International Association of Oil & Gas Producers

Geomatics 462 series
Data models note 3

Interface between pipeline data models and the OGP Seabed Survey Data Model

Revision history

Version	Date	Amendments
1	January 2014	Initial release

1. Introduction

The International Association of Oil and Gas Producers (OGP) published the Seabed Survey Data Model (SSDM) Version 1 in April 2011, the SSDM is now the de facto industry standard for the delivery of seabed survey data for GIS.

The OGP SSDM is applied for hydrographic and geophysical seabed surveys such as: platform and drilling hazard site surveys, pipeline route surveys, pipeline pre-lay and inspection surveys, debris surveys, bathymetric and other types of seabed surveys using side scan sonar (SSS), singlebeam and multibeam echosounder (MBES), and single and multi-channel high-resolution seismic. The data model does not include or cover the ROV based (video) pipeline as-built and inspection surveys. The majority of data from pipeline ROV surveys are pertinent to pipeline data models (*e.g.* field joints, anodes, free spans, pipeline burial) with the exception of seabed data like bathymetry and seabed features acquired and mapped with bathymetry and sonar sensors on ROVs.

Operators have expressed a need for being able to integrate the seabed survey data stored in the SSDM format (*e.g.* bathymetry, survey metadata, seabed features, shallow geohazards) with pipeline infrastructure and ROV data (*e.g.* inspection, as-built events) that are stored in pipeline data models. The interface between pipeline data models and the SSDM will allow the integration of the sweep, site, environmental and geotechnical survey data with the associated pipeline infrastructure.

The development of this guidance was based on close cooperation between the OGP Geomatics Committee SSDM Task Force and the PODS organisation and APDM Technical Committee.

2. Objective

The objective of this document is to provide guidance on the interface between the SSDM and the current version of the industry following pipeline data models: Pipeline Open Data Standard Relational (PODS Relational), Pipeline Open Data Standard Esri Spatial (PODS Spatial) and the ArcGIS Pipeline Data Model (APDM).

This guidance does not require changes to the structure of the SSDM but it does require addition of a table to the PODS and APDM. Companies with internally developed pipeline data models may adopt a similar concept/mechanism for the integration of the SSDM with pipeline industry data models.

In this document, references to "pipeline data models" mean PODS Relational, PODS Spatial and APDM.

3. Benefits of Interface

SSDM and pipeline data models are designed to store differing survey data types; however, the data itself can often be tightly related. Therefore an interface between the data models will ensure that all survey data is linked in the GIS environment which enables easy query, analysis and visualisation of seabed survey related pipeline information (survey reports, data and related metadata) while using a standards based approach.

4. Overview of pipeline data models

This guidance note is applicable only to the three most common industry pipeline data models—PODS Relational, PODS Spatial and APDM.

Understanding the commonality and differences between these models is fundamental to the proposed solution for integration with the SSDM. Key features are compared in Figure 4.1 below.

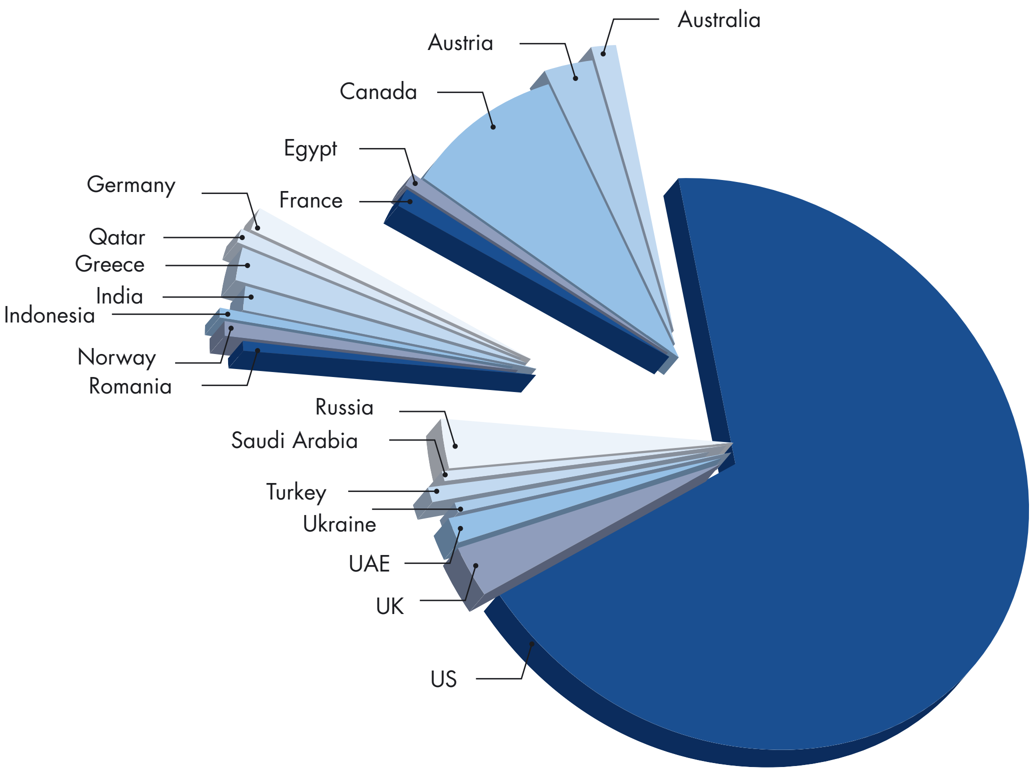
Figure 4.1: *Comparison of industry pipeline data models*

Topic	PODS Spatial 5.1.1	PODS Relational 6.0	APDM 6.0
Data model flexibility	Standard-based (PODS Table structure intended to be implemented as is). Standard core is identical to APDM.	Standard-based (PODS table structure is meant to be implemented as is).	Template with a standard core that is identical to PODS Spatial. Flexible use of table structure.
Event-/Feature-based	Can be implemented as event- or feature-based model.	Can only be implemented as event based model.	Can be implemented as event- or feature-based model.
GIS enabled	Implemented within an Esri Geodatabase.	No inherent GIS functionality (stores linear referencing and coordinate information in tables).	Implemented within an Esri Geodatabase.
Modularised	Planned.	Yes.	Not applicable—use of table structure and definitions is flexible.
Access to model	Must be a PODS member and requires access to licensed Esri tools.	Must be a PODS member.	Free, but requires access to licensed Esri tools.

PODS is a recognised industry standard that defines a comprehensive feature dataset to describe pipeline systems including assets, inspections, maintenance, cathodic protection, operations, attached and offline features, risk analysis, and geographic location. The PODS standard was developed in 1998 to help pipeline companies comply with Integrity Management (IM) regulations in the US. Today it is estimated that approximately 530,000 miles of regulated pipelines in the US are managed by PODS member companies utilising this standard. Outside the US, statistics on PODS usage are more difficult to ascertain. Approximately 30% of PODS members companies are located outside the US (see Figure 4.2). PODS and APDM are applicable within an offshore context and are capable of managing umbilical and subsea architecture data, however there are no official statistics available on onshore vs. offshore use of pipeline data models.

Figure 4.2: *PODS membership by country*

122 member companies as of 15 August 2012
Many PODS member companies have global operations



APDM is a GIS data model template with a standard core; it allows operators to start with a set of core elements of the model and design their data model by adding features and refining the existing features. The APDM was developed jointly by the Esri Pipeline Interest Group and industry experts gathered from pipeline operators and service providers. APDM is currently governed by the APDM Standing Committee, which consists of ten industry participants from vendor and operator companies and is led by Esri.

