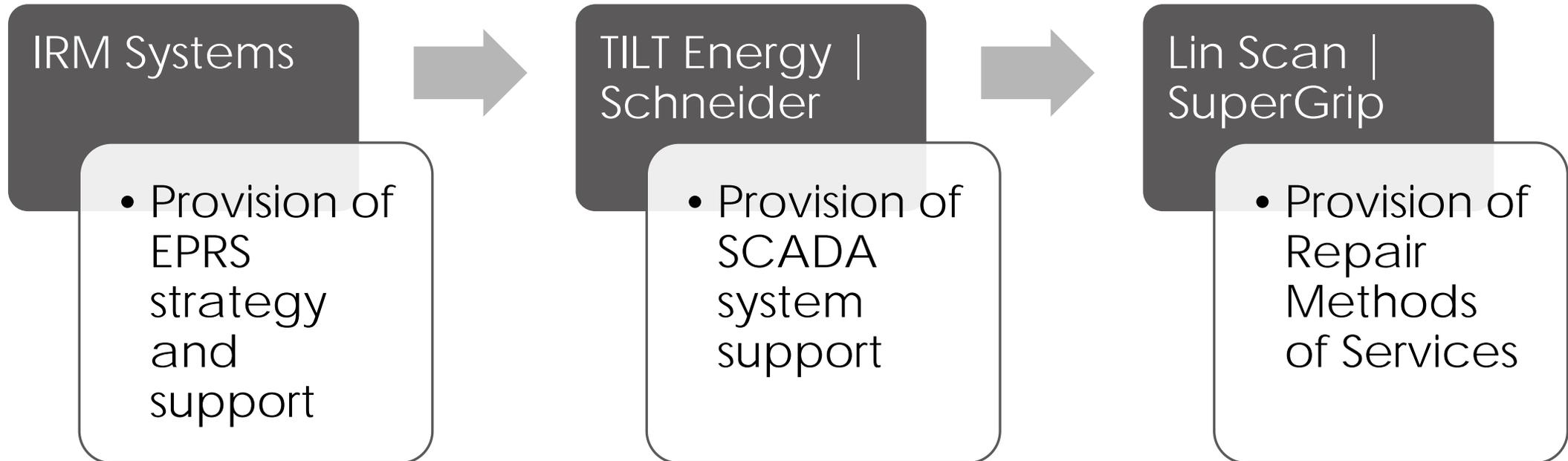


# Emergency Pipeline Repair and Leak Detection

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# Key Partners



# EPRS, Leak Detection & Repairs



## Emergency Pipeline Repair Systems:

- Risk Assessment / FMEA of pipeline and subsea infrastructure;
- Repair method selection (auditable justification), timescales;
- CAPEX/OPEX and cost-benefit analysis;
- Procurement planning & execution support;
- Development of repair procedures, strategies and responsibility arrangement.

## Live repairs and defect assessment:

- Live repairs and defect assessment;
- Defect / damage assessment and surveys;
- Span assessment and review;
- ECA - local & global analysis;
- Sleeve and clamp engineering;
- Hyperbaric welding.

