



Archer

End-to-End Solution on Well P&A

Barricade® – Medusa® – Romar SS1000 & EZ Clean®



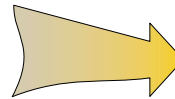
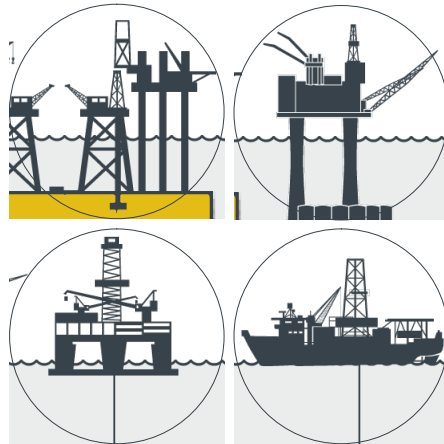
Agenda

1. Introduction to Archer Intervention Portfolio
2. Well Decommissioning Guidelines (P&A and SRS)
3. Archer – End-to-End Solution on Well P&A
4. Archer – Barricade ® Perf, Wash and cement
5. Abrado – Medusa ® Section Milling
6. Romar – SS1000 Modular and EZ Clean ® Surface Swarf Handling
7. Integrated P&A services

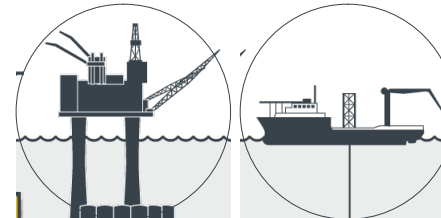
THE APPLICATION

INTERVENTION & CONVEYANCE

HEAVY intervention



LIGHT intervention



Vessel

Fixed installations, Semis, Drill
Ships

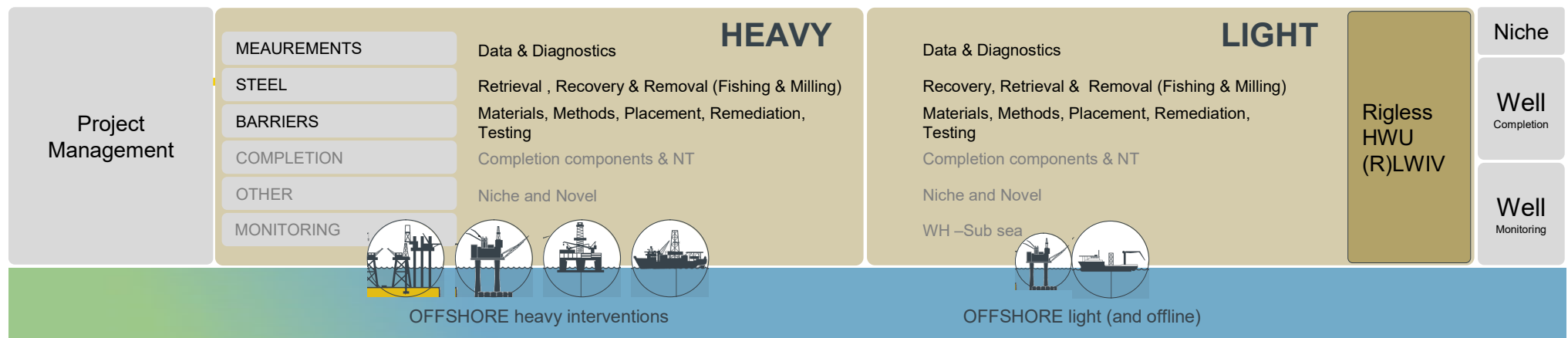
Conveyance

Drillpipe

Rigless, LWIV

Coiled Tubing

Archer Intervention – Broad Industry Portfolio

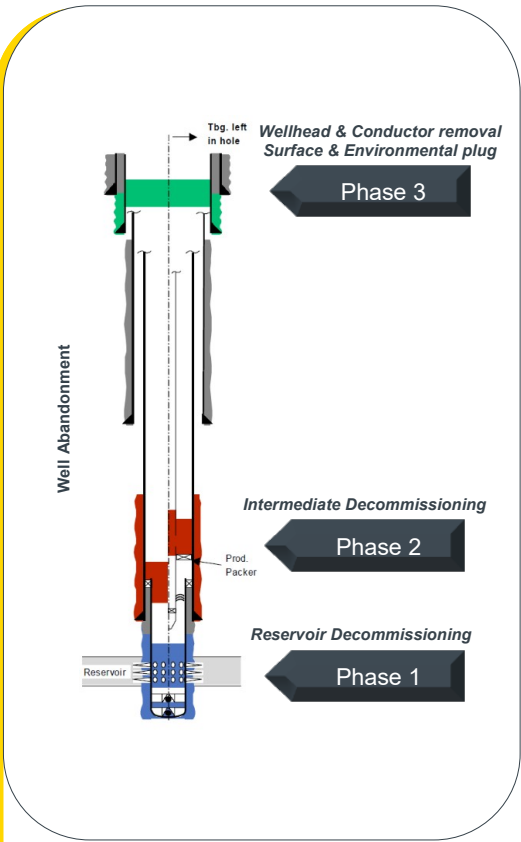


	PM		HEAVY Intervention											LIGHT Intervention																					
			Fishing	Cut & Pull		Milling		Well Integrity				Conductor Retrieval		Logging	Conveyance & Powered Downhole Mechanical Services			Well Integrity																	
