# Integrated Operations in the High North Joint Industry Project

Twenty-five companies from different parts in the value chain have joined forces to design, implement and demonstrate a reliable and robust ICT architecture to be used for petroleum exploration and production in an Arctic setting. Open standards are used to ensure interoperability, to facilitate integration and to transfer data. Combined with advances in information sharing and knowledge management technologies, this readily improves the basis for collaborative decision making and thereby facilitates more effective work processes.

IOHN

The Arctic region holds vast amounts of extractive energy resources. Most of these resources are located offshore in environmentally very sensitive areas possibly beneath thick ice and/or in deep water. Weather and distance from existing infrastructure and centers of population add additional operational and logistic challenges.

In order to meet all these requirements and at the same time maintain profitable operations, the industry needs to create new field development and operational concepts that include heavily instrumented facilities. These operational concepts will often be based on a lean local organization supported remotely from a combination of an asset organization, multi-asset support centers and external expert centers. This is what has been called the second generation of Integrated Operations.

An important prerequisite for this development is a robust and secure digital infrastructure as a platform for effective and efficient data and information exchange and decision making. To enable collaboration across boundaries in a smooth and efficient manner, a digital platform based on open standards is required, thus allowing for a much higher degree of interoperability across applications, disciplines, geographic locations and organizations than is common today.

## The Integrated Operations in the High North project

The goal for the Integrated Operations in the High North (IOHN) project is to design, implement and demonstrate a reliable and robust architecture for Integrated Operations Generation 2 (IO G2). Existing open standards are used and extended when required and new standards are incubated to ensure interoperability, to facilitate integration and to transfer data. To make data-to-information-to-decisions work processes more efficient, information and knowledge models based on open standards are also developed and used.

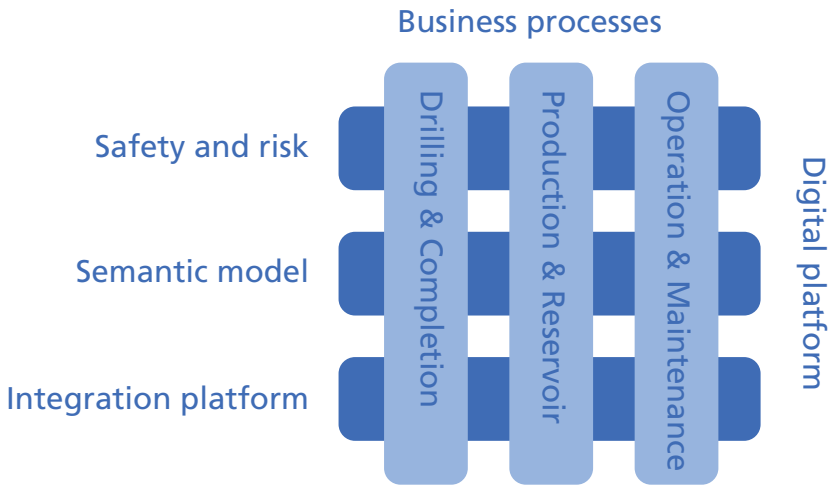
The IOHN project is set up as six activities organized in a matrix; three related to the digital platform and three related to pilots for different business domains. Within the different business domains, architectural relevant use cases have been defined. These use cases form the basis for extracting the requirements for the digital platform and are used later on to test (parts of) the digital platform and to validate the value potential for IO G2.

Robust and secure digital infrastructure as a platform for effective and efficient data and information exchange and decision making.

## Digital platform

The digital platform, being a crucial enabler for IO G2, forms a natural foundation for the IOHN project. Besides an activity on the integration platform itself, two additional activities are defined working on two very important aspects of the architecture for IO G2. A first additional activity is working on the integration of information, i.e. making sure that data and information may be used seamlessly across boundaries using open standards based on ISO 15926, POSC Caesar Association's oil and gas ontology and semantic web technologies. A second additional activity focuses on specific safety and security aspects for highly interconnected and software intensive systems.

**IOHN Project layout**



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## Use cases

Use cases within three different business domains are defined in the IOHN project. The use cases are used to extract the requirements for and to test and validate the value potential of the digital platform through pilots.

