SPE 112018

Integrated Competence: Operator-Service Company Integration Increases the Performance and Value of the Well Construction Process

Sanjay Kanvinde, SPE, Katy Heidenreich, SPE, Barry Parsons, SPE, and Greg Pearson, Schlumberger, and Tore Kristiansen, SPE, and Ketil Andersen, SPE, StatoilHydro

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

This paper presents a framework and a systematic top-down approach for implementing a company-wide operator-service company integration program for well construction services called *integrated competence*. The paper describes the key aspects of implementing the integrated competence program: goals, objectives, critical success factors, levels of integration, asset selection and targeting, value creation and key performance indicators (KPIs), multiskill roles, onshore and offshore team configurations, training, and change management.

The integrated competence program developed by StatoilHydro and Schlumberger is an initiative under StatoilHydro's Integrated Operations (IO) corporate initiative and was applied to StatoilHydro's standardized well construction process. The joint team configurations in StatoilHydro's Onshore Operations Centers (OOC) improved collaboration in all phases of the well construction process, and the Schlumberger Support Center provided remote support of drilling operations. In addition, the paper describes two case studies used in the development of the wider program.

The framework, program approach, challenges, and results presented in this paper provide the E&P industry with an example of operator-service company integration, with possible implications for their own current and future digital initiatives, particularly those focused on the well construction process.

Introduction

Integrated Operations—defined by StatoilHydro as new work processes that use real-time data to improve the collaboration between disciplines, organizations, companies, and locations to achieve safer, better, and faster decisions—has been an area of considerable focus in the operationally challenging region of the Norwegian Continental Shelf (NCS) (OLF, 2005). OLF (Oljeindustriens Landsforening, the Norwegian Oil Industry Association) has estimated that implementation of IO on the NCS can increase oil recovery by 3 to 4%, accelerate production by 5 to 10%, and lower operational costs by 20 to 30% (OLF, 2003). Further, in an updated study, OLF has concluded that implementing IO across the NCS has a potential value of approximately 250 billion Norwegian Kroner (OLF, 2006).

In StatoilHydro, the integrated operations program is a strategic corporate initiative that has evolved through several phases, delivering increasingly higher business value over time. These phases are improved collaboration, standardization of work processes, evolving the way of working in each asset, evolving the way of working across each asset, and cross company collaboration (Henriquez, 2007). StatoilHydro launched the integrated competence program with Schlumberger Drilling and Measurements (D&M) to improve cross-company collaboration and improve the performance of and value from large-value contracts using integrated operations principles.

Program Approach

The program team applied an integrated approach to defining the project plans. During a series of two-day work sessions, with 8 to 10 experts participating in each session, the team defined the details of six interrelated dimensions of the program. These six dimensions included specifics on the "why" (goals and KPIs), "how" (process and tasks), "who" (roles and people), "what" (data), "where" (geographical view), and "when" (sequence and timing).

Program Goals, Benefits, and KPIs

The overall goal of the integrated competence project is to improve performance and value from large value contracts using integrated operations principles. In order to achieve this high-level goal, the program team identified six specific areas where integrated competence could create value from specific benefits:

1. **Enhance staffing and resource allocation** through optimal use of resources, mentoring and personal development of younger staff, creating an attractive environment for a larger resource pool (e.g. those not able to go offshore), and establishing new career development paths.
2. **Create additional value** through optimal well placement, improved reservoir understanding and reserves estimates, better exploitation of technology and specific opportunities offered during operations.
3. **Strengthen the decision-making organization onshore** through better access to expertise, fewer iterations in the planning cycle due to improved coordination, better and more efficient operational decisions, improved uncertainty management, knowledge capture and sharing between assets, and improved equipment planning.
4. **Strengthen the operating offshore organization** through 24x7 support to operations offshore, increased capacity, and improved equipment availability.
5. **Improve operations (increased performance, reduced downtime)** through increased operating factor, improved drilling performance (meters per day, days per completion), consistent use of best practices, less train wrecks, and better quality control and assurance of real-time and post-job deliverables.
6. **Improve health, safety, and environment (HSE)** through safer decisions (reduction of severe incidents) and reduced exposure offshore of personnel (Ringstad and Andersen, 2006).

In addition, high-level business KPIs (e.g., drilling performance and operational efficiency) and individual operational KPIs (e.g., percentage of new training completed) were defined in alignment with the existing performance measurement and reporting processes of StatoilHydro.