	Project Management	Front End Wells Planning	Standard Fishing	Advanced Fishing	Casing Recovery	DHP Casing Recovery	Casing Recovery High Tier	Standard Milling	Pilot Milling & Section	Advanced Section Milling	Wellbore Departure	Isolation Plugs & testing	Barrier Placement	Annular Remediation	Wellbore Clean up	Mechanical Perforation	Conductor Retrieval	Cutting Boring & Welding	Slickline Services	Production Logging	Cement & Corrosion	Logging Imaging	Conveyance (High Tier)	Powered DMS	Powered DMS	Powered DMS Rotation	Powered DMS (FD)	Well Integrity Plugs **	New Materials Isolation	Downhole Ballistics	Coiled Tubing	Stimulation	Pressure Pumping	Cementing & Fluids	Wellhead retrievals
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Conveyance	Drillpipe Tubing Workstring											Slickline Wireline Other High Tier Conveyance Coiled Tubing																							

● Archer
● Alliance / Partner

OIL & GAS UK WELL DECOMMISSIONING GUIDELINES

Decommissioning Phase

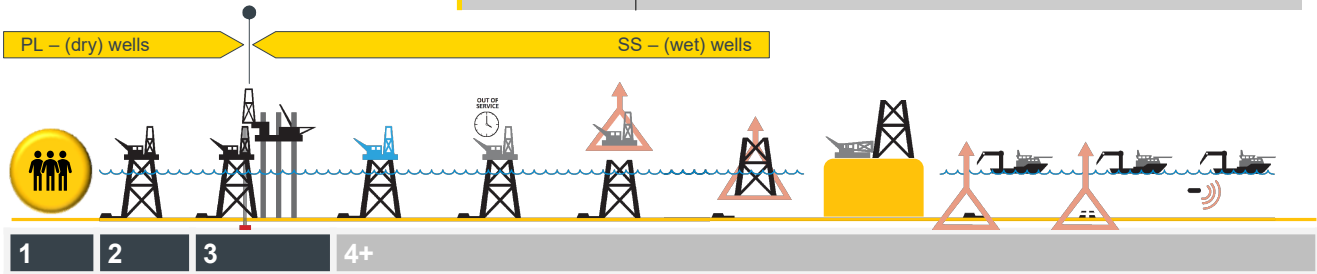


Work Breakdown Structure (WBS) DRY

WBS	Description
1	Operator Project Management
2	Post – CoP OPEX
3	Well P&A Decommissioning
4	Facilities/Pipeline De-energising
5	Topsides Preparation
6	Topsides Removal
7	Substructure Removal
8	Topside/Substructure recycling
9	Subsea Infrastructure
10	Site remediation
11	Post decommissioning monitoring

