Better ways of working with Asset Integrity data

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Date: Wed 30th October

Asset Integrity Management/ MMO
Health, safety and environment: a top priority

Our vision is to be the preferred partner for solutions in the oil and gas industry through living our values.

Customer drive
Building customer trust is key to our business

HSE mindset
We take personal responsibility for HSE because we care

People and teams
All our major achievements are team efforts

Open and direct dialogue
We encourage early and honest communication

Hands-on management
We know our business and get things done

Delivering quality results
We deliver consistently and strive to beat our goals
This is Aker Solutions

- Provides oilfield products, systems and services for customers in the oil and gas industry world-wide
- Built on more than 170 years of industrial tradition
- Employs approximately 28 000 people in more than 34 countries

Employees: 21 500
Contract staff: 6 500
Revenues: 44.9 bn
EBITDA: 4.7 bn
Market Cap: 32.4 bn

Revenues and profits are in NOK and for 2012. Market capitalisation as of February 2013.
Business areas

- **Engineering**
- **Drilling technologies**
- **Subsea**
- **Umbilicals**
- **Process systems**
- **Mooring and loading systems**
- **Maintenance, modifications and operations**
- **Oilfield services and marine assets**
- **Well intervention services**
Where we are – a global footprint

Countries: 34
Locations: ~ 80
- engineering hubs
- service bases
- manufacturing plants
- sales offices
- project management

Angola
Luanda

Australia
Perth

Azerbaijan
Baku

Brazil
Curitiba
Rio das Ostras
Rio de Janeiro

Brunei

Canada
Calgary
St. John’s

China
Beijing
Shanghai
Shenzhen
Yichang

Cyprus
Limassol

Denmark
Copenhagen
Esbjerg

Equ. Guinea
Malabo

Finland
Helsinki
Ulvia

France
Paris

Germany
Bad Fallingsbostel
Erkelenz

Ghana
Takoradi

India
Kakinada
Mumbai
Pune

Indonesia
Batam
Jakarta

Ivory Coast
Abidjan

Malaysia
Kuala Lumpur
Labuan
Pekan
Port Klang

Nigeria
Lagos
Port Harcourt

Norway
Asker
Arendal
Bergen
Egersund

Norway [cont.]
Fornebu
Hammerfest
Horten
Kristiansand
S Kristiansund
N Kolmisnes/Sture
Lyngdal
Midsund
Moss
Mongstad
Narvik
Oslo
Porsgrunn
Sandnessjøen
Stavanger
Stokke
Stord
Tranby
Tromsø

Norway [cont.]
Trondheim
Agotnes
Alesund

Oman
Muscat

Russia
Moscow
St Petersburg

Sweden
Gothenburg

UK
Aberdeen
Great Yarmouth
Hastings
London
Maidenhead
Stockton-on-Tees
Whitstable

USA
Houston
Katy
Mobile

Vietnam
Vung Tau

South Africa
Germiston

South Korea
Gyungnam
Pusan

Thailand
Bangkok
Sattahip
Songhkla

UAE
Abu Dhabi
Dubai

Name in red = Dedicated AIM offices
## Index

- Introduction of MMO Asset Integrity Management (AIM)
  - Asset Integrity management throughout an asset's lifetime and services applicable for Subsea Integrity Management
- Systems and Technology
Asset Integrity Management

*Global footprint and opportunities for more than 350 engineers and inspection specialists*

- Norway
  - Engineering Services
    - Oslo
    - Stavanger
    - Bergen
    - Trondheim
  - Field Services
    - Bergen
    - Mongstad
    - Ågotnes
    - Kristiansund
  - In-Service Inspection
    - Stavanger
    - Bergen
    - Kollsnes
    - Sture
    - Mongstad
    - Stjørdal

- UK
  - Engineering Services
    - Aberdeen
    - Glasgow

- North America
  - Houston
  - St. Johns (Canada)

- Aker Solutions Office
- Aker Solutions, AIM Office

**Countries: 34**
**Locations: ~80**
- engineering hubs
- service bases
- manufacturing plants
- sales offices
- project management
Asset Integrity Management (AIM) a strategic business stream in Maintenance Modification and Operation (MMO)

Major modifications and E&C frame agreements

Front-end | Asset integrity mgmt. | Fabrication | Hock-up | Decom
Aker Solutions Asset Integrity Management (AIM)

Aker Solutions is a leading AIM player in NCS, differentiated by providing services across the entire life cycle

- Aker Solutions is one of the leading suppliers of AIM services in NCS and the largest supplier of inspection execution and maintenance planning for upstream O&G in Norway
- Have the capability to deliver complete range of services required to ensure the technical integrity of an asset – from in-service inspection and condition monitoring to analysis of degradations and development of complete maintenance and inspection programs

Systems & Methods
Integrity Engineers
Tools & Technology
Field Services
Aker Solutions Asset Integrity Management delivers a unique combination of engineering and field services covering the complete asset lifecycle.