Critical Success Factors

During the program-planning phase, the team identified several factors that were critical for the program to succeed. These included commitment of senior management in both companies, support of the various stakeholders of the program including asset management and offshore staff in both companies, readiness of the enabling infrastructure, resolution of working hours/compensation issues to enable the required work schedules, and the training and staffing of necessary personnel in both companies.

Program Implementation

Defining Operator-Service Company Integration

During the planning phase of the program, the team first answered the key question *'what does operator-service company integration mean?'* The team identified the key integration drivers and then defined the breadth and depth of integration within a framework that was usable throughout the program. The figure below shows the three phases of the well construction process and Level 1 to Level 5 of integration in each of the phases.

	Maturity Scale here represents: 1. Involment early in the cycle 2. Correct Competency in the various phases	Maturity Scale here represent: 1. Increasing levels of collaboration and impact on decision making 2. Sharing of resources/expertise	The main drivers in this process are: 1. Capture and distribution of knowledge & best practices 2. Continuous improvement of work process
	Well Planning	**Well Operations**	**Well Evaluation**
Level 5	* Sharing of Resources/expertise across geographical locations as default. * Access to global experts as needed.	* Sharing of Resources/expertise across geographical locations as default. * Access to global experts as needed.	* Systematic enhancements to well construction processes across Statoil
Level 4	* Sharing of resources/expertise in geographical location as matter of practice	* Sharing of resources/expertise in geographical location as matter of practice	* Systematic communication of well construction knowledge and best practices in Statoil
Level 3	* Operational expertise (MLWD and DD) also used in the detailed planning and engineering phase	* DD, Wellsite Geologist, Drilling/ Well Engineer and other Wellsite expertise in Operations Room as default mode of operations (operations dependent). * Rest of Well Operations Team interacting in Operations Support Room as default mode of operations.	* Systematic communication of knowledge and best practices after every well and consistently incorporated for future activities within the asset team
Level 2	* DSM trained on WD1328. * Consistent involvement of DSM starting in the conceptual phase (uncertainly assessment on method selection). * Well Planning performed in Collaboration room	* M/LWD and Data Engineer expertise in Operations Room (24x7 SLB service) as default mode of operation. * Drilling/ Well Engineer in Operations Support Room as default mode of operations (dayshift). * Well Operations Team interacting in Operations Support Room as needed.	* Consistent involvement of DSM and operational expertise (wellsite geologist, well engineer, data engineer, drilling supervisor, MLWD and DD) in the after action review and post operation meeting
Level 1	* Consistent involvement of DSM from the detailed operational procedures phase	* RT (depth & time) down hole data and Surface Logging Data sent to shore into applications and available for collaboration team (RTS definition of 100% of the times)	* After action review and post operation meeting happening systematically within the Well Operations Team

Fig. 1 Levels of Integration

Task and Role Analysis

The second question the program team had to answer was '*How do the current tasks and roles need to change to deliver the program benefits?*' To answer this, the program team analyzed the current onshore and offshore team configurations to identify new roles, cross-training requirements, capacity requirements, and the configuration of future teams to enable improved collaboration and efficiency. In addition, a detailed task-mapping exercise was performed as below:

- Analyze the current roles and responsibilities by breaking down their assignments into discrete tasks.
- Classify the tasks into pre-job, during-job, and post-job phases.
- Identify tasks that could be performed onshore and those that had to remain offshore.
- Identify new roles required to perform these tasks offshore and onshore.
- Generate a responsibility assignment matrix using RACI diagrams for the new team configurations (RACI, 2007).
- Identify any new training requirements to perform the task.
- Identify any new IT requirements to perform the task.

For each change in task, a Hazard Analysis and Risk Control (HARC) process was followed to ensure clear identification of any additional risks caused by changing task configurations. For each identified risk, prevention measures to decrease its likelihood and mitigation measures to reduce its severity were established to bring the residual risks to acceptable levels.

As a result of the task and role analysis exercise, the program team identified two new roles of drilling and measurements offshore technician and mud logging offshore technician. In addition, two roles of cross-trained M/LWD engineer (Measurements/Logging While Drilling) and cross-trained directional drilling engineer were identified. Job descriptions, training requirements, and task lists were then prepared for these roles.

