SUBMARINE CABLE PROJECT SHALLOW WATER INSTALLATION SOLUTIONS

Haixin Sun, Jas Dhooper, Hao Chen, Yasheng Ma (Huawei Marine Networks Co., Ltd.)
Email: sunhaixin1@huawei.com

Huawei Marine Networks Co., Ltd.), 5F-B2, TEDA MSD, No.62, Second Avenue, TEDA, Tianjin, China 300457

Abstract: In the year of 2016, a fiber optic submarine cable was successfully delivered by HMN in the Caribbean Sea. The marine solution for this extreme shallow water deployment was done within an active ferry barge route and the strict regulatory environmental protection requirements. These factors formed great challenges to the project. The project was indeed unique in many ways, that resulted in very limited practical options for implementation. This paper describes the challenges we met in the project and how we navigated the complexity during installation, which can be treated as references for other shallow water installation projects.

1. INTRODUCTION

In the year of 2016, a newly-build fiber optic submarine cable system was successfully delivered in Caribbean Sea. The System snakes 24 kilometers across a shallow bay (refer to Figure 1). Extremely shallow water depth within whole route over long distance, ferry barge route crossings threats and strict environmental protection requirements formed great challenges to the project. The project was so unique that only a single solution could be used to accomplish the mission. This paper describes the challenges we met in the project and the solutions we took during installation, which can be treated as references for other shallow water projects installation operations.

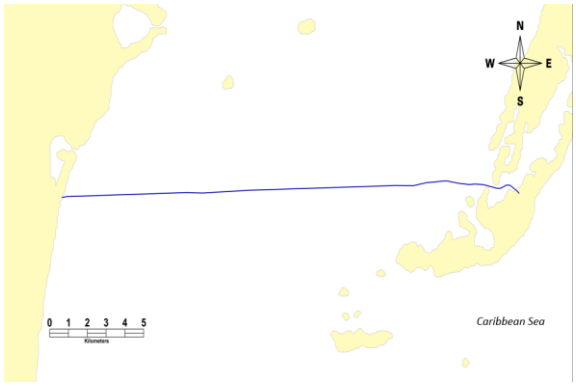

Figure 1: Cable Route

2. CHALLENGES MET

First challenge, extremely shallow water. Along the whole cable route of 24 kilometers, the water depth is never deeper than 3.5 meters. There's one point even less than 0.6 meters nearby a narrow channel on the offshore route. All these factors formed the biggest challenge to the project noting that traditional cable vessels have limitation in operating in such shallow water environments.

Second challenge, a busy ferry barge route crossing. Along the cable route, there are totally three points crossed by ferry barge routes. Busy ferry operations and barge routes, heavily loaded passenger ferries all represented background threatens the cable and operations.

Third challenge, strict environmental protection requirement. Since the route was nearby a famous local tourism attraction, the local government raised strict environmental protection requirements, and the most particular requirement was that no turbidity pollution was allowed during all operations.

3. SOLUTIONS PROVIDED

First, since the industry standard traditional cable ships are not suitable for the project, project team modified a barge and enable it the installation capability (refer to Figure 2). Through efforts of searching, the team found a one feet draft, sixty-five feet long local sourced barge, which is suitable for the project. The barge is powered by two 200 HP YAMAHA engines, which is capable enough to drive the barge, equipment and cables. Cable tank is welded by steel tubes with the minimum bending radius of 1.0 meter, which can meet the requirement of cable storage. Steel bars are welded as the following design, working as cable track ways. A simple chute is fixed at the stern to ensure the cable smoothly passing through. Cable hauler engine is placed in the same line between cable trackway and chute, which is designed to provide pulling force during loading, landing and discharge. Two simple sheds are set as storage space and integration space. Storage space is used for storing necessary tools and facilities. Integration space is designed for making joint box in case of any cable accident happens. Captain and surveyor are working inside the Control & Survey Room. All power supply are from a portable generator onboard. As for positioning, four points anchoring method is adopted during shore end landing. During surface lay operation, two support boats are placed at each side of the barge, providing pushing force like thrusters.

