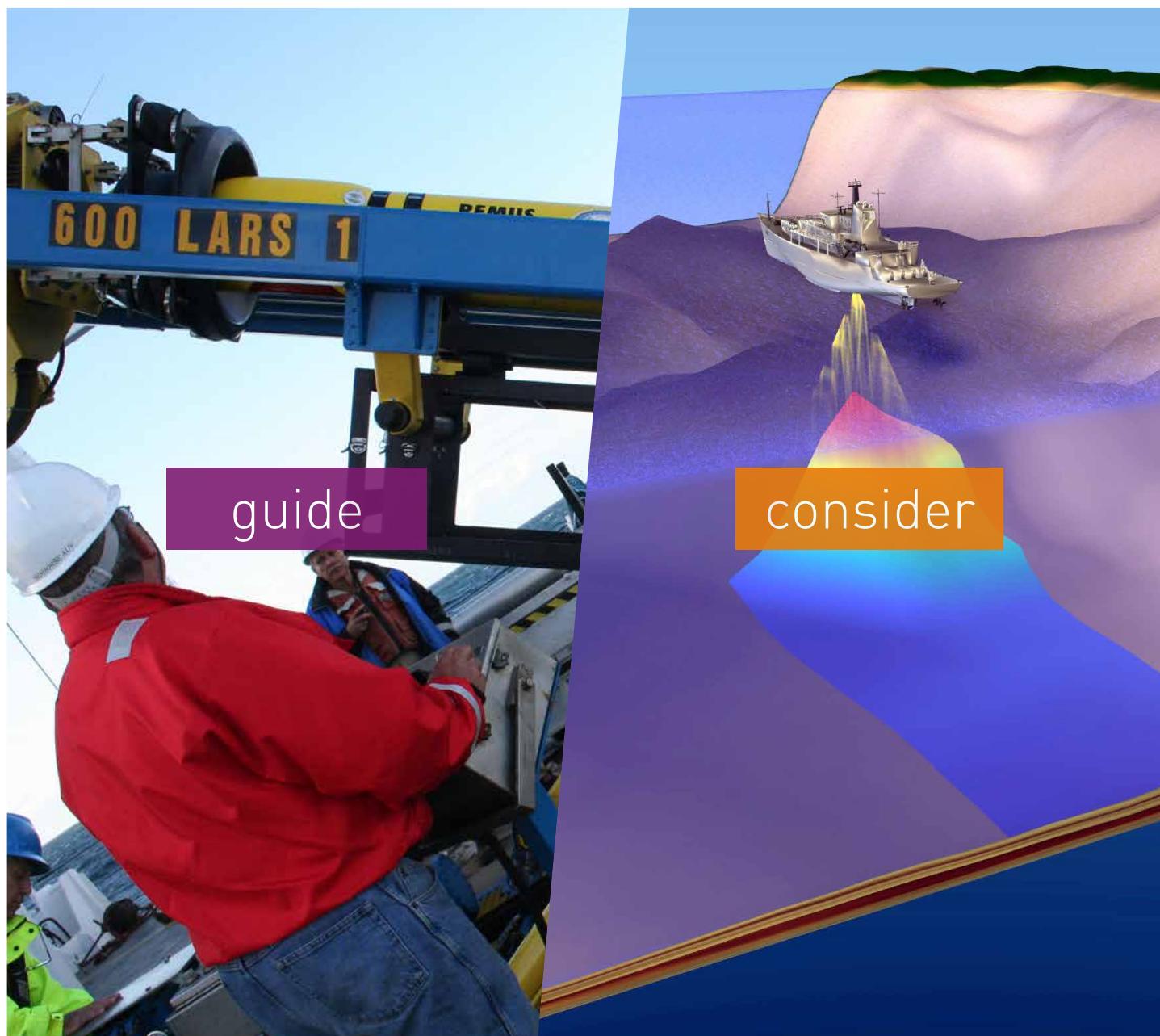


# Guideline for the delivery of the Seabed Survey Data Model



---

## Acknowledgements

Seabed Survey Data Model Task Force members

Geo-Information Subcommittee members

Geodesy Subcommittee members

### Feedback

IOGP welcomes feedback on our reports: [publications@iogp.org](mailto:publications@iogp.org)

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# Guideline for the delivery of the Seabed Survey Data Model

## Revision history

VERSION	DATE	AMENDMENTS
1.0	January 2013	Initial release
2.0	January 2017	Version 2 release

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# Foreword

This technical specification is published by the International Association of Oil & Gas Producers (IOGP) Geomatics Committee. Use of this document does not require IOGP membership, however, the IOGP is not obliged to provide support for the use of this specification and the associated Seabed Survey Data Model (SSDM) and is not liable for any consequences that arise from use of the SSDM.

Oil and gas exploration and production companies (O&G companies) undertake hydrographic and geophysical surveys to support the planning and execution of many activities such as:

- Evaluation of potential well locations
- Identifying hazards, and selection of suitable drilling and offshore facility locations, and pipeline routes
- Asset integrity management

The O&G companies utilize survey contractors to acquire, process and deliver seabed survey data.

To enable efficient integration and management of the survey data and results throughout the O&G life cycle, the IOGP Geomatics Committee has published the SSDM to enable delivery of consistently structured survey data and results in GIS format.

# 1. Scope

The scope of this technical specification is to describe the SSDM GIS data delivery as well as provide guidance to survey contractors in how the GIS data and survey deliverables should be structured and supplied to the operator. The SSDM utilizes geographic data modelling to provide standardization of how seabed survey data is structured, attributed and presented by survey contractors to O&G companies in GIS format.

O&G companies may use this technical specification to define requirements for seabed survey data delivery, and supplement it with additional company-specific elements if required.

The technical specification is based on the SSDM GIS data model template (developed on the ESRI geodatabase and ArcGIS software) as provided on the IOGP Geomatics Committee web site <http://www.iogp.org/Geomatics>

The same principles will apply if an O&G company uses other GIS database formats and software to implement the SSDM but the detailed method is beyond the scope of this document. The industry de-facto or vendor proprietary data formats for the various survey equipment and sensor types are not discussed but assumed to be part of the survey deliverables as specified by the O&G company. For example:

- Side scan sonar data, single channel seismic (sub-bottom profiler) data, and high resolution multi-channel seismic data. These data are typically stored and delivered in its respective formats, e.g. Triton XTF, SEG-D/SEG-Y, GeoTIFF, etc.
- Singlebeam/multibeam echo sounder raw, processed and gridded data.
- Vessel, source, streamer and other positioning data. Typically delivered in IOGP P-format.

Survey data and results are often delivered as CAD files for Front End Engineering Design purposes, electronic format map delivery etc. The CAD files should co-exist with the GIS data deliverable and they should be delivered in an agreed folder structure (see section 5) together with other deliverables. The CAD deliverable specifications are beyond the scope of this document.

This technical specification applies to all O&G company and contractors involved in offshore survey data acquisition and delivery.

