EPIM LogisticsHub (ELH)

A common knowledgebase for tracking Cargo Carrying Units (CCUs) and equipment in the Norwegian Offshore Industry

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Agenda

1. Introduction
   ✓ Norwegian Oil and Gas
   ✓ PCA
   ✓ EPIM

2. Radio Frequency Identification (RFID) deployment in oil and gas

3. Offshore Logistics - Norway

4. EPIM LogisticsHub
   ✓ Phase I
   ✓ Phase II

5. Summing up
Norwegian Oil and Gas is a professional body and employer’s association for oil and supplier companies doing exploration and production of oil and gas on the Norwegian Continental Shelf (NCS). NOG works to solve common challenges for the members and to strengthen the competitiveness of the NCS.
Integrated Operations (IO)

1. Instrumented Automated identification and data capture (AIDC) and automation

2. Interconnected Digital infrastructure and Information security

3. Integrated data Information management

4. Innovative computing and business intelligent software

5. Intelligent decisions

- Analysis
- Visualization
- Knowledge
- Decisions
- Actions
IO Generation 1 and 2

**Integration across companies**

**Generation 1**
- Integrated onshore and offshore centers
- Continuous onshore support

**Potential**

**Generation 2**
- Integrated operation centers of operators and vendors
- Heavily automated processes
- 24/7 operation

**Integration across onshore and offshore**

**History**
- Self-sustainable fields
- Specialized onshore units
- Periodic onshore support

**Limited integration**


**Time**
Information Strategy

Intelligent systems and components

Virtual model of reservoirs, wells, production process & facilities

Distributed control & surveillance systems

Oil and Gas Ontology based on GIM, Semantic Web and Web services

Fiber cable

Operators

Collaboration tools

Vendors

Integrated, onshore-based operation centers

4D and 4C seismic (sea bottom or conventional)

Down hole sensors and processing equipment

Operators

Vendors

Integrated, onshore-based operation centers

Collaboration tools

Oil and Gas Ontology based on GIM, Semantic Web and Web services

Fiber cable

Intelligent systems and components

Virtual model of reservoirs, wells, production process & facilities

Distributed control & surveillance systems

9
PCA is a non-profit global member organization with focus on lifecycle data integration and interoperability through the **Generic Information Modeling (GIM)** standard (ISO 15926) and W3C recommendations.

The GIM standard is methodology standard that can be used for data integration and interoperability of any data from any domain - industrial, commercial and/or public sector.
GIM Reference Data Library

Domain Specific Nomenclatures

Health, Safety & Environment

Seismic

Drilling & Completion

Reservoir & Production

Operations & Maintenance

Logistics & Transportation

Integrated Lifecycle Asset Planning

GIM Data Model

Structure and add to PCA Reference Data Library (RDL)

Determine entity type

Determine specialization and other relationships

PCA (Oil & Gas & Process Industry Ontologies and Reference Data)
Holistic view on Asset Management

- Technology (PERA)
  - ERP (4)
  - Networks (5)
  - Control systems (2)
  - Operations Mgmt (3)
  - Intelligent devices (1)
  - Physical (0)

- Knowledge (GIM)
  - 4D Model
  - Core RD
  - Catalog RD
  - RemEDIATE
  - Decommission
  - RD
  - Std.
  - Core RD

- Business (PEAM)
  - Conceptualization
  - Platform
    - Plants
    - Facilities
  - Design
  - Build
  - Commission

GIM = Generic Information Modeling
RD = Reference Data
PERA = Purdue Enterprise Reference Architecture
PEAM = PISTEP Engineering Activity Model

ISO 15926 Integrated Lifecycle Data
E&P Information Management Association (EPIM)

**EPIM** is governed by the **operators on the NCS** and shall facilitate IT solutions and services for the oil and gas industry through standardization of requirements and processes.

**EPIM solutions based on the GIM standard**
Semantic Web Technology and GIM is the way forward

Evolution:
- Web 1.0 – Pages and documents
- Web 2.0 – Social networking
- Web 3.0 – Semantic Web

GIM can be expressed in RDF statements and Semantic Web Technology can be deployed

Resource Description Framework (RDF) is a distributed data model on the Semantic Web consisting of a triple

| Subject | Predicate | Object |

Any table of data might be expressed as RDF triples where
- Subject is the row number
- Predicate is the content of column
- Object is the cell value

A database for RDF triples is called a triplestore. Easy to merge/add new data, put meaning to data, transfer data between triplestores, query many triplestores as one data base.

