RELIABILITY, OPERABILITY AND MAINTAINABILITY FOR DEEPWATER SUBSEA DEVELOPMENT – A PARADIGM SHIFT

PETRONAS – PETRAD – INTSOK – CCOP DEEPWATER SUBSEA TIE-BACK

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Presentation Outline

1. Presentation Objectives
2. Concept revisited - reliability, maintainability and availability
3. Subsea Reliability & Integrity Management System
4. Summary
1. Presentation Objectives

2. Concept revisited - reliability, maintainability and availability

3. Subsea Reliability & Integrity Management System

4. Summary
Presentation Objectives

• To provide an overview of the difference in approach for managing reliability, availability and operability for subsea facilities.
1. Presentation Objectives

2. Concept revisited - reliability, maintainability and availability

3. Subsea Reliability & Integrity Management System

4. Summary
Operators strive for maximum availability as it is linked to business goals.
Maintainability – 3 basic strategies. Which one is the preferred for subsea?

1. **Corrective Maintenance (CM)** i.e repair or replace when failure occurs
2. **Planned Preventive Maintenance (PPM)** i.e time based maintenance/replacement
3. **Condition based maintenance (CBM)** i.e monitoring the performance and perform maintenance/replacement when condition deteriorates

Traditionally for topsides, the preferred approach is to do CBM followed by PPM. CM is the least preferred strategy due to higher cost involved (including production deferment cost)
For subsea, the most cost optimum strategy is the least preferred strategy for topsides facilities

- For subsea, the preferred strategy is Corrective Maintenance (CM) i.e repair or replace when failure occurs
- PPM and CBM are more expensive to implement due the high cost associated with offshore operations and infrastructure requirement
- For subsea’s CM strategy, the focus is on minimising the time to restore failed equipment (e.g. retrievability)

However, Corrective Maintenance strategy itself when implemented is still not cost efficient. There’s a need to eliminate potential failures when possible
How frequent equipment fails
“Mean time to failure”

Reliability

How equipment’s functionality was restored after a failure
“Mean time to repair”

Maintainability

Focus is to maximise reliability. i.e reducing the frequency of failure

Availability

Equipment / System Uptime

For subsea, the main drive is to maximise equipment reliability to achieve the targeted availability
For subsea, the main drive is to maximise equipment reliability to achieve the targeted availability.

The main focus on extending life of equipment before failure (failure free operating period) and thus reducing the frequency of failures.

- **Early Life Failures**: An expensive learning curve. Can be minimised by good design, fabrication and testing philosophy with proven installation techniques.
- **Random Failures**: These are the remaining through life failures. Largely caused by unforeseen external events or usage conditions. Can be minimised by designing out and operating to prevent all foreseeable failures.
- **Wear out Failures**: Decommission before this period.
- **Failure Free Operating Period**: Goal.

**Anticipated Field Life**

**System Life Cycle**
In order to achieve maximum reliability, the following activities are undertaken

• **Removing early life failure**
  – Design it right
    – Use of proven designs – frame agreement concept
    – Use components with known high reliability
    – Redundancy (in critical areas)
  – Construct and manufacture it right - comprehensive testing regime
  – Specifying proven installation techniques

• **Minimise random failures or their impact to production**
  – Simplest possible designs/architecture- avoid complexity
  – Design for easy replacement
  – Good operating practice

• **Management of reliability activities are important to ensure they are done efficiently**- PETRONAS Subsea Reliability & Integrity Management System (S-RIMS)
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4. Summary
• A system to ensure all the reliability activities are managed properly specifically during the design stage

• Reference Standard
  – API RP 17N - Subsea Production System Reliability & Technical Risk Management
The S-RIMS system – the main philosophy

‘Leave no stone unturned’

Make every possible effort to check and verify all equipment design, conditions, functionalities, interfaces and performance are in acceptable state before deployment subsea.
The S-RIMS system – the main process

- Define reliability & availability goals & requirements
- Assurance that the requirements have been met
- Developing plan for the required reliability activities
- Implement reliability activities

1. Define
2. Plan
3. Implement
4. Feedback
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4. Summary
• Reliability and integrity is an important aspect of subsea development project
  – To reduce the need of maintaining and repairing the equipment.
• Reliability and integrity achieved through:
  – Attention to detail
  – Managing failure through good design, quality in manufacture (testing), flawless installation and operations control
THANK YOU