Subsea Springboard

Focus on Reducing Operational Costs

15th September 2016
Agenda:

08:00  Introduction and Welcome  
Neil Gordon and Gordon Drummond

08:05  Life Extension Through Flexible Riser re-use  
Gilles Gardner, Technical Manager, 2H Offshore

08:20  Making the Most of Inspection Data to Truly Reduce Risk and Optimize Inspection Costs  
Dr Caroline Roberts-Haritonov, Director, Astrimar

08:35  Autonomous Subsea Power: A New Idea for Reducing Operational Costs  
Richard Knox, Managing Director, EC-OG

08:50  Cost effective IRM data harvesting and management  
Douglas Sinclair, Technical Software Business Unit Manager, Apollo

09:05  V-ASSURE, Integrity management of Subsea Control Systems  
Neil Cruickshank, Technical Sales Manager, Viper Subsea Technology

09:20  Clearer Inspection Data –  Raymond Ruth, Sales Manager, NETmc Marine

09:35  In a low cost marketplace, how can subsea operators continue to prosper while maximising field and asset life? – Bruce Stuart, VP Business Development Subsea Production, Proserv

09:50  Innovative asset management solutions that maximise economic recovery, enable world class production efficiency and set industry standard for opex reduction – Martin Carruth, Integrity Management Product Manager, GE Oil & Gas

10:05  Spare Parts Optimisation – Pierre Secher, Head of Oil and Gas, Apsys
Making the most of inspection data to reduce risk and optimize inspection costs

Caroline Roberts Haritonov
Director, Astrimar
Our Focus on Understanding Reliability

- Improved understanding of reliability enables
  - Reliability improvement of new and existing equipment
  - Monitoring to prevent, predict or pre-empt failure
  - Prioritisation of inspection and maintenance to higher risk equipment
  - Preparedness to improve efficiency of response in event of failure
The Challenge of Risk Based Asset Integrity Management

- Risk based asset integrity management enables prioritisation of inspection and testing based on knowledge of equipment failure risk.

- Estimates of equipment risk, accounting for actual equipment condition is difficult and is often subjective.

- Determination of inspection frequencies often uses rules of thumb.

- Client recognized need for more quantitative approach to RBI to predict asset specific probability of failure and time to failure.
  - To ensure in-house risk assessments reflect latest knowledge on equipment and risk assessments are relevant and informative.
  - To enable inspection intervals to be determined based on risk and risk acceptance criteria.
Using all Observables from Inspection, Monitoring and Testing

- Increasing quantities of condition data being collected through higher resolution data gathering and “Big Data” handling
  - But are we making best use of it?

- Observables can take a number of different forms, e.g.:
  - Anomaly (as an entity or as a scaled entity)
  - Process measurement
  - NDT and monitoring

![Diagram of observables and transition rates]

- Assess presence & degree of degradation
- Calculate transition rates
- Update probability of failure over time

Astrimar

pRIOriti-AIM.com
Application of pRIOriti-AIM

- Asset equipment details
  - System breakdown
  - Failure Modes
  - Associated Anomalies

- AIM database

- Condition Data
  - t0 t1 t2 t3 t4 t5 t6 t7
  - J1 N N N D D D D D
  - J2 N N D D D D N N N
  - J3 N N N N N D D D
  - J4 N N N N N N N N D

- Maintenance repairs replacements

- RBI decision making

- Update asset reliability and risk assessment

- Inspection and Test

- Inspection/Test Plan

pRIOriti-AIM.com
Early Application Experience

• Creates good anomaly discipline to define failed & degraded states

• Need to maintain time history – installation, start-up, anomaly observation

• User needs to be clear on failure/transition rates – item versus population

• Good FMECA supports effective tool implementation

• Tool supports sensitivity studies – what-if

• Enables updated risks to reflect actual equipment states and failure probability

• Enables prioritised allocation of inspection resources
Current / Planned Developments

Valve Testing Model based on Signature Data

Integrating with FFP, DA and CRA

- Fitness for Purpose (FFP)
- Defect Assessment (DA)
- Corrosion risk Assessment (CRA)

Cloud based interface and storage

Equipment - Barrier State-Space Model

Condition states: \{N,D,F\}
Barrier states: \{A,B,C\}
Combined states \{NA,NB,NC,DA,DB,DC,FA,FB, FC\}
Thank you for your time and attention
• Apollo is a technically-led engineering consultancy and repairs/modifications organisation.
  – Structural Engineering
  – Process and Flow Assurance
  – Technical Safety
• Clients include...

