SPE 112117

Deploying FIELD OF THE FUTURE on Major Projects

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This paper was prepared for presentation at the 2008 SPE Intelligent Energy Conference and Exhibition held in Amsterdam, The Netherlands, 25–27 February 2008.

Abstract

BP has achieved considerable success in developing and deploying FIELD OF THE FUTURE technologies into existing, operating assets around the world. BP wants to ensure that new field developments will benefit from the FIELD OF THE FUTURE programme from first oil or gas.

BP has developed a consistent process, which all major projects must follow from discovery through to first oil or gas. This paper will describe the sub-processes and tools that have been developed within this overall framework to ensure FIELD OF THE FUTURE technologies are part of each major project and how the operating philosophy is developed to exploit them.

In the early stages of the project, the value that the FIELD OF THE FUTURE programme can bring must be understood as field development options are created, analysed and ranked. Some technologies may enable innovative solutions particularly where there are complex reservoirs or difficult locations and logistics. The selection of the preferred option must take into account a range of reservoir, commercial and technical considerations, many of which are impacted by FIELD OF THE FUTURE technologies.

As the chosen development option is worked up, the necessary infrastructure must be included in the project scope. Furthermore, as the Operations' team start to develop operating and maintenance strategies, their processes and organisation must be designed around the FIELD OF THE FUTURE technologies.

Various tools have been developed to assist the project team in identifying value and developing the project scope and these will be described in the paper.

The paper will conclude with case studies showing how these new project processes have been used in major projects.

Introduction

The BP initiative to implement a digital oilfield is called the FIELD OF THE FUTURE programme. Tools and processes developed as part of this programme have been successfully deployed in a number of existing assets, demonstrating and returning real value to BP (Dudley 2006), (Oyewole, 2007), (Pannett 2007), (Sisk 2007).

Within BP, a global technology team develops the FIELD OF THE FUTURE technologies and provides assistance to operating units to implement them in the field.

BP has a significant portfolio of Major Projects that will be executed and come on line over the next 5 – 10 years. Clearly, BP wants to maximize the value of these MPs by exploiting the technologies we have available, including those from the FIELD OF THE FUTURE programme.

FIELD OF THE FUTURE in BP

Through the FIELD OF THE FUTURE programme, BP has developed, or is developing, technologies in the following areas, which are related to our model of the FIELD OF THE FUTURE (Figure 1) and which impact how we deliver our capital projects:

- Remote Performance Management (RPM) layer
  - Well surveillance and performance (Foot, 2006) using the BP developed ISIS product

- Facilities surveillance and performance using the BP developed D2D product
- Optimisation layer
  - Model based operational support (Stenhouse, 2006)
  - Down hole flow control (DHFC)
  - Distributed Temperature Sensing (DTS)

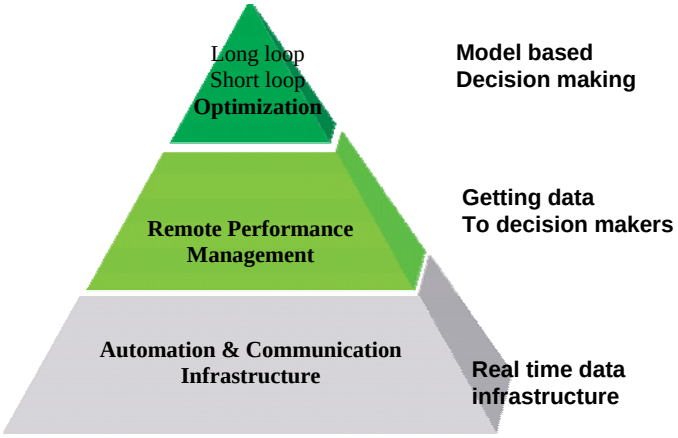

Figure 1: FIELD OF THE FUTURE capability pyramid

In addition, a number of technologies have moved on from the FIELD OF THE FUTURE programme to become part of the way we do business. These include Automation and BP's Advanced Collaboration Environments (Castro 2007), (Edwards, 2006), (Phillips, 2007)

As well as the technologies, BP has been very much involved with developing new business processes to ensure the technologies are understood and used by the asset teams, and that processes and accountabilities are designed and implemented to maintain, support and develop the tools over the asset life. This "Business Transformation" has been key to getting the FIELD OF THE FUTURE technologies embedded in the way we work. (Feineman, 2006).

