Life Extension of Subsea Umbilical Systems – Assessment Process

Marian Copilet
Technical Solutions Manager - APAC
November 2016
About Oceaneering

Oceaneering pushes the frontiers of deep water, space, and motion entertainment environments to execute with new, leading-edge technologies to solve tomorrow’s challenges, today.
Core Values

Oceaneering’s core values establish a common culture and demonstrate what is most important for us as a company. Our core values summarize the beliefs that drive us and reflect the way we interact with our customers, suppliers, and fellow employees.
Ageing and Life Extension (ALE) in many parts of the world have reached (or will soon reach) the end of their originally specified design life. 

Better understanding of existing oil/gas reservoirs.

Access to new technologies increases the recoverable oil / gas reserves.

Use of existing infrastructure to support new developments (tiebacks) and minimize overall CapEx cost.

Asset replacement, in order to cover a short life extension, is not always cost-effective.
Life Extension of Subsea Umbilical Systems

Why is ALE such an important consideration?

Oceaneering Umbilical Awards Pre 1990 Producing Fields

Number of Umbilicals in Producing Fields

Life of Umbilical

Still Operating?
There are no specific guidelines from industry standards.

Oceaneering approach is based on the “Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations” (Issue 1, April 2012), the “Guidance on Ageing and Life Extension Aspects of Electrical, Control & Instrumentation Equipment” (Issue 1, May 2014), and the accumulated know-how within the company.
Life Extension of Subsea Umbilical Systems
The Oceaneering Approach

Support from a multi-skilled team of engineers and SMEs from various Oceaneering business units
Asset Life Extension Assessment

Identify Potential Asset Life Extension Issues

Understanding of current condition, asset risk register, and, where applicable, historical review:

- A systematic assessment of asset performance history should be conducted to support asset life extension goals and requirements.
- A review of available asset documentation should be conducted in support of this.
- Data gathering is a precursor to identifying and evaluating any issues required to be resolved in support of asset life extension.

Reference: “Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations” document (Issue 1, April 2012)
Asset Life Extension Assessment
Identify Potential Risks via Gap Analysis

This involves a **critical review of what is and isn’t currently known about asset condition**. This should consider:

- Original, current, and any anticipated standards applicable to the equipment
- Potential degradation mechanisms
- Ageing/wear out models
- Existing life extension strategies, if available
- Known anomalies and defects

Reference: “Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations” document (Issue 1, April 2012)
Asset Life Extension Assessment

Rating Identified Risks

This assessment should **identify any gaps that should be addressed** to support the asset life extension:

- Does current condition and existing threats to integrity of the asset give confidence that it can remain fit-for-purpose for the proposed extension?
- Could the degradation/failure occur?
- If this degradation occurred, would it be identified through the current inspection/testing regime?
- Is there a prior record of similar degradation/failure mode?
- Could the issue occur or re-occur during the Life Extension period?
- What action is required in each of the above cases?

Reference: “Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations” document (Issue 1, April 2012)
Asset Life Extension Assessment
Supporting the ALE Recommendations

- The output from the gap analysis is the basis for establishing the work scope required to support the specified asset’s life extension goals.
- An Asset Life Extension report captures the output from the process.
- The report should include recommendations for future actions and schedule to support the life extension case.
- A commercial assessment of the costs of life extension vs. the cost of replacement shall be conducted.

Reference: “Guidance on the Management of Ageing and Life Extension for UKCS Oil and Gas Installations” document (Issue 1, April 2012)
Asset Life Extension

Typical Recommendations for Subsea Umbilical Systems

Possible recommendation, based on known failure modes, can include:

- **Chemical Compatibility**: Review of existing test results or conduct additional tests in order to validate the compatibility of the operating fluids with the existing materials, for the extended period of time.

- **Fatigue Analysis**: Review of existing analysis results or completion of new/additional analysis to demonstrate the fatigue damage on the metallic elements of the umbilical, for the extended period of time.

- **Anode Verification**: Review of anode size calculations and evaluation of the need for replacement, in order to meet the desired extended life.

- **Survey**: Visual inspection of specific areas of concern within the umbilical system in order to confirm or monitor failure modes occurrence.

- **EC Performance Remediation**: Evaluate the need for and potential benefits of using electrical cable performance remediation technology.
Typical Issues Related to Umbilical Systems
Chemical Compatibility

- Long(er) term effects of exposure to operational fluids;
- Effects of temperature and UV radiation
- Changes in fluids
- Fluid Mixtures
Typical Issues Related to Umbilical Systems
Fatigue Damage Verification Analysis

Reassess umbilical fatigue damage using:

- Installation information
- Actual riser configuration
- Latest Met-ocean data and RAO Curves
- Modern tools and methods
Typical Issues Related to Umbilical Systems
Anode Mass Verification Calculation

Re-assessment of the required mass of anodes for the desired life extension
Typical Issues Related to Umbilical Systems

Visual Inspection

Hang-off point inspection for:

- Hose fittings condition
- UV Degradation
- I/J-Tube Flange Bolts condition
- Methanol trap seals condition
Typical Issues Related to Umbilical Systems

Electrical Performance Remediation

VIPER SUBSEA – V-LIFE

- Reverses the effects of water ingress into electrical cables and equipment
- Can extend the life of failing umbilicals
- ‘Buys time’ whilst a new umbilical is procured
- Can remove the need to buy a new umbilical
- Can be used to postpone field abandonment
Typical Issues Related to Umbilical Systems

Armour Wires Integrity

• Potential use for Umbilical wires integrity verification
  – Corrosion
  – Breaks
  – Dents
• Work-in-progress: ongoing trials to characterize armour wire defects
Asset Life Extension

Decision Making

Discovery

Risk Identification

Risk Assessment

Reporting

Task #1

Task #2

Task #3

Task #N

Review Results → Decision

→ Replace / upgrade the equipment

→ Replace / upgrade part(s) of the equipment

→ Purchase sufficient spares to maintain the operation of the existing equipment.

→ Identify the level of support available.

→ Arrange for the system to be supported by a 3rd party.

→ Do nothing and accept the risk
Discussion and Conclusions

What can we do differently?

- What would help making these decisions years from now?
  - Better document and data management
    - Design documentation
    - Failure reports
    - Inspection reports
    - Performance monitoring
      - Pressure cycles
      - Electric readings
      - Strain
      - Temperature
      - Vibration
      - Etc.
Please visit oceaneering.com for more information