International Association of Oil & Gas Producers

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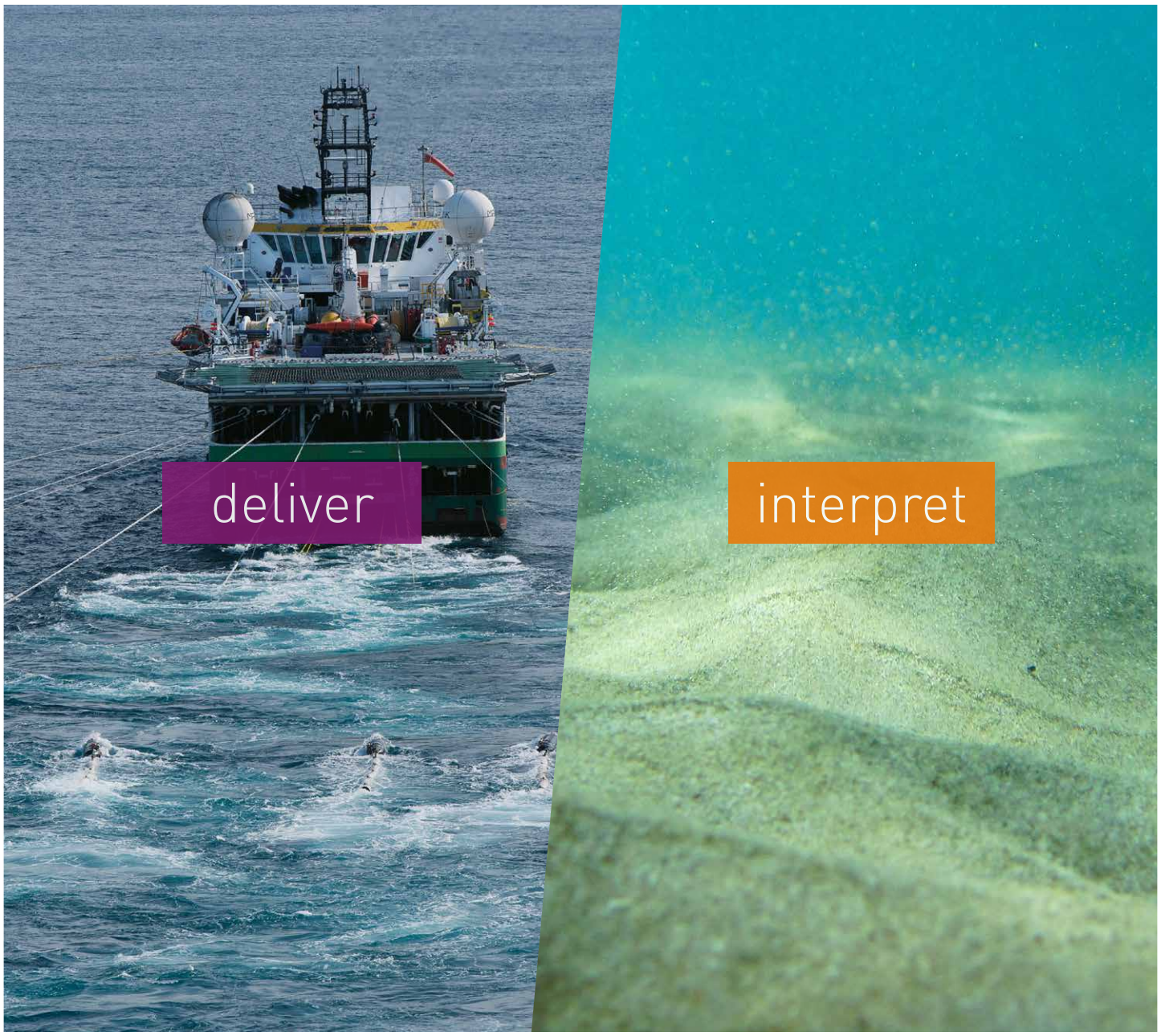
Guidelines for the use of the Seabed Survey Data Model