Why ontology?
The real world is complex and changing, we need a solution that can cope with the complexity and adapt to the changes.
That's what ontology does for us
# General business case for EPIM’s solutions

<table>
<thead>
<tr>
<th>Operators cost structure:</th>
<th>Internal costs</th>
<th>External costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 %</td>
<td>80 %</td>
</tr>
</tbody>
</table>

**Consequence:**
- Common industry requirements: 5 times higher cost reductions!
- Individual operator requirements: Not sustainable

Plus the benefit of sharing development and operations costs!

**Example 1 ELH as common industry requirement**
- 25% cost reduction within logistics for the operators | Internal 5% |
- 25% cost reduction within logistics for the suppliers | External 20% |
- Total cost reduction for the operators: 5% x 5 = 25% 

**Example 2 ELH as individual operator requirements**
- 25% cost reduction within logistics for the operators | Internal 5% |
- 10% cost increase within logistics for the suppliers | External -8% |
- Total cost increase for the operators: 3%
Summing up NOG, PCA and EPIM

NORSOK concluded in 1995 that, the GIM technology had a potential of reducing CAPEX and OPEX with 25% and 20%, respectively.

NOK 50 billion in cost reduction per year on the NCS!

Think global – act local!

<table>
<thead>
<tr>
<th>Initiator</th>
<th>Standardization</th>
<th>Operations</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment reporting</td>
<td>Part of GIM</td>
<td>EPIM EnvironmentHub</td>
<td>License to operate</td>
</tr>
<tr>
<td>Drilling/prod. reporting</td>
<td>Part of GIM</td>
<td>EPIM ReportingHub</td>
<td>NOK 10+ billion per year</td>
</tr>
<tr>
<td>Top site</td>
<td>Part of GIM</td>
<td></td>
<td>NOK ? billion per year</td>
</tr>
<tr>
<td>Subsea installation</td>
<td>Part of GIM</td>
<td></td>
<td>NOK ? billion per year</td>
</tr>
<tr>
<td>Equipment</td>
<td>Part of GIM</td>
<td>EPIM EqHub</td>
<td>NOK 10 billion per year</td>
</tr>
<tr>
<td>Logistics</td>
<td>Part of GIM</td>
<td>EPIM LogisticsHub</td>
<td>NOK 2 billion per year</td>
</tr>
</tbody>
</table>

**EPIM**

<table>
<thead>
<tr>
<th>Initiator</th>
<th>Standardization</th>
<th>Operations</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Part of GIM</td>
<td>XML schemas</td>
<td>NOK 15 billions per year</td>
</tr>
</tbody>
</table>

Operators
RADIO FREQUENCY IDENTIFICATION (RFID) IN THE OIL AND GAS INDUSTRY

To get access to real time quality data that improve work processes and lead to safer, faster and better decisions
Norwegian Oil and Gas’ Guideline No. 112

Deployment of RFID in oil and gas

Deployment of RFID in oil and gas for the domains:

✓ Personnel
✓ Containers
✓ Drill strings
✓ Fixed equipment
✓ Mobile equipment

The guideline is based on ISO standards.

The Guideline No. 112 is available at:
Purpose of an RFID architecture

To promote open and scalable deployment of RFID technology with plug and play ID methods for both sensing/actuating and interface to enterprise systems.