Technological Software business unit launched in 2014.
• Developed to address real-world data management issues, Apollo KnowHow is our first software product.
• Common data management scenarios:
  – Legacy applications – often out-of-date, complex and expensive.
  – Excel – simple, but inflexible and inefficient.
• Apollo KnowHow solution:
  – Cost-effective, usable data management.
  – Replace legacy applications, Excel, etc.
  – Web-based interface and dashboards.
  – Any type of data – IRM, controls, etc.
  – Data management and workflow.
• Migrate data from legacy applications, Excel, etc.
• Secure and corporate-compliant data management:
  – Oracle, Microsoft SQL Server, Microsoft Azure (cloud).
Apollo KnowHow

- Already deployed in the North Sea.
- Cost-effective deployment and ongoing support.
- Ongoing product development:
  - Mobile interfaces.
  - Visualisation interfaces (e.g. R2S).
Apollo KnowHow – summary

✓ Cost-effectively replace legacy data management applications.
✓ Fit-for-purpose – developed to do what you need.
✓ Migrate and cleanse data from legacy products/sources.
✓ Quick to deploy – developed in 2015 and already deployed in the North Sea.
✓ Corporate IT-compliant.
✓ Web-based.
✓ Multi-user.
✓ User-friendly.
✓ Ongoing development and enhancement.
V-ASSURE

Reducing the cost of Asset Integrity Management
Products

V-LIFE: Low IR remediation

V-IR: Fault location subsea

V-LIM: Integrity Monitoring

Livewire –online SSTDR
V-ASSURE Services

V-ASSURE is an integrated suite of services designed to help maximise the availability of subsea production control systems.

V-ASSURE is designed to match the requirements of:

- **ISO 55000** Asset Management
- **DNVGL-RP-0002** Integrity Management of Subsea Production Systems
Managing Threats

- Known Knowns
- Knows
- Planned Intervention
- Intermittent Fault
- IR Degradation
- Parts Obsolescence
- Unknown Unknowns
- Unknown Knowns
- Hydraulic Release
V-ASSURE Services

- **Annual Condition Assessment**: A risk-based assessment of the Subsea Control System recommending mitigations to maximise availability.
- **Integrity Map**: An interactive ‘map’ of the subsea control system that is used as a log book to record interventions, faults and changes.
- **Fix on Fail**: A fast response to controls problems as-and-when they occur from experts in hydraulics, electrical, and software. No fixed charges.
- **Fluid Accounting**: A monthly account of control fluid consumption (estimated versus actual) to assist demonstration of regulatory compliance.
The **V-ASSURE** Annual Condition Assessment follows the guidelines in DNVGL-RP-0002 and aligns with the risk-based techniques used to assure the integrity of subsea **structures** and **pipelines**.

- An annual CA Report is issued and highlights presented to the Asset team.

- The CA considers Health & Safety, Environmental and Commercial risks and identifies recommended mitigations that should be applied to those rated **Red** and **Amber**.
**Subsea Controls System Availability**

93%

**Last 31 days availability (%)**

![Bar Chart]

**Action Tracker**

<table>
<thead>
<tr>
<th>Issue</th>
<th>System</th>
<th>Date</th>
<th>Priority</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>EPU</td>
<td>05-Jan-2016</td>
<td>Medium</td>
<td>after new well #5 was installed CH1 tripped on start-up due to low overcurrent trip settings. To be changed at next maintenance round.</td>
<td>ON HOLD</td>
</tr>
<tr>
<td>#7</td>
<td>TUTU</td>
<td>12-August-2016</td>
<td>Low</td>
<td>Visual gauge installed to HP lines to be added to drawings.</td>
<td>OPEN</td>
</tr>
<tr>
<td>#8</td>
<td>EPU</td>
<td>12-August-2016</td>
<td>HIGH</td>
<td>Maintenance routine schedule for October 2016.</td>
<td>OPEN</td>
</tr>
</tbody>
</table>
Clearer Data
Clearer Decisions

7 minutes that could improve your Integrity
Don’t like this?