Acknowledgements

Seabed Survey Data Model Task Force members
Geo-Information Subcommittee members
Geodesy Subcommittee members

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Feedback

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Revision history

VERSION	DATE	AMENDMENTS
1.0	April 2011	Initial release
1.1	March 2013	Re-design of Figure 1 to match guidance note 462-02
2.0	January 2017	Release of version 2

Contents

Foreword

Exploration & Production (E&P) companies aim to manage seabed survey data based on sound geo-information management principles and practices. Historically, geographical features interpreted from seabed survey have been delivered in unstructured CAD files that have led to many difficulties in the management of survey data, including difficulty in integrating and sharing data from different surveys with joint venture partners.

The IOGP Seabed Survey Data Model (SSDM) task force was formed in 2010 to define a standard GIS data model for seabed surveys. The SSDM template is provided in ESRI geodatabase format as most oil and gas (O&G) companies widely utilize ESRI software for geo-information management and mapping and GML Schema for open data model implementation on any GIS.

1. Scope

This technical guidance note describes the Seabed Survey Data Model (SSDM), a specification used in oil and gas E&P industry in handling the delivery of various seabed survey datasets in GIS data format. The SSDM consists of the following material:

1) ESRI geodatabase template – a data model template to be used for the storage and exchange of GIS seabed survey data deliverables.
2) Data dictionary – a document which details and describes the different components of the SSDM geodatabase template and includes conceptual data model diagrams – used to help illustrate the architecture of the SSDM data model.
3) ArcGIS and CAD stylesheet – standardized symbology library for the features stored in the geodatabase. This can be used to create symbolized layer files and standardized maps.
4) User and contractor guidelines – basic guidelines for how O&G companies and survey contractors can utilize the SSDM.
5) ArcSDE SSDM implementation guide – guide for how to implement the SSDM data model schema into an O&G company's corporate database (ArcSDE). This complements the workflow where companies receive deliverables in a standardized template that can be loaded to the corporate database after the data is quality controlled.
6) Frequently asked questions document – a document that aims to answer the regular questions that are asked about the SSDM.

2. Areas of application

The SSDM models survey project details (extents, equipment coverage, tracklines etc.), hydrographical, shallow geophysical and geotechnical geographical entities and attributes. It includes surface and subsurface geologic hazards that are interpreted from seabed survey data.

At the present time, the main areas of the SSDM application are:

1) Seabed clearance and bathymetric surveys – side scan sonar, singlebeam/ multibeam echosounder, sub-bottom profiler, magnetometer, or various combinations of these systems.
2) Platform and drilling hazard site surveys – 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.

The role of the SSDM in pipeline inspection survey is limited, and existing data models (APDM/PPDM/PODS/Pipeline Operators Forum) for ROV inspection survey domain are available. It is recognized that seabed surveys are often carried out on or around existing infrastructure and installations in the field. The infrastructure and installation component is left undefined in the SSDM and the SSDM is expected to be used in conjunction with existing data models (e.g. APDM) that have been adopted by an O&G company, in order to capture the full range of acquired data and referenced data sets. Please refer to GN 462-03, *Interface between pipeline data models and the IOGP Seabed Survey Data Model*.