**Engineering Services**
- Maintenance & Inspection Engineering
- Structural Integrity Management
- Subsea Integrity Management
- Data Management, Systems & Tools

**Field Services**
- In-Service Inspection & Corrosion Management
- Advanced Inspection & Monitoring Technology
- Inspection (NDT) and Quality Control
- Rope Access Services

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Design | Construction | Operations | Life Extensions | Decom
Asset Integrity Management has a role in all phases of an assets lifecycle

**Exploration**
- Integrity Management of mobile drilling rigs
- NDT Inspection

**Development**
- Concept, FEEDs, Feasibility
- Tech. Integrity analysis/studies
- Maint. engineering.
- IO, CM/CBM Strategy
- Non-Intrusive tech.strategy
- Riser and Umbilical analysis
- Baseline Inspection

**Production**
- Field Services
- In-Service Inspection
- Maintenance and Inspection plan and preparation
- Advanced Inspection and Monitoring Technology

**Life Extensions**
- Integrity assessment and analysis quantifying remaining life of plant, systems and equipment
- Structural Inspection and Maintenance Program analyses, SIMP™

**Decom.**
- Safe decomm and removal
- Structural Analysis and Inspection

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Design → Construction → Operations → Life Extensions → Decom
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Asset Integrity Management starts at early design...
The foundation for an optimal Asset Integrity Management Program is made during the design phase:

**Design & Strategy Analysis**
- Integrity Management Philosophy & Strategies
- Maintenance Philosophy & Strategies
- IO and CM/CBM Strategy
- Risk Assessments
- Design Review and Verification
- Material evaluation and selection
- Reliability, Availability and Maintainability analysis (RAM)
- SIL assessment
- Failure mode, effects, and criticality analysis (FMECA)
- Production availability analysis
- Operations workload analysis
- Regularity analysis
- LCC/LCI analysis
- Manning and OPEX analysis
- Work Processes
- Process Safety and Hazards Analysis (PHA/HAZOP)

**Maintenance & Inspection Programs**
- Maintenance & inspection management systems
- Criticality Analysis
- Reliability Centered Maintenance (RCM)
- Risk Based Inspection analysis (RBI)
- Structural Inspection Program (SIMP)
- Condition-based maintenance planning
- Integrated Operations planning

Increased focus on Integrated Operations (IO) and Condition Monitoring Strategies at an early stage to ensure equipment and systems is designed for real time condition monitoring.
…continues throughout fabrication and construction…

- Ensure quality of:
  - Materials
  - Welds
  - Measurements
  - Drawings
  - Documentation
  - etc…

- Save baseline technical condition data in integrity databases to improve future condition analysis and trending

MMO AIM fab & construction project examples:

- Development and qualification of welding and inspection procedures
- 3rd party verification
- Inspection (NDT) and quality control during fabrication and construction
- Advanced inspection technology to improve quality and efficiency of inspection (focus on classing)

Inspection of new riser using Phased Array and Time of Flight Ultrasonic

Development of inspection procedures using advanced simulation
...lives on during operation to ensure safe operation, optimized availability and reduced cost

- Understanding of design integrity
- Inspection
- Continuous monitoring
- Interaction with maintenance contractor

In-depth knowledge of the technical integrity of an installation through analysis of input

MMO AIM in-service/operation project examples:

- Inspection (NDT) of subsea equipment during overhaul/repair at Ågotnes
- Re-classing of risers using Advanced inspection technology
- Development and optimization of maintenance and inspection programs
- Integrity assessment and analysis to quantify remaining life and fitness for services (FFS) to optimize operation
Advanced Inspection Technology

“Find all defects and degradations before they become critical”

In the lead developing solutions and new applications

Engineering competence and hands on experience

Advanced Electromagnetic Inspection

Vibration & Stress Measurement

Advanced Ultrasonic Inspection

Digital Radiography

Advanced Termographic Inspection

Video

Design  Construction  Operations  Life Extensions  Decom
New opportunities with “Digital Inspection Methods”

- Increased coverage, speed, POD and sizing = “more reliable”
- Real documentation and possible to “re-analyse”
- Remote Analysis - send data from offshore to onshore or any location
- Central storage of data – “no paper in a drawer” — better access
- Compare new and old results (trending) and compare results from different equipment and methods

Improved Life Time calculations

Better input to RBI/RCM models

Adjust and optimize intervals/plans

Improved Integrity Management and increased confidence
Advanced Inspection Technology
Subsea and riser inspection