## Leak detection

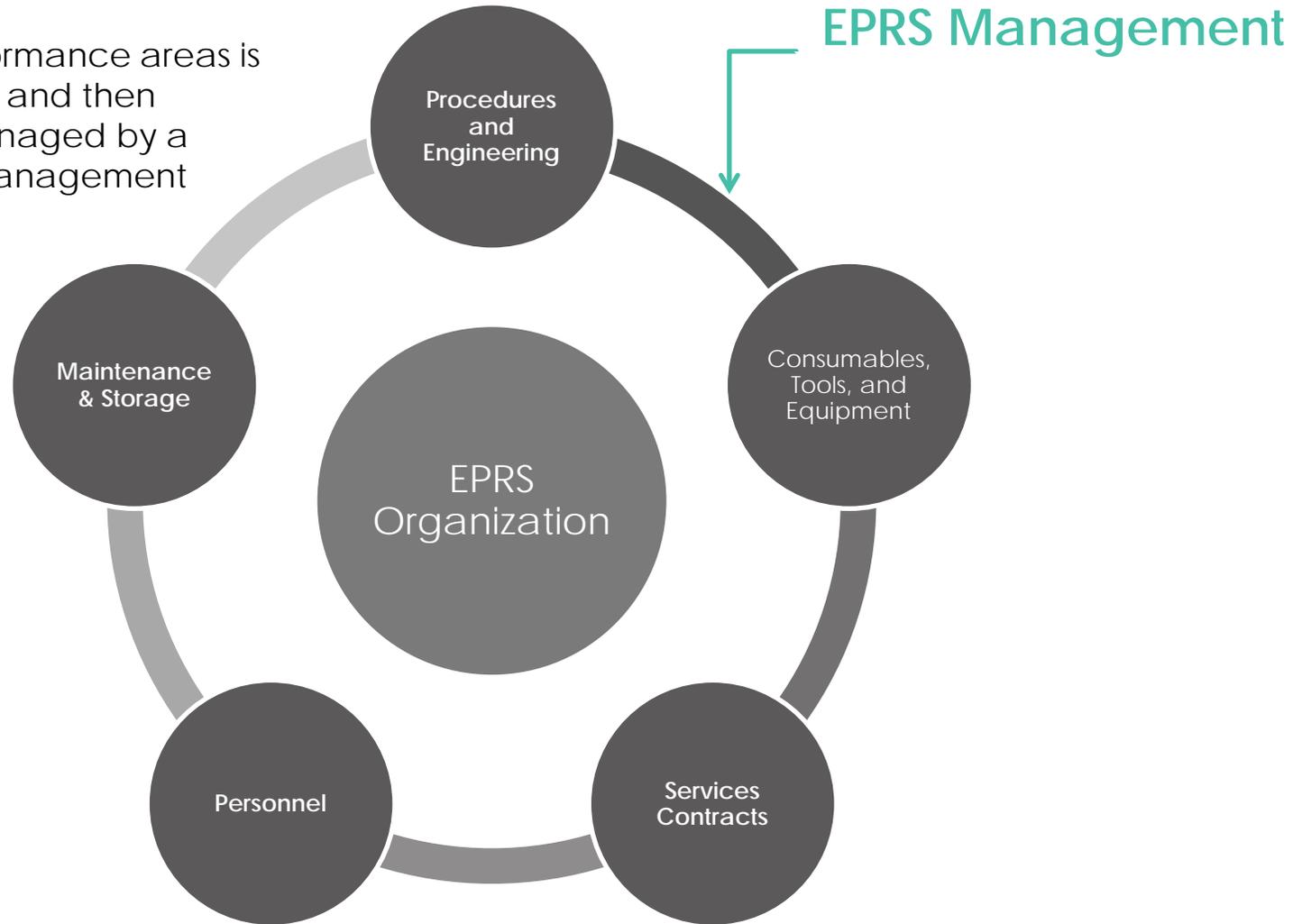
- Review of leak detection systems and processes for compliance;
- SCADA leak detection lead time assessment;
- Leak detection method selection (acoustic, ground monitoring, fibre optic, system monitoring, surveys).

## Vandalism management

- Risk management and optimisation review;
- Covered under EPRS service;
- Fibre optics installation;
- Drones management, coordination and reporting.