Guideline for RFID Architecture and Integration

Norwegian Oil & Gas’ Architecture and Integration

RFID System functionality
RFID System maintainability
RFID System availability
RFID System security

Operator Architecture Principles
# RFID Signal Integration Model (& PERA)

<table>
<thead>
<tr>
<th>Operation</th>
<th>RFID Hardware</th>
<th>RFID Middleware</th>
<th>RFID Software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical environment</strong></td>
<td><strong>RFID</strong></td>
<td><strong>Hardware</strong></td>
<td><strong>RFID</strong></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td><strong>Tag</strong></td>
<td><strong>Air</strong></td>
<td><strong>Device</strong></td>
</tr>
<tr>
<td><strong>Motion</strong></td>
<td><strong>Sensor</strong></td>
<td><strong>Interface</strong></td>
<td><strong>Interface</strong></td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td><strong>Actuator</strong></td>
<td><strong>Antenna</strong></td>
<td><strong>Device</strong></td>
</tr>
<tr>
<td><strong>Forces</strong></td>
<td><strong>Reader/</strong></td>
<td><strong>Wireless</strong></td>
<td><strong>Management</strong></td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td><strong>Encoder</strong></td>
<td><strong>sensor</strong></td>
<td><strong>Event</strong></td>
</tr>
<tr>
<td><strong>items</strong></td>
<td><strong>Logical</strong></td>
<td><strong>network</strong></td>
<td><strong>Interface</strong></td>
</tr>
</tbody>
</table>

**Logical Memory Map**: Tag Driver and Mapping Rules

**Logical Memory**: Device Infrastructure

**Encoding and Management Rules**: Device

**Device RESPONSES**: Command Response Unit

**APPLICATION RESPONSES**: Command

**Application COMMANDS**: Data Collection

**DATA RESPONSES**: Filtering and aggregation of Data

**APPLICATION RESPONSES**: Data Management

**Database Repositories**: Data Service Applications

**Business Applications**: Personnel Tracking

**ISO 18000**: Data Service Applications

**ISO/IEC 15962**: Personnel Tracking

**ISO/IEC 15961**: Carg Carrying Units

**ISO 15926**: Back-end Application

**GUID**: ISO/IEC 15459

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E&P Information Management Association
Logistics on the NCS – An overview 2013

- **Licensees**
  - 500+ Active Production Licensees
  - 80+ Fields in production
  - 10+ Active Transport Licensees

- **40 Operators**
  - 14 operators with production
  - 1 operator of pipelines
  - 6 operators with PDO (no prod.)
  - 19 operators with only exploration

- **Cargo & Passenger**
  - Supply ships
    - Cargo Carrying Units
      - Equipment
  - Helicopter
    - People (POB)
    - Equipment
  - Tanker
    - Oil

- **Suppliers of products and services**
  - Rig suppliers
  - Service companies
  - O&M contractors
  - Transport suppliers

**Tracking using RFID?**

**Offshore supply bases**
- **Kirkenesbase**, Kirkenes
- **Polarbase**, Hammerfest
- **Norbase**, Harstad
- **Helgelandsbase**, Sannessjøen
- **Vestbase**, Kristiansund
- **Kistiansundbase**, Kristiansund
- **Fjordbase**, Florø
- **Mongstadbase**, Lindås
- **Coast Center Base**, Sotra
- **Stordbase**, Stord
- **Norsea base**, Tananger, SOLA
- **Norsea base**, Dusavika, Stavanger
The supply chain as seen from the operator

The CCU:
- Who
- What
- Where
- When
- Why
+ documents / info.

CCU owner → Transport → Supplier → Transport → Supply base → Transport → Installation → CCU back to the owner
A LogisticsHub may provide information to all operators and suppliers

EPIM
LogisticsHub

The CCU:
✓ Who
✓ What
✓ Where
✓ When
✓ Why
+ documents / info.

CCU owner
Transport
Supplier
Transport
Supply base/Operator
Transport
Platform/Rig

CCU back to the owner
AUTOMATIC IDENTIFICATION AND DATA CAPTURE (AIDC)

TRACKING TECHNOLOGIES AT SITES
A typical layout of a supply base

A supply base is typically divided into zones where different business process events take place:

- Arriving (with lorry)
- Inspecting
- Holding
- Unloading (Accepting)
- Unpacking (Receiving)
- Packing (Picking)
- Staging outbound (ISPS zone)
- Loading
- Departing
- Arriving (with ship)
- Unloading (Accepting)
- Unpacking (Receiving)
- Packing (Picking)
- Staging outbound (Lorry zone)
- Loading
- Departing
Forklift trucks play an important role for tracking CCUs at onshore locations.
## Tracking (AIDC) technology

