Seabed Survey Data Model

OGP Geomatics Industry Day Overview

Gareth Wright, Woodside Energy

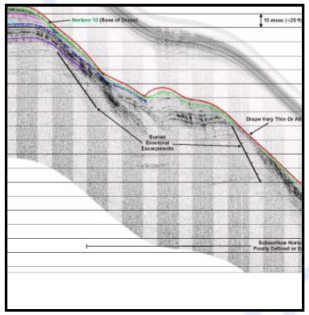
October, 2012

Seabed Surveys

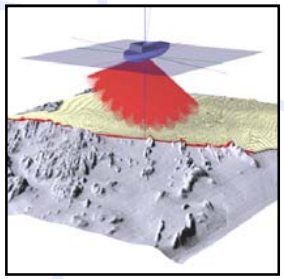
- O&G companies spend millions of dollars each year conducting:
  - Pipeline route surveys
  - Rig site surveys
  - Field development surveys
  - Debris surveys
  - Environmental surveys etc

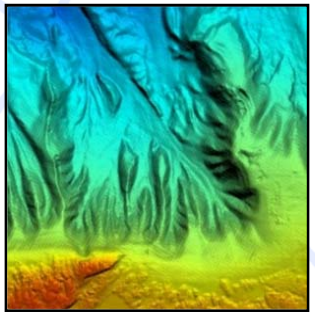
- The data acquired by these surveys is used for planning purposes, operational support and to manage risks

Sub-bottom profilers

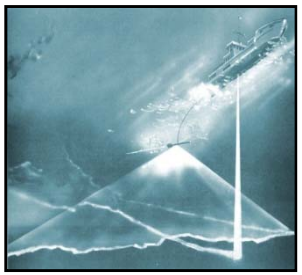


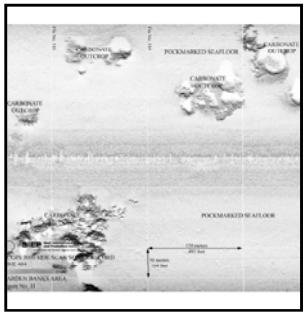
Multi-beam echosounders



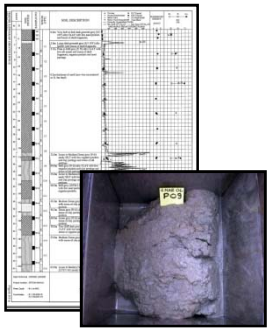


Side scan sonar





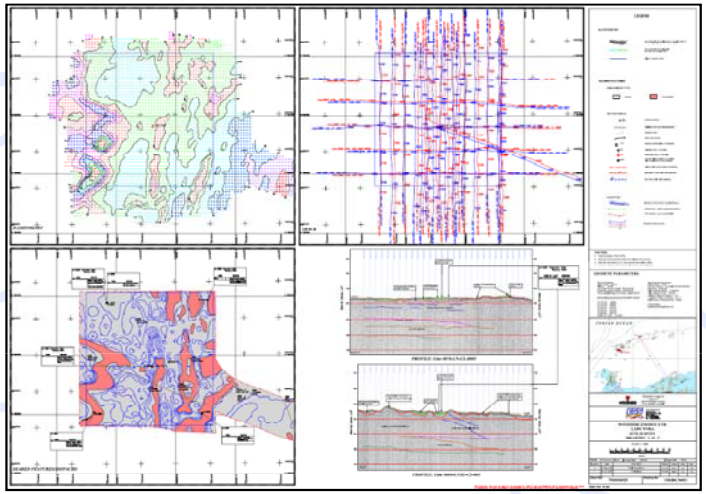
Geotechnical sampling

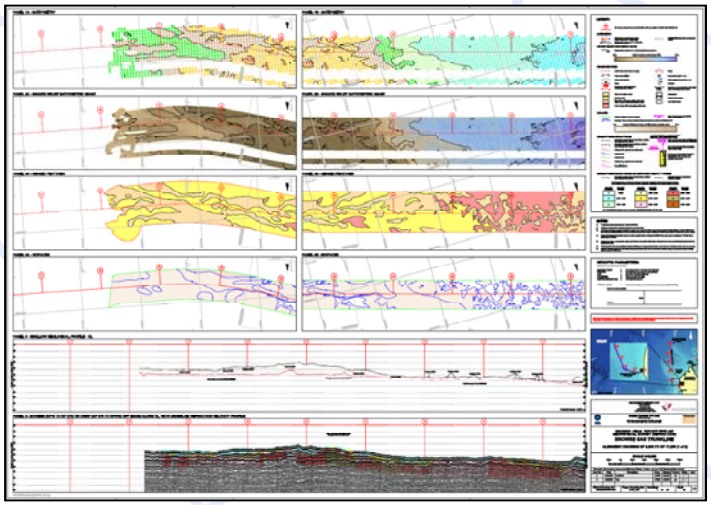


Source: ESRI PUG 2010 Presentation – Seabed Survey Data: Maximising Value (http://www.esri.com/events/petroleum-energy/pdfs/agenda.pdf)

Traditional Deliverables

Hardcopy maps, CAD files and immature GIS projects



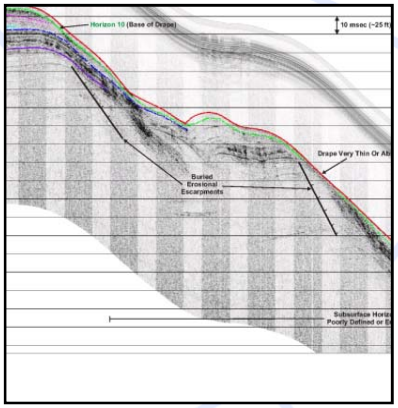


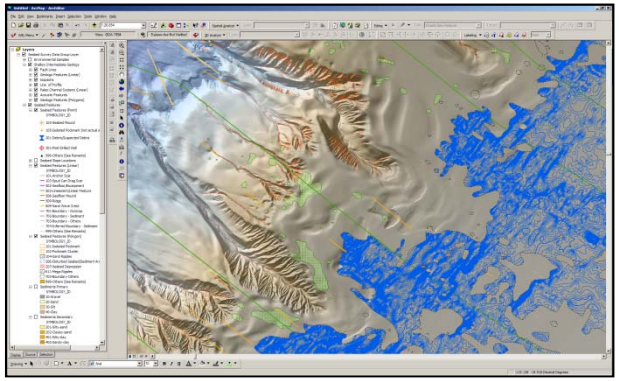
Survey reports

What is the SSDM?

- A GIS template for Seabed Survey industry
- Based on an ESRI Geodatabase format as ESRI ArcGIS this is the de-facto industry standard for spatial data management, mapping and GIS
- Provide core components typically used in Oil & Gas companies' offshore seabed surveys
- OGP SSDM effort is pioneered by Shell and Woodside
- Many surveys have been successfully delivered in SSDM

"Vision is for the industry to have a template/standard for how seabed survey data is delivered to and managed by oil and gas companies"



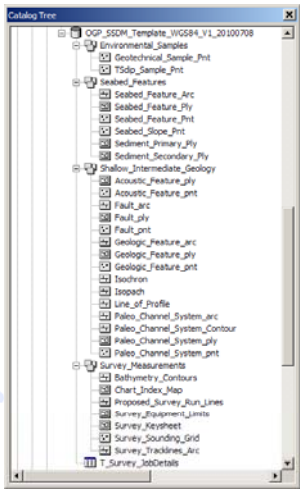


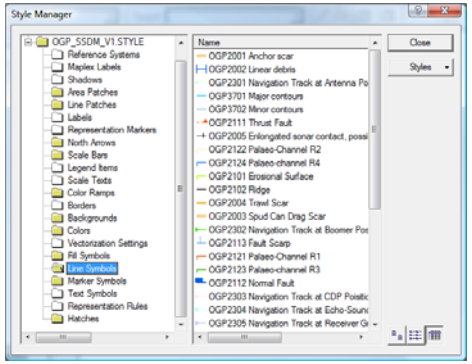
Why the need for the SSDM?

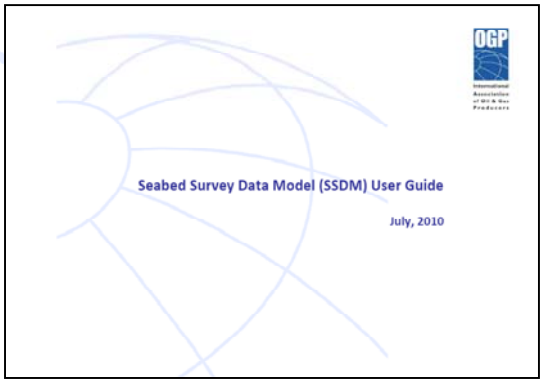
- Typically seabed survey data has been captured and delivered by survey contractors in unstructured CAD or GIS files:
  - Difficult and costly to manage internally
  - Difficult to integrate survey data
  - Difficult to share survey data with Joint Venture Partners
  - Lack of integration within business workflows
- OGP now proactively define structured data model for better data management.
- Driven by the principles of sound geo-information management, OGP endorsed the seabed survey data model (SSDM):
  - A complete survey data management workflow
  - Improved geohazards catalogue and interpretation knowledge base
  - Improved integration with geosciences software and data exchanges
  - Improved accessibility through spatial database engine and web services

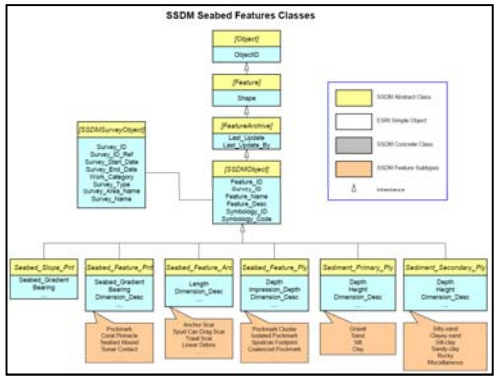
The SSDM V1 Material (Released in April 2011)

