would not be considered MEDIN compliant:

Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
methodID	M	Provide an identifier for each method used to allow links to be made to the data.	Free text;	MBES4376, 02465, 02896
systemDetails	C	State the name and number of the MBES system used: manufacturer, model	Controlled vocabulary: SeaDataNet SeaVOX Device Catalogue **L22** at http://seadatanet.maris2.nl/v_bodc_vocab_v2/welcome.asp; or Free text if new system	Kongsberg Maritime EM 1002S

	processing Organisation	C	The organisation(s) that processed the data if different from the originator identified in general metadata	Controlled vocabulary: **European Directory of Marine Organizations** at http://seadatanet.maris2.nl/edmo/	2588 ABP Marine Environmental Services Ltd
	acquisitionSoftware	C	State data acquisition software used	Free text; separated by semi-colon if more than one software type used e.g. topside systems	Kongsberg SIS
	acquisitionSoftware Version	C	State data acquisition software version used	Free text; separated by semi-colon if more than one software type used e.g. topside systems	v 3.8.3
	processing Software	C	State processing software version used	Free text; separated by semi-colon if more than one software type used	CARIS HIPS/SIPS
	processing SoftwareVersion	C	State the system frequency setting capability	Free text; separated by semi-colon if more than one software type used;	. v4.0
	systemFrequency Type	C	State the system frequency setting capability	Free text;	Single
	min/MaxDepth	C	Minimum/ maximum depth range of system	Free text; units = metres	0.5-200
	calibrationDate	C	Date of last calibration	yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2009-01-24 13:33:00
	acquiredData	C	State data acquired	Free text; separated by semi-colon for distinct data types	Bathymetry; Beam Averaged Back Scatter; Time Series Backscatter; Water Column Data
	processedData	C	State data processed	Free text; separated by semi-colon for distinct data types	Processed Depths; Mean Backscatter

	coverage	C	Indication of coverage over area surveyed	Text; from list: Full – complete area coverage Corridor – Network of spaced lines with reasonable regularity Mixed – combination of full, corridor or sparse Sparse – random lines in area Not entered – value has not been assigned Not available – cannot find appropriate value	Corridor
	interpolation	C	State any interpolation techniques used	Recommended controlled vocabulary; From ISO TC 211 / ISO 19123 CV_Interpolation_ Method	cubic
	gridSize	C	State the grid size used (option for inclusion where not provided with data file)	Free text; units=metres	2
	storageFormat	C	Data format for logged data	Free text;	QINSy DB
	proceduresUsed	C	Any written methodology used should be referenced and linked. If the methodology is not referenced then provide a full description here.	Free text;	Methodology follows the IHO S-44 Standards for Hydrographic Surveys http://www.iho.int/iho_pubs/standard/S-44_5E.pdf
	qualityControl Scheme	C	Description of any quality control scheme that data were audited under during the processing	Free text;	Data audited using outcomes defined in scope of work

Additional Items:

Please provide as much information as possible:

	Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
	systemMounting Point	C	State the mounting of the system: Hull, Bow, Side, Pole/Rig, ROV, AUV, Towed	Free text;	Hull Mounted

	frequenciesUsed	O	State range of frequencies for the acquisition	Free text; units = kHz	100
	calibrationDetails	O	Give summary of calibration details	Free text;	Known target used for calibration
	storageMedium	O	The storage medium used for the data	Free text; separated by semi-colon if more than one media used;	1TB Portable Hard drive DVD Dell Precision R5500 4TB RAID 5 external hard drive
	surveyNotes	O	Any further notes on the acquisition that may be of relevance to data acquisition and processing.	Free text;	Due to rough weather the survey ceased for WOW at date/time, recommenced at date/time
	processingNotes	O	Any further notes on data processing that may be of relevance	Free text;	Algorithm applied to remove data artefacts, gridded values promoted using shoalest value for cell
	processingQC Notes	O	Any further notes on data processing quality that may be of relevance	Free text;	QC procedure applied using Integrated Management System procedures
	profiledOceanData ID	**C**	To provide link to CTD cast used for deriving sound velocity in water and correcting the data acquisition.	Free text; If more than one cast applicable use semi colon delimited list with KP ranges applicable.	CTD1234
	tideID	**C**	To provide link to tide file applicable for the acquired data. As an alternative can be linked to the tidal extent	Free text; If more than one tide file applicable use semi colon delimited list with KP ranges applicable.	TIDE02022011_0900 _1600
	ancillaryID	**C**	To provide link to Secchi disc and ancillary metocean measurements applicable at time of data acquisition.	Free text; If more than one file applicable use semi colon delimited list with KP ranges applicable.	SEC12072011_1234

Appendix C

Data

This section describes the required data content and format for multibeam echo sounder (MBES) and singlebeam echo sounder (SBES) data. Data should be reduced to a vertical datum (e.g. chart datum, or mean sea level), had any spurious depths removed (e.g. spikes, outliers) and quality controlled. This guideline covers both full density and gridded data.

