

Absoft White Paper

Optimised linear asset management for oil and gas

**Geoff Taggart
Absoft Limited**

Contents

Executive summary	1
Introduction	2
What new functionality does SAP LAM provide?	2
Defining linear assets	3
How does segmentation work?	3
Condition monitoring	5
Technical structure and networks	7
Technical structure	7
Graphical representation	8
Networks	8
Reporting	9
Classification and confirmations	10
Enhanced classification system	10
Work order confirmation	11
Conclusion	12
About Absoft	13

Executive summary

Linear assets can provide numerous complications for maintenance departments. With pipelines or cabling stretching tens, hundreds or thousands of miles long, completing an effective maintenance plan can be challenging.

This white paper will provide an insight into how SAP® Linear Asset Management (SAP LAM) will enable you to reduce maintenance complication by designing and operating effective linear asset maintenance systems.

Using the SAP LAM solution, maintenance personnel can not only produce a data technical structure more closely resembling the physical actuality, but also produce more accurate recordings due to upgraded condition monitoring and confirmation of functionality.

Ultimately, SAP LAM can enable many millions to be saved through more targeted and effective maintenance of linear assets.

SAP LAM solution delivers:

- A simplified method of defining the detailed technical structure of linear assets
- The functionality to build asset networks, allowing users to define and display how any relevant assets are connected
- Enhanced classification functionality for differing characteristics to be defined across sections of an asset

- The means to plan and execute work at an exact point of the asset, with precise maintenance shift handovers
- Improved condition based maintenance planning, monitoring and reporting
- Effective integrity reporting, allowing the condition of assets to be analysed along a specific section, or the entire length of an asset, over a period of time

Introduction

SAP LAM functionality is designed to specifically address the requirements of maintenance teams responsible for maintaining and operating linear assets.

Oil and gas companies which own linear assets should be able to answer these questions if they are to effectively manage their maintenance:

- What linear assets do I have?
- Where are linear assets physically located?
- How are they connected?
- What condition are they in?
- What maintenance has been carried out and where?
- Where, exactly, do they currently require maintenance?
- Can I ensure the integrity of assets?
- How do I know the assets are operating at optimum performance?

SAP LAM enables maintenance supervisors to readily answer these questions. Maintenance departments find that creating a technical structure to accurately represent the linear assets in their infrastructure network is a highly complex process. Therefore creating maintenance and inspection strategies can be difficult to both accurately plan and report. Yet maintaining the integrity of these assets is to ensure performance optimisation and compliance with HSE regulations.

Failure of these assets can have a catastrophic impact, such as:

- Financial loss due to production downtime, and increased costs to repair/ replace equipment failure
- Damage due to corporate reputation, particularly if there is an environmentally sensitive or safety critical asset failure
- Lost time injuries or even loss of life

Therefore, it is essential to have a system capable of easily defining, maintaining and monitoring linear assets, providing simple asset condition reporting and facilitating a proactive response to integrity management in order to reduce the risk of 'fix on failure'.

What new functionality does SAP LAM provide?

- Enhanced functionality for technical objects
- Enhanced classification to support the definition of any particular asset attribute
- Enhanced work order processing to cater for linear work definition, planning, execution and confirmation
- Enhanced functionality for condition monitoring, providing additional measurement points, counters and documentation
- Enhanced reporting capability for all relevant objects, providing the ability to search and report on all linear asset attributes

Defining linear assets

Due to length, liner assets need to be maintained in segments, such as subsea pipelines and topside pipe networks.