Team and Support Center Configurations

The third question the program team had to address within the context of the program goals was '*What will be the configurations of the teams offshore and onshore and across assets?'*

The support structure between offshore operations, the Schlumberger Support Center, the asset's OOC, and the StatoilHydro wide Subsurface Support Center (SSC) was defined. At a more detailed level, the five integration levels defined earlier and the task and role analysis provided guidance on the configurations of the teams offshore and onshore. Team configuration diagrams were defined detailing the roles, office locations, and shift schedules for each of the five levels of integration in the well planning, well operations and well evaluation phases. These team configuration diagrams were provided to the implementing assets as a guide to setting up asset operations.

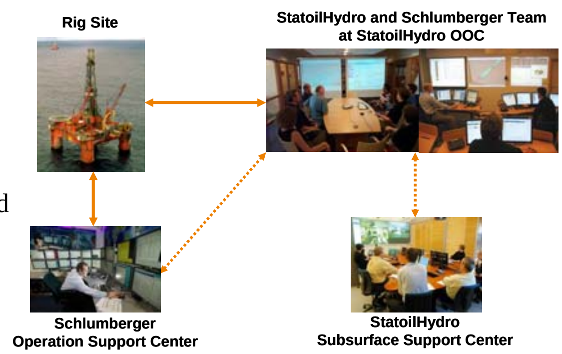

Fig. 2 Support Center Configuration

Personnel Issues

After defining the team configurations, the program team identified and addressed several inter-related personnel issues in more detail as summarized below:

- **Shifts**: Identify the requirements for onshore work, and design a shift plan to meet those requirements consistent with local labor laws and labor agreements. An 8x3 weekday and 12x2 weekend shift plan was selected to meet requirements for a 24x7 position onshore.
- **Compensation**: Identify any compensation-related considerations, such as overtime pay and weekend bonuses, and prepare a cost model and proposal from the service provider.
- **Staffing and resources**: Level 4 integration aims to secure sharing of resources across assets and geographical organizations. Synergies between assets, especially those co-located in a particular geographical area, were identified in terms of reduction of personnel onshore achievable by performing 'multi-asset' operations and developing cross-trained roles onshore and offshore. In addition, Schlumberger and StatoilHydro decided to engage a third-party expert in a study to analyze Schlumberger North Sea offshore operations, staffing, and workload as related to remote operations. The study will be based on a scientific approach and will provide independent expert input to management, based on which future Level 4 staffing decisions will be made.
- **New career development paths**: For each new role defined, a career development path was created. The task-mapping exercise clarified the fact that the new roles required new personality profiles. For example, the onshore measurements-while drilling (MWD) engineer position becomes much more analytical. The offshore technician role is almost entirely rig task-driven and suits a more 'hands on' type of person. This distinction allows better deployment of expertise.

Company-wide Asset Prioritization and Targeting

The challenge of systematically implementing a global program across a large company is to create focus by prioritizing and targeting the assets for implementation. Instead of subjectively prioritizing the list of assets, the project team identified and defined four factors influencing the decision.

1. **Potential for business impact**: production size in barrels of oil equivalent (BOE); impact, defined as the potential ability for earlier production and increased recovery; status as per existing business KPIs; cost savings by operation type (mobile rigs, satellites etc.); strategic reasons.
2. **Ease of implementation in asset**: status of facilities now and in the immediate future; number and strength of internal champions in the asset; level of business ownership and IO competency in the asset; competitiveness rating.
3. **Level of planned activity**: three-year drilling plans.
4. **Geographical synergy**: measure of the potential for sharing of resources across assets and operating regions.

A weight was then assigned to these four decision factors. Each company asset under consideration within the study was given a score from 1 to 10 against each of these factors to arrive at a final weighted score, which provided the implementation priority as shown in the rank column of Fig. 3.

Each asset in scope was then analyzed for its ‘as is’ status and ‘to-be’ target using the integration levels defined earlier. This provided a baseline and a company-wide overview for program implementation.

Overall, the approach was transparent and easy to explain to management and the organization. This approach also allowed the program team to perform sensitivity analysis on the prioritization decision.

