

# **Society for Underwater Technology Middle East Branch**

## **Emergency Pipeline Repair Systems (EPRS)**

An overview of the tools and methods available for the  
on-bottom repair of rigid pipelines

**Tuesday 13 December 2022**

09:00 - 15:30 at Khalifa University, SAN Campus and  
Dolphin Energy KIZAD



**Presenter: Mr. Mark Oliver Thomer, Sr. Manager EPRS PD and MI & I – Dolphin Energy**

# Subsea Emergency Pipeline Repair

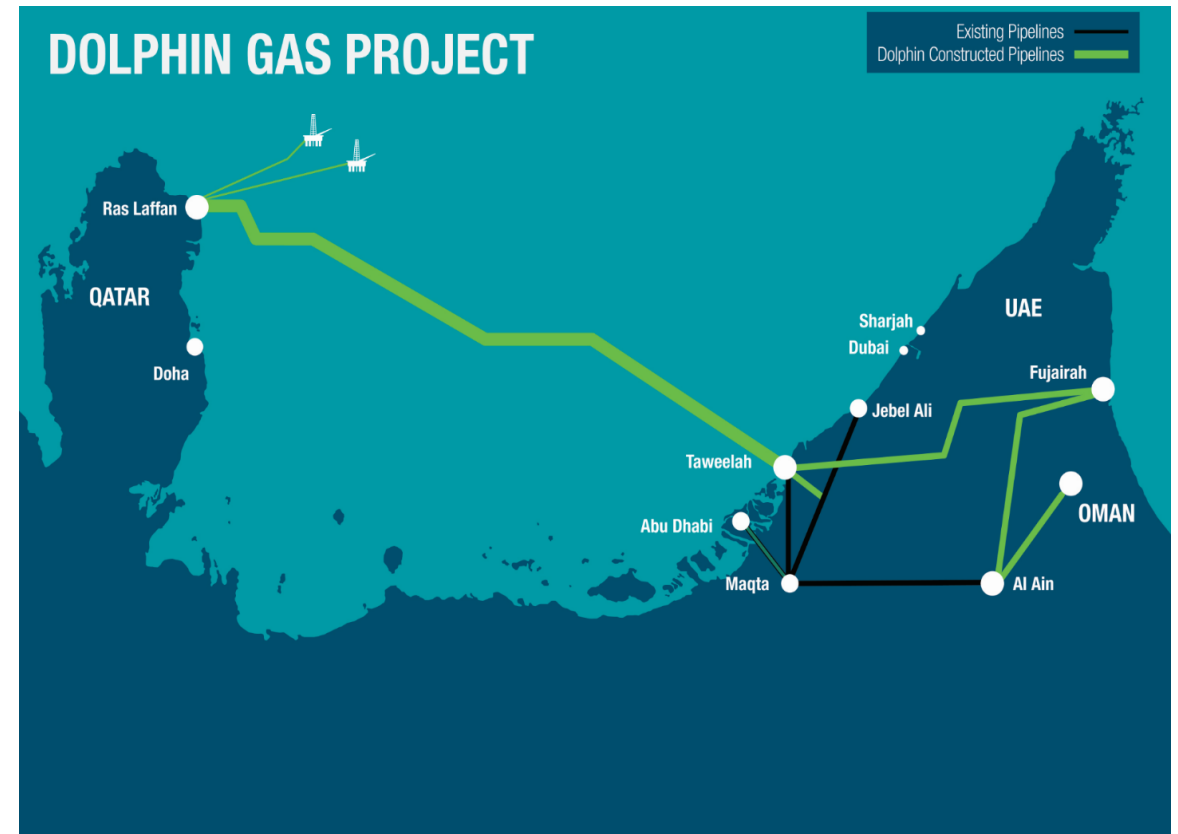
## An Operators Perspective

December 13, 2022



# Company Background

- Supplier of natural gas to the UAE & Oman
- Supplies 2 billion standard cubic feet of natural gas daily (approx. 30% of UAE's gas demand)
- Dolphin Energy operates several 36" & 48" high pressure gas pipelines (raw & treated)
- Gas production from wellheads in Qatar started in 2007



# EPRS System Background

**2009**



Dolphin Energy was tasked by its shareholders to develop a comprehensive methodology, equipment and systems able to:

**2019**

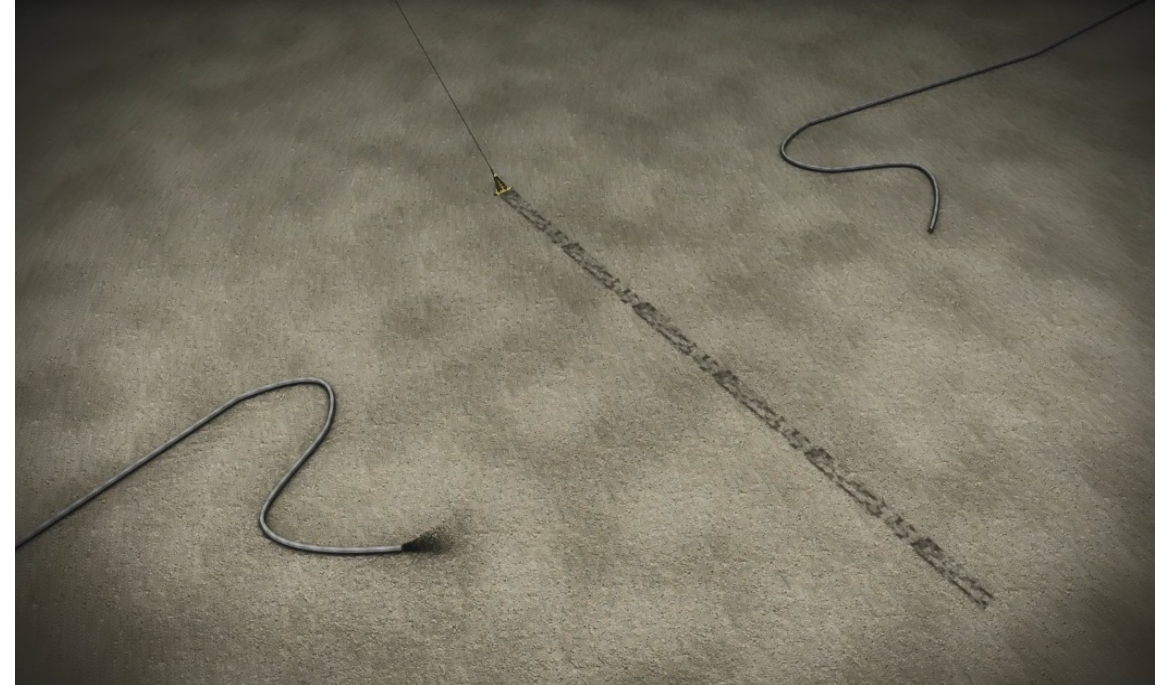
Repair a full rupture to any of Dolphin Energy's subsea pipelines in a short timeframe

Repair minor damage under planned maintenance campaigns

**DOLPHIN EPRS PROJECT**

# EPRS Challenges

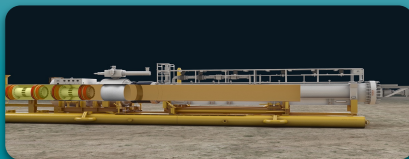
- Being prepared for the unexpected
- Repair pipeline in the fastest possible way (including relay of pipe string)
- Above water tie-in / repair not possible
- Restore repaired pipeline to originally welded condition
- Pipeline flooded with multiphase medium consisting of raw or treated gas, seawater, debris from the rupture and organic and inorganic particles (up to 70% of pipeline flooded)



Simulation of 48" Pipeline Breach  
"Garden Hose Affect"  
Up to 1,500 meters damaged pipeline section

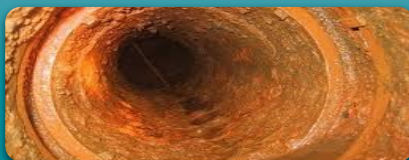
# EPRS Challenges

## 4 Key Challenges During a Repair



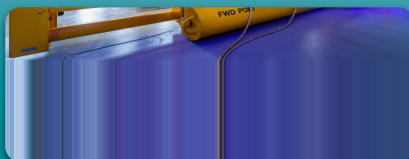
### Handling of Pipeline Content

- Multiphase medium (raw gas, seawater, debris etc.)
- Onshore terminals not equipped to deal with quantity



### Exposure to Seawater

- Extended exposure to seawater (up to 5 months)
- 48" pipeline designed for sweet gas



### Availability of Specialized Equipment

- Large bespoke equipment needed for subsea repair of large diameter gas pipeline
- Huge equipment spreads needed at the time of intervention



### Economic Factors

- Need to balance CAPEX with risk of pipeline damage / rupture
- Detailed market analysis to minimize upfront CAPEX

# Dolphin Energy's EPRS System - ASSIST

## ASSIST SOLUTION

The ASSIST Solution consists of the following...

### OWNED EPRS TOOLS

Specialized subsea tools and equipment for pipeline repair

### AGREEMENTS

Long Term Service Contracts for hired services and equipment

### DOCUMENTS

Repair procedures and processes to carry out a subsea intervention.

### MARINE BASE

KIZAD Marine Base as an operating hub for all subsea operations.

