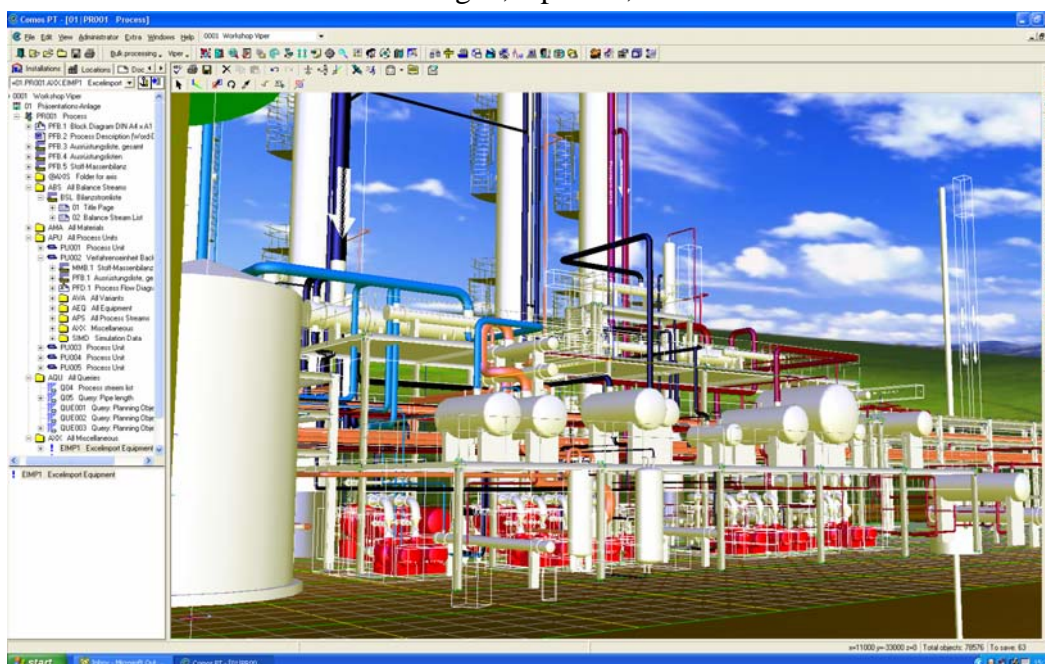**Plant Engineering Lifecycle Conference 2005**

The Hague, April 10, 2005



*Innotec's Cosmos PT[1]*

The plant data management business has evolved significantly in the last few years. Members of the USPI-NL industry association report a decline of interest in data modeling *per se* with a refocus on part catalogues. The general feeling is that data modeling has proved too complex and contentious. On the other hand, a list of parts in a standard format has a more immediate usefulness. ISO 15926 Part 4 is presented as a huge table of plant components (pumps, valves etc.) with attribute values. This standard is seeing real-world deployment, notably on BP's Plutonia development in Angola and on Chevron's Algerian Saha project. The impact of a standard parts list is especially important as a plant moves from front end engineering design (FEED), through construction and on to maintenance and eventual decommissioning. These different stages of a plant's lifecycle are often conducted by different engineering prime contractors (EPC) under the control of the owner operator (OO). Data and IT handover is critical for performance – ensuring that changes to the initial design are reflected in the real-world 'as-built' specifications. Data handover is key here and greatly facilitated by the use of standard formats. This report underscores the convergence of previous industry effort into the consensus that is ISO 15926. We include some historical background on the standard's evolution and further resources on the standard and one popular XML-based realization, XMpLant.

**Highlights**

Standards history

ISO 15926 in Shell

BP – Greater Plutonia project

ChevronTexaco Saha project

XMpLant

ISO 15926 backgrounder

Exhibitors

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[1] Image courtesy Innotec.

## Contents

Keynote Address – Jan de Jager, Technip NL



*de Jager*

In 10 years to 2003, oils managed to triple earnings while engineering and construction earnings decreased! This is despite projects growing in size with what is now a significant risk imbalance. Technip's five largest projects total about €3billion i.e. about €600 million per contract or one third of the Technip group equity! Oils are 'transferring risk to suppliers,' this in turn is leading to a 'claim culture' as lawyers sort out the mess of who should do what and who should pay for it. Technip has grown from 6,000 to 19,000 people in five years and there is considerable pressure to look for offshore labor. Today's students in Europe and the USA do not find engineering 'sexy' and the cost differential is driving offshoring (in the US and EU, upwards of 50€/hour, in India, around $20/hour). The need to upgrade facilities for offshoring has led to high IT investment – in the €70-80 million/year for Technip. Technip is now very IT cost sensitive and doesn't need every software upgrade. The company went straight from Windows 95 to XP. Another annoyance for Technip is clients who mandate their own tools for engineering contracts and who refuse E&C[2] data in 'standard formats', resulting in 'inefficiencies and extra cost'.

Data volume growth has pushed Technip to a 'paperless office'. But in general, according to de Jager, 'IT tools do not save a single engineering hour, although they reduce inconsistencies'. Contract obligations mean that Technip still supplies container loads of paper along with the Adobe pdfs on a CD-ROM. A year later the client asks what they are supposed to do with the paper! Paper documentation's rigidity leads to other issues – a 100 page document covering inspection and testing of a compressor contained contradictory information. Such documents are unlikely to be read and hard to update.

A new relationship between contractor and client is necessary. De Jager believes we need to redress the risk/reward imbalance and to let business people, not lawyers, run the show. Globalization is an enabler, but not a great cost saver. Projects can be shared between global sites leveraging Lotus Notes databases and redlining software and avoiding the proliferation of point to point emails. The industry needs 'one global standard for data' which should be accepted by clients. In the supply chain, Technip leverages its own http://www.epc-business.com/ tool.

