

The Clarence Strait HDD of Bandar Abbas-Laft-Gevarzin Gas Transmission Pipeline



Presenter: **Suly Tang**

CEO – LIYAN Technologies / Drillmaster Trenchless

CONTENTS



Part 01

Project Overview

Part 02

Major Challenges

Part 03

Preparations

Part 04

Construction Process

Part 05

Significances



PART 01

Project Overview

Bandar Abbas-Laft-Gevarzin Gas Transmission Pipeline



- IGAT-7: 907km, connects east of Asalouyeh to Hormozgan.
- Branch line, 59km
- Client: NIGC
- Main Contractor: DSCO
- HDD EC: LIYAN
- Length: 2,970m
- TVD: 70m
- Pipe Spec: 30" Gas +6" FOC
- Formation: Clay/Sand
- Rig: 500T & 280T

Bandar Abbas-Laft-Gevarzin Gas Transmission Pipeline



- **Gas Pipeline**
- **Steel Grade: X65**
- **D762mm x WT19.05mm**
- **Welded in one complete piece**
- **Buoyancy Control & Roller**

Bandar Abbas-Laft-Gevarzin Gas Transmission Pipeline



- Busy shipping channel
- 500T rig at Laft (Qeshm Island); 280T rig at Pol (Bandar Abbas)
- Length – 2970m; TVD-70m

The background of the slide is a photograph of a pipeline construction site. A large, dark-colored pipe is laid out on a sandy, uneven ground. In the background, there are several high-voltage electrical transmission towers and power lines stretching across the horizon under a clear blue sky. The image is partially overlaid by a large red diagonal shape on the right side.

PART 02

PART 2

Major Challenges

Part 2 Major Challenges

I. Limited Geotechnical Info

- Only 3 boreholes
- No borehole along centerline
- Bridge geotechnical info
- 400-500m away from bridge



Part 2 Major Challenges

II. Seismic Belt



Shallow M4.9 Earthquake hit near Bandar Abbas in

Shallow M5.8 and M5.9 earthquakes hit southern Iran

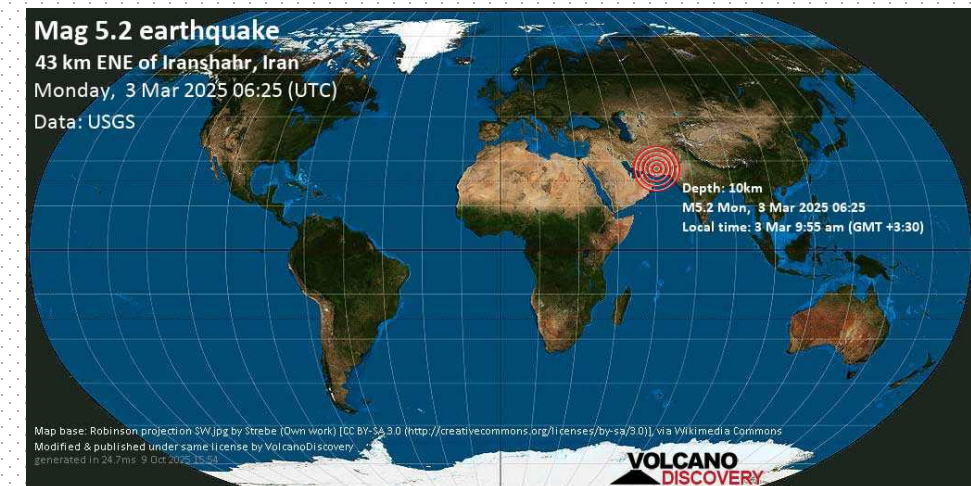


Magnitude 5.8 quake hits in vicinity of Iran's Qeshm island in the Gulf

By REUTERS
FEBRUARY 16, 2020 14:53
By REUTERS
FEBRUARY 16, 2020 14:53

A magnitude 5.8 earthquake hit in the vicinity of Iran's Qeshm island in the Gulf, the Fars news agency reported on Sunday.

- Mediterranean-Himalayan seismic belt
- Shallow/intermediate Destructive
- 5.3 magnitude earthquake during construction
- Reamer stuck downhole



III. Waves

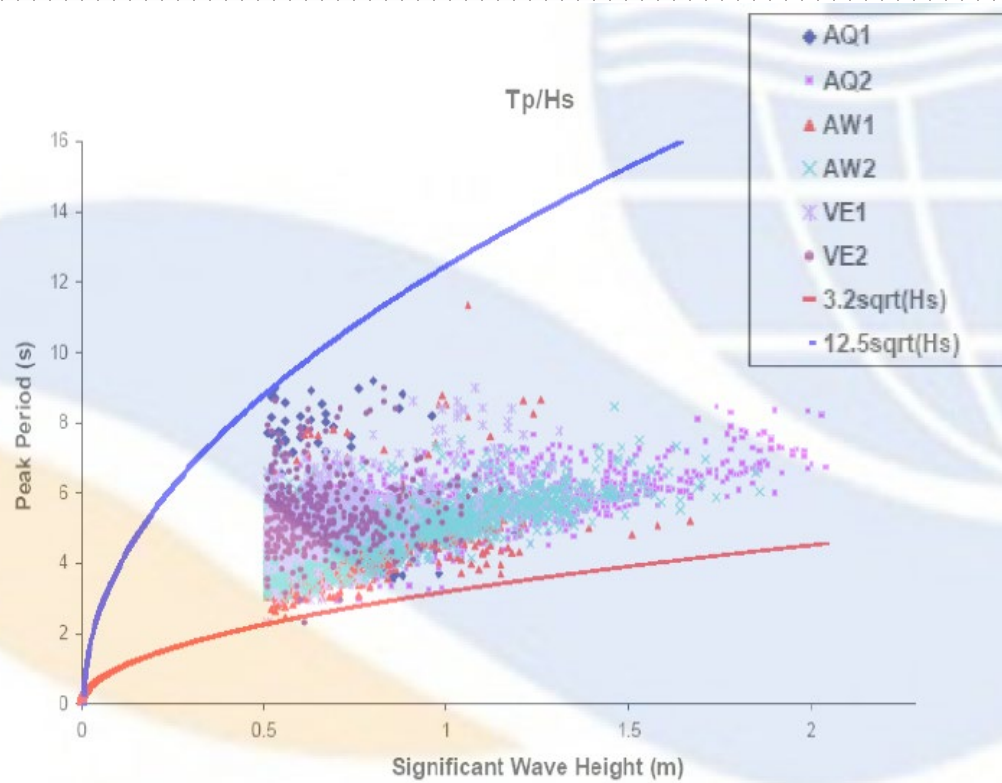


Fig. 1) Variation of peak wave period with significant wave height.