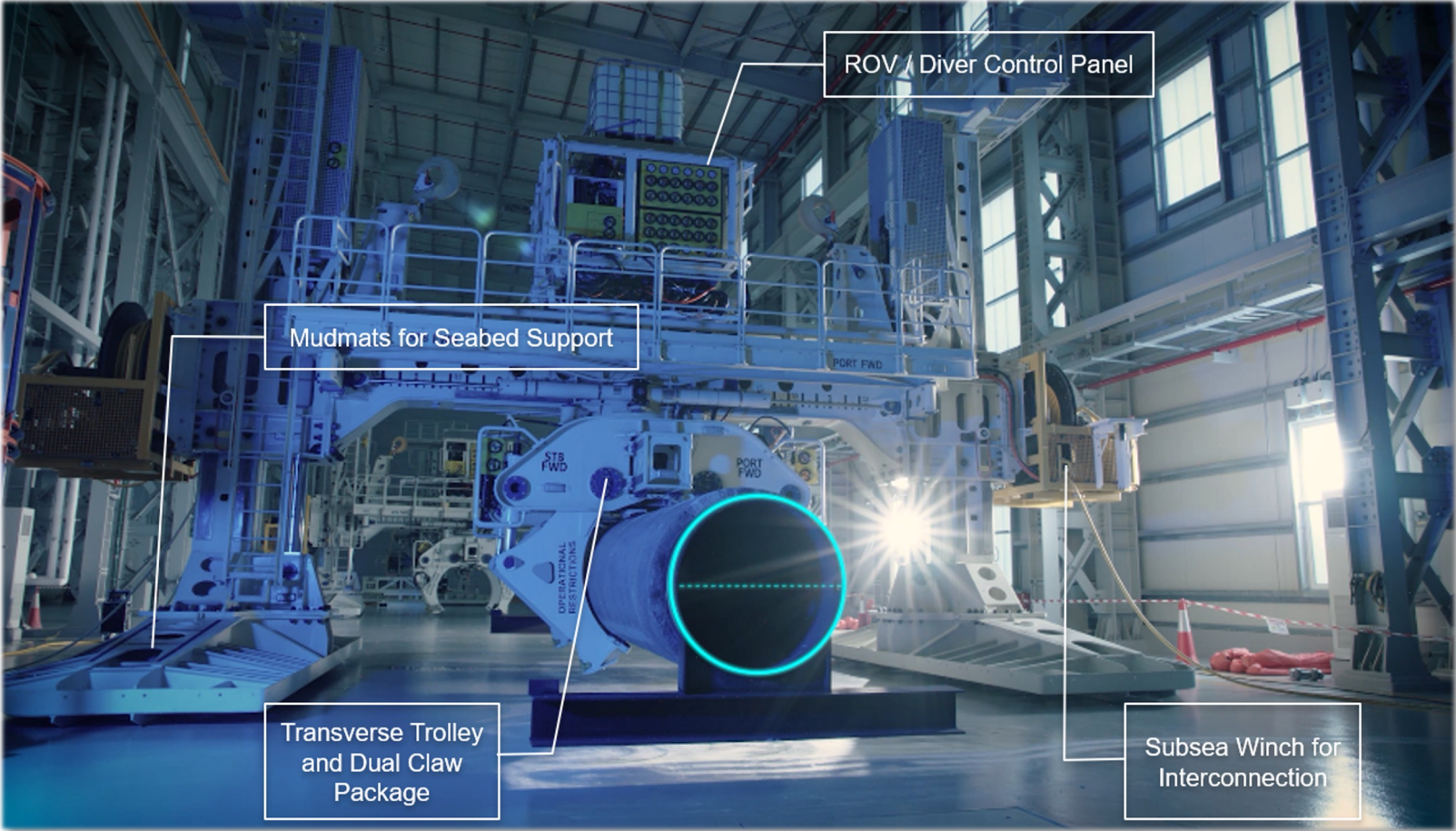
# Owned EPRS Tooling – Pipeline Handling Frames

- Lifting capacity of 150 tons (vertical) and 30 tons (lateral)
- 5 Degrees of Motion: Vertical, lateral, yaw, tilt and push/pull
- Powered by subsea hydraulics (1kV topside power supply)
- Used for rough and fine pipe alignment and lifting
- Position pipe within less than 1mm accuracy under full load
- Equipped with modular subsea winches to interconnect subsea equipment
- Covers all pipeline sizes
- Diverless, ROV or diver operated



