CAT Submarine Network: A Case Study

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Abstract: CAT Submarine Network (CSN) is a turnkey, repeatered, trunk and branch undersea fibre optic system in the Gulf of Thailand. CSN has the particularity of being a submarine cable system designed for transporting both public telecom traffic from shore to shore and private traffic to and from several oil and gas offshore platforms. It is part of a telecom network fully owned and operated by CAT Telecom PCL (CAT), a telecom operator in Thailand.

CSN represents a major reference in submarine cable systems to offshore oil and gas facilities, where oil & gas operators show growing interest. Its implementation and construction was kicked-off in September 2011 and it is expected to be in service in Q1 2013.

The purpose of this paper is to present the CSN system and the challenges encountered and managed during its design and installation.

1. INTRODUCTION

The CAT Submarine Network (CSN) project originated in 2007 when an oil & gas operator in the Gulf of Thailand decided to connect its existing offshore production platforms to a submarine optical fibre network.

The expected technical benefits from transmission by optical fibre instead of satellite, microwave or troposcatter communication links were higher bandwidth capability, increased availability and reduced latency. The business interest was to unlock significant operating costs reductions, and potentially increased recovery and production, while laying the foundations for work process transformation and more integrated operations.

After analysing different investment models, it was decided to adopt an OPEX model instead of investing CAPEX into its own network infrastructure. A national telecom operator assumed the investment cost and the oil & gas operator committed to buy bandwidth services from this telecom operator on a long term basis. This service model was attractive to the oil & gas operator since the management of such submarine optical fiber infrastructure does not belong to its core business and reduce the system construction and maintenance expense risk. It also allowed the telecom operator to include revenues from other potential service users in the business case such as transport of national telecom traffic.

CAT has award a contract to Loxley Wireless and Italian-Thai Development, Thai companies, as main contractors for the supply of the overall CSN system presented in this paper. The contract was to deliver a network designed to provide bandwidth services to offshore production platforms belonging to the oil & gas

companies present in the Gulf of Thailand and, at the same time, to support CAT public telecom traffic.

The subcontract for the supply of the submarine optical fiber network portion of CSN was awarded to Alcatel-Lucent Submarine Networks.

2. SYSTEM DESIGN

The CSN system architecture comprises over 1,200 km repeatered trunk connecting Sri Racha to Songkhla, and multiple repeaterless branches to existing and planned offshore production platforms in the Gulf of Thailand.

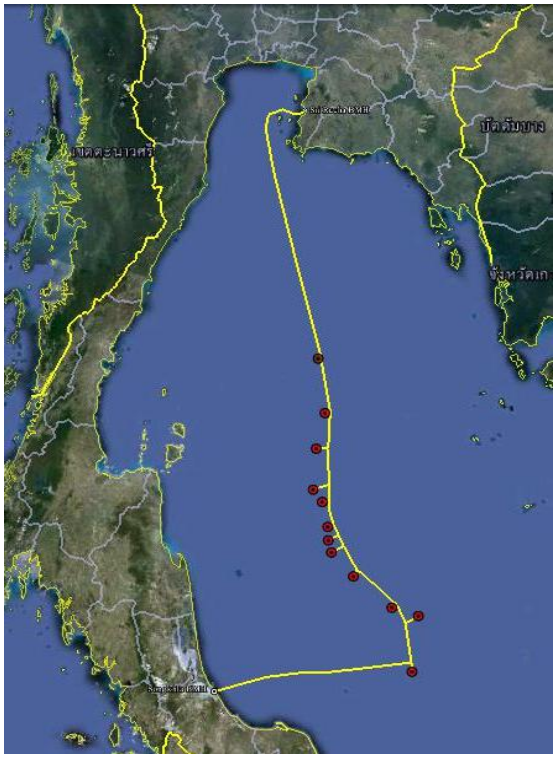

Figure 1: CSN Route Overview

The CSN system has express optical fibre pairs dedicated to the transport of CAT public telecoms traffic from Sri Racha to Songkhla, carried over 40 Gb/s or 100 Gb/s wavelengths, and an omnibus optical fibre pair to the transport of traffic with offshore production platforms.

Each branch interconnects one offshore production platform to the trunk on the omnibus fibre pair. The connection between the trunk and one branch goes through an Optical Add/Drop Multiplexing Branching Unit (OADM BU) which routes one dedicated wavelength carrying bandwidth signal toward each branch. This design ensures the connection of each offshore production platform with both onshore cable landing stations to achieve route redundancy, while avoiding any interdependencies between platforms.

All offshore production platforms connected to CSN system are fixed platforms. The static riser cable landing on each platform is either fed through a protection J-tube, or alternatively with Uraduct™ type half shells strapped to the platform jacket. Each riser cable was anchored to the platform deck and jointed on the seabed with the branch cable.

3. IMPLEMENTATION

Looking from a marine perspective, CSN was a challenging system: 1,200 km cable system in heavily fished shallow waters, connecting multiple offshore platforms in highly developed oil and gas fields, with non-homogeneous seabed, conditions, crossed by dozens of pipelines.

In order to mitigate the risk of delays due to the number of interfaces involved on the project, and to separate the different technical and administrative challenges, a flexible plan was required. The various tasks to be executed were split and the best resources and timing were selected for each of them.

Just like separate shore ends for traditional submarine telecom cable systems, a specific spread was mobilized early enough in the program allowing separate – the last mile cables to the platform ends –

to be installed independently from the main lay, taking into account all platforms specific constraints, without directly impacting the project main lay and critical path.