The scope and value proposition for the FIELD OF THE FUTURE programme has already been well documented. (Reddick, 2006).

Major Projects in BP

BP has a significant portfolio of Major Projects that will be delivered over the next few years, representing a significant element of BP's future production. The range of projects includes:

- New basin development
- New fixed and floating platforms
- Subsea tiebacks to existing offshore facilities and to shore-based facilities
- Infill developments
- Extension of existing infrastructure (e.g. compression, subsea pumping, etc.)

Opportunities include oil and gas fields, some of which are offshore and have a low number of high and very high rate wells and others which are onshore and have a high number of lower rate wells. The global range covers virtually all continents. BP works with a range of partners, JVs and national oil companies in these field developments

Major Projects' Process in BP

Successful implementation of Major Projects depends on leveraging the company's skills and experience from past projects. This is embedded in BP's Major Project Common Process (MPcp), which describes the deliverables required (particularly in the early stages of the project) and the assurance to ensure that the project team are making the correct assessments and decisions.

Projects follow a 5 stage gated process, the stages of which are:

- Appraise – during which new opportunities are appraised and options generated
- Select – during which the options are evaluated and the preferred one selected
- Define – during which the selected option is more fully defined (typically through Front End Engineering Design)

- Execute – during which the asset is fully designed, procured and constructed
- Operate – when the asset is put into economic operation.

As part of the MPcp, guidelines describe best practice based on BP's collective project expertise and experience. As part of the guidelines, BP sets technical biases which steer the technical and operational strategy for new projects. The FIELD OF THE FUTURE programme is a major technology lever to support the technical biases.

FIELD OF THE FUTURE objectives in Major Projects

It is essential that new Major Projects do not merely replicate technology of 10, 20 or 30 years ago. Whereas experience from the past is vital to successful project delivery, we need to exploit new technologies to make assets safer, easier and cheaper to operate, with higher production and better access to reserves. The FIELD OF THE FUTURE technologies help to deliver all of these aspirations.

There are a number of reasons why we need to introduce the FIELD OF THE FUTURE programme to the Project team early on the project lifecycle so that the whole project can be designed around the FIELD OF THE FUTURE value proposition.

First of all, there are some obvious issues that we need to get into the project scope because it is cheaper and easier to implement them as part of the project rather than trying to retrofit them later.

Space: We need a certain space to be available for FIELD OF THE FUTURE technologies to be installed – most obviously this includes space for servers (with conditioned environment and power) but also includes space for collaboration, video conferencing, sharing etc. both at the facility and in regional offices. If this space is not available initially, it is very difficult to get the space at a later date – particularly for offshore developments where space is always at a premium.

Communications: We require high quality, high capacity, low latency communications from the asset to the wider BP world to carry data, voice and video. The preference here is for fibre optics to be used to achieve the quality and capacity. This can be a major cost item and needs to be clearly specified in the project scope since it will be very difficult to get it authorized later on once the project has been sanctioned. In some cases we have to tailor the design to match lower bandwidth systems.

Instrumentation: FIELD OF THE FUTURE technologies depend on a feed of high quality process data, from wells, well heads and facilities. Installing these as part of the project is significantly cheaper than trying to retrofit them – particularly for subsea trees and manifolds. Fitting additional instrumentation after the facility is in operation, particularly where process penetrations are required, creates integrity and operational issues. Adding instrumentation when the asset is operational can be a very slow process as normal operations are affected and management of change processes have to be strictly adhered to. It may be difficult to get the appropriate level of Operations' support and focus to get the installation completed within a reasonable time.

Control Systems and Infrastructure: Much of the real time data is fed through the Integrated Control and Safety System (ICSS) to a data historian. This historian is then connected to the BP data networks. This infrastructure needs to be designed and implemented with the FIELD OF THE FUTURE requirements in mind. Again, modifying the ICSS after first oil or gas is a much more difficult process as it requires careful control and management of change.