The APDM template can be downloaded from www.apdm.net.

Changes to the core APDM data model are considered as new Esri technologies are made available and are based on feedback from the APDM user community at large. The changes are voted on and approved by Esri and the APDM Standing Committee.

PODS Spatial is an evolution of the PODS Relational model and APDM. PODS Spatial is designed using the APDM database core elements and remains a standards-based model. PODS Spatial leverages the industry standards for tables and attribute structure from a traditional PODS Relational model and is implemented with Esri Geodatabase technology.

The class hierarchies for PODS Spatial and APDM are identical and both organisations strive to keep the two models aligned.

PODS Spatial and APDM can be implemented as an event- or feature-based model, whilst PODS Relational only as an event-based model.

The PODS Spatial and APDM model are expressly designed for implementation as an object-relational Esri geodatabase for use with Esri's ArcGIS® and ArcSDE® products.

PODS Relational is software application vendor neutral and operators may choose an appropriate GIS application for their organisation.

The PODS organisation has released a modularised version of PODS Relational 6.0. The standard has been broken down into 31 modular components which may be implemented independently with certain dependencies. This modular approach is intended to provide operators, especially international operators not subject to US regulations, with the flexibility to tailor their PODS implementation to their specific needs.

PODS releases are voted on and approved by the PODS Technical Committee and the PODS Board of Directors. Members have the opportunity to review and comment on all PODS releases before they are finalised, and members' comments and PODS responses are included as part of the release files.

Suggested changes and additions to the standard may come from various sources, including member comments, PODS working groups, and the Board of Directors. Recommendations for modification of the standard should be submitted to the PODS Executive Director. As each release is being scoped, the PODS Board of Directors has the final approval of which modifications are included in a given release. Since 2004, a new version of the PODS standard has been released every two to three years. With the changes made possible in PODS 6.0, the organisation will now be able to release incremental additions and modifications to the standard via minor releases of individual modules rather than the entire PODS standard. Further, the organisation will be able to develop and release individual modules, with targeted functions specific to regional or industry segment needs.

To use PODS an organisation must be a current PODS member.

5. Pipeline data models: core structure

PODS and APDM are based on the linear referencing concept and are entity-relationship intensive data models. Linear referencing is the method of storing geographic locations based on relative positions along a measured line using distance or temporal measures, like kilometres or hours. Further examples of linear referencing are described in Section 8: *Online pipeline features and events*.

Understanding the structure of these models, entity-relationships and the linear referencing concept is fundamental to the understanding of the integration of these models with the SSDM.

There are four data types found in PODS and APDM:

- Centreline data—the pipeline centreline, is geometric with a built-in *measure* or distance system. PODS Relational stores coordinate information for the centreline features. PODS Spatial and APDM stores an actual geometric object within an Esri Geodatabase as a point (control points) and a polyline (StationSeries) representing the spatial location of the pipeline route.
- Online (linear) event data—tables/features with attributes that locate *events* or *features* on a route (or pipeline) utilising the relative station or measure, thus indicating geographic position—valves, coating, subsea spans, *etc*.
- Offline data—purely geometric features (points, lines, polygons) representing things close to or surrounding the pipeline. PODS Relational stores coordinate information and/or bearing/distance for offline features within attributes. The coordinate information in PODS Relational is not compulsory. Guidance describing the relevance of offline features between PODS/APDM and the SSDM is discussed in Section 7: *Segregation of survey data into pipeline data models and the SSDM*.

- Tabular data—tables with attributes that contain no spatial component, but are associated to pipeline features, like owner/operator contact details, readings, external documents, *etc*.

These data elements are organised into several sub-modules based on the function of the associated data. The Stationed Centreline module is common between PODS and APDM and represents the core pipeline information that forms the foundation for the whole PODS/APDM model. All other tables in the models are linked either directly or indirectly to these core tables. This is the module that will be the focus of integration with the SSDM.

The following core elements are common between PODS Relational, PODS Spatial and APDM:

- Pipeline centreline/hierarchy management
- Document storage
- Report/activity management
- Site/facility management

6. Pipeline centreline/hierarchy management

Pipeline hierarchy defines the location and organisation of pipeline routes and forms a framework for relating all events on or near the pipeline infrastructure.

There are slight differences between the pipeline centreline hierarchy between PODS Spatial/APDM and PODS Relational due to the latter having no inherent GIS functionality.

Figure 6.1 and Figure 6.2 below shows the main tables that comprise the hierarchy of the pipeline routes in PODS Spatial, APDM and PODS Relational. Figure 6.3 below compares equivalent hierarchy elements across these models.