The static riser cable for the last miles connections was loaded in the vessel that could be cut as required on-board, leaving the possibility to reshuffle the order of last mile installation to the platform as needed - a good way to address the potential delays due to conflicts between platform production & maintenance activities and top side construction as well as weather and technical delays.

Being based in the region, the C/S Lodbrog was selected as the vessel for the last mile campaigns. The vessel was first proposed for review to the oil and gas operator, together with basic principles for the installation. Once these basic principles were agreed, the formal process of approval started, involving detailed engineering of the installation procedures, thorough review of HSE plans, and formal vessel formal OCIMF OVID audits.

Figure 2: Riser Installation

The last mile installation was an "all-in-one" operation consisting of

- a pre-lay survey – in lieu of a grapnel run considered undesirable in the congested seabed close to the platforms,
- cable pull-in,
- hang off installation at the top side of the platform,
- cable lay,
- complete burial by jetting ROV.

All of the above operations were carried out with the on-broad resources of the C/S Lodbrog used as a multi-purpose last mile installation tool. All platforms had been prepared well ahead of the installation with the required set of top-side gear comprising air compressor, winch, pulleys, necessary scaffolding, etc. The principle was that all the works would be done independently by the cable ship without any support vessel (apart presence of tug boat planed as risk mitigation measure), hence minimizing disruption to the day-to-day platform operations.

Figure 3: Pre-installation of Rigging Plant

To that end, and in addition to the normal cable ship spread, the C/S Lodbrog was equipped with an inspection ROV, with sufficient agility and reach for all subsea monitoring work required – bell-mouth monitoring, and cable touch-down monitoring. It was crewed throughout the

campaign with all platform pull-in and jointing staff transferred everyday by workboat between the vessel and the platforms.

Figure 4: ROV Monitoring and Inspection of Bell-mouth

For the main trunk cable, the C/S Ile de Sein was selected for the operation. After a successful OVID audit of C/S Ile de Sein, the C/S Ile de Sein completed the load of the entire system in Calais, and transited to the Gulf of Thailand to reach Sri Racha shore end for the installation. Considering the fishing threat, the target was simply to fully bury the entire system (by simultaneous plough burial or PLIB), with the exception of the 20+ pipeline crossings identified along the route, where additional protection was being considered. The main lay was carried out in two steps:

- from Sri Racha southbound through the oil & gas operator field, to a final splice location,
- then from Songkhla northbound through the oil & gas operator field to the final splice location

Most of the main lay installation was carried out in the concession blocks of the platforms, where stringent rules, similar to those for last mile installation, were applicable. Strict adherence to the onboard cable operation procedures and adherence to the pre-agreed RPL, while maintaining the highest HSE standards, were key requirements. In addition, a significant part of the route was to be plough buried parallel to pipelines, sometimes at less than 50 m distance. To ensure safe installation, the plough was fitted with front and side view obstacle sonar, and a state-of-the-art acoustic positioning system. This not only made the ploughing operations safer close to the pipelines, but also gathered an accurate set of as-laid data, for the future subsea activities in the field. In those areas of close proximity to pipelines, the PLGR was also run with an acoustic positioning system fitted to the grapnel.

To further improve the reliability of the system, additional protection had to be installed on the non-buried cable at certain pipeline crossings. Concrete mattresses were selected as the preferred methodology.

This installation was also carried out by the C/S Ile de Sein. To achieve safe and efficient deployment, again within oil & gas standards, the C/S Ile de Sein was fitted with the same inspection ROV that had performed well for the last miles. All mattresses were deployed with the rear deck A-frame using a dedicated deployment structure with hydraulic release, specifically designed for these types of mattresses.

4. CONTRACTUAL CONSIDERATIONS

The installation of a submarine optical network connecting offshore platform(s) will generally involve completion of works within the platform exclusion zone.

The traditional contract framework used by the telecoms industry for the supply of a submarine optical fibre cable requires

some adaptations to properly address the implications of works being undertaken within the area controlled tightly by the oil & gas operator.

In particular, the following aspects need careful attention from the telecom operator and the supplier when setting up contract:

- The terms and conditions in the head contract with the oil & gas operator should allow mutual waiver of recourse between the oil & gas operator group and the contractor group, including all subcontractors involved for the completion of works in the platform exclusion zone. This is common practice in the oil & gas industry but not in the submarine telecom cable industry.

- The access to the as-laid data for subsea production equipment from the oil & gas operator is critical at the route engineering phase to prevent any risk of incident.

- The access to existing survey data from the oil & gas operator on the selected cable route can be of help for the route engineering, reducing the need for additional marine survey.

- A detailed responsibility matrix should be developed in advance of the supply contract signature to define the responsibilities of each party for the engineering, the procurement, the logistics and the installation of the system for each platform.

- A close cooperation and good understanding during the implementation is a must to have for achieving the objective of the operation.

5. CONCLUSIONS

The CAT Submarine Network (CSN) is the first large submarine cable system developed and to be operated by a traditional telecom operator for the connection of oil and gas offshore production platforms with the onshore operation offices. The telecom operator builds, operates and maintains the system and then offers the bandwidth on the system as a service for oil and gas operator under a service agreement scheme.

Although the supply project may look very similar to a traditional submarine telecommunication supply project, there are in fact many specific differences.

In particular, the layered contractual schemes for submarine telecom operators wishing to deliver submarine optic fiber communication services to oil & gas offshore production platforms deserve special attention to capture the specific aspects of work required to be executed by system supply contractor(s) in the close proximity of properties of oil & gas companies during such a project implementation as well as the future system maintenance.