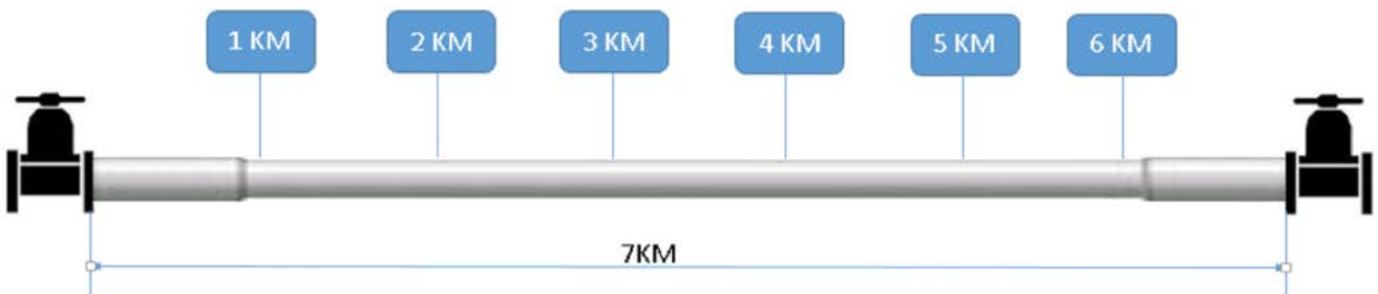
Measurements are defined along the asset to specify where work is to be carried out, conditions monitored or metering results recorded.

How does segmentation work?

Reference patterns allow segmentation, specifying positions on an asset by defining markers. These markers can simply represent an exact position by using functional location, or using equipment locations. Markers specify the absolute position from the starting point of the linear asset and the length of the marker.

Distances between markers can be uniform, or can be defined as individual distances. Using markers, it is possible to identify the absolute position or section.

Maintenance plans specify when, how often and what work must be performed. Work orders identify maintenance requirements and allow the work to be planned and executed at exact positions.