## 2. The Seabed Survey Data Model (SSDM)

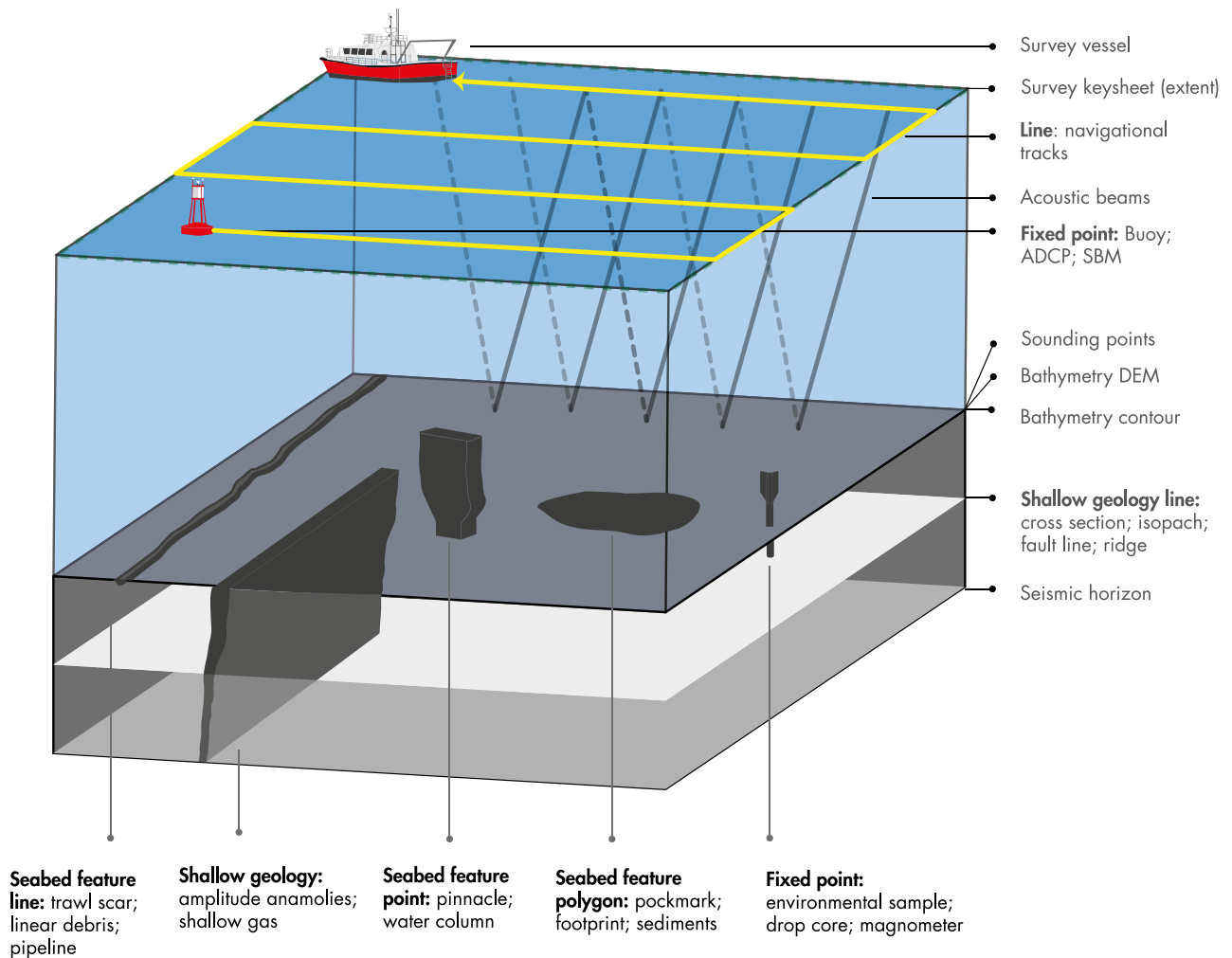
The SSDM serves to capture survey project details (extents, equipment, coverage, track lines etc), hydrographic, shallow geophysical and geotechnical geographical entities and attributes, including surface and subsurface man made and geohazards that are interpreted from the seabed survey. These are conceptually summarized in Figure 1.

Currently, the SSDM may be used for delivery of data and presentation of results from the following survey types:

- 1) Seabed clearance and bathymetric surveys - side scan sonar, singlebeam / multibeam echosounder, sub-bottom profiler, magnetometer, or various combinations of these systems<sup>1</sup>.
- 2) Platform and drilling hazard site surveys (refer to the IOGP Guidelines for the conduct of drilling hazard site surveys, reference 373-18-2) – typically the above systems, plus shallow high-resolution or ultra-high resolution 2D/3D seismic data acquisition.
- 3) Pipeline route surveys, pipeline span/surveillance/inspection surveys – typically using echosounder, side scan sonar and sub-bottom profiler (or combinations of these systems), but excluding ROV based pipeline inspection survey.
- 4) Environmental/benthic and geotechnical surveys – seabed sampling, shallow coring, cone penetrometer tests (CPTs), water sampling, photography and video.

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<sup>1</sup> <http://www.iogp.org/pubs/373-18-2.pdf>



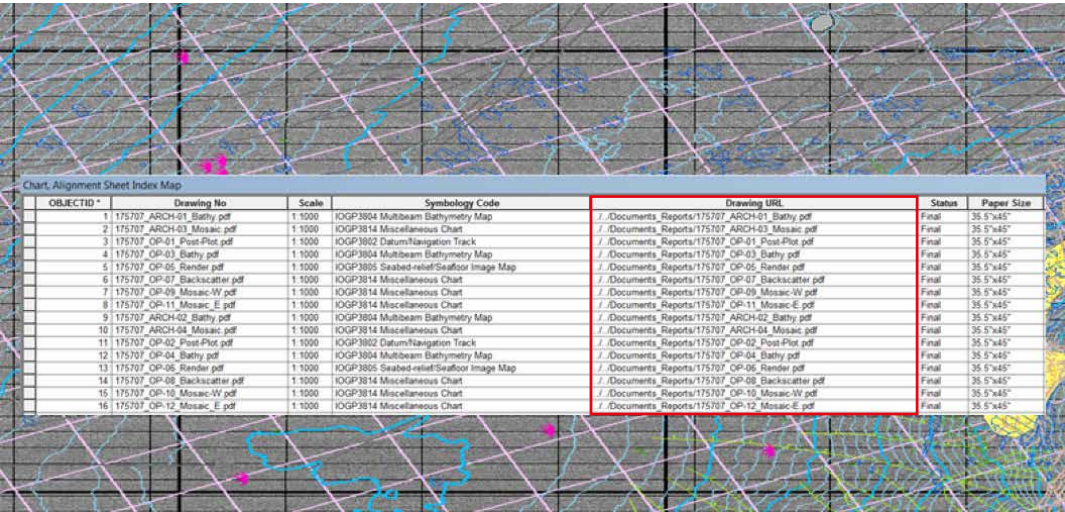
**Figure 1:** The conceptual framework diagram of the Seabed Survey Data Model

The SSDM is a GIS data model, this document therefore does not include discussion of:

- Data models/file format for survey equipment and processed data e.g. side scan sonar and seismic data. This is typically delivered in proprietary or industry formats.
- Data models/file formats of survey data processing systems e.g. for processing of seismic data and multibeam echo sounder data.



Raw and processed survey data should be stored and supplied in agreed formats (e.g. XTF, SEG-D/SEG-Y, and Microsoft Excel/Word Document). The SSDM enables data to be hyperlinked to the GIS features and can therefore serve as a central component for presentation of survey results and access to the data as seen in Figure 2.



**Figure 2:** An example of how an O&G company is hyperlinking Charts to the corresponding chart index in SSDM using the folder structure as described in section 5 [Data Delivery Folder Structure Guidance]. This enables a user to conduct a map based search for delivered charts.

## 3. O&G Company Provisions

As part of utilizing the SSDM, the survey contractor should be supplied with:

- 1) The SSDM standard components – template and descriptions
- 2) The Survey Job particulars – unique survey activity number
- 3) The Survey Project Coordinate Reference System (CRS), which includes the preferred units of measure
- 4) Existing Company data.

---

### 3.1 The SSDM standard components

The standard components of the SSDM consist of:

- 1) The IOGP SSDM GIS database template or application schema (ESRI Geodatabase/SeabedML).
- 2) The IOGP SSDM symbology style sheet (ArcGIS/CAD Stylesheets) – symbol library for the features stored in the geodatabase. This can be used to create symbolized layer files and standardized maps.
- 3) SSDM data dictionary – illustrates the structure of SSDM Data Model and provides the detailed definition of each feature class, object class along with the list of domains and symbology codes.
- 4) IOGP Geomatics Committee Guidance Notes:
  - a) IOGP Geomatics Committee 462 series Data models note 1, *Guidelines for the use of the Seabed Survey Data Model*
  - b) SSDM User and contractor guidelines document – basic guidelines for how survey contractors and O&G companies can utilize the SSDM
  - c) Guidance Note for Interface between Pipeline Data Models and the IOGP Seabed Survey Data Model
  - d) SSDM Frequently asked questions document – a document that aims to answer the regular questions that are asked about the SSDM.