Figure 6.1: *Pipeline Hierarchy in PODS Spatial and APDM*

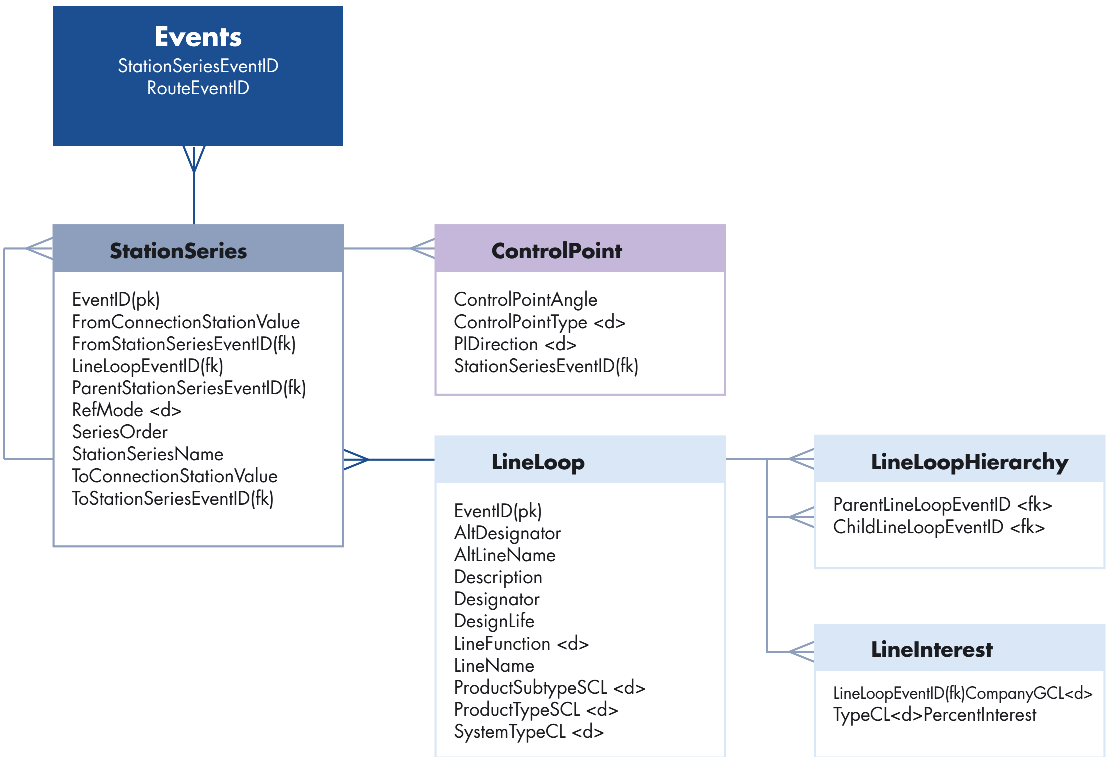


Figure 6.2: *Pipeline hierarchy in PODS Relational*

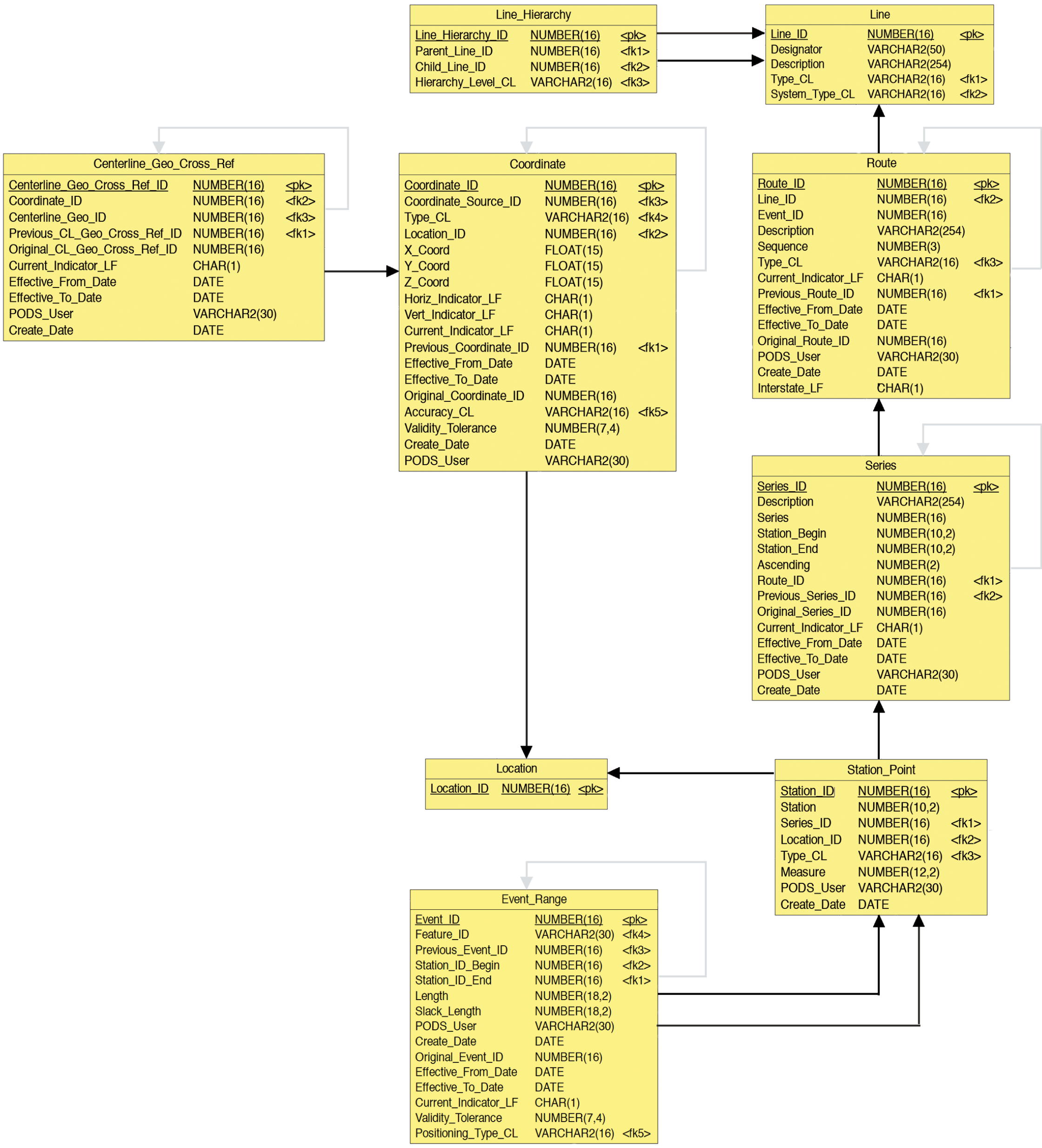


Figure 6.3: *Hierarchy elements comparison between PODS Relational, PODS Spatial and APDM*

Elements	PODS Spatial	APDM	PODS Relational
Gathering System & Transmission	LineLoopHierarchy	LineLoopHierarchy	Line_Hierarchy
Gathering System & Transmission	LineLoop	LineLoop	Line
Centreline	StationSeries(RefMode= Continuous)	Route (with or without measure)	Route
Centreline	StationSeries(RefMode= Engineering)	Route (with or without measure)	Series
Centreline	ControlPoint	ControlPoint	Station_Point

The remainder of this document primarily utilises table, field names and examples from PODS Spatial, but all concepts and most object names are applicable to PODS Relational and APDM. Any significant differences not mentioned here are noted in the subsequent sections.

A StationSeries represent a pipeline centreline and is comprised of a single continuous pipeline centreline (RefMode=Continuous)—equivalent to PODS Relational *Route* —and one or more engineering series (RefMode=Engineering)—equivalent to PODS Relational *Series*.

The *Continuous* StationSeries/Routes store measures for as-built routes that are continuous and uninterrupted. The measures value starts at 0 for the beginning of each route, and the end measure shows the total length for the route. The primary definition of the pipeline as-built location, as defined by the control points (*x,y,z*) and associated measures (*m*), needs to be of sufficient resolution to accurately define the actual 3D position of the pipeline to support future engineering and pipeline integrity monitoring activities.

The *Engineering* StationSeries/Series allow operators to manage re-routes, when discontinuities are introduced into the stationing. Re-route scenarios are not common in the offshore environment, hence station equations are not discussed further in this guidance note.

At the time of the centreline construction the Continuous StationSeries/Route and Engineering StationSeries/Series are identical and all online events are referenced to the continuous route.

Product flow does not determine stationing direction. It is a rule of thumb that *measure* for Continuous StationSeries/Routes increases in the direction of flow, but the opposite may also be the case. Stationing for Engineering Series is captured in the direction of one, if not all of the following:

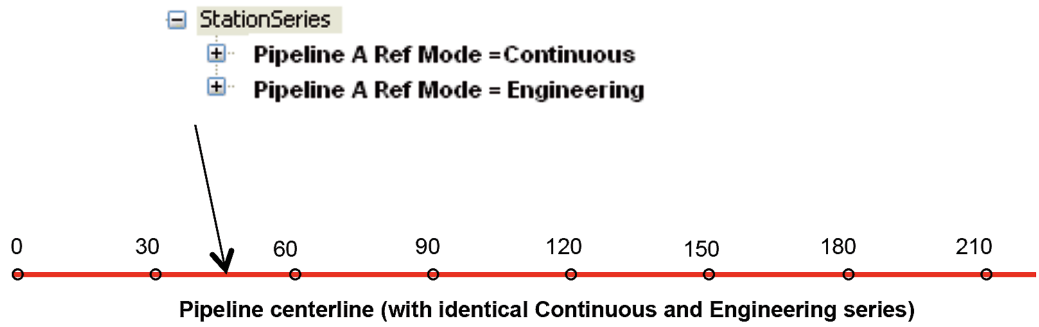
- the direction of the initial survey
- the direction of the construction
- arbitrary decision.

There could be multiple Engineering StationSeries/Series that have stationing direction changes within the same route.

Each vertex in a StationSeries feature must be covered by a control point (ControlPoint, Station_Point). Control points store *x,y,z* (absolute position) and *m* (measure value—linear reference/relative position) for the route (sometimes referred to as stationing or Kilometre Posts—KPs). Control points represent the start and end points of the route and intermediate positions representing a change in direction of the route (PI—Points of Inflection) such as horizontal or vertical bends along the route.