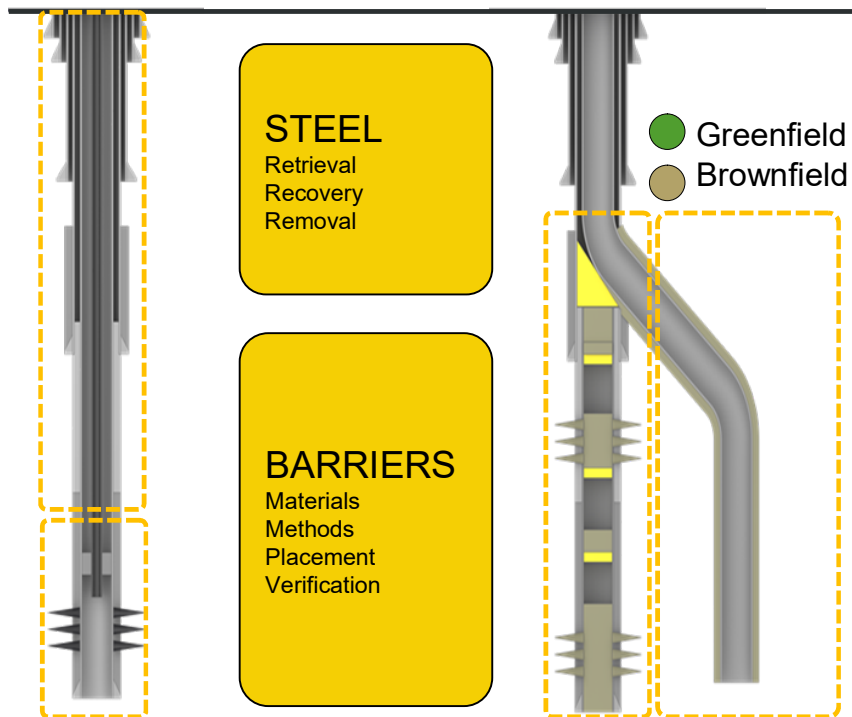
Well Category (type) P&A Code Description

Type	Description
PL 1 – 3 – 3	
PL – Platform Well SS – Subsea Well LA – Land Well	
Position 1 – Phase 1 Reservoir Decom type Position 2 – Phase 2 Intermediate Decom type Position 3 – Phase 3 Wellhead & Conductor removal type	
0	No work required – a phase or phases of the well decommissioning work may already have been completed
1	Simple rigless decommissioning – using wireline, pumping, crane, jacks. Subsea will use a well intervention vessel and be riserless
2	Complex rigless decommissioning – using coiled tubing or hydraulic workover unit, wireline, pumping, crane, jacks, Subsea wells will use a well intervention vessel with riser
3	Simple rig-based decommissioning - requiring retrieval of tubing and casing using a rig.
4	Complex rig-based decommissioning – may have poor access and poor cement requiring retrieval of tubing and casing, milling and cement repairs.



P&A and Slot Recovery Themes

Overview



PLANNING & DESIGN

MEASUREMENTS

STEEL

BARRIERS

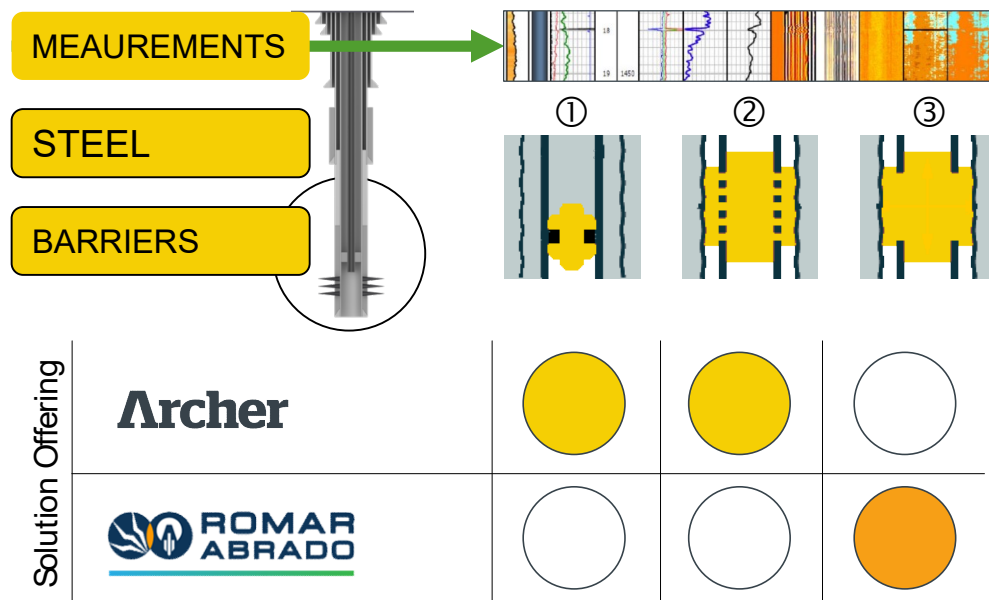
COMPLETION

OTHER (Niche & Novel)