The above materials can be freely downloaded from the IOGP Geomatics Committee web site <http://www.iogp.org/Geomatics#2521682-seabed-survey-data-model>

---

## 3.2 The Survey Job Particulars

The O&G company should provide a unique survey activity identification number/reference text for the survey job. This is required to allow the SURVEY\_ID (number) and SURVEY\_ID\_REF (text) fields to be attributed within the features classes inside the SSDM geodatabase. These fields act as relational keys and help define relationships within the geodatabase.

While not compulsory, it is recommended that the O&G company pre-fill the following in the geodatabase template or supply the particulars for the survey project to the survey contractor to be populated into the survey geodatabase:

- the "T\_Survey\_JobDetails" table with values for SURVEY\_ID or SURVEY\_ID\_REF, project description, survey name, scope of work link, assurance plan link, client name, etc.
- the "Survey\_Keysheet" feature class with a proposed survey extent and populate the SURVEY\_ID or SURVEY\_ID\_REF, survey name and survey type fields.
- the "Proposed\_Survey\_Run\_Lines" feature class with the proposed survey design.
- if applicable, the proposed seabed sampling/geotechnical coring borehole locations are pre-filled in the "Geotechnical\_Sample\_Pnt" feature class.

---

## 3.3 The Survey Project Coordinate Reference Systems (CRS)

All coordinates in SSDM reference a single horizontal and vertical Coordinate Reference System. It is important that the O&G company explicitly describes the horizontal and vertical coordinate reference systems associated with the seabed survey project by providing the identification of indirect (EPSG - full OGC URN string) and/or direct description (Well-known text (WKT)) for the whole model in T\_Survey\_JobDetails table.

The sample SSDM geodatabase available from the IOGP Geomatics Committee web site <http://www.iogp.org/Geomatics> is referenced to the WGS 84 geographic CRS (as an example), but is not referenced to a vertical datum. The contractor should provide the SSDM geodatabase referenced to the O&G company defined horizontal and vertical CRS, indicate Original CRS where applicable and define transformation parameters if data was transformed. It is recommended that the CRS set up of the geodatabase is verified by the O&G company geodetic specialist.

---

### 3.4 Existing company data

Where applicable, the O&G company should provide the survey contractor with existing relevant data for the survey area, in SSDM format. This should include but not be limited to locations of existing platforms, pipelines and other facilities, and proposed pipeline routes, facility or well locations where route/site selection is the objective of the survey job, or existing site survey data.

**Note:** Pipeline infrastructure and asset facilities are not part of the SSDM and so the O&G company should use their chosen standard pipeline and facility data models. The same approach should be taken for other data types which are beyond the scope of SSDM, but may be valuable input to survey planning.

The O&G company should provide a capable survey/geo-information management representative who can liaise with the survey contractor on the SSDM deliverable requirements. Ensuring there is a good engagement between the operator and the survey contractor is fundamental to a positive outcome being reached, particularly when it comes to ensuring operator specific requirements are met.

## 4. GIS data delivery requirements

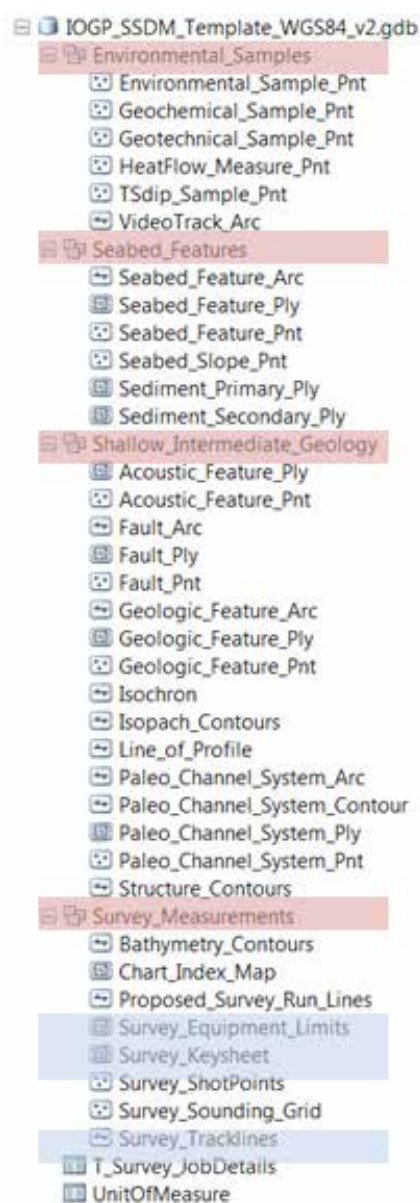
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### 4.1 SSDM geodatabase

The SSDM geodatabase is the primary component of the GIS deliverable. This deliverable should be based on the SSDM template that is provided as part of this standard. The geodatabase is organized into four feature data sets. Each feature data set is based on a theme/type of acquired data (see Figure 3) i.e. environmental samples, seabed features, Interpreted shallow geology and survey measurements. The geodatabase template provided to the survey contractor should contain all of the feature data sets and feature classes, however, not all of these will be relevant for each survey type e.g. a bathymetric survey will not involve the use of sub-bottom profilers or high-resolution seismic equipment and hence interpreted features won't be loaded to the Interpreted shallow/geology features classes as subsurface data is not acquired. A general guideline indicating which seabed features belong to which SSDM geodatabase feature classes is provided in Appendix A.

Survey contractors are only expected to populate the relevant feature classes. Population of the feature classes includes completing the attribute tables for each utilized feature class.

It is mandatory that the *survey keysheet*, *survey equipment limits* and *survey track lines* feature classes are populated and attributed as this provides important feature level metadata and survey navigation information to users of the geodatabase.

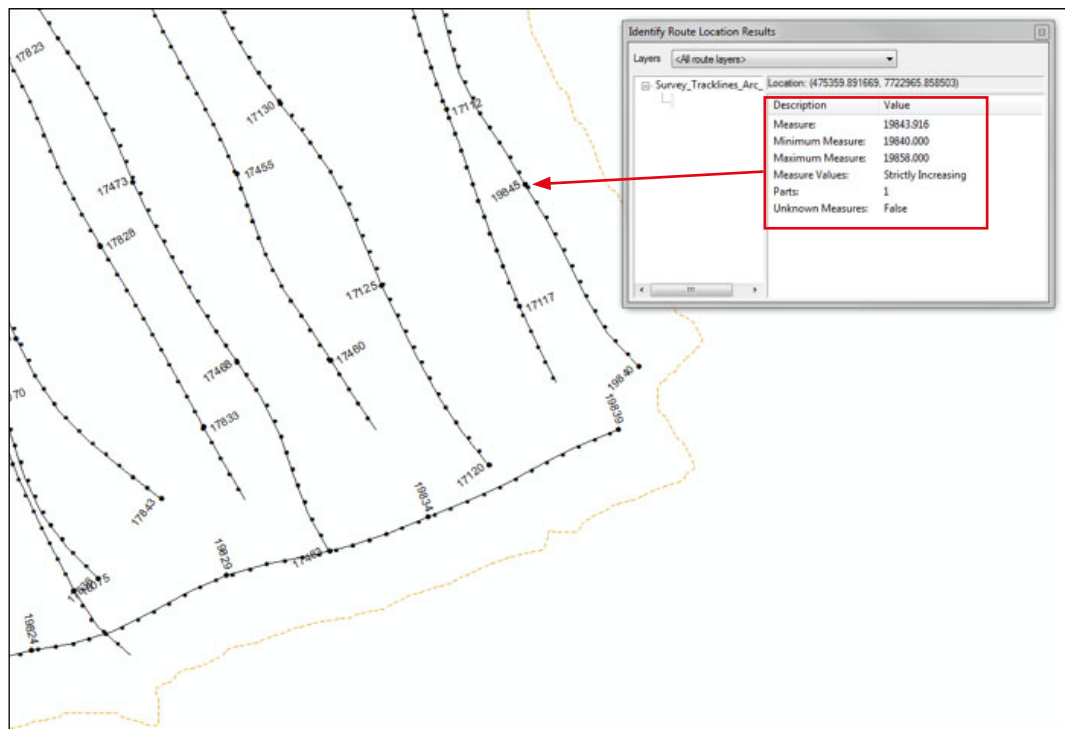


**Figure 3:** The SSDM geodatabase with the feature data sets highlighted in red and the survey keysheet, survey track lines and survey equipment limits feature classes highlighted in blue.

