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WHITEPAPER

Opportunities & Pitfalls of Document Control in Major Oil & Gas Capital Projects

A discussion paper for those responsible for major downstream, midstream or upstream capital projects

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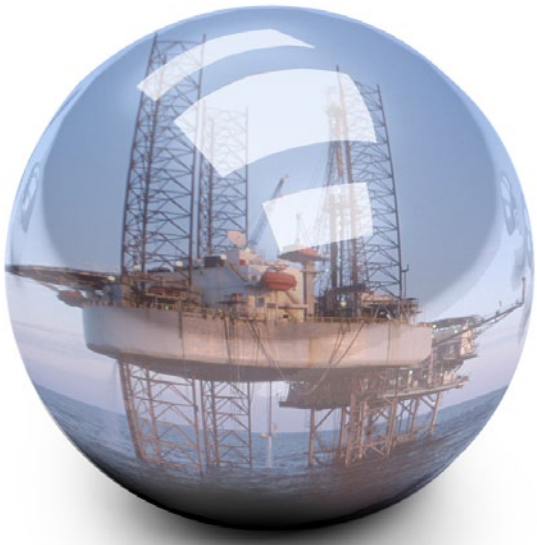


Executive Summary

With the growth in the complexity of major capital projects (MCP) and the exponential data growth in the oil & gas industry today – whether upstream, midstream or downstream – the effective management and control over thousands of engineering documents shared between numerous stakeholders has never been more important. These challenges have been further exacerbated by the need to control and reduce the risks associated with these projects.

Get your document control wrong - the incorrect revision of an engineering document in a construction pack, for example, or poor procedures at the planning and design stage – and you are vulnerable to increased corporate risk, failed audits, the wrath of the regulators, cost overruns that can extend into the millions of dollars, and significant risks in relation to safety, schedules, and corporate reputation.

Get your document control right - you can look forward to positive impacts on the bottom line and major capital projects on budget, on time and to the highest specifications.

The goal of this white paper is to address some of the challenges facing document managers and controllers in the oil & gas industry today, issues to be aware of, and some of the options for a more integrated and flexible approach to document control.

While not a panacea to document control issues today, the paper will argue that owner operators and EPC (Engineering, Procurement and Construction) contractors can only map out a document control strategy if it is flexible, fully aligned with their business strategy, and where technology is the 'enabler' rather than the key driver.

1. Introduction – Document Control Today

The oil and gas industry is a highly document-intensive business today! Whether it is downstream assets, such as a refinery, through to upstream assets onshore or offshore, large-scale oil & gas projects today are extremely complex affairs.

More often than not, they involve hundreds of engineers from different organisations working together to commission, design and construct assets before handover to operations. It involves the investment of many working lives and requires the necessary information to be placed at the fingertips of the right people at the right time in the right format.

additional business layer that sets the rules of engagement for document management systems today.

Document Control is essentially where the real value-added business applications are applied to document management, ensuring that all document management systems adhere to business, contractual and regulatory rules and generate real value for both the organisation and for the successful completion and operation of MCPs.

Document Control is fundamentally about traceability - about capturing every detail about what happens to docu-

Yet, what is document control, how does it differ from document management, and why is it so crucial to the success of MCPs today?

Document Management is essentially the mechanics of managing documents. It is about securely organising documents in a way that allows them to be retrieved by anyone who needs them. In this way, it plays a key role in supporting effective project management and ensuring that information is available to all key stakeholders so that they can work together seamlessly and collaboratively together.

Yet, while document management's responsibilities are to manage and collate information, document control is an

ments and drawings as they move between different parties and provides the business-focused audit trail that is the essential cornerstone of project management today. If implemented correctly, document control can provide enormous benefits to MCPs in regard to improved returns on investment (ROI), reduced risk and exposure and greater transparency.

So, what are the key challenges in document control strategies today, what needs to be incorporated into any Major Capital Project, and what are the obstacles to success?

2. The Challenges

2.1 The Growth & Complexity of Operations

MCPs in the oil & gas industry today are highly complex and include a variety of stages from final investment decision (FID) through to first cargo which involves setting up contractual boundaries, project planning and scheduling, execution, and ultimate hand-over. On a typical project, for example, a single engineer can author hundreds or even thousands of project-related documents with the management of these documents essential to a smooth construction process. The costs are also huge with projects, such as the Gorgon LNG project, offshore Australia having a budget of US$42 billion!