MONITORING

Barricade® + Medusa® + Romar® = End-to-End Solutions

Drivers



Decision based on measurements for best barrier placement

CBL / VDL (mV) Interpretation						Ultrasonic (Mrayl) Interpretation		
1	2	3	4	5	6	1	2	3
9-5/8" 40 to 53.5ppf (Expected Free Pipe 57 mV when CBL tool is properly calibrated)	High Bonding Quality (Bond Index BI = 100%)	Transmitter firing Casing Formation Mud Amplitude (mV)	% of Bond Index (BI): Class Q/Insect Cement: 100% 1.7 to 3.7 mV Pozmix/Light Cement: 100% 3.2 to 6.2 mV	Weak / no casing arrivals + clear formation arrivals		>3.0 Mrayl Cement acoustic impedance	Echo amplitude time Internal radius Thickness Annular material impedance and cement map	Acoustic impedance map (brown track) is uniform/Homogenous, Good cement.
	Moderate Bonding Quality (Bond Index BI 90-60%)		% of Bond Index (BI): Class Q/Insect Cement: 60% 6.7 to 11.9 mV Pozmix/Light Cement: 60% 10.6 to 16.4 mV	Moderate contrast casing arrivals + Moderate contrast formation arrivals		2.6 - 3.0 Mrayl Solid/Liquid threshold	Channel	Isolated Pockets / channels / slightly heterogeneous
	Low Bonding Quality (Bond Index BI < 60%)		Frm: > 30 mV Cmt: > 20 mV CBL Amplitude drops at casing/collars & correlate peak signal with stand length	Strong casing arrivals + Weak / no formation arrivals (VDL signature is straight vertical lines)		0.5 - 2.6 Mrayl Liquid acoustic impedance < 0.5 Gas or dry micro annulus		Heterogenous / connected pockets and channels

- Low Bonding – easy to Perf, Wash and Cement
- Medium Bonding – Moderate with high chances to Perf, Wash and Cement successfully
- High Bonding – difficult to Perf, Wash and Cement / Section Milling to be considered