By definition there must be two control point features at each location where two Engineering StationSeries/Series connect end-to-end. The two control points will have the same measure value, but their engineering stationing values will be different. Note that a corresponding vertex is therefore required in the underlying Continuous StationSeries/Route feature, even if there is no deflection in the line at that location.

Figure 6.4: *Schematic of PODS-based stationed centreline*



Operators organise their pipeline databases and maintenance systems based on the hierarchy of the centreline features. PODS and APDM allow operators to organise and manage hierarchy through LineLoop/Line object class. LineLoop/Line record represents a single pipeline or pipeline loop made up of multiple segments from platform to platform, manifold to manifold, pump station to pump station as defined by a pipeline operator. It could be a transmission line or a gathering line. The LineLoop record should be uniquely named/identified in order to relate to other pipeline integrity management and accounting databases.

Figure 6.5: *Example of organising pipeline system within pipeline data model*

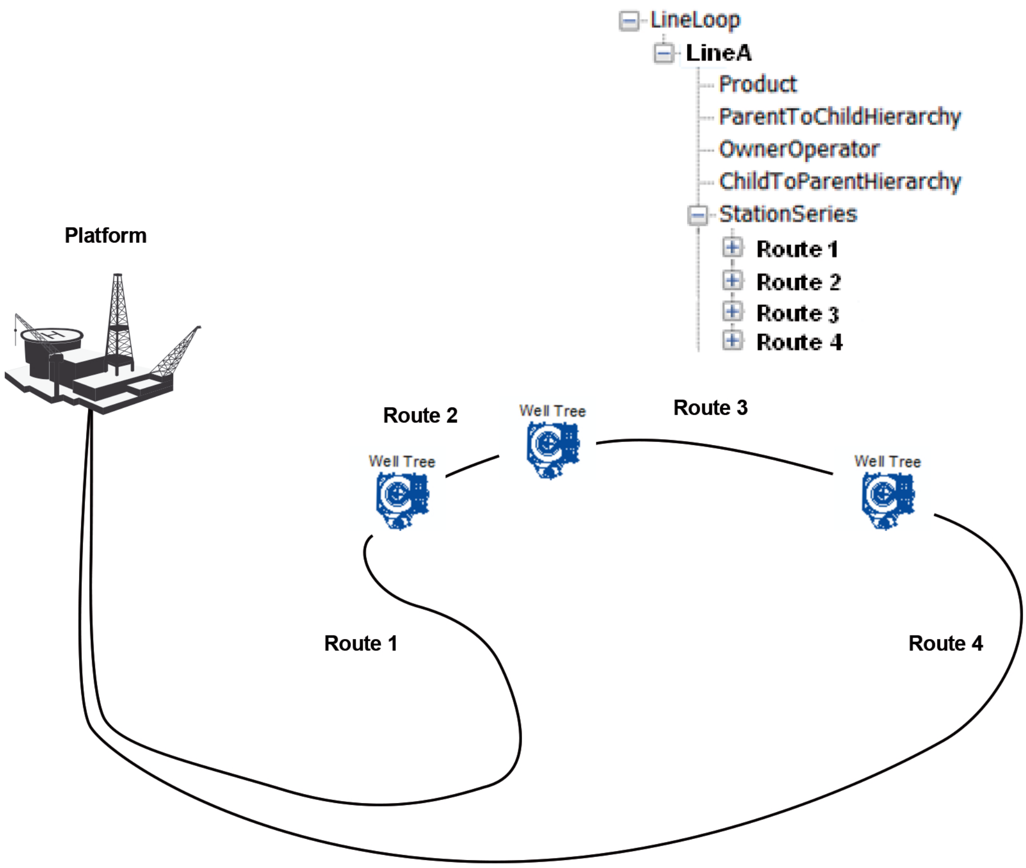
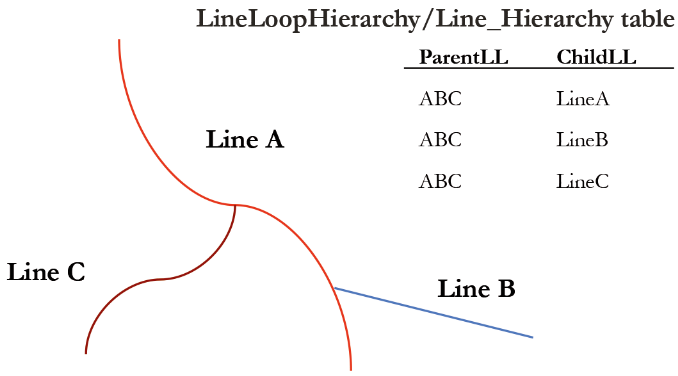


Figure 6.5 illustrates potential methods of organising a pipeline system within the data models, that is, one logical line that has four physical lines. Another possible implementation would be to organise the Figure 6.5 example as one *Continuous* route (launcher to receiver) with route 1,2,3,4 as *Engineering* series.

Multiple lines A, B and C each consisting of multiple routes (StationSeries) can also be grouped into a one gathering system, ABC (see Figure 6.6).

Figure 6.6: *Example of organising pipelines systems (onshore/offshore) based on hierarchy*



LineLoopHierarchy/Line_Hierarchy object class (Figure 6.6) models relationships between parent and child LineLoops/Lines and is used to establish a hierarchy of LineLoops/Lines. This means three records in the LineLoopHierarchy/Line_Hierarchy table, which relates Line A, Line B, Line C into logical grouping ABC.

7. Segregation of survey data into pipeline data models and the SSDM

Currently there is no industry-based template to deliver the subsea pipeline survey data in a standard form. Each survey contractor may provide this data in a proprietary structure or in an operator specified format, which needs to be converted or migrated into the chosen pipeline data model structure.

It is recognised that there is a need for an industry standard for exchanging this type of data. Figure 7.1 describes the different types of pipeline surveys and applicability of survey events to PODS/SSDM or both.

Figure 7.1: *Guidance for storage of survey events based on pipeline survey type*