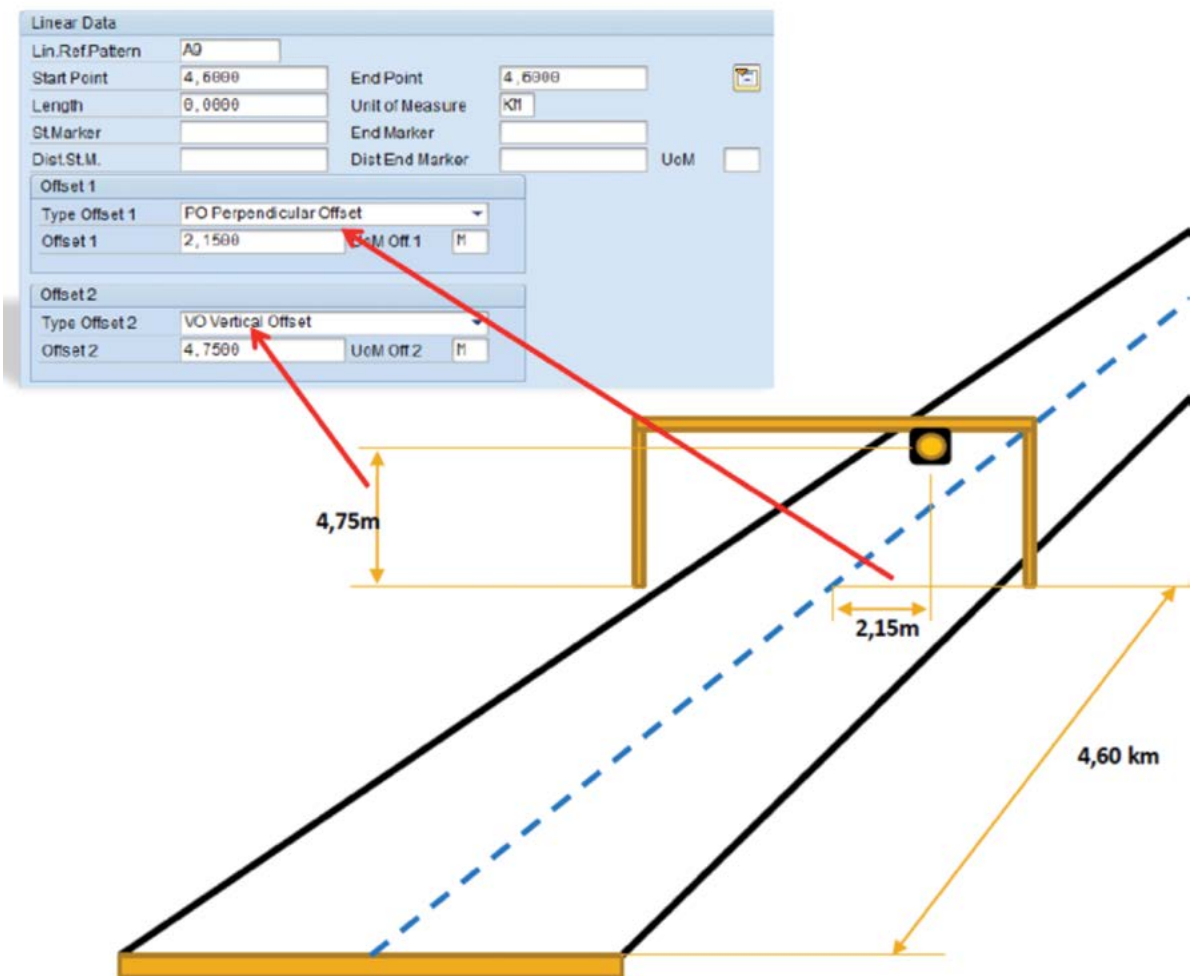


Linear Data			
Start Point	2.0150	End Point	3.0000
Length	10.0000	Unit of Measure	KM
St.Marker	KM2	End Marker	KM3
Dist.St.M.	0.0150	Dist End Marker	0.0000
		UoM	KM

A red arrow points from the 'Dist.St.M.' field (0.0150) to the '1 KM' marker in the diagram above.

Positional offsets can be used to specify a position of an asset in three dimensions. Here we use a perpendicular offset and a vertical offset to represent a specific location on a sign gantry:

- 4.6km along a linear asset
- Vertical offset of 4.75m vertically on the asset
- Perpendicular offset of 2.15m



Condition monitoring

Measuring points are used to specify the type of inspection that is required on an asset and contains:

- Information relating to the measurement to be performed
- Tolerances
- Target values
- Position
- Unit of measure

Measurement points can be set up for a section of an asset.

Tolerances can be defined to inform when the performance of an asset is deteriorating.

Multiple measurements can be recorded at different positions along the asset.

Easy to monitor condition over the length of an asset.

Display Measurement Documents: Measurement Document List

S	MeasDoc.	MeasPoint	Description of measuring point	Date	Meas/TCRdg	Unit	Start Point	Start Marker	End Point	End Marker	Length	Order
	593	349	Pipe Wall thickness check	07.05.2014	47.00	mm	3.045	KM3	3.045		10.000	
	602	349	Pipe Wall thickness check	07.05.2014	46.92	mm	3.050	KM3	3.050		10.000	
	603	349	Pipe Wall thickness check	07.05.2014	46.84	mm	3.055	KM3	3.055		10.000	

Measurement readings indicate what condition the asset is in and how it is performing. Readings are taken and entered against the measuring point. These ongoing readings then allow the condition of the asset to be monitored over time.

By performing regular measurements, any deterioration in the condition of the asset can be identified before the point of failure.

Condition is monitored by taking measurement readings and evaluating them against upper and lower parameters.

For measuring points created to cover a section of the asset, readings can be taken and entered at multiple points along the asset. This allows monitoring and reporting along the entire length of an asset from one measuring point.

The readings above show a series of measurements for checking the wall thickness of the pipeline, carried out at different positions on the linear asset. It clearly shows degradation and erosion as wall measurements become thinner moving along the length.

Technical structure and networks

Technical structure

The technical structure shows what linear assets exist, with SAP LAM making it easier to identify characteristics such as length, equipment locations, start points and end points.

Functional Location Structure: Structure List

Functional loc. ABZ-SF01-DF01-PL Valid From 07.05.2014
 Description Pipeline Sections length 100KM

Functional Loc.	Description	Start Point	End Point	Length	Unit
ABZ-SF01-DF01-PL	Pipeline Sections length 100KM				
ABZ-SF01-DF01-PL-01	Pipeline Section 01	0.000	10.000	10.000	KM
10000143	Flow Transmitter PTX-0000001	5.000	5.000	0.000	KM
10000153	Pressure Transmitter PTX-0000001	0.020	0.020	0.000	KM
10000154	Pressure Transmitter PTX-0000002	9.080	9.080	0.000	KM
ABZ-SF01-DF01-PL-02	Pipeline Section 02	10.000	20.000	10.000	KM
10000144	Flow Transmitter PTX-0000002	15.000	15.000	0.000	KM
10000155	Pressure Transmitter PTX-0000003	10.020	10.020	0.000	KM
10000156	Pressure Transmitter PTX-0000004	19.080	19.080	0.000	KM
ABZ-SF01-DF01-PL-03	Pipeline Section 03	20.000	30.000	10.000	KM
10000145	Flow Transmitter PTX-0000003	25.000	25.000	0.000	KM
10000157	Pressure Transmitter PTX-0000005	20.020	20.020	0.000	KM
10000158	Pressure Transmitter PTX-0000006	29.080	29.080	0.000	KM

Lists report all asset relevant data, available to search and display in reports.