Above: Variation of peak wave period with significant wave height*

*Spectral Analysis of shallow water waves in Persian Gulf - Sam Mazahert, etl. Nov, 2010 第2页



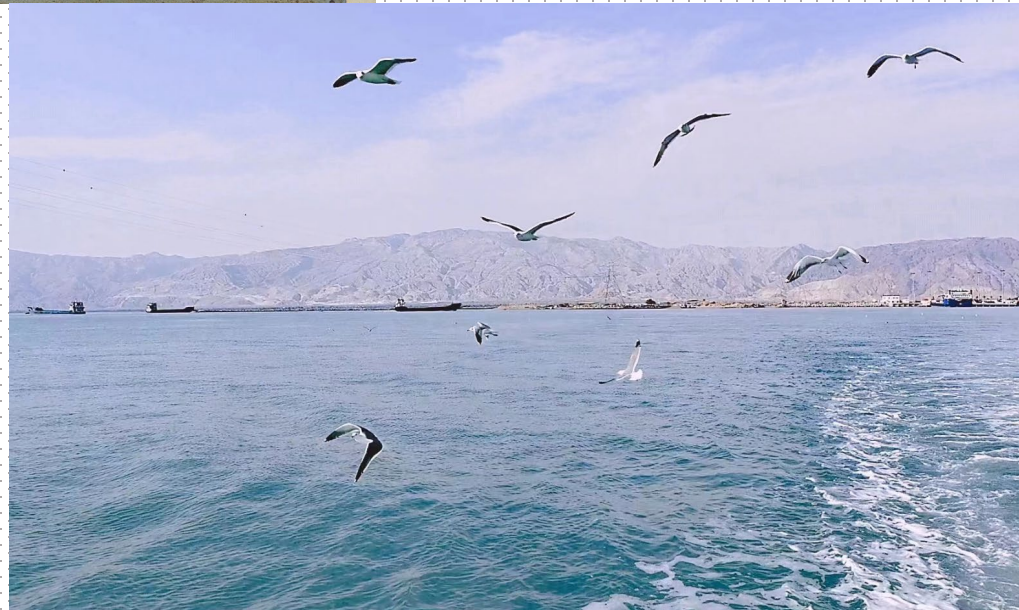
- Wave height at 0.5-2m in Q2/Q3
- Not available to set up BTS
- Above – Waves in crossing area

Part 2 Major Challenges

IV. Sensitive Environment



- UNESCO Global Geopark
- Wildlife habitat
- Channel & port for dual use
- Frac-out forbidden

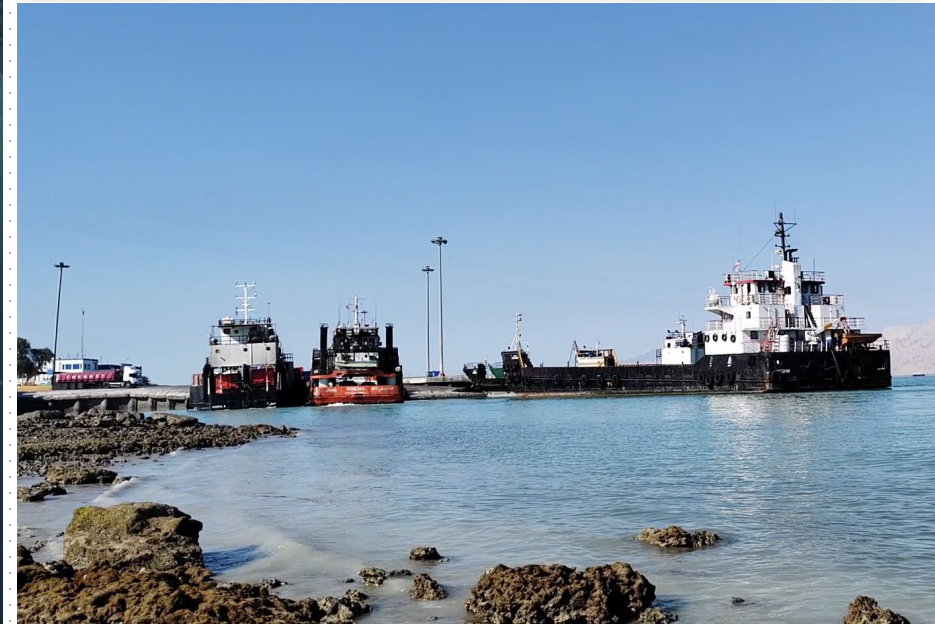


Part 2 Major Challenges

V. Magnetic Interference - Entry



- Ferry terminal, busy shipping
- 130m from entry to terminal
- Existing 16" pipe, 15m clearance
- Overhead HV cable



Part 2 Major Challenges

V. Magnetic Interference - Exit



- Overhead HV cable
- Ferry terminal, busy shipping
- Existing 16" pipe, 12m clearance



Part 2 Major Challenges

VI. Other Factors

- **Customs:** Lead time for mobilize
- **Political:** Limitation for tools
- **Climate:** Extreme hot (12hrs)
- **Geographical:** Lack of water
- **Religion:** Food





