

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

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

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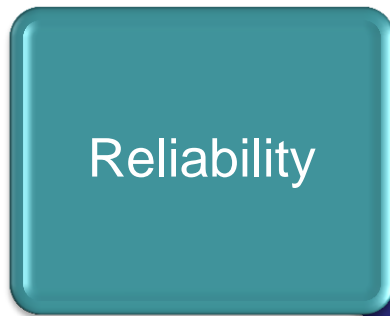
- 1. Presentation Objectives**
- 2. Concept revisited - reliability, maintainability and availability**
- 3. Subsea Reliability & Integrity Management System**
- 4. Summary**

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- **To provide an overview of the difference in approach for managing reliability, availability and operability for subsea facilities.**

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How frequent equipment fails
“Mean time to failure”



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



Equipment /
System Uptime

Operators strive for maximum availability as it is linked to business goals

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 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

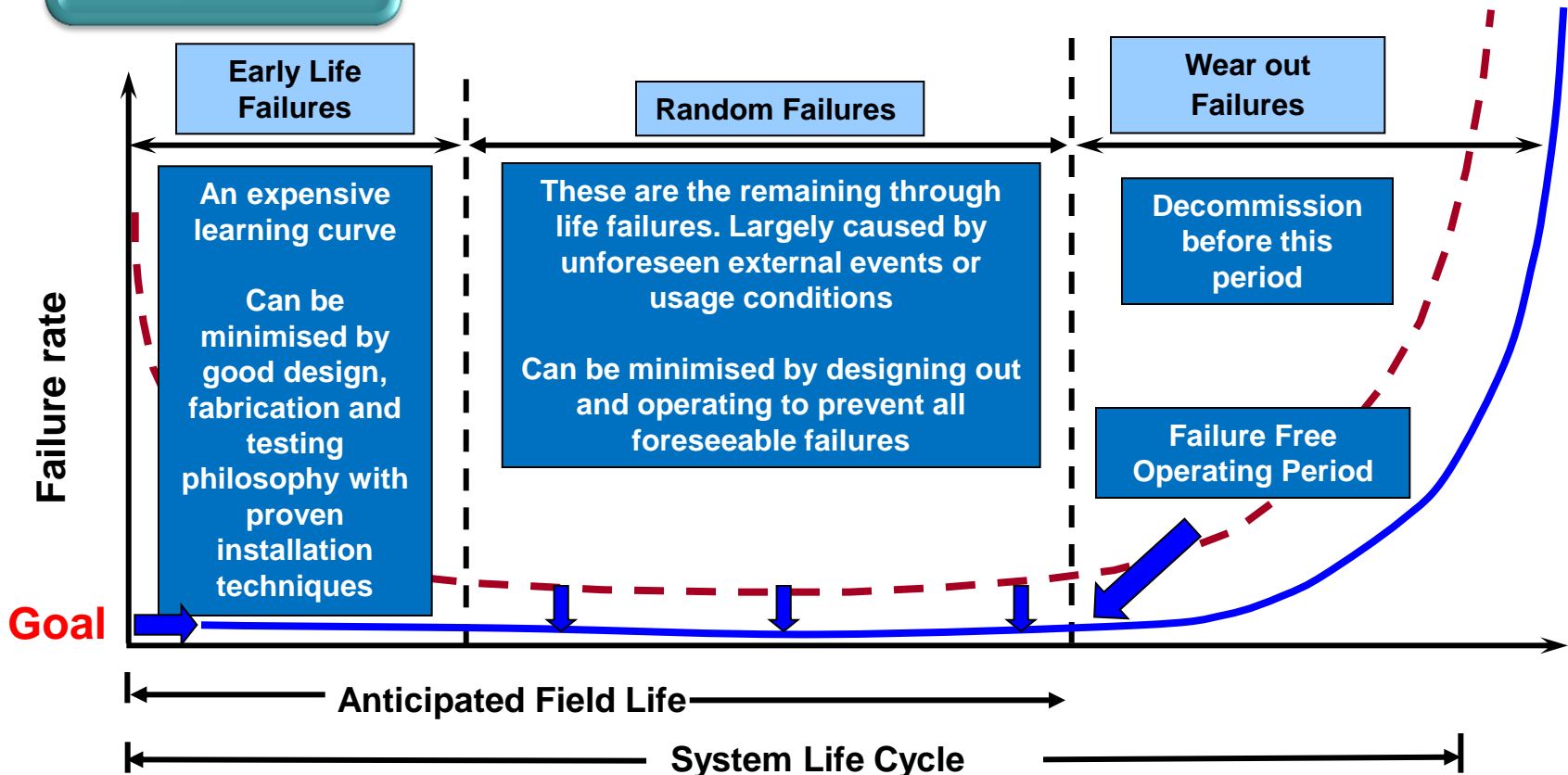
Availability

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

Equipment / System Uptime

Reliability

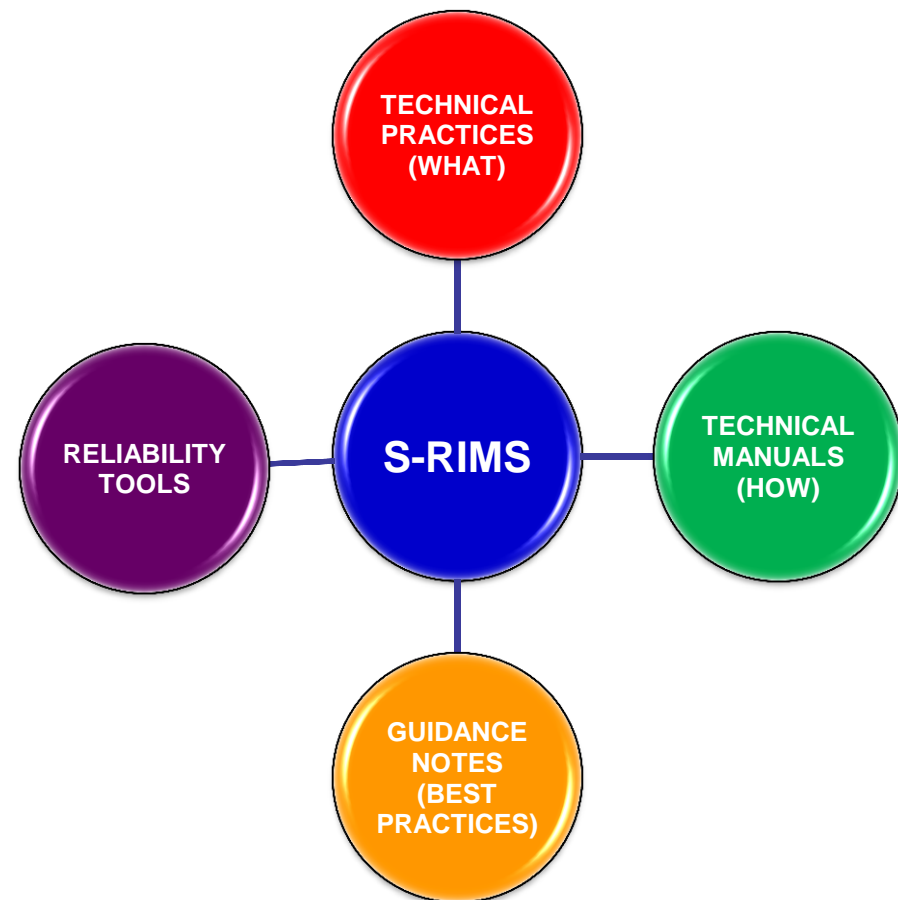
The main focus on extending life of equipment before failure (failure free operating period) and thus reducing the frequency of failures