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[2] Engineering and Construction.

## Plant Engineering with Aspect Objects – Hans Jürgen Weidemann, ABB



*Weidemann*

ABB's 'Aspect Objets' technology represents plant components along with their roles in different subsystems. The same valve may be used as a component of a reactor or as part of a heating system. Systems and their components can be navigated in tree views. Aspect Objects integrates documents, CMMS[3] (MRO Software's Maximo) and SCADA data from FieldBus etc. An order management tool models the customer's sales department, linking procedures to production. 'Easy navigation is the key to managing plant automation,' enabled by a 'consistent view of objects in context'.

### Q&A

*Is this your own development?*

We use XML standards engineering data exchange (IEC 1131), otherwise we use Microsoft Office 'standards.' There is no intent to build a proprietary system.

## Semantic Relationship modeling in Gellish, Croon Elektrotechniek

Gellish is a data exchange modeling language designed for storing and querying plant and other data types. Gellish was used by Croon Elektrotechniek in the engineering of the Westerschedle tunnel. A Gellish database was delivered in Microsoft Access for as-built project maintenance. The semantic-web like modeling language relates to ISO 10303 Steplib and the ubiquitous ISO 15126.

### Q&A

*How does Gellish compare with OWL[4]?*

Gellish is more intuitive and richer than OWL.

*And to the Semantic web?*

There are similarities but the semantic web is missing good definitions of classes – everything is 'definable', but the RDF[5] standard lacks clarity.

## European Union Information Society – Erastos Filos, European Commission

The EU anticipates a move to a 'single market for ICT[6] Research and Development', with the intent of making the EU the 'largest Knowledge-based economy by 2010'. There is a strong tradition of EU-funded R&D, but only 5% of EU-wide R&D is covered at EU level. The 6th EU 'Framework' program ran from 2003-2006 with a €17 billion budget (€3.6 for ICT). The 7th EU Framework program is currently asking member countries for a doubling of research budgets with a focus on bringing industry and academia together into 'bigger R&D units'. More from www.cordis.lu/technology-platforms and the 2003 report

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[3] Computerized maintenance management system.

[4] Web Ontology Language.

[5] Resource description framework.

[6] Information and Communications Technology.

'Investing in research, an action plan for Europe.' Reference was also made to 'Intelligent Manufacturing Systems' www.ims.org

> **Q&A**
>
> *There is a perception that couple of guys in a garage manage to make a world-beating company in the US, whereas the EU throws money at research with less return. Isn't there a case to be made for less publicly-funded R&D which tends to suck young talent into secure jobs and away from risk taking?*
>
> Only a small portion of EU R&D is funded by the commission, the objective of the Framework program is to create EU-wide R&D rather than country-based initiatives.

### Standards backgrounder - Interview with Anne-Marie Walters, Bentley Systems

Walters was previously a chemical engineer with BP and later with Sema Group, Schlumberger and Atos. A Schlumberger study determined that ESSI (an Intergraph spin-off with BP as flagship client) was a key player in information systems for asset management and Walters joined the company which has now become part of Bechtel. Walters traced the background to the ISO 15926 which was originally developed by the Norwegian POSC CAESAR organization and PI STEP, the Epistle data model from Shell. Following the UK North Sea Piper Alpha disaster, the Cullen Report found that a contributory factor had been the poor data on the facility. There were poor records of the plant 'as built' and a lack of control over the plethoric sub-contractors involved in maintaining and running the facility. BP, Shell and AMEC decided to do something under the auspices of the UK CRINE[7] initiative, applying Aerospace STEP processes to the petroleum industry in what became PI STEP. CAESAR systems was engaged in similar work in Norway, extending the POSC Epicentre data model to engineering. In the Netherlands, the Shell-driven EPISTLE data modeling exercise determined that 'you can't model a plant like upstream data'. Eventually PI STEP and POSC/CAESAR converged on EPISTLE. Later the Dutch USPI-NL industry organization added equipment and supplies to the equation. All three, PI STEP, POSC CAESAR and USPI-NL then converged to a high level PIEBASE organization whose chairman's committee 'sold' the standard to the International Standards Organization (ISO) which eventually became ISO 15926. ISO 15926 is now managed by the POSC/CAESAR organization. Latterly there has been a decline in funding of standards work with a focus on 'getting them out and using them'.

Today a new US standards body has entered the fray – the FIATECH organization – backed by DOW and Dupont. This initiative got a big boost last year from a US government NIST[8] study which looked at major capital facilities such as private and government buildings. The study found that US capital projects wasted $16 billion annually because of poor IT interoperability – underlining the need for better plant data management. Today several projects are piloting ISO 15926. Several vendors are using XMpLant from Noumenon, (Adrian Laud with links to POSC/CAESAR). This initiative leverages 15926 plus the STEP XML standard. Current work focuses on data translation, interoperability and delivery to the standard. Industry wants FIATECH to manage XMpLant.

Bentley has been acquiring various engineering CAD/CAM tools as follows: Intergraph's PDS, (which was developed on top of Bentley's Microstation), REBIS AutoPlant (AutoCad's plant application) and Bechtel's 3DS (now Bentley's Plant Space). These are now being ported into Bentley's own SmartPlant environment (see below). The REBIS acquisition heralded a change in Bentley to an 'open platform' with read/write of AutoCad

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[7] Cost Reduction in the New Era (this was back in the days of $10 oil!).

[8] National Institute of Standards.

files. Bentley also acquired ESSI and now 'covers both CAD and data management', through ESSI's eWarehouse. Project documents are managed with Project Wise, a specialist CAD DMS. Bentley also acquired Aspen Tech's AxSys chemical engineering process simulation tool, part of HySys. So Bentley now has a front end engineering tool as well.

