

THE RIGHT START FOR OFFSHORE FIBRE CONNECTIVITY

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Abstract: The necessity for fibre optic connections to support enhanced operating models for oil & gas companies has already been demonstrated. Fibre optic technology is relatively recent in the offshore oil & gas industry and far removed from the core competencies of oil & gas companies. Neither the system suppliers nor the owners/operators of submarine cable systems are very familiar with the technical and contractual practices of the offshore oil & gas industry. In the discussions which take place between the submarine cable industry and the oil & gas companies concerning potential projects, are the discussions taking place between the right people? Are the right topics presented in the right way, technically and contractually? Are the right business models being studied?

This paper expands upon the major points necessary to ensure sound projects, reliable proposals, and emphasizes the role of consultants.

1 FIBRE OPTIC NETWORKS FOR OFFSHORE OIL & GAS

The main existing networks today are found in the North Sea, the Campos Basin off the coast of Brazil, and in the Gulf of Mexico.

Possible deployments under consideration by various parties include operations off the coast of Angola, Nigeria, Australia (Northwest Shelf), in the Barents Sea north of Russia, and in the Gulf of Thailand.

The main questions addressed by this paper are:

- Why does it take so long to develop new projects?
- Are there ways to be more efficient in the project development phase?

2 OFFSHORE FIBRE OPTIC CONNECTIVITY IN THE OIL & GAS COMPANY’S ORGANISATION AND PROJECT MANAGEMENT PROCESS

The telecom division of an oil & gas company is usually part of the corporate administration or information technology division of the company. While it provides an essential support service, it is not ‘core business’ for the company.

Nevertheless in the Exploration & Production (E&P) area, an E&P telecom division is assigned certain human resources and follows the corporate rules.

CAPEX is allocated for each offshore production asset development project based on the pre-engineering phase, then the basic engineering phase. If the fibre optic project is not pushed forward in these phases, it will not be part of the subsequent tender packages for the construction phase of the project. Consequently any fibre optic project will be difficult to launch.

Fibre optic connectivity is nearly ignored by the oil & gas company managers in the production areas, since the main concern for any single asset is to have some type of connectivity, in whatever form. Offshore production asset development projects are mainly about reservoir development architecture, and nature of the supporting telecommunications facilities per se is not a major concern.

Even if considered at the right time of a production asset development, a subsea fibre optic telecom project is likely to connect several different assets, at different stages of their development or production life, managed by different project managers with different project accounts. This leads to the question of how the oil & gas company can manage a common telecom infrastructure project serving several assets. This is another question to settle.

Once an asset is delivered to the production area, there will be only OPEX for the oil & gas company, typically covering maintenance, operating costs, and periodic revamping of the asset.

A sub-sea fibre optic telecom system connecting different assets can also be considered like a connectivity service delivered under a service contract, similar to the way that satellite and/or microwave radio services are delivered by telecom operators under services contracts.

In many countries, a State Oil Company or State Oil Ministry is a stakeholder and/or decisions maker in any infrastructure project to be shared by the different oil & gas companies operating on their blocks in the EEZ, including any subsea fibre optic telecommunications system.

- With some many different possible scenarios, there are often more questions than answers:
- What will be the business model?
- Who will buy what? From whom?
- Who will sell what? To whom?

- What will be the applicable rules?
- Will it be a CAPEX infrastructure project?
- Or an OPEX services scheme? Or both?
- With which partitioning?
- ...

In conclusion the fibre optic telecom service could be provided by an asset owned and managed by the oil & gas company(ies), or it could be a connectivity service provided by a dedicated telecom operator, or something in between the solutions.

Today, a connectivity service contract for a fibre optic connectivity solution between oil & gas companies and a telecom operator does not exist anywhere in the world.

Numerous questions and options! ...This may go some way to explaining why the process is long and tortuous. Let's look at how we might speed up the learning curve.

3 DRIVERS

Below are presented some of the main drivers seen over the past few years, some of which may help to 'accelerate' the development process for some offshore fibre optic projects.

3.1 Corporate Policy

At least 2 major oil & gas companies now request the fibre optic connection of each new offshore production asset as a corporate policy rule, and most of the other 'majors' are also considering this. While some continue to outsource their telecom service requirements, certain others are advancing with "e-field" activities which increasingly integrate remote operations requiring reliable communications between shore-based facilities and offshore assets, even the subsea ones in some cases. .