PART 03

PART 3

Preparations

I. Document - HDD MDR List

Document ID	Title	Status
IR-BALG-LP-001	HDD PRE-QUALIFICATION DOSSIER	Revision:03 Accepted for Construction
IR-BALG-LP-002	PLAN DRAWING OF CLARENCE STRAIT CROSSING	Revision:04 Accepted for Design
IR-BALG-LP-003	HDD MUD MANAGEMENT PLAN	Revision:02 Issued for Acceptance
IR-BALG-LP-004	DRILLING SEQUENCE PROCEDURE	Revision:00 Issued for Review
IR-BALG-LP-005	HDD GROUND SETTLEMENT AND HEAVE ANALYSIS	Revision:02 Accepted for Construction
IR-BALG-LP-006	CABLES STRING PULLING HEAD/PULLING ASSEMBLY DETAILS	Revision:00 Issued for Review
IR-BALG-LP-007	LONGITUDINAL PROFILE DRAWING OF NILE RIVER CROSSING	Revision:04 Accepted for Construction
IR-BALG-LP-008	SPECIFICATION FOR CLARENCE STRAIT CROSSING	Revision:04 Accepted for Design
IR-BALG-LP-009	HDD EQUIPMENT AND SPECIAL TOOLS LIST	Not reviewed by CPY
IR-BALG-LP-010	STRESS ANALYSIS IN HDD FOR CASING PIPE FOR HV CABLES	Revision:03 Accepted for Design
IR-BALG-LP-011	HDD STEERING AND MONITORING PLAN	Revision:03 Issued for Acceptance
IR-BALG-LP-012	HDD PULL BACK MECHANICAL CALCULATIONS	Revision:01 Accepted for Construction
IR-BALG-LP-013	STRESS ANALYSIS IN HDD FOR 30" STEEL WATER PIPE	Revision:03 Accepted for Design
IR-BALG-LP-014	PIPE STRING FABRICATION SITE LAYOUT	Revision:01 Issued for Review
IR-BALG-LP-015	HDD DRILLING FLUID HYDROFRACTURE ANALYSIS	Revision:03 Accepted for Construction
IR-BALG-LP-016	STRESS ANALYSIS IN HDD FOR STEEL PIPE FOR FOC CASING	Revision:02 Accepted for Design
IR-BALG-LP-017	STEERING REPORT	Revision:02 Issued for Review
IR-BALG-LP-018	HDD RIG DATASHEET	Revision:01 Issued for Information
IR-BALG-LP-019	PIPESIDE / EXIT POINT SITE LAYOUT	Revision:05 Accepted for Construction
IR-BALG-LP-020	HDD DRILLING MUD VOLUME AND POWER CALCULATIONS	Revision:00 Issued for Information
IR-BALG-LP-021	STRESS ANALYSIS IN HDD FOR 20" STEEL OIL PIPE	Revision:04 Accepted for Design
IR-BALG-LP-022	PIPE STRING PULLING HEAD/PULLING ASSEMBLY DETAILS	Revision:00 Issued for Review
IR-BALG-LP-023	RIGSIDE / ENTRY POINT SITE LAYOUT	Revision:05 Accepted for Construction
IR-BALG-LP-024	MUD BREAKTHROUGH AND DISPOSAL PLAN	Revision:00 Issued for Review
IR-BALG-LP-025	PIPE STRING OVERBEND ARRANGEMENT AND LIFTING DETAIL	Revision:00 Issued for Review
IR-BALG-LP-026	HDD CONSTRUCTION ENVIROMENTAL MITIGATIONS PLAN	Revision:01 Accepted for Construction
IR-BALG-LP-027	HDD INSPECTION AND TEST PLAN	
IR-BALG-LP-028	PIPE STRING CONVEYOR/ROLLER DETAILS	Revision:00 Issued for Review
IR-BALG-LP-029	PIPE STRING INSTALLATION DETAILS	
IR-BALG-LP-030	METHOD STATEMENT OF CLARENCE STRAIT HDD CROSSING	Revision:02 Issued for Review
IR-BALG-LP-031	HDD ANCHORAGE CALCULATIONS	Revision:00 Issued for Review
IR-BALG-LP-032	HDD STRING INSTALLATION PROCEDURE	Revision:00 Issued for Review
IR-BALG-LP-033	MONITORING PLAN FOR PRESENCE OF SHALLOW GAS	Revision:00 Issued for Review
IR-BALG-LP-034	HDD CONSTRUCTION RISK REGISTER	Revision:00 Issued for Review
IR-BALG-LP-035	Technical Note for Design of Mud Pits	Revision:02 Accepted for Construction
IR-BALG-LP-036	HDD Execution Plan	Revision:02 Accepted for Construction
IR-BALG-LP-037	SECTION DRAWING OF CLARENCE STRAIT CROSSING	Revision:04 Accepted for Construction
IR-BALG-LP-038	NOISE MODELLING REPORT OF HDD CONSTRUCTION	Revision:05 Accepted for Construction
IR-BALG-LP-039	Method Statement for Magnetic Sources Setup and Maintenance during HDD Steering Operation	Revision:00 Issued for Review

A total of **39** documents submitted, incl 9 engineering, 25 construction, 4 HSE and 1 quality.

- International guideline
- Wide coverage
- Detail calculation & analysis

I. Document - International Guideline



Catalog No. PR-277-144507-E01

INSTALLATION OF PIPELINES BY HORIZONTAL DIRECTIONAL DRILLING, AN ENGINEERING DESIGN GUIDE

CNST-1-3

Contract PR-277-144507

Contractor Project Number: 1505

Prepared for the

Design Materials & Construction Technical Committee

Of

Pipeline Research Council International, Inc.