- NDT Level III service for Subsea
- Various subsea component recertification
- HPDR recertification
- Merlin risers recertification
- Casing risers recertification
- Clip risers recertification
- WOS risers 3.party evaluation
- WOS risers recertification
- WOS risers – Phased Array and ToFD weld inspection
Life extension (Examples)

Inspection and re-certification of Riser at Aker Ågotnes

- Production platforms (lifetime extension):
  - Statoil, Njord A, 2011
  - Petrofac, Northern Producer, 2008
  - Statoil, Veslefrikk A, 1999

- Drilling platforms (SIMP™ implemented):
  - Stena Drilling, Stena Spey, 2013
  - Songa Offshore, Songa Dee, 2011
  - Dolphin Drilling, Borgny Dolphin, 2010
  - Dolphin Drilling, Borgholm Dolphin, 2008
  - Dolphin Drilling, Bredford Dolphin, 2007
  - Odfjell Drilling, Deepsea Delta, 2006
  - Odfjell Drilling, Deepsea Bergen, 2005
  - Dolphin Drilling, Port Reval, 2005
  - Dolphin Drilling, Byford Dolphin, 2005
  - Dolphin Drilling, Borgsten Dolphin, 2005
  - Odfjell Drilling, Deepsea Trym, 2004
**SIMP™ method**

- **As-Is verification**
  - Verify modification scope
    - Modification ok?
    - Painting ok?
    - Toe grinding ok?
  - Establish inspection scope for the next RS
    - Based on fatigue life
    - Inspection, modification and crack history
    - 5 years intervals
  - Updating inspection history and inspection program continuously

- **Benefits implementing SIMP™**
  - More cost effective inspection
  - Reduced risk of through thickness cracks
  - Higher reliability
  - In-shore inspection every 5 year not every 2.5 year
  - Higher operability

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Local FE models for calculation of SCF in fatigue areas. FE model run separately. Establishing relation between beam model and local FE model. Hot spot method applied with mesh t x t.

Result:
- Modification scope for the next Renewal Survey (RS) to reach a fatigue life of 20 years.
- Modified IIP
- Inspection scope for the next RS
- Class approved drawings
…finally, it ends with decommissioning of the asset

- Focus on HSE!
- Inspection of structures and equipment to ensure safe disassembly and lifting operation
- Ensure hazardous materials are detected and handled correctly
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Data Management, Systems and Tools

To meet the customer requirements...

Cost efficient execution
Our internal systems enables low-cost, high quality execution based on our proprietary experience database

Simple, low-risk integration
Our offering is easy to implement and integrate with client systems, and require limited use of IT consultancy, e.g. SAP

Comprehensive CMMS integration
We are able to serve high-end clients with comprehensive systems partnering with high-end software providers

...our current systems portfolio...

Coabis™ Integrity Management
Integri-Tech FFS

Pyramid – Maintenance & Inspection
Engineering and Analysis

SIMP™
Structural Integrity Maintenance Program

...integrates through myAIM

Evaluation & optimization analysis
Condition monitoring and inspection execution
Maintenance & inspection programs and plans
Condition based maintenance support
Design & strategy analysis

Integration with client work processes and CMMS
(Computerized Maintenance Management System)

State of the art integrated modular portfolio of integrity management
Coabis and Integri-Tech

Information Management

Anomalies

- Criticality 1

- Criticality 2

- Criticality 3

Others

Defects & Damage

Integri-Tech FFS is fully Quantitative

WEB PORTAL 3D Visualisation
Advanced Inspection Technology

Center of competence for development of procedures and techniques.

Storage of all digital inspection data and reports.

Level III evaluation of results.

3. party evaluation.
Delivering all aspects of Asset Integrity Management

- MMO AIM scope the integrity engineering projects based on the Customer needs and the development phase, operational phase and the condition of the assets.
Technical Integrity Analysis and Studies

**Risk Based Inspection**

- Secure optimum availability at acceptable risk.
- Prioritize inspection efforts on the items driving the risk.

**Non-Intrusive Inspection (NII)**

- Where the RBI identifies internal degradation mechanisms which can be followed up through periodic inspection, it is recommended to evaluate if the inspection can be performed non-intrusively.

**Technical Integrity Management Services (TIMS)**

- TIMS is a multidisciplinary service which brings together a unique package of expertise, tools and systems to help the Client achieve optimum asset performance.
Aker Solutions offer Integrated Operation

Access to more and better technical condition data improves Integrated Operations and Asset Integrity Management
Questions?

Thank You!

To be the preferred global asset integrity management partner to the oil & gas industry providing services across the entire lifecycle of an asset.
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