Bentley is pulling all this together into its DigitalPlant environment, leveraging the 'openness' of the underlying MicroStation format, third party vendor formats and XMpLant. DigitalPlant has been used on BP's North Sea Claire field, two Algerian Gas fields (In Salah and In Amenas) and two projects in Baku. BP's digital business unit is in process of ratifying DigitalPlant for global deployment. DigitalPlant is also used by ChevronTexaco on the Aqbani development in the Middle East. Other clients include the Wood Group in the North Sea and Conoco Phillips.

## Change management with Spescom eB – Lyn Fernie, Aker Kvaerner

The nuclear industry presents complex challenges with respect to 'as designed', 'as built' and 'as maintained' manifestations of the plant. These can diverge to become contradictory, with degrading data and loss of efficiency. Considerable effort is wasted on corrective action instead of plant improvement. An ICT[9] study determined that employee effectiveness increases from 10% to 100% as data integration grows from 25% to 100%. Most industries only manage a 75% information integration level so employee effectiveness is only 10% of its potential. Aker Kvaerner Engineering Services (AKES) uses Spescom eB to manage engineering life cycle information, from the initial bid response to plant decommissioning. Many third party 'silos' – from SAP, Primas Primavera, P3e PIL, GIS, MS Office, e-mail and CAD – are linked in a 'collaborative workspace'. When a change is approved (a formal process) Spescom eB change analysis is used to visualize the 'ripple effect' of the change. This has given 'significant improvement' in approval cycles. eB shows all documents and items affected and the people and organizations to be notified. Fernie's case study involved the refurbishing of a radiological unit prior to decommissioning. This €4 million project produced 2,000 documents on SCADA and other instrumentation. Change is managed in eB and score carded on KPIs. Thanks to eB, milestones were reached 20% early. Productivity was 144%, and costs 94% of estimates.

## Greater Plutonia Project (Angola) – Andy Till, BP Exploration

Angola Block 18 holds 6 deepwater fields. The Greater Plutonia project involves a 300m long FPSO[10] designed by EPC[11] Kellog Brown and Root[12] (KBR) and built by Hyundi Heavy Industry, Korea. BP, 'the learning organization' agreed on the ISO 15926 standard for data and documents – which was written into the contract, along with detailed responsibilities for handover. This has resulted in a clear data model and good data visibility. Links from an equipment tag number point from project documents to OEM[13] documents giving equipment characteristics etc.
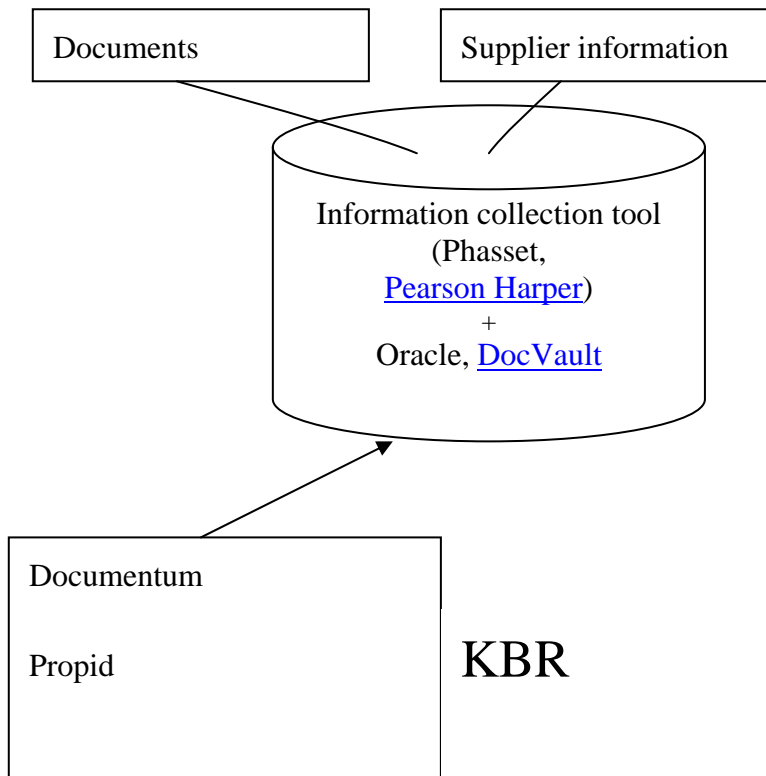
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[9] Information and Communications Technology.

[10] Floating Production, Storage and Offshore Loading (vessel).

[11] Engineering Prime Contractor.

[12] KBR is part of Halliburton.

[13] Original Equipment Manufacturer.

Till reported issues with spaces, slashes and dots in drawing names and suggested that there should be less 'optional' information in the standard. Electronic data and documents can be viewed in a single window for global access. 80,000 documents are available in a 'Virtual project Room' publishing tool with 3D views of plant (Aveva Vnet). Users can click and go to documents with hotspots for more plant information.

Till believes that data formats and requirements should be written into contracts, with a 'comprehensive information set' available for the different stakeholders. In the Angola context – where distance and import regulations can make for long delivery times, this helps ensure that everything is ready (especially spares) for first oil. Unfortunately, 'consistent, clean data is not generally available from vendors'. The Angola project 'only scratches the surface of the possibilities of standards-based engineering and handover'.

## ISO 15926 Part 4 – Dalip Sud, Shell Global Solutions



*Dalip Sud, Shell Global Solutions*

ISO 15926 (Part 4) is a 'text book' of references, the Register, organized by disciplines (rotating, piping, instrumentation, activities etc.) with 12,000 core definitions of plant objects. The Register also captures inter-relationships such as 'is a member of', 'has a role of' etc. Shell's own parts library, ShellLib, builds on the ISO standard, Step Lib, and links

to commercial catalogues. Today Shell uses a mixture of proprietary tools along with its own libraries – but is moving to use and integrate with ISO 15926.