- ESRI Personal Geodatabase template
- Data Dictionary
- ArcGIS Stylesheet
- Conceptual data model diagrams
- User and contractor guidelines
- ArcSDE SSDM Implementation Guide
- FAQ's document
- OGP SSDM guidance note



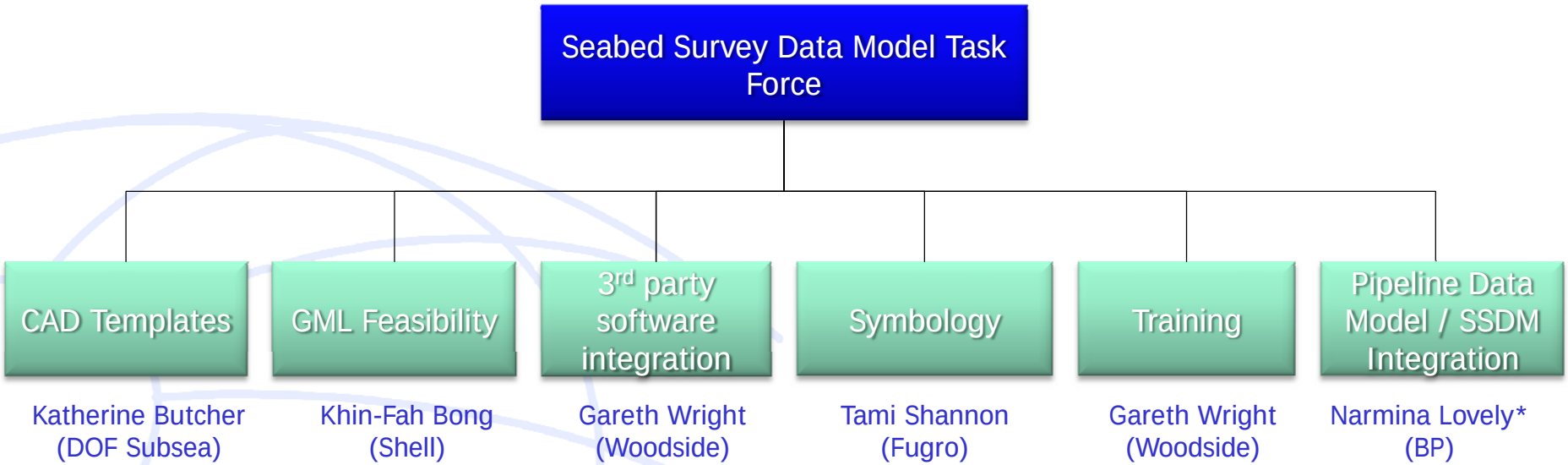






- OGP website: http://info.ogp.org.uk/geodesy/ssdm.html
- Now on Esri data model support page: http://support.esri.com/en/downloads/datamodel/detail/50

SSDM Task Force 2012-13



Task Force

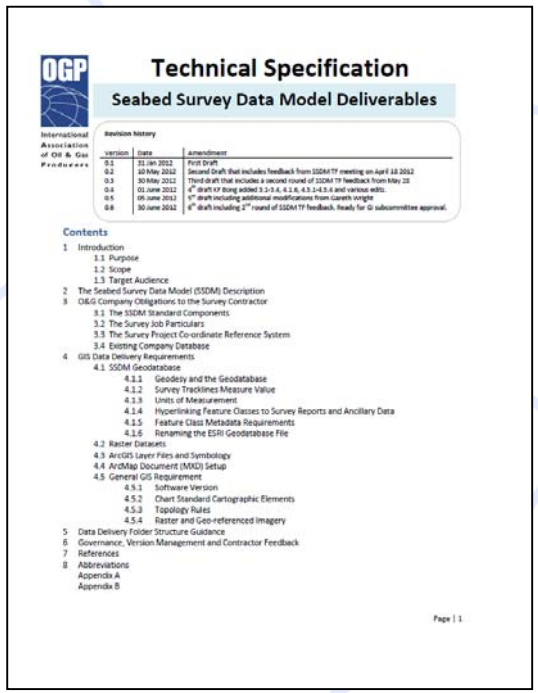
Sub-group

- SSDM Task Force Terms of Reference in place for these activities
- 2012-13 work program in place and task force sub-group leads are making good progress

** Janet Sinclair (PODS), Peter Veenstra (APDM) and Luke Hutmacher (PODS ESRI lead) will be involved*

2012-13 Deliverables

- SSDM Technical Specification
  - Designed to be used by O&G companies to embed into their survey contracts
  - Both O&G companies and survey contractors involved in the development of the document
  - Currently going through OGP approval process



Technical Specification

Seabed Survey Data Model Deliverables

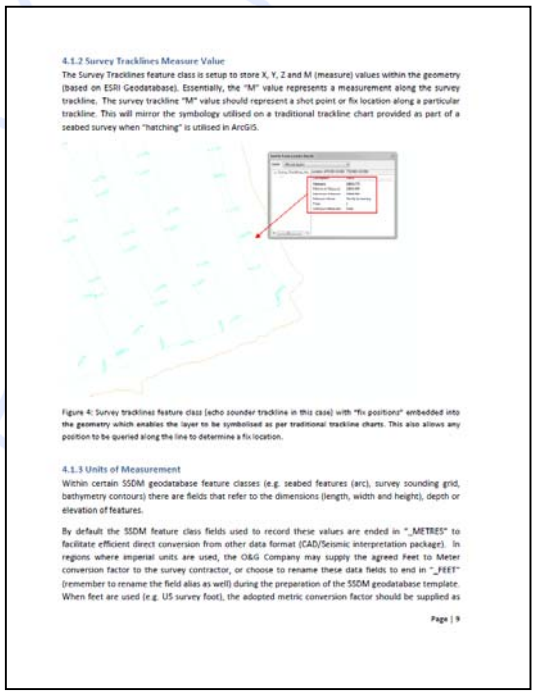
International Association of Oil & Gas Producers

Revision history

version	Date	Amendment
0.1	31 Jan 2012	First Draft
0.2	10 May 2012	Second Draft that includes feedback from SSDM TF meeting on April 18 2012
0.3	30 May 2012	Third draft that includes a second round of SSDM TF feedback from May 28
0.4	01 June 2012	4th draft KF Rong added 3.1-3.4, 4.1.6, 4.3.1-4.3.4 and various edits.
0.5	05 June 2012	5th draft including additional modifications from Gareth Knight
0.6	30 June 2012	6th draft including 2nd round of SSDM TF feedback. Ready for OGP subcommittee approval.

Contents

Page | 1



4.1.2 Survey Tracklines Measure Value

The Survey Tracklines feature class is setup to store X, Y, Z and M (measure) values within the geometry (based on ESRI Geodatabase). Essentially, the "M" value represents a measurement along the survey trackline. The survey trackline "M" value should represent a shot point or fix location along a particular trackline. This will mirror the symbology utilised on a traditional trackline chart provided as part of a seabed survey when "hatching" is utilised in ArcGIS.

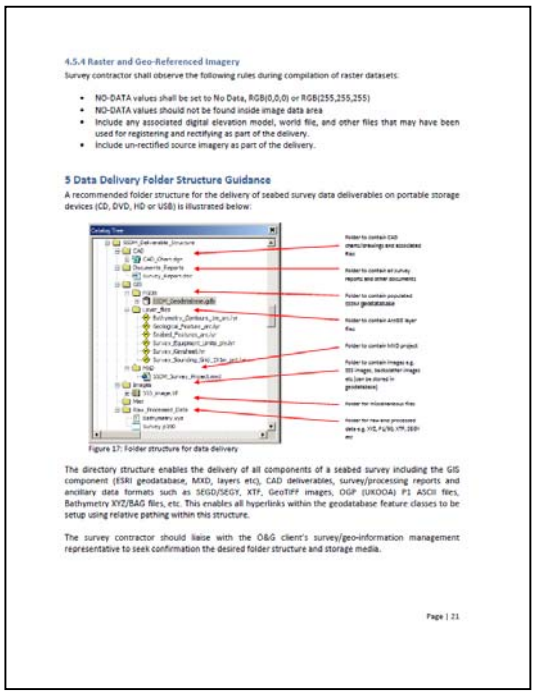
Figure 4: Survey tracklines feature class (echo sounder trackline in this case) with "fix positions" embedded into the geometry which enables the layer to be symbolised as per traditional trackline charts. This also allows any position to be queried along the line to determine a fix location.

4.1.3 Units of Measurement

Within certain SSDM geodatabase feature classes (e.g. seabed features (arc), survey sounding grid, bathymetry contours) there are fields that refer to the dimensions (length, width and height), depth or elevation of features.

By default the SSDM feature class fields used to record these values are ended in "_METRES" to facilitate efficient direct conversion from other data format (CAD/Seismic interpretation package). In regions where imperial units are used, the O&G Company may supply the agreed Feet to Meter conversion factor to the survey contractor, or choose to rename these data fields to end in "_FEET" (remember to rename the field alias as well) during the preparation of the SSDM geodatabase template. When feet are used (e.g. US survey foot), the adopted metric conversion factor should be supplied as

Page | 9



4.5.4 Raster and Geo-Referenced Imagery

Survey contractor shall observe the following rules during compilation of raster datasets:

- NO-DATA values shall 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 model, world file, 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 delivery of seabed survey data deliverables on portable storage devices (CD, DVD, HD or USB) is illustrated below:

Figure 17: Folder structure for data delivery

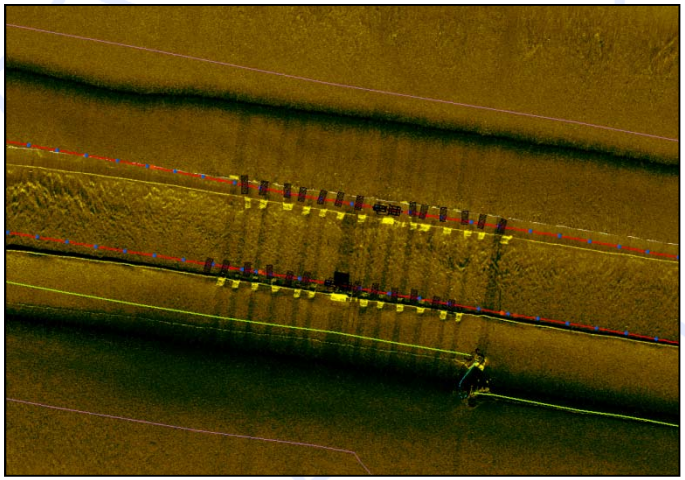
The directory structure enables the delivery of all components of a seabed survey including the GIS component (ESRI geodatabase, MXD, layers etc), CAD deliverables, survey/processing reports and ancillary data formats such as SEGD/SEGY, XTF, GeoTIFF images, OGP (UKOOA) P1 ASCII files, Bathymetry XYZ/BAG files, etc. This enables all hyperlinks within the geodatabase feature classes to be setup using relative pathing within this structure.