#### 4.1.1 Survey track lines measure value

The survey track lines feature class is set up to store Easting, Northing, Elevation/Depth and M (measure) values within the geometry (based on ESRI Geodatabase).

The 'M' value represents a measurement along the survey track line e.g. a shot point or 'fix' location. This will mirror the symbology utilized on a traditional track chart provided as part of a seabed survey when 'hatching' is utilized in ArcGIS (refer Figure 4).



**Figure 4:** Survey track lines feature class (echo sounder track line in this case) with "fix positions" embedded into the geometry which enables the layer to be symbolized as per traditional track charts. This also allows any position to be queried along the line to determine a fix location.

### 4.1.2 Units of Measure

SSDM v2 includes a centralized reference table for units of measure ('UnitOfMeasure') for all of the objects in SSDM.

Measurement units in 'UnitOfMeasure' Table should reference the Energistics Unit Symbols (<http://www.energistics.org/asset-data-management/unit-of-measure-standard>).

'UnitofMeasure' can be joined to any table in SSDM version 2 to examine units alongside measurements.

'UnitofMeasure' table is scalable to store multiple units for a specific field differentiated by unique survey job numbers (Survey\_ID or Survey\_ID\_Ref).

### 4.1.3 Hyperlinking Feature Classes to survey reports and survey data

As discussed in section 2, seabed survey project deliverables includes a number of data sets (seismic data, bathymetric data, side scan sonar data, photos, videos, sample results), charts and reports in conjunction with the GIS deliverable itself. Each of the respective feature classes in the SSDM geodatabase that may require a hyperlink to a data set, chart or report have an attribute field that enables the file path to be populated to that file. For example, the *survey keysheet* feature class contains a REPORT\_URL field that enables the file path to be added to the survey report.

Similar fields exist for the:

- *chart index map* (DRAWING\_URL) – to populate the file path to the CAD or PDF file for maps or charts produced by the survey contractor (seabed features map, track plots, multi-beam bathymetry map etc.)
- *survey track lines* (HIRES\_SEISMIC\_RAP\_URL and HIRES\_SEISMIC\_EQL\_URL) – to populate the file path to a seismic image.
- *geotechnical sample* (DATA\_URL and REPORT\_URL) – to populate the file path to the geotechnical report and/or core logs.
- *line of profile* (CHART\_URL) – to populate the file path to a cross-section chart/diagram.

Refer to Figures 2 and 5.



This enables users of the GIS project to locate the data and then to identify specific features and open up associated information and files relating to that geographic feature provided that the necessary data/document viewers are available. In essence, it allows users to conduct map based search for reports, data etc. associated with the survey project.

During data loading by the survey contractor (outside of the O&G company's system environment) relative path names will be needed to define the location of the documents and data. It is the responsibility of the O&G company to update these to absolute path names or hyperlink values during data loading to company data and information stores, or provide other means to relate or link the data and reports with the GIS project data.

Name	Type (or Domain)	Length	Precision	Scale	Allow Nulls	Default Value	Description
PROFILE_TYPE	CROSS_SECTION_TYPE	20	0	0	true		Cross Section Type (i.e. Bathymetric) – refer to domain list for code
PROFILE_NAME	esriFieldTypeString	50	0	0	true		Profile Name
PROFILE_DESC	esriFieldTypeString	100	0	0	true		Profile Description (i.e. Bathymetric Profile A-A')
DRAWING_NO	esriFieldTypeString	50	0	0	true		Document Reference Number Containing Profile
CHART_URL	esriFieldTypeString	255	0	0	true		Document Reference or Profile Image Hyperlink URL
STRATIGRAPHIC_SEQ	esriFieldTypeString	20	0	0	true		Stratigraphic Sequence of Geological Cross Profile

**Figures 5:** Line of profile Feature class showing the field available to populate the file path to a cross-section chart/diagram

#### 4.1.4 Feature class metadata requirements

All feature classes utilized as part of the survey deliverable should be accompanied by a metadata statement (refer Figure 6). The metadata should, as a minimum, detail the feature class description, credits, acquisition and processing methodology, interpretation used to produce the deliverables as well as a quality and accuracy statement. This metadata statement may be embedded into the ESRI Geodatabase (as ArcGIS metadata Item Description or ISO 19139 style sheet) or as an external XML file complied with ISO 19139 XML implementation schema for ISO 19115 metadata standard.

The O&G company should specify their preferred metadata standard. The ISO 19139 stylesheet or ArcGIS metadata stylesheet in ArcGIS are acceptable metadata standards used by O&G companies. However, when not specified, the ISO 19139 stylesheet is the recommended default, in order to have better compatibility with other software applications especially when the survey results are part of an OGC cataloguing service. It should be noted that the SSDM material available on the IOGP Geomatics Committee web site <http://www.iogp.org/Geomatics> contains some basic metadata templates that can be used.

It should be noted that the attributes defined in the SSDM provide feature level metadata within the feature classes. For example, the survey keysheet and survey equipment limits provide all of the necessary information for a survey e.g. survey dates, equipment used, equipment coverage, links to the survey reports etc.

**Resource Identification** ▶

**CITATION**  
 Title: Survey\_Keysheet\_phy\_WEL  
 Creation Date: 2011-08-30T00:00:00  
 Presentation Format: digital map

**THEMES OR CATEGORIES OF THE RESOURCE**: structure, oceans, utilitiesCommunication

**KEYWORDS**: 002  
**THESAURUS**

**ABSTRACT (DESCRIPTION)**  
 For this survey, it was intended that the inspections would be conducted using a Gavia Compact Autonomous Underwater Vehicle (CAUV) as the primary survey tool, with a side scan sonar (SSS) system as backup. The CAUV was used successfully from KP 23 to KP 50 of the pipeline but after this point there were technical difficulties with the CAUV that prevented it functioning properly. As a result the SSS was used as the primary survey tool for the remainder of the survey. The work area extended from Mermaid Sound to the Pluto platform and from the Goodwyn Alpha platform to the PER-02 well location on the Northwest Shelf. Water depths throughout the survey area varied between approximately 20 m and 260 m. The survey vessel was chartered by for use during the survey. The vessel is owned and operated by (GOM).

**PURPOSE (SUMMARY)**  
 Survey Pty Ltd was contracted by to provide external pipeline inspection survey services for the 2011 Annual Pipeline Surveys. In order to comply with the licensing requirements of the Western Australian Department of Mines and Petroleum, undertakes annual subsea surveys of the pipelines to assess their external and structural integrity.

**DATASET LANGUAGES**: English (AUSTRALIA)  
**DATASET CHARACTER SET**: utf8 - 8 bit UCS Transfer Format

**RESOURCE CONSTRAINTS**  
**CONSTRAINTS**  
 LIMITATIONS OF USE  
 Positional accuracy of the side scan sonar (SSS) is ± 2-3 metres along track and ± 8 metres offtrack (perpendicular to the pipeline).