Furthermore, with capital construction projects in the oil and gas industry comprising a significant percentage of company spend, there is also an increased need for predictability, transparency and cost containment within such projects.

The Continued Growth of Major Capital Projects in the Oil & Gas Sector

- Despite slower growth, the International Energy Agency (IEA) still forecasts world primary energy demand growing by 1.6% per year through to 2030. To meet this requirement, the IEA is calling for an energy supply investment of $1 trillion per year through 2030.
- The latest World Deepwater Market Report from analysts Douglas Westwood forecasts a 90% growth in deepwater expenditure between 2012 and 2016 as compared to the previous five year period with a total of $232 billion predicted to be spent subsea.
- In the last four years alone, capital projects at oil & gas operator, Chevron have grown by $5 billion.
- Worldwide E&P spending in 2012 is expected to increase to $598 billion from $544 in 2011, according to Barclays Capital and the Barclays Global 2012 E&P Spending Outlook.

In addition, the complexity of such projects has also been exacerbated by the growth and complexity of EPCM (Engineering, Procurement and Construction Management) consortiums. Rather than the nomination of a single EPCM as was often the case in the past, today there is an increasing number of interfaces between different stakeholders and differing contractual arrangements with significant implications for document control. The net result is that document control must be highly effective, flexible and innovative to manage the complexity of MCPs within the oil & gas industry today.

2.2 The Danger of Cost Overruns

While 15 years ago, only 10% of large oil and gas projects ran more than 50% over budget, in 2011 this figure had doubled to 20%, according to a Schlumberger Business Consulting report. While only one element of cost containment, document control can play a key role in merging capital investment strategies with project execution requirements. Document control's ability to collect data and track all stakeholders as well as providing multiple access to real-time project data can play a crucial role in enabling operators to track the progress of projects and pre-empt cost overruns.

2.3 The Different Execution Models

It's also important to understand the different models on MCP projects today. As referenced in the previous section, MCPs today tend to have ever moving boundaries with changing vendors, and continually evolving project and contract boundaries. A typical execution strategy, for example, is to select a single EPC contractor - a contractor who will take responsibility for the design, purchasing, construction and commissioning and transfer ownership back to operations. The EPC contractor might carry out the front end engineering design (FEED) and detailed design or they might subcontract this work.

For some, the whole project from feasibility through to engineering, procurement and construction could all be done in house, or parts of the feasibility study or all of engineering design, procurement and construction may be outsourced. The fact is that no project is the same and document control will never work with a 'One Size Fits All Approach'. In order to be truly effective, document control must be flexible and align itself with specific project and business needs.

Major Capital Projects - A Lot to Think About!

Major capital projects are so varied today that it's almost impossible to define a typical project. Here are some common stages, however, all of which have major implications for document control.

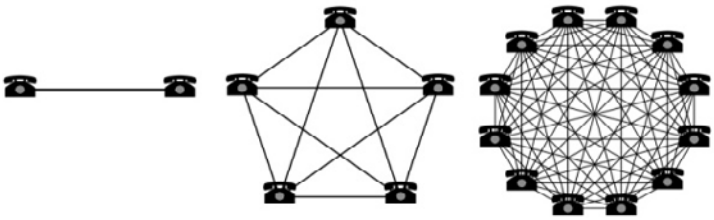
- ***Business Strategy/Feasibility Studies*** to identify the capital investment opportunities, define an execution strategy and secure the funding.
- ***Project Planning.*** The goal of project planning is to create a structured project that is technically viable, financially feasible, environmentally sustainable and capable of execution at an acceptable commercial risk.
- ***Execution.*** The focus is now on the mobilization and coordination of resources to carry out the plan.
- ***Project Management.*** The project management world is one of work breakdown structures, resources, schedules and costs codes. It is concerned with describing and organising the work of the project.
- ***Supplier Framework Agreements.*** To minimise the total cost of ownership during operations, many EPC companies set up a framework agreement for suppliers and vendors. Throughout the project the suppliers will submit the information deliverables (vendor documents) associated with their contractual package for checking and acceptance by the EPC contractor and/or the Owner/Operator.
- ***Project Control.*** Controlling is an on-going activity throughout project execution, ensuring that project objectives are met.
- ***Closure and Handover***. This is the phase for commissioning, handover, engineering turnover and formal acceptance, and is where any final stage payments are made to contractors as well as engineering document handover.