	Business Impact 40%	Ease of implementation 30%	Activity Level 20%	Geographical Synergy 10%	Score	Rank
Asset A	6	10	5	1	6.5	
Asset B	5	8	9	5	6.7	
Asset C	8	3	4	5	5.4	
Asset D	6	8	7	5	6.7	
Asset E	4	9	5	8	6.1	
Asset F	5	10	5	8	6.8	3
Asset G	4	3	3	8	3.9	
Asset H-1	10	4	9	8	7.8	1
Asset H-2	10	4	9	8	7.8	1
Asset H-3	10	4	9	8	7.8	1
Asset I	6	2	9	9	5.7	
Asset J-1	5	10	9	9	7.7	2
Asset J-2	5	10	9	9	7.7	2
Asset J-3	5	10	8	9	7.5	2
Asset K	10	2	4	9	6.3	
Asset L	4	4	5	9	4.7	
Asset M	5	4	9	9	5.9	
Asset N	5	6	8	9	6.3	
Asset O	5	8	8	9	6.9	
Asset P	4	1	10	6	4.5	

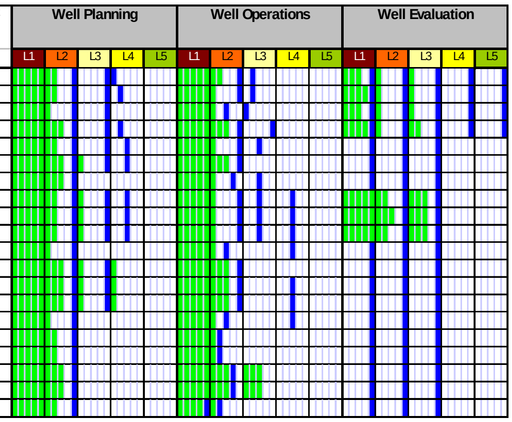

Fig. 3 Asset Prioritization and Targeting

Program Results and Case Studies

Understanding Performance and Value Creation

As described earlier, several specific benefits lead to improved performance and value creation from the integrated competence program. The program team created a value map by mapping each identified benefit to each of the levels of integration (Fig. 1) in the well planning, well operations, and well evaluation phase of the well construction process. A simple qualitative and quantitative classification was used: H = High Value Creation (5), M = Medium Value Creation (3), and L = Low Value Creation (1). The intention of the value map was not to quantify each benefit in absolute terms, but to obtain a relative view of the benefits to guide and focus the implementation plans. Several key observations were derived from the value map. Level 2 (28%) and Level 3 (38%) of integration deliver the largest share of the value. As one might expect, the largest share of value from this program is created from the well operations phase (44%) of well construction process, but well planning (33%) and well evaluation (23%) collectively create more value and are relatively easier to achieve. Each of the value creation areas highlighted uniform contributions, with Improved Operations (26%) showing the most promise.

Additionally, correlating the prioritization and targeting exercise to the value map provided an additional perspective of asset-specific and company-wide “as is” and “to be” value realization.

Case Study 1 - Statfjord Onshore Operations Centre

Remote Measurements While Drilling (MWD) services from Statfjord OOC.

Schlumberger has provided remote, day shift, MWD services to the Statfjord asset from the StatoilHydro Statfjord OOC since May 2005. The night shift is run from the offshore rig as normal. Since inception, remote operation services have been performed on 7 to 10 wells per year. The joint StatoilHydro-Schlumberger onshore team improved collaboration in all phases of the process and is an example of Level-2 integration described in Fig. 1.

Strengthen the Decision-making Organization Onshore

The decision-making organization onshore is strengthened by the presence of the StatoilHydro drilling engineer and the operations geologist together with the Schlumberger MWD engineer in the OOC during drilling operations. In addition, the presence of the MWD engineer in the OOC during the day means that they are available to the entire drilling team not only during the execution stage but also during the well planning and evaluation stages. Their presence in the OOC enables the team to embrace integrated operations principles in the work process; this is particularly important for project-organized processes and team-based work methods. MWD engineer participation in uncertainty assessment and peer reviews reduces the number of iterations in the planning cycle. In addition, access to their expertise improves coordination and equipment planning.

Improve Operations

The Statfjord asset, like many other assets, suffers bed-space restrictions and is constantly seeking ways to optimize bed-space utilization offshore. Remote Operations enables services normally provided at the rig site to be run remotely from an onshore location such as the StatoilHydro OOC thereby alleviating problems with bed-space restrictions.

Traditionally, crew utilization and the efficiency of the offshore operation often mean that the actual efficiency of specific offshore crews can be as low as 35%. Moving the engineers onshore improves their utilization and increases their effective efficiency by more than 100%.

Basing MWD engineers in the OOC removes them from the distractions of the rig, providing them with a working environment where they can ensure better quality assurance and control of real-time and post-job deliverables and deliver post-job deliverables faster.

Fig. 4 Remote MWD Services

Case Study 2 - Norne Onshore Operations Centre

Well Placement operations run remotely from the Norne asset office facility in Harstad.