3.2 Evolving Operational Models

The main drivers are the signal reliability and low latency to allow increased automation of processes and reduction of costs. Qualified personnel for offshore facilities are more and more difficult to find. Increased automation and remotely controlled operations reduce skilled personnel requirements, HSE risks, and personnel logistics concerning offshore living quarters. This can avoid the loss of a lot of working days due to the inability to transfer production workers to the production platform because of rough weather, etc.

3.3 Continuity/Improvement of Production

Production can continue if shut down and re-start of subsea wells due to platform evacuation for the passage of typhoons, cyclones etc. can be avoided. In some areas, such evacuations can occur several times per year.

3.4 Increasing Complexity of Subsea Monitoring & Control

Fibre optic connectivity is also coming into some parts of oil & gas company core 'production' business via increased subsea monitoring, processing and controls, and increasing lengths of tie-backs. There are an increasing number of active components on the seabed, as well as relay pumping, separators, reservoir monitoring, etc. all requiring more sensors and more real time control. The increase of data volumes and real-time monitoring requires optical fibre solutions instead of copper. For a future very deep offshore oil & gas development in West Africa, the subsea control project director of a well known major oil & gas company required the FPSOs to be connected to shore with optical fibre!

3.5 Reliability

For a well known oil & gas company in a West African deep offshore project, the offloading buoy is controlled from FPSO over a short radio link. If the radio signal is

lost, offloading of the FPSO must slow down or even stop, with all the consequences which may include the stopping of some subsea production wells. The first riser based deep offshore fibre optic connection will offer reliable connectivity and safe control of the off-loading buoy.

3.6 Security

Security concerns in some areas like Nigeria will probably accelerate the process.

4 WIRELESS VS. FIBRE OPTICS - CAN THEY BE TREATED THE SAME WAY BY OIL & GAS COMPANIES?

The oil & gas company's telecom team is mainly involved in the offshore asset connectivity with satellite and microwave services. (This presentation does not concern the rest of the telecom package - CCTV, radars, SCADA, etc.).

The oil & gas company's telecom team for the area, assisted by the corporate organization, will discuss two main points:

- The service contract based on a well known and controlled specification with a telecom operator
- Some minor erection and installation points, e.g. antennae, dishes, wiring.

In some specific cases the oil company can develop its own microwave network, but the main work will be carried out onshore.

The more usual solution is the service contract as mentioned above, and this is treated as OPEX, typically of \$0.3M average magnitude per year.

There are typically no connections with the seabed, therefore interfaces are limited to the surface instrumentation and control division of the oil & gas company, similar to onshore projects.

In consequence:

Some major oil & gas companies outsource telecom requirements to telecom

operators. At least 2 of the 'majors' consider telecoms as a service and not an infrastructure because it is not a core business activity.

However, even these two 'majors' consider fibre optic connectivity as an improved telecom service compared to wireless connectivity, but they still ignore the subsea infrastructure, at least at the telecom division level.

In contrast, two other 'majors' consider the subsea telecom infrastructure as critical for production as the oil or gas export line.

Potential show stopper:

What ever the strategy, OPEX or CAPEX, the oil & gas company will face the telecom system supplier at least for the '**last mile**' connections to offshore assets. How to approach the floating production system to be connected with the fibre optic cable?

Oil & gas companies' inputs to the telecom system supplier are compulsory on both technical and contractual aspects to make such projects possible in time and within budget.

5 WHAT'S NEW IN THE OIL & GAS FOR TELECOM ACTORS

In general the core business of subsea telecom networks suppliers or subsea networks operators is mainly to connect onshore points using cables laid in the ocean.

In general once away from the landfall and the EEZ, the cable is laid on the seabed in the open sea. The main installation rules are those of the telecom industry.

With offshore oil & gas projects, things are somewhat different.

In general, the main 'backbone' link is configured as an offshore ring installed through the exploration blocks, and the 'last miles' are branches off the backbone cable to the deck of the offshore production facilities. The 'last miles' must pass through the field development area of

the oil & gas company, which is crowded with numerous items of subsea hardware for wells, umbilicals, pipes, tie-backs, PLEMS, etc. Therefore the rules applicable to the cable installation will be dictated by the oil & gas company. These will not be known by telecom operators or the system suppliers.