If EPCs map to Part 4, this is done once and for all. The original ISO idea was that everyone should use STEP, but it is now recognized that many tools and business processes preclude wholesale change. The alternative adopted is to map and extract data to ISO. Where it is required, 'industry can now start exchanging data without having to map each time.' Another key initiative is the USPI-NL/Fiatech handover guide.

> **Q&A**

> *What's the overhead of using the ISO standard?*

> In the early days, we were talking about data modeling – at an astronomical cost. Today we just map equipment definition and terms. The effort has been drastically reduced, down to man-weeks. This needs to be done internally at first, prioritizing equipment according to a vendor's specialist domain.

## Knowledge Management in Europoort Refinery – Rob Van der Velden, Kuwait Petroleum

Elsevier Knowledge Management (originally SBC) has developed a KM system for Kuwait Petroleum's Super Claus process-based sulfur plant in Rotterdam. The project set out to capture knowledge from experienced and retiring gasoline plant operators. The resulting uniform operating procedures have now been extended across the plant. Captured information includes instrument codes, safety valves, symbology, document and schematic cross reference. The final documents are Adobe PDFs. Reed Elsevier's Terhorst unit developed the KM software which delivers 'intelligent' pdf documents on a CD-ROM.

## Standards-based engineering IM – Adrian Goulding, Chevron Texaco

ChevronTexaco's Saha condensate project is a $1.9 billion, 100,000 bbl/day development. CTC issued guidance on documents and drawing classification tags, there were 'deficiencies' in their implementation. Goulding described the contract specifications as 'appalling' in terms of standards and format prescription. This was because managers believe wrongly that standards increase costs. They don't! Today CTC's contracts now include precise terms and ensure good data and documents. Initial construction started without an IT/IM plan – this was rectified by adding IT and data management. CTC put in a Documentum eRoom server which was easy to use. In fact the technology began to drive adoption, users could see benefits from standard document nomenclature. The 'whole thing accelerated' to embrace transmittals and change management. Documents have been captured for handover from Documentum, Filenet, JDEdwards World and many local systems. Documents are 'standardized' in Excel and Word. Issues remain with clarification, layout and units. Goulding asks 'should CTC drive a standard here?' It would be good to have more standard EPC output but CTC 'doesn't want to get into the EPC's business'. There remain 'lots of handwritten stuff' in commissioning documentation. But vendor documents (manuals) on PDF are being re-organized by CTC into a Data Warehouse which now holds the 'best information in the concession' and 'will become a standard.'

## Round Table Discussion

**Edwin Stötefalk** – Only a few years ago, the debate at the Plant Information Management tradeshow revolved around the question, 'What is the point?' Today, standards are 'happening' – and automation is next.

**Jan de Jager** (Technip) – Standards can no longer be ignored by contractors, and Owner Operators (OO) need to know what they want, especially as the OOs' engineering function is decreasing.

*Do you bid twice – with both internal and external standards?*

**de Jager** – We are often forced to use the OO's standard which adds 15% to cost. Moreover different OO departments (operations, engineering) may mandate different standards!

**Dalip Sud** (Shell) – We recognize this issue – although it is as yet unresolved (in Shell). The problem is that no one has solid figures of what baseline costs are.

**Anne-Marie Walters** (Bentley) – A NIST study unveiled at the Daratech trade show in the in USA put the wind into the sails of industry with some hard numbers. Across US Capex spend, some $15.8 billion is lost due to poor IT interoperability. These costs are borne by the OO's.

**Paul van Exel** *(USPI-NL – Does industry want to do more to promote the standard?*

**Jean-Jacques Rey** (GdF) – Yes – for the Register/list, not for data model.

**Per Malm** (Statoil) – We are in the process of turning Statfiord from an oil producer to a gas producer. Suddenly we need lots of early engineering documents – not easy to locate and use these old documents.

**Others**

One problem is that most OO's don't understand basic best practices – USPI and Fiatech should cooperate on this.

Asset info is itself an asset, maybe it should appear on the balance sheet?

The outsourcing trend is all very well but it takes 10 years to train locals and this sucks jobs out of EU. Youngsters today steer clear of engineering.

Exhibitors

*Bentley Systems Digital Plant*
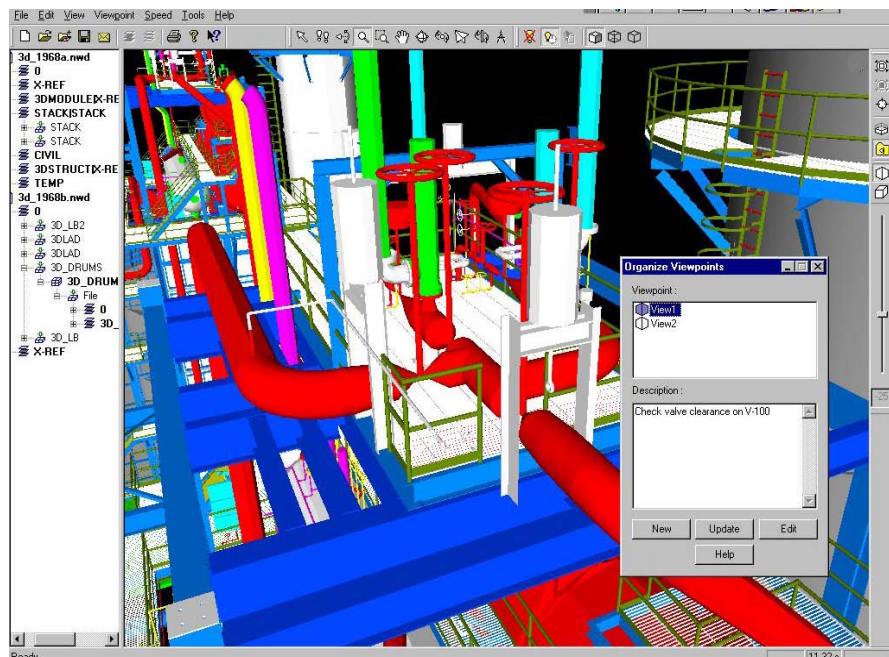


*Bentley Digital Plant[14]*

Bentley Systems' new 'DigitalPlant' solution made its EU debut at the PELC show. DigitalPlant integrates engineering and business information in systems such as SAP. DigitalPlant's engineering tools are based on Microstation and AutoCad, with 2D schematics, 3D visualization, 4D animation and '5D' cost-based visualization. Connectivity with ERP systems allows for change management and time-based search and