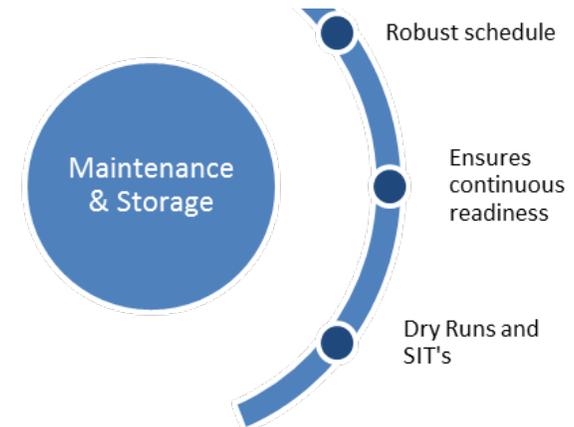
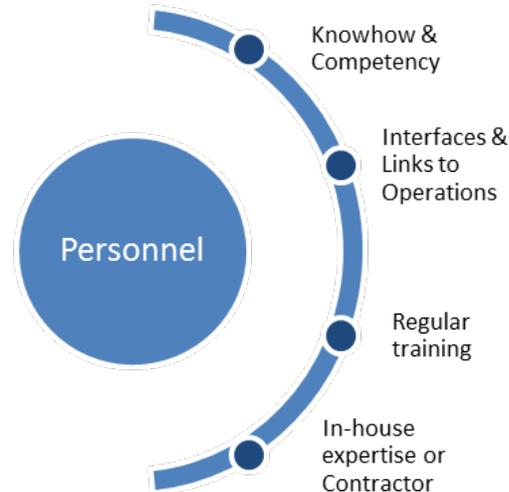
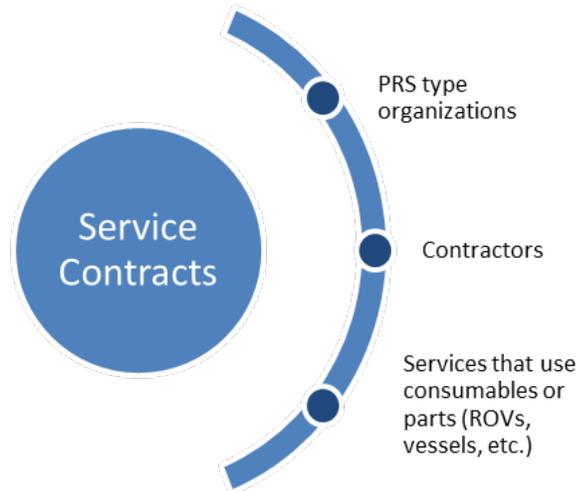
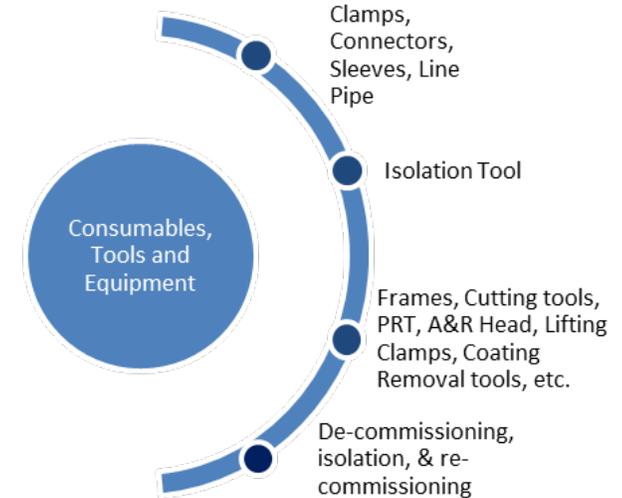
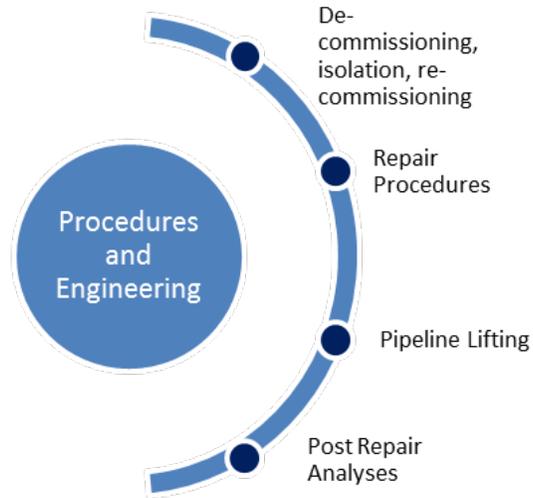
# Performance Areas

Each of the five performance areas is defined and aligned, and then coordinated and managed by a single, emergency management team