Telecom cables are typically anchored horizontally on a beach, but 'last mile' cables typically terminate with a riser cable anchored vertically at the top of an I/J tube, or the cable extremity may be abandoned on the seabed with a subsea connector for future connection with planned offshore facilities. Such terminations are new for the subsea telecom industry and they must be qualified by the oil & gas companies, whose rules can be different from one to the other.

Specific rules are applied by oil & gas companies for crossing and working alongside pipes, cables, and umbilicals, as well as for working in the vicinity of production facilities.

Positioning accuracy for the cable could be more stringent than is usual for the telecom industry, and full post-lay survey may be compulsory.

Reliability of the signal being the essence of such systems, this necessitates specific burial tooling, control of burial depth, and alternative protection for difficult burial areas. "Target" burial depth is not the right terminology for oil & gas companies, therefore a fully documented geophysical and geotechnical marine survey is almost certainly required.

Liability and insurance issues can also become contractual nightmares, especially when the cable ships must "play" close to floating production systems, with ploughs used close to large pipelines and other subsea structures. The rules and procedures for risk management are therefore different from the telecom subsea cable business.

Project management rules are very high standard in the oil & gas industry, with

particular attention being paid to quality assurance, documentation and HSE. In general oil & gas companies request a very close follow-up of all project phases - engineering, manufacturing and installation.

Any misunderstanding or underestimation of the above will have a substantial effect on the final cost of the project as well as on the project time schedule.

6 WHAT IS THE RIGHT START FOR OFFSHORE FIBRE CONNECTIVITY?

The arguments developed below are based on the premise of using the ways of the oil & gas industry for project development - by starting with a FEED study for the fibre optic networks, carried out by competent and recognized consultants in the oil & gas industry as well as in the telecom industry.

The FEED study will be the oil & gas company's reference to decide whether or not to proceed with the fibre optic project in one way or another, therefore the study has to be well documented and agreed by the oil & gas company.

6.1 FEED Study (Front-End Engineering and Design)

The scope of the FEED study should include at least the following:

- Definition of the assets to be connected today and in the foreseeable future.
- Cable Route Study:
 - Optimization of the backbone route considering the offshore assets to be connected and the specific environment
 - Optimization of the 'last miles' from each branching unit (BU) in the backbone to the asset to be connected, considering the oil & gas company rules.
- Definition and architecture of the network.

- Definition of any new products to be designed and qualified - dynamic risers and terminations, subsea optical connectors (for cable termination assemblies) FORJ (fibre optic rotary joint for turrets).
- Definition and agreement with the oil & gas company of the cable protection strategy, taking into account:
 - Buriability of the seabed?
 - Which type of burial tool, which burial depth?
 - Which cable alternative protection solution when burial is not feasible or not at the right specified burial depth?
- Any study (static, dynamic) which may be compulsory to develop new products or to demonstrate the feasibility versus the environment:
 - Cable stability versus currents, swell, seabed displacement, movements.
- Study of logistics from port, airport to the marine base, then to the field.
- Budget for such a project and the specification for the call for tender.

The above will first require a Desk Top Study in order to collect all the necessary local data needed for a better evaluation of the environment:

- Bathymetry, geophysical and geotechnical data of the seabed where the cable is intended to be installed.

A lot of this data is usually available in the oil & gas company's GIS, gathered from the previous intensive works on the seabed during the development of the field, or from pipeline projects, etc. The study therefore requires an introduction to the geomatic services of the oil & gas company, at both corporate and local levels.

On a recent Barents Sea FEED study, the oil & gas companies ordered the detailed

marine survey. This could be the best solution, since the oil & gas companies are ordering many surveys of a high standard concerning their own concessions/blocks, consequently they possess a large GIS.

- Situation, drawings, charts of the offshore assets to be connected.
- The weather and metocean data.
- A good analysis of the possible external threats for the cable along the route, whether existing or planned:
 - Any human activities such as fishing (a study of the different types of fishing and relative threats to the cable), construction, prohibited areas, anchorages ...
- Any seismic risks.
- Others factors specific to the area, such as high tidal currents, seabed movements associated with heavy seas or cyclones, meteorological data concerning routes and frequency of cyclones, etc.
- A visit to the following locations where the cable is expected to land:
 - Platforms to be connected
 - Potential landfalls.
- Investigation of the necessary processes and local administrations to be consulted for obtaining different licences, rights of way, operational permits etc. to allow the work to proceed.