**\* SPATIAL REPRESENTATION TYPE**: vector

**\* PROCESSING ENVIRONMENT**: Microsoft Windows Server 2008 R2 Version 6.1 (Build 7601) Service Pack 1; ESRI ArcGIS 10.0.0.2414

**OTHER EXTENT INFORMATION**  
**GEOGRAPHIC EXTENT**  
**BOUNDING RECTANGLE**  
 \* EXTENT TYPE: Extent used for searching  
 \* WEST LONGITUDE: 125.971907  
 \* EAST LONGITUDE: 126.228636  
 \* NORTH LATITUDE: -10.517914  
 \* SOUTH LATITUDE: -10.664589

**OTHER EXTENT INFORMATION**  
**GEOGRAPHIC EXTENT**  
**BOUNDING RECTANGLE**  
 \* EXTENT TYPE: Extent used for searching  
 \* WEST LONGITUDE: 115.122593  
 \* EAST LONGITUDE: 116.777496  
 \* NORTH LATITUDE: -19.512341  
 \* SOUTH LATITUDE: -20.605629  
 \* EXTENT CONTAINS THE RESOURCE: Yes

**Figure 6:** An example of a metadata statement for a seabed survey delivered using the SSDM geodatabase

#### 4.1.5 Renaming the SSDM ESRI geodatabase

The SSDM geodatabase template as downloaded from the IOGP Geomatics Committee web site <http://www.iogp.org/Geomatics> has the following file naming convention:

< Source>\_<CRS>\_<SSDM Version Number>\_<Date>\_<ArcGIS Version>.<file extension>,

e.g. IOGP\_SSDM\_Template\_EPSG4326\_V2\_20161231\_10.mdb

For the delivery of a particular survey job, the recommended file naming convention is:

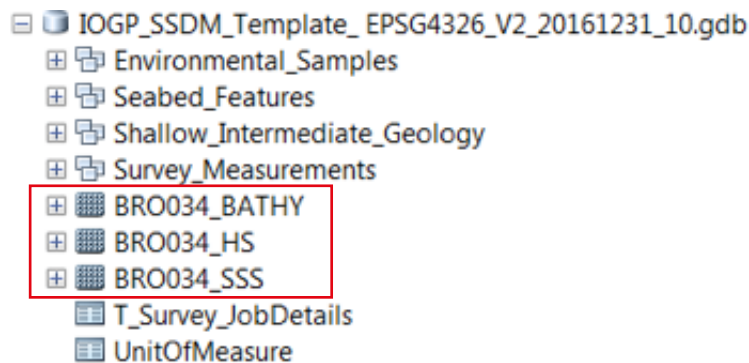
< SURVEY\_ID\_REF>\_<CRS>\_<SSDM VersionNumber>\_<Date>\_<ArcGIS Version>.<file extension>, where:

- SURVEY\_ID\_REF
  - This represents the O&G company's survey project naming convention e.g. BR0034, BRO21052012, PROJECT25 etc
- Horizontal CRS Name
  - Recommended to use Horizontal CRS EPSG code
- SSDM Version Number and Date
  - Remain unchanged as in IOGP\_SSDM\_Template\_ EPSG4326\_ V2\_20161231\_10.gdb
- ArcGIS Version
  - May be changed to match the ArcGIS version being used to compile the geodatabase.
- File Extension
  - ESRI File Geodatabase (.gdb) or Personal Geodatabase (.mdb).

The operator should specify the preferred ESRI Geodatabase format (and ArcGIS release version where relevant) to be used. The ESRI File Geodatabase is the recommended format, particularly for larger surveys where raster data (e.g. side scan mosaics) is being loaded to the geodatabase as it has the capacity to hold more data. The personal geodatabase has a size limit of 2GB.

## 4.2 Raster data sets

As part of a seabed survey project there will be some data sets that are best delivered in a raster format e.g. side scan sonar mosaics, multibeam backscatter mosaics, bathymetry grid, sun-illuminated bathymetry images, picked seismic horizons etc. (refer Figure 7). It is recommended that these are loaded as ESRI Raster/Mosaic data sets or as Terrain data sets. Alternatively, these raster files can be stored in the 'Images' folder as described in the deliverable folder structure discussed in section 5.



**Figure 7:** An example of a bathymetry surface, sun-illuminated bathymetry surface and side scan sonar raster loaded into the SSDM geodatabase

The recommended naming convention for the raster data sets is:

<SURVEY\_ID\_REF>\_<DataType>\_<Subtype>, where:

- SURVEY\_ID\_REF
  - This represents the O&G company's survey project naming convention e.g. BR0034, BR021052012, PROJECT25 etc
- DataType
  - Bathy – Bathymetry digital terrain model
  - HS – Bathymetry hill shaded/sun illuminated raster
  - SSS – Side scan sonar raster
  - Slope – Slope/gradient raster
  - BS – Multibeam echo sounder backscatter raster
- Subtype (optional)
  - Further description of raster data e.g. HiRes, Smoothed, Raw etc.

By default, feature class metadata requirements are also applicable to raster data sets.

### 4.3 ArcGIS layer files and symbology

Where required by the O&G company, the ArcGIS layer files component of the GIS deliverable can be created using the supplied ArcGIS stylesheet for the SSDM as provided on the IOGP Geomatics Committee web site: <http://www.iogp.org/Geomatics>

These layer files can be set up once and reused for subsequent survey projects.

The SSDM geodatabase feature class contains the symbology code value in the SYMBOLOGY\_CODE field which is in the following format:

IOGPXXXX e.g. IOGP3102 = Sand, IOGP3103 = Silt.

Essentially, each feature class and its domains should be symbolized by using the correct symbology from the ArcGIS Stylesheet shown in Figure 8.