Barricade® - Perforate, Wash & Cement

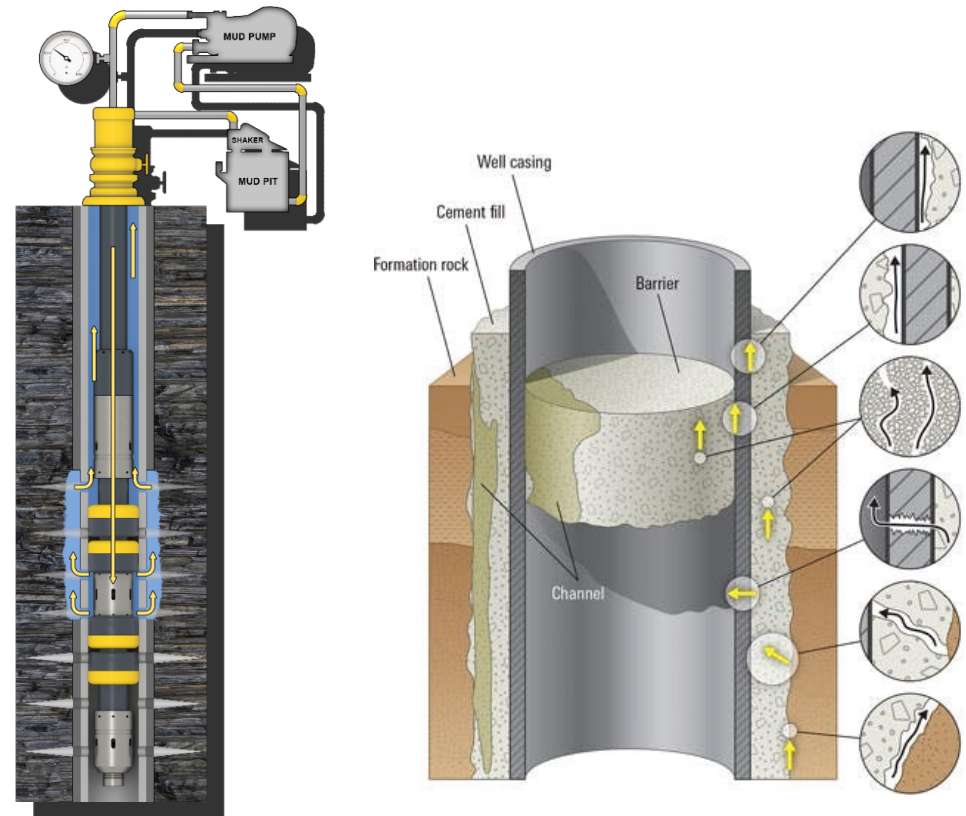
The Archer Method

Features and Benefits

- Time-saving
- Closed loop system for optimum use of hydraulic energy
- Traditionally used for loose annulus content
- Continuous service quality improvement

Typical length of interval

- Combining Primary and Secondary Barrier
 - 80 m to cover min 2 x 30 m
- Single Barrier
 - 50 m to cover min 1 x 30 m



SPE-210783-MS • Perforate, Wash & Cementing Technique Remediates Cemented Annulus to Achieve High Quality Bond Across the Entire Interval in Complex Slot Recovery Operation •
Bjørn Tore Torvestad – Fernando Zapata Bermudez

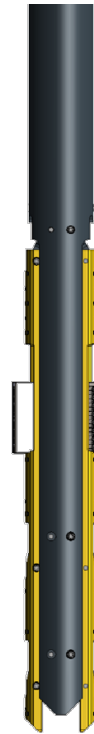
Medusa® - Section Milling Solutions

The Archer Method

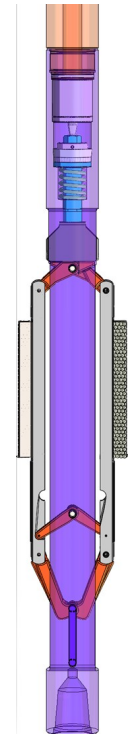
- Archer adds to their P&A and Slot Recovery portfolio with the acquisition of Abrado – an industry leader in Section Milling Solutions.
- Abrado's portfolio includes technologies for single-string, multi-string, and thru-tubing section milling. As well as bi-directional and swarf-less milling capabilities.
- These technologies join Stronghold® Barricade® (PWC) and THOR® (Cut & Pull), enabling Archer to deliver a complete solution for P&A barrier installation.



- Conventional Section Milling (Single Casing)



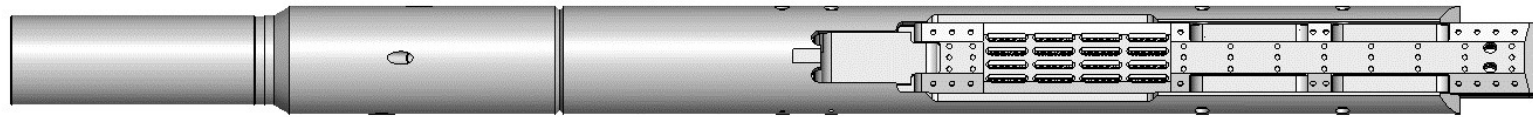
- **Medusa®** Multi-String Section Milling



- **Medusa® SLIM™** Thru-tubing Section Milling (In Development)