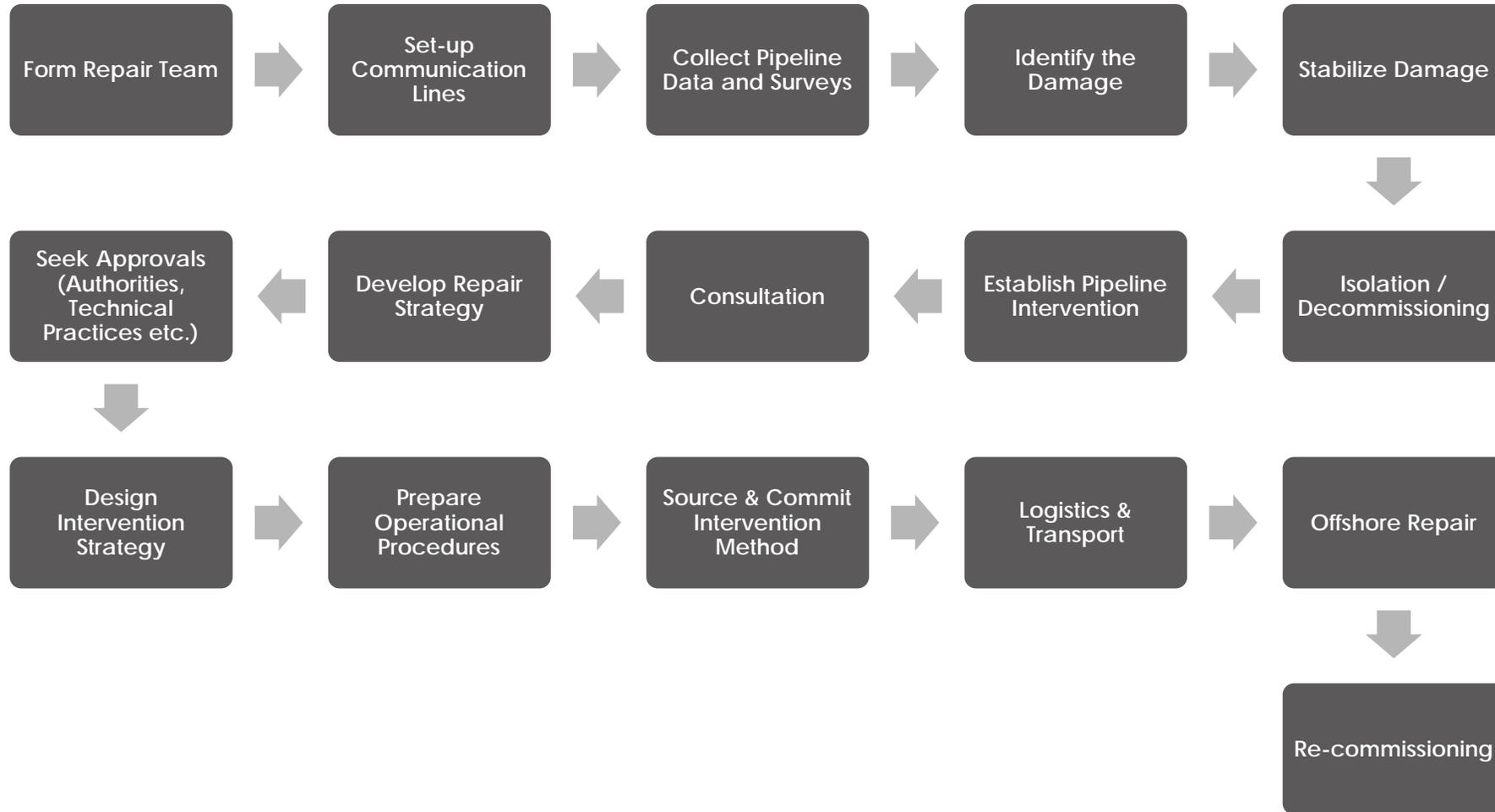


# Performance Areas

- Depending on the specific conditions of the assets, the relevant capabilities are resourced, trained where necessary, and made ready
- **EPRS Management** provides coordination and project management of all the key performance areas



# 16 Step Repair – from Incident



# Development of EPRS

Data Gathering

Failure Scenarios

Proposed Repair Scenarios

Initial Assessment / Engineering

Solution Selection

Preparation (Team)

Preparation (Tool)

FAT and Site Preparation

Mobilise

Equipment Set-up and Test

Isolation and Monitoring

Job Execution

De-isolation and Commission

Data Gathering

- Asset register, Local context, Risk review

Failure Scenarios

- Scenarios and possible repair options, Consolidation with client, Review with local processes

Proposed Repair Scenarios

- Flow charts, Required hardware, Vendor identification, Cost benefit analysis

Preparation (Tool)

- Detailed design and fabrication, Testing of solution (internal, external), Project site activities, FAT documentation

FAT and Site Preparation

- FAT execution and client engagement, Site / isolation preparation

Mobilise

- Final site checks, Prepare operational procedures

Initial Assessment / Engineering

- Review of current configuration, Inspection as required, Assessments e.g. FEA, Material consideration