2.4 The Importance of Scalability

Bob Metcalf, a leading electrical engineer and widely accredited with the invention of the Ethernet standard, stated in his Metcalfe's Law that "The community value of a network grows as the square of the number of its users increase".

The same is true of a system that supports the global execution of major capital projects. Such a system is about managing the processes and documents that organisations and individuals need to follow to get larger and larger jobs done, as well as ensuring that it is as effective and functional with thousands of users as it would be with just a few.

In many MCPs today, however, there is not always an understanding at the outset as to exactly what documental control systems will be required. Many projects also tend to start expanding after the initial analysis and design has been completed leading to cost overruns. In such circumstances, it's essential that any document control system is able to scale up and, as Metcalf put it, ensure that the value of the communications network grows accordingly.



Metcalf's Law

2.5 The Importance of the Handover

One of the most important responsibilities for document control today is at the handover to the operator stage. It is at this stage where all of the plant/facility drawings, layouts, equipment, and infrastructure information are handed over to the operator for the operations and maintenance of the site. Asset information must also be imported into the systems operators use to operate and maintain the facility.

As well as the need for this information to be accurate, it is also essential that it can be accessed and managed easily by the operator. Operators need the same collaborative engineering platforms as during the construction

phase and the role of document control in MCPs must continue well beyond construction completion. The challenges for document control practitioners is ensuring that there is a seamless integration between different systems and the very latest engineering information provided to the operators.

2.6 The Need for Regulatory Compliance

Finally, there is the challenge of regulatory compliance. Oil & gas projects today face a host of regulations with the regulatory and reporting landscape particularly complex.

Not only do operators have to conduct operations in a variety of regulatory, Health & Safety and tax regimes but they also have big upfront investment needs, which often go hand in hand with uncertainty about long-term outcomes. In such circumstances, any failure to develop appropriate project controls and document control systems to comply with governance, legal and regulatory standards are likely be treated strictly. The onus on document control systems to date is to be flexible and transparent enough to meet these complex set of health, safety and government regulations

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2.7 Managing the Risk

All these document control challenges above are essentially about managing risk – whether it is the complexity of projects or different execution models; or ensuring that the correct documentation and controls are available for handover and adhere to specific regulations. Document control today is essentially about flexibility and transparency and ensuring that risk is both assessed and mitigated before it's too late.

And the dangers of getting your document control wrong, as our examples illustrate, can be widespread leading to budget overruns, high levels of corporate risk, and a negative impact on both the bottom line and the company's reputation.

Unacceptable Corporate Risk

The lack of a standard information control solution can have a real impact on a company's bottom line. It can lead to:

- Failed internal audits.
- Lack of clarity when undergoing change management processes.
- Liability for missing documents in the case of law suits.
- The inability to demonstrate regulatory compliance.
- Heavy fines through incorrect information being provided to regulators.
- HSE incidents and damages to corporate reputation.
- Increased project costs compared to contractors with superior document control systems.