- **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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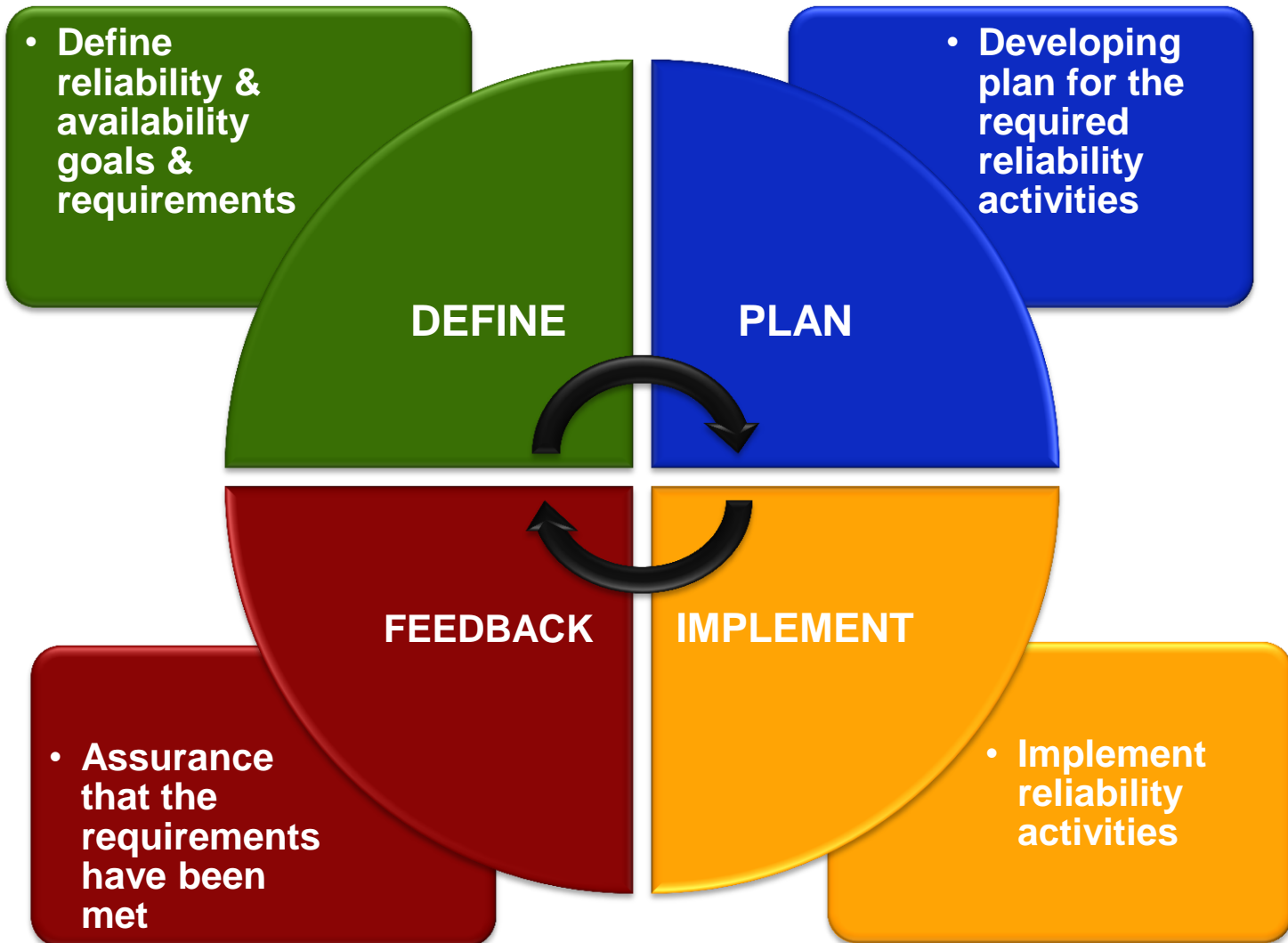
- A system to ensure all the reliability activities are managed properly specifically during the design stage
- Reference Standard
 - **ISO 20815:2008 - Petroleum, petrochemical and natural gas industries – Production Assurance and Reliability Management**
 - **API RP 17N - Subsea Production System Reliability & Technical Risk Management**



‘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.





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- **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