Solution Selection

- Tool selection, Solution and component design, Design reports, Risk review

Preparation (Team)

- Form repair team, Set-up communication lines, Consultation and risk assessment

Equipment Set-up and Test

- Preparation and transportation, deployment and pre-isolation set up

Isolation and Monitoring

- Site activities, Isolation setting, Isolation monitoring

Job Execution

- Repair work, Logistics and transport

De-isolation and Commission

- Re-instatement, Re-commissioning

# Pipeline Repair

Anomaly/ Feature	Grinding	Weld Deposition	Composite Repair (1)	Welded Sleeve (reinforce)	Welded Sleeve (pressure containing)	Grout or Epoxy-filled Sleeve or Clamp	Mechanical Clamp	Cut Out
Leak	No	No	Yes (Temp only)	No	Yes	No	Yes	Yes
Internal corrosion	No	No	Yes (Temp only)	Yes (Temp only)	Yes (Temp only)	Yes (Temp only)	Yes (Temp only)	Yes (Temp only)
External corrosion	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Crack	Yes	No	Yes (After grinding)	No	Yes	Yes	No	Yes
Gouge	Yes	No	Yes (Smooth)	Yes	Yes	Yes	No	Yes
Dent	No	No	Yes (< 12.5% wall)	No	Yes <sup>2</sup>	Yes	No	Yes
Buckle	No	No	No	No	No	Yes	No	Yes
Girth Weld Anomaly	Yes	No	No	No	Yes	No	No	Yes
Seam Weld Anomaly	Yes	No	No	No	Yes	No	No	Yes

1. Composite repairs will not normally be applicable for subsea repair but they have been used in splash zone areas.  
 2. Only if no fatigue issues.

## Techniques

- Weld deposition and patch repairs
- Composite sleeves
- Welded sleeves
- Epoxy filled sleeves
- Mechanical clamps
- Cut-out

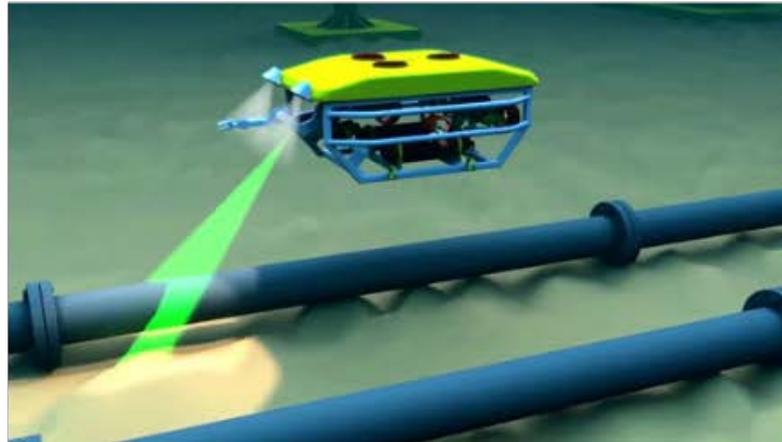
## Isolation

- Line clearance
- Hot-tap, line plug and bypass
- Freeze plugging
- Isolation pigs
- Remotely operated plugs
- Subsea repair deployment
- Mechanical connectors

# Laser leak detection

## Laser leak detection by ROV

- Optical detection tool to detect emission of fluids from a flexible pipeline
- Detection of hydrocarbons or special developed injection dye. Reflected light detected by an intelligent camera.



Leak detection by ROV

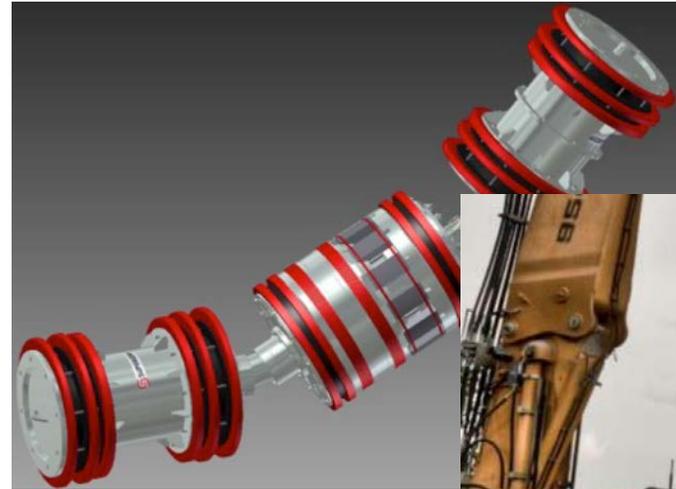


Laser Leak Detection System (LD53)