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[14] Image courtesy Bentley Systems.

query. DigitalPlant leverages Bentley's eWarehouse, a 'scalable, standards-based data store for plant information.' DigitalPlant users include BP, ChevronTexaco and BHB Billiton. More from ron.kuhfeld@bentley.com.

*CEA Technology – 4D Octopus*
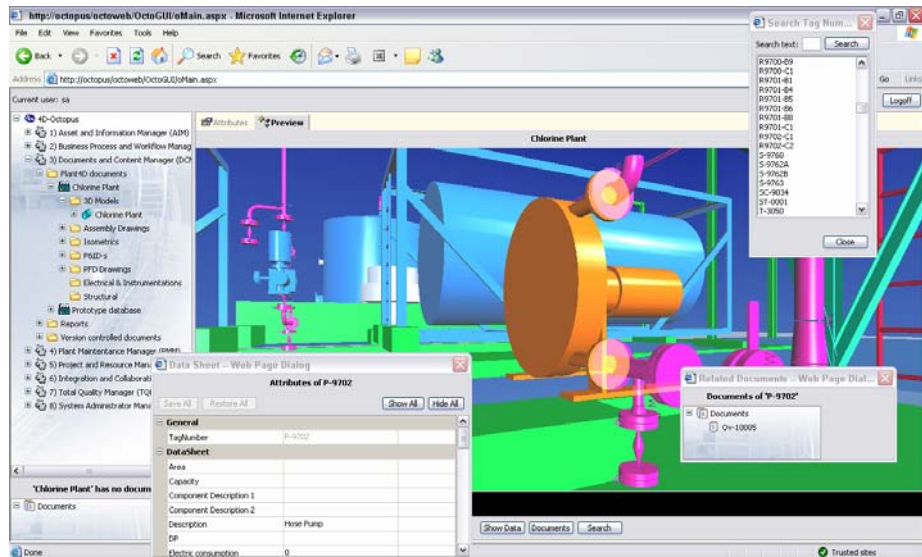


*CEA Technology's Octopus[15]*

CEA Technology recently launched 4D-Octopus, an Asset and Information Management solution for all stages of a Plant Life Cycl - from design to decommissioning. 4D-Octopus lets users modify plant data through a web browser. Data navigation is through a tree structure, with visualization in an interactive P&ID viewer and 3D viewer. An Integration and Collaboration Module supports project handover with modifications merged with the as-built plant data in a controlled way. Data storage is 'non proprietary' and one-time data entry assures consistency. Files, data, drawings, pictures and scanned files are integrated with the 2D schematics and the 3D model. 4D Octopus is used by BP at its UK Grangemouth refinery. More from Tonny Dijck and www.cea-int.com.

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[15] Image courtesy CEA Technology.
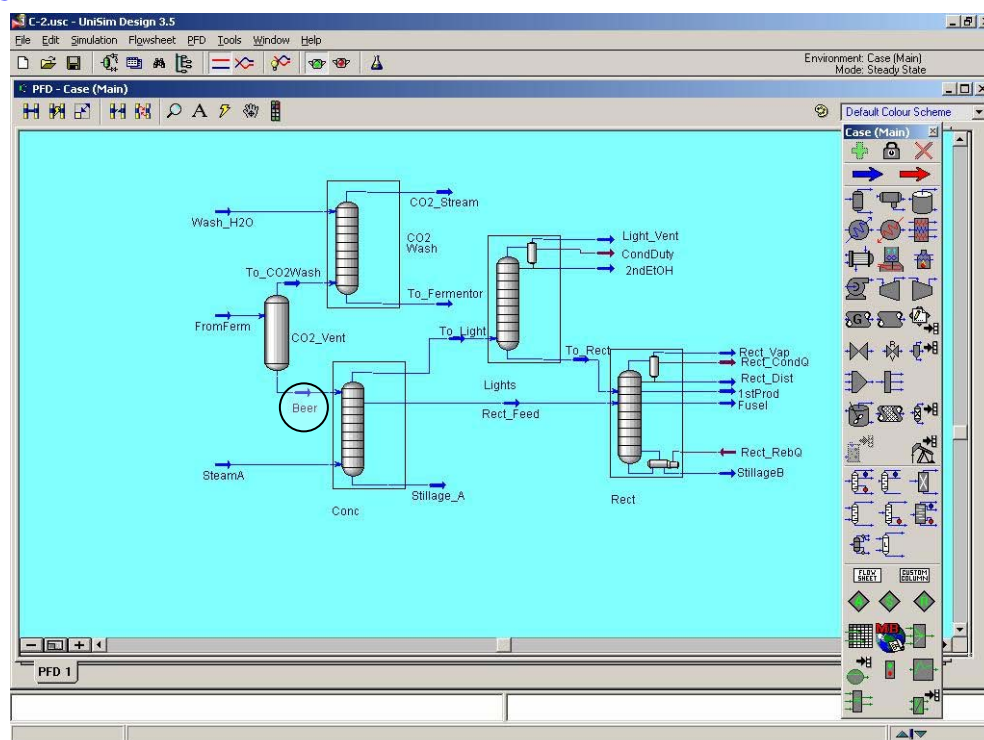
*Honeywell UniSim*