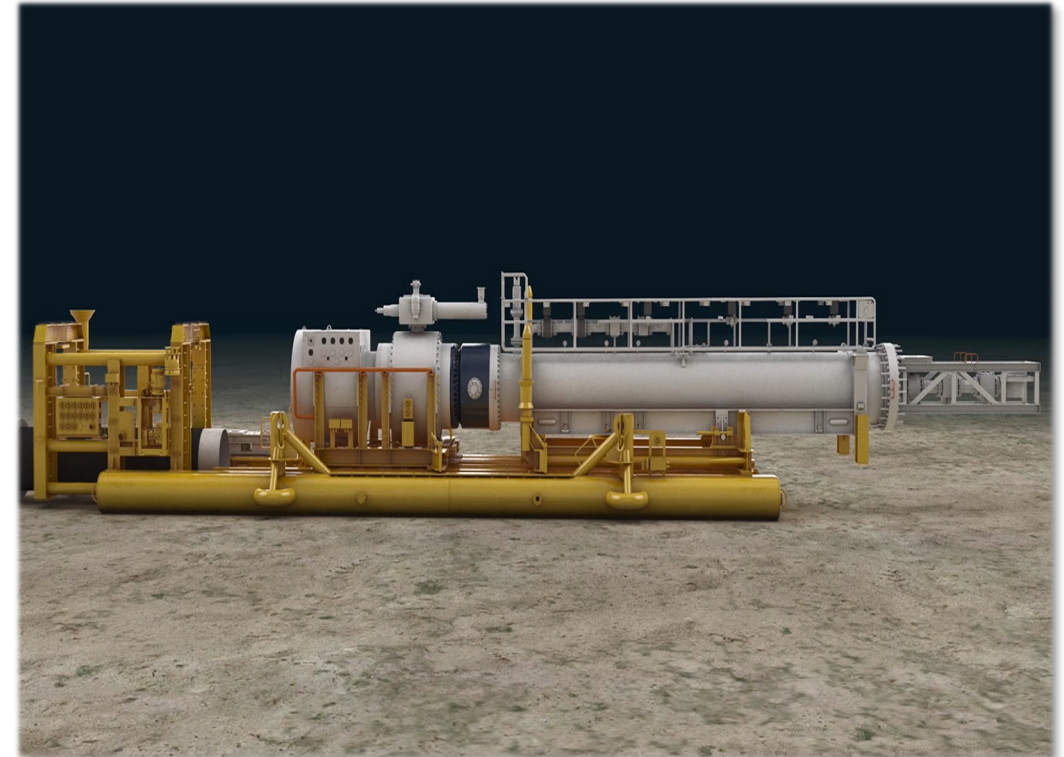


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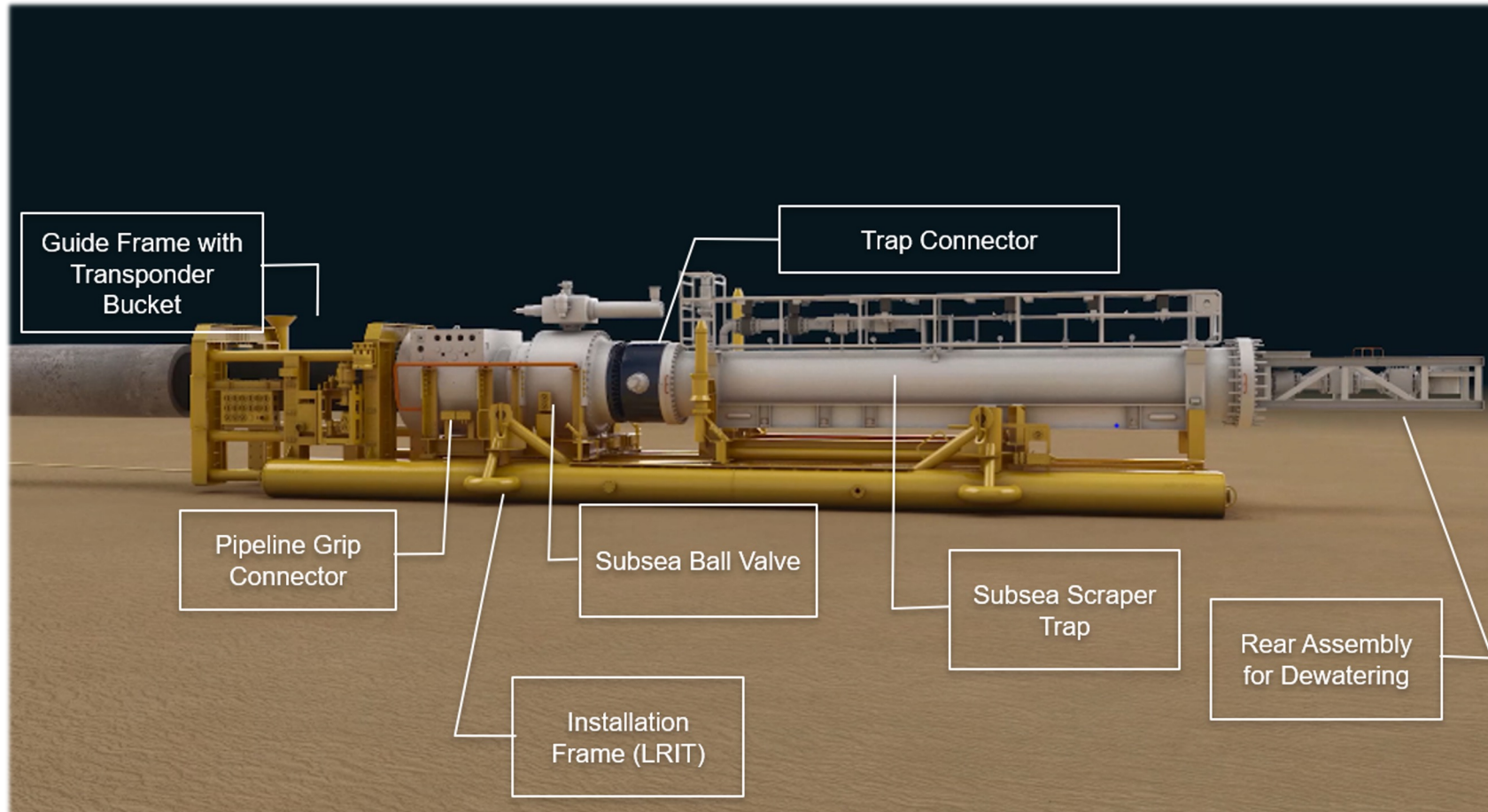


# Owned EPRS Tooling – Subsea Launcher & Receiver

- Grip connector that provides gripping and sealing of the prepared open pipeline
- Subsea ball valve to allow decommissioning and prevent reflooding
- Trap connector that allows trap to disconnected and reconnected to the SLR; and
- Trap to receive and launch scrapers and isolation plugs
- SLR installation tool called an LRIT
- Powered by subsea hydraulics (1kV topside power supply)
- Separate SLR for 36" & 48" sizes but common installation tool
- Allows dewatering of pipeline and isolation of pipeline on seabed
- Allows recovery and re-launch of trap without reflooding of pipeline
- Diverless, ROV or diver operated