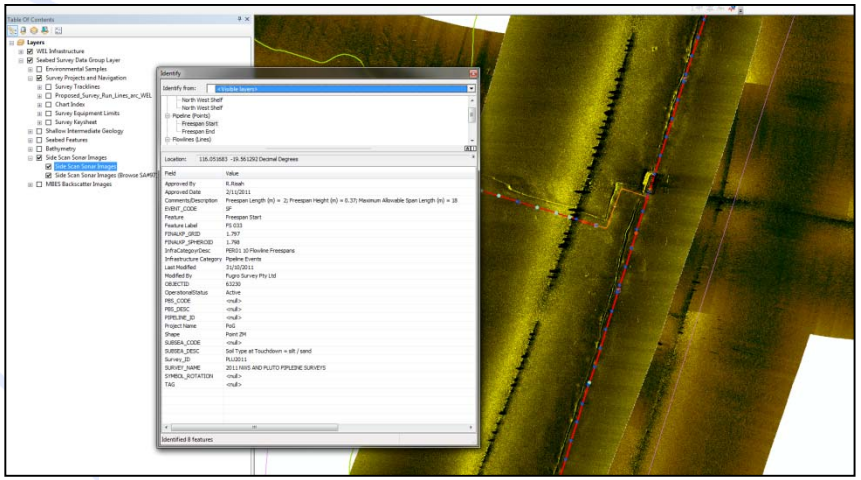
The survey contractor should liaise with the O&G client's survey/geo-information management representative to seek confirmation the desired folder structure and storage media.

Page | 21

The SSDM V2 Material (~2013 Release)

- SeabedML GML data exchange format
- CAD templates for MicroStation and AutoCAD
- Improved SSDM symbology stylesheet
- Refined geodatabase template (if warranted based on industry feedback)
- Example SSDM dataset and improved training materials
- Technical note on integrating the SSDM with industry pipeline data models e.g. PODS and APDM

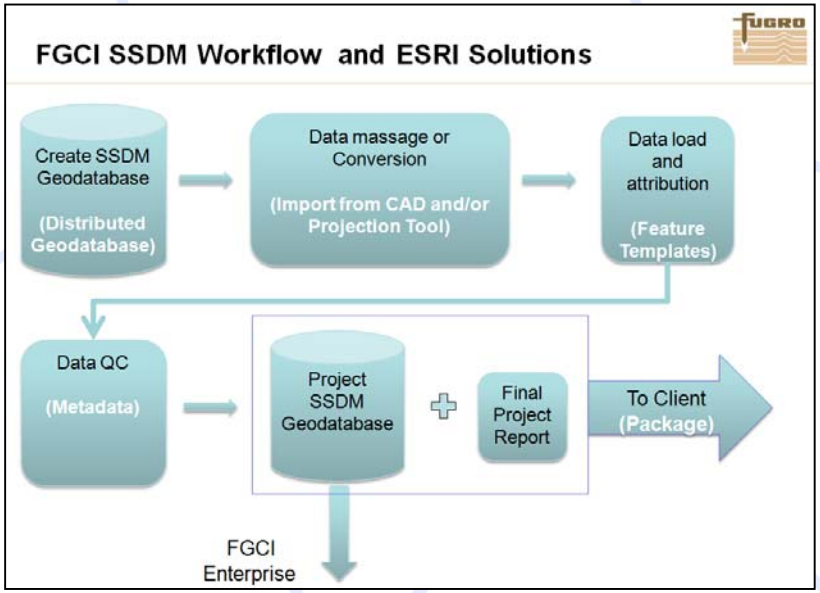


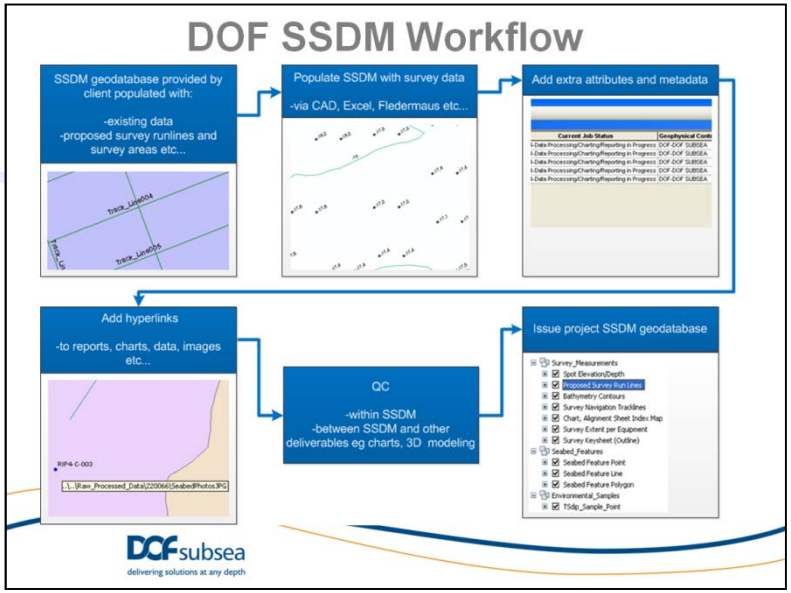


Integrating the SSDM with pipeline data models enables the SSDM to be used for as-built pipeline and pipeline inspection surveys

Global Survey Contractor Adoption

- Global survey companies are adopting the SSDM as the backbone to their survey data deliverables to clients
- A number of survey contractors are building scripts and tools to streamline the process of loading seabed survey data to the SSDM from their processing and interpretation software
- GIS capability within survey companies are matching the requirements of their clients SSDM deliverables

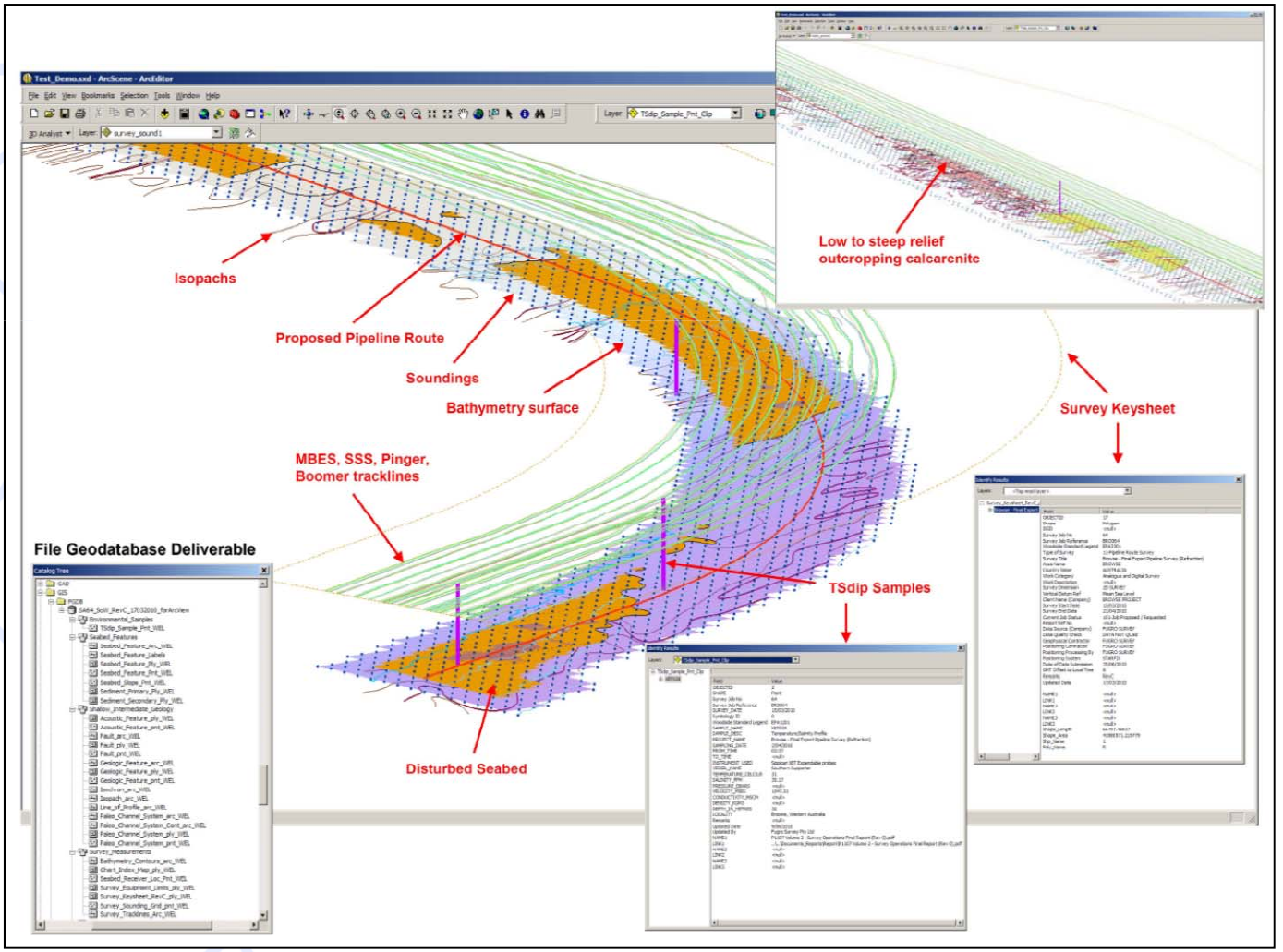




Source: 2012 ESRI UC presentation by Tami Shannon and Aaron Broughton (Fugro Geoconsulting, Houston, Texas) and DOF Subsea SSDM Workflow courtesy of Katherine Butcher (DOF Subsea, Perth)