Medusa® Section Milling

The Abrado Technology



11.50" OD tool to mill 13 3/8" to 30" casings



8.25" OD tool to mill 9 5/8" to 16" casings



5.50" OD tool to mill 7" to 13 3/8" casings

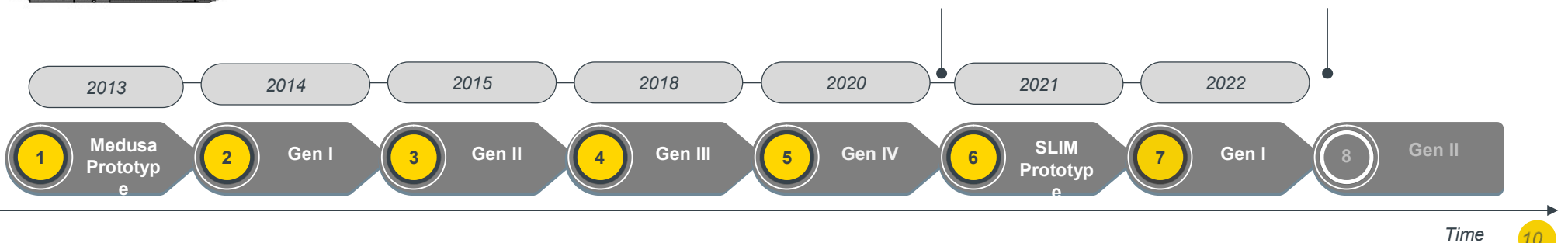


4.375" OD tool to mill 5 1/2" to 9 5/8" casings



Birth of SLIM

TODAY



ROMAR® - Surface Swarf handling

The ROMAR Surface Units

SS1000

- Increase performance and reliability of downhole operations
- Eliminate NPT related to plugged flow lines and cavities
- Hands-free and autonomous operation (HSE)

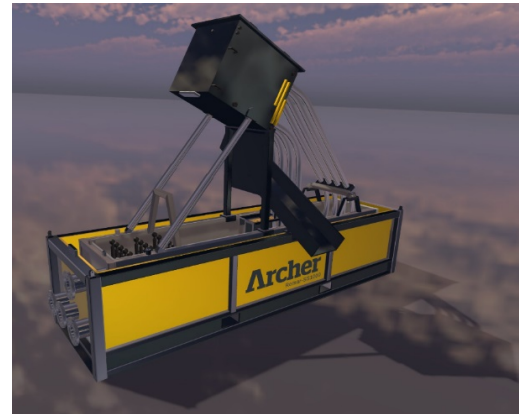
SS1000 Modular

- Smaller footprint
- Placed directly into flow line
- Breaks down and packs into shipping box that can be air freighted

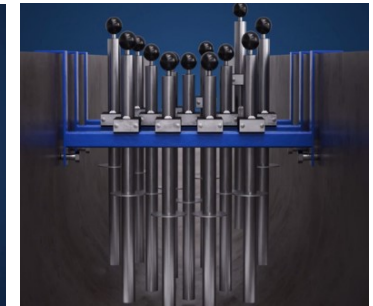
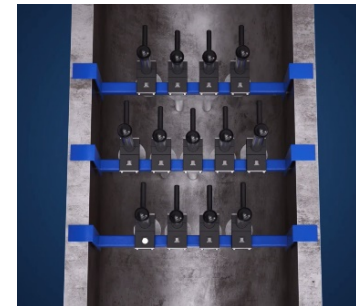
EZ-Clean Ditch Magnets

- Rods weigh 3.5 kg and can be lifted with one hand
- Swarf removed by retracting handle
- No manual wiping or scraping required (HSE)
- Modular frames can be customized to fit most applications