# Owned EPRS Tooling – Subsea Launcher & Receiver

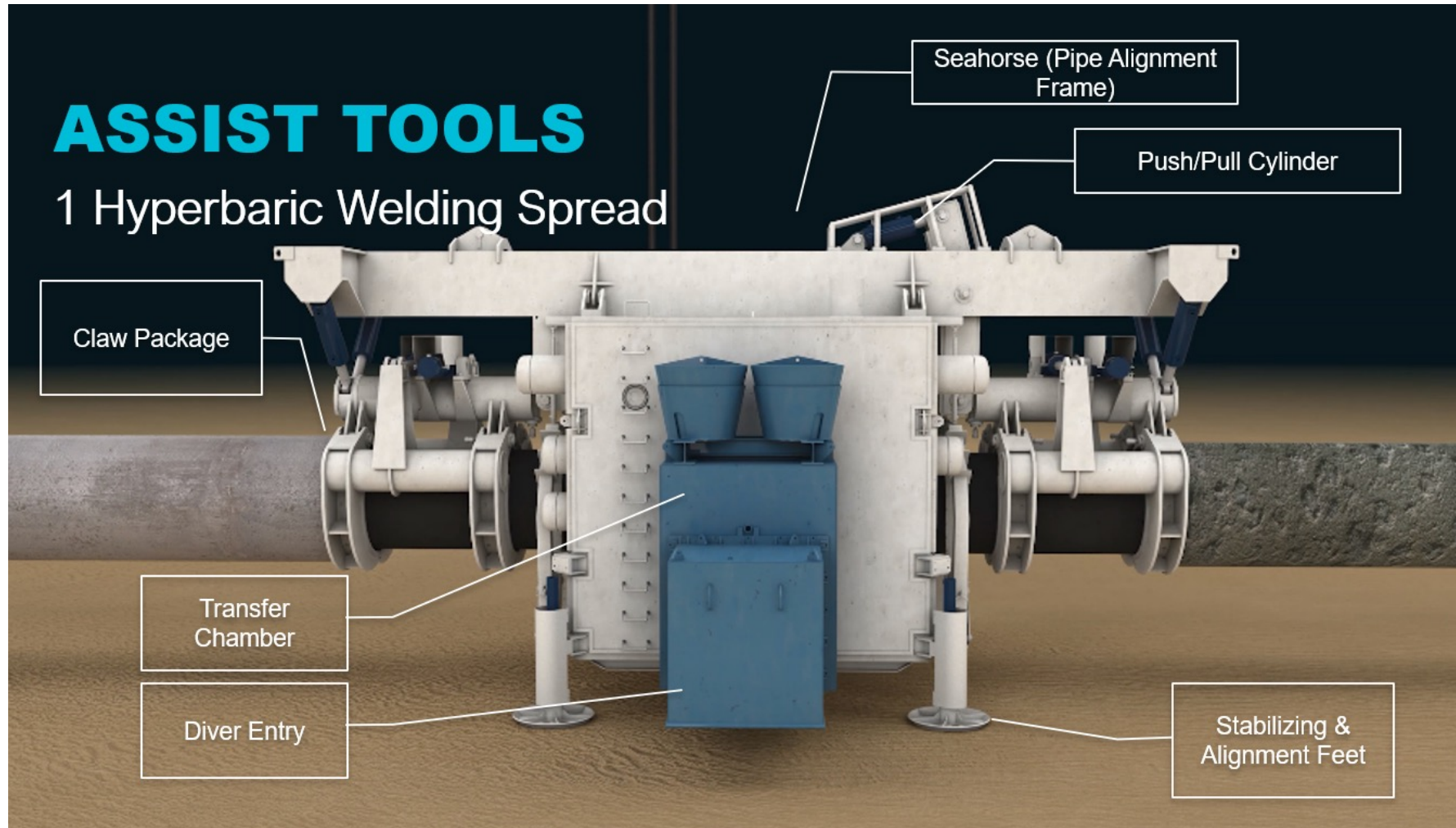


# Owned EPRS Tooling – Hyperbaric Welding Spread

- Diver assisted welding
- Covers pipelines 36” – 48”
- Up to 100 meters water depth
- Fully Norsok and IMCA compliant
- Used for welding pipeline subsea in a dry environment
- Dedicated topside spread incl. weld control container
- Utilizes DSV of opportunity
- Team of qualified diver welders available