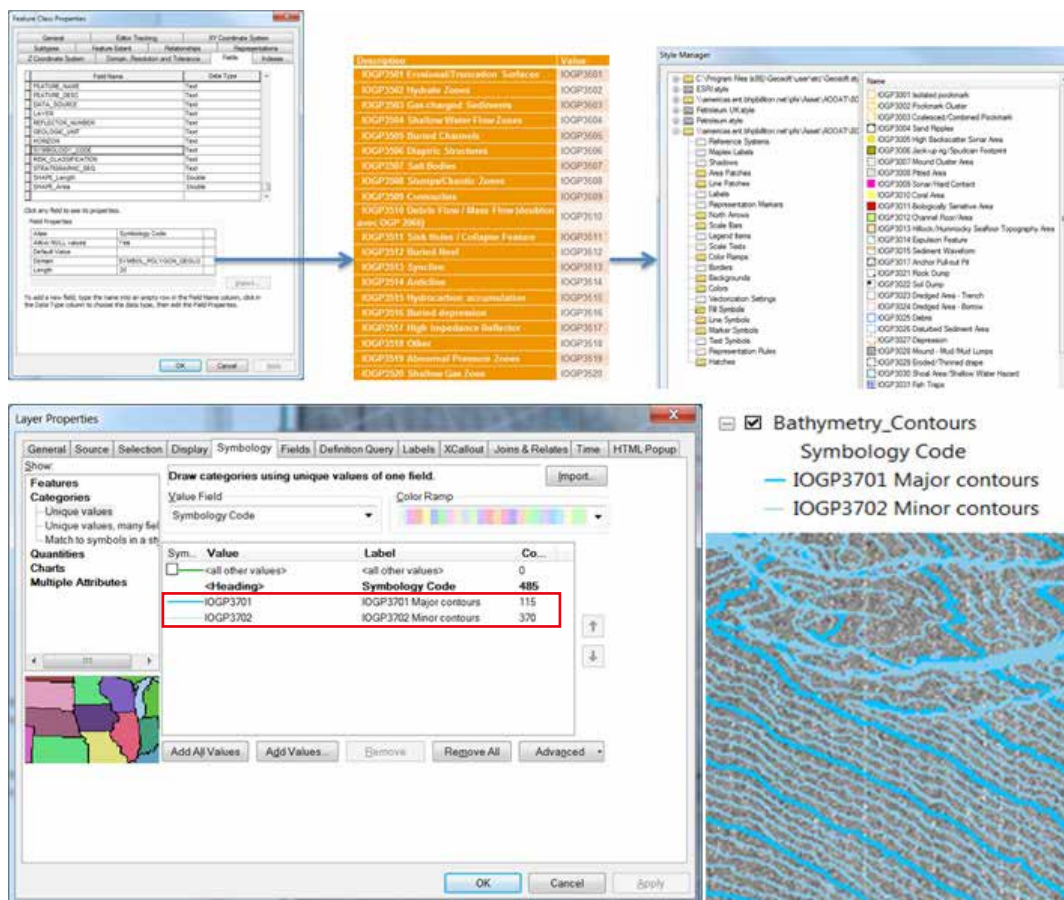
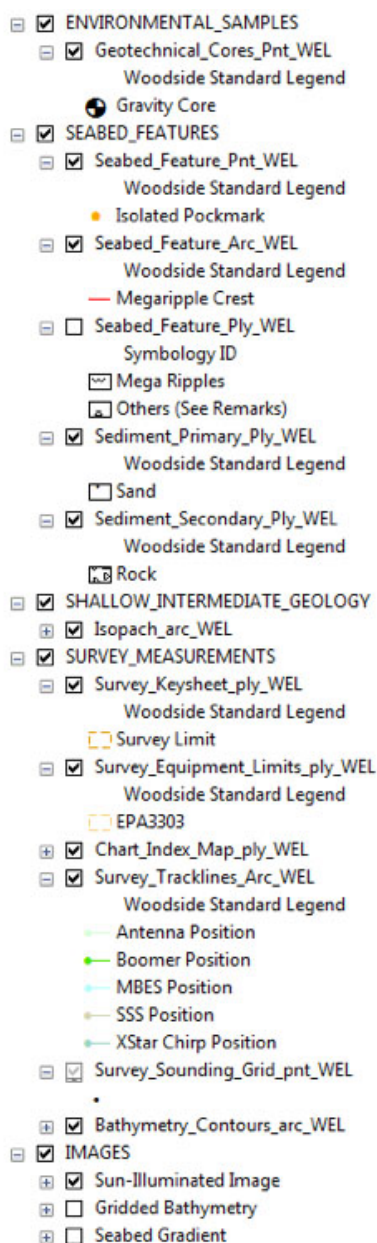


Figure 8: Feature class symbology codes and ArcGIS layer file symbology settings

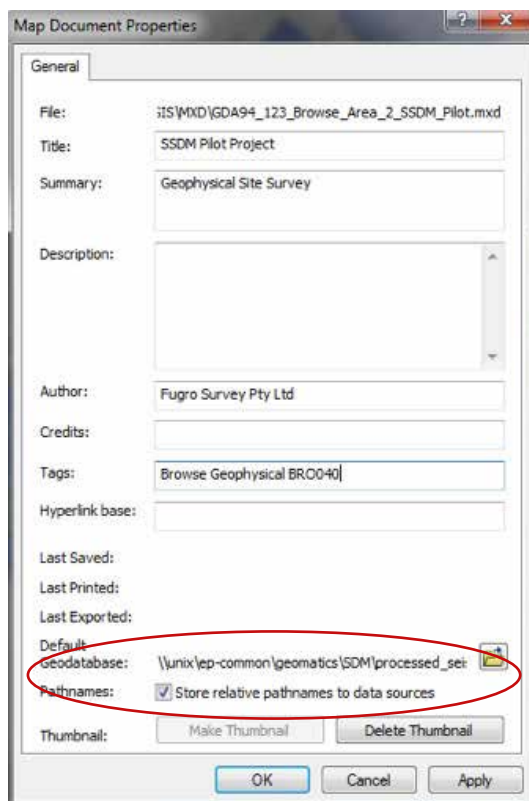
Based on these principles, ArcGIS layer files can be set up for each feature class (and rasters where applicable) utilized in the survey project. All related layer files can be made into group layer files. These group layer files will be based on the feature data set themes set up inside the geodatabase i.e. Survey Measurements group layer, Seabed Features group layer, Shallow Geology group layer and Environmental Samples group layer (see Figure 9 below for example).



**Figure 9:** SSDM layer files set up as per the feature data set themes and with the correct symbology assigned

## 4.4 ArcMap Map Document (MXD) setup

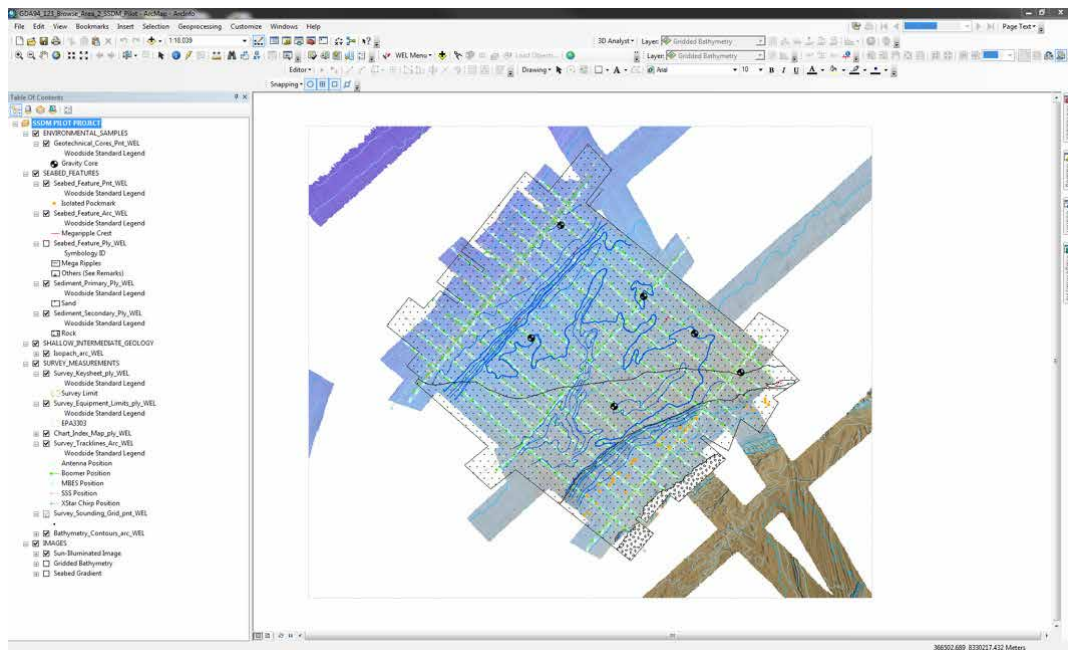
Where an ArcMap Map Document (MXD) is required for the survey project (if specified by the O&G company), the MXD should be set up such that the data source options are set to 'relative path names' as shown in Figure 10.



**Figure 10:** Setting up relative path names as the data source option in ArcMap (File → Map Document Properties)

The MXD may contain the layer files that were set up as described in Section 4.3 and the cartography elements for each chart if ArcMap is used as the charting tool (Figure 11).





**Figure 11:** An example screenshot of an SSDM MXD that is set up with the correct symbology and layer structure

## 4.5 General GIS requirements

General requirements pertaining to the SSDM GIS deliverable that should be followed by the survey contractor are covered in the following subsections.

### 4.5.1 Software version

Unless otherwise specified by the O&G company, all ESRI ArcGIS data deliverables should be supplied in ArcGIS version 9.2 or above. The survey contractor is advised to liaise with the O&G company on the specific version of GIS software to be used.



### 4.5.2 Standard cartographic elements

As a general cartographic standard, a map document should have a map frame in layout/paper space and a map grid in real world/model space.