ROMAR SS1000 Swarf handling unit



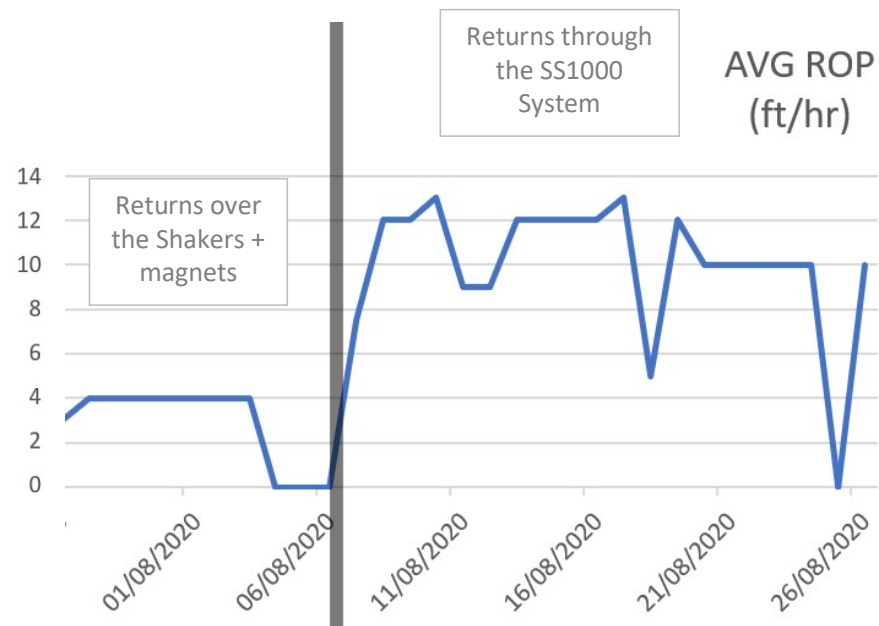
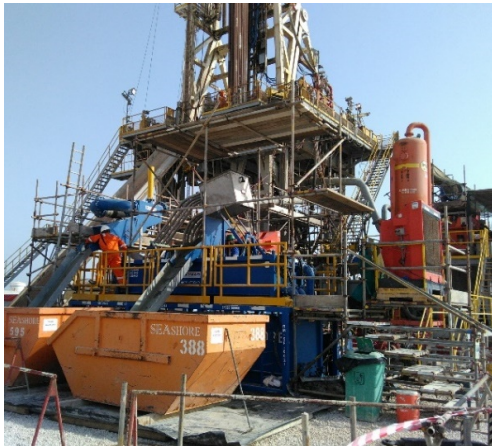
EZ-Clean Ditch Magnets



ROMAR® - SS1000 System - Performance Benchmarking

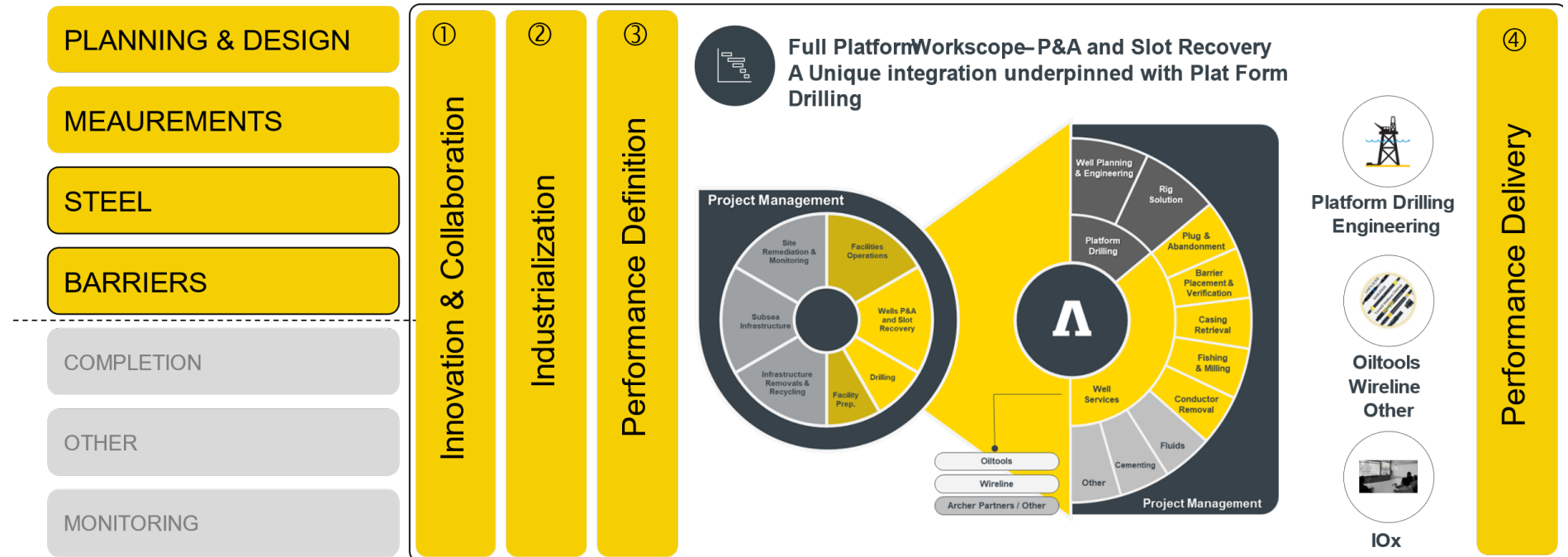
The ROMAR Surface Units

Romar's SS1000 system was mobilised to milling operations on the Ras Laffan Field in the Middle East. The rig milled 7" for a period before the SS1000 installation was complete. Thus, there is a direct comparison of milling performance between putting returns over the shakers vs the SS1000 system.