# Owned EPRS Tooling – Hyperbaric Welding Spread



# Specific DIR Challenge

## DIR Operational Sequence 1<sup>st</sup> Step – Pipeline Preparation

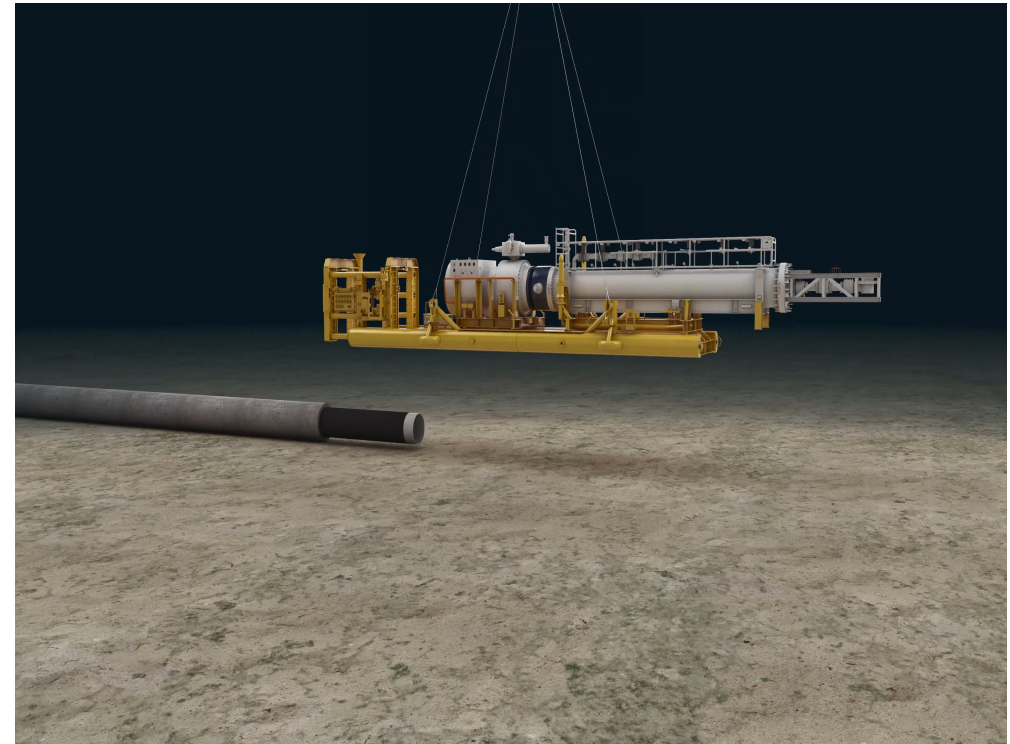
- Operational assets to be made safe
- Initial subsea survey of damage location
- Immediate decommissioning option (single scraper run) with pipeline reflooding
- Pipeline content can be recovered via hot-stab and flexible to the topside
- Damage pipeline section is cut and removed.
- Pipe ends are prepared by concrete and anti-corrosion coating removal through CRT
- Survey to select location with minimal ovalization



# Specific DIR Challenge

## DIR Operational Sequence 2<sup>nd</sup> and 3<sup>rd</sup> Steps – Decommissioning and Isolation

- Subsea Launcher & Receiver landed over pipeline
- Connect to pipeline via grip connector
- Decommissioning pigs launched from onshore and received in SLR
- Remove trap to vessel and load isolation plugs
- Launch and set isolation plugs subsea
- Pipeline is now dry and ready for repair

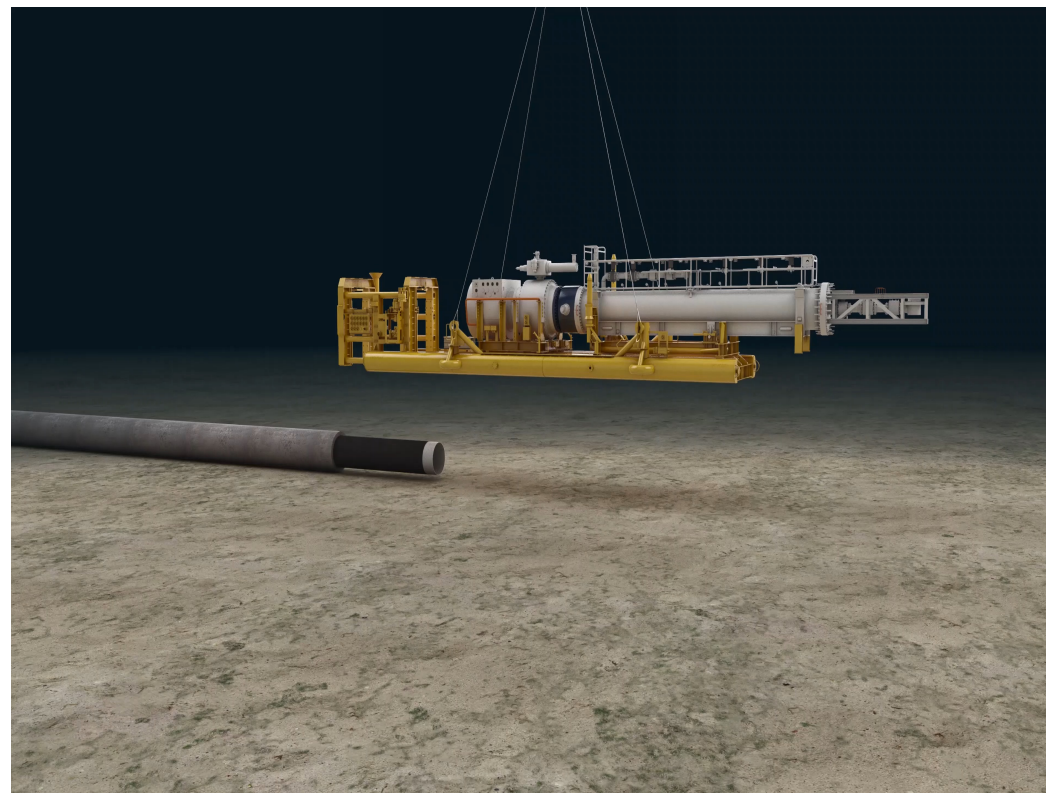


# Specific DIR Challenge

## DIR Operational Sequence

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# Specific DIR Challenge

- DIR equipment requirements are demanding
- Sealines require 1M gallon liquid N2
- Extensive market study carried out to determine long term equipment availability ad-hoc for intervention
- Equipment availability not guaranteed on emergency basis due to varying flow and pressure requirements