*Honeywell's UniSim[16]*

Honeywell now owns the IPR on HySys which was divested by AspenTech on instruction from the US SEC[17]. This has now been repackaged as Honeywell's UniSim comprising Design, Operate and Optimize Suites. Honeywell is working with Schlumberger, Scandpower and other third party vendors to ensure their HySys-based tools operate with UniSim. UniSim already has an interface with Pipesys and Scandpower Petroleum technology's Olga 2000. Re offshore production optimization, 'This has been done for years with APCs[18]'. Honeywell has been preaching the merits of APCs to the offshore industry - but this has largely fallen on deaf ears. Recently APC has shown its worth on BP's Ula field. Quote from Vasbinder 'The Aspen Lifecycle simulation story is dead'. More from Honeywell Process Solutions unit at simulation@honeywell.com and www.acs.honeywell.com/ps.

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[16] Image courtesy Honeywell.

[17] Securities Exchange Commission – anti monopoly regulator.

[18] Advanced Process Controller.

*IBM/Dassault SmarTeam*
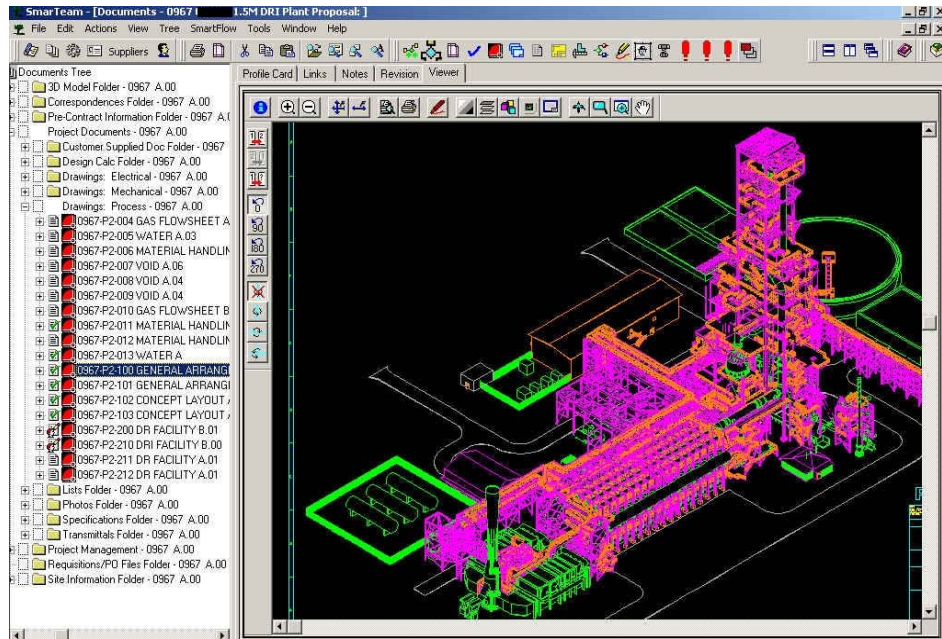


*Dassault's SmarTeam[19]*

Dassault's Smarteam plant data management interfaces with its flagship Catia Computer Aided Design tool and Delmia for plant automation and simulation. Delmia is used to simulate shutdown, maintenance and restart – training operators to handle incidents and change. Also developed an Asset Lifecycle Management (ALM) portal for BP showing data from Catia, SAP, Integraph etc. Catia and SmarTeam are jointly marketed by IBM and Dassault - the result of a 24 year long marketing collaboration.