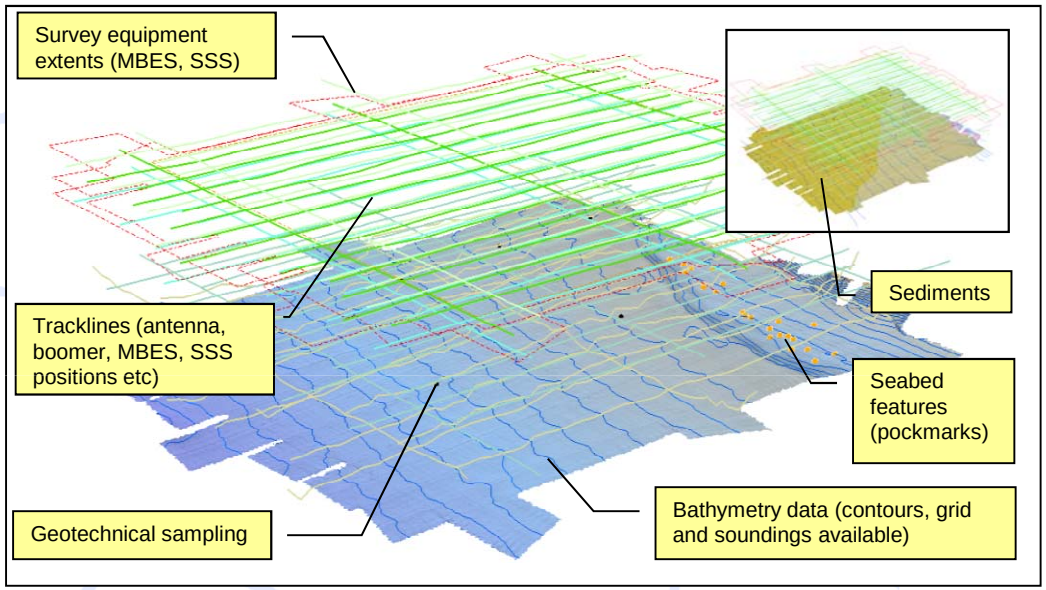
SSDM Examples

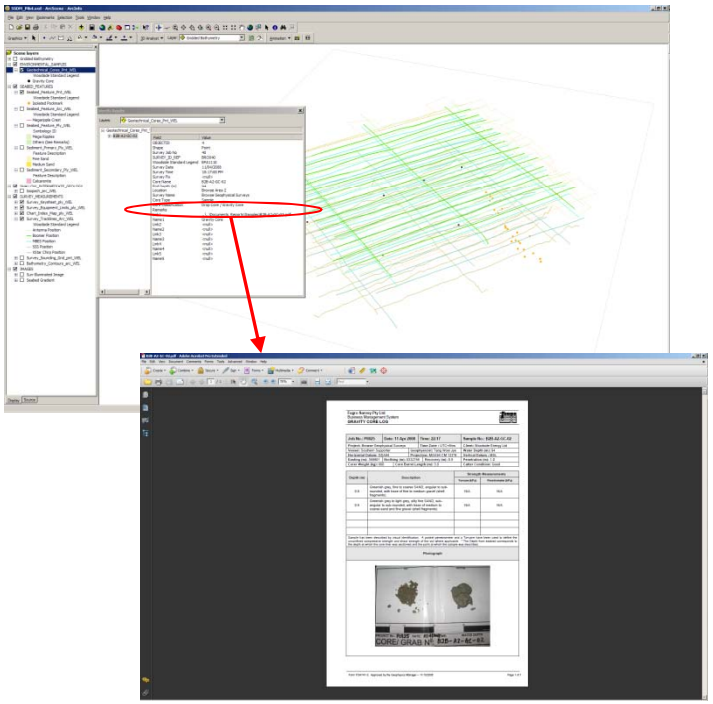
Proposed Pipeline Route Survey

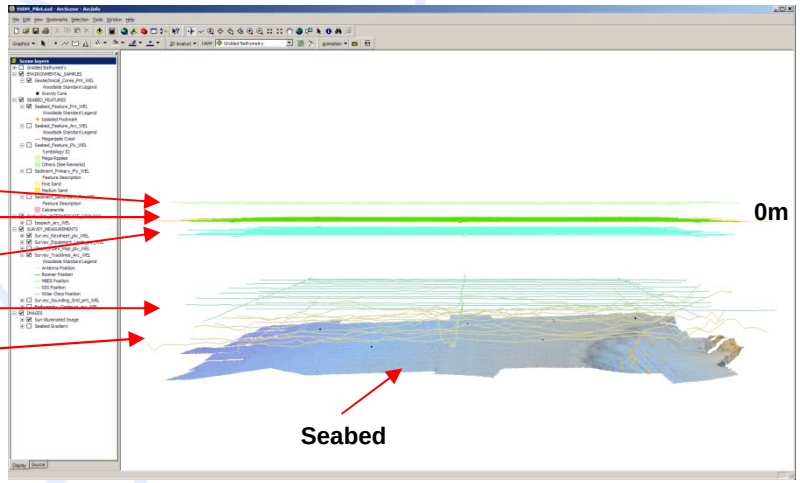


SSDM Examples

Proposed Platform Survey



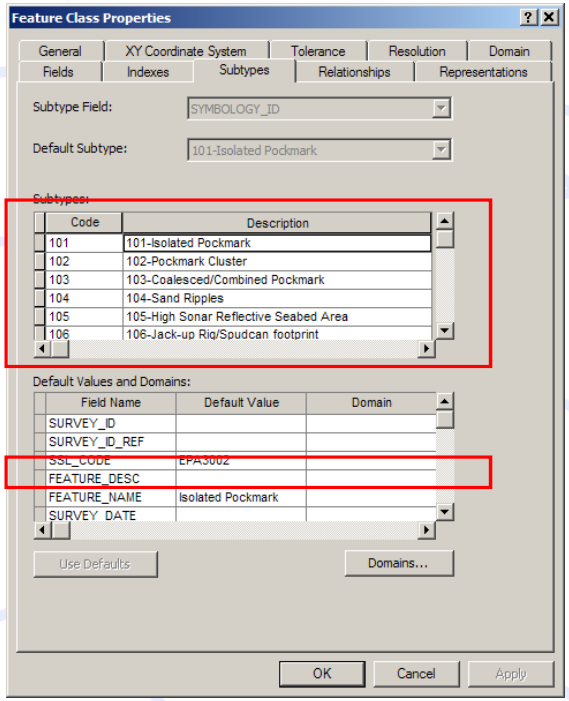




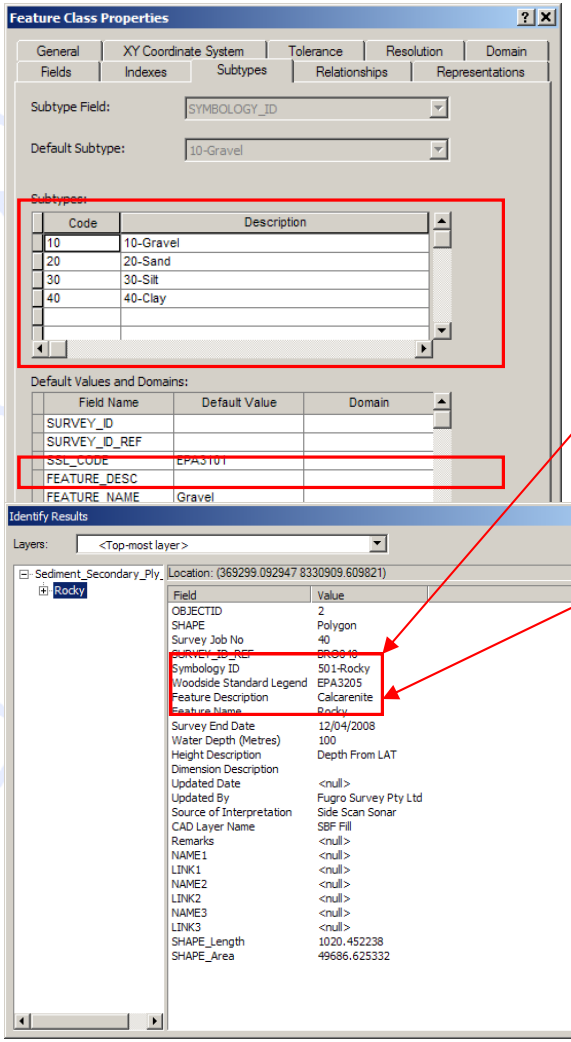
SSDM Examples

Consistency in data attribution

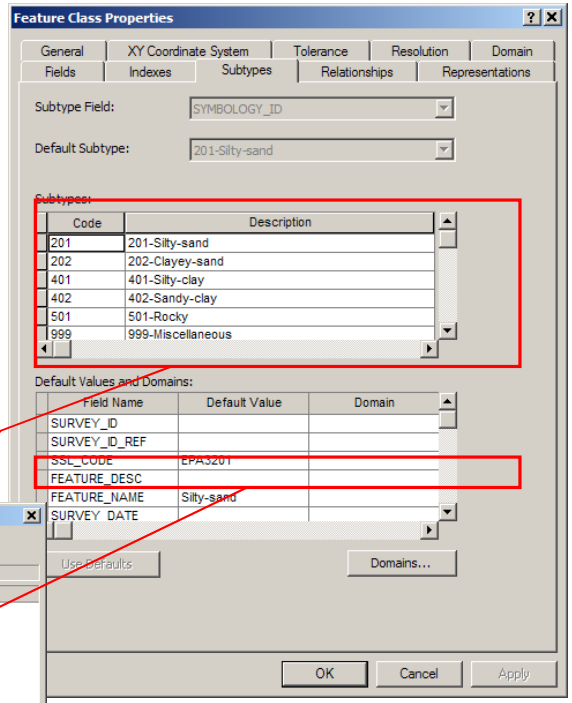
Seabed Features



Primary Sediment