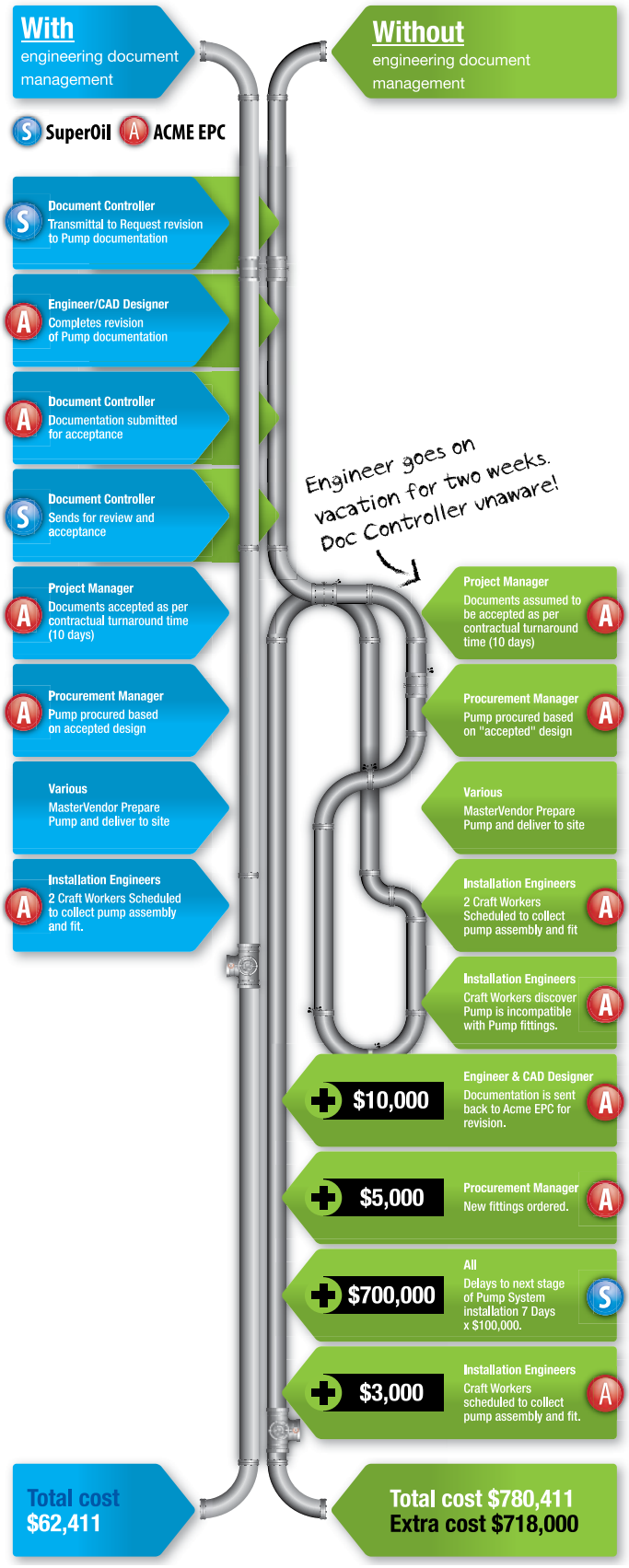
The Dangers of Going on Vacation!

The figure below illustrates how a major capital project can go off track due to a lack of communication and the absence of strong document control procedures. In this example, it concerns a replacement pump.

The initial steps involve the 'Transmittal to Request revision to Pump documentation' which is passed from the Document Controller at the operator to the Engineer/CAD designer at the EPC. The pump documentation is revised and sent for acceptance with the operator via their document controller and then to the operator's engineer. At this stage, the process has been closely managed with cumulative costs of only $10,000. Then, the engineer at the operator goes on vacation.

With ten days having passed, the EPC assumes that the documentation has been approved and the pump is procured based on the approved design. The pump is then delivered to site with costs now at just over $62,000. The pump, however, is found to be incompatible with the pump fittings, the documentation is sent back for review and new fittings ordered. The delays to the next stage of the pump system can be calculated at $100,000 per day with suddenly the mistake resulting in cost overruns of over $700,000 – an expensive vacation!

Replacing a pump during Commissioning of a Capital Project With and Without Document Management and Control



3. The Solutions: The Technology Options

This paper has examined some of the key drivers and issues affecting document control in the oil & gas sector today. Let's now take a look at some of the 'enablers', in particular technology.

Technology is central to document control with a number of recent developments having ensured that the era of manual processes and legacy tools is fast disappearing. Recent developments include:

3.1 The Growth of Enterprise Content Management (ECM) Systems

Enterprise Content Management (ECM) systems are today the cornerstone of many document control systems offering a platform-wide approach to the capturing, searching and networking of documents.

Many current off-the-shelf ECM systems, however, come with limitations in regard to ease of use and access and are often unable to store crucial metadata within the document. Typical metadata includes filing tags, such as authors and dates, due date, discipline etc...