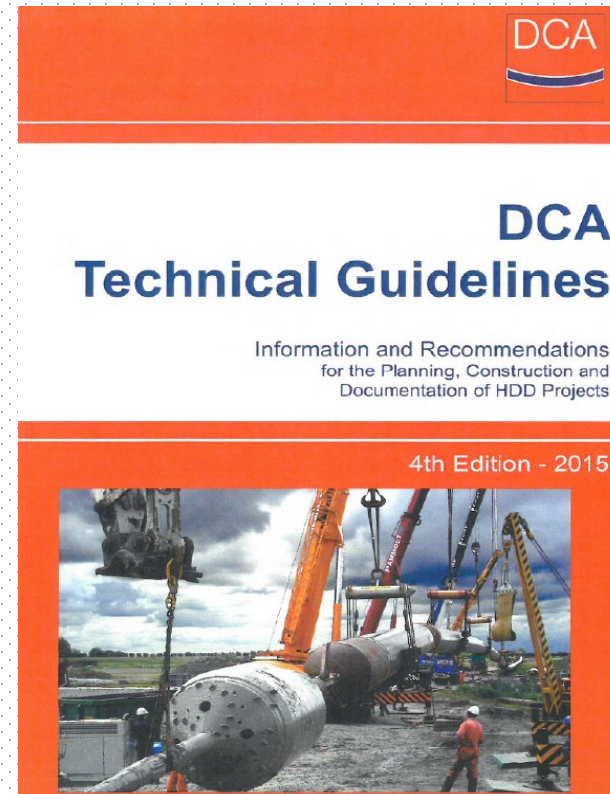
Prepared by the following Research Agencies:

J. D. Hair & Associates, Inc

Release Date:

September 23, 2015

PRCI

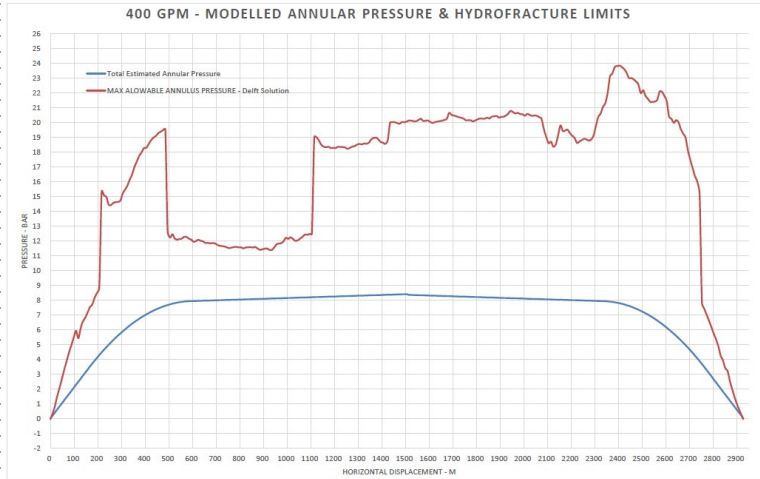


DCA-Europe

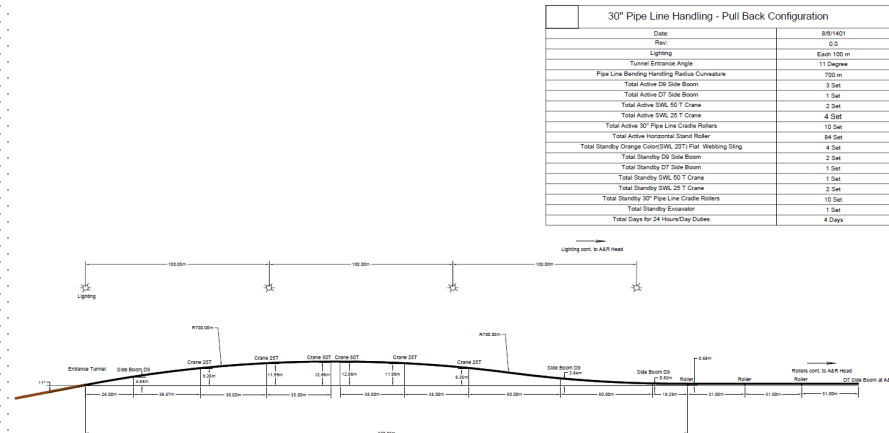
Part 3 Preparations

I. Document - Wide coverage

$$P_{lim} = u + [\sigma'_o(1 + \sin\varphi) + c \cdot \cos\varphi + c \cdot \cot\varphi] \left[\left(\frac{R_o}{R_{p,max}} \right)^2 + \frac{\sigma'_o \cdot \sin\varphi + c \cdot \cos\varphi}{G} \right]^{\frac{-\sin\varphi}{1+\sin\varphi}}$$

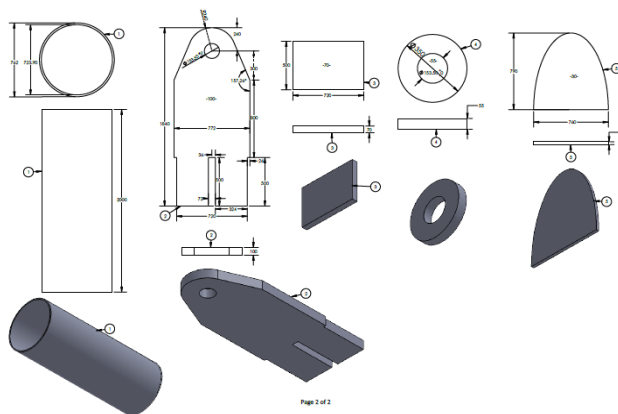


30" Pipe Line Pull Back - 11° Entrance Lifting Diagram



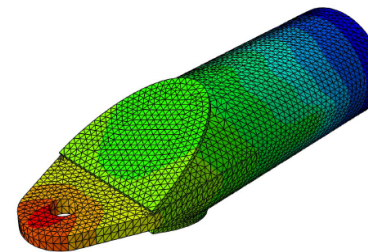
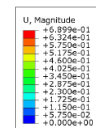
- Frac-out analysis
- Anchorage cal.
- Steering Plan
- Pull head cal.
- Shallow gas
- Overbend analysis

Pull Head 30" OD x 0.75" THK x 450T Swivel x G2140-300T Crosby Shackle



Printed using Abaqus/CAE on: Sun Aug 28 08:46:27 Iran Daylight Time 2022

SIMULIA



COB: Job-1.osb Abaqus/Standard 6.14-1 Sun Aug 28 08:34:55 Iran Daylight Time 2022
 Step: Step-1
 Increment: 11: Step Time = 1.000
 Primary Var: U1 Magnitude
 Deformed Var: U Deformation Scale Factor = 1.000e+00