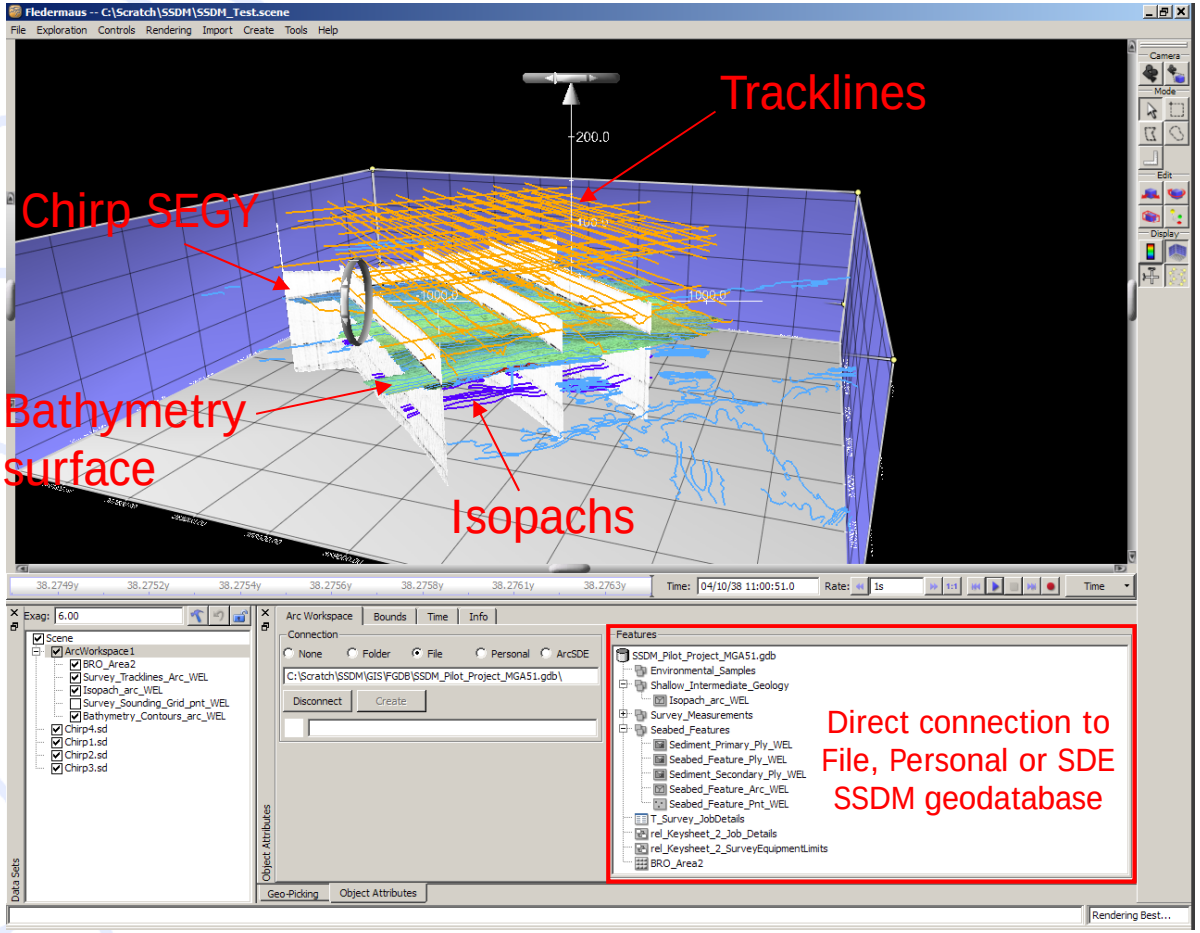


Secondary Sediment



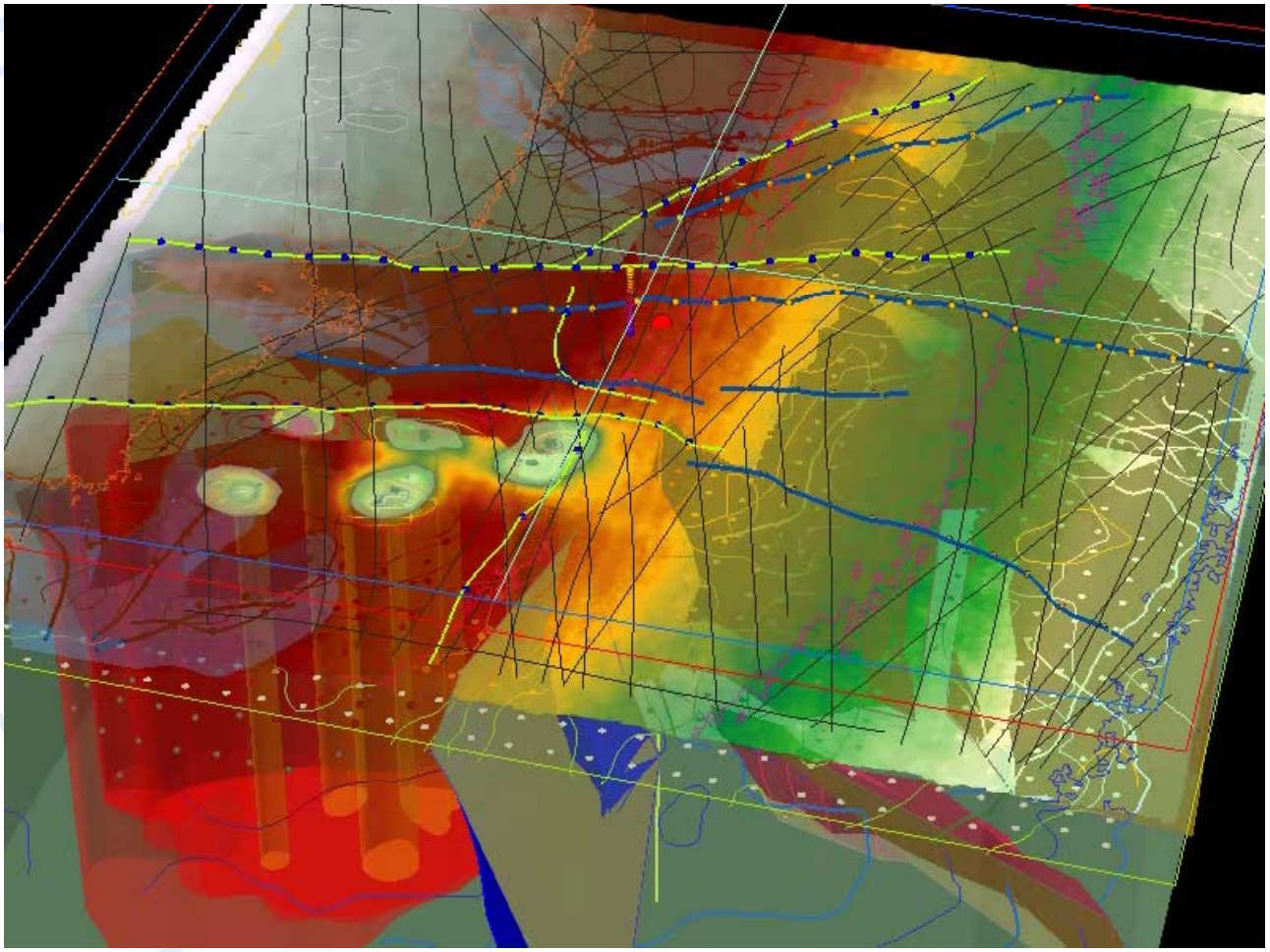
SSDM Examples

- Integration With IVS Fledermaus 7.2 for 3D Visualisation
- CARIS and CODAOctypus have expressed interest in supporting the SSDM
- A number of SSDM toolkits becoming available e.g. MariSoft, VisualGIS etc
- Consulting firms e.g. Exprodat provides history survey data conversion services