Archer P&A

Platform Drilling & Well Services



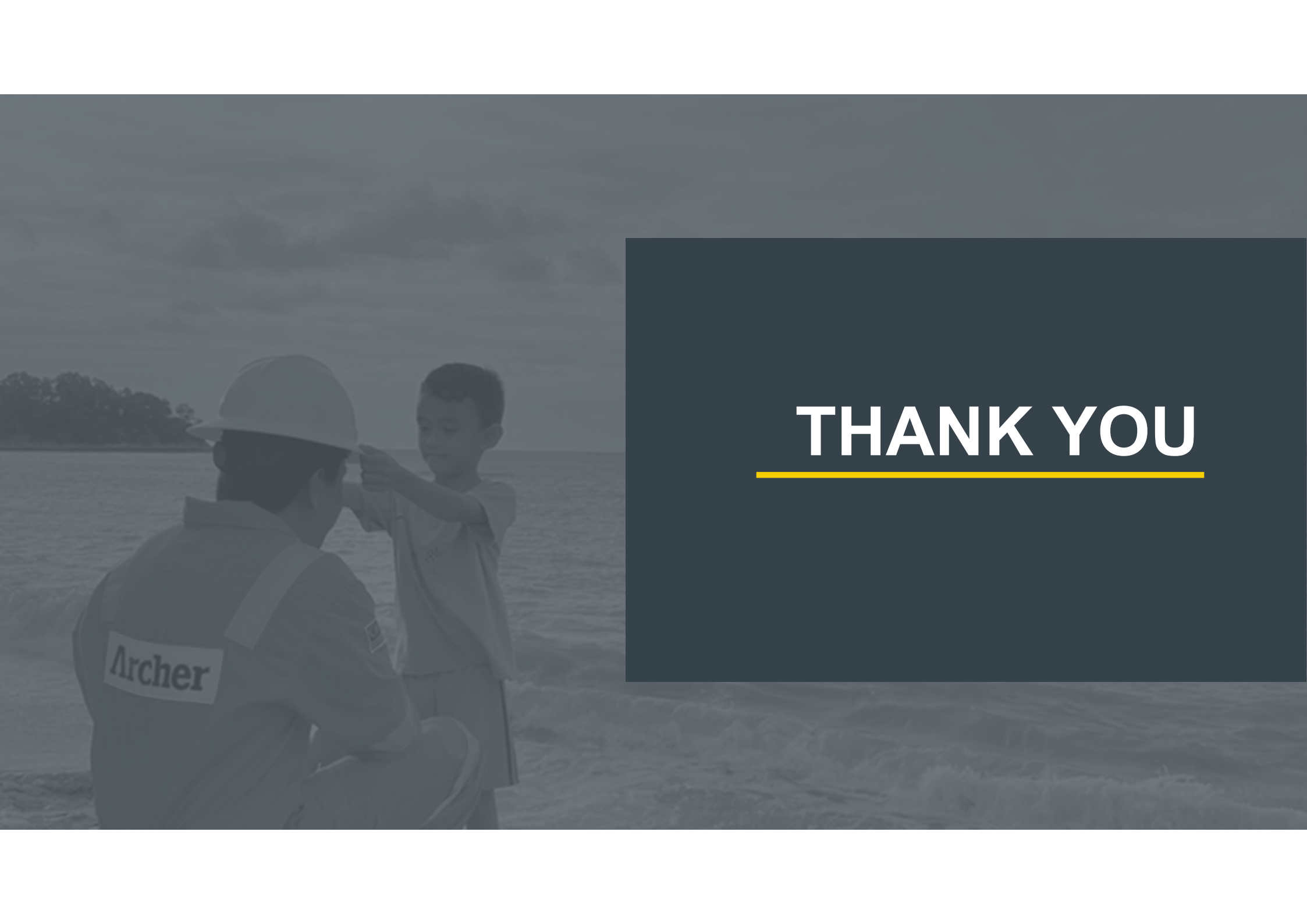
Develop & Deliver Products



Solutions – Optimize the Well Program



Optimize the Wells Campaign



THANK YOU