The data content and format are specific to each data guideline and the relevant data guideline should be consulted for each type of data.

C.1 Well Organised Data

Where geophysical survey data are supplied to a Data Archive Centre (DAC), it is recommended that the data are incorporated within a standard documented folder structure as this reduces data archiving costs. For an example folder structure refer to the BGS Offshore Acquisition Folder Structure at http://www.bgs.ac.uk/downloads/start.cfm?id=2256.

An inventory of files and their respective sizes, and supply formats and media should be provided to the DAC. It is very important that a link can be made between the bathymetry data files and the bathymetry metadata information.

C.2 Data Format

Preferred Format

Swath bathymetry data are logged in a variety of industrial formats according to the survey acquisition software utilised by the survey organisation. However where bathymetric data are submitted to a DAC, the preferred formats for ingestion by the bathymetry DAC (UKHO) are:

Processed, Full Density Data	**Thinned/Gridded Data**
CARIS HIPS HDCS Directory	ASCII XYZ
Fledermaus PFM	ASCII XYA
	CARIS .csar file
	.bag file

Other Formats

Where it is required that raw backscatter and/or water column values are included within the data set, native industry proprietary formats should be used for data exchange. This also provides additional flexibility in that backscatter data may be reanalysed at a later date. Other commonly used industry data formats may be accepted by the bathymetry DAC (UKHO) and the geophysics DAC (BGS) for MBES bathymetry and backscatter data. However, these will require extra work by the DAC and there is a possibility that the DAC may need to recover the cost by making an administrative charge. Please contact BGS (medin@bgs.ac.uk) or UKHO (bathy.dac@ukho.gov.uk) to discuss this issue.

ASCII data

The tables below are suitable for processed data exchange by comma or tab delimited ASCII XYZ/XYA text file i.e. *.xyz, *.csv, *.txt, *.asc, *.dat. Processed data can either be provided at full density (swath) data points, or as a summary grid of specified size. The following tables document the content of processed/exported ungridded (full density) and gridded/thinned swath data respectively.

C.3 Guidance

Processed, full density data - *Multibeam Echo Sounder (MBES) or Singlebeam Echo Sounder (SBES)*

Processed, full density data is data that has been reduced to a vertical datum (e.g. chart datum, or mean sea level) and had any spurious depths removed (e.g. spikes, outliers). The dataset contains all the good data points from the survey and has not been thinned or gridded in any way. If you are providing gridded data, you should use the next table for guidance.

Survey acquisition software that routinely logs this information comply with MEDIN standards The data forms provided are guidance for what your MBES and SBES dataset should contain, you are not expected to transfer your bathymetry dataset into a spreadsheet format.

MBES and SBES data should be clearly linked to the acquisition information for a given file set and replicate. The preferred format for a sounding is where each sounding is presented as a row, so that other ping information can be retained with the sounding. Data columns are based on OGP SSDM Survey_Sounding_Grid GIS feature class and the content of the GSF format.

This information **must** be supplied as part of processed, full density data (survey acquisition software that routinely log this information comply with MEDIN standards):

	Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
	dateAndTime	**M**	Ping/fix record date and time	yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2009-01-24 13:33:00
	fixPing	**M**	Numeric fix number applicable	Integer	1234

	XCoordinate	**M**	Longitude or Easting of the ping/fix according to defined coordinate reference system for survey. For longitude, east is positive and west is negative.	Decimal degrees; at least six decimal places or Decimal; Units = metres	-3.476363, 234865.55
	YCoordinate	**M**	Latitude or Northing of the ping/fix according to defined coordinate reference system for survey. For latitude, north is positive and south is negative.	Decimal degrees; at least six decimal places or Decimal; Units = metres	54.583736, 5963487.00
	depth[1]	**M**	Tidally reduced and corrected water depth in metres	Decimal ; Units = metres	20.6
	mean Amplitude[1]	**M**	Mean return amplitude (for backscatter)	Decimal; Units = decibels	

Additional Information:

Please supply as much of the following information as possible to help others assess your data (your survey acquisition software may already log this information):

	Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
	rawDepth	**C**	Un-reduced water depth in metres, where available	Decimal;Units = metres	21.3
	tidal Reduction	**C**	Tidal reduction applied to raw depth, where available (can be GNSS tide)	Decimal;Units = metres	0.9
	relative Amplitude	**C**	Relative return amplitude (for backscatter) to an arbitrary level	Decimal; Units = decibels	
	KPDistance Along	**O**	Chainage according to kilometre post (KP) scheme or length and direction of programmed line/ transect. May be negative value if data logging commences before start of line is reached.	Decimal kilometres for KP scheme, Decimal metres for distance scheme	1.005, 1005.00
	pingMode	**O**	Ping mode for ping	Text; from list: Deep Medium Shallow	Deep

