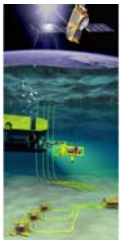
UNIVERSITY OF ABERDEEN

SUBSEA INTEGRITY RESEARCH GROUP

"COMBINING TECHNOLOGY WITH MANAGEMENT TO TACKLE INCREASING CHALLENGES OF SUBSEA INTEGRITY"



Subsea challenges are only **second to** Space Developments.

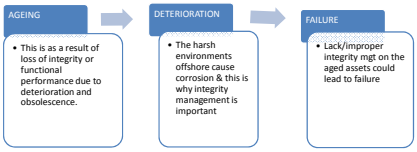
Subsea materials/equipment are being installed at 30,000+ feet below water level and come under harsh attack from corrosive fluids.
Subsea metallurgy is pushing the material limits creating the need to develop bespoke and ultra-resistant alloys.

Thus, making it highly comparable to the stringent requirements of space program, in terms of technological demands.

BACKGROUND

With over forty years of oil and gas production in the UK sector of the North Sea, a significant number of platforms are approaching or have exceeded their original design life, typically specified as 20 or 25 years. Over 50% of the total population of fixed platforms on the UKCS has exceeded the original design life and this proportion is steadily increasing with time. There is a continued requirement to produce oil or gas including, where hydrocarbon reserves are being depleted, the increased use of enhanced oil recovery together with the possibility of future CO2 sequestration, and hence the majority of installations are likely to remain operational for a significant period of time in the foreseeable future. Indeed, in some cases, there are plans to extend the operational life to multiples of the design life to the middle of the century.

The challenge:



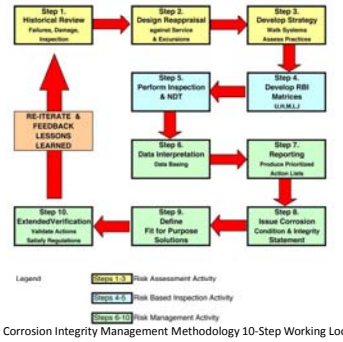
CONSEQUENCES

- Loss of lives
- Damage to reputation
- Loss to the business(which could eventually lead to company fold up)
- Law suits
- Loss of assets
- Compensation etc.

"What we do"

Our research team combines technology with management to tackle the increasing challenges of integrity management by using several analytical models to calculate and analyse the reliability of these assets, some of which are:

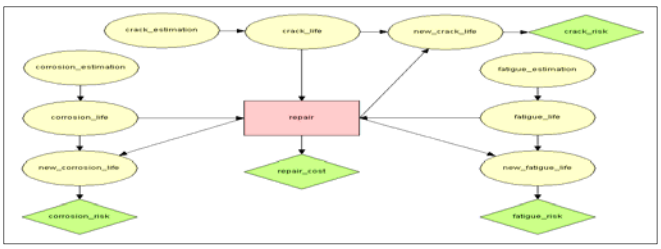
- Qualitative models/approaches
- Quantitatve models/approaches
- Semi-quantitative approaches/models
- Maintenance Optimization



Risk Based Corrosion Integrity Management Methodology 10-Step Working Loop

Likelihood	Consequences				
	Insignificant (Minor problem easily handled by normal day to day processes)	Minor (Some disruption possible, e.g. damage equal to $500k)	Moderate (Significant time/resources required, e.g. damage equal to $1million)	Major (Operations severely damaged, e.g. damage equal to $10 million)	Catastrophic (Business survival is at risk damage equal to $25 Million)
Almost certain (e.g. >90% chance)	High	High	Extreme	Extreme	Extreme
Likely (e.g. between 60% and 90% chance)	Moderate	High	High	Extreme	Extreme
Moderate (e.g. between 10% and 60% chance)	Low	Moderate	High	Extreme	Extreme
Unlikely (e.g. between 2% and 10% chance)	Low	Low	Moderate	High	Extreme
Rare (e.g. <2% chance)	Low	Low	Moderate	High	High

Risk Assessment Matrix



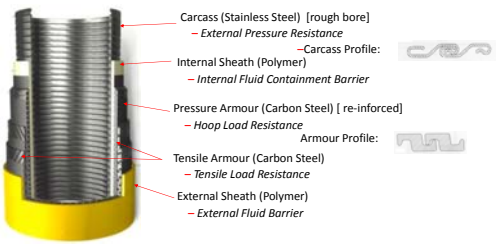
Draft Bayesian Network Model Decision making tool for pipeline maintenance

Current research work by the team includes:

- *Pipeline Integrity Supporting Inspection Decisions under Aging*. Robbie Williamson, Principal Integrity Engineer of the Wood Group Integrity Management, UK, EngD
- *Decision Making in the Maintenance of Subsea Pipelines*. Fiddoson Fiddo, PhD.
- *Risk and Safety Implications of Corrosion Effects on Water, Oil and Gas Pipelines*. Mark Ukelabuchi Ideozu, PhD.
- *Ageing and Life Extension of Offshore Pressure Systems*. Reza Shahrivar, Lloyd's Register, PhD.
- *Managing the Integrity & Reliability of Subsea Assets under High Temperature & High Pressure (HTHP) conditions*. Innocent Friday Uwuijaren, Senior Mechanical Engineer, Aker Solutions. Will join the team in January 2012 for a PhD programme.
- *Safety, Risk and Mechanical Reliability Research for Oil and Gas Industry*. Muhammad Ali Qureshi, will join the team in February 2012 for a PhD programme.
- *Decision Making through Bayesian Network Modelling in Pipeline Maintenance*. Mattia Gandolfi, ERASMUS exchange student from the University of Parma, Italy.
- *On Barriers for Further Development of Solar Energy*. Cristina Martinez Moya, ERASMUS exchange student from UPC Barcelona, Spain.
- *MEng thesis: Bayesian Network Modelling for Decision Making in Maintenance*. Carlos Lozano.
- Sameer Ashok Chapgaon, MSc in Subsea Engineering, University of Aberdeen.
- Abhishek Mamgain, MSc in Subsea Engineering, University of Aberdeen.
- *MEng advanced topic: On Assessing the Potential of Ageing Pipeline Infrastructure*. Kieran Reddington.
- *MEng advanced topic: How New Technologies Can Help Ensure Reliability of Ageing Offshore Pipelines*. Craig Scott Morrison.
- *MEng advanced topic: On Tackling the Inspection Difficulties Associated with Ageing Pipelines*. Gavin William Merchant.

Innocent carrying out an inspection

Reza on the Casablanca Platform in Spain



Pressure Armour Unlocking
Internal pressure sheath rupture through unsupported gap

THE TEAM

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