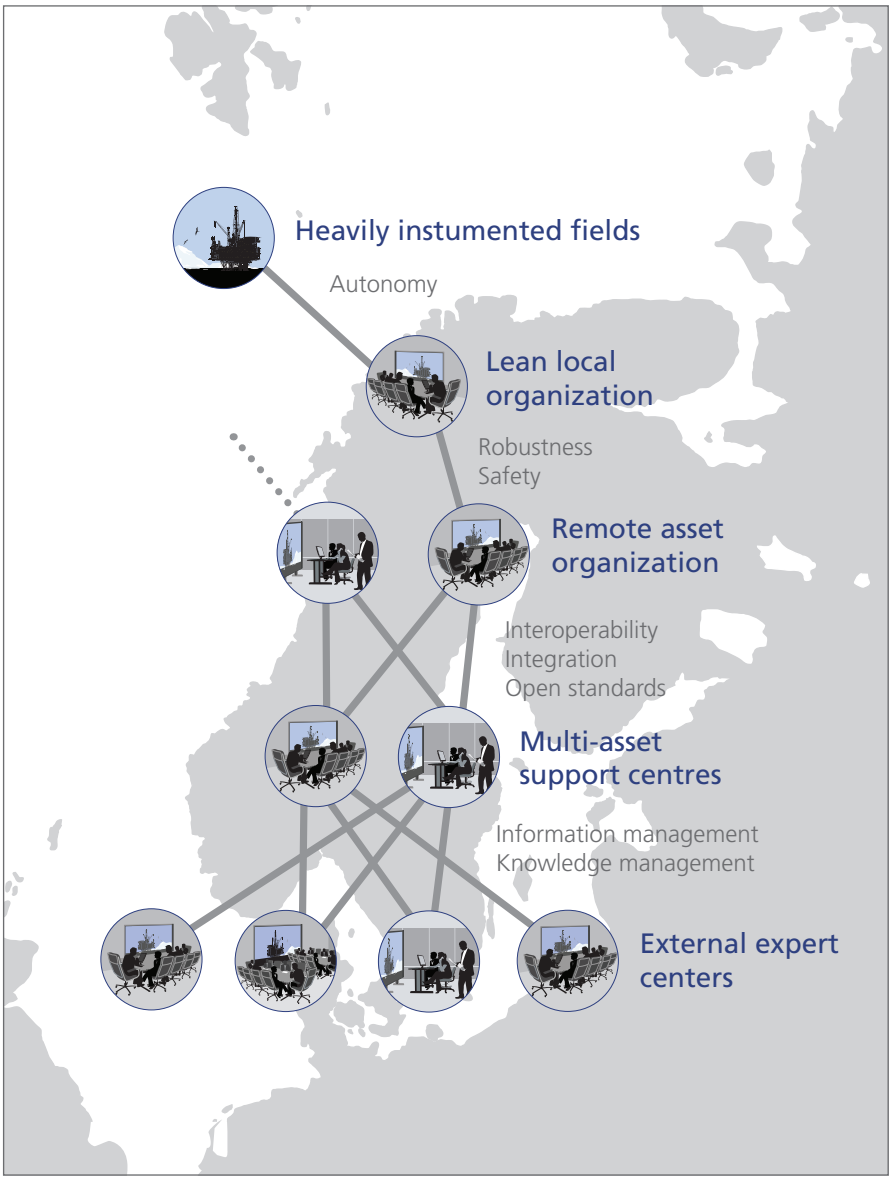
The drilling and completion use cases focus on seamless interoperability through open standards at the drilling control level. There is currently a gap between available real-time data and a cost-effective and timely utilization of it during drilling operations. Improvements will come from systems that are closing the loop, i.e. by automatically analyzing the real-time data stream, autonomous decision making and directly intervening with the drilling control system. Such systems that may integrate with external service providers rely on standardized, machine-readable knowledge of the drilling domain. This will lead to a better safeguarding of operational limits, less unproductive time and, in the end, better and more efficient well placement. It is also a stepping stone towards concepts such as an unmanned subsea autonomous drilling rig that may be a game changer under Arctic conditions.

The reservoir and production use cases focus on the detection of sand production and associated erosion management, which are common challenges for the industry. Sand production may constitute severe safety, financial and environmental risks as well as lost opportunities. Within the arctic setting, the criticality of these risks only increases and it is therefore crucial to have trustworthy data with respect to both measurements of sand volumes as well as reliable methodologies for erosion monitoring and predictions. One of the possibilities that arises from the digital platform is increased collaboration and interoperability, which is a key characteristic for IOG2. The pilot is exploring this opportunity by facilitating new work processes for an expert competence center supporting several assets with production-related issues.

The operations and maintenance use cases focus on Condition-Based Maintenance (CBM) of an environment sensitive part of a subsea control system, and coupling this to the Enterprise Resource Planning (ERP) system. The objective is to maximize production regularity within the limits of safe operations. Condition-based maintenance is usually split into corrective maintenance (after equipment has broken down), preventive maintenance (routinely performed inspections) and predictive maintenance (analyses and predictions of the equipment's status), where the latter is assumed to be the most cost efficient when executed correctly. The pilot aims to move the maintenance processes from preventive and corrective maintenance to predictive maintenance by combining aggregated sensor information with ERP systems and advanced planning facilities, focusing on a subsea system.

To enable collaboration across boundaries in a smooth and efficient manner, a digital platform based on open standards is required.

**Collaboration across boundaries**



## Status of the project

The IOHN project has started successfully in May 2008. Work is well underway on the digital platform and the different pilots. In 2010, the first proofs-of-concept for the different pilots are expected, along with work on different parts of the digital platform. The project is also working on position papers on how semantic web technologies and autonomous systems may impact the current operational models. At the moment twenty-five companies from different parts in the petroleum exploration and production value chain are participating in the project.

The twenty-five companies participating in the IOHN project at the time of publication (March 2010) are (in alphabetical order):

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|---|---|---|---|
| ABB | ENI | IO Centre | POSC Caesar Association |
| Abelia | Epsis | IRIS | Petroleum Safety Authority Norway |
| Baker Hughes | FMC | Kongsberg | Siemens |
| Cisco | FSI | National Oilwell Varco | Statoil |
| Computas | IBM | NTNU | The Norwegian Defence |
| DNV | Invenia | OLF | University of Oslo and University of Stavanger |

More information about the project may be found in the paper presented at the "Transformational Solutions" session at Intelligent Energy 2010 (SPE 127550), on the project website (http://www.iohn.org) or via info@ iohn.org.