

HDD – Five Shore Approaches Successfully Delivered



Arendal

EXECUTION YOU CAN TRUST

Company Overview

- ▶ Arendal is a company specialized in EPC solutions based in Monterrey Mexico, founded in 1995 with a solid corporate governance, with an exceptional track record as well as vast experience in complex projects for oil and gas, infrastructure, and power
- ▶ Focused in the development of energy projects with presence in all oil & gas value chain: **Upstream, Midstream, Onshore/ Offshore** and **Downstream**
- ▶ 125 + Projects executed throughout Mexico since its inception, all of them finished on time, within budget scopes. Arendal has access to innovative construction methods and focus on efficiency and last generation equipment
- ▶ Arendal is a Mexican company that has participated the most in pipeline construction in Mexico
- ▶ We integrate solutions that meet the requirements of our clients in quality, safety, due time and proposed form
- ▶ Working in the most extreme conditions, we contribute to energy production of the country, always using tools and procedures that respect the environment and marine habitat
- ▶ We are the largest contractor of Horizontal Directional Drilling in Latin America, owning one of the largest drillers in the world



Project Description

Our client has under development a production contract with the Mexican oil and gas development authority, for one of the oil fields located in the coast of Tabasco. This field is located approximately 30 km from the coast and covers an area of 39,598 km²

Arendal's scope of work include the execution of:

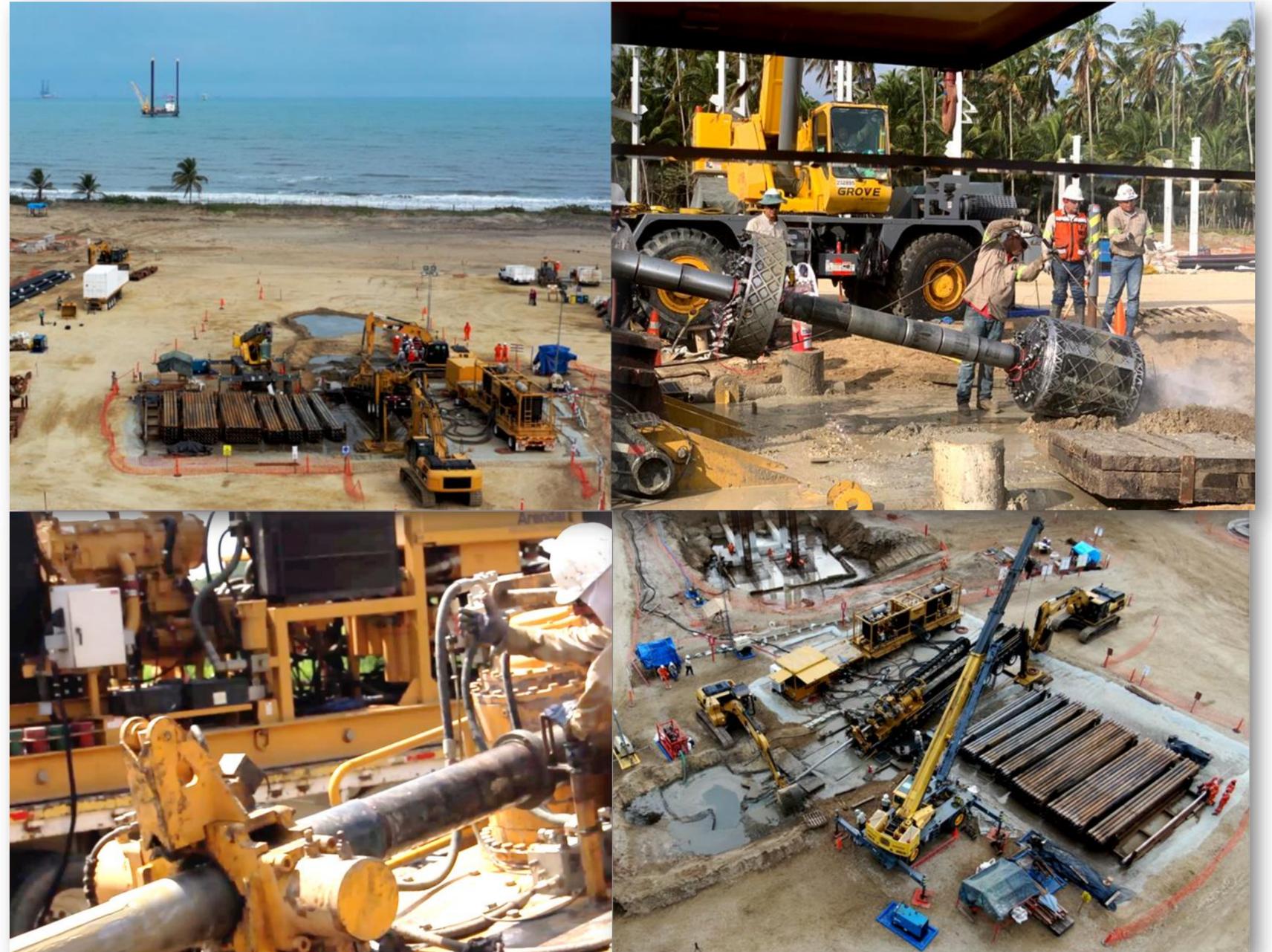
5 shore approach crossings using 10, 12, 14, 16 and 24 "Ø horizontal directional drilling, all with a length of approximately 1,200 meters