The following cartographic elements are recommended as minimum:

- Map title
- Legend
- Scale bar and relative scale
- North arrow
- Document control table including but no limited to Originator, Checker, Approval, and Revision Number and Date
- O&G company Document Reference Number, Project/Job Number
- Geodetic and projected CRS graticules and grids including labels
- Horizontal and vertical CRS including EPSG code and name
- Unit of Measurement Conversion Factor, e.g. Metre-Feet conversion factor
- The intended hard copy sheet size, such as A1, A2, A3, etc.
- File path and file name.

### 4.5.3 Topology rules

Survey contractor should observe the following topology rules during compilation of GIS data:

- No unresolved node errors or line segment intersections
- Line features should contain neither under-shoots, over-shoots, nor duplicate entities
- Unnecessary line splits should be removed and only occur at nodes and logical intersections
- No polygon slivers, no self-crossing polygon boundaries, no polygons with negative area
- No open polygons; all polygon features must be closed
- Line features, including contours should not be broken or gaps inserted for the sole purpose of placing a label.

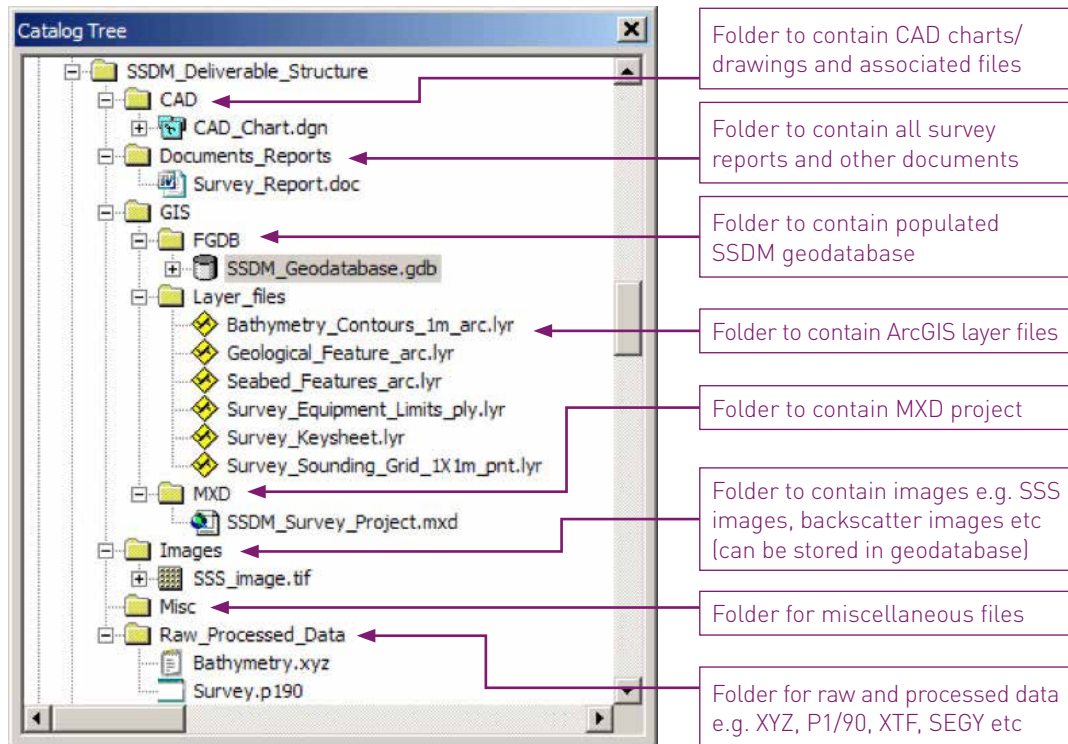
#### 4.5.4 Raster and Geo-Referenced Imagery

Survey contractor should observe the following rules during compilation of raster data sets:

- NO-DATA values should be set to No Data, RGB(0,0,0) or RGB(255,255,255)
- NO-DATA values should not be found inside image data area
- Include any associated digital elevation models, world files, and other files that may have been used for registering and rectifying as part of the delivery
- Include un-rectified source imagery as part of the delivery.

## 5. Data delivery folder structure guidance

A recommended folder structure for the seabed survey data deliverables on portable storage devices (CD, DVD, HD or USB) is illustrated in Figure 12.



**Figure 12:** Folder structure for data delivery

The directory structure enables the delivery of all data sets from a seabed survey including the GIS deliverable (ESRI geodatabase, MXD, layers etc), CAD deliverables, survey/processing reports and survey data formats such as SEG D/ SEG Y, XTF, GeoTIFF images, positioning data, Bathymetry XYZ/BAG files, etc. This enables all hyperlinks within the geodatabase feature classes to be set up using relative path names within this structure.

## 6. Governance, version management and contractor feedback

The governance and version management of the SSDM model is under the custodianship of the IOGP Geomatics Committee, Geo-information Subcommittee. If, in the process of delivering survey results and data in the SSDM format, the survey contractor experience issues with the model, they are encouraged to feed this back to the IOGP Geomatics Committee or via their client. To provide any feedback direct to IOGP please contact IOGP Geomatics and Metocean Committee Manager Lucyna Kryla-Straszewska ([lks@iogp.org](mailto:lks@iogp.org)).

The maintenance of the SSDM will be considered as the process of supporting a data model after delivery to correct a problem/error in the existing data model and provide assistance, direction, coordination from 6 months to one year along with the delivery of documentation. After completion of the maintenance period, SSDM Task Force will be formally closed.

The enhancement of the SSDM will be considered as the process of modifying a data model after delivery intended to increase or decrease functionality and capability from the existing design. For enhancements to the SSDMv2 data model, clear scope will be defined and the participation and interest from the industry will be solicited again and formed as a new Task Force.

# Abbreviations

## CAD

Computer Aided Design

## CRS

Coordinate Reference System

## EPSG

EPSG was the acronym for the European Petroleum Survey Group. It is now known as the Geomatics Committee of the International Association of Oil and Gas Producers (IOGP)

## ESRI

Environment Systems Research Institute, Inc., developer of the ArcGIS suite of software products.

## E&P

Exploration and Production

## GIS

Geographic Information System

## Hatching

Hatches are line or marker symbols displayed (in ArcGIS layers) on top of features at an interval specified in route measure units.

## HR2D / HR3D Seismic

High resolution 2D or 3D seismic

## HRS / UHRS

High / Ultra-high resolution seismic

## LADS

Laser airborne depth sounder

## MBES

Multibeam Echo Sounder

## MXD

ESRI ArcMap Document

## O&G company

Oil and gas exploration and production company  
(also sometimes referred to as “Operator”)

## OGC

Open Geospatial Consortium

## IOGP

The International Association of Oil & Gas Producers

## ROV

Remotely Operated Vehicle

## SBP

Sub-bottom Profiler

## SSDM

Seabed Survey Data Model

## SSS

Side Scan Sonar

# References

ESRI, ArcGIS Pipeline Data Model Version 4.0, Technical Paper, 2007.

IOGP Seabed Survey Data Model – Frequently Asked Question (FAQ), Oct 2010.

ISO 19115:2003 – Geographic information – Metadata.

Please refer to the IOGP website <http://www.iogp.org/Geomatics#2521682-seabed-survey-data-model> to download the following documents and material:

- Data Model Template (ESRI and GML)
- Data Dictionary
- ArcGIS/ CAD Style File
- Sample Metadata Files
- IOGP Seabed Survey Data Model Task Force Discussion/Position Paper, June 2010.
- IOGP Seabed Survey Data Model – User and Contractor Guidelines, Oct 2010.
- IOGP Seabed Survey Data Model – ArcSDE Implementation Guide, Oct 2010.
- IOGP Seabed Survey Data Model – GN 462-03, *Interface between pipeline data models and the IOGP Seabed Survey Data Model*.

# Appendix A

A general guide for association between seabed survey data types and SSDM geodatabase feature classes are illustrated in the table below.