Composite colour camera footage.
Clearer Data
A Comparison
High Definition Is a nightmare

- HD SDI 1Gbps
- Needs a dedicated fibre in the umbilical
- Expensive connectors
- Limited connections permitted
- Not easily transferred between ROVs
- Needs specialist lighting
- Not all umbilical have fibre
- Very large video files
- High cost of long term storage
The Solution

Digital Video Camera Inspector – DVCi

High Definition Video Over copper
DVCi
Proof of concept

- 1000m bell wire
- Jointed bell wire
- 1500m Twisted pair
- Tested at ROV manufacturer
- Dive system main lift umbilical
- Multiple platform operation
DVCi
System Description

• Complete system
• Low logistics
• Full 1080P HD
• Encoding in the camera
• Low bit rates
• Twisted pair or Coax
• Almost any ROV/Dive system
DVCi
Other benefits

- Simple to use
- Complete bottom-to-top encoding and acquisition
- As easy to install as a standard composite camera
- Works over Ethernet
- DVCiR has full 10X optical zoom camera
- Black and white mode
- Back light compensation
- Diver lamp controller
- Lower storage requirements
Footage of DVCi video captured from a Cougar ROV. Client switches from colour to B/W for overview of site. Only normal ROV lighting was used.
DVCi
Summary

• Complete bottom-to-top encoding and acquisition
• Enables HD over copper conductors
• Lower cost vehicles
• Low volume data
Clearer Data
Clearer Decisions
Clearer Future
A Reminder
Proserv ACT

Reducing Production Risk, Maximising Field Life
Proserv ACT

Proserv Augmented Controls Technology (ACT) has been used to retrofit 16 subsea controls projects to date.

Our Subsea Control System Electronics Technology is:

- Reducing our clients’ production risks by overcoming obsolescence issues
- Providing the comms hub for the addition of new instrumentation to already installed fields to deliver improved production data
- De-risking our clients’ business model by delivering confidence of uninterrupted daily production because of our proven high reliability products and systems
- Allowing the operator to add new wells to installed fields using the already installed controls system infrastructure. Co-exist with other OEM Control Systems

The technology provides our clients with a subsea controls solution for their brownfield assets where no sensible (aka ‘economic’) solution appears available.

While every application and solution is different the technology developed creates clear commercial, operational and technical advantages for your aging subsea assets
Operational Benefits

The Proserv ACT solutions provide not only commercial benefit from directly measurable uptime and revenue gain, but also in our operational upgrade approach

• **Phased approach to field upgrades**
  ACT allows the introduction of a single well at a time or clusters, which reduces installation downtime

• **Limited downtime when transitioning to ACT**
  ACT can be installed well by well and leg by leg to maintain your production uptime

• **Minimised DCS intervention**
  ACT tools are available to minimise implementation by using proven solutions already utilised with your control systems

• **Minimise disruption**
  Implementation is designed to fit right into your existing system – often operators see no change

• **Improved diagnostics and monitoring**
  Once installed ACT provides state of the art feedback on performance with the old and new systems
What is Co-exist?

Co-exist can describe a number of subsea communications solutions. Co-exist means - it is not necessary to replace the existing umbilical and distribution system.

- Sharing power supply and using a separate line for signal
- Signal superimposed on shared powerline
- Signal superimposing on top of incumbent signal (with or without shared power)

Proserv use a combination of spread spectrum techniques with embedded tools to analyse the existing system background noise and signal harmonics and maximise the Proserv superimposed signal without compromising either our or the existing signal integrity.
Proserv ACT solutions provide greater capabilities than you would have ever thought your old Brownfield control system capable of.

- **Additional Instrumentation**
  Add sand detection, corrosion monitoring, further down hole or tree pressure and temperature measurement

- **Improved data speed**
  Enables additional instrumentation including flow metering and video monitoring

- **Greater power management**
  Provides increased use for instruments or electrical actuator overrides which enables not only monitoring but control options where otherwise not available to you

- **Web enabled interfaces**
  Means you no longer require special tools for diagnostics either locally or from a remote onshore location
Augmented Control Technology is proven

How long can you afford to do nothing?

- ACT is a proven alternative for existing brownfield subsea control systems.
- The benefits are clear.
- Hundreds of subsea fields are suffering from inaction

Break the cycle and improve your productivity

The time to ACT is now!
Championing the UK Subsea Sector across the World

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