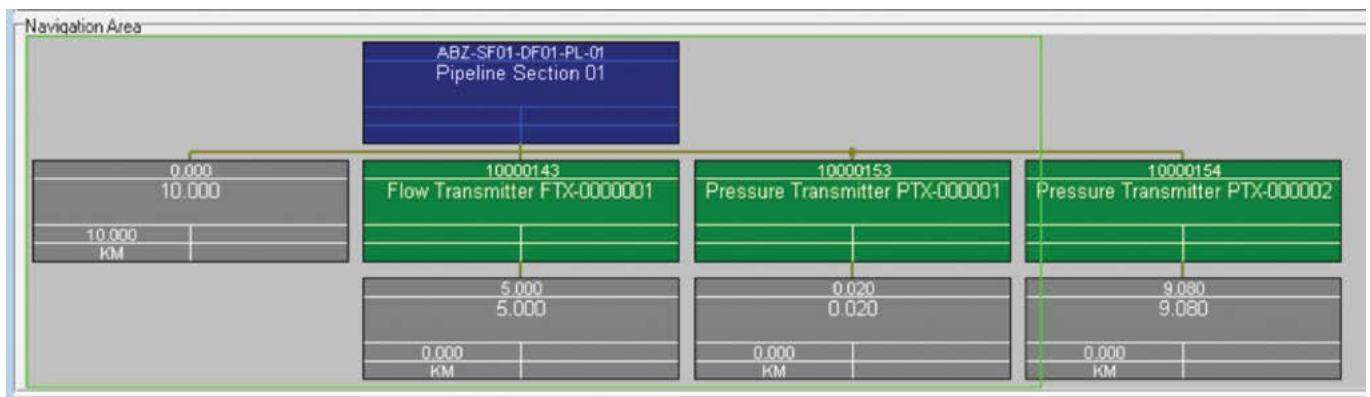
Display Functional Location: Functional Location List

Layout for Characteristics

S	Functional Location	Description of functional location	PIPI	Start Point	End Point	Length
	ABZ-SF01-DF01-PL	Pipeline Sections length 100KM	YB_			
	ABZ-SF01-DF01-PL-01	Pipeline Section 01	YB_	0.000	10.000	10.000
	ABZ-SF01-DF01-PL-02	Pipeline Section 02	YB_	10.000	20.000	10.000
	ABZ-SF01-DF01-PL-03	Pipeline Section 03	YB_	20.000	30.000	10.000
	ABZ-SF01-DF01-PL-04	Pipeline Section 04	YB_	30.000	40.000	10.000
	ABZ-SF01-DF01-PL-05	Pipeline Section 05	YB_	40.000	50.000	10.000
	ABZ-SF01-DF01-PL-06	Pipeline Section 06	YB_	50.000	60.000	10.000
	ABZ-SF01-DF01-PL-07	Pipeline Section 07	YB_	60.000	70.000	10.000
	ABZ-SF01-DF01-PL-08	Pipeline Section 08	YB_	70.000	80.000	10.000
	ABZ-SF01-DF01-PL-09	Pipeline Section 09	YB_	80.000	90.000	10.000
	ABZ-SF01-DF01-PL-10	Pipeline Section 10	YB_	90.000	100.000	10.000

Graphical representation

It is possible to produce a graphical display of the network, showing all objects their length and where they are located.



Networks

Networks show how assets are connected. When networks are created, all objects created can be reported upon as an entire network, a section, or one specific point. Network reports list all object links, notifications, work orders and measurement documents created by individual objects which clearly defines the point or section they were created.