I. Document – Pull Force Calculation

As per PRCI & NSO

Pipe Installation	Pull Force F_{pipe} [MT]	Calculated F_{inst} [MT]
30in Gas Pipe	210.373	210.373
	Max. Pull Force	210.373

Pipe Installation	Pull Force F_{pipe} [MT]	Final Pull Force F_{inst} [MT]
30in Gas Pipe	210.373	262.97
Required Pull Force for HDD Rig (1.25 times of F_{inst})		262.97

- **Soil Friction:** $\mu_{soil} = 0.3$ (0.2-0.4)
- **Mud Density:** $W_{mud} = 1150 \text{ kg/m}^3$ (1078-1318 kg/m^3)
- **Fluidic Drag:** $\mu_{mud} = 300 \text{ N/m}^2$ (PRCI 172 N/m^2)
- **Roller Friction:** $\mu_{roller} = 0.1$

Description	Symbol		Value
Horizontal length of crossing	L_h	=	2948.095 m
Depth of crossing w.r.t RL	$Depth$	=	69 m
Angle of entry of pipe string	θ_{in}	=	11 deg
Angle of exit of pipe string	θ_{out}	=	11 deg
Radius of curvature (pipe side)	R_{in}	=	2000 m
Radius of curvature (rig side)	R_{out}	=	2000 m
Entry height w.r.t RL	h_{in}	=	5.09 m
Exit height w.r.t. RL	h_{out}	=	4.61 m

Part 3 Preparations

II. Equipment & Labor - Rig



Drillto ZT-280 HDD Rig



Drillto ZT-500 HDD Rig

II. Equipment & Labor - List

Item	Description	Model	Qty	Remark
1	Mud Pump	CBW-2800	2 sets	Elephant
2	Mud Recycling System	GN	2 sets	GN Solids
3	Generator	300kw	2 sets	JIMEI
4	Magnetic Guidance System	ParaTrack	2 sets	Vector Magnetics
5	Drill Pipe	6-5/8"FH	350 pcs	Drillto
6	Drill Pipe	7-5/8"FH	70 pcs	Drillto
7	Barrel/Fly-cutter Reamer		2 sets	Drillto
8	Split-bit hole opener		4 sets	HTI
9	Mud Motor	ABH-2°	2 pcs	Prime Horizontal
10	MT Tricone Bit	12 ¼"	2 pcs	Kingdream

II. Equipment & Labor - List

Site Organization

Item	Position	Qty	Remark
1	HDD Manager	2	Day/Night shift
2	Driller	4	Day/Night shift, Entry & Exit
3	Steering Engineer	4	Day/Night shift, Entry & Exit
4	Mud Engineer	2	Day/Night shift, Entry & Exit
5	Mud Man	4	Day/Night shift, local
6	HSE	2	Day/Night shift, local
7	Quality Inspector	2	Day/Night shift, Entry & Exit
8	Crane Operation	4	Day/Night shift, Entry & Exit, local
9	Mechanics/Electrician	2	Day/Night shift, Entry & Exit
10	Roughneck	6	Day/Night shift, Entry & Exit, local

Part 3 Preparations



II. Equipment & Labor - Site



Part 3 Preparations

III. Site Preparation

Entry/Exit Site Layout



III. Site Preparation

Entry Side Main HDD Rig



III. Site Preparation

Exit Side Auxiliary HDD Rig



Part 3 Preparations

III. Site Preparation - Anchorage

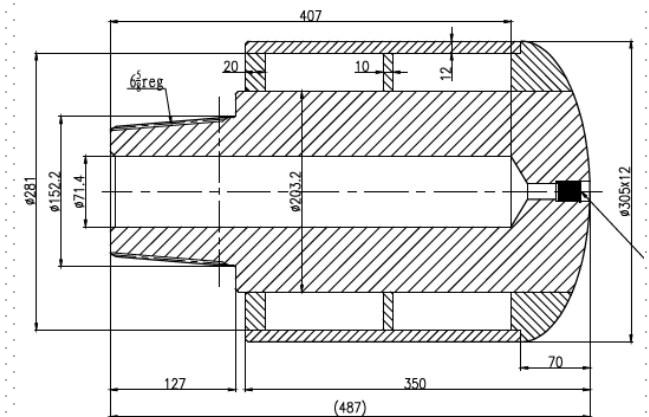


- Removeable vibration hammer
- Dual pile sheet - WRU13
- Steel grade - S275
- Anchoring length – 12m
- Concrete - C25/30

III. Site Preparation – Casing Installation



- 90m 20" casing at both sides
- Installation - Forward reaming
- 12in bull nose + 24" reamer + 22" centraliser



Part 3 Preparations

III. Site Preparation – Casing Installation



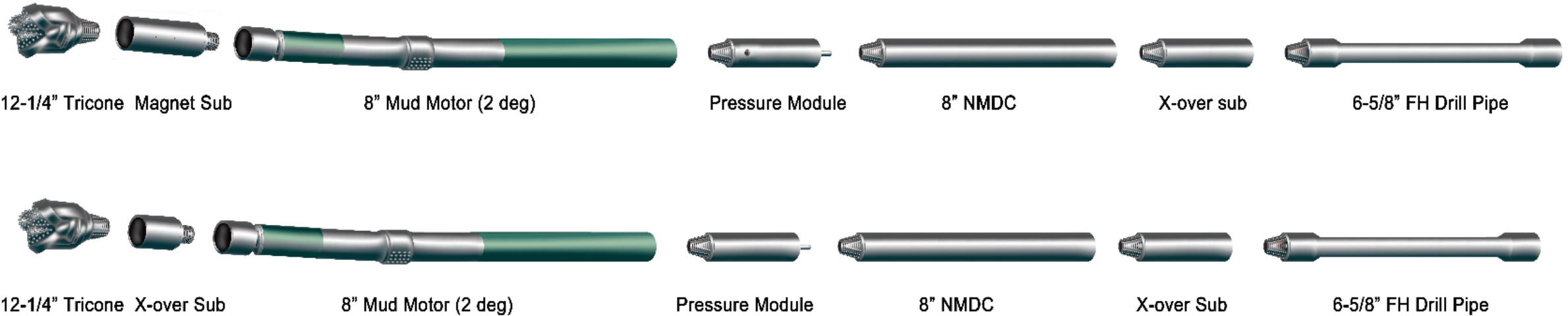
A large yellow horizontal directional drilling (HDD) rig is shown in operation. A long, silver-colored drill pipe extends from the rig into a deep, rectangular trench filled with sand. The rig is mounted on a concrete base. In the background, there are yellow storage containers and a clear blue sky.