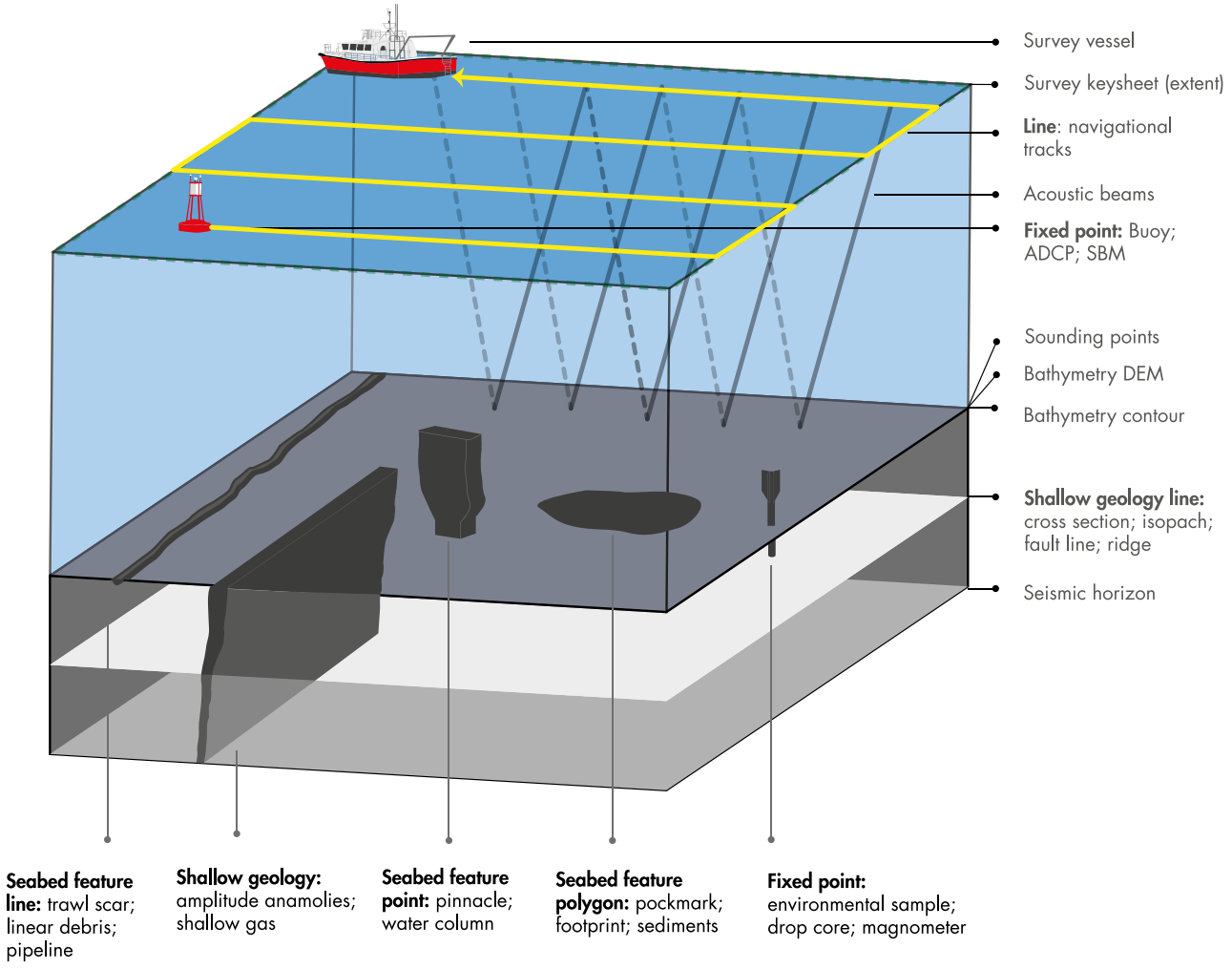

Figure 1: The conceptual framework diagram of the Seabed Survey Data Model

3. General recommendations

The following are general recommendations for the use of the IOGP SSDM:

Data Modelling and Government

1) The IOGP Geomatics Committee, represented by the IOGP SSDM Task Force, is the governing body for the IOGP SSDM. The Task Force defines the core data model and maintains a data dictionary (registry) of feature datasets, feature classes, domains and core symbology codes.
2) For an O&G company, the core SSDM *must* be implemented to constitute a valid IOGP SSDM implementation. However, O&G companies *may* extend the data model (feature datasets, feature classes, domains and feature attributes) to address their company-specific requirements.