[1] Interchangeable according to whether XYZ or XYA is supplied

	waveForm	**O**	Wave form for ping	Text; from list CW – Carrier wave (traditional tone) FM – Frequency modulated Mix - combination of the two	Mix
	roughness (E1)[2]	**C**	Singlebeam only. Representative roughness echo return where using RoxAnn AGDS or similar system	Decimal; Units = decibels	
	hardness (E2)[2]	**C**	Singlebeam only. Representative hardness echo return where using RoxAnn AGDS or similar system	Decimal; Units = decibels	
	Q1[2]	**C**	Singlebeam only. Representative Q1 Eigen vector reduction if using QTC View ADGS or similar system	Decimal; Units = decibels	
	Q2[2]	**C**	Singlebeam only. Representative Q2 Eigen vector reduction if using QTC View ADGS or similar system	Decimal; Units = decibels	
	Q3[2]	**C**	Singlebeam only.Representative Q3 Eigen vector reduction if using QTC View ADGS or similar system	Decimal; Units = decibels	
	position Uncertainty	**O**	Estimated position error (can be split into along track and across track if necessary), 2s value (95%)	Decimal;Units = metres	
	depth Uncertainty	**O**	Estimated depth error, where available 2sigma value (95%)	Decimal;Units = metres	
	TPU	**O**	Total propagated uncertainty on position and depth error 2sigma value (95%)	Decimal;Units = metres	
	geometry	**O**	Storage of geometry	Point Surface - TIN Surface - grid/raster (interpolated)	

[2] SBES data only

Processed, Gridded Data - *Multibeam Echo Sounder (MBES) or Singlebeam Echo Sounder (SBES)*

Processed, gridded data is data that has been reduced to a vertical datum (e.g. chart datum, or mean sea level) and had any spurious depths removed (e.g. spikes, outliers). The dataset has been thinned using a grid of a defined resolution and retaining only 1 data point per grid cell. Depending on the gridding method used, the retained data point could be located at its true position or represented at the centre of the grid cell. If you are providing ungridded data you should use the previous table for guidance.

Commonly used software that routinely logs this information comply with MEDIN standards. The data forms provided are guidance for what your MBES and SBES dataset should contain, you are not expected to transfer your bathymetry dataset into a spreadsheet format.

This information **must** be supplied as part of processed, gridded data (software that routinely logs this information complies with MEDIN standards):

Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
XCoordinate	**M**	Longitude or Easting of the ping/fix according to defined coordinate reference system for survey. For longitude, east is positive and west is negative.	Decimal degrees; at least six decimal places or Decimal; Units = metres	-3.476363, 234865.55
YCoordinate	**M**	Latitude or Northing of the ping/fix according to defined coordinate reference system for survey. For latitude, north is positive and south is negative.	Decimal degrees; at least six decimal places Or Decimal; Units = metres	54.583736, 5963487.00
depth[1]	**M**	Representational tidally reduced water depth at gridded location in metres	Decimal;Units = metres	20.6
Amplitude[1]	**M**	Representational amplitude at gridded location (for backscatter)	Decimal; Units = decibels	

[1] Interchangeable according to whether XYZ or XYA is supplied

Additional Items:
Please provide as much of the following information as possible to help others assess your data:

Field Title	MCO	Description	Recommended Controlled Vocabulary or Format	Examples
surveyCode	**O**	A unique code for the survey to allow the gridded data output to be linked for the entire survey, where Line Event Identifier not applicable. Can be included in the file name as an alternative.	Free text;	http://www.noc.ac.uk/JCR3022; http://www.bennett.ac.uk/RIBJULY_03_01)
Roughness (E1)[2]	**C**	Singlebeam only. Representative roughness echo return where using RoxAnn AGDS or similar system	Decimal; Units = decibels	
Hardness (E2)[2]	**C**	Singlebeam only. Representative hardness echo return where using RoxAnn AGDS or similar system	Decimal; Units = decibels	
Q1[2]	**C**	Singlebeam only. Representative Q1 Eigen vector reduction if using QTC View ADGS or similar system	Decimal; Units = decibels	
Q2[2]	**C**	Singlebeam only. Representative Q2 Eigen vector reduction if using QTC View ADGS or similar system	Decimal; Units = decibels	
Q3[2]	**C**	Singlebeam only. Representative Q3 Eigen vector reduction if using QTC View ADGS or similar system	Decimal; Units = decibels	
gridSize[3]	**O**	Grid size (can be included in the file name as an alternative)	Decimal;Units = metres	
gridUnits[3]	**O**	Use to state grid size units (can be included in the file name as an alternative)	Text;	from list: Metres Decimal Degrees
geometry	**O**	Storage of geometry	Point Surface - TIN Surface - grid/raster	

[2] SBES data only
[3] MBES data only