Multi-Level Functional Location Network List: Network List

Object	Object Name	Object Description	PI_OIL	Oil Pipelines	PIPE	Pipeline
TRUN100	SF01 Pipeline Network		100.000	100.000	KM	
Object Links						
Functional Locations						
ABZ-SF01-DF01-PL-01	Pipeline Section 01		10.000	10.000	KM	
Orders						
4002096	PM01	Carry Out Pipe thickness Inspection	4.000	10.000	KM	
4002100	PM01	Pipe Wall Thickness Checks	5.000	10.000	KM	SETC
4002120	PM01	Pipe Wall Thickness Checks	5.000	10.000	KM	SETC
4002122	PM01	Routine Pipeline Inspection	3.000	10.000	KM	
4002123	PM01	Routine Pipeline Inspection	4.000	10.000	KM	
4002124	PM01	Routine Pipeline Inspection	5.000	10.000	KM	
4002125	PM01	Routine Pipeline Inspection	6.000	10.000	KM	
Measuring Points						
349		Pipe Wall thickness check	4.000	10.000	KM	Z_PIPE_WALLTHICKNESS
570		45.00 mm	4.000	10.000	KM	23.04.2014
571		44.91 mm	4.000	10.000	KM	23.04.2014
572		40.00 mm	4.000	10.000	KM	23.04.2014
Notifications						
10001539	M1	Pipeline Thickness check	5.000	10.000	KM	MS 1.010 KM
10001541	M1	Carry Out Pipe thickness Inspection	4.000	10.000	KM	
10001544	M1	Carry Out Pipe thickness Inspection	4.000	10.000	KM	
10001553	M1	Carry Out Pipe thickness Inspection	10.000	10.000	KM	
TRUN101	Point to point using no linked object		100.005	100.000	KM	
Object Links						

Reporting

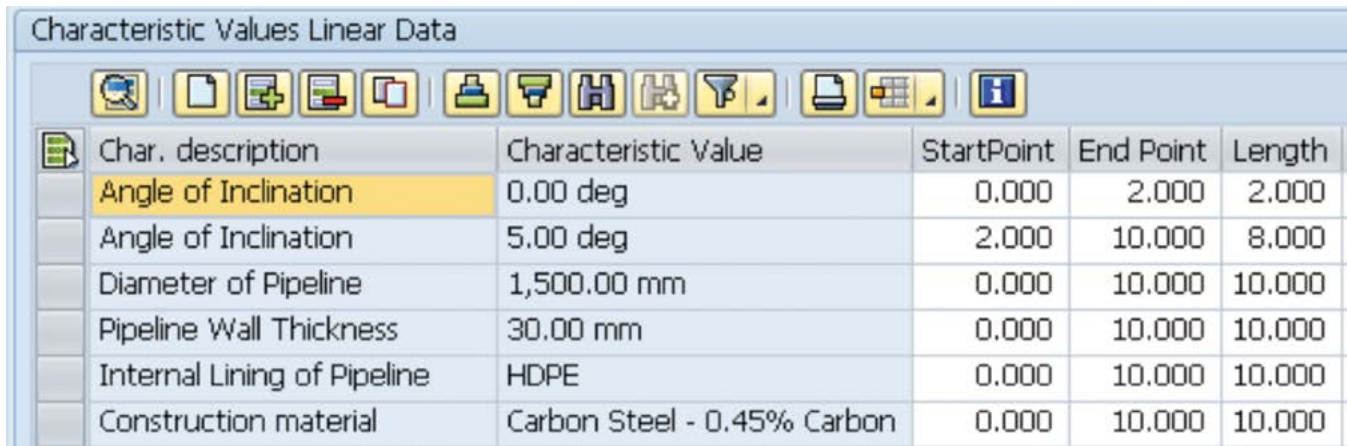
SAP LAM provides enhanced reporting capability, with the ability to search or display data on any of the new linear asset fields. The additional functionality enables maintenance, condition monitoring or asset integrity reporting to be carried out at a greater level of detail. Reports can be produced for either a certain section or exact point of any linear asset.