<table>
<thead>
<tr>
<th>Cargo Carrying Unit (CCU)</th>
<th>Onshore Gate/Portable</th>
<th>Onshore Forklift truck</th>
<th>Onshore cranes</th>
<th>Offshore Gate/Portable</th>
<th>Offshore cranes</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID Tag</td>
<td>RFID reader &amp; antenna</td>
<td>Identec Solutions D EN i-PORT M350 2 v1.11 F Laird, S8655P</td>
<td>Tracking package available similar to the forklift truck</td>
<td>RFID reader &amp; antenna</td>
<td>Tracking package available</td>
</tr>
<tr>
<td>Identec Solutions i-Q350X FL</td>
<td>Identec Solutions 2-WAY Main Cabinet 10dB Yagi antenna</td>
<td></td>
<td></td>
<td>Identec Solutions GA – Main Cabinet Model Aarial Oy Av2091</td>
<td>Identec Solutions Atex approved and available in 2013 ~ NOK ?????</td>
</tr>
<tr>
<td>Identec Solutions i-Roc 62x</td>
<td>Handheld RFID reader</td>
<td>Garmin GPS 16 17</td>
<td></td>
<td>Handheld RFID reader</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identec Solutions Forklift truck package</td>
<td>PC LXE VX9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Server/client and software package per site
Identec Solutions
Forklift truck package

Server/client and software package per site
Identec Solutions
Forklift truck package

Price dependent on the offshore crane ~ NOK ?????
EPIM LOGISTICSHUB

PHASE I

CARGO CARRYING UNITS
ELH’s Conceptual Data Model
Phase I of ELH has focus on the following business process events:

- Arriving
- Inspecting
- Unloading
- Internal moving
- Loading
- Departing
Master data
Regularly updating of master data

CCU Owners
Owner ID
Type Certificate
Hirer Period

NORSOK Z015 Units
Norwegian Oil & Gas sealed CCU

Ordinary CCU
Dangerous CCU

NPD Fact Pages
PCA RDS
GS1 GLN Register
The Brønnøysund Registers

ELH schematic overview

EPIM LogisticsHub
Application
- Analysis
- Presentations
Query and inferences
Data base
Receive, validate, transform and load

XML (query)
XML (response)

CCU Owners
RFID Reader
RFID Tag Event
Updating Event
Appl.

Supplier location
Transport positions
Supply base location
Operator locations
Rig owner location

Supply Chain

Dangerous CCU
Ordinary CCU
RFID Reader
RFID Tag Event
Updating Event
Appl.

Application
- Analysis
- Presentations
Query and inferences
Data base
Receive, validate, transform and load

XML (query)
XML (response)
Data flow in ELH

1. Receiving XML file
2. Validating
3. Decision
4. Returning with error message
5. New event data
6. Storing as XML file
7. Storing as RDF triples
8. Querying reporting
9. Generating RDF report
10. Transforming to XML file and validating
11. Sending
12. Regular statistical reporting
13. EPIM website

User

Response

Brønnøysund Register
GS1 GLN Register
NPD Fact Pages
PCA RDS
ELH’s Master data and standard ontologies
EPIM LOGISTICS HUB

PHASE II

CONTENT OF THE CCUs
Business process events at site for phase II of ELH

The CCU going offshore

- Arriving
- Inspecting
- Departing
- Unloading
- Repair CCU
- Holding
- Update documentation
- Unpacking
- Storing CCU
- Packing
- Staging outbound
- Loading
- Departing

The CCU returning from offshore

- Arriving
- Unloading
- Inspecting
- Damaged CCU
- Unpacking
- Storing CCU
- Packing
- Staging outbound
- Loading
- Departing

Important business process events in Phase II of ELH
Defining the equipment in the CCUs

- Define the mobile equipment
- Define the fixed equipment offshore
  - Non standard equipment
  - Standard equipment (80% of ...)
Summing up LogisticsHub

- LogisticsHub - a knowledgebase (triplestore) that communicate with the users through a Web service
- Master data - automatic updates
- CCU owners provides information about the CCUs before sent to the hirer
- The hirer has to supply necessary documentation
- The users have to install tracking solutions at their sites
- 6 different types users - CCU owner, supplier, transporter, supply base, rig owner and operator
- Very good investment for the offshore industry