Drilling and well design: DHFC and DTS require different and more costly drilling and completions.

But beyond the consideration of project scope, space for equipment, instrumentation, etc., early consideration of the impact of the FIELD OF THE FUTURE technologies has much wider implications for the Project.

In some cases, consideration of the way in which FIELD OF THE FUTURE can impact a field development may allow different options to be generated and selected in the Appraise and Select phases of the Major Project. In one example, onshore compression was the base case because although offshore compression was better from a process perspective, the difficulty in maintaining the machines in that particular location would have caused problems. However, when the project team were made aware of the Remote Performance Management scope of FIELD OF THE FUTURE, offshore compression came back in as a viable option.

Even if FIELD OF THE FUTURE technology does not impact the identification of development options, or provide differentiation between them during the Select phase, it can still have a significant impact on the scope of the project.

Some examples are:

- Greater use of RPM can change how an asset is operated, allowing more of the team to be located in a safer office location rather than at the facility. For offshore projects, a reduction in offshore accommodation can be achieved leading to considerable capex and opex savings. For onshore projects, RPM can reduce the need to travel to remote locations, thereby reducing travel risk and environmental footprint.

- DHFC and DTS can enable substantially different drilling schemes, allowing the same reserves to be accessed with fewer wells and/or allowing access to more of the oil/gas in place.
- Remote equipment monitoring (particularly for rotating machinery) allows different models for operations and maintenance, lowering the barriers to third parties delivering a total service

It is clear that the availability of FIELD OF THE FUTURE technology creates more levels of complexity in assessing the value proposition of competing options. The key to addressing this is to have from the outset a clear strategy for how the asset will be operated – for it is this that drives the demand for the technology, not the other way round!

To support Major Projects in assessing the value of the development, the FIELD OF THE FUTURE global technology team is developing guidance on the range of costs and benefits that the technologies can deliver. Of course, the actual level of value is dependent on the particular field and the particular application – nevertheless, guidance from existing implementations, particularly those having similar features, can be very useful to the project team.

FIELD OF THE FUTURE in the Project Process

The MPcp has been developed in BP to define what projects need to do at each phase of their lifecycle. There are clearly identified points where the technology options need to be properly investigated and assessed through the project's Technology Plan. The FIELD OF THE FUTURE technologies represent a significant part of the range of technologies to be included in the Technology Plan.

MPcp defines specific review points throughout the project and we have developed guidelines and checklists to support the assurance process to ensure that projects have properly assessed FIELD OF THE FUTURE technologies in selecting the right project and defining the scope.

Thus during engineering assurance reviews, the relevant engineering technical authorities are able to check that the project has included the appropriate infrastructure, as well as the FIELD OF THE FUTURE technologies.

Throughout the early phases of a Major Project, the FIELD OF THE FUTURE global technology team is available to assist the project team. Initially, support will be required to provide an initial awareness of the FIELD OF THE FUTURE programme – its scope, the technology, the operational impact and the business value. This awareness also includes what it means to the project team and the project scope. It is worth noting that the more established the FIELD OF THE FUTURE programme becomes, the more people become aware of it and as new projects come along, the chances that the project team have already been exposed to the programme and the technologies increases. So over time, we expect the need to help teams become aware and to understand the programme and technology will diminish. This is when it becomes "business as usual", even though the technology may be continually developed and enhanced with new functionality.

Once the project team have gained an understanding, they can work with the FIELD OF THE FUTURE global technology team to define the scope and the detailed design. An important output of this work is the schedule for implementation of the FIELD OF THE FUTURE technology so that the technology team can schedule the project's requirements in with the wider demand from across BP.

During the scoping period of the project, the requirements for FIELD OF THE FUTURE technology need to be driven by the project's operations' team. This is because the operations' philosophy will determine the need for RPM, well monitoring, collaboration and communications. This understanding needs to be shared by the whole project team, including the design contractors. If we are not careful, additional instrumentation which is included to support RPM can be "value engineered" out if the engineering team are not aware of the operational philosophy of the completed asset.

