

## Case Study: Active Knowledge Management for Integrated Operations (AKSIO)

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### General Description

#### Introduction

Integrated Operations are implemented when offshore oil platforms are connected by high-speed data links to on-shore control centers, and multidisciplinary teams collaborate to optimize operations and rapidly solve any problems.

Deep-sea drilling projects are technically sophisticated and highly complex, and require expert knowledge. Even with the extensive use of information technology for monitoring, analyzing and making decisions about projects, knowledge transfer sometimes fails and results in expensive down-time.

The importance of effective Knowledge Management (KM) has for a long time been recognized by the international oil and gas industry. Still, KM challenges have not been solved in a generally satisfactory manner. Shortcomings include unsystematic registration and qualification of knowledge, lack of common terminology, insufficient tools for search, and inadequate management of and linking to tacit knowledge. The Active Knowledge Management for Integrated Operations (AKSIO) aims to better connect knowledge processes to existing core work processes.

#### The solution

The goal of AKSIO is to provide decision makers in drilling processes with the best available knowledge in a task-relevant, timely, and contextual manner. A further goal is to provide feedback loops that capture new knowledge and delete obsolete knowledge.

The AKSIO system focuses on the transfer of inter-project experience both in the planning and operation of the drilling process. The system has been developed and tested for Statoil, which is the largest oil company on the Norwegian Continental Shelf, and covers experiences with over 2,500 drilling operations since the early 90s. A wide range of data is collected including that relating to Health Safety and the Environment.

Drilling operations involve processes for knowledge creation and knowledge reuse (see Figure 1).

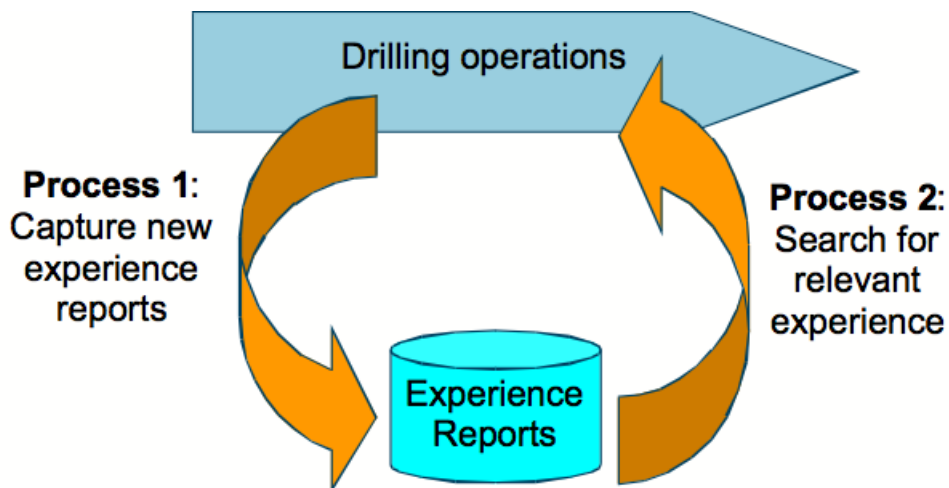


Figure 1: KM processes in drilling operations

The individual drilling projects are responsible for recording positive and negative experiences during drilling operations in a module in the reporting system called Daily Drilling Report (abbreviated to DBR in Norwegian). AKSIO adds some crucial missing pieces in quality assurance and annotation, and also links to relevant documents and people. This process is run by the discipline advisors, whose responsibility is to maintain best practices in their respective areas.

The objective of the reuse improvements is to discover relevant experiences that could affect current or planned drilling operations. The improvements in reuse hinge around a search engine that uses an ontology that is embedded in existing work processes (see Figure 2).



### Search filters

click below to enable filter

discipline

operation

equipment

state  
 select all  unselect all  
 Corrosion (2)  
 Erosion (3)  
 Lack Of Maintenance (4)  
 Leak in barrier elements (7)  
 Scale Deposition (4)  
 Too High Mud Density (4)  
 Too low mud density (1)  
 Well Integrity Problem (10)

keywords\_ref

wellbore\_id\_ref

field\_id  
 select all  unselect all  
 EXPLORATION (2)  
 GULLFAKS (1)  
 GULLFAKS SØR (1)  
 HEIDRUN (2)  
 HULDRA (1)  
 KVITEBJØRN (4)  
 MIDGARD (1)  
 NORNE (2)  
 RIMFAKS (1)  
 SNORRE (1)  
 STATFJORD (4)