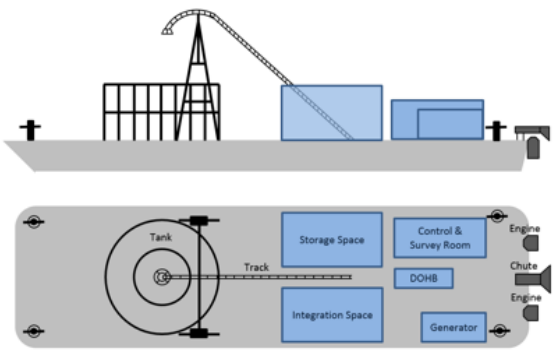

Figure 2: Frame of the vessel and equipment onboard

Second, route check. For shallow water installation projects, safely pass is the most critical issue. In order to ensure the safe pass on the route, the team executed an onsite survey in shallow sections along the route. With a marked pole holding in hand, divers walked along the designed route. Water depth was recorded every 5 meters at both high tide and low tide time, isobaths was drawn accordingly. Hence, an accurate and safe route was ensured.

Third, installation window. Considering the limited ship performance, the team made good use of the installation window. After checking weather forecast, a sunny windless day was chosen as the big day. Direct shore end landing was executed at 08:00 in the morning, and the main lay barge laid to the shallowest section at 15:00 in the afternoon, which was the exact high tide time. After safely past the shallowest section, the barge reached the other end at 17:00 in the evening, then the next shore end landing executed.

Fourth, DP and slack control. Considering there's no DP system on barge, in order to keep positioning during landing and jointing, traditional four-point anchoring method was adopted, support boats were standby at each side. During shore end landing, cable hauler provides pulling force to pay out cable towards beach. During cable laying, to avoid cable damage by mismatch between hauler speed and vessel speed, the hauler was abandoned, and the cable was paid out by gravity. Thanks to the smooth seabed and steady vessel speed, the cable was laid perfectly without any suspension.

Fifth, eliminating shallow water and barge route risk. The extremely shallow water depth, busy barge routes, and other human activity form great threats to the cable safety. The first method is to apply double armoured cable along the whole route in case any damage before burial. The second method is to apply long distance of AP pipes on risky sections, especially on barge route crossings.

The third method is to deepen burial the cable to 2 meters by PLB sledge on barge route crossing sections. Finally, we sought assistance from the local port authority, and they broadcasted to the surrounding barges the existence of the marine cable under water, and to be aware of the barge draught and cruising speed.

Sixth, strict environmental restrictions. The cable route snakes nearby a famous local tourism attraction. Local government requires no turbidity spread is allowed during all operations. In order to meet the requirement, the team invented a curtain. The curtain is formed by top float PVC tubes, vertical nylon cloth and bottom weight. When the PLB burial operations being executed by diver and sledge, one team works on jetting operation, the other works on moving and stabilizing the curtain. Two teams work cooperatively, all turbidity were held inside the curtain without any spread out.

4. RESULTS ACHIEVED

The whole delivery stage lasted for almost two months, which including half month preparation, one day main installation, as well as one and half month protection. Preparation was consisted of barge modification, barge sea trial, equipment calibration, turbidity curtain manufacture, weather studies and survey on shallow waters. Main installation refers to direct shore end landing on two ends and surface lay of 24 km main system. Protection work includes AP pipes installation, clamps installation, hand jetting burial and sledge burial. In order to minimum cable exposure time and avoid damage by third party, protection work was executed by two teams at two ends simultaneously.
Thanks to the well-arranged plan and qualified work performance, the project was successfully delivered in both time and quality.

5. EXPERIENCE TO SHARE

First, water depth and vessel draught. Whether the vessel can safely pass the route or not is the priority issue for shallow water installation. Therefore, water depth at both high tide and low tide shall be clear, and vessel loaded with cable draught data shall be clear as well.

Second, suitable installation ship. Besides the draught, the vessel shall be also capable of marine cable installation, including loading, laying, positioning, storage, jointing, etc.

Third, cable safety. Since there are too many human activity threats in shallow water, enough attention shall be paid on the safety of cable, enough protection methods shall be applied on cable, such as AP pipes, deep burial, port broad casting, etc.

Finally, the critical importance to the environment places strict conditions on such operations as to ensure no future effects affect the beauty of the region.