Tools to support the Major Projects

Major Projects need to have a ready access to the best guidance to implementing new technology. This avoids the constant need to relearn how to do things. Within the FIELD OF THE FUTURE programme, we have developed a set of "blueprints" to encapsulate the lessons we have learnt and provide straight forward guidance on how to implement FIELD OF THE FUTURE technologies.

The blueprints produced to date include:

- Automation
- Remote Performance Management
- Digital Infrastructure
- Advanced Collaborative Environments
- Model Based Operational Support

The first blueprint to be produced and issued was the automation blueprint. Although this mainly covered technologies that were well established (such as the Integrated Control and Safety System (ICSS) and the plant data historian), for the first time we set a common standard for the infrastructure to support the rest of the FIELD OF THE FUTURE technologies.

Furthermore, the automation blueprint went beyond the traditional limited scope of the control and safety systems and incorporated a number of higher level functions as well, such as advanced process control, training simulation, etc.

The automation blueprint was rapidly taken up by Major Projects, who were encouraged to complete a compliance checklist against each of the sections, recognising that in some instances there would be a valid reason for not complying. An example would be for a Major Project that was an extension to an existing facility which might limit them from wide adoption of a recommended technology such as foundation fieldbus.

The same process is now being followed for all of the other blueprints. This is very helpful to the project team, particularly the engineering contractor, as it helps them identify all of the elements of the technology and infrastructure required.

Major Project examples

The FIELD OF THE FUTURE programme has only delivered productised technology solutions in the past few years. Therefore, Major Projects that are coming to First Oil and Gas now passed their early Appraise, Select and Define phases before the technology was readily available. In these cases, FIELD OF THE FUTURE technology has been a retrofit to the project scope. Some examples are as follows.

Floating production, new field

For a large offshore project, the control and data infrastructure was in place to support ISIS for monitoring the high rate oil wells. This is one of the first occasions in BP where ISIS has been available from First Oil to provide a well monitoring tool to the Operations' team from Day 1 (the other example is discussed below). The typical control and data infrastructure now installed on all new projects also supports D2D workflows, in particular base visualisation. The project team has developed several hundred screens to enable real time process data to be shared with users on shore and in remote support locations such as Sunbury and Houston.

To provide access to the global expertise within BP, the project has implemented ACEs in both the country's capital and back in Sunbury in the UK. The use of the ACEs in conjunction with shared real time data has already shown its worth to the asset operations' team.

Because ISIS has been available from First Oil, we had to ensure that the asset team were given the appropriate skills so that they could not only gain maximum benefit from the technology, but also be in a position to support and maintain it (e.g. adding new wells to the system configuration, attending to data supply errors, etc.). To this end, a "Value Realisation" team has been working with the asset team to identify the work flows and accountabilities and to ensure that these are embedded in the day to day operations.

Offshore, existing basin

In another offshore, deep water project, ISIS has again been implemented from First Oil. Whereas the first example was the first BP operated field in the basin, this second project is in a basin where BP already has 6 major offshore facilities in operation, many of which already have FIELD OF THE FUTURE technologies deeply embedded in the asset teams' operating philosophy and practices – in particular ISIS, ACEs and shared real time data. In this example the asset team have a clearer idea of what they can expect.

High rate, offshore gas

Elsewhere in the world, ISIS has been applied to high rate offshore gas wells. In one particular basin, a programme of cloned platforms to deliver new capacity has deployed simple well head platforms with tie backs to a central processing facility. ISIS has been an integral part of new gas wells as they come on stream.

Redevelopment of existing offshore field

In the North Sea, a major redevelopment scheme of an existing asset is underway in which the main production platform will be replaced. ISIS is already deployed in the existing wells and will be carried forward to the new development. However, the replacement of the main processing facilities has been the catalyst for a major expansion of FIELD OF THE FUTURE applications. Using the blueprints, the Project Team have identified a number of new applications that they want to implement using the real time data. A strategy document identifies where applications should be located (e.g. in the ICSS or in D2D) and they have embarked on a programme to develop the applications that are not readily available in the market place. These "local" applications will initially be developed specifically for this one asset. However, they have been catalogued and if there is sufficient interest from elsewhere in the company, the applications can be productised in the future for global deployment. These applications are designed to monitor and optimise specific items of equipment such as chemical injection.