PART 04

Construction

Part 4 Construction Process

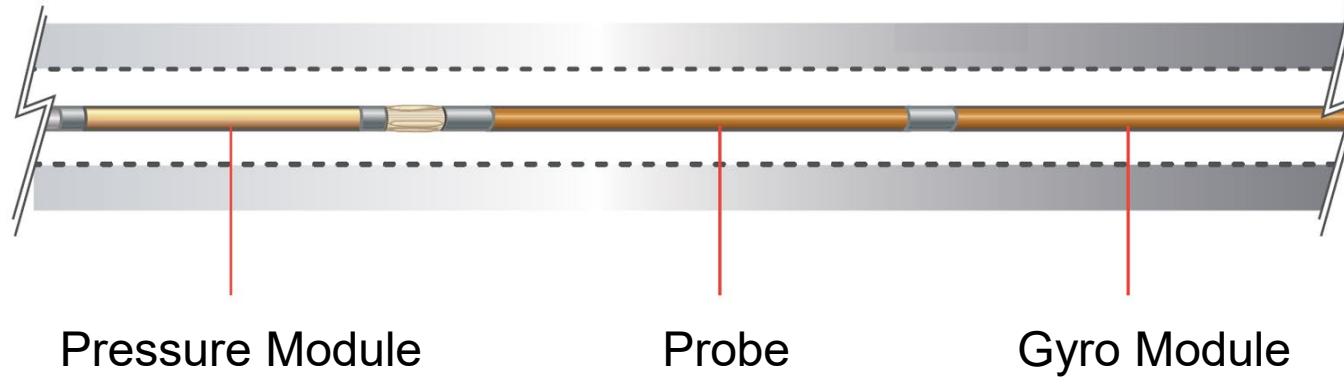
I. Pilot hole - BHA



- Magnet sub as part of BHA, installed at the beginning, no need to trip out.
- Prevention for frac-out: big drill bit, pressure module to record annular pressure

Part 4 Construction Process

I. Pilot Hole – Steering Tool Kit

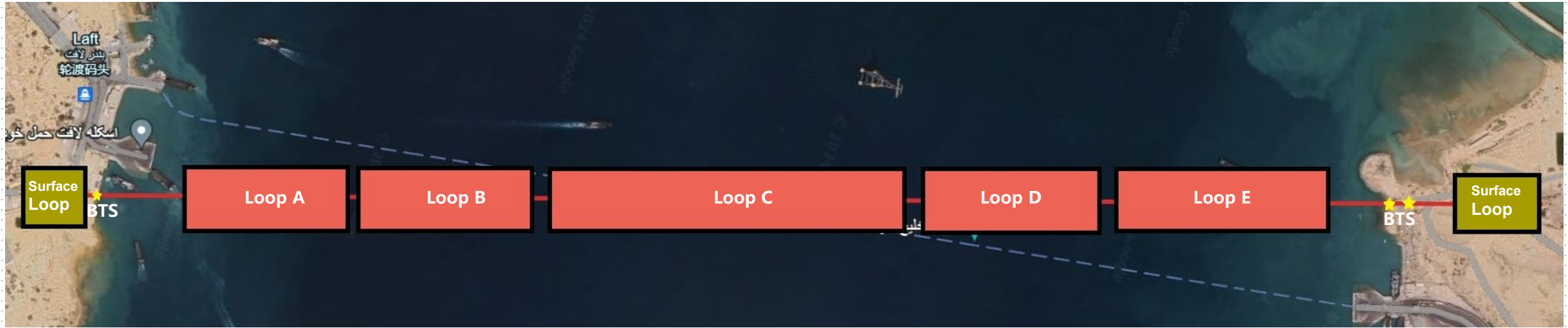


Gyro accuracy:

- Inc.: $\pm 0.02^\circ$
- Az.: $\pm 0.04^\circ$
- TF: $\pm 0.5^\circ$

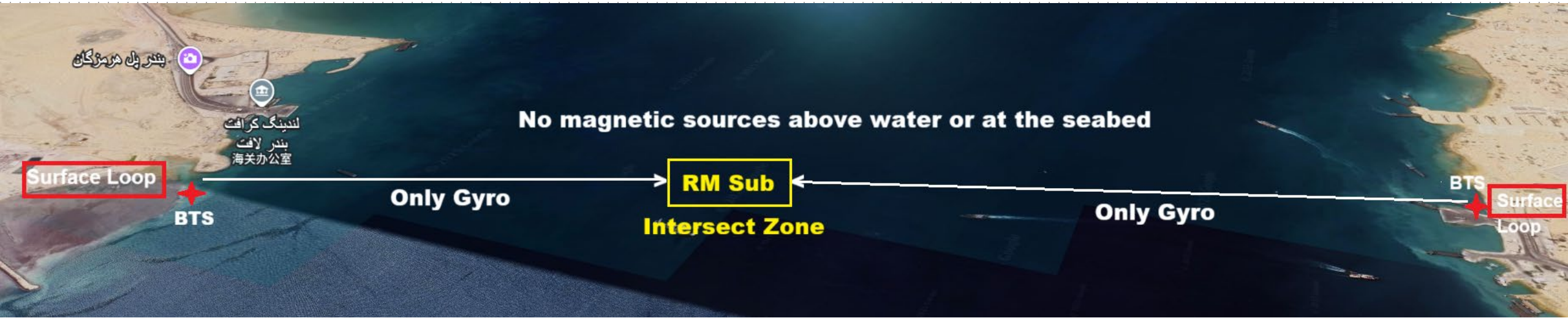


I. Pilot Hole – Steering Plan (Phase I) June, 2023



- Magnetic Sources: Surface loop (90m/205m) + BTS (90m/290m) + Seabed loop (50x100m-ABDE)
- Gyro module as secondary verification
- Loop C was intersect area (50x400m)
- Both FOC and gas pipe pilot holes were successfully intersected at one time.