The result is that many ECM platforms require extensive customisation to incorporate the document control processes required to meat specific MCP requirements.

The dangers of a bespoke system are that all too often the technologies tend to 'morph' into expensive, complex and disruptive systems with little bearing on the actual business and project management requirements. There is often also a lack of domain knowledge from the system integrator with the client having to pay for consultants and then spending an inordinate amount of time teaching them about their processes.

3.2 Engineering Portals & Social Networking

Engineering web-based portals are also an important means of managing project documentation. Although such portals have been around for almost 20 years, it seems that requirements are still in flux as there remains no clear market leader.

The benefits of an engineering information portal include the ability to provide a single window to view engineering information in a secure manner. Portals foster easy collaboration between stakeholders, support productivity gains and enable multiple stakeholders to view engineering information, such as 3D models, intelligent drawings, and data sheets, seamlessly and securely. Furthermore, with such information being made available independently of different authoring systems and geographical locations, it can also lead to reduced cycle times.

Linked to engineering portals is the growth of social networking. Today social networking platforms are also providing an important role in connecting technical people from across regions and disciplines.

3.3 Cloud-Based Computing

Finally, one of the latest technology developments in document control today is the rise of cloud-based Application Service Providers. Already, private cloud-based solutions are increasingly being adopted in the oil & gas sector to enable better collaboration among joint venture partners and to establish standard procedures in the areas of licence agreement and management, for example.

The benefits of cloud computing are clear. Through a thin client device, such as an iPad or laptop, users can enjoy an elastic capacity of data and computer power on demand, zero maintenance costs, and significantly reduced capital expenditure requirements.

Cloud computing can also lead to a much more integrated and seamless document control workflow. With cloud computing, project engineers can enjoy real-time collaboration across different projects and access information from a single, truly scalable system – Metcalf's law in practice.

Timing may also be a factor. For example with a major new venture that cannot wait for the organisation, business processes and IT infrastructure to be in place the best solution may be to start in the cloud and then transition on-premise when the company is ready.

One of the biggest obstacles to cloud computing, however, remains that of security. How can operators feel comfortable moving such business-critical data away from an in-house environment into a public space?

It's important here to distinguish between public and private clouds. Whereas a public cloud entails the cloud being open to a largely unrestricted universe of potential users, the cloud can also be restricted to a single company with just as robust security put in place as one would for internal IT servers. In the case of MCPs, on premise 'cloud-based' systems relate to software installed and run on on-premise systems (in the building) of the organisation using the software, rather than at a remote facility, such as at a server farm or cloud somewhere on the internet.

Other concerns of cloud-based computing include the logistics required in moving documents from one place to another – how can one transfer interrelated links and meta data, for example?

Factors, such as this and the difficulty of handover and the integration of on-premise and off-premise processes, also need to be taken into account. The benefit of off-premises is that they help multiple organisations to collaborate whereas the benefit of on-premises is that they integrate better with internal interdepartmental processes.

If you can find a solution provider that can provide both the flexibility of cloud based with the rich functionality of on-premise systems then you can combine the best of two worlds.

For all the concerns, however, cloud computing will certainly have an important role to play in document control developments in the oil & gas industry as well as meeting many of the challenges relating to data overload and scalability.

Cloud Computing – The Pros and Cons

The Positives

+ Can accommodate vast storage needs.
+ Reduced IT infrastructure costs.
+ A scalable, 'pay as you go' approach.
+ High availability.
+ Good for collaboration with other parties.

The Negatives

- Compliance.
- Integration with internal interdepartmental processes.
- Difficulty of handover at the end of the project

4. The Need for Purpose-Built Document Control Applications

For all the benefits and potential of technology, however, it's vital that technology doesn't dominate document control projects at the expense of the key business, engineering and project management drivers.

As mentioned in the previous section, too often enterprise content management systems can become much more than what was originally intended. Technology for technologies sake is never sufficient and must never hide the original business drivers and take the focus away from the MCP.

There is also a high cost of ownership in supporting and upgrading custom ECM solutions. Furthermore, many programmes and solutions on offer from system integrators and consultants are simply a collection of some custom components from the last project or rewrites of older systems with updated software languages. One has to ask the question - have such solution providers genuinely tried to understand the business drivers, engaged with users, learned from past mistakes and, as a result, delivered better solutions?