*Quillion's Jaguar property browser*
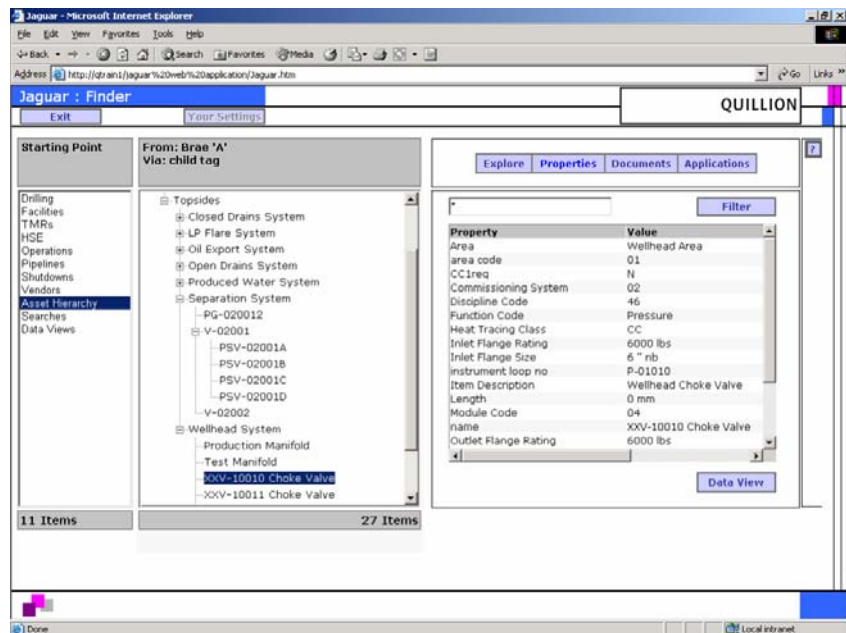


*Quillion's Jaguar Property Browser[20]*

Case study with AMEC plc – Please find attached a zip file of 3 screenshots showing DataManager on the web, drilled down an asset hierarchy tree to a tag of interest. The 3 views show the different tabs - properties, documents and applications (sources of related
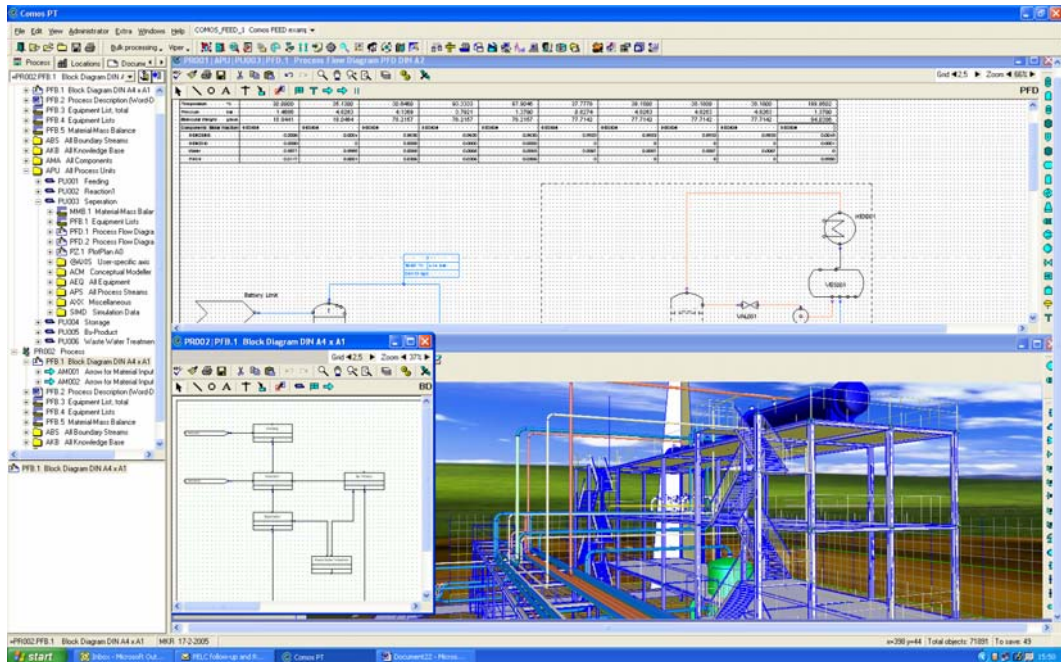
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[19] Image courtesy Dassault/IBM.

[20] Image courtesy Quillion.

data for that tag). I have also attached a press release about the project and the case study in PDF format
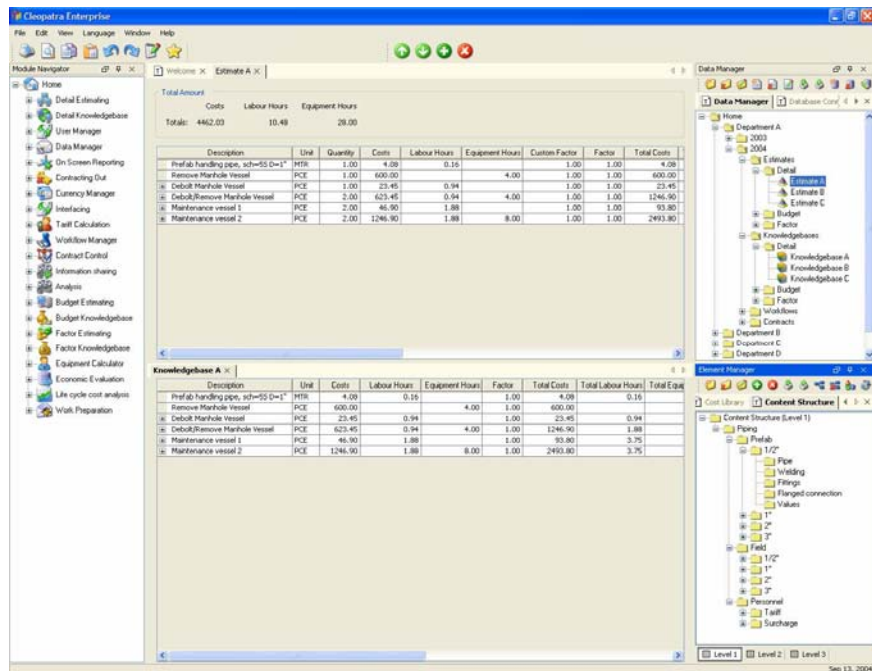
*Innotec Cosmos PT*



*Innotec Cosmos PT[21]*

Cosmos PT plant engineering and lifecycle solution. Database and Cosmos MotionX XML-based data exchage. More from Ron Jansen and Innotec.

*Cleopatra Enterprise - Cost Engineering*



*Detailed estimate with Knowledge Base[22]*

Cost Engineering Consultancy(CEC)-Cost Engineering Software (CES) developed Cleopatra from the CBA application, developed for Shell in 1995. CEC-CES is in the

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[21] Image courtesy CEC.

[22] Image courtesy Cost Engineering.

process of upgrading the tool to 'create a more advanced cost engineering software product, supporting the entire project life cycle.' Cleopatra Enterprise supports cost engineering activities such as estimating and contracting out, for both owner and contractor, supporting the full life-cycle process, from design and commissioning to abandonment. Cleopatra Enterprise supports cost estimating, construction and maintenance costing, contract and bid management. The tool integrates with corporate ERP systems and other external information sources throughout the project life-cycle. More from Ko des Bouvrie and CEC-CES.NL.