Pipeline survey type	Survey definition	Events stored in
Pipeline route survey	Proposed pipeline route corridor survey conducted before the actual installation used to identify the best route. The use of geophysical and geotechnical survey techniques are most common, in addition to video, still cameras and other environmental survey techniques.	SSDM The proposed pipeline route in PODS/APDM or in-house pipeline data model
Pipeline pre-lay survey	Pre-lay survey is conducted immediately before the actual installation. It uses visual techniques only along the actual route itself (*i.e.* not a corridor) to confirm that no changes have occurred since the original route survey. ROV sector scanning sonar (also called obstacle avoidance sonar) is often also used, but typically only recorded on video black box.	SSDM The proposed pipeline route in PODS/APDM or in-house pipeline data model
Pipeline as-laid survey	The aim of the as-laid survey is to undertake a complete visual and instrumental ROV inspection along the pipeline as soon as the pipeline has been laid. The as-laid survey will define the accurate position of the pipeline, the pipe-seabed configuration (visual and instrumental) and the external status of the pipe. The as-laid results will be used to confirm/finalise the design of post-lay intervention works.	PODS/APDM or in-house pipeline data model
Pipeline as-built survey	The aim of the as-built survey is to undertake a visual and instrumental ROV inspection of the post-lay intervention work such as trenching or rock cover areas just after their completion. The as-built survey will define the final status of the pipeline and of the post-lay intervention works.	PODS/APDM or in-house pipeline data model
Acoustic pipeline inspections using SSS and MBES	The aim of an acoustic pipeline inspection is to record the current condition, position of the operated pipeline and the seabed conditions in the vicinity of the pipeline. Typical mapped results from this type of inspection are: outlines of structures, depressions and mounds, abrupt changes in slope, sunken objects, debris, cables, chains, piles, seabed material, sand ripples, dredges, pipeline free spans, *etc*. The survey results are interpreted from SSS and MBES data. If the interpreted results intersect the pipeline centreline the data should be converted to online events and stored in pipeline data models (Figure 7.2). If the interpreted features (*e.g.* scours, debris) do not intersect the pipeline centreline, offline features should be stored in the SSDM (Figure 7.2).	PODS/APDM or in-house pipeline data model SSDM
Visual pipeline inspection using ROV conveyed video cameras	Typical mapped results from this type of inspection are: free spans, pipeline damage, debris, position and condition of anodes and cathodic protection, crossings, lateral movement, *etc*. The survey results reference the intersection of the specific event with the centreline and are typically reported by *x,y,z* and *m* station value.	PODS/APDM or in-house pipeline data model
Internal pipeline inspection	The aim of the internal pipeline inspection is to assess the internal condition of the pipeline through the use of inspection gauges or 'pigs' to measure pipe thickness and corrosion and other conditions along the pipeline.	PODS/APDM or in-house pipeline data model

Figure 7.2: *Interpretation of side scan sonar image*

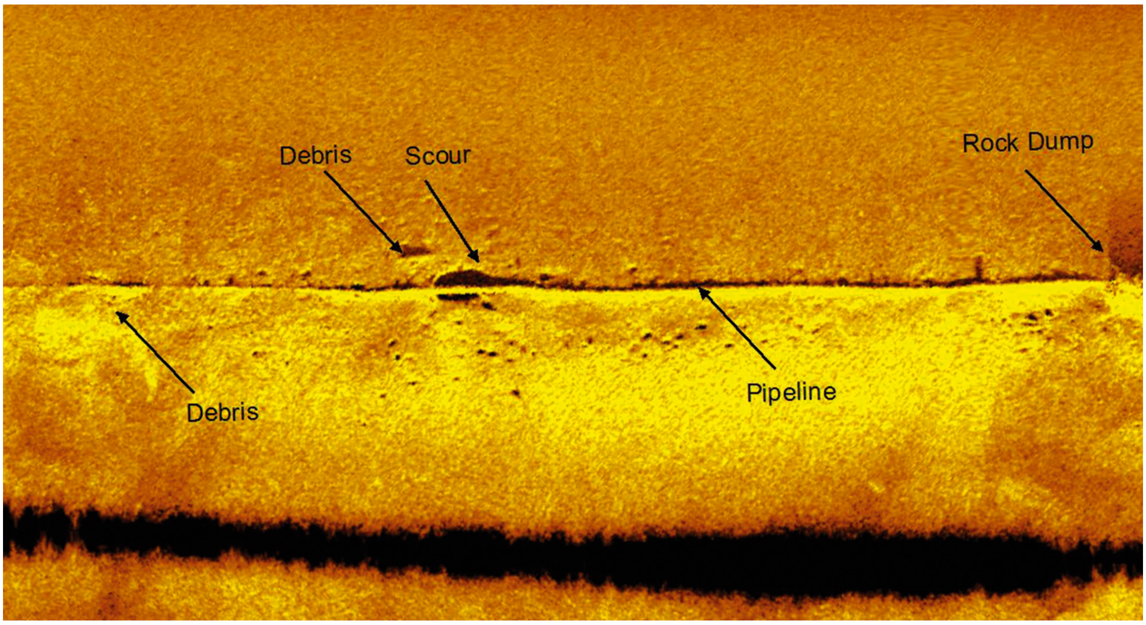


Figure 7.2 provides an example of the interpretation of events from an acoustic pipeline inspection. Information that affects the integrity of the pipeline, such as debris, and the rock dump that intersect the pipeline centreline should be captured as an online event in pipeline data models. All other features (*e.g.* debris in this case) that do not intersect the pipeline route should be stored in respective feature classes in the SSDM.

Figure 7.3: *Segregation of survey data into pipeline data models and the SSDM*

Pipeline data models	SSDM
Supplied in various proprietary template structures for incorporation into pipeline data models:	*Delivery requirements specified in OGP Guideline for the delivery of SSDM:*
Centreline Control points Pipeline events Transverse profile data (5 point listing) Cathodic protection readings Internal inspections, *etc*.	Survey extent Bathymetry soundings Contours Raster data (MBES) Imagery (SSS, hillshaded bathymetry) Navigation (survey tracklines) Chart index Seabed sampling & CPT Seabed and geologic features, *etc*.

← Pipeline as-laid survey →
Pipeline as-built survey
Acoustic pipeline inspection survey (SSS, MBES)
Visual pipeline inspection survey (ROV)

As-built survey (structures positioning, jumpers, *etc*) Metrology survey Inline inspection survey	Pipeline route survey Pipeline pre-lay survey Sweep (debris) survey Site survey Bathymetry/topography (SBES/MBES/LADS) survey 2D seismic survey 3D seismic survey 4D seismic survey Environmental survey Geotechnical investigation

8. Online pipeline features and events

Pipeline features and events are managed in PODS and APDM via event tables that store the location attributes indicating the geographic position on (online) or off (offline) the pipeline route based on a defined coordinate reference system. These event tables are organised and managed in pipeline data models according to their use and function (offshore, cathodic protection, regulatory, physical inspection, *etc.*).

The offshore module for PODS has provision for offshore specific event tables but the selection is limited and needs further extension for full offshore implementation.

The definition of pipeline features and event tables between PODS and APDM is not identical. The core attributes that define the classes are consistent. APDM offers optional feature classes and objects in addition to the 'core' as a starting template from which custom models could be created and evolved.

Features and events can be represented both as point or linear features. Online events utilise the Measure field for points and BeginMeasure, EndMeasure field values for linear representation to denote the relative position on the stationed pipeline route. This is achieved with Esri's ArcGIS Linear Referencing Functionality.

Online events represent necessary information pertaining to pipeline components (valves, fittings, *etc.*), design specifications (pressure, coating, *etc.*), inspection results (spans, buried sections, damage, debris, marine growth).

Each route has a unique GUID value stored in its EventID field. Event tables have a RouteEventID field, which is a foreign key or relate field to the EventID value for the route. This allows the set of events to be associated with their respective route (Figure 8.1).