Low rate, onshore gas

Although much of the focus for the FIELD OF THE FUTURE programme is high rate, offshore oil and gas, in North America, low rate, high well count, onshore gas production has also benefited from the blueprints. Several new projects to

expand production into new areas of existing fields have taken onboard the automation blueprint to define the requirements for remote monitoring and control of many well pads and gathering stations. In addition, the automation blueprint is being used as the basis for a major upgrade project to the existing control infrastructure. ACEs have been deployed to provide support from Houston to remote locations.

New projects in the future

For the next wave of projects due to deliver from 2010 onwards, we have been able to influence the scope of the project right from the early phases. We have been maintaining a list of project opportunities that are on the horizon so that we can be ready to engage the project teams at the appropriate stage in the project's lifecycle.

For a series of FPSOs, the strategy is to design one, build many. Therefore getting the FIELD OF THE FUTURE scope for the first project in the series is very important. The global technology team has been working with the project team, defining the scope using the blueprints to identify the technologies that will create value for the asset lifecycle. Lessons from other FPSOs are also a valuable input to the scope and design.

In another basin, an existing set of offshore platforms use a range of FIELD OF THE FUTURE technologies, including ISIS, D2D, ACE, DHFC, DTS and a full field optimiser. A series of renewal projects is in its early Appraise phase and we are holding discussions with the project teams to select appropriate FIELD OF THE FUTURE technologies for inclusion in the project scope. This is conditioned by the strategy already in place for the existing assets – clearly the new assets need to fit in with any regional strategy with regards to range of applications, infrastructure, etc.

This latter point is becoming increasingly important where existing assets are retrofitted with FIELD OF THE FUTURE technologies and regional strategies are put in place. New projects in these regions then have to ensure that they are compatible with these regional strategies.

Conclusions and Lessons

Embedding FIELD OF THE FUTURE technologies into new Major Projects requires early involvement of the FIELD OF THE FUTURE global technology team working with the project team. Key inputs to the discussion are:

- The features of the field development (e.g. type of reservoir, number of stacked pay zones) etc.
- The location of the field development, particularly in relation to how and where it will be supported
- The operating and maintenance philosophy, e.g. in relation to third party support of equipment
- Any existing regional FIELD OF THE FUTURE strategy.

Tools such as the blueprints help Project Teams up the learning curve and enable them take the capabilities offered by the FIELD OF THE FUTURE programme into account when defining and selecting development options.

The tools also allow Project Teams to define the requirements for FIELD OF THE FUTURE technologies as part of the overall project scope. Early engagement ensures that the scope contains the necessary infrastructure and technologies *before* it is frozen and the project sanctioned – adding to the scope after sanction is always very difficult to do, no matter how valuable the additional scope may be. Some elements of the FIELD OF THE FUTURE scope are minor but others may make a significant impact on the overall project cost estimate (such as fibre optic communications to offshore facilities).

The blueprints allow us to embed best practice for implementing technologies and infrastructure. There are often many ways in which to implement data historians, servers and communications. However, for data efficiency, security and functionality there are often some options which are best – embedding these solutions in the blueprints ensures that new projects have the best start to implementation and avoids the same lessons being learnt by different project teams around the globe

As part of defining the scope, it is also important to define and communicate the value. It is easy for Project Teams to value engineer out technologies and infrastructure (e.g. additional instrumentation) if they do not understand its value to the operational asset.

Having FIELD OF THE FUTURE technologies available from First Oil can provide significant benefits to the project commissioning and operations' team. We have a significant experience now of using the real time data elements of RPM to support commissioning activities. Early gathering of well and reservoir data gives a "history" of the field enabling better understanding and hence field optimisation over the life of the asset.

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