I. Pilot Hole – Steering Plan (Phase II) March, 2025



- Magnetic Sources: Surface loop (90m/205m) + BTS (90m/290m). No sources above or down water.
- Gyro module in water area for both pilot holes
- Rotating Magnet Sub used in the intersect zone (Accuracy: 70m).
- Successfully intersected with RM sub (Active Magnetic Ranging).

Part 4 Construction Process

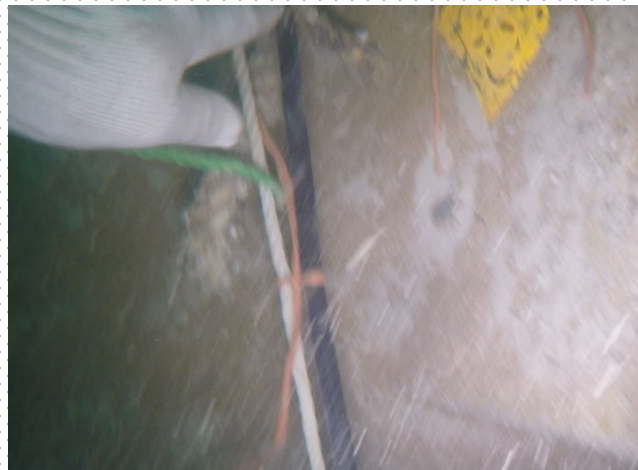
I. Pilot Hole – Steering Plan

Concrete block as coordinate for seabed loop



I. Pilot Hole – Steering Plan

Diver checked seedbed loop



I. Pilot Hole – Steering Plan

BTS Setup



I. Pilot Hole – Steering Plan

Phase I Pilot holes by PMR Intersection



Above: Pilot hole for gas pipe successfully intersected and punched out



Left: Pilot hole for FOC successfully intersected and punched out

Part 4 Construction Process

I. Pilot Hole – Steering Plan

Phase II Pilot hole by AMR Intersection



Top Left: Measuring the length of bit and RM sub

Top Middle: Calibrating the RM sub

Top Right: Running RMRS software for ranging

Down Left: Running P2 and Gyro Shot

Left: Pilot hole for FOC successfully intersected and punched out

I. Pilot Hole – Steering Plan

**Phase II Pilot hole
successfully intersected on
Mar 16, 2025 with RM sub.**

**Right: RM sub wi/ tricone bit
entered the casing and came
out at exit side.**

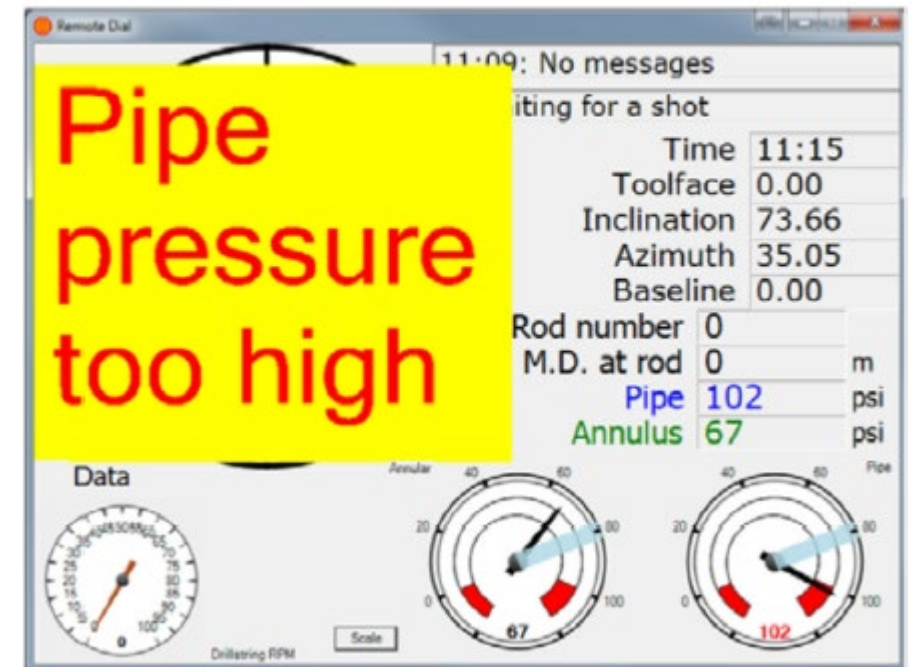


Part 4 Construction Process



I. Pilot Hole – Frac-out Preventions

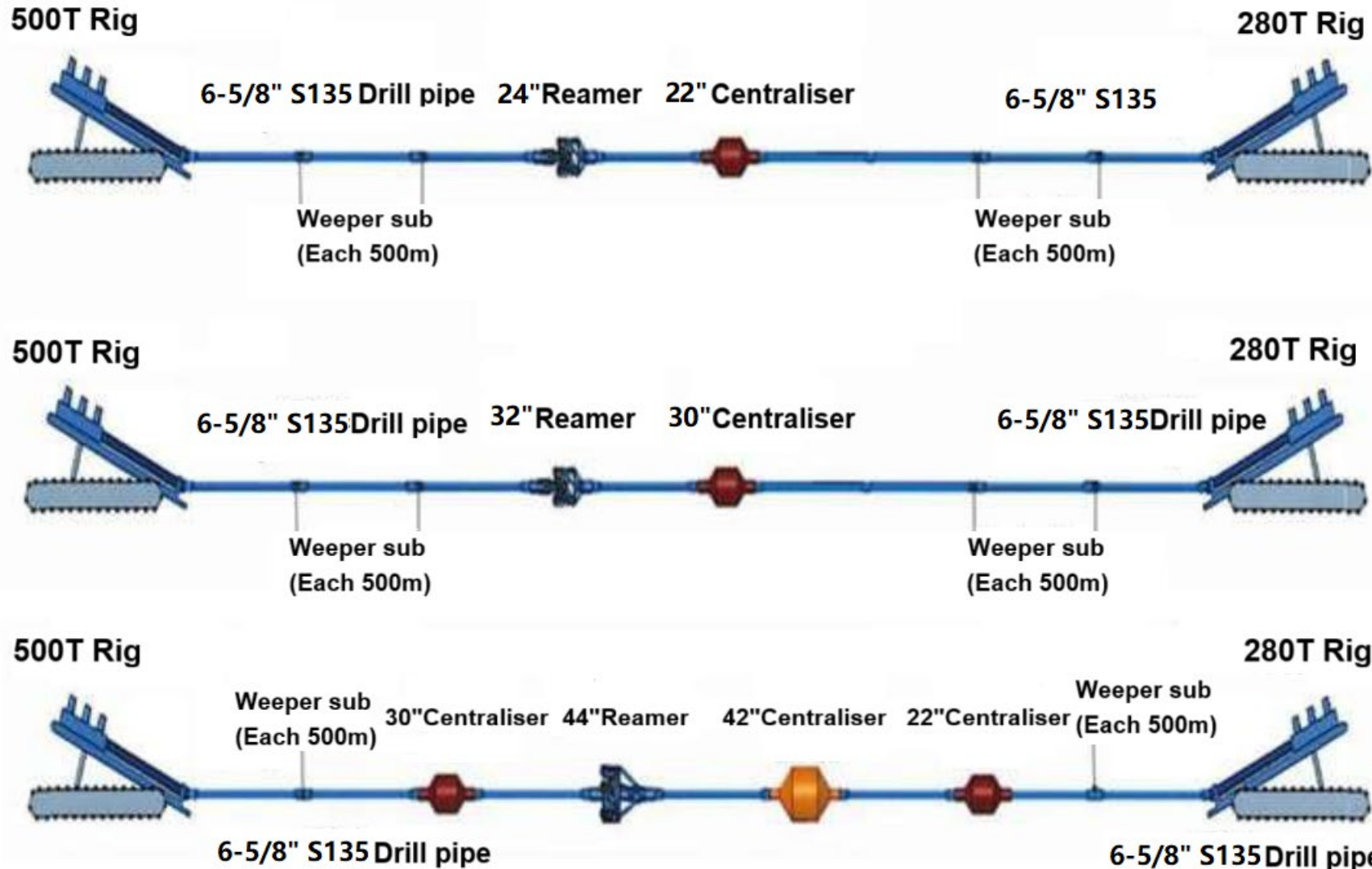
1. Intersect method to reduce frac-out risk
2. To install casings at both side (90m), to segregate bad layer
3. Hydro-fracture Analysis (Deft Equation)
4. Pressure module to monitor annulus
5. Routine check along centerline with drone
6. Strictly abide by Mud Management Plan



Right: Annular pressure monitoring

II. Reaming Operation

Three Passes of Reaming(24" /32" /44")



Part 4 Construction Process

II. Reaming Operation

Reamers



II. Reaming Operation



- **Simultaneous Reaming**
500T rig – back ream(Pull)
280T rig – coordinated
- **FOC casing not as return**
Float valve sub used
to pump from either side

II. Cleaning Operation



- Left: 42inch cleaning
- Running two passes of cleaning before final product pipe pullback.



III. Pullback – FOC

Pullback in one piece (3000m)



On July 15, 2023, after 36hrs pullback operation, FOC casing was successfully installed.