### Results 1 - 10 of 10

1. **Mud as barrier during P&A phase**

2006-08-31T10:00:00Z

**Description:** Sufficient barriers are available without using mud as barrier element during killing of well and ni...

STATFJORD NO 33/12-B-17 PERM P&A Kristiansen Steffen KILL WELL

2007-05-17T10:22:49Z

Cementing Network Sementeringsnettverk Technical Sidetrack Tekniske Sidesteg Bronnintegritet Well Integrity Swabbing Swabbing Too High Mud Density Too high mud density Too low mud density Well Integrity Problem Well Integrity Problem

83%

[annotate](#)

[comment](#)
2. **Top plug/20" EZSY**

2002-06-26T10:00:00Z

**Description:** Experience: In a "standard" OPR design, the upper cement plug would cover the 13 3/8" out of well as...

EXPLORATION NO 6406/1-1 PA FLUGBACK/KICK-OFF

2007-05-16T09:36:40Z 2007-05-16T09:41:07Z

Cementing Network Sementeringsnettverk Directional Drilling Network Directional Drilling Network Bronnintegritet Well Integrity Casing Faningsror Deep set tubing plug Deep set tubing plug Liner top packer Liner top packer Mechanical tubular plugs Well Integrity Problem Well Integrity Problem

53%

[annotate](#)

[comment](#)
3. **RIH with drill stem teststring.**

2002-06-13T10:00:00Z

**Description:** RIH with drill stem teststring. Took weight when entering 7" liner with test string. Worked some pas...

RIMFAKS NO 34/10-J-4 H DST DRILL STEM TEST

2007-05-16T09:36:40Z 2007-05-16T09:41:07Z

Bronnintegritet Well Integrity Swabbing Swabbing Completion string component Completion string component Downhole tester valve Downhole tester valve Borestring Drilling Subsea production tree Subsea test tree Subsea test tree Surface test tree Surface test tree Well test packer Well test string Well test string Well test string components Erosion Erosjon Lack Of Maintenance Lack Of Maintenance Leak in barrier elements Leak in barrier elements Well Integrity Problem Well Integrity Problem

48%

[annotate](#)

[comment](#)
4. **Flowing well**

2003-02-20T11:00:00Z

**Description:** The well was temporary handed back to production during changeover from slick line to 5/16" cable fo...

HEIDRUN NO 6507/7-A-20 WIREL Holi Trond OTHER

2007-05-16T09:36:40Z

Cementing Network Sementeringsnettverk Technical Sidetrack Tekniske Sidesteg Bronnintegritet Well Integrity Snubbing safety head Snubbing safety head UBD none return valve UBD none return valve Corrosion Corrosion Erosion Erosjon Lack Of Maintenance Lack Of Maintenance Leak in barrier elements Leak in barrier elements Scale Deposition Scale Deposition Too High Mud Density Too high mud density Well Integrity Problem Well

43%

[annotate](#)

[comment](#)

Figure 1: Searching for experiences. (A larger screen dump image is also available.)

The shared domain ontology is used for semantic annotation, and for retrieval of information. It is developed collaboratively by the discipline advisors, and covers operations, equipment, events and failure states in drilling operations. It also includes relations between these concepts, for example, to indicate that a particular event may result in a failure state.

#### Semantic Web technology

AKSIO is built on Semantic Web standards. Experiences are represented in Resource Description Format (RDF), and discipline advisors add comments, semantic annotations, and links to people as RDF descriptions. Concepts from the drilling domain are modeled in Web Ontology Language (OWL), which serves as a backbone on which experiences can be organized and described. It also serves as the backbone for search, ranking and navigation.

#### Conclusion and further work

AKSIO shows how Semantic Web technology can be used for knowledge management in the oil and gas domain. The system has been tested over a three month period with discipline advisors and one drilling project at Statoil. Computas will continue to pursue this technology approach in this industry and in other domains.

#### Key benefits of Semantic Web technology

- Standards-based, neutral platform that is able to express and connect existing knowledge resources (tacit and explicit).
- Domain knowledge is expressed in a shared ontology, so that business knowledge can be separated from the code.
- Easier to include new metadata and references than with traditional database systems.
- Legacy data is exposed using RDF allowing data recombination and reuse.