Today more than ever, there is a need for purpose-built flexible document control applications with built-in business processes and which are able to align themselves more seamlessly with existing business processes.

This is even more important with the huge variety and complexity of MCPs today with varying contractual boundaries including a mixture of in-house and external engineering, procurement and construction, and a growing portfolio of projects using different contractual models and strategies.

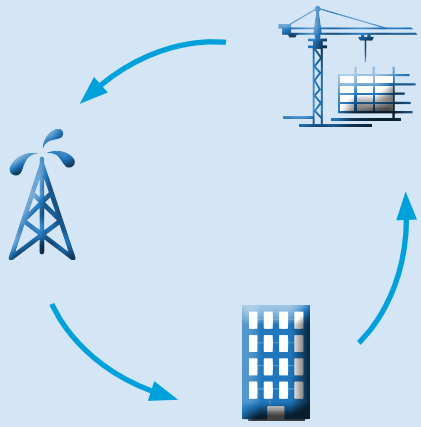
Let's take a look at how a flexible and business-focused document control solution can add value at different stages of the MCP process.

Alberta Oil Sands From Project to Operation

McLaren Software worked with a major Oil Sands owner/operator where the business challenge was to select and implement a system which managed and controlled documentation from project start up to operations. There were two million drawings with an additional 1,000 drawings being produced per month; 1,600 Users; and access required to 57 EPCs based worldwide.

McLaren built an enterprise-wide document control system where each business unit had responsibility for their own documentation and management; a formal squad check was put in place to check all design and construction documents; secured access was provided to EPC personnel; and the management of sealed master drawings was implemented in line with government regulations.

The Benefits of a Flexible, Enterprise Content Management System



A leading independent exploration & production (E&P) company was engaged on a major project in the Southern North Sea, installing unmanned compression facilities in a mature field. Once complete, the new processing unit will enable the operator to pump more natural gas from the seabed.

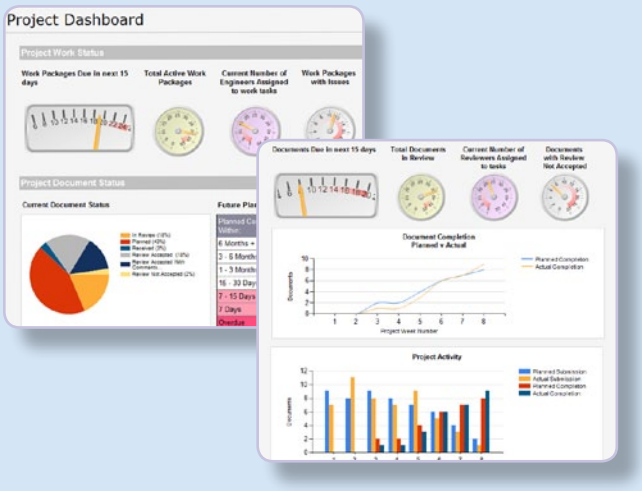
During the development of the platform, the operator created more than 3,000 engineering-related documents with the goal being to migrate 90,000 drawings from a legacy engineering document management system into Enterprise Engineer, a document management system.

The operator opted for a flexible content management system from McLaren Software that could help save time and man hours; enable productivity gains from the internal team and contractors; manage the risk associated with the design and construction of the facility; centrally control all project documents; and provide secure access to the appropriate parties at the right time.

McLaren's Enterprise application suite, which runs on top of the leading ECM (Enterprise Content Management) software is helping the operator manage its complex and rigorous document control demands. The operator can now create, classify, store and manage all its documents and drawings, including components such as default document types, dialogs, automatic numbering, filing and document lifecycles.

The internal review process is now automated, providing a way to automatically associate a review sheet with a drawing or other document and project leaders can now also run reports to see when review documents are near a deadline, and then send bulletin reminders to specified distribution lists within the system.

The ability to run reports rather than relying on the document control team has also provided management with a valuable insight into individual projects. The operator has also seen significant returns from the "buy-don't-build" philosophy and the automation and process control that the new system provides. Today, any project overruns will be linked to external issues rather than content management and process failures.