Format of Data Exchange

1) The IOGP SSDM Version 2 template is provided both as ESRI geodatabase (XML Schema) and SeabedML (GML application schema).

Application Tools

1) There are no restrictions on the use of GIS and CAD systems, as long as they fully support the IOGP SSDM.

Symbology

1) The IOGP SSDM Task Force provides a core list of the symbology codes and associated symbology styles in CAD and GIS format for the SSDM feature classes.
2) O&G companies may extend the symbology codes and define their own cartographic symbology for the existing core codes and new codes.

Metadata

1) ISO 19115 metadata standard is recommended but O&G companies may choose a specific metadata standard in conjunction with their native GIS data format.
2) The IOGP SSDM provides a minimum set of feature level metadata. O&G companies may extend the feature level metadata to meet their requirements.

4. Data dictionary

The SSDM data dictionary provides the detailed definition of each Feature class, Object class and associated domains in the SSDM.

The SSDM data dictionary is available on IOGP website:
http://www.iogp.org/Geomatics#2521682-seabed-survey-data-model

5. Data Model Template

SSDM Schema contains thirty-eight objects setup into four feature datasets (survey measurements, seabed features, interpreted shallow geology and environmental samples).

Please refer to the SSDM data dictionary for a detailed description of the schema.

The SSDM schema is provided by the IOGP SSDM Task Force in the following formats:

- Enterprise Architect Project File (.eap)
- XML Schema (.xml file)
- ESRI file geodatabase (.gdb)
- GML Schema (.xsd)

Enterprise Architect Project File

SSDM version 2 was designed using UML profile for ArcGIS/GML in Enterprise Architect that is exported to XML Workspace document for physical implementation.

.EAP file is the source file for xml, .xsd, logical and conceptual diagrams and data dictionary for SSDM.

XML Schema

ArcGIS XML file is provided for physical implementation in any Esri Geodatabase (.xml file)

Esri File Geodatabase

Esri File Geodatabase is provided as an example of the physical Implementation of SSDM.

All coordinates in SSDM reference a single horizontal and vertical Coordinate Reference System.

All feature datasets in the provided template SSDM geodatabase are setup using the WGS 84 (EPSG::4326)

Please note that the type of geodatabase and the CRS to which the feature datasets are referenced can be altered as per individual O&G company requirements. This is achievable using the tools provided in ESRI ArcCatalog or defining the CRS System within the Enterprise Architect for export into ArcGIS XML schema.

The identification of indirect (EPSG – full OGC URN string) and direct description (Well-known text (WKT)) of the CRS for the whole model will be defined as string text in the attribute fields of T_Survey_JobDetails table. Please refer to the SSDM data dictionary on detailed description of the schema.

Note: Although a CAD template has yet to be provided by IOGP, the O&G company may choose to implement the data model on their selected CAD system capable of using a GIS data model, and provide their CAD-based SSDM template to the survey contractor.

6. The use of the SSDM template

The SSDM template is typically used in the following manner:

- The O&G company implements the core IOGP SSDM template, and extends the template when necessary to include additional attributes, topology rules, and relationship classes, which can be company-specific. The O&G company then issues the template to their survey contractor for a particular survey project or can embed it in their deliverable specifications (as part of a survey contractor framework agreement) so that it can be used routinely.
- The survey contractor first renames the template for the survey project, and populates the SSDM geodatabase either directly, or by data loading from other charting tools (e.g. CAD), and then completes the attribute entries. This is usually done by a GIS/CAD specialist. The geodatabase file is then submitted to the company together with other external files and data types, such as CAD drawings, XYZ, sonar images and SEG-Y.
- The same process is repeated for each survey project.
- At O&G company level, as well as for specific survey projects, the SSDM can be used as a template for implementation on a corporate GIS database, such as the ArcSDE geodatabase.