Lift boat, supply boats and diving support was provided by our client

This work was a high priority for our client because it is the final stage in order to be able to connect marine production and service pipelines between the offshore platform and the onshore facility.

Main Challenges

- ▶ Zero accidents
- ▶ Coordination for optimal management of working time windows due to impacts of meteorological conditions
- ▶ Constant coordination between the client and Arendal to ensure timely completion and optimization of resources
- ▶ Caring for the environment through a bentonite mud management strategy



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Optimized Traditional Directional Drilling Execution

The traditional process of executing this type of shore approach crossings, is to drill the pilot hole and subsequently carry out a minimum of 2 reaming passes and 1 cleaning pass of the drilled hole before performing the pullback.

Execution involves the use of at least 1 barge-type vessel in order to store, mainly drill pipe, accessories and tools at sea during drilling maneuvers.

Typically, the execution time of a 1,200 meter crossing can take several work days, as follows:

- ▶ 3 days for pilot hole drilling
- ▶ 6 days for reaming passes (2)
- ▶ 1 day for cleaning pass
- ▶ 1 day for offshore tool change
- ▶ 1 day pullback

10 to 12 days of work for each crossing, according complexity

The consumption of bentonite for mud production during the drilling process is mainly a function of the reaming and cleaning passes to be carried out.

From an environmental point of view, the high volume of mud production involves a complex structure of control over the handling and disposal of mud.

Our Innovative Strategy Results

For this project, Arendal designed an innovative process for the execution of the drilling and pulling works of the pipeline called “**pullback & reaming**” or “**two steps**”, which consists of:

- ▶ A pilot hole drilling process only with an average diameter of 14”Ø
- ▶ When the drilling is completed at the projected point, carry out the pull-back process of the pipe to be installed, doing it simultaneously “cutting and pulling” on a diameter of up to 36”Ø.

This innovative process enabled the Arendal work team to complete the drilling work of five Shore Approach in a record time of 5 equivalent work shifts on average for **each crossing**.

The days taken to drill 1,200 m was as follows:

- ▶ 3 for pilot hole drilling
- ▶ 1 for offshore tool change
- ▶ 1 to perform the "pullback & reaming"

5 days of work for each crossing

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Grounding some numbers

	Traditional	Contractual Schedule	Actual Performance	Comments
Shore Approach Execution	75 days (all 5 shore approaches)	10 to 12 days per shore approach crossing of 1,200 meters 55 days (all 5 shore approaches)	5 days per each Shore Approach crossing 25 days (all 5 shore approaches)	Worldclass performance in Shore Approach execution
Vessel Optimization	85 days	65 days	35 days	Our client significantly saved vessel utilization due to the shortened schedule. Given present weather conditions, associated risks were also significantly reduced.
Bentonite Mud Usage	1,346 ton	680 ton	278 ton	We maintained zero environmental impact
HSE Objectives	Physical integrity of workers and do no harm to the environment	Zero accidents Zero environmental incidents	Zero accidents, incidents, first aids, etc. Zero environmental incidents	Arendal's yearly safety award achieved by this project

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Main Benefits

- ▶ Infrastructure availability **earlier** than planned.
- ▶ Cost reduction for both Arendal and our client who supplied the vessels for the offshore activities.
- ▶ Less time to perform, **less risk** of tunnel collapse.
- ▶ Significant reduction of **bentonite usage and mud disposal** with respect to both traditional drilling procedures and our contractual schedule.
- ▶ Due to the **extreme weather season** conditions and waves over **5 meters height**, this innovative process allowed us to take advantage of short working time windows to coordinate the offshore vessel and execute complete activities
- ▶ **24-hour close coordination** between the onshore, Arendal, and offshore, client, teams for activities such as changing the drilling tool and pulling the pipelines, temporarily placed at the bottom of the sea, towards land.