5. Adding Value at Every Stage

5.1 The Planning Stage

The planning stage is crucial to any MCP and will often determine the long-term success of the project. A failure to take into account design, construction, commissioning and operational issues during the planning phases will have a highly negative impact further down the road.

The planning phase only begins after the business strategy and feasibility studies have taken place which, in terms of documentation, will often require key reports to be presented for the Capital Investment Board responsible for the final decision. Planning, permits and receipts from planning and regulatory authorities will all also be required.

During the planning stage, a flexible and business-focused document control system is key to allowing operators to allocate risk and control the project's value chain. It also is where the project management plan is developed with document control playing a central role in ensuring that all parties are aligned with the baseline schedule and understand the project's path.

Key documents, that will need to be created, approved and meta tagged, include Terms of Reference (TOR), Work Breakdown Structure (WBS), Detailed Cost Model, and the Design Basis Memorandum (DBM).

It's also during this stage that key resources, land acquisitions, and operation permits will have to be identified and be integrated within the document control system. At this stage, the WBS is also key, with a necessary balance required between being too granular (where the size of the network becomes unwieldy and the cost of planning excessive) or too coarse where it is impossible to develop realistic schedules and details of resource requirements during the project.

5.2 Project Execution

A flexible business-focused document control system is crucial at this stage with a plethora of documents moving around project teams.

Significant regulatory compliance and standards documentation are transferred to the project, activities are often separated into building, mechanical and electrical; and organizational codes are set up for project activities. Bid and multi-contractual packages are also developed and existing as-built asset documentation will either be used for reference by the project or be revised throughout the project.

At this stage, the flexibility of the document control system is central to integrating the requirements of the project management and engineering teams who are often coming to the project from different perspectives – in the case of project managers the organising of the work of the project and in the case of engineers, the engineering-oriented process to create physical assets. Metadata population, integrity checking, version control, approval workflows and transmittal receipts also need to work seamlessly.

Project risk also needs to be managed by a complete verifiable, auditable record of what was sent, to whom, when, for what purpose and in what context, and cost management and reduction issues must be ongoing through project execution. Effective and flexible document control, for example, can play an important role in expenditure tracking and costs to date as well as the tracking of engineering hours and cycle time. Project control in this respect often consists of a project portal which includes a Project Summary, Project Directory, Released Documentation, and Key Performance Indicators (KPIs).

While technology requirements may be considered to be in hand at the planning stage, it is often when construction starts that modifications have to be made to ensure increased scalability and the introduction of more stakeholders. At this stage, it's important that technology doesn't start to be the driving force ahead of the key business drivers on the project and where business practices are sacrificed for what IT consultants think the systems are capable of.

5.3 Close-Out and Handover

It is at this stage that any documentation that was created and/or revised throughout the project is formally transferred from the vendors and sub-contractors to the EPCM and then the operator. This is a crucial stage where it is essential that all the correct engineering information is passed on for operation and maintenance.

To avoid a poor handover, operators must be given the opportunity to work with the project team – both just prior to handover and earlier in the project lifecycle. A flexible document control system is crucial here in providing additional access to documentation as well as providing ease of use to the new team as well as a complete audit trail.

Furthermore, operators are also looking to replicate success by applying the same design or practice to new facilities. With this in mind, it is essential that any document control system is fully integrated, up to date and able to be replicated so that project management, engineering and design information can be reused, when required, and change managed - after it has been passed to the operator.

6. Conclusions – One Size Doesn't Fit All

Document control and management and the successful completion of MCPs are huge topics that have filled numerous books, white papers and manuals. What this short white paper has attempted to do, however, is at a business-focused level identify some of the key issues and complexities in document control on oil & gas MCPs today.

If there was one key take-away for me it would that due to the range of MCPs in progress that a 'One Size Fits All' approach is impractical. Some MCPs, for example, will be better suited to enterprise document control systems hosted on premises, others a more collaborative cloud-based workspace but without the risk of providing third party access to in-house systems and networks, while others are willing to adopt a complete cloud-based solution (see our options below).