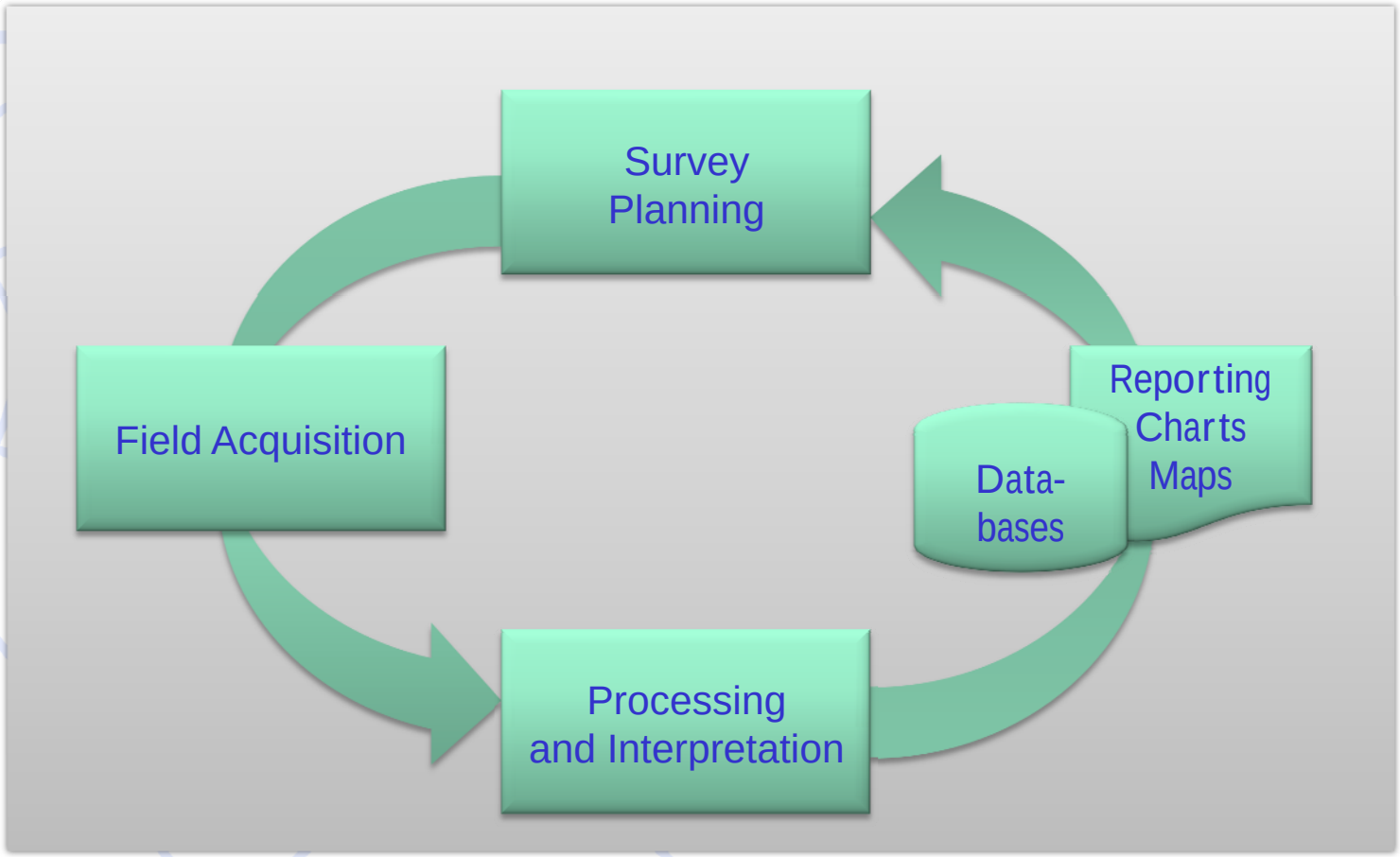
SSDM Examples

Site Survey Animation



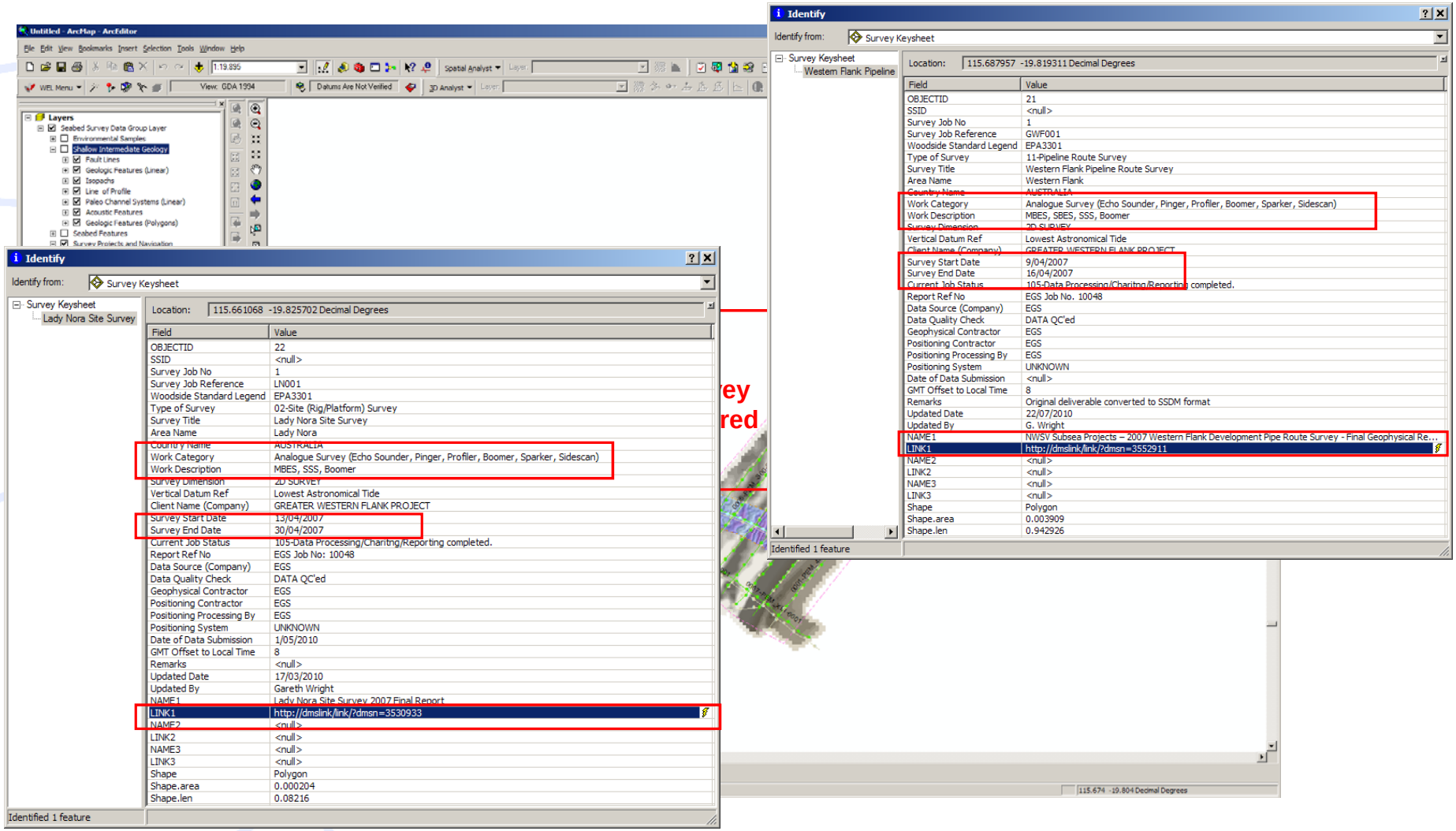
Seabed Survey Workflow

- SSDM provides a structured workflow for managing survey data

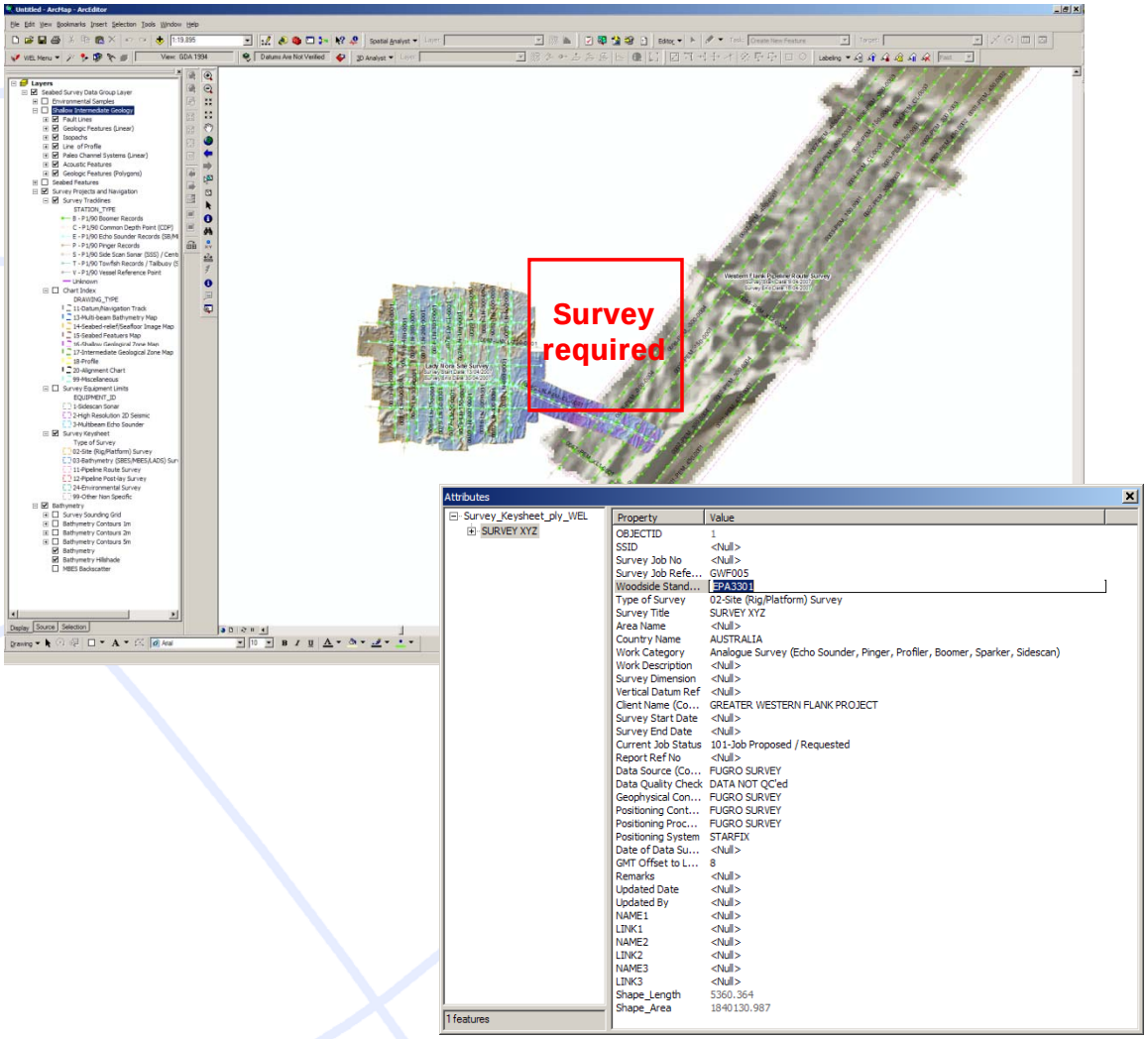


Survey Planning

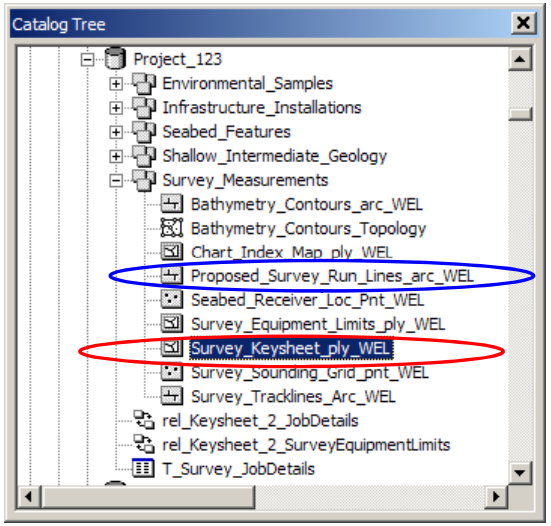
- What surveys have been undertaken previously and is this data adequate for the task at hand?



