The Use of Real Time Monitoring to Extend the Operating Life of Offshore Platforms

June 2014
Agenda

- Introduction
- Challenges
- Why Monitor?
- Monitoring Technologies
- Case Study: Valemon
  - Project Overview
  - Client Objectives
  - Monitoring System
  - Data and Results
- Conclusion
Introduction

Platform Age: A Visual Representation
Challenges
Offshore Platforms

Design | Environment | Fatigue | Corrosion | Impacts
Challenges

Ageing Platforms

• Design
  – Platform loading / wave relationship
  – Natural frequency
  – Foundation stiffness

• Lack of historical data
  – Design criteria
  – Inspection History
  – Repairs

• Regulations and Design Codes
  – API, NORSOK, etc.
Operating Past Design Life

Why?

- Asset life extension being driven by:
  - Technological Advancements
  - High price of oil
  - Increasing use of subsea tiebacks
  - Operator focus on cutting costs

www.pulse-monitoring.com
Why are Clients Monitoring?

- Extending operating life
- Structural Integrity (Storm Events)
- Early warning systems (Structural or Foundational)
- Optimising inspection programs
- Increasing deck mass
- Adding conductors / risers
- Assessing Repairs
- Collision detection
- Design verification (New Installations)
Why Monitor?
Reliability Engineering Life Cycle

- Design Verification
- Fatigue Rate
- Useful Life
- Assumed Design Life
- Service Life (Years)
- $ Saved
- Monitoring Investment
- Monitoring ROI
- ROI
- Investment
- Monitoring
Monitoring Technologies

Equipment Used

- Accelerometers
- Inclinometers

- Strain Gauges

- Environmental (Wave Radar & ADCP)
Monitoring Technologies
Software and Data Management
Monitoring Technologies
Data Processing and Reporting

- Spectrum of the motion data (Acceleration versus Freq)
- Natural frequency determination
- Integration of time series (Displacement)
- Wave information (Wave height, Period or directions)
- Screens of anomalies
- Repair / modification verification
  - Decrease of displacement
Valemon Jacket Monitoring

Introduction

- Location: Norwegian North Sea
- Water Depth: 135m
- Valemon jacket
  - 9,000 tonne
  - 20 slot capacity
- Monitoring Campaign: 2012/13
Valemon Jacket Monitoring

Client requirements

- Monitor pre-drilling phase:
  - Monitor deflections of jacket and jackup
- Confirm that equipment is operated within design limits:
  - Confirm that jacket deflections remained within expected levels
- Validate & calibrate simulation models:
  - Compare measured and predicted responses to improve models for future operations
Valemon Jacket Monitoring

Monitoring system

www.pulse-monitoring.com
Valemon Jacket Monitoring

Loggers

- 3 axis precision accelerometers
- Installed in Eexd- rated housings
- Hardwired back to central control room using armoured cable
Valemon Jacket Monitoring

Strain sticks

- Strain sticks installed in 3 locations
- Measuring curvature of the riser
- Each stick linked to an EExd logger
Valemon Jacket Monitoring

Environmental sensors

- Air-gap wave radar installed
- Measuring wave height and period
- ADCP - measuring current speed and direction through depth
Valemon Jacket Monitoring

Data – Displacement

Event E
Valemon Jacket Monitoring

Data – Valemon Jacket Motion / Wave Height

**Graph: Nobel Denton Hs vs. Displacement**

- **Displacement (m)** vs. **Significant Wave Height, Hs (m)**
- Data points: Maximum Measured Displacement
- Line: Calculated (Nobel Denton)
Valemon Jacket Monitoring
Data - Jacket Motion Fatigue

Event Timeline

- Measured Data
- Predicted Data
- Significant Wave Height Hs
Valemon Jacket Monitoring

Outcome

• Monitoring systems demonstrated responses of critical equipment remained within design limits during campaign length
• The jacket moves 25-33% as much as jackup
• Complex responses of the jackup to wave loading observed
• Preliminary model calibration achieved, but difficult to fully calibrate at this stage
  – Sensitive to many parameters
  – Effect of jacket
  – Assumptions lead to uncertainty
Conclusion

- Platform monitoring is integral to the IM Strategy of offshore platforms
- Online Monitoring is used to measure actual response vs predicted responses to validate design and improve models for future operations
- Data used to make informed decisions on life extension of assets
Questions?