**Table 1:** GIS data requirements by data type

ID	Data Type	Deliverable Format	Equipment/Data Sources	Comment
1	<b>Survey Vessel and Sensor Tracks/Positioning Data</b>	SSDM (Proposed Survey Sail Lines, Survey Track lines) OGP P1/11 format	O&G company to provide proposed sail lines.  Contractor to provide survey track lines and vessel and sensor positioning data.	This is required for all equipment used during the survey e.g. MBES, SSS, SBP etc. Shot points/ fix positions should be embedded as "M" values within the survey track lines feature class (see section 4.1.1)
2	<b>Survey Chart Extents</b>	SSDM (Chart Index)	Contractor to provide based on charts generated.	May include hyperlinks to the charts in PDF or other format.
3	<b>Survey Extents/Project Details</b>	SSDM (Survey Keysheet and Job Detail table)	O&G company to provide Survey project extent and unique survey activity identification number.  Job Details table also completed by operator with company numbers, contract numbers etc.	Survey Keysheet is the extent of a survey project.
4	<b>Survey coverage/limits per equipment type</b>	SSDM (Survey Equipment Limits)	Contractor to provide equipments areas of use polygons.	Usually determined from the outer limits of data sets e.g. SSS mosaic, bathymetry data.
5	<b>Seabed features, sediment classifications, subsurface geological features, geohazards</b>	SSDM (Seabed Features, Sediments, Geological Feature, Acoustic Anomaly, Fault, Paleo Channel System)	Interpretation of data from SSS, MBES, Sub-bottom profiles, HRS/HR2D/UHRS/HR3D, magnetometer	Usually involves data exchange with the processing and interpretation software.
6	<b>Water Column Sound Velocity Profile</b>	SSDM (TSdip Sample) Data spreadsheet (e.g. MS Excel)	Sound Velocity Profiler / Sensor	
7	<b>Seabed Sampling &amp; CPT</b>	SSDM (Geotechnical Sample Point)  If applicable Geotechnical Factual Report.	Soil Sampling and CPT equipment	SSDM only capture sample location and brief description. Laboratory testing results and core sample descriptions are handled separately and beyond the scope of SSDM.



ID	Data Type	Deliverable Format	Equipment/Data Sources	Comment
8	<b>Bathymetry (MBES/SBES)</b>	SSDM (Bathymetry Contours, Survey Sounding Grid) and ESRI Raster or Terrain Data sets  Proprietary Sensor / Vendor data logging format  Bathymetry Attributed Grid (BAG)  ASCII XYZ (raw and processed) and ASCII KP,X,Y,Z for SBES route surveys	MBES, SBES, LADS	The ASCII XYZ files includes the records: easting (m), northing (m), depth (m), space or comma delimited to at least two decimal places.
9	<b>Side Scan Sonar Data</b>	ESRI File Geodatabase Raster data set, GeoTIFF or JPEG2000 of SSS mosaic (NO DATA = 0,0,0 or 255,255,255)  CodaOctopus (.cod); Extended Triton Format (.xtf) for sail line data	SSS	Both georeferenced individual SSS lines and SSS mosaic are accepted in the SSDM.
10	<b>Acoustic Backscatter Data</b>	ESRI File Geodatabase Raster data set, GeoTIFF or JPEG2000 of image mosaic (NO DATA = 0,0,0 or 255,255,255)	MBES, SSS	
11	<b>Seismic Data</b>	1. Raw data and processed data (SEG-D/SEG-Y) 2. Velocity profile data 3. SSDM (Line of Profile)	Single and multi channel seismic profiling equipment	Line of Profile feature class is to represent the location of a particular cross-section that has been interpreted from the seismic data. This can then be hyperlinked to the profile generated
12	<b>Interpreted Seismic Horizon</b>	SSDM (Isopach, Isochor) ESRI Raster or Terrain data sets  ASCII X, Y, Z (below seabed) file of the horizon	Single and multi channel seismic profiling equipment	Operator to provide seismic horizon and ASCII file naming conversion.

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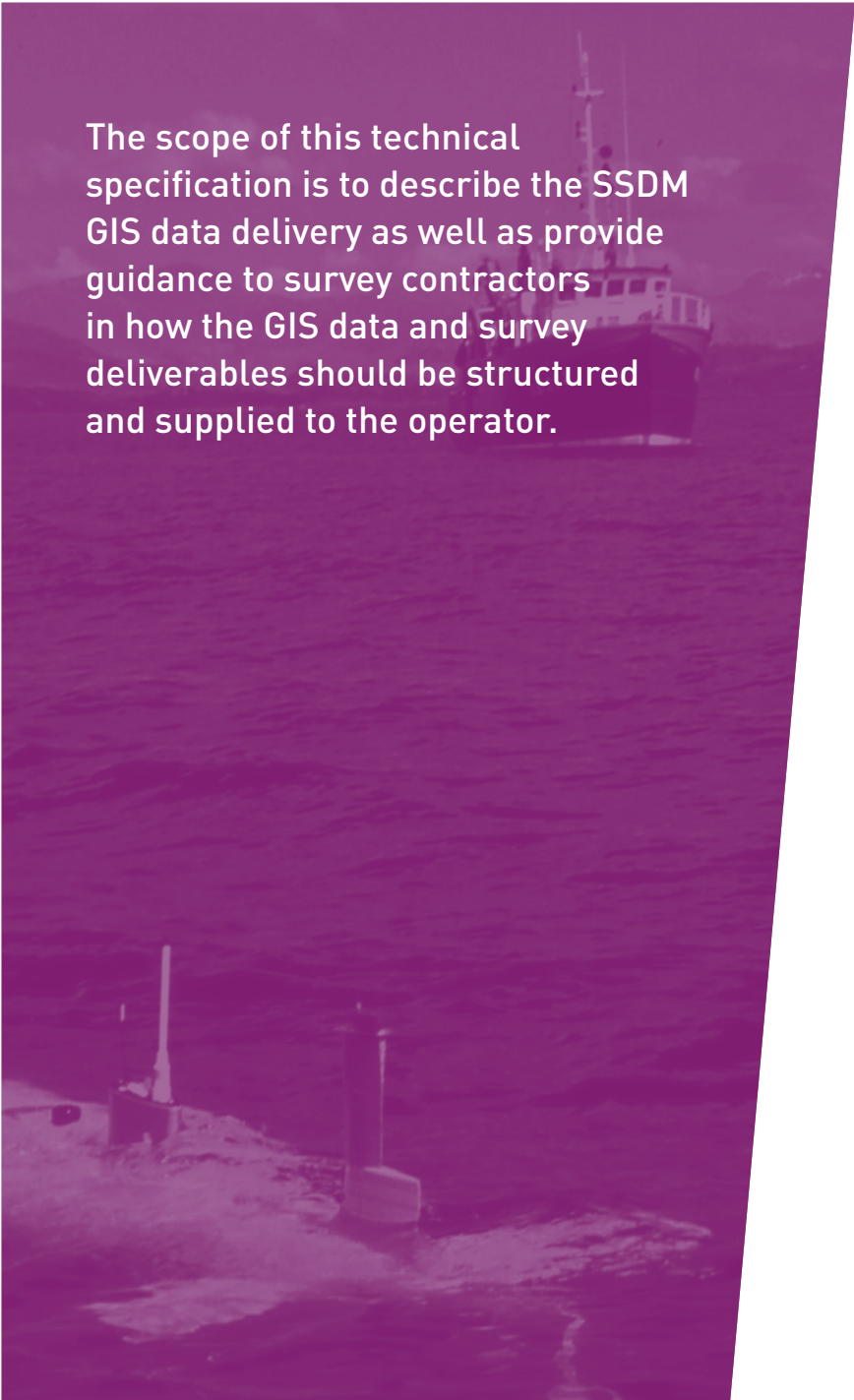
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The scope of this technical specification is to describe the SSDM GIS data delivery as well as provide guidance to survey contractors in how the GIS data and survey deliverables should be structured and supplied to the operator.