Survey Planning



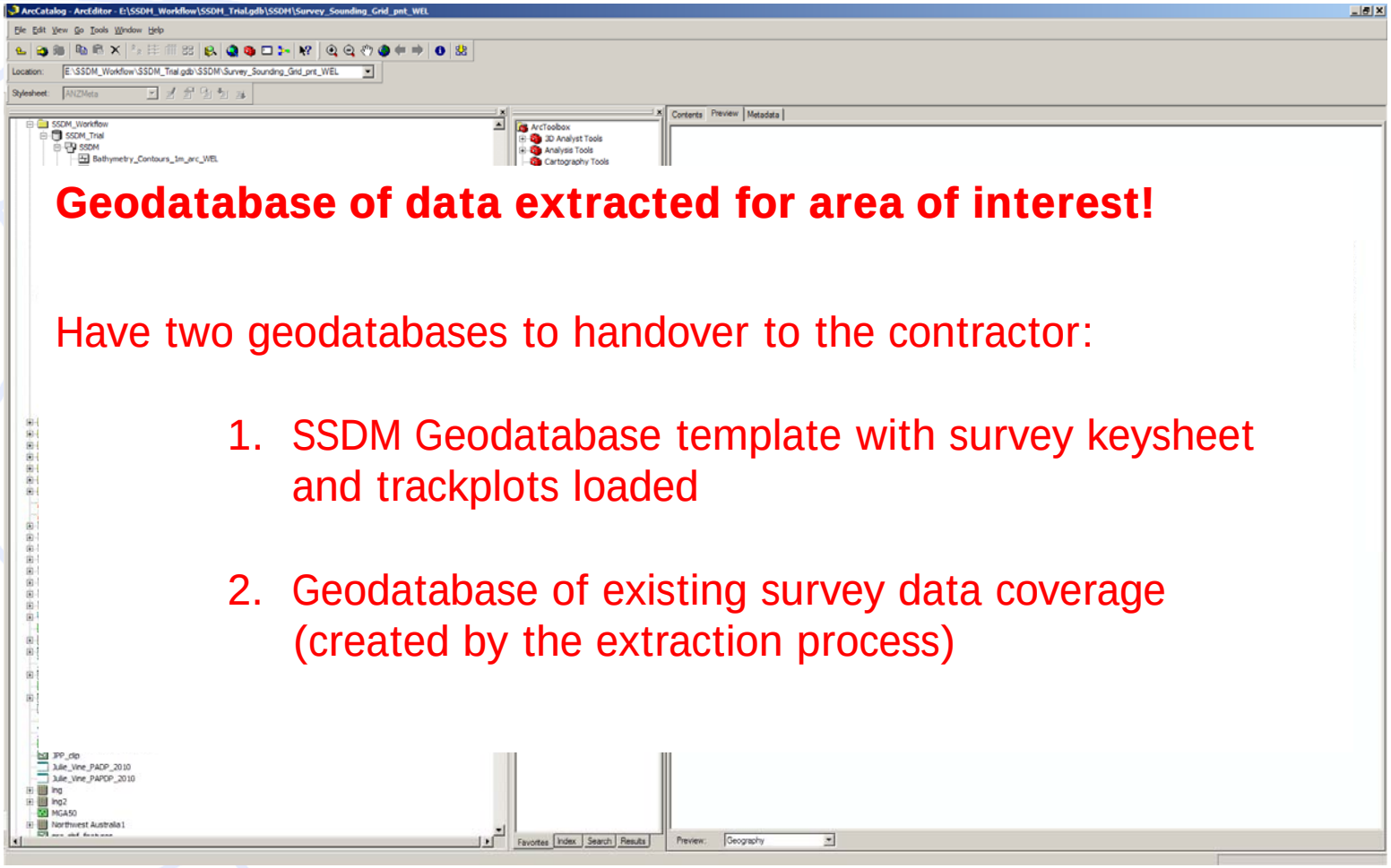
If proposed runlines are generated internally these can also be loaded to the proposed run lines feature class



Survey keysheet (survey extent) and survey details can be loaded e.g. survey name, survey type etc.

SSDM template used to load the runlines and keysheet can then be forwarded on to survey contractor to populate with data acquired by the survey

Survey Planning



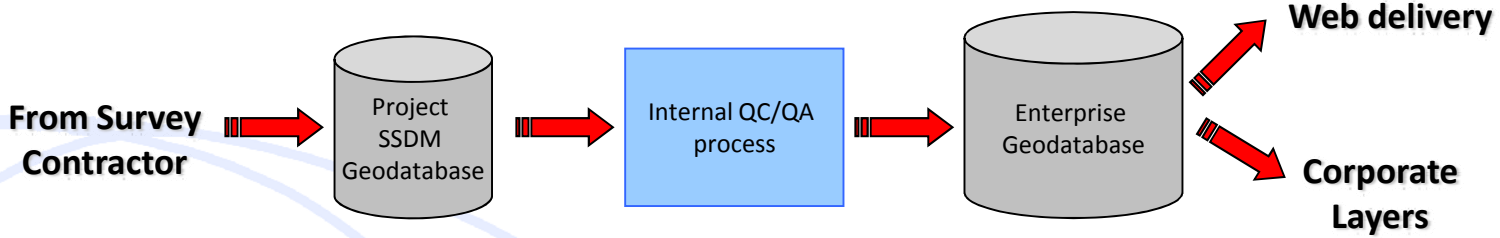
Geodatabase of data extracted for area of interest!

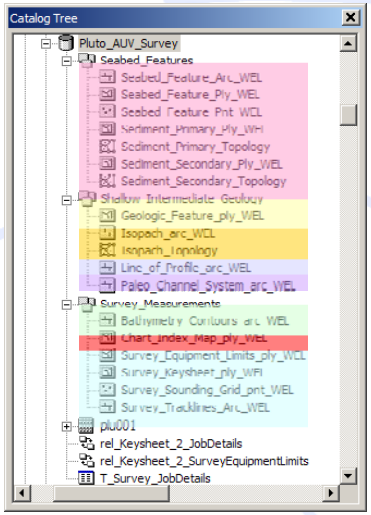
Have two geodatabases to handover to the contractor:

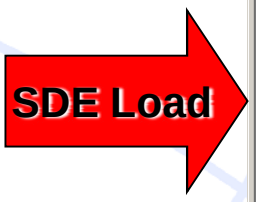
1. SSDM Geodatabase template with survey keysheet and trackplots loaded

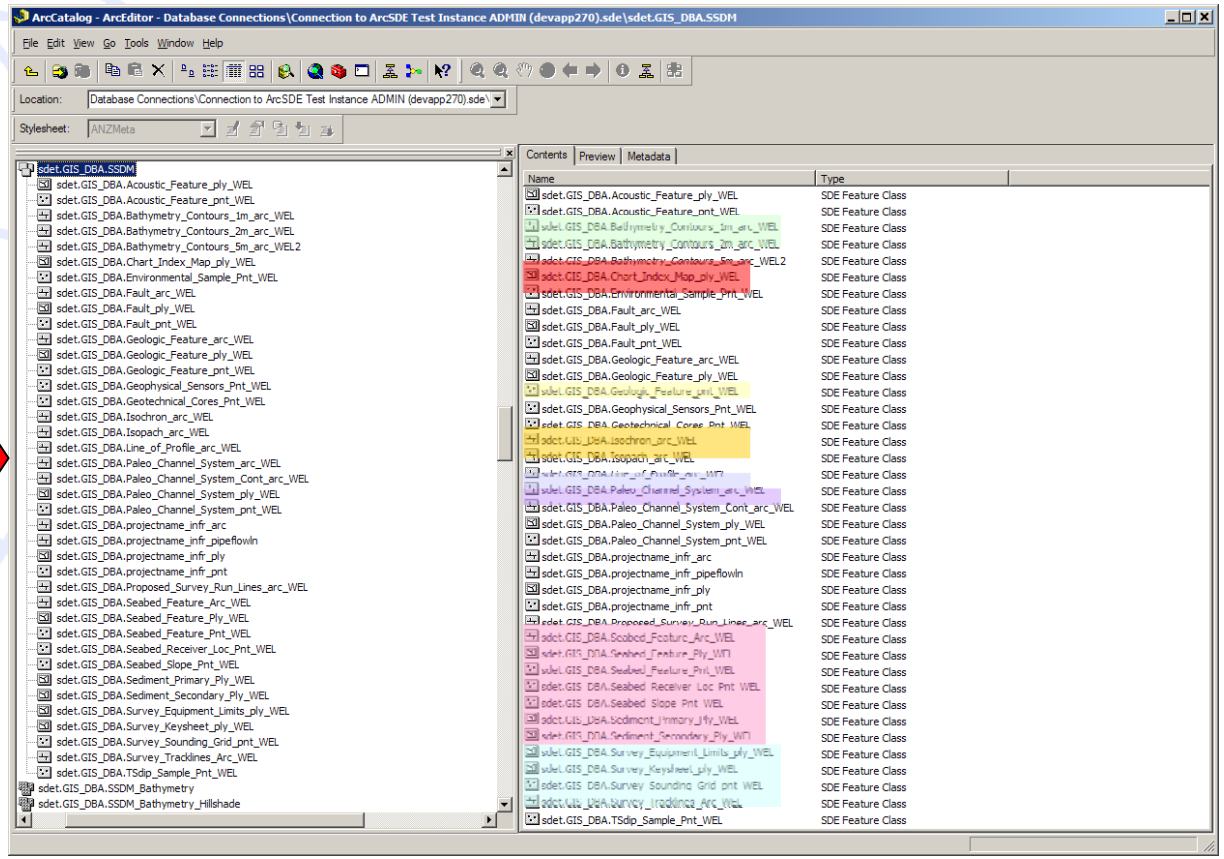
2. Geodatabase of existing survey data coverage (created by the extraction process)