Requirement	Phase 1 2 Weeks after Incident	Phase 2 4 Weeks after Incident	Phase 3 8 Weeks after Incident	Phase 4 8+ Weeks after Incident
Required Air Pressure	6 barg	20 barg	Up to 35 barg	ambient
Required Air Flow	8,000 scfm	16,000 scfm	8,000 scfm	16,000 scfm
Required Dew Point	-	-	-	(-) 20°C
Required Nitrogen Qty.	45,000 m <sup>3</sup>	-	-	45,000 m <sup>3</sup>

- Study also concluded that it was possible to cover all requirements with individual equipment for each phase
- Economic analysis: 98% of the potential CAPEX and OPEX saved by relying on the market
- Procedures and processes are developed with flexibility to utilize equipment of opportunity

# Agreements – Long Term Service Contracts

**Dolphin Energy has established long-term service agreements to provide the support services required for successful pipeline repair and intervention**

## **STRATEGIC**

- ASSIST Management Services
- All Marine Services
- Decommissioning & Commissioning Services
- Hyperbaric Welding Services
- Isolation Services

## **HIGH IMPORTANCE**

- Supply of Diamond Wire Cutting Tools
- Onshore and Offshore Lifting and Transport Engineering
- Maintenance & Operation of Major ASSIST Equipment

## **AD-HOC**

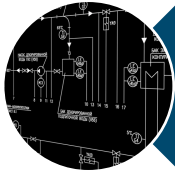
- General Transport & Logistics Services
- General Fabrication Services
- Saturation Diving Medical & Rescue Services
- Air Diving Services
- Port Support & Administrative Services

# Agreements – Long Term Service Contracts



## Readiness

LTSA Provider understands scope and has personnel and equipment available when needed. All contractual matters are agreed and finalized



## Validation & Update of Engineering

Engineering is reviewed and validated. LTSA provider takes ownership. Periodic review and updates of key documentation



## 6 Monthly Readiness Validation

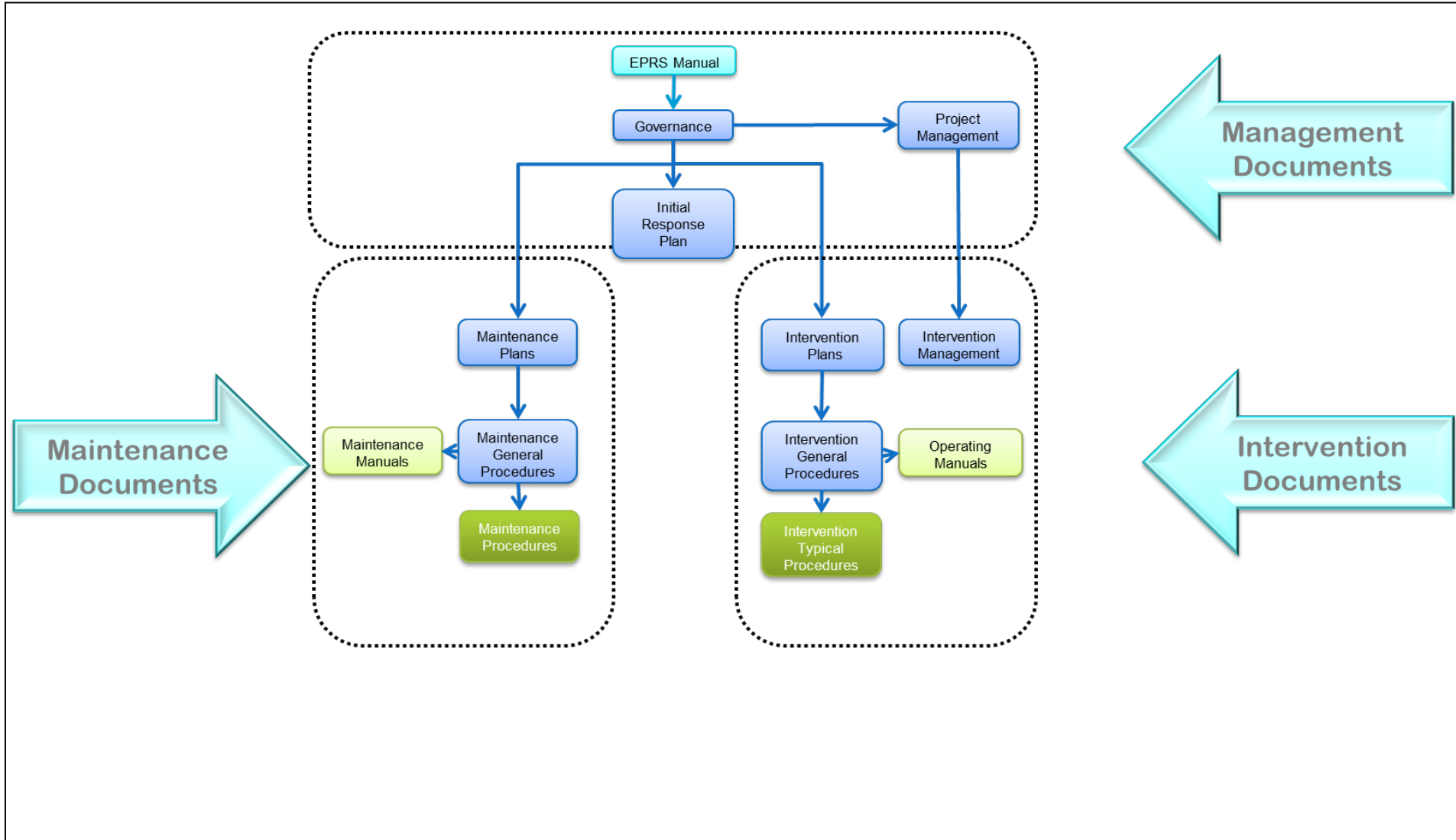
Validate utilization of equipment and personnel for past and upcoming period. Able to identify bottlenecks and changes in key assumptions.