*McLaren – Filenet Enterprise Engineer*
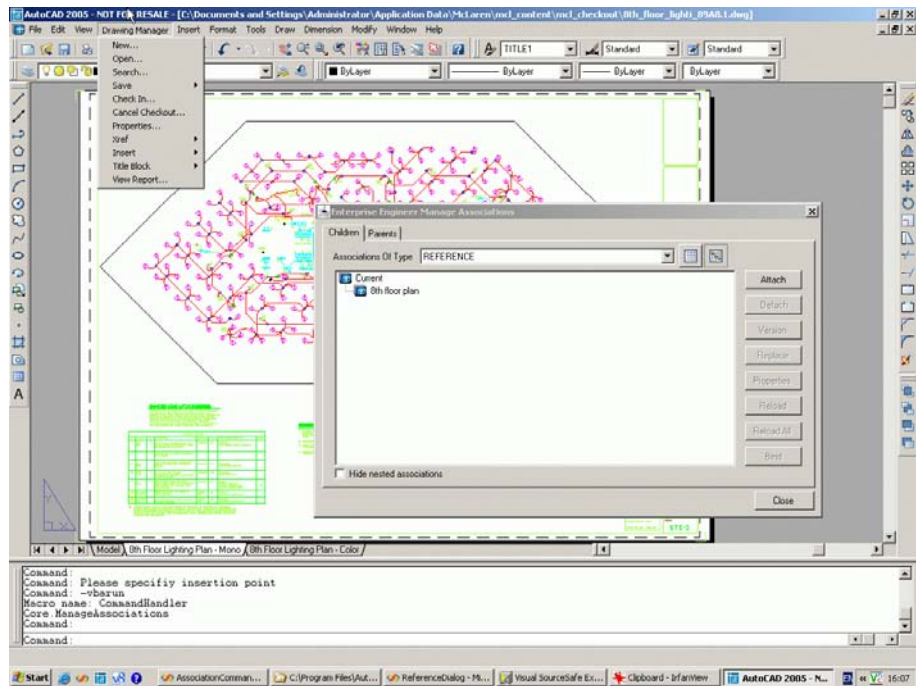


*FileNet Enterprise Engineer*[23]

The McLaren/Filenet joint venture has just released Enterprise Engineer, built on McLaren's Enterprise Engineer and Filenet 8. Enterprise Engineer is a Microsoft .NET-based application to manage 'all forms of engineering content' including drawings, correspondence, procedures, specifications and other related documents. Partner Pearson Harper uses Filenet in its Phasset Solution. More from Tawna Canhoto and www.filenet.com.

## Getting Started with the ISO 15926 Standard

The ISO 15926 standard is a part of the TC184/SC4 Industrial Data standard set describes and manages industrial product data. The Oil and Gas ISO 15926 standard itself covers the 'life-cycle' data for oil and gas production facilities including engineering construction and operations. For a background to the ISO 15926, we recommend the InfoWeb introduction. A course on the standard is also available from the POSC/CAESAR organization.

## XMpLant[24] – Noumenon Consulting

XMpLant[25] is being adopted by the major players (AVEVA, Bentley and Intergraph) and there are over 80 subscribers to the public domain model on

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[23] Image courtesy FileNet.

[24] This section contributed by Adrian Laud, Noumenon Consulting.

http://groups.msn.com/XMpLant. The model is an implementation of ISO 15926 and 10303 and the XMpLant technology is being used in around 20 major projects.

The emphasis is on integration and exchange of process plant information. This includes adding value to legacy data such as dumb P&ID's and Spreadsheets applying rules to add intelligence. Also a key factor is that the XMpLant XML models are a engineering neutral open model that provide an archive of design information independent of the design systems.

XMpLant is a neutral model based on ISO 15926-2,4 and ISO10303-42. This XML technology has been used to migrate thousands of models, creating intelligent and structured models in the target system. In these projects data driven XMpLant interfaces for the major process plant design applications (AutoPlant, PDS, PDMS, Plant4D, PlantSpace, SmartPlant), among others, were developed. A major new feature with recent developments is the conversion of Catalogues and Specifications using XML neutral files. The neutral model used by XMpLant is in the public domain and can be accessed at http://groups.msn.com/XMpLant the XMpLant technology can be licensed from Noumenon Consulting Ltd.

The EPISTLE framework, the basis of STEP AP221 which became **ISO 15926,** broke the mould in that it defined only a sparse framework and rules for classification where the objects themselves were classified in a separate part – a ***Reference Data Library*** (RDL). Effort could then be directed to agreeing the terms and objects used and their classification – the contents of the RDL. This is still a controlled document but it is a separate part of the standard that can be updated on a regular basis.

As the focus was on handover and operations much of the classifications for design objects has not yet been included and in particular 2D and 3D geometry. This precludes the use of ISO 15926 for the full design information.

However **ISO 10303-42** covers most of the geometric objects required for 2D and 3D and so a combination of the flexible data model for process plant items and the fixed model for geometry provides a solution.

The combination of ISO 15926 and ISO 10303-42 provides a neutral model in which to hold the full design information however, it does not help with getting the information in and out of the design (or operations) systems. Suppliers of design systems which have adopted the model used by XMpLant include Aveva, Bentley, CEA Systems, Intergraph, INOVx and RealityWave.

The XMpLant toolkit was first deployed in 1999 and has since been used on many major projects with new system interfaces being developed by Noumenon and system suppliers. Most interfaces being developed using the toolkit (XMpLant Development Environment XMpDE). There are several other interfaces in development by Noumenon and other companies – there are over 70 companies who subscribe to the XMpLant group (http://groups.msn.com/XMpLant ) where the Schema is posted.

*This report has been produced as part of The Data Room's Technology Watch Service. All material is © 2005 The Data Room unless otherwise stated. For more information about The Data Room's technology Watch Service please contact:*

*The Data Room*

*+33 1 4623 9596*

*info@oilit.com*

*www.oilit.com*

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[25] XMpLant is a registered Trade Mark of XMTools Ltd.