Seabed Survey Workflow



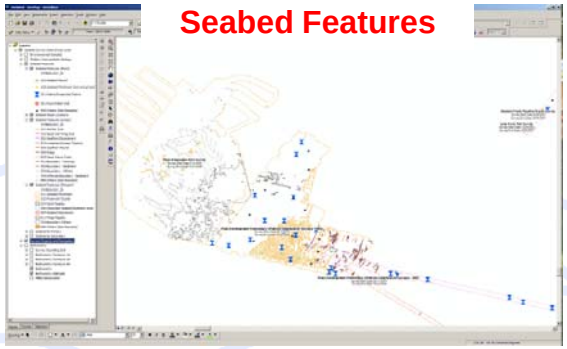




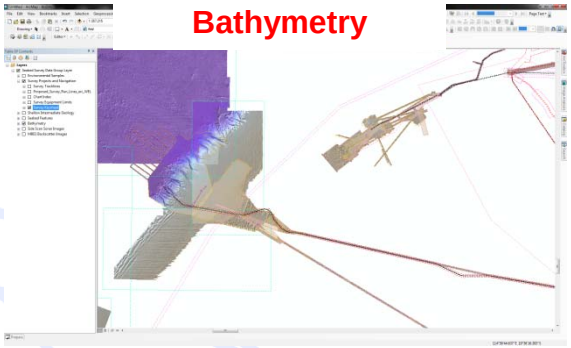


Corporate Seabed Survey Layers

Seabed Features

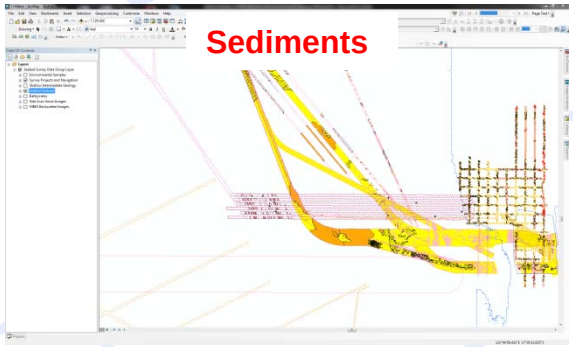


Bathymetry

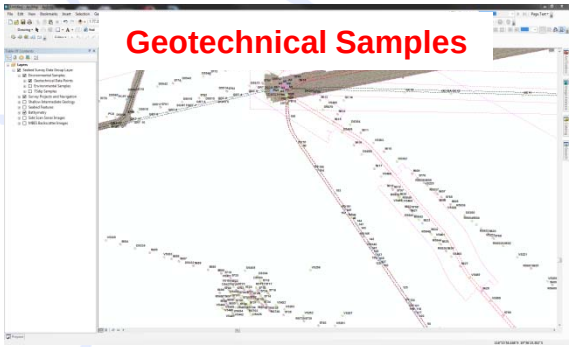


Side Scan Mosaics

Sediments

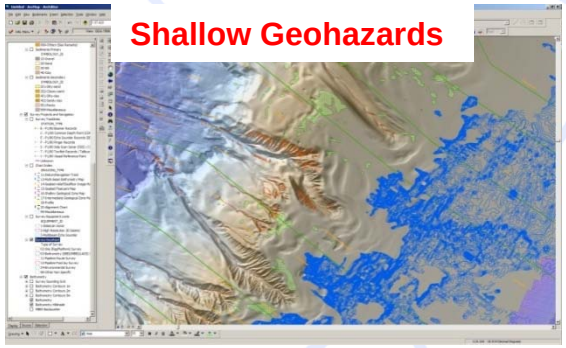


Geotechnical Samples

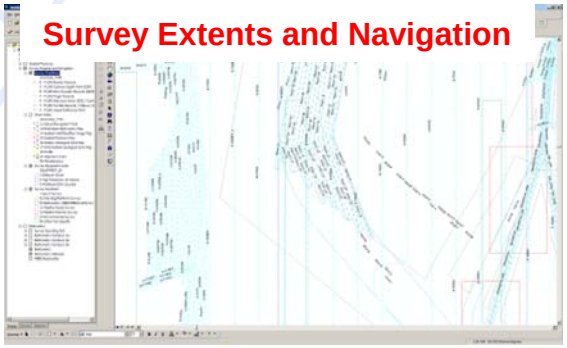


MBES Backscatter Mosaics

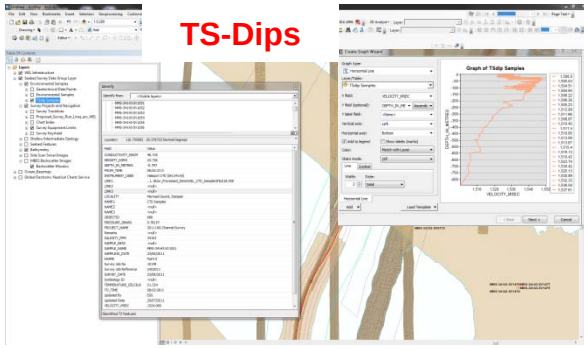
Shallow Geohazards



Survey Extents and Navigation

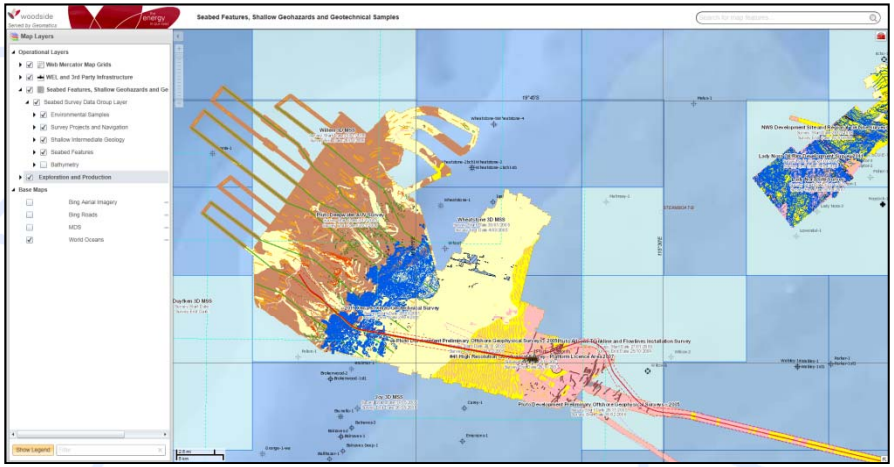


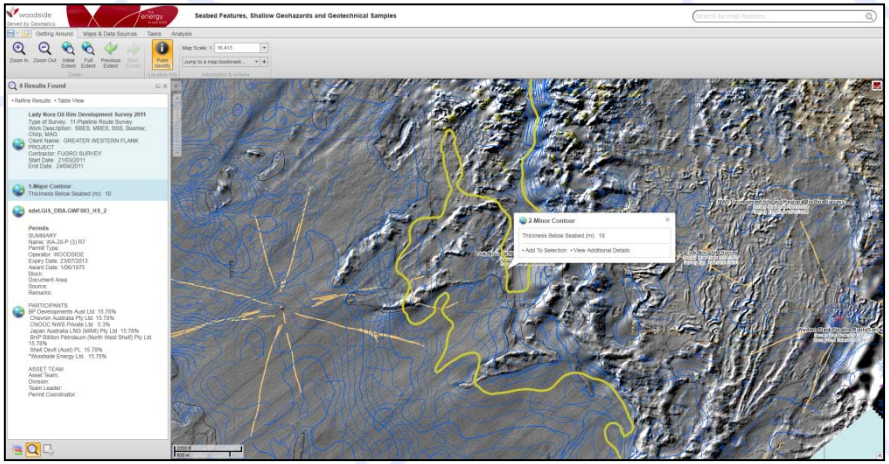
TS-Dips

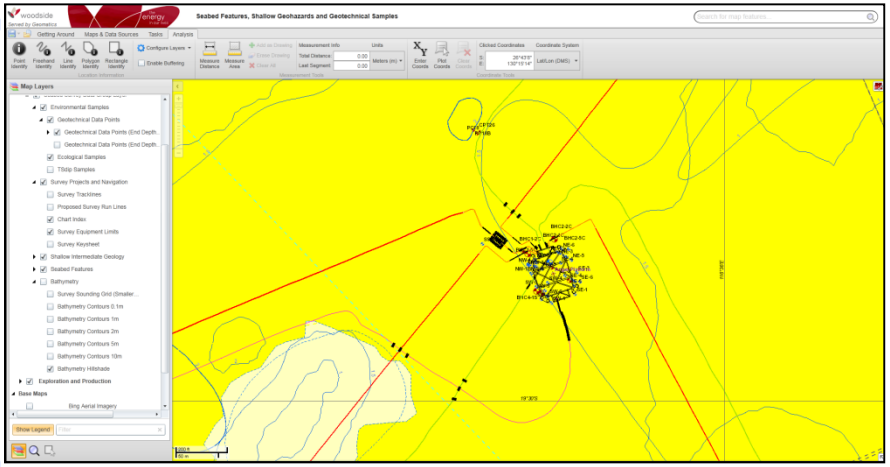


Web Maps

- Provide the data to the enterprise without the need for users to have ArcGIS Desktop e.g. drillers







Summary

- The SSDM provides a better framework for managing and utilising seabed survey data
- Better storage and management of seabed survey data provides huge business value to O&G companies
  - Operational support
  - Improves the efficiency of regional geohazards studies
- The SSDM has been proven to work through its use within Shell and Woodside
- SSDM has good survey contractor and software vendor support
- The OGP Seabed Survey Data Model V1 is officially available and can be downloaded from the OGP Geomatics site
- For any SSDM questions please contact:

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Questions?