## Drills & Audits

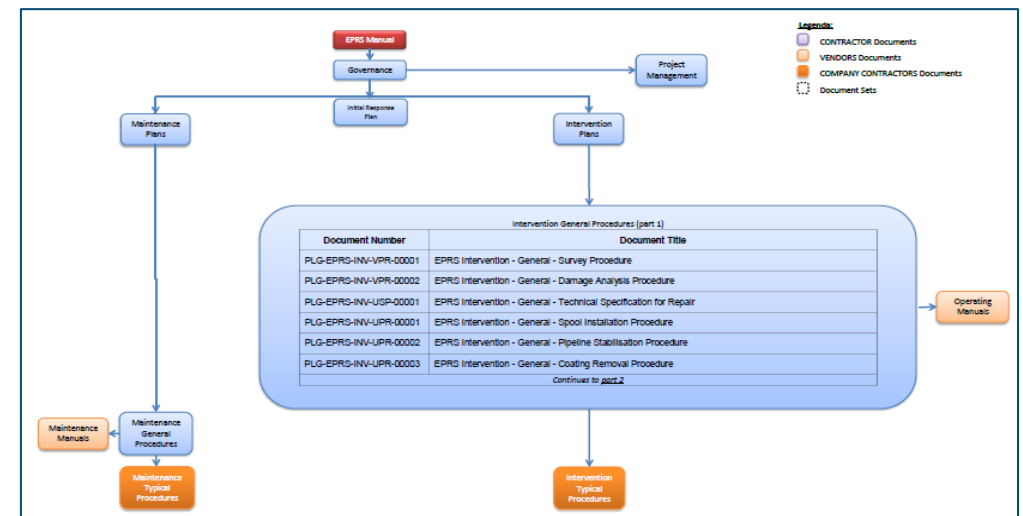
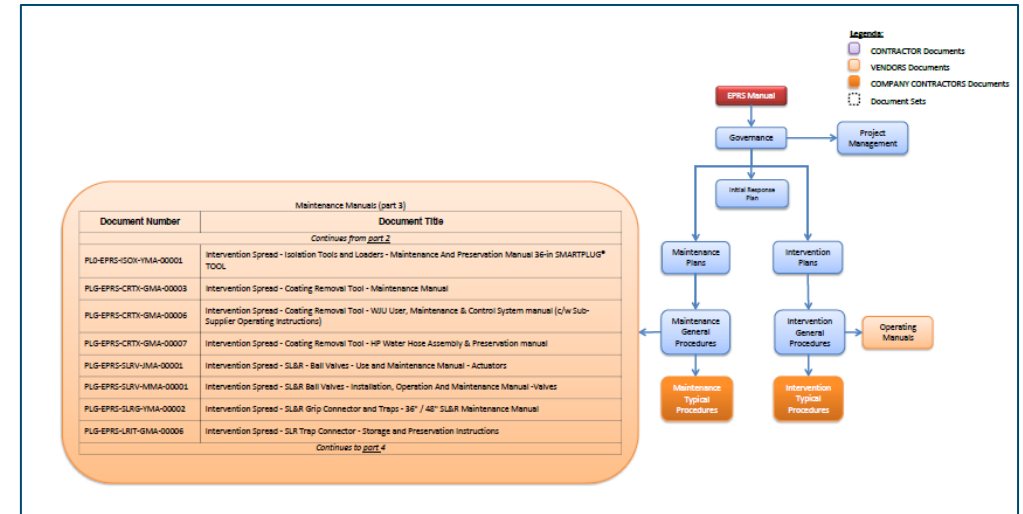
At least one annual large scale exercise conducted to ensure readiness obligations are met.

# EPRS Documents



# EPRS Documents - Engineering

- Required procedures, calculations and manuals prepared
- Based on the most onerous intervention scenario
- Typical procedures and calculations that can be easily updated based on actual intervention scenario
- Includes all LTSA Provider documentation
- Cover all stages of readiness and intervention
- Regular reviews and updates



# KEZAD Marine Base

# KEZAD

## MARINE BASE

It covers more than 5,000m<sup>2</sup> of indoor storage and workshop areas serviced with a 100 ton overhead crane. The Marine Base has the facilities to support extensive subsea tool testing and preparation for mobilizations and has direct access to Khalifa Port via the Modular Path.

The dedicated Marine Base in KIZAD will serve as a hub for all maintenance and subsea interventions.

Hub for testing and training subsea works.



# Key Factors for Long Term Readiness

- Partner with local and international vendors and contractors for subsea repair
- Maintain readiness through regular maintenance, testing and exercises
- Provide access to ASSIST to regional operators and main Contractors



THE END