Strengthen the Decision-making Organization Onshore

The onshore decision-making organization was strengthened by creating a team of experienced people who are able to make decisions 24 hours a day by working collaboratively on the latest data and models, thus delivering a high-quality well. This joint StatoilHydro-Schlumberger onshore team comprises three teams, each working eight-hour shifts. Each team comprises one member of the StatoilHydro geology and geophysics (G&G) team, a Schlumberger/StatoilHydro drilling engineer, a Schlumberger directional drilling engineer and a Schlumberger well placement engineer. The removal of well placement personnel from the wellsite, the addition of directional drilling personnel to the team, and the cross-company collaboration in all three phases of the well construction process, represents Level 3 integration as described in Fig. 1. Data from the rig are delivered to shore by a Web-based data presentation system and are uploaded into geosteering modeling software in real time enabling the onshore team to make timely and accurate geosteering decisions.

Improve Operations

The Schlumberger support center staff members (Fig. 2) monitor data quality around the clock for all North Sea operations and collaborate with the wellsite crew to resolve any data anomalies and to ensure high data quality. In turn, knowing that the data they receive are quality controlled, well placement team members can make critical steering decisions with confidence. If there are any questions regarding the data, the Schlumberger support center team is available to answer them at all times.

Create Additional Value

This collaborative team configuration onshore improved access to expertise ensuring better and more efficient decisions in real time. This, in turn, allowed better exploitation of technology and opportunities offered during operations, enabling the team to deliver wells that consistently exceed expectations. For example, a recent Norne operation resulted in a perforated producing interval that was 30% longer than planned; daily production is 10% more than predicted at 3000m^3/d (Fig. 5).

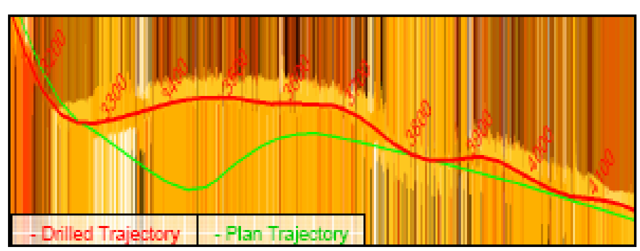

Fig. 5 Well Placement at Norne

Conclusions

Various E&P companies are in different stages of implementing digital initiatives to realize operational and commercial benefits across the core processes of drilling, production, and reservoir management. Once these programs are in place and the digitized processes begin delivering benefits, tighter integration with service company expertise offers the next level of value creation opportunity for operators. The framework, program approach, challenges, and results presented in this paper provide the E&P industry with an example of operator-service company integration, with possible implications for their own current and future digital initiatives, particularly those focused on the well construction process.

Acknowledgements

The authors thank their colleagues for their contributions to the integrated competence program. Special thanks go to Anders Olai Eiternes, Leif Kristian Jensen, Harald Laastad , Jess Milter, Ivar Martin Morvik, Peter Eilsø Nielsen, and Runar Kolseth Nyberg from StatoilHydro; Nils Arild Espeland, Chris Partridge, Gavin Rennick, and Colin Scott from Schlumberger; and Hilde Dagrun, Arie Romer, and Leif Tharaldsen from Geoservices.

The authors also thank the management of StatoilHydro and Schlumberger for their permission to publish this material.

References

1. Henriquez, A, 2007. The Road Ahead, presented at the Norwegian Petroleum Society Conference on Intelligent Fields and Integrated Operations, Stavanger, 28-29 September
2. OLF, 2003. eDrift på norsk sokkel - det tredje effektiviseringsspranget http://www.olf.no/io/rapporter/?51367.pdf
3. OLF, 2005. Integrated Work Processes: Future Work processes on the Norwegian Continental Shelf. http://www.olf.no/io/rapporter/?51638.pdf
4. OLF, 2006. Potential value of Integrated Operations on the Norwegian Shelf. OLF Report, http://www.olf.no/english/news/?32101.pdf
5. RACI, 2007. For more information on RACI diagrams see: http://en.wikipedia.org/wiki/RACI_diagram (accessed Dec 2007).
6. Ringstad, A.J. and Andersen, K. 2006. Integrated Operations and HSE – Major Issues and Strategies. Paper SPE 98530 presented at the SPE International Health, Safety & Environment Conference, Abu Dhabi, UAE, 2-4 April.