There are also significant potential benefits from cloud based solutions that can secure collaboration between OO's and EPCs and / or EPCs and their sub contractors and can also be linked to the security and scalability of enterprise scale on-premise systems.

Whatever decision operators make, however, it is vital to have a flexible approach to document control with an integration of both internal and external functions, an understanding that document control effectively means business processes, and that technology is just an 'enabler' to achieving business goals.

Managing the complexity of capital projects in the oil & gas sector has never been more important. Document control remains central to future successes.

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About Mark Goodwin

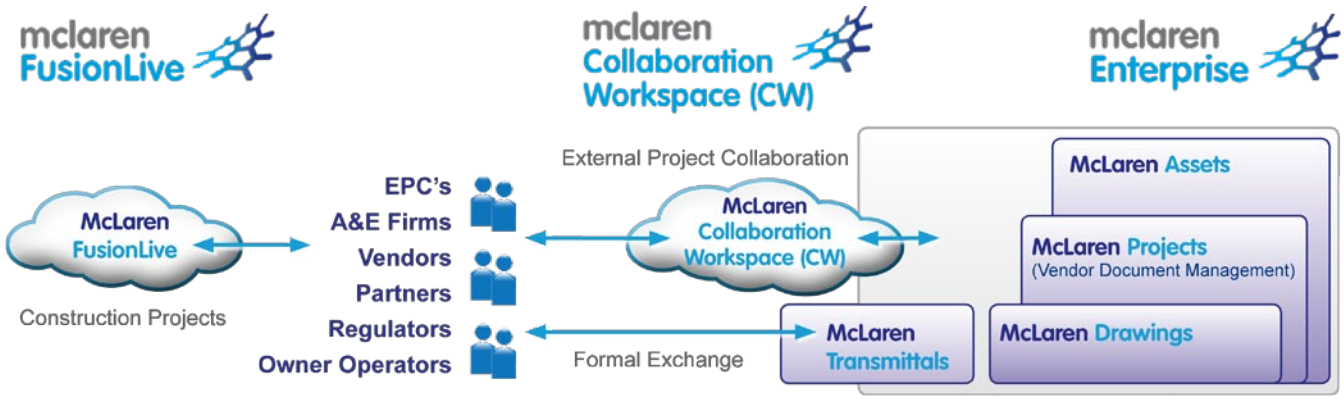
Qualified as a Chartered Instrumentation & Control Engineer with over 20 years' experience of both major capital engineering projects and asset operations. Prior to joining McLaren Software Mark worked as an Engineer at Thames Water and at Black & Veatch. At McLaren Software Mark, as Director, Product Architecture is responsible for transforming customer requirements and technology advances into pragmatic business applications.

About McLaren Software

McLaren Software is a fully owned subsidiary of Idox plc (www.idoxgroup.com). Idox acquired McLaren Software in October 2010 as part of the group's future growth strategy.

In 2011 Idox acquired CTSpace, a leading Cloud and Enterprise engineering document management company now incorprated under the McLaren Software brand.

Partnering with industry technology leaders including EMC (EMC - Documentum), IBM (IBM - FileNet P8). Microsoft (Windows, SharePoint, Microsoft Office), Autodesk (AutoCAD), Bentley Systems (MicroStation) all McLaren solutions are accredited through partner programs to ensure continued product and roadmap compatibility.



With development centres in the UK, USA, Russia and India, over 200,000 users across 15,000 capital project and asset operations in over 50 countries, McLaren is an established international leader in the Engineering Document Management, Control and Collaboration market.

Over 20 years of industry, engineering document management, control and engineering project collaboration experience sets McLaren apart from general document management vendors.

McLaren is unique in providing solutions to support the entire lifecycle of an operational asset from design to operations & maintenance with solutions available in the Cloud, Hosted or On-Premise.

McLaren Professional Services provide consultancy, training, implementation and support offerings to ensure customers obtain the maximum benefit from their investment in McLaren Software.

McLaren Training Services enable customers to choose between configuring solutions to meet specific requirements themselves or in partnership with the McLaren Professional Services Teams.

Whichever choice of system or configuration options, McLaren is dedicated to help Owner Operators, EPC Contractors and companies within the AEC industry design, build and operate, safe, efficient and compliant plants and facilities.

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