III. Pullback – Gas Pipe (Phase II)



Gas pipe pullback in one piece with buoyance control



Pulling Force: Initial pulling force **160 tons** (maximum), average pulling force **134 tons**.

III. Pullback – Gas Pipe (Phase II)



On Jun 12, 2025, after 38hrs operation without assisted equipment, 30in gas pipe successfully installed.



PART 5

Significance

I. Jointly fulfill Belt & Road Initiative to promote connectivity



LIYAN' s trenchless footprint in the Middle East after SE Asia.

Overcame plenty of difficulties to complete the project.

Client gave trust and support to make construction smooth.

II. Concerns from all parties, with sound strategic and economic significance



Minister of Petroleum



State-level representatives



Local government & 3rd party



III. Create record for local longest HDD

Iran to set up underwater pipeline to supply gas to Qeshm Island

TEHRAN, Iran, Jan.17

Trend:

Iran Gas Engineering and Development Company is working on laying an underwater pipeline to supply gas to Qeshm Island, said the Managing Director of the company Reza Nowshadi, **Trend** reports citing ILNA.

The 30-inch Bandar Abbas- Laft- Gevarzin pipeline will transfer gas via the Persian Gulf waters to Qeshm Island, Nowshadi noted.

Iran Gas Engineering and Development Company is using Horizontal Directional Drilling HDD in this project.

"The necessary equipment has been purchased, and HDD machines will be installed in the region in the next two months," Nowshadi explained.

The supplied gas will be used to feed Qeshm power plant, the industrial city there as well as a number of factories.

- **Completed under complex layer**
- **Huge magnetic interference**
- **Overcame extreme climate**
- **The longest HDD in local area**

IV. Multiple breakthroughs & Leading the innovation of Trenchless Technology

- First time to install seabed loops (4↑100X50m; 1↑400X50m)
- The application and verification of gyro module in long distance HDD
- The application of pressure module to monitor annulus in long distance HDD
- The application of RM sub in long distance HDD intersect without magnetic sources in water (Phase II)
- To pull back one complete 3000m pipe with one rig, without assisted device

Thank you!



If further information required,
please feel free to contact Suly Tang

WhatsApp: **+86-17267491525**

Email: suly@liyanbiz.com