Classification and confirmations

Enhanced classification system

Enhanced classification functionality allows you to monitor differing conditions at various points along an asset. For example you may have a 30km pipeline, from 0 to 10km the wall thickness is 15mm, from 10km to 20km the wall thickness is 20mm and from 20km to 30km it may be 30mm. Alternatively, you may have a 10km pipeline, which has no incline for 2km distance and then have a 5 degree angle of incline for 8km.

The following diagram below shows how the classification system can specify this information.



The screenshot shows a software interface window titled "Characteristic Values Linear Data". It features a toolbar with icons for search, print, save, undo, redo, zoom, and other functions. Below the toolbar is a table with the following data:

Char. description	Characteristic Value	StartPoint	End Point	Length
Angle of Inclination	0.00 deg	0.000	2.000	2.000
Angle of Inclination	5.00 deg	2.000	10.000	8.000
Diameter of Pipeline	1,500.00 mm	0.000	10.000	10.000
Pipeline Wall Thickness	30.00 mm	0.000	10.000	10.000
Internal Lining of Pipeline	HDPE	0.000	10.000	10.000
Construction material	Carbon Steel - 0.45% Carbon	0.000	10.000	10.000

Work order confirmation

When work is being carried out on linear assets, it can be continuous across several shift changes. To confirm work that has been performed, SAP LAM allows the recording of the start and end points. This means the following shift team know exactly which point the work has been completed, enabling work to be resumed from the exact point the previous shift reached.

This is a simple and effective process to identify where work was carried out, by whom and between which points on the asset.

Confirmation	Counter	Created On	Created by	Order	Functional Location	Start Point	End Point	Length	Actual work
4522	4	08.05.2014	GTAGGART	4002141	ABZ-SF01-DF01-PL-01	2.750	3.150	0.400	4.0
4522	5	08.05.2014	GTAGGART	4002141	ABZ-SF01-DF01-PL-01	3.150	4.000	0.850	4.0
4522	6	08.05.2014	GTAGGART	4002141	ABZ-SF01-DF01-PL-01	4.000	4.350	0.350	4.0

Conclusion

SAP LAM offers an effective solution for maintaining linear assets. Its functionality allows an exact representation of your linear assets. Planning and executing maintenance for any part of your assets can be achieved through condition based monitoring.

Multiple measurements along the length of the asset allow for in-depth, time series monitoring. Enhanced reporting functionality also enables better visibility of the condition of all components contained within your linear networks.

The solution allows a condition based maintenance strategy that is capable of maintaining, inspecting and reporting on performance and condition of your linear assets, allowing any deterioration in condition to be identified before the point of failure.

Ultimately, implementing SAP LAM will help you streamline maintenance operations and provide enhanced reporting for internal and statutory requirements, and sustain the optimum condition and performance of linear assets throughout their lifespan.

With all of this additional functionality, you can make significant time and financial savings from your linear asset maintenance.

If you would like to find out more about SAP LAM, please call +44 (0)1224 707088 or email info@absoft.co.uk

About Absoft

Driving operational excellence and enhanced business performance through SAP best practice.

Absoft is a dedicated SAP specialist, established in 1991. Our SAP expertise, preconfigured templates, solutions and accelerators mean we deliver the best business and technical solutions for your individual needs to the highest standards of quality, quickly.

We are the only SAP partner to specialise in upstream oil and gas. We are working with leading players in the industry and have been for over 20 years, uniquely combining business process, oil and gas and SAP expertise to deliver best practice solutions globally.

If you are working with SAP then Absoft can save your business time and money, leading to increased revenue and bottom line impact.

We enable:

- Highly tailored, best in quality SAP technical and functional support
- The best SAP solutions for your oil and gas business, implemented on time and on budget
- More cost efficient and profitable upstream operations
- More value from your growth and acquisition activity
- Safe and compliant oil and gas operations
- Dedicated oil and gas SAP experts working as part of your team for maximum performance

Absoft's track record for delivering value for upstream oil and gas companies and our support clients is unrivalled. Our customers praise our flexibility and ability to integrate with their internal teams.

Aberdeen | London | Stavanger

T. +44 (0)1224 707088 E. info@absoft.co.uk W. www.absoft.co.uk

© 2014 SAP AG. SAP, the SAP logo and any SAP products and services mentioned herein are trademarks or registered trademarks of SAP AG in Germany and in several other countries.