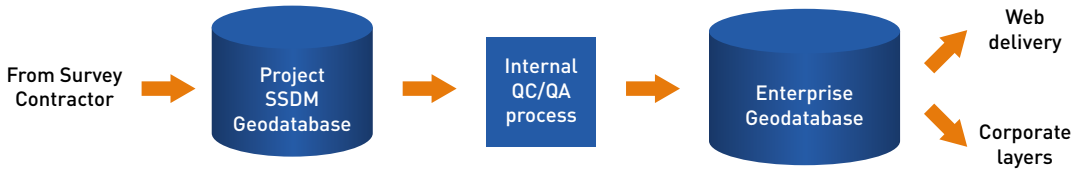

Figure 2: The IOGP SSDM workflow from survey contractor to corporate delivery of seabed survey data

Please refer to the guideline documents on data loading and ArcSDE implementation.

Abbreviations

APDM
ArcGIS Pipeline Data Model

ESRI
Environment Systems Research Institute, Inc., owner of ArcGIS suite of software products

CRS
Coordinate Reference System

E&P company
Oil and Gas Exploration and Production company

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)

GIS/CAD
Geographical Information System/Computer-Aided Drafting

GML
Geography Markup Language

SSDM
Seabed Survey Data Model

O&G company
Oil and Gas company

OGC URN
Open Geospatial Consortium Resource Specific String

ROV
Remotely Operated Vehicle

UML
Unified Modeling Language

Glossary

Core SSDM, Core Model, Core Symbology Codes

The core SSDM is the complete data model as supplied by the IOGP Geomatics Committee, including all feature classes, tables and domains. This includes the utilization of the standard symbology codes. Without implementing these core components, the model will not be considered a valid IOGP SSDM implementation, because it won't easily translate to a valid IOGP SSDM, which defeats the purpose of having an industry standard data model.

High-resolution or Ultra-high resolution 2D/3D Seismic Survey

Also commonly referred to as **Digital Survey**. The technique is identical in principle to conventional marine Seismic, except that the energy source is much smaller, and the streamer is much shorter at between 600 to 1200 metres. Typically, one 2D streamer has 24 to 72 traces, 12.5 m short interval, and the record sample rate of 0.25 ms to 4 ms, 120 channels.

Instantiated

Instantiation is the creation of a real instance or particular realization of an abstraction or template such as a class of objects.

Polyline ZM

A polyline ZM feature class is a polyline feature class that is able to store X, Y, Z, and M values along the linear feature. In the SSDM for example, the tracklines feature class benefits from being ZM enabled so that the tracklines can be displayed in 3D. This also allows measure values to be stored within each trackline so shot point locations can be located and symbolized.

Primary key

The primary key of a relational table uniquely identifies each record in the table. In the case of the SSDM this is the Survey_ID (long integer) or Survey_ID_Ref (text) fields which are used to uniquely identify the survey project either by a unique number or alpha-numeric method.

Shallow Geophysical Survey

Also referred to as **Analogue Survey** and includes the use of singlebeam/ multibeam echosounder, side-scan sonar, sub-bottom profiler and magnetometer equipment, or combinations of these systems.

Site Survey

A site survey is carried out before a well is drilled, as an HSE, operational and regulatory requirement to have detailed seabed and shallow geophysical information around the well location for platform/template/manifold and drilling hazard avoidance. Also commonly referred to **Analogue and Digital Site Survey** where both shallow geophysical analogue systems (side-scan, sub-bottom, echosounder) and high-resolution (HR) seismic systems are deployed together.

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 462-02, *Guideline for the delivery of the Seabed Survey Data Model.*
- IOGP Seabed Survey Data Model – GN 462-03, *Interface between Pipeline Data Models and the IOGP Seabed Survey Data Model.*

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This technical guidance note describes the Seabed Survey Data Model (SSDM), a specification used in oil and gas E&P industry in handling the delivery of various seabed survey datasets in GIS data format.