# Equipment

Pipeline SCADA support;  
Piggable isolation plugs;  
Pipeline repair clamps;  
Pipeline sleeves and wraps;  
Excavators & swamp buggies;  
Welding equipment;  
Off-loading trucks;  
Pumps and auxiliaries;  
Hot tap and stopples;  
Cyclone dust separator  
ETC.



# Track Record



Nigeria  
Sakhalin  
Philippines  
North Sea

Development of complete EPRS for shallow- and deep water trunk- and flow-lines



Southern Chinese Sea

Development of EPRS concept for a complete deep-water transport system



North Sea

Assessment, repair scenario and EPRS development for multiple pipelines



Shaping the future.



Mediterranean

Assessment, repair scenario and EPRS development for pipelines offshore Spain



Black Sea

EPRS development for Deepwater export pipeline system



# Capability Statement



## Emergency Pipeline Repair Solutions

## Pipeline Wrap / Sleeve Repair

### EPRS design and development for NGL pipeline

**Client**  
SUKEP

The 20" NGL pipeline is a 224km long pipe which starts at the Separation Plant at St Fergus and ends at the terminal at Mossmorran. Sectional isolation facilities include 21 block valves situated along its route at intervals <12km.

**Location**  
UK

Integrity of the NGL pipeline is monitored using three different techniques; acoustic monitoring, mass balance and pressure rate of change. Cathodic protection (CP) of the pipeline is provided by impressed current systems spread over 14 CP stations along the pipeline, shared jointly with British Gas and BP.

**Water depth**  
Landline

**Activities**  
EPRS  
Excavation  
EPRS presentation  
Simulated modelling  
GIS coordinates



Pipeline path

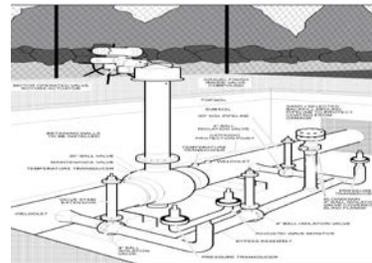
The objective of the project was to identify, understand and develop the activities and engineering solution required for an emergency pipeline repair solution.

**Duration**  
2015 - 2016

FEED and detailed design inclusive of a workshop conducted whereby damage scenarios and possible repair methods were identified and their applicability to the NGL discussed.

The Workshop concluded with the selection of the Hot Tap and Plug (HT&P) repair method for major damage and Epoxy clamp/wrap repair for minor damage. Other follow-up actions associated with repair-related operational procedures were also identified and consolidated into a document for tracking.

A repair manual was developed, providing the end-user with a detailed procedure on how to execute the repair should the need arise.



3D representation of valve station repair

Long lead items will be identified, detailed and proposed to be procured, requirements for service contract arrangements will also be detailed, with the intent on minimizing production downtime i.e. duration from the start of event to recommissioning and restart of production.

### 36" pipeline isolation joint repair in Oman

**Client**  
Van Oord

An isolation joint (as part of the cathodic protection system) of a 36" pipeline was leaking through the internal sealing mechanism of the joint. It was not possible to isolate this joint implying that the repair had to be applied live. Therefore one of the critical aspects of this repair application was the associated safety aspects of diverting the leaking gas from the joint while the repair was being implemented.

**Location**  
Qatar

**Water depth**  
Pipeline Specification:  
Design Pressure : 92 bar  
Design Temperature : 500C

**Activities**  
Design of repair  
FAT, SIT etc.  
Design and CAD  
Development of procedures  
Execution

**Duration**  
2016



Insulation joint

The installation procedure for the clamp and composite repair consisted of the following steps;

1. Clean surface of joint and seal leak
2. Apply temporary clamp and gas diversion system
3. Prepare surface of pipeline
4. Apply composite repair
5. Perform QA/QC checks



**Scope of work**



**Challenges**

To overcome challenges associated with the project co-ordination and planning associated with a job of this scale. The greatest challenge was the assurance of safety during the repair application.



First two layers of the composite repair