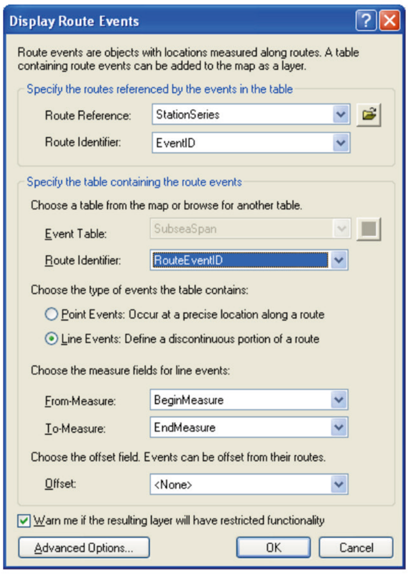
Figure 8.1: *Locating online events on pipeline route*

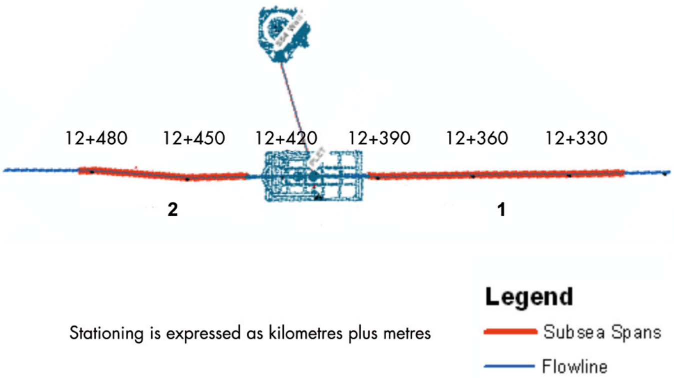
Span Event Table

EventID	RouteEventID	BeginMeasure	EndMeasure	
{10734671-32C1-467E-AD11-B754AECAC5BC}	{AF8F61DD-437E-448B-BDFF-61282F108EBA}	12435	12484	1
{E9E0761F-979B-4729-8280-5A8BFBA016CF}	{AF8F61DD-437E-448B-BDFF-61282F108EBA}	12300	12390	2

StationSeries

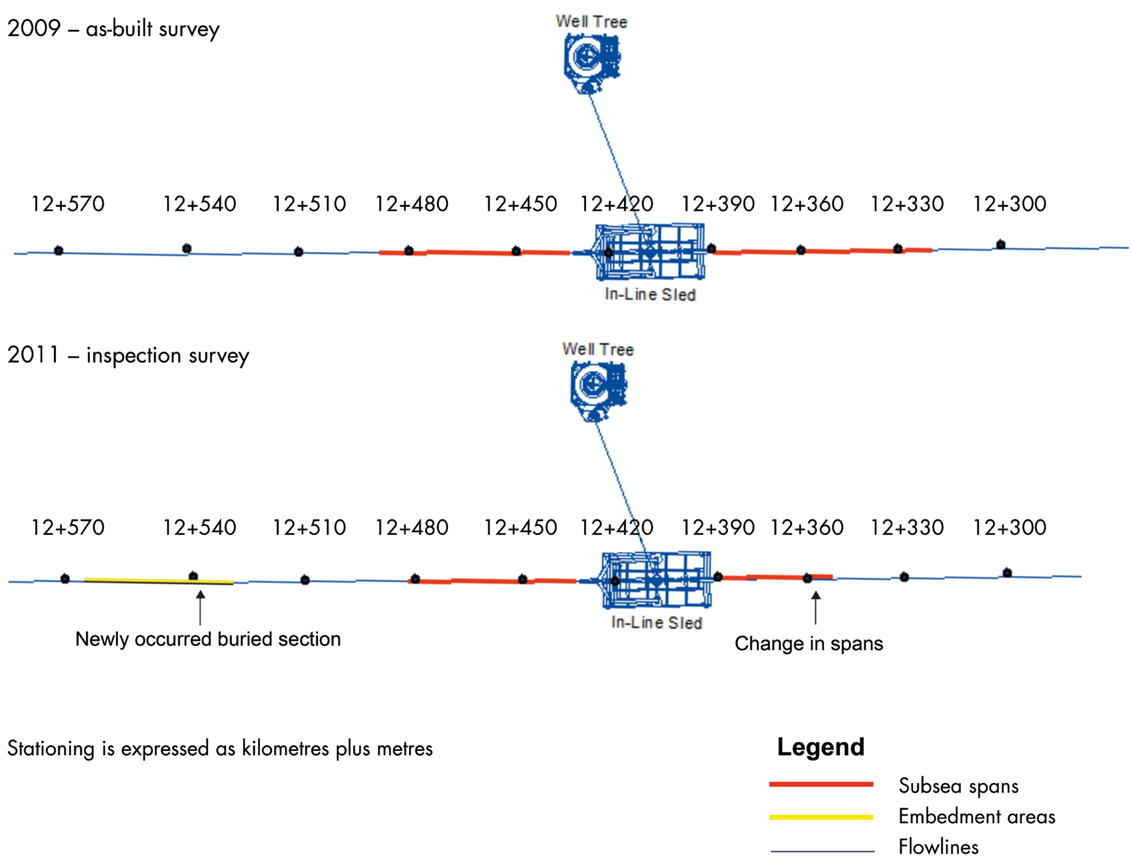
EventID *	OriginEventID *	Historical	RefMode *	BeginStation	EndStation	BeginMeasure	EndMeasure
{AF8F61DD-437E-448B-BDFF-6	{AF8F61DD-437E-448B-BDF	Current	Continuous			0	41389.6
{8B913D5C-BA49-4280-B018-E	{8B913D5C-BA49-4280-B01	Current	Engineering	0	41389.6	0	41389.6





Because online pipeline features are represented as linear events defined relative to a particular route, the position of these features will change dynamically to reflect any changes in the geometry of this route, that is, changes due to movement of the pipeline centreline, pipeline re-routes, and abandonment. It also allows the comparison of these events from multiple inspection surveys (Figure 8.2) given that the same station reference is used between these surveys. Association of survey results with a specific activity/inspection is demonstrated in Figure 9.1: *Cross-referencing pipeline and event information to Report/Activity*.

Figure 8.2: *Comparison of the online events from multiple surveys*



9. Integration of PODS/APDM and SSDM

PODS and APDM models allows relevant activities and operations along pipeline infrastructures to be tracked. PODS' report table and APDM's activity table also allow sets of features to be grouped, linked and stored in different tables under a single activity.

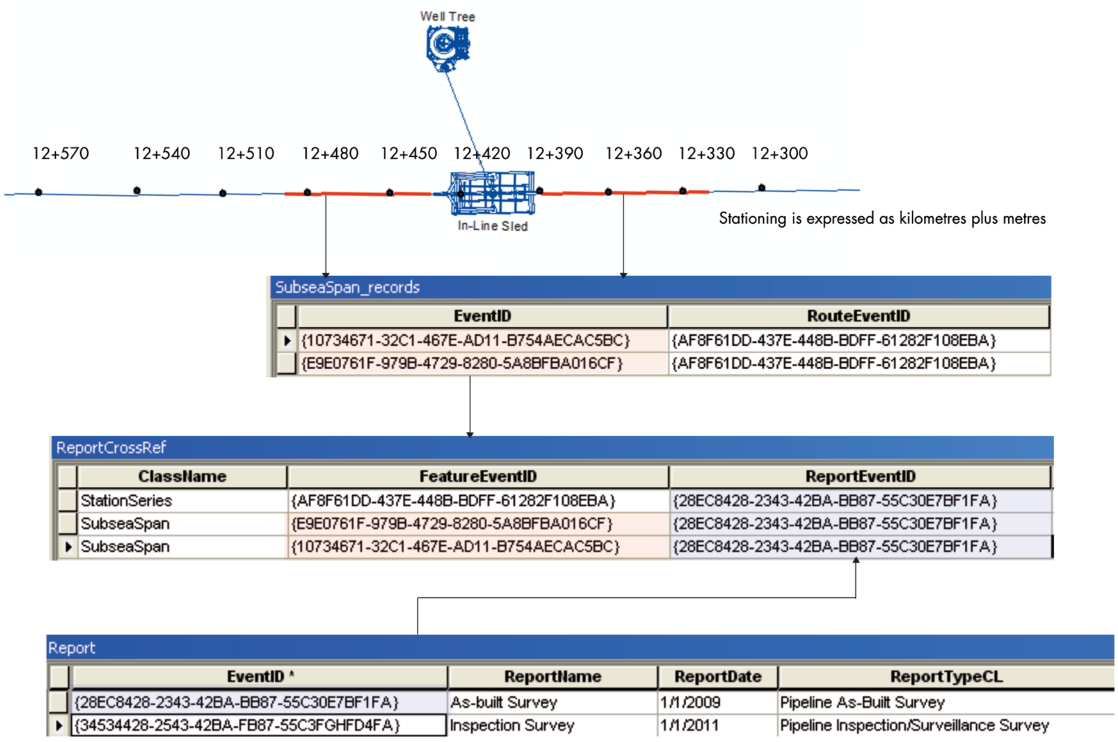
Reports (activities) fall under a broad list of categories:

- Data reconciliation
- Life cycle phase change—change from construction to operations
- Re-route
- Regulatory analysis
- Inspection or assessment

Report/activity can be referenced to one or multiple features from one or multiple tables via ReportCrossRef table in PODS and through the use of audit tables in APDM.

Every table in PODS Spatial (minus metadata tables) has a relationship to ReportCrossRef table, which in turn relates to the report table. Essentially, this creates multiple many-to-many relationships, aggregated into a single table (Figure 9.1). In PODS Relational the relationship between Report_Cross_Ref and other tables is implicit.

Figure 9.1: *Cross-referencing pipeline and event information to report/activity*



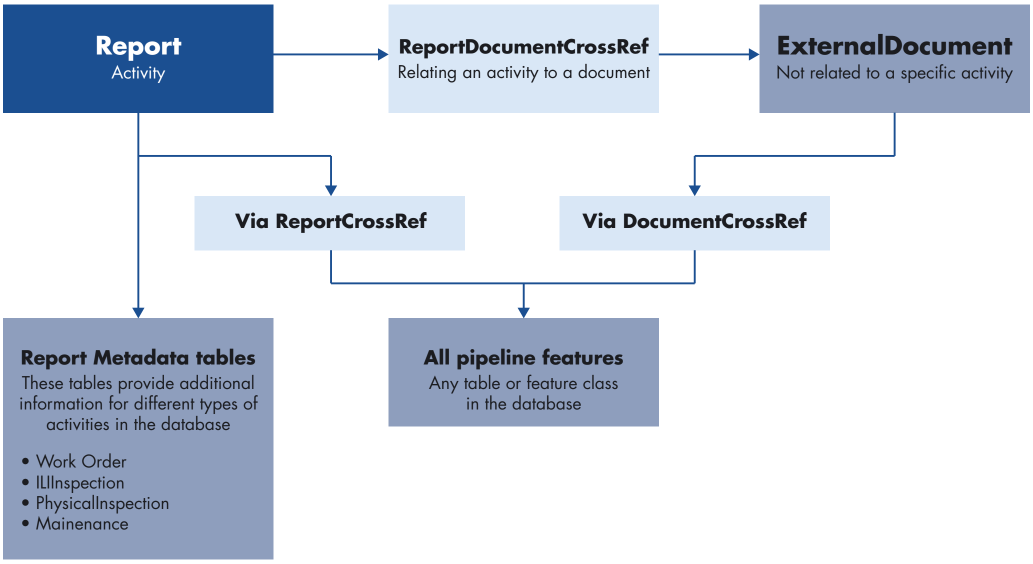
The report table stores common information across all activities, such as activity date, activity description and activity type.

The report metadata tables exist to record additional information about an individual report. For example, an ILI inspection requires a date and name in addition to tool type information, vendor information and odometer reading information. Whilst this information is a pre-requisite for ILI inspections, maintenance activities, for example, will require a different set of information to be recorded. The design of report and activity tables in PODS and APDM therefore provides a flexible method of reporting a diverse range of activities along a pipeline route.

Reports/activities can be linked to one or more external documents that describe the activity in more detail via ReportDocumentCrossRef table.

Features and records can also be linked directly to ExternalDocument via DocumentCrossRef Table.

Figure 9.2: *Report/activity/document management in PODS*



Data fields such as Survey_ID and Survey_ID_Ref are common across all objects in the SSDM and are used to define relationships within the SSDM schema. Unlike PODS/APDM, the SSDM does not offer relationship classes between the features and records and the SSDM user will need to define their own relationship queries if required.

Operators may utilise the Survey_ID (number) field for numeric numbering for their survey activities or Survey_ID_Ref (text) field for alphanumeric survey job numbering or both. Survey_ID_Ref can be used to store GUID as in the EventID of PODS/APDM.

SSDM Survey_KeySheet (feature class) and T_Survey_JobDetails (table) serve the same purpose as a report table in PODS or activity table in APDM. It tracks the subsea survey activities and their extents on or around the subsea infrastructure and groups a set of features stored in different SSDM tables under a single survey (activity) utilising implicit relationships via Survey_ID or Survey_ID_Ref fields.

T_Survey_JobDetails table serves as a metadata table to the Survey_KeySheet feature class, providing additional details about a survey activity and links to the external documents and reports. SSDM users may extend the T_Survey_JobDetails to configure additional survey metadata as required.

The solution for the SSDM integration with pipeline data models requires the incorporation of a new metadata table for the report/activity table within the pipeline data-models. This new metadata table will be a mirror of the Survey_KeySheet table in the SSDM, supplemented with PODS required fields and with the addition of new fields to capture positioning and accuracy parameters. This change is subject to OGP making a formal submission to the PODS Board and seeking their approval. Until this change is approved, users will have to add this table themselves.

It is recommended that this new table in pipeline data models is called SurveyKeySheet. Keeping the same table name in both data models is the best approach for integration. In the event of an Operator's choice to integrate two schemas in one geodatabase, both schemas can use the same table.

The new pipeline data model metadata table SurveyKeySheet should include the fields shown in Figure 9.3.

Figure 9.3: *SurveyKeySheet table (metadata table to report/activity)*

PODS Spatial and APDM				**PODS Relational**
Field name	**Field type**	**Field source**	**Attribute definition**	**Relevance**
OBJECTID	Object ID	Esri geodatabase	The ObjectID attribute is a system ID provided to all registered classes within an Esri geodatabase.	N/A—Geodatabase specific
EventID	GUID	Pipeline data model	A globally unique identifier for the class.	N/A—stored in Event_Range table
OriginEventID	GUID	Pipeline data model	The original GUID for a feature. OriginEventID is set to be equal to EventID when a feature is first created.	N/A—stored in Event_Range table
CreatedBy	Text (45)	Pipeline data model	User ID of the operator who created the feature. A value is applied once to this attribute when the object is first created.	N/A—stored in Event_Range table
CreatedDate	Date	Pipeline data model	The timestamp when the initial record for the object was created in the database.	N/A—stored in Event_Range table
EffectiveFromDate	Date	Pipeline data model	The date a particular record in the database went into effect in the real world.	N/A—stored in Event_Range table
EffectiveToDate	Date	Pipeline data model	The date at which a particular record in the database is no longer in effect.	N/A—stored in Event_Range table
LastModified	Date	Pipeline data model	The timestamp for the last modification of the record in the database.	N/A—stored in Event_Range table
ModifiedBy	Text (45)	Pipeline data model	User-ID of the operator who last modified the feature.	N/A—stored in Event_Range table
HistoricalState	Text (30)	Pipeline data model	Indicates whether the record represents the current or historical status of the referenced object or feature.	Applicable
ProcessFlag	Text (25)	Pipeline data model	A catch-all field for application developers used for temporarily storing values, tags, and codes required for application processing.	Applicable
SourceCL	Text (16)	Pipeline data model	Indicates source of data record.	Applicable