The quality of the budget estimate and consequently of the project specification will rely on the quality of the data gathered during the FEED study. The oil & gas company input is paramount to recover data from the right division (e.g. the corporate as well as local geomatic division, the new asset project team, the local production team, the local subsea construction team, ...). The following items are therefore keys for the FEED study to succeed:

- The commitment of the oil & gas company project team to introduce the right internal people to the project consultant
- The level of resources and skills for the analysis of the data and necessary studies provided by the project consultant.

6.2 The Consultant

The Consultant's work specification, both for equipment and installation rely on detailed studies agreed with the oil & gas company. This means that the Consultant's team must have many different skills:

- Telecom engineers for the definition of network architecture
- Geophysics and geotechnical skills for the cable route study
- Specialist skills in mechanical engineering and fluid dynamics for specific cable protection issues, including but not limited to cable stabilisation on the seabed, and definition of dynamic risers
- Product specialists for specific definition of the optical fibre cable, powering, subsea connectors, rotary joints, etc.
- Specialists in oil & gas company quality assurance and HSE policies.

Another key element is the definition of the huge documentation package required by oil & gas companies, as well as the process associated with the project management, in particular the pre-requisites for validation of step N and the way to proceed to step N+1. This process can consume significant time and resources, and unless properly managed can interfere directly with the schedule and overall cost of a project.

The above detailed process must include any long, costly qualification of new equipment or new methodologies.

Consultants working in the core E&P part of the oil & gas industry will be known by the oil & gas companies, and will probably be able to go directly to the right people inside the oil & gas company organization to get information, and discuss the different problems highlighted by a FEED study. In contrast, the telecom subsea consultant will typically not have this capability, and would be well advised to work in collaboration with one of the well known oil & gas consulting companies like JP. Kenny, Bechtel, Mustang, Technip, etc.

6.3 Contractual Framework, Business Model

Oil & gas companies regularly sign contracts with other oil & gas companies to develop fields in partnership. All deep offshore developments are carried out with such consortia, as a means of risk sharing.

Oil & gas companies also regularly sign contracts with other oil & gas companies for the development of a shared facility, such as a gas export pipeline for the gas produced by any of their facilities in the area, e.g. the pipeline developed by Chevron in Angola to serve all producers.

Another common arrangement is for oil & gas companies to sign service contracts with contractors like SBM to produce so many barrels/day for a period of X years, then SBM signs EPIC sub-contracts with sub-contractors. It is a team which negotiates with the oil & gas companies, e.g. SBM + its EPIC sub-contractors.

The combined skills of an oil & gas consultant and a telecom consultant will probably lead to a more realistic and efficient approach both for the fibre optic connectivity services option (OPEX) as well as for the infrastructure option (CAPEX), whether shared or not.

The uniqueness of the oil & gas requirements for fibre optic communications must not be underestimated. Attempts to develop projects combining offshore oil & gas traffic with other telecom business on a common

infrastructure have only led to failure. Such promises will kill projects.

Oil & gas companies buy connectivity not bandwidth with fibre optics. The business plan must take this into account, focusing on the benefits brought by fibre connectivity, not a comparison bandwidth costs (e.g. vs. satellite or microwave).

Specific contracts must be built to allow coherence and continuity between the supply contract linking the EPIC telecom supplier with the telecom operator, and the connectivity service contract linking the oil & gas company(ies) with the telecom operator. So far none of these exist.

The 'backbone' of a fibre optic network could be easily shared by different oil & gas companies or be considered as a common access to connectivity, while each 'last mile' from the BU to the offshore asset could be considered as a private access, funded individually.

7 CONCLUSION

To produce effective results for offshore fibre optic projects, telecom consultants would be well advised to sign agreements with well known oil & gas consultants in order to:

- Present the project in a better way to the right people inside the oil & gas companies' organizations. This will speed up the process and increase the knowledge of the oil & gas companies concerning fibre optic connectivity.
- Better involve the oil & gas companies and all its necessary specialists for the benefit of the FEED study, because majority of data and requirements come from the oil & gas companies.
- Progressively improve the skills of the consulting team.
- Carry out fully documented FEED studies to get the most accurate budget from the potential suppliers. The better the FEED study, the easier it will be to compare offers from telecom system

suppliers. The detailed marine survey must be included at some stage in the FEED study.

- Work the business models and business plan taking in consideration the oil & gas company culture and requests, not just push fascinating but unrealistic ideas. This can often arise when discussing a connectivity service contract with telecom operators unfamiliar with the full requirements for oil & gas applications.