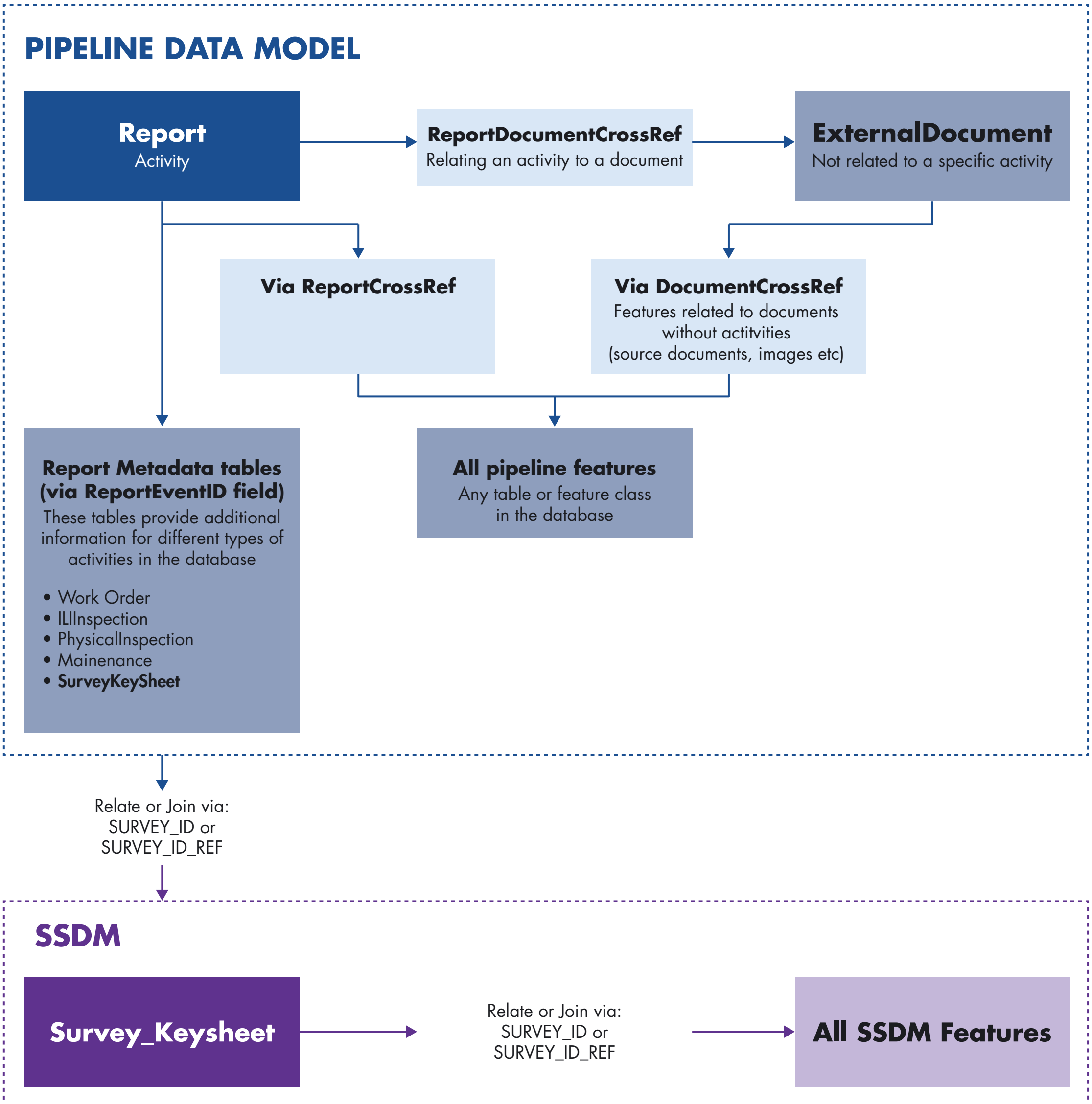
PODS Spatial and APDM				PODS Relational
Field name	**Field type**	**Field source**	**Attribute definition**	**Relevance**
Remarks	Text (500)	Pipeline data model	Open text field used for storing comments and remarks for a database record.	Applicable
Description	Text (255)	Pipeline data model	This field describes full details of the feature. It may be used in conjunction with comments to accurately describe the feature.	Applicable
ReportEventID	GUID	Pipeline data model	Foreign key to the report table.	Applicable
SurveyID	Long integer	SSDM	Numeric survey job number.	Applicable
SurveyIDRef	Text (36)	SSDM	Alphanumeric survey job number or GUID.	Applicable
VerticalDatumDescription	Text(50)	SSDM	Vertical datum definition	Applicable
LocalTimeGMTOffset	Short integer	SSDM	Set to default (change default based on region).	Applicable
QualityStandard	Text(12)	SSDM	Indication on whether survey data is QC'ed or not.	Applicable
SurveyStartDate	Date	SSDM	Survey start date.	Applicable
SurveyEndDate	Date	SSDM	Survey end date.	Applicable
PositioningContractor	Text(50)	SSDM	Survey company name.	Applicable
PositioningSystemPrimary	Text(250)	New	Description of primary positioning system (LBL, USBL, DGPS, INS).	Applicable
PostioningSystemSecondary	Text(250)	New	Description of secondary positioning system .	Applicable
RelativePositioningMethod	Text(250)	New	Description of relative positioning method.	Applicable
RelativePositioningAccuracy	Text(50)	New	Description of relative positioning accuracy.	Applicable
SurfacePositioningAccuracy	Text(50)	New	description of surface positioning accuracy.	Applicable
ROVSensors	Text(250)	New	Types of ROV sensors utilised for survey.	Applicable

The decision to add an additional SurveyKeySheet table to a pipeline data model, instead of achieving integration through the addition of fields (Survey_ID or Survey_ID_Ref) to report/activity tables in PODS/APDM was based upon operator's need for a table to store positioning method and accuracy statements for the pipeline data and equipment. This gives an operator freedom to capture survey metadata for activities such as jumper metrology and structure installations whilst at the same time, serving as an integration mechanism between PODS/APDM data (pipelines and associated events) and the SSDM (seabed, geologic features, bathymetry, *etc*.).

SurveyKeySheet in pipeline data models stored as an object class will allow the metrology survey metadata and structure installation survey parameters to be captured without having to create unnecessary boundary outlines for the smaller scale activities.

For surveys that have a defined boundary, such as a construction corridor, regulatory boundary, inspection range extent, the boundary polygon can be stored in the SSDM Survey_KeySheet feature class, and it can be related to PODS/APDM SurveyKeySheet object class via Survey_ID or Survey_ID_Ref field.

Figure 9.4: *Integration of a pipeline data model and the SSDM*



10. Abbreviations

APDM	ArcGIS Pipeline Data Model
AUV	Autonomous Underwater Vehicle
Esri	Environment Systems Research Institute, Inc., owner of ArcGIS suite of software products.
GUID	Globally Unique Identifier
MBES	Multi Beam Echo Sounder
PODS	Pipeline Open Data Standard
ROV	Remotely Operated Vehicle
SSDM	Seabed Survey Data Model
SSS	Side Scan Sonar

11. References

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